AtkinsRéalis

MIAMI-DADE COUNTY SOLID WASTE MANAGEMENT

Market Research Report

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Table 1-1 – Abbreviations

Abbreviation	Description
AD	Anaerobic Digestion
AMSL	Above Mean Sea Level
ATC	Advanced Thermal Conversion
CAPEX	Capital Expenditure
CER	Carbon Energy Reforming System
EPA	Environmental Protection Agency
EPC	Engineer Procure Construct
FDEP	Florida Department of Environmental Protection
FPL	Florida Power & Light Company
LCA	Life Cycle Assessment
LDPE	Low-density Polyethylene
MD DSWM	Miami-Dade Department of Solid Waste Management
MRF	Material Resource Recovery
MSW	Municipal Solid Waste
OPEX	Operating Expense
PPP/P3	Public Private Partnership
RDF	Refuse Derived Fuel
RRF	Resource Recovery Facility
SSWC	Sustainable Solid Waste Campus
SWOT	Strengths Weaknesses Opportunities and Threats
TPD	Tons per Day
TPH	Tons per Hour
TPY	Tons Per Year
WTE	Waste-to-Energy

1. EXECUTIVE SUMMARY

Pursuant to Miami-Dade County Resolution R-198-25 and R-190-25, this report has been generated to address the following directives from the Board of County Commissioners.

1.1 MIAMI-DADE COUNTY RESOLUTION R-198-25, SECTION 2

"This Board directs the County Mayor or County Mayor's designee to undertake a comprehensive review and analysis involving industry experts from all available sectors of waste management to further explore the feasibility of constructing a new WTE facility. Specifically, the County Mayor or County Mayor's designee shall solicit information and technical advice from waste management industry experts on the best available delivery options and recommended procurement approaches for the design, construction, operation and/or maintenance of a new WTE facility for the County including but not limited to: (1) traditional government procurement methods such as design-build solicitations; (2) public private partnership (P3) agreements; and (3) utilizing unsolicited proposals to determine which approach is the most cost and time efficient for the delivery of a WTE facility.

The County Mayor or County Mayor's designee shall not limit its comprehensive analysis to already identified potential sites or locations nor to assumptions as to the size and capacity of the WTE facility. The County Mayor or designee shall explore all available options with waste management industry experts including but not limited to constructing a larger regional WTE facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste. The County Mayor or County Mayor's designee shall also explore with waste management industry experts all waste disposal methods the Board has directed the County Mayor or County Mayor's designee to analyze in items passed by the Board within the last 45 days. The Board also directs the County Mayor or County Mayor's designee to explore and analyze available funding sources and technologies, including P3s, federal tax credits, and federal and state grants, to contribute to or defray the costs of the County's solid waste system including any construction, operation and maintenance costs associated with a solid waste campus, WTE facility, or landfill expansion."

Pursuant to Section 2, the County Strategic Procurement Department and AtkinsRéalis have compiled and distributed a set of questions on March 7th, 2025, titled "Market Research for Municipal Solid Waste Management Solutions" to over 125 firms from the waste management industry for their response. These questions were also posted on the Department of Solid Waste Management website from March 7th until the response due date of April 14th. This Market Research effort requested members of the wider waste management industry to explore all available commercial options at any location with the goal of managing the County's waste. The number of responses to the Market Research questionnaire from companies is thirty-eight (38).

Regarding the recommended procurement approaches, the County's Strategic Procurement Department has established the available delivery models to the County as the traditional methods which include Design/Bid/Build and Design/Build, or an alternative method via a Public Private Partnership for Design/Build/Finance/Operate/Maintain or some version thereof. In addition, AtkinsRéalis has provided corresponding analysis based on industry norms and standards related to these available procurement models. These elements are detailed in Section 2.1 below.

One significant result from the Market Research effort is the recommendation from three respondents, led by Florida Power & Light (FPL), FCC and Insoftel, to engage the County in a P3 arrangement for the financing, design, construction, operation, and maintenance of a new Sustainable Solid Waste Campus. FPL and FCC have featured Waste-to-Energy using Mass Burning Technology as the primary waste handling element of their solid waste campus along with other waste processing technologies. Insoftel features Refuse Derived Fuel (RDF) Technology with Waste-to-Energy as their sole waste processing technology. An executive level summary of these three offerings has been provided below with additional details available in Appendix F.

The response from the group established with Florida Power and Light (FPL), Kanadevia Inova, ReWorld Holding Corp, & CDM Smith Inc. recommends the County choose a County-owned site, to build a solid waste campus on that County-owned land and for a "tipping fee" arrangement to be the primary payment method and would be fully financed, designed, built, operated (including revenue management whereby FPL retains revenues from both electricity sales and byproduct sales) and maintained by FPL and their consortium partners. FPL has indicated the capital cost estimate range provided by Arcadis in their 2024 reports is in-line with industry norms. FPL has also stated they have access to low-cost debt options.

The response from the group established by FCC, MasTec, and Babcock & Wilcox (B&W) has also provided a comprehensive P3 arrangement. FCC has indicated they would use a new-build finance rate model which will result in their ability to finance, design, build, operate and maintain the facility based on a "concession fee" arrangement with the County. FCC has provided a table of capital and operational costs for each of the technologies they are offering within their overall response, which are generally in-line with the previously estimated ranges provided by Arcadis in their 2024 reports. Based on a recent news release it has been reported that FCC Environmental Services has agreed to purchase Wheelabrator South Broward Inc., which owns the South Broward Waste-to-Energy (WTE) Facility in Fort Lauderdale, Florida, from WIN Waste Innovations.

The response from Insoftel (Synergy Conversion Solution) features Refuse Derived Fuel (RDF) equipment which will supply an on-site waste-to-energy facility. It is worth noting that an RDF facility is different from a mass burn facility in that it requires a processing facility to sort and remove noncombustible materials from MSW. This involves the screening, shredding, and grinding of waste to create RDF. These require frequent maintenance and upkeep. In addition, Synergy is proposing 37 processing modules and 8 Organic Rankine

Cycle (ORC) turbines which is a lot more equipment compared to a typical Waste to Energy Facility and therefore may require a higher maintenance allocation. Synergy did not provide any installed base in the US or Canada similar to what they have proposed. MSW facilities do not require separate processing facilities. Specific information was not supplied regarding their other partners for Construction or Operations and Maintenance. Additional information will be required related to the execution method since Insoftel provided a range of options available for the funding arrangement and partnership agreement.

Both FPL and FCC will require the County to provide and choose the site. While FPL specifically states they will lease the land from the County, FCC has not provided specific details on a lease arrangement. Insoftel has not included information related to siting.

Should the County decide to pursue these P3 respondents' offers, further investigation related to their offering and execution model is necessary to further explore their viability and cost certainty because the requisite level of detail has not yet been provided in their responses.

Regarding federal tax credits, AtkinsRéalis has engaged Subconsultant Roessler and Associates to provide a summary Technical Memorandum and Life Cycle Analysis (LCA) framework which directionally indicates that the current federal rules are applicable to the proposed 4,000 tons per day WTE facility and provides analysis for other technology options. This report is included as Appendix C, attached.

Per the Technical Memorandum generated by Roessler and Associates in Appendix C, under the Clean Energy Investment Tax Credit (CE-ITC), the County could reasonably expect to generate between $63 million and $535 million in lump sum tax credits for the County at the time of completion of construction for a Waste-to-Energy facility for the originally specified 4,000 tons per day throughput. Proposed legislation in the US House of Representatives as of May 2025 could remove this funding if passed into law.

Regarding the State of Florida waste-to-energy grants, the State legislature passed legislation in 2022, SB 1764, which would have provided funding to Counties which operate waste-to-energy facilities, but the funding was pulled prior to the bill being passed by the legislature and is therefore not currently available.

Hauling and disposing of waste has been proposed by existing contractors Waste Management and Waste Connections. The existing summary of contracts between the County and these two companies is detailed below.

The following table describes the current contract costs for landfill disposal as well as the County's own landfills (South Dade and North Dade).

Table 1.1-1 – County Cost of Disposal by Location before NDL/SDL Closures

Summary of County Disposal Costs with North Dade Landfill and South Dade Landfill

Contracted Airspace		Maximum annual contractual capacity (tons)	Minimum annual delivery (tons)	Assumed annual disposal (tons)	Disposal Fee	Transfer Fee	Fuel surcharge to be paid by County	Total fee per ton to be paid to WMI/WCF	Disposal to be paid to County	Surcharge to be paid to County	Expenses: Expenses to Operate SD/NDL/Transfer Station	Expenses: Paid by County for Contracted Airspace	Revenue: From surcharge and tipping Fee
Medley	WMI	700,000		650,000	$ 45.41			$ 45.41	$ 74.40	$ 2.77		$ (29,516,500)	$ 50,160,500
Okeechobee	WMI	2,000,000		568,000	$ 37.98							$ (21,572,640)	$ 42,259,200
FEC Intermodal	WMI		550,000	568,000		$ 30.99		$ 71.22	$ 74.40			$ (17,602,320)	$ -
Fuel Surcharge	WMI			568,000			$ 2.25					$ (1,278,000)	$ -
JED (by Road)	WCF		62,400	62,400	$ 72.25			$ 72.25	$ 74.40			$ (4,508,400)	$ 4,642,560
Heart of Florida (By Rail)	WCF	800,000	249,600	249,600	$ 72.25							$ (18,033,600)	$ 18,570,240
Surcharge Revenue	WCF	50,000								$ 5.00			$ 250,000
SDL	County			430,000	$ 74.40				$ 74.40	$ -	$ 37.66	$ (16,193,800)	$ 31,992,000
NDL	County			140,000	$ 74.40				$ 74.40	$ -	$ 37.66	$ (5,272,400)	$ 10,416,000
Transfer Fee	County			1,280,000	$ 16.28						$ 39.75	$ (50,880,000)	$ 20,838,400
Assumed Total Disposal Quantity (tons)				**2,100,000**								$ (164,857,660)	$ 179,128,900
Cost of Disposal per Ton to County												**$ (78.50)**	

Notes - County's collection cost from point of generation to the WTS not included

* Transfer fee paid by WMI/ WCF to the County for waste delivered to County transfer station.

Table 1.1-2 – County Cost of Disposal by Location after NDL/SDL Closures

Summary of County Disposal Costs without North Dade Landfill and South Dade Landfill

Contracted Airspace		Maximum annual contractual capacity (tons)	Minimum annual delivery (tons)	Assumed annual disposal (tons)	Disposal Fee	Transfer Fee	Fuel surcharge to be paid by County	Total fee per ton to be paid to WMI/WCF	Disposal be paid to County	Surcharge to be paid to County	Expenses: Expenses to Operate SD/NDL/Transfer Station	Expenses: Paid by County for Contracted Airspace	Revenue: From surcharge and tipping Fee
Medley	WMI	700,000		700,000	$ 45.41			$ 45.41	$ 74.40	$ 2.77		$ (31,787,000)	$ 54,019,000
Okeechobee	WMI	2,000,000		1,088,000	$ 37.98							$ (77,487,360)	$ 80,947,200
FEC Intermodal	WMI		550,000	1,088,000		$ 30.99		$ 71.22	$74.40				
Fuel Surcharge	WMI			1,088,000			$ 2.25						
JED (by Road)	WCF		62,400	62,400	$ 72.25			$ 72.25	$ 74.40			$ (4,508,400)	$ 4,642,560
Heart of Florida (By Rail)	WCF	800,000	249,600	249,600	$ 72.25				$ 74.40			$ (18,033,600)	$ 18,570,240
Surcharge Revenue	WCF	50,000							$ 5.00				$ 250,000
WMI Put Obligation	County		100,000	-		$ 16.28			$ 74.40				
WCF Put Obligation	County		250,000	-		$ 16.28			$ 74.40				
Transfer Fee	County			1,850,000		$ 16.28			$ 16.28		$ 39.75	$ (73,537,500)	$ 30,118,000
Assumed Total Disposal Quantity (tons)				**2,100,000**								$ (205,353,860)	$ 188,547,000
Cost of Disposal per Ton to County												**$ (97.79)**	

Notes - County's collection cost from point of generation to the WTS not included

* Transfer fee paid by WMI/ WCF to the County for waste delivered to County transfer station.

Related to the potential for a larger regional waste-to-energy facility, the responses from FPL (1,480,000 TPY overall), FCC (1,760,000 TPY overall) and Insoftel (1,600,000 TPY overall) have not recommended a larger regional waste-to-energy facility within their responses. Their responses are all nominally in-line with the originally specified 4,000 tons per day facility.

1.2 MIAMI-DADE COUNTY RESOLUTION R-198-25, SECTION 3

"This Board directs the County Mayor or County Mayor's designee to maximize input from industry sources and to disclose to the Board all efforts made to maximize such input, identify all industry sources from which information and recommendations were received, and disclose all recommendations from industry sources. The County Mayor or County Mayor's designee shall ask waste management industry experts to address the challenges identified by the County Mayor in her January 2025 Report in building a new WTE facility."

Pursuant to Section 3, the County Strategic Procurement Department and AtkinsRéalis have compiled and distributed a set of questions on March 7th, 2025, titled "Market Research for Municipal Solid Waste Management Solutions" to over 125 waste management industry experts for their response. These questions were also posted on the Department of Solid Waste Management website from March 7th until the response due date of April 14th. This Market Research effort requested members of the wider waste management industry to explore all available commercial options at any location with the goal of managing the County's waste.

The County has received thirty-eight (38) responses from companies and groups of companies which have been divided into categories that best represent their technology solutions for analysis:

- Six (6) Waste-to-Energy
- Five (5) Landfill and Disposal
- Ten (10) Material Recovery and Recycling
- Four (4) Organic Waste, Composting and Anaerobic Digestion
- Seven (7) Advanced Thermal Conversion
- Four (4) Alternative Technologies
- Two (2) Single Constituent Solutions

In the effort to comprehensively review each response received, a SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats) has been completed for each of the respondents and is detailed within Section 3 of the body of the report below.

The following are high-level summaries of the above categories:

Waste-to-Energy Summary of Industry Responses

Several entities submitted responses that included WTE as one of the offerings to handle a portion of the 2,400,000 TPY of municipal solid waste to be handled. Out of the six submittals from the Respondents, two of them (FCC and FPL) stand out as moderately complete and with the depth of relevant experience to be considered viable solution providers. None of the respondents provided a specific site where the facility can be located but have offered to work with the County to locate a parcel and work through the challenges of community relations and permitting related issues.

One respondent, Insoftel (Synergy), has provided an adequately detailed response to be considered a viable option for further discussion. Additional details related to their execution partners and other team members are not available at this time, but their response also merits further investigation.

Giant Green Leaf and Frontline Waste have provided responses that address a portion of the County's overall waste stream. Giant Green Leaf's solution currently exists as a small pilot plant; scaling up to meet the required capacity by the County may encounter a few challenges.

Frontline Waste is an equipment manufacturer and will need to team up with other groups to provide a complete solution.

WEF Innovations LLC stated that they transform daily waste into energy, food and water; however, they did not address most of the items listed in the questionnaire. Although they are not providing a complete solution, they may be able to supply systems that augment existing infrastructure. WEF's submittal did not provide any estimated cost data, specific offering, required acreage, timeline, information about the company, its execution partner's funding model or installed base. WEF's offering falls short of meeting the threshold as a complete solution provider.

Below is a summary of the respondents. Please refer to Table 1.2-1 below for additional summary details of the individual SWOT analysis of each response as well as Section 3.1 for the individual SWOT analyses for the Waste-to-Energy category.

Table 1.2-1 – WTE Respondent Summary Overview

Waste-to-Energy	Throughput (TPD & TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Cost ($/ton)
FCC, MasTec, Babcock & Wilcox (B&W) (Operating in US)	1,000,000 TPY to WTE 550,000 TPY - Bulk & C&D Waste Recycle 150,000 TPY - Composting 60,000 TPY - MRF Recycle 600K TPY going to Landfill	50 to 80 Acres for Ecopark	WTE - $1,500M to $1,900M Bulk & C&D Waste Recycle - $40M to $60M Composting - $10M to $15M MRF Recycle - $60M to $100M Landfilling cost per current arrangement (see table 5.1-2 for estimates)	The EcoPark will take approximately 4 to 8 years Permitting - 1 to 3 years Design build – 3 to 5 years Operations - 25 to 30 years WTE - 3 to 5 years MRF - 2 to 4 years Bulk Facility - 2 to 4 years Composting - 2 to 4 years	200+ employees to fully staff the Ecopark	WTE - $45 to $75 Bulk & C&D Waste Recycle - $40 to $60 Composting - $35 to $50 MRF Recycle - $60 to $100 Landfill Per current arrangement (see table 5.1-2 for estimates)
WEF Innovations (No current US Operations)	Not provided.	Not provided.	Not provided.	Not provided.	Not provided.	Not provided.

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Waste-to-Energy	Throughput (TPD & TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Cost ($/ton)
Insoftel -Synergy Conversion Solutions (No current US Operations)	4409 TPD of municipal solid waste (MSW) (1,609,375 TPY) 790,625 TPY to Landfill	~ 99 Acres	Waste-to-Energy facility is between $1.625 to $2.1 billion USD	Schedule based on Modular expansion: 25% operational capacity - Year 2 50% operational capacity - Year 3 75% operational capacity - Year 4 Full operational capacity - Year 6	90+ direct jobs, including 20+ highly trained technicians	Annual maintenance expenditures are projected at approximately $35 million USD; $22/ton
Giant Green Leaf (Evergreen Technology) - (Pilot plant in Manitoba, Canada; No US operations cited.)	Waste-to-Energy – 184 TPD waste processed per module. 6 modules proposed for 1,100 TPD (401,500 TPY). 40 MW electric or 70 MW thermal. 18-22 modules required for 4,000 TPD goal 1,998,000 TPY to Landfill to make up the difference to 2,400,000 TPY	A typical 570MM UWTE system (1,100 TPD) requires ~12 acres for full operations. A system capable of processing 4,000 TPD (Miami-Dade's estimated need) would require ~ 28-37 acres	For a single 570MM UWtE facility (6-module system), the total estimated capital cost is approximately: ~USD $306.43 million from engineering to operation	Feasibility & site Selection - 6 months Permitting 6 to 9 months Design and Engineering - 4 to 6 months – Parallel with Permitting Construction - 12 to 18 months Commissioning and Start-up - 2 to 3 months Total time to operation 24 to 36 months	Operation of the plant will support 60 personnel,	System maintenance and support is estimated at $8.3 million per year + $6.7 M for personnel; total 15 M USD; $38/ton

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Waste-to-Energy	Throughput (TPD & TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Cost ($/ton)
Frontline Waste (No current US Operations)	Modular, slow-pyrolysis waste-to-energy systems Smaller-scale (say 10,000 TPY) for under $4M as a pilot (the JF20 System) and could eventually be scaled up to divert between **300,000 tons and 450,000 tons** of non-recyclable plastics, paper and green biomass waste per year.	Not Provided.	The total deployed CapEx cost would be between $70M to $120M for 10 to 15 JF60 Systems depending on actual waste tonnages	Full deployment of these modular systems would occur within 36 months, depending on a phased approach, as each new system has an estimated 12 month build time.	Not provided.	Not Provided.
Florida Power & Light (FPL), Kanadevia Inova, ReWorld Holding Corp., CDM Smith Inc. (Existing US Operations)	The overall solution offered is for 2.4M TPY -1,300,000 TPY to WTE -180,000 TPY - Anaerobic digestion w/composting -600K TPY going to Landfill.	40 to 60 Acres	Based on FPL's industry experience, the county's cost estimates for the identified sites are within industry standards and align with projections previously provided by the county's experts. (See table in Section 5.1.1.4)	Development of a new WTE facility typically occurs over a 7 to 10-year timeframe contingent upon several key milestones	The new WTE facility will employ between 90 and 110 highly skilled employees in supporting long-term operational and maintenance requirements	Based on FPL's industry experience, the county's cost estimates for the identified sites align with projections previously provided by the county's experts. (See table in Section 5.1.1.4)

Landfill Summary of Industry Responses

Landfills are typically part of a Solid Waste Management System (SWM) plan. In response to market research, five (5) vendors submitted their responses to the questionnaire and offered contracted airspace at their landfills as one of the potential solutions for managing waste generated in the County. A snapshot of their responses is provided in Table 1.2.3 for quick reference.

Of the five service providers, Waste Management Inc. (WMI) and Waste Connections Florida (WCF) already have agreements in place with the County for the transfer and disposal of waste at their respective landfills as well as disposal at the County's North Dade and South Dade landfills, per their respective agreements. Both these agreements were renewed/ executed in 2025 for another 10-year term. Similar to WMI and WCF, GFL Environmental (GFL) is another firm with wide service network across North America providing collection, transfer, disposal and recycling of solid waste.

Unlike WCF, GFL and WMI; EPIC, who responded to the market research, is the rail transportation and disposal division of Synagro Technologies Inc. and specializes in managing transportation and disposal of waste by rail. EPIC does not own any landfills but has established long term arrangements with several landfill owners and operators across North America which provides them with the ability to transfer waste to those facilities for disposal. They are one of the largest independent waste-by-rail service providers in North America with 36 years of experience. As they have noted in their response, EPIC currently has a contractual agreement with the County for transport of biosolids from the wastewater treatment facility.

EnCAP-IT, the fifth responder in the landfill category, is not considered a waste management service provider but is a consulting engineering firm who has offered their engineering design services, should the County be interested in vertical expansion of their landfills using a mechanically stabilized earthen wall (MSE). There could be various approaches for landfill vertical expansion, not just the one proposed by EnCAP-IT, however, any vertical expansion of a landfill is controlled by the underlying geology.

SWOT analyses were completed for all the five responses to provide relative comparatives of the service they have offered. Each of these service providers brings their unique strengths when it comes to waste collection, waste recycling, waste transportation by rail and/or road, waste processing and waste disposal at their owned/contracted landfills. It does provide an opportunity for the County to utilize the contracted airspace from these service providers, as an interim arrangement, while the County works on an informed decision to set the path forward for long term management of solid waste for the County. In terms of any CAPEX, all four service providers (WMI, WCF, GFL, EPIC) have expressed their willingness to invest as required for developing any new infrastructure necessary to deliver their services efficiently e.g., rail spur, strategically located waste transfer facility etc. They are open to private public partnerships as well. Absolute reliance on the contracted airspace although it provides good opportunity for the County to get away from perpetual liability should they own any new landfill, there are always inherent challenges and downsides to this approach. One of the biggest threats to contracted airspace is the uncertainty in the fee structure

which could be binding if the County has not vested in additional alternate option(s). Another aspect which should not be overlooked is the financial health of the firm given the changing dynamics in the global environment. However, these aspects can be addressed via partial reliance on this contracted airspace instead of full dependency.

Table 1.2-2 – Landfilling and Disposal Offering Summary Overview

Landfilling and Disposal	Throughput (tons/hr) & (TPY)	Acreage required	Capital Cost ($)	Timeline	Staff required	Operating Costs ($/ton)
Synagro (EPIC) (Current US Operations)	Rail transport company - can transport any amount Minimum quantity 350,000 TPY	Not required except for setting up rail spur	Cost not provided Private or P3 funding options	9 months	County staff not required	Not provided.
Waste Management Inc. (Current US Operations)	Current Agreement – Up to 2,000,000 TPY at Okeechobee and 700,000 TPY at Medley Landfill. Additional Capability – 1,000,000+ TPY as needed. Options available for organic processing, composting and single stream recycling	All infrastructure in place for landfill current and future capacity. Rail extension to landfill required. Require a property for transfer station	Cost to relocate intermodal facility and add transfer station	6 months to acquire additional waste containers	Not provided.	Existing contract rates established (See Table 1.1-1 on Page 11)
Waste Connections Florida (Current US Operations)	Current Agreement - up to 312,000 TPY with ability to increase capacity Material sorting	All infrastructure in place for landfill current and future capacity. Rail extension to landfill required and spur at Transfer station in development	Not provided.	Not provided.	Not provided.	Existing contract rates established (See Table 1.1-1 on Page 11)

Landfilling and Disposal	Throughput (tons/hr) & (TPY)	Acreage required	Capital Cost ($)	Timeline	Staff required	Operating Costs ($/ton)
GFL Environmental (Current US Operations)	"GFL anticipates having a disposal option for MD that will meet the needs of MD" Options available for composting, recycling and landfilling	Not provided	Not provided. Private funding	Not provided.	Not provided.	$70-75 / ton
EnCAP-IT (Developed solutions for US clients)	Not provided. Extending airspace capacity at North Dade and South Dade Landfills	N/A	Not provided.	Not provided.	Not provided.	Not provided.

Material Recovery and Recycling Summary of Industry Responses

Material Recovery Facilities (MRFs) sort and recover recyclable materials, which primarily include plastics, papers and metals in MSW. There are two main types of MRF's: clean, where their inputs are only recyclable materials which are separated from each other and sent to their respective reprocessing facilities, and dirty, which receive mixed unsorted MSW and recover recyclables from it. The former tends to produce higher purity outputs thanks to the source segregation and separate collection which takes place, while the latter typically have less, as there are substantial contamination and reject quantities. This is proven technology, albeit currently in Europe there is a tendency to move away from dirty MRF's due to their low efficiency. Advanced sorting technologies, such as artificial intelligence (AI), robotics and infrared optical sorting have significantly improved efficiency and staff safety, while chemical recycling is an emerging technology with substantial R&D activity, however there are still substantial barriers in output standards and markets which need to be overcome.

Ten (10) companies submitted responses on materials recovery and recycling systems. These companies have offered a wide range of technologies for recyclable material recovery and most of them did not provide high level cost estimates, while their financing structures ranged from full private to full public funding and grants, while no one has specified a location for a single plant that would process Miami Dade's MSW. A large recycling and recovery plant processing 4,000 TPD would be expected to come across significant obstacles in its permitting and consents process, which would potentially impact negatively on its development program, which is also affected by very complex designs, construction processes and supply chains typically required for such assets. The key risks are related to the ability of such plants to manage all the MSW inputs required under this project, rather than only source segregated recyclables, as well as the quality and marketability of their outputs. From our experience from several Mechanical Biological Treatment plants operated over decades in Europe, we have observed that especially soft plastic paper and cardboard materials recovered cannot achieve marketable quality grades or organic outputs are heavily contaminated, thus resulting in substantial proportions of outputs being deemed as residuals and ending up being landfilled, also reducing potential operational revenues and these plants commercial viability.

Table 1.2-3 – Materials Recovery and Recycling SWOT Summary Overview

Materials Recovery and Recycling	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Encina (No current US Operations)	Dirty MRF, waste sorting with waste plastic recycling, can process up to 500,000 TPY	4-5 acres	Not provided.	3-5 years	Not provided. Ops mostly by Encina	Not provided.
Goldfinch (Developing facility in Georgia for 2026)	3,091 TPY	15 acres	Not provided Private funding model	3 years	40	Not provided.
Juno Technology (Current US Operations)	1,100 TPD option to triple capacity with second module waste sorting/anaerobic digestion	30 acres	$325-$400 M private funding model	3 years	75	$20-25M per year
RePower South (Current US Operations)	Dirty MRF, waste sorting, can process up to 500,000 TPY	Not provided, but likely 4-5 acres	Not provided.	3-7 years	Not provided, operation mostly by Repower	Not provided.
Gravitas Infinitum (Carbotura) (No current US Operations)	400 to 4,000 TPD 100% landfilling or 100% material recovery and recycling	3 acres per 100 TPD of capacity	$200-2,0000MM - payment & waste guarantees required	24 months	Not provided.	Fee based revenue model

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Materials Recovery and Recycling	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
AMP Robotics (Current US Operations)	25 tons/hr per module landfill and recycling	Depending on agreed quantity of waste to be processed	Not provided Public or private funding model	30 months	Not provided.	Not provided.
Upland Road (No current US Operations)	2,000 – 2,400 TPD material recovery and recycling	150 acres plus 15 acres for recycled paper mill if adopted	$2750M P3 development opportunity	36 months Phase 1 48 months Phase 2	300	$425 - $450 M per year Tipping Fee: $65 - $75/ton
Novastus (Current US Operations)	1,920 TPD material recovery and solid fuel conversion for transport to PC boiler	5 acres plus storage	$90 M option for public or private funding	36 months	22	$70/ton public ownership option
EcoPods Miami (Pilot-scale US Operations)	pilot scale modular - novel technology sorting/anaerobic digestion to produce synfuel	< 1 acre per module co-located at existing landfills	$5M per module staged P3 financing option	5 years for scaled up facility	Not provided.	Not provided.
Fetch Waste Solutions (Operating in Ohio, USA)	400,000 to 1,000,000 TPY mixed waste processing	6 acres plus storage/handling	$140M for 1M ton per year private funding	24 months	Up to 90	$40-50 per ton plus 20% of recyclables

Composting and Anaerobic Digestion Summary of Industry

Organic wastes are classified in two broad streams: food and green wastes. Their treatment is done with aerobic processes which produce compost and Anaerobic Digestion, which produces digestate, liquors and biogas, which can be either sent to the gas grid or used for electricity generation. Aerobic processes are undertaken either in open areas with windrows and aerated static piles or with in-vessel systems, where the treatment takes place within enclosed reactors. All these technologies are fully proven for source separated organic waste; however, it is noted that Anaerobic Digestion is more sensitive to feedstock composition and variability as it is a more complex process.

This category of aerobic and anaerobic technologies processes exclusively source separated organic waste management and does not, therefore, cover the needs of the County for full treatment of 4,000 TPD of MSW. Aerobic processes (composting) have been successfully used for several decades for food waste and yard waste, while anerobic digestion has less flexibility with regards to input fluctuation and quality.

None of the organic process providers provided complete sets of information, while two are relatively large companies with international experience. Revenue can be generated through the sale of compost and biogas; however their markets are typically volatile, and these proceeds would be extremely difficult to recover the substantial CAPEX investment required for the development of plants of the scale required for Miami-Dade County. End markets will need to be developed for compost products, preferably local consumers, to avoid transportation costs. Collection of yard and food waste will need to be separated and adds to the cost of operating this category of technology.

Table 1.2-4 – Organic Waste, Composting, and Anaerobic Digestion Offering Summary Overview

Organic Waste, Composting, Anaerobic Digestion	Throughput (tph) (TPY)	Acreage required	Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Sustainable Generation (Existing US Operations)	Scalable	4-5 acres but will depend upon organic waste quantity to be composted	Not provided.	Not provided.	Not provided.	Not provided.
Orlando Bioenergy (Project development in Orlando and North Carolina)	500,000 to 1,000,000 TPY organic materials	20 acres	$100M Private Funding	3.5 years	Not provided.	Not provided.
Your Soilmate (Existing Service in Miami)	500 gal/week [approx. 37 tons per week] pick up and composting	7 acres	Private Funding	0.5 years	Not provided.	$592/month [approx. $4/ton]
Envisions Holding (Existing US Operations)	130,000 TPY mixed organics composting	30 acres [estimated from Everett, WA facility using Google Earth]	Private Funding	1 years	Not provided.	Not provided.

Advanced Thermal Conversion Summary of Industry Responses

Advanced Thermal Conversion is a suite of technologies which is considered as an alternative to moving grate and fluidized bed, which are very widely spread in the US and the rest of the world for the recovery of energy from the mass burn of MSW, residual and waste fuels. These technologies include gasification, pyrolysis and plasma arc. They have very limited applications on MSW and are preferred for specific feedstock streams with very limited variability in their composition and properties, such as plastics and waste tires. Their outputs also tend to differ from moving grate, as they produce syngas, chars, slags, biofuels, oils and hydrocarbon compounds, as well as various other gases.

Seven respondents provided solutions based on Advanced Thermal Conversion (ATC) technologies which include pyrolysis and gasification. The key reported strengths related with the ATC technologies are the production of multiple outputs including syngas, biofuels and aggregates.

The weaknesses which were identified in the responses provided were significantly more than the strengths and fully in line with what the current broader ATC market. These technologies have very complex operations and no information was provided that would increase one's comfort that these risks would not materialize for Miami-Dade. The options in the responses can only process very limited inputs and waste streams, which could render them inappropriate for Miami-Dade with its 4,000 tons of MSW per day which requires treatment. Moreover, the limited input waste streams require pre-processing in most cases, which would mean additional investment and land needed to implement them in Miami-Dade. Scaling them to Miami-Dade requirements would be a potentially unsurmountable challenge as the unit sizes are small ranging from 3 to 50 tons/hr. The key weakness that was identified was the lack of project references for ATC and there was no ATC provider with a track record or financial standing and company size that would have a good risk profile for Miami-Dade.

Table 1.2-5 – SWOT Overview Advanced Thermal Conversion

Advanced Thermal Conversion	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Bradam Energies (Developing Projects in North America)	Each CER system is a process line @ 12.3 tons/hr	5 acres for north landfill, 17 acres for south landfill	Not provided. private or P3 funding	6mo. for contract development with MD, 6mo. for permitting, 36 months construction	Bradam responsible for O&M	Not provided.
Tritor Energy (No current US Operations)	600 TPD material sorting, recovery and RDF production	1.48 acres	$12 million per unit	0.75 years	Not provided.	Not provided.
Spartan Holdings (Existing US Operations)	150 TPD LDPE/plastic pyrolysis to syn fuel or power generation	<1 acre	$25 to $60 million depending on feedstock public or private funding options	1.2 years	10 to 12	Not provided.
C6 Energy Services (Operating in many countries)	2,750 TPD material sorting, option for syn fuel, electricity production	7.41 acres	$1,100 million	Not provided.	Not provided.	$420/ton
Wastaway (Existing US Operations)	15.98 tons/hr	50,000 sqft building	Not provided.	24 months	16 hours /day	Not provided.

Advanced Thermal Conversion	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
TECAM / BFS Spectrum Tech (No current US Operations)	30 tons/hr Thermal treatment plus cogen	4-6 acres	$230 Million process, balance of plant, and civil private and public funding option	Contract to operational in 18-24 months	Two operation personnel required	Not provided.
Globe Guard Technologies / INTEC (No current US Operations)	Syngas production from organic waste 3.3 tons/hr conditioned waste per reactor, 4200 TPD total for two plants	29.6 acres	$1,518 million at US$1.13/Euro	3.5 years	Not provided.	Not provided.

Alternative Technologies Summary of Industry Responses

The respondents also included in the technologies that they can offer some alternative options from conventional thermal, biological or mechanical treatment, which are analyzed in the previous sections. Four responses were provided, which would be classified as alternative technologies. These range from educational applications to greenhouse type facilities and baling equipment and plants.

Cambridge Technologies provides a baling technology, which can bulk waste and allow it to be temporarily stored. The bulk waste can be easily transported and used as fuel for waste to energy plants. Cambridge Technologies claims to possess a rich set of project references. However, this is a pre-processing, storage and logistics solution, which does not cover the totality of the MSW management stages from collection to process and residuals disposal, so it can only be considered as an initial stage of the overall waste management system for Miami-Dade.

The other respondents did not provide relevant solutions to Waste Management demonstrating capacity, experience or financial standing that would enable them to deliver a large project that would process 4,000 TPD.

Table 1.2-6 – Alternative Technologies Offering Summary Overview

Alternative Technologies	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Cambridge Project Development (No current US Operations)	Scalable @ 420 TPD per unit - MSW baling for export	<1 acre	$1M per unit DWM funding	2 years for 12 units	Not provided.	$5/ton plus transport
Green Energy Solutions LLC (No current US Operations)	700 TPD - hybrid with farm 500 TPD standard WTE	Not provided.	$230 M total project cost - hybrid	1.5 years	Not provided.	$72.01/TPY Hybrid w/farm
Skyscraper Farm (No current US Operations)	Not provided.	Not provided	Not provided.	Not provided	Not provided.	Not provided
Scrapp (No current US Operations)	Software solutions	N/A	Not provided.	0.5 years	Not provided.	$150,000 per year

Single Constituent Solutions Summary of Industry Responses

Other technologies which can offer a specific method to manage waste are classified as single constituent solutions, as they would not be considered as standalone means to waste management.

Two respondents proposed solutions that specialize in one specific method for the waste management solution. Recycling Equipment Systems Corporation can reportedly handle 4,000 tons of waste per day; however, they only bulk and bale the waste and do not provide a complete solution for Miami-Dade's MSW. Their solution essentially compacts the waste and transports it along for someone else to handle or process.

Table 1.2-7 – Single-Constituent Technologies Offering Summary Overview

Single-Constituent Technologies	Throughput	Acreage required	Cost ($ millions)	Timeline (years)	Staff required	Operating Cost ($/ton)
Recycling Equipment Solutions Corporation (Existing US Operations)	5000 baling and long-haul	<1 acre	$12-15M	0.5	Not provided.	Low
EcoCa (No current US Operations)	1 ton/hr tires only	<1 acre	$4M	Not provided.	Not provided.	Not provided.

The Market Research questionnaire also requested waste management industry experts to provide recommendations to mitigate the challenges identified by the Mayor in her January 2025 report regarding building a waste-to-energy facility.

The responses from the industry have not included significant responses that would address the challenges identified by the Mayor.

1.3 MIAMI-DADE COUNTY RESOLUTION R-198-25, SECTION 4

"This Board directs the County Mayor or County Mayor's designee to prepare a written report addressing all the directives set forth in this resolution. The County Mayor or County Mayor's designee shall submit and place on an agenda of the full Board without committee review pursuant to Rule 5.06(j) of the Board's Rules of Procedure, such report within 120 days. To the extent that the Board had previously directed the County Mayor or County Mayor's designee in Board items passed within the last 45 days to prepare and submit reports to the Board on waste disposal options, such reports shall be consolidated into the report and information due within 120 days pursuant to this resolution."

Pursuant to Section 4, this report serves as one part of a larger report compiled by the Department of Solid Waste Management staff.

1.4 MIAMI-DADE COUNTY RESOLUTION R-190-25, SECTION 2

"WHEREAS, in the absence of a County Commission-approved solid waste master plan, the Board of County Commissioners directs the administration to use the information provided by AtkinsRéalis, along with the Department's current initiatives and Board-approved actions, to present an alternative plan for Board consideration that details options in the event of fluctuations in the cost of current and/or approved waste management solutions,

Section 2. Directs the County Mayor or County Mayor's designee to request and receive from AtkinsRéalis: (a) market research; (b) financing/procurement options; (c) alternative delivery methods; (d) updated EPA permitting and funding options; (e) state and local funding options; and (f) a report detailing said information, to the extent legally permissible. The County Mayor or Mayor's designee shall prepare a report containing the foregoing for Board consideration within 30 days of the adoption of this resolution. The completed report shall be placed on an agenda of the full Board without committee review pursuant to Rule 5.06(j) of the Board's Rules of Procedure."

Pursuant to Section 2(a), the County Strategic Procurement Department and AtkinsRéalis have compiled and distributed a set of questions on March 7th, 2025, titled "Market Research for Municipal Solid Waste Management Solutions" to over 125 members of the waste management industry for their response. These questions were also posted on the Department of Solid Waste Management website from March 7th until the response due date of April 14th. This Market Research effort requested members of the wider waste management industry to explore all available commercial options at any location with the goal of managing the County's waste.

Pursuant to Section 2(b) and 2(c), please refer to Section 2.1 below which describes the procurement options available to the County per the Strategic Procurement Department as well as analysis provided by AtkinsRéalis related to these options.

Pursuant to Section 2(d), the EPA permitting update is shown in Section 2.4. Recent developments in EPA permitting suggest a more favorable regulatory environment for Waste-to-Energy (WTE) and Landfill Gas-to-Energy (LGTE) projects. The previous administration postponed stringent Maximum Achievable Control Technology (MACT) standards due to feasibility concerns, and the new administration froze regulatory actions for further review. EPA has since reopened the comment period, enabling industry groups like MDC to submit feedback by May 30, 2025. Additionally, the Solid Waste Association of North America (SWANA) raised critical industry concerns, prompting EPA's engagement and policy updates. The agency reaffirmed landfill regulations, emphasized WTE's role in waste management, and allocated over $165 million for battery recycling and fire prevention. With collaboration replacing uncertainty, prospects for WTE and LGTE projects have improved, restoring confidence in financing and permitting under more practical emission standards.

Pursuant to Section 2(e), State and Local funding options have been researched with the primary result being the existence of SB 1764, which was passed during the 2022 Legislative Session. This bill aims to provide financial assistance and incentive grants to

Counties who operate waste-to-energy facilities. The bill was introduced with an annual $100M annual funding but was passed with the funding removed.

Pursuant to Section 2(f), this report serves as the report requested.

1.5 MIAMI-DADE COUNTY RESOLUTION R-190-25, SECTION 3

"The County Mayor or County Mayor's designee is directed to develop and present an alternative solid waste management plan for Board consideration. This plan shall use the information provided by AtkinsRéalis, the Department's current initiatives, and previously approved Board actions. The plan must address:

(a) Potential cost fluctuations in current and/or approved solid waste management options

(b) Strategies to manage and mitigate these cost fluctuations

(c) Recommendations for incorporating new waste management methods or technologies."

Pursuant to Section 3, the project team has reviewed available information, specifically, previously issued reports. This data, including a review of the 2020 Solid Waste Management Master Plan from HDR, formed the basis for the "alternative solid waste management study". Newer data from current operations, waste characterization studies, information developed from the Market Research effort, and existing solid waste management master plans from comparable municipalities selected by the project team were used to supplement the historical reports. This full document is detailed in Appendix B.

The team has utilized the available data to generate a high-level summary of the existing state of solid waste management within the County for use as a baseline. The team has established a 30-year planning period divided into three equal 10-year increments to develop a list of studies, policies and projects that could be implemented to improve and adjust current waste management practices and allowed appropriate assessment of individual risks/mitigation strategies for possible or probable cost fluctuations to the existing plans and methods to mitigate them, as these differ between those three ten-year periods.

Possible enhancements to the current waste management systems have been identified for their progressive implementation over a 30-year period based on their best-fit for the 10-year sub-period. A general overview of the potential impacts to the existing waste collection system pursuant to those enhancements has also been assessed.

These suggestions are based on proven, mature programs, policies or processes that other, similar municipalities (in population, geographic size and/or constraints) have implemented. Comparisons will be limited to municipalities within the United States of America and Canada to ensure that compatibility with cultural habits in waste management can be achieved.

The outcome from this limited scope study will consist of a conceptual strategic plan / guidance document to assist the County with additional information as requested in Resolution 250174 (R-190-25). It is believed that the County may utilize this information to plan for additional detailed studies and/ process evaluations as may be necessary to further strengthen their approach to solid waste management going forward. Timelines for the recommendations are generated in 10-year windows from 0-10, 10-20 and 20-30 years.

The end-product deliverable therefore includes:

- Summary of the current state of solid waste management in Miami-Dade County.
- High-Level Financial Risks analysis and mitigation.
- Recommendations for detailed additional studies
- Recommendations for completing a comprehensive SWMMP.

As additional background information, an overview of the current Waste Characterization from a recent on-site study performed by SCS Engineers has been provided in Appendix E for reference.

2. RESOLUTION 250538 (R-198-25), WASTE-TO-ENERGY ANALYSIS

2.1 PROJECT DELIVERY OPTIONS

From Miami-Dade County Strategic Procurement Department staff:

Traditional public procurement methods for a construction project typically involve utilizing either a Design/Bid/Build (DBB) or Design/Build (DB) delivery model. In both models, only the design and construction of the project are addressed. The later phases of the project (i.e., operation and maintenance) are addressed either by the public agency performing the work or contracting with one or more private entities to perform the work.

In an alternative procurement method for a construction project via a Public Private Partnership (P3), the public agency will use a Design/Build/Finance/Operate/Maintain (DBFOM) delivery model, which can also be used in various combinations such as DBF, DBFO, DBFM or DBOM. However, it should be noted that whether or not the finance component is included in a P3 may impact the interest in the project for certain firms.

A simple definition of a P3 is a contractual agreement between a public agency and a private entity for a project that involves the private sector sharing risks and rewards with the public sector in order to deliver services or facilities. In the context of a construction-related P3 project, Section 255.065, Florida Statutes, Public Private Partnerships defines a Qualifying Project which can be summarized to be a facility or project that serves a public purpose; any public facility or infrastructure that is used or will be used by the public at large or in support of an accepted public purpose or activity; or that supports a service delivery system in the public sector. For projects that involve a facility owned or operated by the governing board of a county, a Qualifying Project also means only those projects that the governing board designates as such.

Section 2-8.2.6 of the Miami-Dade County Code, Public Private Partnerships; Unsolicited Proposals defines a P3 as a contractual arrangement between the County and a private entity to Design, Build, Finance, Operate, and/or Maintain (DBFOM) an improvement by the private entity with the public improvement remaining in County ownership and control or reverting to County control at the end of the contract term. This section of the Code further divides a Qualifying Project into either a P3 Qualifying Project or a Non-P3 Qualifying Project. To designate a P3 Qualifying Project, the Board of County Commissioners would adopt an Authorizing Resolution. A Value for Money (VfM) analysis is required for all P3 Qualifying Projects prior to publication of a solicitation. A VfM is the best practice when considering options for large projects and is used to compare the project lifecycle financial impacts of a P3 method of delivery with the financial impacts for a traditional method. This section of the Code also addresses unsolicited proposals submitted to the County for Qualifying Projects. A Non-P3 Qualifying Project means a project is received as an unsolicited proposal and approved for publication but is not designated to follow the requirements for a P3 under this section of the Code.

Analysis by AtkinsRéalis is as follows… P3 models have been used across a wide range of asset classes, including waste-to-energy. The primary benefits of using a P3 procurement model relative to a traditional procurement model are:

1. Risk transfer to a private partner to finance, deliver, operate and maintain (or, as noted above, a different combination of these activities) a new facility under a long duration, fixed-price, performance-based contract.
2. Transfer of financing obligations to the private partner. The public partner will have long-term payment obligations, rather than payment of the full cost of design and construction upon completion of the facility.
3. Long-term certainty over operational costs

Considerations associated with using a P3 model include:

1. Complexity:

   Using a P3 model introduces an additional level of complexity due to the nature of agreements required for a long-term contractual arrangement and the introduction of private financing. Under non-recourse project financing, common to P3s, lenders perform extensive due diligence on the project structure, developer and contractors, revenues and expenses, technology risk, adequacy of insurance, project security, and suite of contract documents. Reliance on debt means that project revenues must be reliable, putting a high level of scrutiny on the expected operational performance and reliability. Processing technologies that have multiple deployments and long performance track records help attract a broader range of project lenders and improve competitiveness of costs by decreasing risk premiums. A well developed and structured project, and project documents will facilitate interest from both developers and lenders.

2. Understanding Revenue Dynamics:

   Analyze projected cash flows from tipping fees and energy sales and any other byproduct sales revenues. The sensitivity and certainty of treated volumes, operating costs, sales revenues will have a direct impact on financing availability and cost. This analysis helps in structuring attractive financing arrangements and clarifying risk during negotiations.

3. Engagement with Lenders:

   Understand the perspective of financial institutions regarding WTE projects. Conduct a market sounding with the lending community to identify their requirements regarding revenue components and revenue stability, creditworthiness, and the project's overall risk profile.

4. Performance Metrics and Accountability:

   Develop performance metrics tied to tipping fees, energy output, and environmental impact. Clearly articulated performance standards in contracts incentivize the private partner to exceed baseline expectations.

5. Community Involvement and Acceptance:

   Stakeholder engagement is crucial in successful WTE projects. Implement strategies for community outreach and feedback to address possible concerns, fostering public trust and support, and any risks to project schedule.

6. Market Analysis for Pricing Strategies:

   Conduct a rigorous market analysis to assess electricity pricing forecasts and the potential impact on revenue. This analysis can inform risk-sharing discussions and support financial viability.

7. Flexibility Clauses:

   Include flexibility within the P3 agreement to adapt to changing market conditions, regulations, or technological advancements, ensuring the facility can adjust to unforeseen circumstances or leverage new opportunities.

8. Long-Term Relationship Management:

   Establish governance structures for managing the long-term relationship with the private partner, ensuring that both parties are aligned throughout the partnership's duration.

9. Form of P3 Model:

   The most common form of P3 would include a full DBFOM arrangement, which would typically be entered into following a procurement period lasting at least 12 months, including an RFQ shortlisting phase and an RFP phase that results in a fixed price for design, construction, O&M and committed project financing. In some cases where the public sector is not looking for private financing, but the integration of delivery and operations and maintenance can provide benefits, particularly in cases where the technology suppliers are integral in both phases of the project (e.g. transit systems, water treatment, and potentially WTE), DBOM models are sometimes employed. For projects with long or complex development periods and that would benefit from including input from the eventual private partner, and/or where it is difficult for bidders to develop a fixed price given the status of the project development, a progressive DBFOM model could be considered. This allows for a separate collaborative development period through an interim agreement to enable additional project definition/development, risk analysis and requirements definition prior to locking into a final fixed price under a comprehensive agreement. This model is less common and used selectively by procurement agencies. It has the potential benefits of more transparent pricing and efficient risk transfer but also places additional demands and complexity on the procuring agency to execute successfully.

2.2 INDUSTRY INPUT FOR WTE FACILITY

Market research data from several entities with WTE as the primary offering are summarized hereinafter. Out of the six submittals reviewed, two namely FCC and FPL stand out based on the strength of the consortium team, depth of relevant experience and completeness of their offering. Insoftel (Synergy conversion solutions) provided an RDF WTE offering and addressed most of the items listed on the questionnaire. Giant Green Leaf also provided WTE as the primary offering. Additional discussions are required to define the offering further and have clarity. Front line waste is a manufacturer of equipment and WEF Innovation LLC did not provide verifiable operating plant data and lacked some of the details required in the questionnaire. None of the respondents provided a specific site where the facility can be located but several have offered to work with the County to locate a parcel and work through the challenges of community relations and permit-related issues.

Refer to Appendix F – Waste-to-Energy Respondent Summary Table which provides a summary with details of the offerings by the WTE respondents.

2.2.1 FCC, MASTEC, AND BABCOCK & WILCOX (B&W)

FCC Environmental Services
MasTec - EPC Contractor
Babcock & Wilcox (B&W) - Equipment supplier
Technology:

- Waste-to-Energy (Mass Burn) Facility - 1M TPY - This includes Incinerator Bottom Ash (IBA) treatment for bottom ash recycling to process ash reuse & metal recovery - Balance of ash to Landfill
- Material Recovery Facility (MRF) - 60K TPY - 24K TPY residue to WTE Green transportation of product streams
- Bulky Waste Processing Facility - 550K TPY This includes C&D Waste 150K TPY residue to WTE
- Composting Facility - 150K TPY Composting 30K TPY residue to WTE

Overall Assessment:

- The FCC Consortium brings forth a robust team with depth and relevant experience to provide a reasonable solution for the County's waste management handling.
- FCC's response includes leveraging the project for a new build finance rate model which will likely include non-recourse financing. This will be impacted by the financial climate at the time these negotiations commence, the prevailing commercial interest rate and the inflation rate at the time.
- B&W provided the equipment for the WPB Renewable Energy Facility 2; REF facility which was completed in 2017 among other US based WTE installations. This provides relevant and relatively recent experience for an installation in Forida.
- FCC is prepared to handle land acquisition working with the County but did not offer any parcel of land.
- The overall solution offered is for 2.4M TPY with 600K TPY going to Landfill. 1M TPY to WTE, and the remainder to composting, MRF and Bulk recycling facilities as part of the EcoPark.
- FCC provided a range of estimates for the proposed waste handling solutions. See excerpt at the end of this table.
- Feed for Composting, MRF and bulky waste recycling need to be pre-sorted and provided to FCC.
- Overall, the acreage required will be more than what the FCC estimate indicates for the proposed EcoPark.
- The overall timeline provided does not appear to be adequate and needs further review.
- Power purchase agreement, and grid interconnection will need to be negotiated with FPL.
- Financial arrangement with revenue stream sharing from electrical generation, recycle and recovered material sales will require further discussions and negotiations.
- **FCC Environmental Services (FCC)** has agreed to purchase Wheelabrator South Broward Inc., which owns the South Broward Waste-to-Energy (WTE) Facility in

Fort Lauderdale, Florida, from **WIN Waste Innovations**. The transaction is anticipated to close in the second quarter of this year, marking FCC's strategic expansion into the U.S. waste-to-energy sector.

- The P3 arrangement must meet County requirements including Section 255.065, Florida Statutes, or Section 2-8.2.6 of the Miami-Dade County Code

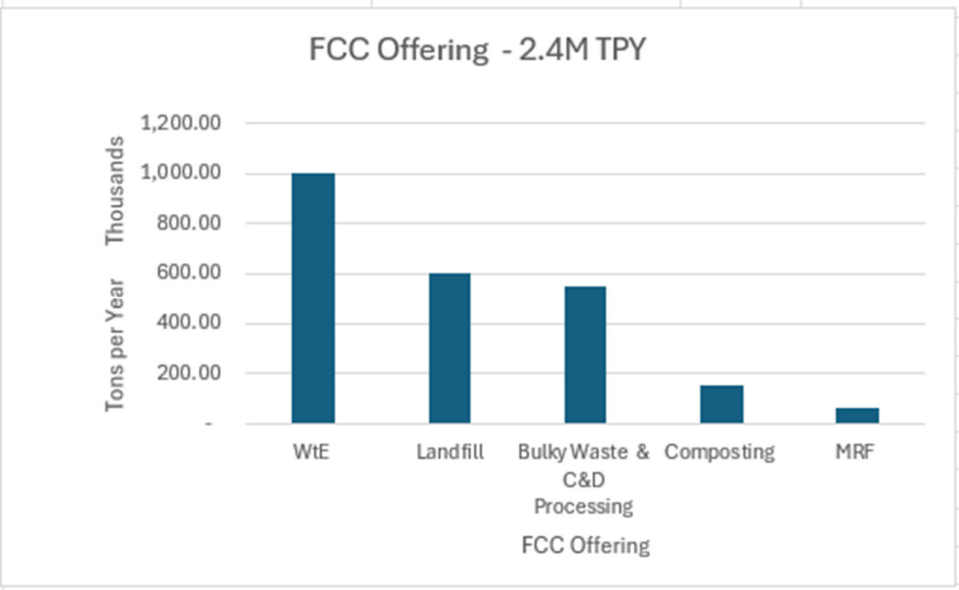

Figure 2.2-1 – FCC's Offering Tons Per Year Relative to Type of Waste Processing

Notes:

1. 10 to 13% of the WTE shall be directed to Landfill as Ash and byproduct of combustion
2. 24,000 TPY residue from MRF directed to WTE facility
3. 150,000 TPY residue from Bulky waste and C&D processing directed to WTE facility
4. 30,000 TPY residue from Composting directed to WTE facility

2.2.2 FLORIDA POWER & LIGHT (FPL), REWORLD, AND KANADEVIA INOVA (KVI)

Florida Power & Light (FPL)- Utility Company
ReWorld Holding Corp; formerly Covanta Holding Corporation – O&M
Kanadevia Inova (KVI), formerly Hitachi Zosen Inova - Equipment supplier & EPC
CDM Smith Inc. - Environmental Consulting Engineering
Technology:

- Waste-to-Energy (Mass Burn) Facility - 1.3M TPY - Four 1,000-ton-per-day-(TPD) combustion lines capable of processing 4,000 TPD or 1.3 million tons of MSW annually
- An anaerobic digestion system capable of processing over 180,000 tons of organic waste annually - continuously fed high-solids AD system with digesters based on

Kompogas AD technology capable of processing up to 500 tons per day (180,000 TPY) and a state-of-the-art three-stage membrane technology.

Overall Assessment:

- The FPL Consortium brings forth a robust team with depth and experience to provide a reasonable solution for the County's waste management handling.
- FPL appears to be in a strong financial position based on their own assertion to access numerous low-cost debt options which could be a benefit to the County.
- KVI does not have a complete WTE facility in the US but has several installations worldwide including the 5500 TPD facility recently completed in Dubai. The Wheelabrator fleet of WTE plants all have KVI's grate and combustion technology in the US installations.
- FPL expects the County to acquire the land and lease back to FPL.
- The overall solution offered is less than 2.4M TPY. FPL is offering a waste to Energy Facility in conjunction with an anaerobic digestion system with the balance to be handled by the contracted landfill capacity.
- No cost estimate provided however FPL has confirmed that previous cost estimates provided by the County's consultants appear to be typical for the industry.
- Feed for the Anaerobic Digester needs to be pre-sorted and provided to FPL.
- Overall, the acreage required likely larger than what the FPL estimates
- While a plant may operate for 30 or even 40-plus years, most operations contracts are for 20 years or less. This model puts Miami-Dade County in a difficult financial position in year 20 when prices are subject to change, or capital contributions may be requested. Partnering with FPL in a P3 model eliminates this process and provides cost certainty for the county over the life of the facility. This will avoid contract negotiations with the O&M entity and thereby avoiding more than expected price escalation.
- FPL has cited the 2018 MDC, FPL collaboration for the clean water recovery project among other projects where the collaborative effort has rendered successful projects.
- The P3 arrangement should meet County requirements including Section 255.065, Florida Statutes, & Section 2-8.2.6 of the Miami-Dade County Code.
- The following items may need to be taken into consideration for the negotiations with FPL. This is not an exhaustive list
    - Power purchase agreement, and grid interconnection can be streamlined as both will be with the same entity
    - Tipping fee arrangements with offsets for land lease back and revenue stream from electrical generation, recycling and recovered material sales will require further discussions and negotiations. Tipping fees are expected to be elevated due to high capital recovery and increased operating cost.
    - Net metering may not be possible; however, the County may be able to negotiate the use of the green/environmental credits.
    - FPL will not require a PPA. The project will likely be in the FPL rate base.

- Grid connection requirements will probably not provide any advantages to FPL versus MDC
- Discussions and negotiations regarding federal (IRA), state and local credits

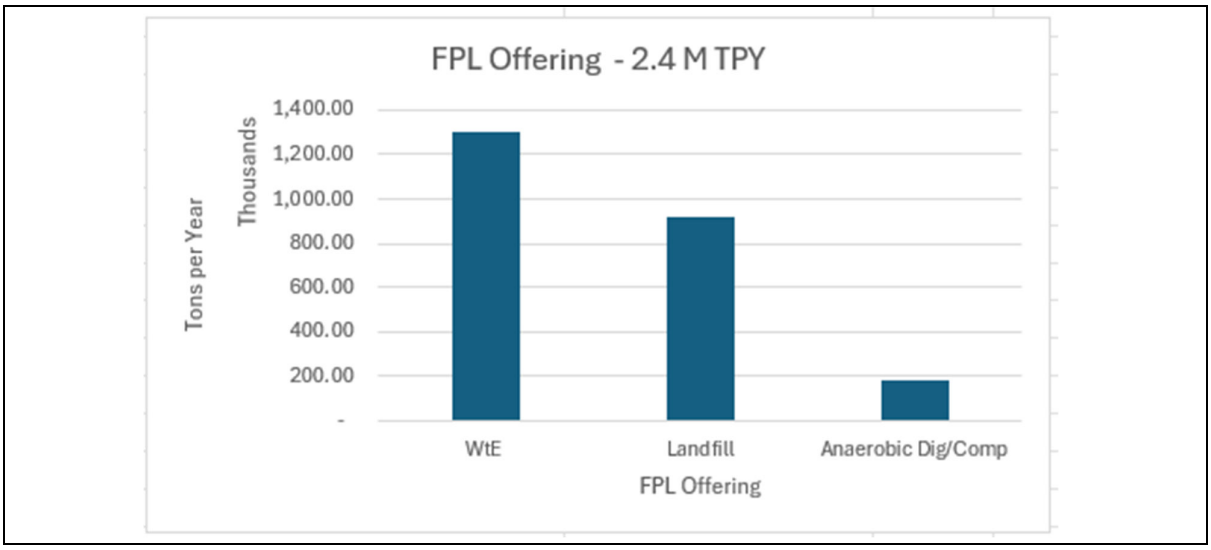

Figure 2.2-2 – FPL's Offering Tons per Year Relative to Type of Waste Processing

Notes:

1. WTE - 1,300,000 TPY
   Estimated 10 to 13% of the WTE shall be directed to Landfill as Ash and byproduct of combustion
2. 920,000 Landfill
3. 180,000 TPY Anaerobic Digestion & Composting

2.2.3 Insoftel (SYNERGY CONVERSION SOLUTIONS)

Technology: Waste-to-RDF (Refuse Derived Fuel) and Waste-to-Energy

Overall Assessment:

- The proposed technology seems feasible; however, the respondent has not provided the following information:
  - Number of employees and related experience designing and building the proposed facility
  - Details regarding the partners or groups that will design, build operate and maintain the facility
  - Details regarding previous installations deployed.
  - Details regarding a proposed site for the facility
  - Inconsistency of information provided regarding power production - 160 MW total vs 55Mw per 110 tons of N-RDF

- The proposed facility is engineered to process 4409 tons of municipal solid waste (MSW) per day, equating to approximately 1.61 million tons annually.
- Feedstock - the waste input is non-hazardous and derived from household and commercial sources, exhibiting an average calorific value of 3.78 kWh/kg (1.714 kWh/lb). Prior to conversion, waste undergoes dimensional reduction, ferrous and non-ferrous separation, moisture optimization, and homogenization, forming the basis for efficient N-RDF (Normalized Refuse Derived Fuel) production
- The plant encompasses 37 independent processing modules, each rated at 18 MW thermal power capacity, culminating in a total thermal power output of 657 MW. In parallel, eight ORC (Organic Rankine Cycle) turbines, each producing 20 MW of electrical power, collectively generate 160 MW of electricity. Facility is projected to generate approximately 55 megawatts of net clean power for every 110 tons of waste processed.
- Total land requirements for the WTE installation are 4,300,000 square feet (~99 acres), of which 2,000,000 (~46 acres) square feet are dedicated to covered facility infrastructure
- In addition to power generation, the system is designed to recover approximately 96,600 tons of recyclable metals per year.
- Estimated Cost - The total projected investment for the Waste-to-Energy facility is between $1.625 to $2.1 billion USD, encompassing all engineering, procurement, and construction activities associated with the deployment of 37 processing modules and 8 Organic Rankine Cycle (ORC) turbines
- Annual maintenance expenditures are projected at approximately $35 million USD
- Schedule based on Modular expansion:
    - 25% operational capacity - Year 2
    - 50% operational capacity - Year 3
    - 75% operational capacity - Year 4
    - Full operational capacity - Year 6
- Partnership and Agreement Structure: Synergy is structured to engage in a variety of partnership agreements and operating models including,
    - Synergy sells, builds and commissions a system for an owner (owner funds the project)
    - Synergy sells, builds and commissions a system for an owner (Synergy funds the project)
    - Synergy works with a funder to build and commissions a system for a project sponsor, where the system is owned by the funder and operated by Synergy or by the project sponsor or a third party – as a service project
    - Synergy is open to other project structures.

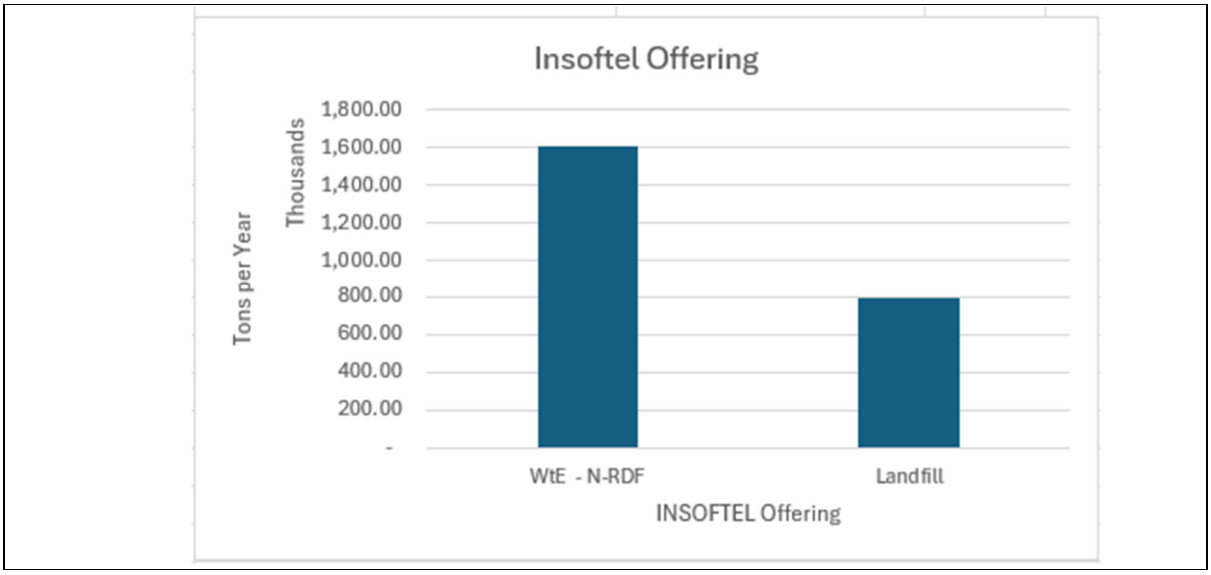

Figure 2.2-3 – Insoftel Offering TPY Relative to Type of Waste Processing

Notes:

1. % of WTE Ash to Landfill not specified by the respondent
2. 790,625 TPY to Landfill

2.2.4 Giant Green Leaf

Technology: Waste-to-Energy

Overall Assessment:

The proposed technology only exists as a pilot plant. Scaling up to capacity will be full of unforeseeable challenges.

The respondent did not include the following information:

- Number of employees and related experience designing and building the proposed facility
- Details regarding the partners or groups that will design, build, operate and maintain the facility. The equipment supplier is VOsPS.
- The only reference plant provided is a pilot plant installed on private acreage in Manitoba, Canada.
- Details regarding a proposed site for the facility

According to GGL "The Universal Waste to Energy (UWTE) system is an advanced, modular waste- to-energy solution that transforms all categories of organic waste—including municipal solid waste (MSW), plastics, industrial, hazardous waste, sewage sludge, and agricultural refuse—into clean electricity and usable heat. Through high-temperature, flameless combustion at 1,350°C, the UWTE system produces zero methane, zero carbon monoxide, and sterilized ash with unprecedented ultra-low emissions."

GGL stated "The Universal Waste to Energy (UWTE) system has been successfully proven and demonstrated by our VOsPS in Manitoba, Canada, where a fully operational 3MM

module has been installed on a private acreage west of Winnipeg. This pilot facility can process a diverse range of waste streams, including Municipal Solid Waste (MSW), Sewage sludge, Agricultural waste (e.g., diseased grain, manure, livestock mortalities), Industrial and medical waste, Chemical and hazardous waste, Plastics and demolition materials."

- Each 95MM (95 million British Thermal Units) UWTE module processes approximately 184 tons per day of unsorted, high-moisture municipal solid waste (MSW) and other hazardous organic inputs. A full-scale 570MM configuration, comprising six 95MM modules, can process 1,100 tons per day with a potential to be scaled up or down as required
- To meet the needs of Miami-Dade County's 4,000 tons per day capacity, the UWTE system can be scaled up to 18-22 modules, deployed as a centralized hub or distributed across multiple strategic locations in the County.

Proposed Technology:

- Quiescent radiant energy vaporization of organic feedstocks
- Flameless High-Temperature Combustion (1,350°C)
- Multi-chamber vaporization with oxygen-deficient processing
- Steam turbine for electricity generation
- Modular, fully automated processing with real-time controls and emergency safety systems
- Site: No site specified requires ~35 acres (for a 4,000 TPD plant) within Miami-Dade's dense urban and suburban landscape
- Cost: large-scale UWTE systems can exceed $400M. For a single 570MM UWTE facility (6-module system), the total estimated capital cost is approximately: ~USD $306.43 million. A full-scale 570MM system, composed of six 95MM modules, is designed to process up to 1,100 tons of waste per day. Funding Model:
- GGL proposes a Public-Private Partnership (PPP) model to share capital burden and operational risk with private investors.
- Explore federal and state funding, green bonds, tax credits, and carbon offset revenues to support financial sustainability
- Detailed 30-year financial models, including revenue scenarios from tipping fees, energy sales, and ash reuse, will be presented to validate ROI
- Operating Cost - Funding Model - O&M estimate - ~15 million USD

Schedule:

- Feasibility & site Selection - 6 months
- Permitting and Approvals - 6 to 9 months
- Design and Engineering - 4 to 6 months
- Construction - 12 to 18 months
- Commissioning and Start-up - 2 to 3 months
- Total time to operation 24 to 36 months

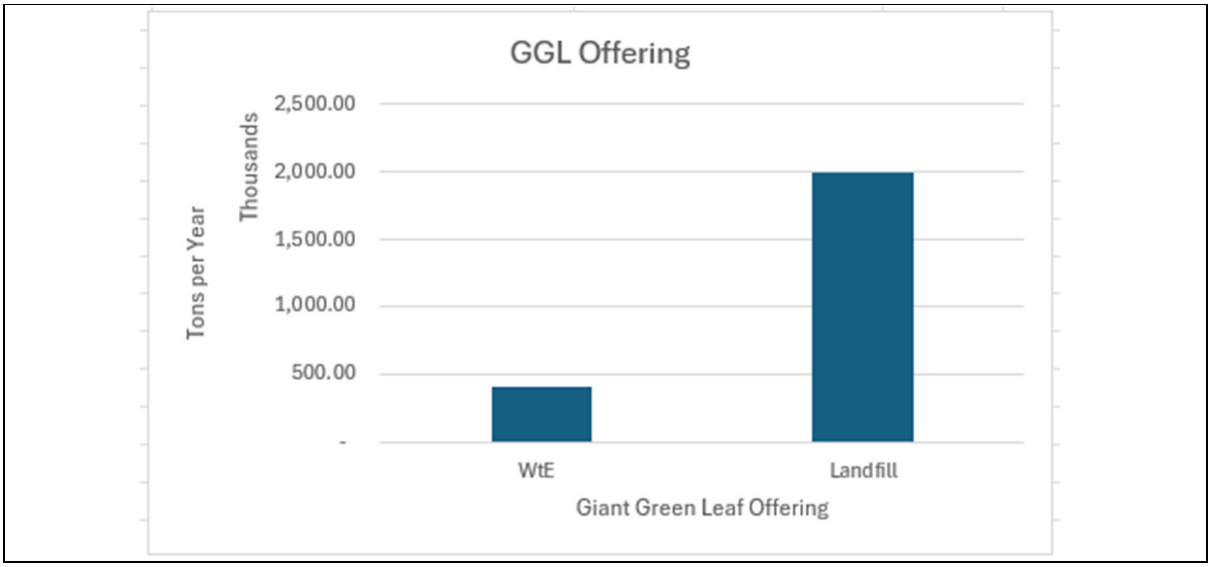

Figure 2.2-4 – GGL Offering TPY Relative to Type of Waste Processing

Notes

1. % of WTE Ash to Landfill not specified by respondent - only mention ~ 73 tons of sterile ash
2. 1,998,500 TYP to Landfill
3. GGL has indicated that the system can be scaled up to match Miami-Dade County's target of 4,000 tons per day by deploying 18-22 modules. Graph shows 1100 TPD capacity

2.2.5 Frontline Waste

Overall Assessment:

- While pyrolysis is viable technology the respondent has not provided any evidence of already deployed units that are currently in operation. The respondent is an equipment manufacturer.
- The respondent did not include the following information:
- Number of employees and related experience designing and building the proposed facility
- Details regarding the partners or groups that will design, build operate and maintain the facility
- Details regarding a proposed site for the facility
- The proposed system is a modular, slow-pyrolysis waste-to-energy system, built by Frontline Waste.
- This solution can be implemented within 12-18 months at a smaller-scale (say 10,000 TPY) for under $4M as a pilot (the JF20 System) and could eventually be scaled up to divert between 300,000 tons and 450,000 tons of non-recyclable plastics, paper and green biomass waste per year. Full deployment of these modular systems would occur within 36 months, depending on a phased approach, as each new system has an estimated 12 month build time

- The total deployed CapEx cost would be between $70M to $120M for 10 to 15 JF60 System depending on actual waste tonnages. 10 JF60 Systems would have the capacity to produce approximately 40 MWs of power, and a total of 330,000 MWhs per year
- Site: No site specified. The respondent stated that it can be deployed using land, already at one or more of the existing landfill areas not yet used as landfill
- Funding model: Frontline Waste would be more than happy to put together P&L financial models for various 3-year implementation scenarios, going from 1 to 15 units ordered, and showcasing a payback period typically less than 5 years.
- Frontline Waste is a manufacturer. Frontline would sell our JF20 pilot unit as well as subsequent JF60 Units directly to Miami-Dade County. Frontline would be open to partnering with another 3rd party waste management firm to put together a formal implementation plan.

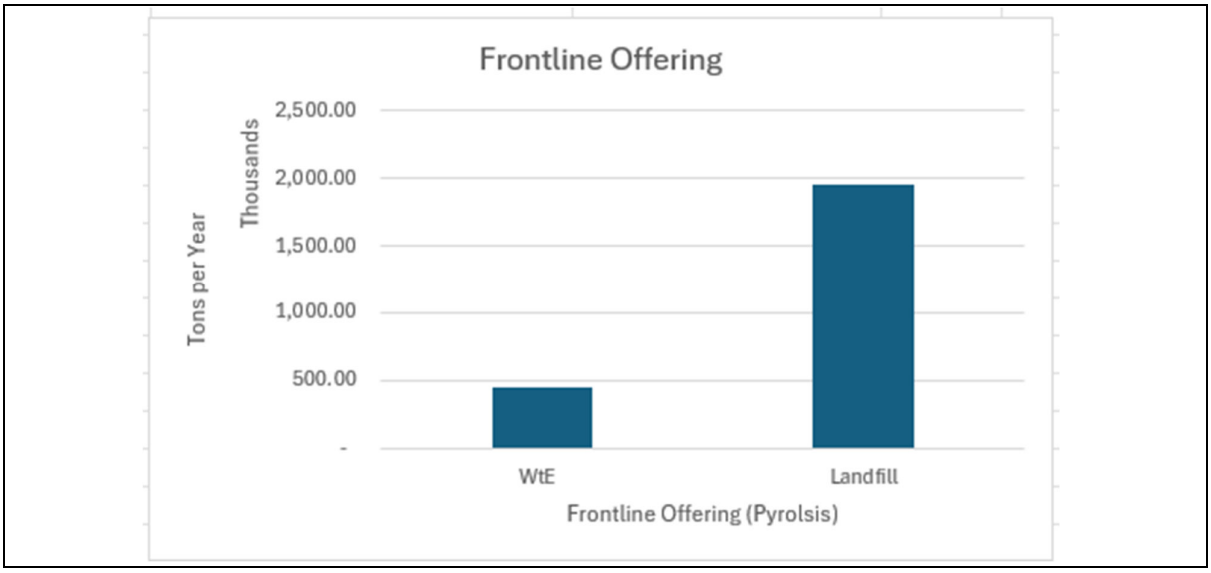

Figure 2.2-5 – Frontline Offering TPY Relative to Type of Waste Processing

Notes
1. % of WTE Ash to Landfill not specified by respondent
2. 1,950,000 TPY to Landfill

2.2.6 WEF Innovations LLC

WEF Innovations LLC did not provide responses to most of the items included in the questionnaire. Their response provided limited information about the company or their offering, limiting them to be considered a viable solution provider. Their offering lacks details for a complete solution, team/partners executing engineering and design, construction, operation and maintenance, and lacks information on an install base for their deployed technology.

WEF Innovations LLC did not provide details on the following:

- Operating plants or facilities currently deployed or running in the US or worldwide using the proposed technology. They cited a facility in Sierra Leon, West Africa, however this was not verified, and no details were made available.

All that was provided are the graphics presentations with no back-up information.

The following is listed in the brochure that WEF Innovations LLC provided:

- WTE - conversion of garbage, recyclables & biowaste to electricity and Biofuel
- Air to Water - conversion of humidity in air to potable water,
- Hydroponics - growing fruits and plants
- Aquaponics - Farming fish for consumption or sale

2.3 ALTERNATIVE WASTE-TO-ENERGY FACILITY SIZING

Related to the potential for a larger regional waste-to-energy facility, the responses from FPL (1,480,000 TPY overall), FCC (1,760,000 TPY overall) and Insoftel (1,600,000 TPY overall) have not recommended a larger regional waste-to-energy facility within their responses. Their responses are all nominally in-line with the originally specified 4,000 tons per day facility.

No information related to ongoing discussions with other municipalities has been provided by the County and it is therefore unavailable for comment in this report.

In theory, a larger waste-to-energy facility could be less expensive for additional throughput due to economies of scale and a smaller facility would be more expensive per ton of throughput due to the relatively fixed costs of permitting, site development, engineering, and other cost factors that exist regardless of facility size.

2.4 EPA PERMITTING UPDATE

There have been favorable developments in EPA permitting and, by extension, state permitting. Towards the end of the previous federal administration, the White House Office of Information and Regulatory Affairs (OIRA) deferred a controversial proposed revision to the Maximum Achievable Control Technology (MACT) rule applicable to new large Waste-to-Energy (WTE) combustion units such as the size previously contemplated by MDC.

On January 16, 2025, under the prior administration, the EPA reopened the comment period, which had closed nearly a year earlier. The stated purpose was as follows:

"The EPA has decided to reopen the comment period for an additional six months to gather further information on the proposed amendments to the Large Municipal Waste Combustor regulations." It should be noted that the reopened comment period is now scheduled to end on May 30, 2025, based on a subsequent (April 21, 2025) action from EPA which has been published in the Federal Register (Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Large Municipal Waste Combustors Voluntary Remand Response and 5- Year Review; Closing of Comment Period, 90 F.R. 16663 (proposed April 21, 2025) https://www.govinfo.gov/content/pkg/FR-2025-04-21/pdf/2025-06757.pdf.

This is an effective shortening of the reopened comment period by 1.5 months.

Industry consensus suggests the 2024 proposed rule included regulatory limits that were more stringent than could be achieved even by new units for two pollutants: carbon monoxide (CO) and cadmium (Cd) emissions. For other pollutants, the degree of reduction as proposed was stringent but likely achievable with proper design of emission control equipment. EPA and OIRA action to delay finalizing the standard in December 2024 may have been based in part on recognizing the difficulty in meeting the proposed limits even for new units. It would be prudent for MDC to work with WTE industry organizations to submit substantive comments to the reopened docket (Docket ID No. EPA-HQ-OAR-2017-0183) by May 30, 2025, that demonstrate the difficulty in meeting some of the limits in the 2024 proposed rule.

By Presidential Memorandum on January 20, 2025, Regulatory Freeze Pending Review, the new administration directed agencies as follows:

"(1) Do not propose or issue any rule in any manner, including by sending a rule to the Office of the Federal Register (the “OFR”), until a department or agency head appointed or designated by the President after noon on January 20, 2025, reviews and approves the rule." "(2) Immediately withdraw any rules that have been sent to the OFR but not published in the Federal Register."

On February 28, 2025, the Solid Waste Association of North America (SWANA) outlined its views on critical issues affecting the industry. In its letter to newly appointed EPA Administrator Lee Zeldin, SWANA highlighted several urgent topics impacting its members:

- Landfill Management, particularly Landfill Gas-to-Energy (LGTE)

- Waste-to-Energy initiatives
- PFAS research, development, and training
- Resource Management, focusing on reuse and recycling
- Lithium-ion Battery risks
- Workforce challenges

A response from EPA's Office of Land and Emergency Management (OLEM) was received on April 11, 2025, addressing the five-pillar initiative "Powering the Great American Comeback."

Pillar 3, "Permitting Reform," emphasizes cooperative federalism and cross-agency partnerships. EPA's abridged responses to SWANA's five issues are as follows:

- **Landfills:** EPA recognizes the essential role of modern engineered landfills in protecting public health and environmental resources. Regulations under Subtitle D of RCRA (largely delegated to states) will remain effective and practical.
- **Waste-to-Energy:** EPA acknowledges the critical role WTE systems play in integrated waste management and reopened the comment period to gather additional information.
- **PFAS:** EPA continues research into PFAS destruction and disposal, with plans to revise guidance within three years based on public comments and scientific developments.
- **Recycling and Resource Management:** EPA supports the use of domestic renewable resources for high-quality materials in infrastructure and consumer goods. Recycling grants of more than $165 million have been selected to enhance battery collection, recycling, and supply chain efforts while preventing fires.
- **Lithium-ion Batteries:** With SWANA's support for best practices and labeling initiatives, combined efforts will improve battery collection and recycling.

The prompt response represents a watershed moment in communications between industry and the EPA. It suggests the potential for cooperation with industry rather than issuing rules having significant uncertainty regarding WTE and LGTE projects.

The prospects for permitting WTE or LGTE projects have significantly improved. The final MACT rule requirements for large municipal waste combustors may closely resemble the 2006 version rather than the rescinded one. While adherence to stringent protective technology remains essential, the ability to secure vendors guarantees and financing has been reinstated.

Regarding landfill permitting, regulations remain unchanged, with permits managed through the Florida Department of Environmental Protection (FDEP). Air permitting (PSD or minor permits) is only required when the facility generates significant non-methane organic compounds (NMOCs) or methane, necessitating gas collection, flaring, or recovery systems.

2.5 TAX INCENTIVES FOR WTE FACILITY

Regarding federal tax credits, AtkinsRéalis has engaged Subconsultant Roessler and Associates to provide a summary Technical Memorandum and Life Cycle Analysis (LCA) framework which will directionally indicate whether the current federal rules are applicable to the proposed 4,000 tons per day WTE facility as well as other technology options. Proposed legislation in the US House of Representatives as of May 2025 could remove the following funding opportunity if passed into law.

The Executive Summary from Roessler and Associates from Appendix C is as follows:

"Roessler and Associates (R&A), under subcontract with AtkinsRéalis, was engaged to evaluate opportunities for Miami-Dade County to pursue federal tax credits in connection with its proposed Sustainable Solid Waste Campus. Following its assessment, R&A believes that the planned Waste-to-Energy (WTE) facility has the potential to qualify for the Clean Energy Credits established under the Inflation Reduction Act (IRA), provided the project satisfies key thresholds applicable to tax-exempt entities for use of domestic materials. Eligibility for the credits also requires the electric generating technology to be classified as zero-greenhouse gas (GHG) emissions. Based on R&A's analysis, WTE should meet this zero-GHG requirement based on the framework established in the final regulations. Unless WTE is explicitly listed, Miami-Dade will be required to complete the emissions determination process prior to submitting its credit tax return. Using current project estimates ranging from $1.5 to $1.9 billion, the Clean Energy Investment Tax Credit (CE-ITC) could reasonably be expected to generate between $63 million and $535 million in tax credits for the County. These are issued to the energy property owner in the year following the facility's start of commercial operations. Credit values increase in a tiered manner if the project satisfies federal prevailing wage, apprenticeship, and domestic content requirements. Compliance with these provisions would also increase the project's overall cost. To evaluate the cost and viability of meeting the bonus requirements, R&A recommends that Miami-Dade include these criteria in their procurement documents and requires proposers to provide the incremental costs. The County should engage tax counsel to support this effort. The final Clean Energy Tax Credit regulations direct the Treasury to provide exemptions from the domestic content requirements for tax-exempt entities. Exemptions are available if the use of domestic products increases overall costs by more than 25%, or if domestic products are not available. While Treasury has issued initial guidance, it currently only applies to projects beginning construction before 2027. If the costs of pursuing the domestic content bonus are deemed prohibitive, properly documenting the basis for an exemption during procurement could allow Miami-Dade to pursue the base credit and prevailing wage bonus, totaling between $315 to $400 million, pending the issuance of additional guidance, as required under the final regulations."

State and local funding options have been researched with the primary result being the existence of SB 1764, which was passed during the 2022 Legislative Session. This bill aims to provide financial assistance and incentive grants to Counties who operate waste-to-energy facilities. The bill was introduced with an annual $100M annual funding but was passed with this funding removed and relies on yearly appropriations for distribution of funds. The following is the summary of SB 1764 (2022) from the Florida

Senate website: “Municipal Solid Waste-to-Energy Program; Creating the Municipal Solid Waste-to-Energy Program within the Department of Agriculture and Consumer Services for a specified purpose; requiring the department, subject to appropriation, to provide annual financial assistance grants to municipal solid waste-to-energy facilities that meet certain requirements; requiring the department to establish a process to verify the amount of certain electric power purchases; directing the Public Service Commission to provide assistance in verifying grant eligibility, etc.” The full bill text is available at the following link: https://www.flsenate.gov/Session/Bill/2022/1764/BillText/er/PDF

3. RESOLUTION 250538 (R-198-25) SWOT ANALYSIS

A SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) has been used for this analysis for the purposes of being able to identify the various positive and negative elements of each response without a numerical ranking. This style of analysis is useful for comparison of moderately disparate offerings

The following sections summarize the SWOT analysis for each waste handling or processing technology category.

3.1 WASTE-TO-ENERGY SWOT SUMMARY

Please refer to Section 1.2 and Table 1.2-1 above for a summary of the respondent offerings for the Waste-to-Energy category.

Refer to Appendix F for a full table-format summary of the following SWOT analyses.

3.1.1 FCC, MASTEC, & BABCOCK & WILCOX (B&W)

Response Summary:
FCC Environmental Services
MasTec - EPC Contractor
B&W - Equipment suppliers

Offering:
Total Waste - 1.8M TPY
Waste-to-Energy (Mass Burn) Facility - 1M TPY - This includes Incinerator Bottom Ash (IBA) treatment for bottom ash recycling to process ash reuse & metal recovery - Balance of ash to Landfill

Material Recovery Facility (MRF) - 60K TPY - 24K TPY residue to WTE
Green transportation of product streams

Bulky Waste Processing Facility - 550K TPY This includes C&D Waste
150K TPY residue to WTE

Composting Facility - 150K TPY Composting
30K TPY residue to WTE
Requires source separated waste feed
Green transportation of product streams

Remaining 600K TPY to Landfill under County's current agreement

Sustainability achieved by integrating the best technologies to maximize recycling and recovery of materials, overall system's energy efficiency, and identifying the most sustainable solution for each waste stream.

Education programs and a visitor center ensure integration with the local community

Finance Approach - Design, finance, build and operate 30-year service life - See excerpted table below for estimate ranges provided.
WTE - Net Revenue Shares could be Electricity Export % share Ferrous & Non-Ferrous Recovered Metals % share
Composting Facility - Net Revenue % Share on Recovered Marketable Products
MRF - Net Revenue % Share on Recovered Recyclables
Bulky Waste Recycling Facility - Net Revenue % Share on Recovered Recyclables & Construction Material

Funding Model

Project Finance as Project Developers (PPP) - The project will be leveraging a New-Build-Finance-Rates model

Consortium entity to design, build, finance, operate, and maintain the Campus via a concession agreement with the County.

The Consortium acts as the implementation partner and is responsible for all activities related to the implementation, management, monitoring, and reporting of the project throughout the project's crediting period.

Miami-Dade County and the Consortium entity can share the revenue from the recycled waste streams generated from the project.

Facility Operation - Operational costs, waste supply agreements, and revenue generation strategies are key considerations

County through the current and future ILA, estimate to supply 1.8 M tons

FCC – Equity injection and Operation and maintenance guarantee including electricity production (Performed by FCC Environmental Services)

Financial institutions to provide non-recourse financing

Concession contract with MD County

SPV (Special Purpose Vehicle) - EPC Contract; O&M Contract EPC JV - See funding Model pictorial representation for details

Federal grants, IRA, state grants production and investment tax credits to be pursued working with the County

Revenue sharing model to be discussed

Energy sales

Recycle sales

Metals sales

Bottom ash

Government incentives and credits

Rate structure

Infrastructure

Utility extensions

ROW and Easements

Road expansions

Design development for EcoPark

The Consortium will fulfil the role of design, build and operate for the entire EcoPark, providing the project with cohesion and enabling the process to be conducted efficiently.

Size and Site Ownership

The consortium doesn't have a preference and understands that the County has dedicated time and resources to analyzing and classifying various potential sites for this comprehensive environmental campus.
The consortium is committed to providing a flexible solution for this project, which includes a site component.
The consortium can offer suitable locations that meet and exceed the criteria outlined by your consultants, or we can provide you with the option to select and own a site of your choice.
The consortium will customize the siting to align with our customers' needs.
Depending on the desired volume and final configuration - 50 to 80 Acres will be required.

Permitting

At a minimum, the following permits will be required to establish an EcoPark in Miami-Dade County
Power Plant Siting Act (PPSA) Certification
Title V Air Emissions Permit
Air Construction Authorization/Prevention of Significant Deterioration
Environmental Resource Permit (ERP)
National Pollution Discharge Elimination System (NPDES)
Industrial Use Permit to Discharge Industrial Wastewater
Stormwater Permitting UIC Permitting (if applicable)

Timing

The EcoPark will take approximately 4 to 8 years
Permitting - 1 to 3 years
Design build – 3 to 5 years
Operations - 25 to 30 years

WTE - 3 to 5 years
MRF - 2 to 4 years
Bulk Facility - 2 to 4 years
Composting - 2 to 4 years

Strengths	Weaknesses
The consortium has relevant experience to execute the proposed offering. Collectively the Consortium brings over 370+ years of experience with: • FCC - 860 recycling and recovery facilities, • FCC - 12 WTE facilities, 410 MW renewable power	• No specific site provided • Site acreage requirement does not include ash monofill. • Site requirements include 4 separate operations (Composting, C&D, MRF and WTE facility all needing its own separate site considerations

• FCC - 4.2 million tons of MSW capacity annually • FCC - Specific experience – Barcelona Ecopark – (Spain) – recycling, anaerobic digestion and composting facilities, • FCC - Las Dehesas Biomethanization Plant (Spain) - world's largest anaerobic digestion facility • FCC - Buckinghamshire Ltd (UK) The Facility recovers energy through the combustion of waste to produce power. • FCC – Recent announcement of FCC Environmental Services (FCC) agreement to purchase Wheelabrator South Broward Inc., which owns the South Broward Waste-to-Energy (WTE) Facility in Fort Lauderdale, Florida, from WIN Waste Innovations. • MasTec - Specific experience as GC for Pasco County and expansion of Lee County WTE Facilities • B&W - Over 500 WTE & Biomass facilities • B&W More than 300 operating utility and industrial boilers in the US, 200 around the world in 40 countries • B&W - More than 5,000 industrial water tube package boilers and other waste heat recovery products installed. • B&W – Average of more than 500,000 US boilermakers' construction hours per year over that last five years. • B&W - specific experience WPB 1M TPY WTE facility in Florida, Copenhagen 400K TPY WTE facility in Denmark and Kelvin 395K WTE Plant in the UK. • The respondents' offering is based on proven well established technology.	• FCC lists 50 years of experience operating WTE facilities, however they have not provided adequate detail to verify operating experience in the US. • Bottom Ash treatment and recovery discussion had minimal details to meet very aggressive recovery rates • Price range provided in the response based on information provided from Arcadis. Landfill option is based on current contracts and no additional insight provided by the respondent. • Timeline provided by respondent does not appear to be adequate. • The respondent's offering is based on the County providing source-separated feed to the recycling and composting facilities. This will need to be discussed further.
Opportunities	**Threats** • The respondent has not provided a specific site for the proposed facility. It is critical

• A larger or smaller facility that may include regional municipalities or counties to look at a regional solution.
• What other technological offerings can the respondent provide as part of a zero-waste goal.
• Details concerning the following were not included as part of their offering and are an opportunity:
  ○ Dust and Odor control provisions
  ○ Sea Level rise considerations
  ○ Health Safety and Environment
  ○ Emissions
  ○ Noise Control and mitigation
• Combustion of solid waste to supplement energy is the environmentally preferred alternative to conventional solid waste disposal according to Florida Statutes under Title XXVIII, Natural Resources, Conservation, Reclamation, and Use. Ss. 377.709.
	that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	• Provide insight regarding the factors that could have impact on Cost control including:
	  ○ Major equipment procurement,
	  ○ Availability of skilled labor for construction and operation
	  ○ External market forces like
	  ○ Supply chain fluctuations,
	  ○ Material cost volatility,
	  ○ Site conditions and mitigation
	  ○ Permitting & Regulatory compliance,
	  ○ Potential tariff risks,
	  ○ Currency exchange rate variations and broader economic conditions
	• The respondent has identified the majority of the required permits. Acquiring the permits in a timely manner as well the impact of the MACT limits by the EPA to be issued in December 2025 will need to be considered and analyzed.
	• MasTec and FCC EPC experience as a team were not outlined. Engineer was not discussed in their response.
	• MasTec experience with Pasco and Lee County are a plus but this project is 4 times larger than those. The respondent needs to provide additional input on measures taken to mitigate handling a much larger campus with multiple facilities.

Material	Annual Inbound Tons	Operational Cost Per Ton (OPEX)	Capital Investment (CAPEX)	Revenue Share
Total Tons = 2.4 M tons (0.6 M tons delivered to the landfill under the current disposal agreement)				
MSW				**MSW**
Waste-to Energy Facility (Mass Burn)	1,000,000	$45 - $75	$1,500M - $1,900M	Net Revenue Shares could be: Electricity Export % share Ferrous & Non-Ferrous Recovered Metals % share
Yard Waste / Organic Material				**Yard Waste / Organic Material**
Composting Facility	150,000	$35 - $50	$10M - $15M	Net Revenue % Share on Recovered Marketable Products
Recyclable Material				**Recyclable Material**
Material Recovery Facility	60,000	$60 - $100	$60M - $100M	Net Revenue % Share on Recovered Recyclables
Bulky Waste				**Bulky Waste**
Bulky Waste Recycling Facility	550,000	$40 - $60	$40M - $60M	Net Revenue % Share on Recovered Recyclables & Construction Material
TOTAL	**1,760,000**			

Figure 3.1-1 – Table of Annual Inbound Tons of Waste and Sorting

3.1.2 FPL, REWORLD HOLDING, KANADEVIA INOVA (KVI); CDM SMITH

Response Summary:
FPL (Florida Power & Light) - Utility Company
ReWorld Holding Corp; formerly Covanta Holding Corporation - Operation and Maintenance
Kanadevia Inova (KVI), formerly Hitachi Zosen Inova - Equipment supplier & EPC
CDM Smith Inc. - Environmental Consulting Engineering

Offering:
Waste-to-Energy (Mass Burn) Facility - 1.3M TPY - Four 1,000-ton-per-day-(TPD) combustion lines capable of processing 4,000 TPD or 1.3 million tons of MSW annually

Anaerobic digestion system capable of processing over 180,000 tons of organic waste annually - continuously fed high-solids AD system with digesters based on Kompogas AD technology capable of processing up to 500 tons per day (180,000 TPY) and a state-of-the-art three-stage membrane technology biogas- upgrading system to meet the county's sustainable waste goals

Composting - the digestate from the Kompogas system is fully compostable material. For composting of the discharge from the dry AD system, the aeration and curing processes of the solid digestate are based

on aerobic processing of the material. The material would be placed in specially designed aeration boxes or bays for 14 days to complete the active composting phase and create finished compost

Material separation plan required for new WTE facilities

Resource recovery education center.

Finance Approach - FPL will cover all costs associated with the development, design, construction, operation and maintenance of the WTE facility through a public-private partnership (P3) with the county.

FPL to provide capital investment and 30-year operational costs associated with the respondent's solution.

Funding Model - Partnering with FPL, an investor-owned, state-regulated electric utility, in a P3 model FPL P3 model, the county will have no out-of-pocket expenses related to the capital deployment of the WTE facility.

Low-cost debt
Monetize Federal tax credits
- possible lowering of County tipping feeds
Energy sales – No PPP – Already factored into the tipping fee
Insurance and risk
Revenue streams
Energy generation
Recycle materials – Metal recovery ferrous and non-ferrous

County responsible for site selection, ownership and lease back to FPL. County will own improvements after the contract term ends.

County is responsible for delivering fixed amount of Waste

FPL will charge tipping fee
Acreage required – 40 to 60 Acres

Schedule
Development of a new WTE facility typically occurs over a seven- to 10-year timeframe contingent upon several key milestones

O&M
FPL will manage all O&M requirements with its partners over the life of the facility. The P3 model reduces the county's risk of managing day-to-day and long-term operational requirements. The new

WTE facility will employ between 90 and 110 highly skilled employees in supporting long-term operational and maintenance requirements.

Health Safety and Environment

FPL will comply with all local, state and federal regulations applicable to the facility including emissions, odor and noise control.

FPL has years of experience with County on zoning, environmental, public health, public works, emergency operations, and other regulations.

The facility will comply with the applicable rules and standards of National Fire Protection Association 850 and requirements of the insurer and the authority having jurisdiction

Strengths	**Weaknesses**
• The consortium has relevant experience to execute the proposed offering. Collectively the Consortium brings over 230+ years of experience including the following experience: • FPL - Several utility facilities, landfills, hydrogen clean energy facilities. FPL owns electric generating resources at 130 sites across its service territory totaling 36 gigawatts • FPL - Operates battery storage projects, which, when combined with its solar projects, enhance its ability to meet customer needs • KVI - Hundreds of WTE facilities worldwide 1600 reference projects. Including recently completed 5500 tons per day Dubai facility. • ReWorld - Operations experience of over 100 facilities. ReWorld owns and operates 60% of the WTE facilities (39 facilities) in North America and over 75% of the WTE facilities operating in Florida. • ReWorld's network of WTE facilities annually diverts over 20 million tons of waste from landfills, recovers and recycles 500,000 tons of metal (enough to build five Golden Gate bridges), recycles or	• Although KVI has supplied equipment to WTE facilities worldwide they do not have a facility in the US. There will be some learning curve complying with US and local codes standards and ordinances. Generally, European environmental codes tend to be more stringent than the US. • The respondent has not provided a specific site for the proposed facility however the proposed acreage estimate is barely enough for a WTE facility. In additional land will be required if future CC is to be implemented. • Respondent included solution to handle 1.3M TPY in WTE and 180K TPY with Anaerobic digestion with composting with the remainder to contracted Landfill. • The respondent provided no cost estimate but stated "Site selection will significantly impact both financial outlay and project timelines, with key considerations including land acquisition costs, permitting challenges, infrastructure requirements and community impact. Based on our industry experience, **the county's cost estimates for the identified sites are within industry standards and align with projections previously provided by the**

reuses 280 million gallons of wastewater (equal to 570 Olympic-sized swimming pools) and generates 10 million megawatt-hours of clean renewable energy (enough to power nearly 1 million homes). • Designed, permitted and/or implemented projects at more than 50 WTE facilities throughout the U.S. and Canada • FPL appears to be in strong financial position based on their own assertion to access numerous other low-cost debt options that could deliver significant cost reductions to both MDC and FPL • KVI experience with numerous recent EPC project delivery • KVI has years of experience with US and South Florida plants with their grate technology • KVI has the capability and experience to provide the full EPC deliverables with the exception of a civil engineer • Interconnection design and permitting details will be streamlined with FPL as the lead • Biomethane production from AD can be used to supplement fuel conversion of MD vehicles to green fuels • FPL benefits: • Influenceable in Florida and reduces a lot of regulatory risk • Experience in Florida with large scale power generation projects • Energy sales included in tipping fees • 30-year contract approach with specific performance and facility material condition standards that include required capital improvement during and at handover to MD eliminates significant future capital risk. EPC/Operating contract wording/requirements are critical for this to be a strength.	**county's experts**. If an alternative site beyond those currently identified is considered, a further cost analysis will be necessary to account for location-specific factors and ensure an accurate assessment of financial and logistical implications." • No proposed site provided therefore the risk of regulatory, and community approval based on the selected location is a significant issue. • The EPC organization was not clearly defined, Civil engineer, US construction partners, DBIA standard contracts? • Metals recovery system is simplistic and will not result in required aggregate quality AND metals recovery yield rates required. • Response for Anaerobic Digestion will require MD to establish a separation and collection plan within the county

Opportunities	Threats

• A smaller or larger facility that may include regional municipalities or counties to look at a regional solution.
• What other alternate technological offerings can the respondent provide as part of a zero-waste goal.
• Combustion of solid waste to supplement energy is the environmentally preferred alternative to conventional solid waste disposal according to Florida Statutes under Title XXVIII, Natural Resources, Conservation, Reclamation, and Use, Ss, 377,709.
• Compost material secondary market opportunities.
• Potential for FPL to have access to sites along existing right of ways
	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs, Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats
	• Provide insight for some of the factors that could have impact on Cost control including:
	  ○ Major equipment procurement,
	  ○ Availability of skilled labor for construction and operation
	  ○ External market forces like
	  ○ Supply chain fluctuations,
	  ○ Material cost volatility,
	  ○ Site conditions and mitigation
	  ○ Permitting & Regulatory compliance,
	  ○ Potential tariff risks,
	  ○ Currency exchange rate variations and broader economic conditions
	• FPL's owner, NextEra, could provide alternatives

3.1.3 INSOFTEL (SYNERGY W2E)

Response Summary:
Waste-to-Energy (RDF) - 1.609 M TPY waste processed. 37 independent processing modules and 8 turbines. 160MW of electricity. 55MW per 100 tons of waste processed.

N-RDF production, producing an uprated fuel quality through shredding, sorting, and mixing materials. N-RDF is pushed through a smoldering process, prior to being oxidized in an oxidation process. The heat is recovered by an organic Rankine steam cycle, to generate electricity using an ORC turbine.

Material Recovery – 87,600 TPY of recyclable metals

Partnership Structure Options
County-Purchased Facility: County funded. Synergy sells, builds and commissions the plant
County-Leased Facility: Synergy funded. Synergy builds and commissions the plant
As-a-Service: plant receives third party sponsorship

The total projected investment for the facility is $1.6-$2.1 billion from engineering to operation.

O&M
Operation of the plant will support at least 90 jobs and at least 20 highly trained technicians. Annual maintenance expenditures are approximated at $35 million.

Health Safety and Environment
Synergy will comply with all local, state and federal regulations applicable to the facility including emissions, odor and noise control

Strengths	**Weaknesses**
• 6-year fully commissioned timeline • Modular additions for hydrogen and oxygen production	• 99 acres required for full capacity • Modular design, requiring multiple systems to meet the feed rate. • Utilizes a fuel upgrade process (N-RDF), which potentially would be high maintenance requirements to keep running.
Opportunities	**Threats**
• Combustion of solid waste to supplement energy is the environmentally preferred alternative to conventional solid waste disposal according to Florida Statutes under Title XXVIII, Natural Resources, Conservation, Reclamation, and Use Ss.377.709.	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:

	○ Land acquisition costs ○ Permitting Challenges & Regulatory Hurdles ○ Infrastructure requirements ○ Community impact ○ Traffic improvements ○ Tariff threats • References to Ministry of Environment may indicate experience is exclusive to Canada • No discussion of existing operations

3.1.4 GIANT GREEN LEAF

Response Summary:

Waste-to-Energy – 184 TPD waste processed per module. 6 modules proposed for 1,100 TPD. 40 MW electric or 70 MW thermal. 18-22 modules required for 4,000 TPD goal.

Ash production – 73 TPD sterile, suitable for construction aggregate and agricultural fertilizer

Partnership Structure Options

P3 -county provides land, permitting, capital, infrastructure, retains ownership and regulatory control. GGL and partners design, build, and operate.
Build Operate Transfer – GGL privately finances.
Build Own Operate – GGL privately finances.
Public – GGL pursues grants, tax credits, and carbon credits.
ESG Capital – partners pursue grants and loans from ESG sources.

The total projected investment for a 6-module system is $290.3 million from engineering to operation.

Estimated total annual revenue of $91 million via sale of power, heat, water purification, ash, and carbon credits. Tipping fees about $100/ton, carbon credits about $160/ton, annual ash sales $1-2 million.

O&M

Total annual estimate $15 million. Operation of the plant will support 60 personnel, estimated at $6.7 million per year. System maintenance and support is estimated at $8.3 million per year.

Health Safety and Environment

63% lower carbon footprint per person versus landfilling. 100% organic waste diversion. Converts hazardous and infectious waste into sterile byproducts.

Strengths	Weaknesses
• Closed-loop waste management can handle a wide variety of waste streams including hazardous, sewer, agricultural, medical, illicit and disaster waste. • Zero methane, zero CO, low NO2 • 12 acres for 1,100 TPD facility. Full 4,000 TPD requires 22-37 acres depending on technology options • 2-3 years to operational • Ash production suitable for sale	• Only proposed a 1,100 TPD facility • No sorting pre-process. Only shredding. No material recovery • Amount of waste needed to go to landfill after shredding needs to be defined • 18-20+ modules to meet MD needs to be further defined. • Space requirements for a full solution doesn't appear to take into consideration the amount of space needed to prepare the waste to an acceptable engineered

	fuel that is required to make the technology functional. • Fuel variability in South Florida due to climatic weather changes is not conducive to a technology that requires specific engineered fuel specs. • Response notes a private installation, however there are no pictures, locations, or operating data showing the installation. • Not technically proven technology.
Opportunities • Combustion of solid waste to supplement energy is the environmentally preferred alternative to conventional solid waste disposal according to Florida Statutes under Title XXVIII, Natural Resources, Conservation, Reclamation, and Use Ss, 377.709. • System processes a broader and more diverse range of waste materials than traditional incinerators or digesters, including Municipal Solid Waste, Industrial Waste. Hazardous & Chemical Waste, Contaminated PPE • Benefits include the potential carbon credit revenue • GGL proposed a possible fully public funding model • System can operate off grid	**Threats** • The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum: o Land acquisition costs o Permitting challenges & regulatory hurdles o Infrastructure requirements o Community impact o Traffic improvements o Tariff threats • Respondent is based out of Scotland • Response shows two different estimates for total annual revenue • No sorting of incoming feed defined • Facility only exists as a pilot and therefore, scaling will need to be proven effective

3.1.5 FRONTLINE WASTE

Response Summary:

Waste-to-Energy – 100 TPD waste processed each module. 4 MW electric produced each. 10-15 units suggested. Offering to address green and blue trash collection containers, which are a fraction of MSW collected currently.

Sargassum – system can process biomass which is described as a local blight.

Partnership Structure Options

- P3 -county provides land, permitting, capital, infrastructure, retains ownership and regulatory control. GGL and partners design, build, and operate.
- Build Operate Transfer – GGL privately finances.
- Build Own Operate – GGL privately finances.
- Public – GGL pursues grants, tax credits, and carbon credits.
- ESG Capital – partners pursue grants and loans from ESG sources.

Total estimated capital of $70-120 million for 10-15 units. Each unit would cost $7-8.5 million.

Estimated total annual revenue of $91 million via sale of power, heat, water purification, ash, and carbon credits. Tipping fees about $100/ton, carbon credits about $160/ton, annual ash sales $1-2 million.

O&M

Total annual estimate $15 million. Operation of the plant will support 60 personnel, estimated at $6.7 million per year. System maintenance and support is estimated at $8.3 million per year.

Health Safety and Environment

63% lower carbon footprint per person versus landfilling. 100% organic waste diversion. Converts hazardous and infectious waste into sterile byproducts.

Strengths	Weaknesses
• Deployment within 3 years, each new unit 12-month lead time	• Frontline is an equipment supplier. They do not provide a suitable solution for the request. • No information regarding infrastructure, footprint, site ownership, permitting, timing, operations and maintenance (O&M), as well as safety, health, and environmental aspects, has been provided at this time. • Sargassum “takes more energy to dry than is derived from burning”

	• Only processes recyclables, less than 50% waste produced by the County • Assumes less footprint than a mass burn WTE facility, however no layout/site plan conceptual drawings were included, and due to the modular design, multiple feed systems, 10 to 15, are assumed by response, which will treat 1,000 to 1,500 TPD, 25% of the overall supply.

Opportunities
• Proposed small-scale pilot at $4million for 20 TPD processing
• Respondent is local to the county
• Combustion of solid waste to supplement energy is the environmentally preferred alternative to conventional solid waste disposal according to Florida Statutes under Title XXVIII, Natural Resources, Conservation, Reclamation, and Use Ss, 307.709
	Threats
	• No existing operations
	• Un-proven technology and integration within WTE facility.
	• Response is offering a pilot plant, with the expectation that the pilot plant will prove out and expand to a multiple unit modular installation.
	• Fuel required for slow pyrolysis not identified in response and will be a substantial operating cost for process.
	• O&M costs are not provided with response, and will be major portion of operating costs over the life of the project.
	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs
	  ○ Permitting challenges & regulatory hurdles
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats

3.1.6 WEF INNOVATIONS

Response Summary:

WEF Innovations LLC provided a few claims from their standard brochure but did not provide the following information:

- Operating plants or facilities currently deployed or running in the US or worldwide using the proposed technology. They cited a facility in Sierra Leon, West Africa, however this was not verified
- No information on number of employees in US, worldwide, or company history.

According to the Brochure provided:

- WTE - conversion of garbage, recyclables & biowaste to electricity and Biofuel
- Air to Water - conversion of humidity in air to potable water
- Hydroponics - growing fruits and plants
- Aquaponics - Farming fish for consumption or sale

Overall Assessment

WEF Innovations LLC did not provide adequate verifiable information about the company or its offering to be considered a viable solution provider. Lack of details on company and available personnel, lack of proven technology deployment that is verifiable.

Strengths	Weaknesses

• No verifiable strength for the offering listed in the brochures	• Lack of verifiable information
	• No cost data
	• No installation in the US or Worldwide where the offered solution is deployed and can be verified - Brochure depicts the following pictures with no details
	  ○ Boston Municipal Solid Waste Sorting Machine
	  ○ Anaerobic digest Biocycle
	  ○ Cultivation systems for algae growth
	  ○ China 5MW Biomass Gasifier Power Plant
	• Generally lacking all the necessary information to be considered as a viable solution provider.
	• No specific site or location provided

Opportunities	Threats
• Solution provider needs to provide evidence of technology deployed that is verifiable	• The proposed solution if deployed will be serial #1 unproven technology which will have numerous setbacks and may not render the benefits shown on the shiny brochures.

3.2 LANDFILL AND DISPOSAL SWOT SUMMARY

Market responses from the following five vendors were included in the Landfills Category. Furthermore, none of these service providers provided the cost of their waste management solution.

Table 3.2-1 – Respondent Type of Service Provider

No.	Respondent's name	Type of service provider
1	Waste Connections Florida (WCF)	Waste Management – Collection, disposal, recycling
2	GFL Environmental (GFL)	Waste Management – Collection, disposal, recycling
3	Waste Management Inc. (WMI)	Waste Management – Collection, disposal, recycling
4	ENCAP-IT	Consulting Engineering Firm not a waste management service provider
5	Environmental Protection & Improvement Company (EPIC)	Rail Transport and Disposal

Three of the five respondents in the landfill category, i.e., WCF, GFL, and WMI are amongst the largest waste management services providers in North America with many years of experience in the industry. The County currently has a 10-year agreement with two of them, WMI and WCF, for providing waste management services as per their respective terms of the agreement.

Unlike WCF, GFL and WMI; EPIC, is the rail transportation and disposal division of Synagro Technologies Inc. and specializes in managing transportation and disposal of waste by rail. EPIC does not own any landfills but has established long term arrangements with several landfill owners and operators across North America which provides them with the ability to transfer waste to those facilities for disposal. They are one of the largest independent waste-by-rail service providers in North America with 36 years of experience.

Each of these service providers brings their unique strengths in terms waste collection, waste recycling, waste transportation by rail and road, waste processing and waste disposal at their owned/contracted landfills. This does provide opportunity for the County to utilize

contracted airspace from these vendors thus potentially eliminating the need for the County to currently expand capacities at their North and South Dade landfills.

All of the service providers have expressed their willingness to invest in CAPEX required for developing any new infrastructure necessary to deliver their services efficiently e.g., rail spur, strategically located waste transfer facility etc. However, they are open to public private partnerships as well.

Absolute reliance on the contracted airspace provides good opportunities for the County to get away from owing perpetual liability of the landfills they own, there are always inherent challenges and downsides to this approach, though mitigable. One of the biggest threats to this approach is the uncertainty in the fee structure at the time of contract renewals and/or new contracts which could be a burden on the rate payers. Another aspect which cannot be overlooked is the long-term financial health of the firm given the changing dynamics in the global environment. However, these aspects can be addressed via partial reliance on this contracted airspace instead of full dependency.

EnCAP-IT is a consulting design firm which has stated if the County is interested in expanding their landfills, they have the design capabilities to participate.

The following table summarizes the SWOT overview for the Landfill and Disposal category.

Table 3.2-2 – SWOT Overview Landfill and Disposal

Landfilling and Disposal	Throughput (tons/hr)-(TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Synagro (EPIC) (Current US Operations)	Rail transport company - can transport any amount Minimum quantity 350,000 TPY	Not required except for setting up rail spur	Cost not provided Private or P3 funding options No CAPEX required from the County for building the infrastructure for rail transport	9 months	County staff not required	Not provided.
Waste Management Inc. (Current US Operations)	Current Agreement – Up to 2,000,000 TPY at Okeechobee and 700,000 TPY at Medley Landfill. Additional Capability – 1,000,000+ TPY as needed. Options available for organic processing, composting and single stream recycling	All infrastructure in place for landfill current and future capacity. Rail extension to landfill required. Require a property for transfer station	Cost to relocate intermodal facility and add transfer station	6 months to acquire additional waste containers	Not provided.	Existing contract rates established (See Table 1.1-1 on Page 11)
Waste Connections Florida (Current US Operations)	Current Agreement - up to 312,000 tons with ability to increase capacity Material sorting	All infrastructure in place for landfill current and future capacity. Rail extension to landfill required and spur at	Not provided.	Not provided.	Not provided.	Existing contract rates established (See Table 1.1-1 on Page 11)

Landfilling and Disposal	Throughput (tons/hr)-(TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
		transfer station in development				
GFL Environmental (Current US Operations)	"GFL anticipates having a disposal option for MD that will meet the needs of MD" Options available for composting, recycling and landfilling	Not provided.	Not provided. Private funding	Not provided.	Not provided.	$70-75 per ton
EnCAP-IT (Developed solutions for US clients)	Not provided. Extending airspace capacity at North Dade and South Dade Landfills	None	Not provided.	Not provided.	Not provided.	Not provided.

3.2.1 WASTE CONNECTIONS

Response Summary:

Company Attributes

- 3rd largest waste management service provider in Norh America with over 30 years of experience.
- Owns two Class I landfills in Florida – JED landfill in St. Cloud and Heart of Florida landfill in Lake Panasoffkee. Both the landfills have more than 50 years of life remaining and currently capture LFG for alternative use and convert the same to electricity.

Response Summary:

Primarily provides collection, transfer (both by, rail and road) and disposal of waste at their two landfills in Florida.

Strengths	**Weaknesses**
• Current agreement for providing recycling collection services to over 150,000 residential units in the County • Current agreement for transfer and disposal of 312,000 tons MSW at Heart of Florida Landfill (249,600 tons by rail and 62,400 tons by road) • Existing Facilities owned by respondent with all required permitting in place	• As with many large private/ corporate business entities, the possibility of any financial hardship/ fund uncertainties can always exist which can impair the services being promised.
Opportunities	**Threats**
• The use of rail significantly reduces the number of trucks on the road along with improved emissions.	• Rate escalations over time • Stricter regulatory changes against landfilling and emissions may drive the cost of their operation which may eventually be passed on to the County.

3.2.2 GFL ENVIRONMENTAL

Response Summary: One of the largest US waste management service providers and facilities developer and operators.	
Strengths	**Weaknesses**
• Strategically located network of 245+ collection operations, 175+ transfer stations, 30+ MRFs, 20+ organics facilities, 7800+ solid waste trucks, and 90+ active landfills owned managed or operated across North America. • It has strong references, while company size and the assets that it owns appear to be in the scale required for the Miami-Dade project • Integrated services including collection, recycling, process and disposal • They are listed on NYSE and have transparent financial and commercial structure. This would also improve prospects for financing the Miami-Dade project, should they take it on • They have services and assets which manage MSW as well as specific streams such as organics	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost.
Opportunities	**Threats**
• They can provide an integrated waste management system, including collection. • Their recycling and organic waste process facilities would generate recyclable outputs • As they have a wide network of recycling plants, they would be in a better position to secure markets and offtakes for organic and recyclable outputs	• Rate escalations over time • Stricter regulatory changes against landfilling and emissions may drive the cost of their operation which may eventually be passed on to the County.

3.2.3 WASTE MANAGEMENT INC.

Company Attributes:

- Largest solid waste service provider in North America serving customers across residential, commercial, and industrial sectors for a very long time
- Firm working on enhancing rail transfer of waste, where feasible, to limit environmental impacts. LNG powered locomotives for long haul.
- Company engaged in all aspects of waste management from collection, transfer, disposal, WTE, and recycling

Response Summary:

- Primarily provides collection, transfer (both by rail and road) and disposal of waste at their two landfills in Florida.
- Also provides collection and processing of curbside recyclables

Strengths	Weaknesses
• Waste management solution available immediately without any lead time. • They provide all waste management solutions, landfilling, recycling, composting, and WTE except thermal technology. • Ability to transfer waste via rail through the Dade Intermodal Facility • Existing Agreements with the County for disposal of up to 2.7 million TPY at their two landfills • Currently processes single stream recycling for the County. A new MRF capable of processing 275,000 • Ability to compost source separated organics collected from the County at their Okeechobee landfill • Willingness to invest in developing a compost site for source separated yard waste collected within the County • The County has annual guaranteed capacity of 700,000 tons at the Medley Landfill and 2,000,000 tons at the Okeechobee Landfill. • All infrastructure is in place for the volume addressed by the WM/County Disposal Agreement. • WM owns all the transfer stations and landfills in their disposal agreement with the County and has contracted with FEC for intermodal and transportation services	• As with many large private/ corporate business entities, possibility of any financial hardship/ fund uncertainties can always exist which can impair the services being promised.

Opportunities	Threats
• Environmental Stewardship: Opportunity to partner with a firm that is proactive in managing environmental impacts and moving towards green energy • Waste Transfer Facility - Willingness to construct a waste transfer facility near SDL owned by WMI at no capital cost to the County	• Rate escalations over time • Stricter regulatory changes against landfilling and emissions may drive the cost of their operation which may eventually be passed on to the County. • Recycling – market availability and Commodity fluctuations

3.2.4 ENCAP-IT

Company Attributes:

- ENCAP-IT is a typical consulting engineering firm engaged in designing landfills. It is not a waste management service provider.

Strengths	Weaknesses
• Being a consulting engineering firm, they provide design and engineering for landfill vertical expansion using a Mechanically Stabilized Earthen (MSE) wall	• Since they are a design and engineering firm, they do not provide any waste management-related services and are therefore not applicable to this intended Market Research. • Nothing proprietary, the engineering design they provide is typical of any geotechnical engineering design for retaining wall structures.
Opportunities	**Threats**
• There could be an opportunity to engage EnCAP-IT for obtaining consulting engineering services for landfill design should the County intends to vertically expand their landfill(s).	• County should revisit any threats should they plan to engage ENCAP-IT for their design engineering needs for landfill vertical expansion.

3.2.5 SYNAGRO (EPIC)

Company Attributes

- EPIC is the rail transportation and disposal division of Synagro Technologies Inc.
- Largest independent waste-by-rail service provider in North America with 36 years of experience. Specializes in managing transportation and disposal by rail.
- Works with all Class I Carriers (CSXT, NS, BNSF, UP railroads)
- Experienced in transporting biosolids, MSW and other commodities.

Offering:

- Their approach is rail transfer of waste and its further disposal at multiple landfill sites outside the County EPIC has arrangement with
- Although EPIC offers to manage the entire 2.4 million tons of waste, they would expect a guaranteed minimum 350,000 tons/ year.
- EPIC seeks minimum contract of 10-years with successive and evergreen ten-year extensions up to 30 years.
- No CAPEX required from the County for building the infrastructure for rail transport. However, any contribution from the County will reduce the costs for transfer and disposal.

Strengths	Weaknesses
• Waste management solution available within relatively a short time frame (12 months). • EPIC has current contract with the County for transport and disposal of biosolids by rail. • Promises guaranteed exclusive capacity at multiple landfills outside of County • Serving New York City and Passaic Valley Sewerage Commission for the past 30 years • Does not require any new permits or CAPEX for developing necessary new waste transfer facility. • Unconstrained disposal - Arrangements with multiple sites for disposal which offers both redundancy and flexibility. Ability to dispose waste outside of Florida	• EPIC's operation is dependent on respective rail entities. Although, not anticipated as EPIC is in this business for a very long time, any disruption from rail entity could impact waste transfer from the County. Since alternate arrangements may exist with the County for managing waste including arrangements with WMI and WCF, such situation could be easily addressed.

Opportunities	Threats
• Rail transport is known to reduce carbon footprint relative to road transport. Therefore, this may present an opportunity for the County to be proactive in reducing their carbon footprint for managing their solid waste.	• Uncertain in rate structure as EPIC may need to develop rail infrastructure and the cost would likely be passed on to the County. • The respondent has not provided a specific site for the proposed facility and rather keep confidential the location of the site. • Contract expiration with EPIC's existing brokered agreements

3.3 MATERIALS RECOVERY AND RECYCLING SWOT SUMMARY

There are 11 companies providing materials recovery and recycling systems that responded to the Miami-Dade Market Research request. A few of these companies offer MRF for MSW as well as an Anaerobic Digestion system for organics.

EcoPods Miami is a decentralized solution with small scale facilities spread across the county. All of the respondent's except 1, Gravitas Infinitum provided a submittal that may be able to meet 4,000 tons per day.

Juno Technology uses a water-based technology that will require 0.4 million gallons of water to operate the technology for 1100 tons per day.

Timelines for the setting up of facilities range from 2.5 to 5 years. The majority of the companies did not provide cost estimates in their response apart from Upland Road who has given an estimate of $2750 million. A pilot plant from EcoPods Miami would take up to a year to set up and cost between $2-5 million. Respondent financing plans ranged from complete private investment to the need for public funds and grants.

Multiple sources of revenue were proposed including gate fees and resource recovery prices.

In terms of site, no company has scoped a specific location. Acreage estimates range from the size of a shipping container for EcoPods to 150 acres for Upland Road.

Companies are also expecting to hold a percentage of ownership in the facilities with several companies having a design, build, own and operate model.

The staff required for these sites range from 22 to 300 full-time equivalent employees.

The main weakness that the respondents offering MRF is the permitting required which is time consuming. Secondly the lack of site identification considering the size and zoning requirements is also a point of note.

The timelines are varied, however the infrastructure required for these solutions and the number of full-time resources that require specialized knowledge should be considered when making a decision.

The strengths and opportunities these respondents present mainly rest with their ability to handle a variety of waste streams and provide meaningful outputs that have value. The companies with combined Anaerobic Digestion systems also present an additional opportunity to accommodate organic waste in a single solution.

The modular aspect is another factor that could be used as an opportunity to accommodate the growing waste requirements.

Table 3.3-1 – Materials Recovery & Recycling SWOT Overview

Materials Recovery and Recycling	Throughput (tons/hr) & (TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Encina (No current US Operations)	Dirty MRF, waste sorting with waste plastic recycling, can process up to 500,000 TPY	4-5 acres	not provided (based on Arcadis 2023 - same as for RePower South)	5-10	Not provided. Ops mostly by Encina	Not Provided
Goldfinch (Developing facility in Georgia for 2026)	2240 TPD/582,400 TPY	15	Not provided Private funding model	3	40	Not Provided
Juno Technology (Current US Operations)	1100 TPD option to triple capacity with second module waste sorting/anaerobic digestion	30	$325-$400 M private funding model	3	75	$20-25M per year
RePower South (Current US Operations)	Dirty MRF, waste sorting, can process up to 500,000 TPY	not provided, but likely 4-5 acres	not provided (Based on Arcadis, 2023, mixed waste processing estimated at ~$85-150/ton)	3-7	not provided, operation mostly by RePower	Not provided.
Gravitas Infinitum (Carbotura) (No current US Operations)	400 to 4,000 TPD 100% landfilling or 100% material recovery and recycling	3 acres per 100 TPD of capacity	$200-2,0000MM - payment & waste guarantees required	24 months	Not provided.	Fee based revenue model
AMP Robotics (Current US Operations)	25 tons/hr per module landfill and recycling	Dependent on agreed quantity of waste to be processed	Not provided Public or private funding model	30 months	Not provided.	Not provided.

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Materials Recovery and Recycling	Throughput (tons/hr) & (TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Upland Road (No current US Operations)	2,000 – 2,400 TPD material recovery and recycling	150 acres plus 15 acres for recycled paper mill if adopted	$2,250 to 2,750 million P3 development opportunity	36 months Phase 1 48 months Phase 2	300	$425 - $475 million annually
Novastus (Current US Operations)	1,920 TPD material recovery and solid fuel conversion for transport to PC boiler	5 acres plus storage	$90,000,000 option for public or private funding	36 months	22	$70/ton public ownership option
EcoPods Miami (Pilot-scale US Operations)	pilot scale modular - novel technology sorting/anaerobic digestion to produce synfuel	< 1 acre per module co-located at existing landfills	$5,000,000 per module, staged P3 financing option	5 years for scaled up facility	Not provided.	Not provided.
Fetch Waste Solutions (Operating in Ohio, USA)	400,000 to 1,000,000 TPY mixed waste processing	6 acres plus storage/handling	$122,350,000 to $138,125,000 for 1,000,000 ton per year throughput -private funding	24 months	up to 90	$40-50 per ton plus 20% of recyclables

3.3.1 ENCINA

Company Attributes:

- Houston based company, mechanical and chemical processing industry, engaged primarily in waste plastic recycling and manufacturing.
- Conventional waste sorting process with conventional technologies typically used in MRFs. Nothing exceptional.

Response Summary:

- Encina proposes to construct and operate MSW sorting facility within the County and produce baled materials for further processing by others.
- The facility proposed is typical of any "Dirty-MRF" intended to sort materials from a mixed waste stream
- Of the various sorted materials, only plastic films and polystyrene will be utilized by Encina for chemical processing. Remaining other sorted recyclables i.e., paper, cardboard, ferrous, and non-ferrous will be baled for the secondary market
- Organics and other non-recoverable waste types will be managed through conventional approaches – landfilling, incineration, composting etc.
- Financial model – waste sorting & processing fee to be paid to Encina and profit sharing from sale proceeds from the baled materials.

Strengths	Weaknesses
• Claims to divert 30% - 60% waste from landfilling	• Doesn't address waste management needs of the County other than processing waste plastics for beneficial reuse. A single modular unit can process MSW up to 500,000 tons/ year. • Facility, land approx. 4-5 acres and building) to be owned by the County. Encina will only provide equipment for sorting which will be housed inside the building. • Lead time of 5-10 years before the proposed waste management solution could be available for implementation.
Opportunities	**Threats**
• Nothing other than a single integrated waste receiving, sorting and baling facility.	• For processing plastics, Encina uses technology patented by others. • Market availability for the quality of baled products is expected to be poor when sorted from a mixed waste stream. • Doesn't provide any information as to who manage (Encina or the County) organics and other non-recoverable waste types. • Project development timings 3- 5years

3.3.2 GOLDFINCH

Response Summary:

- Materials recovery facility (MRF) for municipal solid waste (MSW) and anaerobic digestion (AD) facility.
- Proposed 2 phase approach which can be brought online simultaneously financing permitting:
  - Phase 1: Recovery and sale of final products. 2240 t/d of municipal solid waste. 10 acres of land required. Minimum recovery of 70% MSW
  - Phase 2: AD facility for organics into biogas which can produce RNG, CNG, LNG, hydrogen or electricity. 851 t/d of organics. 5 acres of land required
- Plants are built in trains of 40 tons/hr. Running 2 shifts a day and 5 days per week. Goldfinch proposes 4 trains are required.
- 3 years from selection to operation
- Health, safety and environment considerations provided

Strengths	Weaknesses
• Build, own, operate, model • Established long-term partnerships with recyclers • US based MRF vendor with proven track record • Privately funded by Goldfinch: no public funding, federal or state grants required • Phase 1 operating costs borne by Goldfinch which will be supported through final product sales.	• Phase 2 initial financing will require a tip fee negotiation in-line with disposal rates
Opportunities	**Threats**
• 30% lower cost than national average • GHG reductions • Time savings • Potential site identified within bounds of closed landfill adjacent to Doral incinerator. Open to other location suggestions. Goldfinch will lease the land through a 20-year lease.	• Recycling is prioritized over energy generation • Permits identified for both phases. Acquiring permits in a timely manner as well as the impact of MACT limits by the EPA to be issues in December 2025 will need to be considered and analyzed.

3.3.3 JUNO TECHNOLOGY

Response Summary:

- Modular Juno Clave system with 4 Juno Claves to process 1,100 TPD (380,000 TPY)
- Processing unsorted residential and commercial MSW including fiber, metals, plastics, glass and organic material using a patented wet-separation process.
- Organics are converted to biogas using anaerobic digestion
- Design, bid, build model
- 50-60 acres required
- Required permitting provided
- 150 FTE required to operate and maintain the plant

Strengths	Weaknesses
• Integrated solid waste management system • Production of energy through AD and CHP systems • Multiple feedstock streams • Multiple sources of revenue including gate fees, commodity streams and biogas production • Wide array of outputs • Operating Oregon, USA facility since 2021	• 0.4 million gallons of water required to operate the technology • 3-year timeline to commissioning stage • 20-day downtime required per year
Opportunities	**Threats**

• Produced biogas can be used onsite improving circularity of the system
• Modular system allows for expansion
• Potential increased resource recovery
	• Local zoning and permitting issues
	• Financing through 3rd party investors
	• Operation failures due to complexity
	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats

3.3.4 REPOWER SOUTH

Response Summary:

- Primarily a mixed waste sorting and waste processing company. Mixed waste sorting facilities are generally named as "Dirty MRFs". The company, through a combination of technologies, processes the sorted waste types into a commodity.
- Conventional waste sorting process, followed with technology used for processing sorted waste stream.
- Owns and operates two advanced technology facilities in South Carolina and Alabama (commissioned in 2019) for sorting and processing landfill bound MSW (primarily residential, and select commercial, and industrial) to recover materials for conversion to circular products and energy.
- Company partnered with three technology providers e.g. Bioenergy Devco, LLC, UBQ material Ltd. and Clean Planet Energy to help with waste processing.

Offering:

- Develop (build, finance, own and operate) one or more wase sorting/ processing facilities within the County to serve as a model for sustainable waste management, material recovery and circular economy.
- Deploy robotics and optical sensors for sorting waste from a mixed MSW stream.
- Anaerobic digestion of sorted organics for producing renewable natural gas (RNG)
- Non-recyclables converted to bio-based thermoplastics
- Single use plastics converted to a pyrolysis oil to replace fossil fuel
- The firm's approach to mixed waste handling appears to make lots of promises in line with sustainable waste management and circular economy.
- Facility would be developed as a public private partnership with long term guaranteed waste supply from the County

Strengths	Weaknesses
• Claims to divert 70% + waste from landfilling thus reducing the need for landfilling and reducing the carbon footprint caused by landfilling. • Claims to power 2,500 homes from the RNG generated from anaerobic digestion of organics. • Does not require source separation of waste e.g., blue bag recycling • Self-sustainable facility with no requirements for government subsidies • Relatively small footprint (40 acres) required for a single facility.	• The two facilities in subject were developed in 2019 and are still in their early stages from a performance and long-term efficiency and effectiveness viewpoint. • Limitation to waste quantity they can process (400,000-500,000 tons/ year) will require multiple such facilities to manage waste generated in the County. • The two facilities are located in two other States far away from Florida. A new facility would need to be developed in MDC for efficiency. • Can only sort and process mixed/ single stream waste • Anaerobic digestion technology for food waste to generate power has limitations and challenges.

	• Recovering clean and good quality salvageable material for market from the mixed waste stream could be challenging. This can significantly lower its market value. • Lengthy time frame from start to facility commissioning. Lead time of 3-7 years for the proposed waste management solution to be available for implementation.
Opportunities	**Threats**

• It does provide the opportunity for the County to partner with a company focused on sustainable waste management following the fundamentals of circular economy and support County's environmental goals.
• Opportunity to recover materials from mixed MSW and reduce waste destined for landfilling
• Use of Bio-based thermoplastic as packaging material is gaining popularity, however, the end of life of such product is not well documented.
	• Firm uses technology support from various technology providers which may be proprietary and without their support, the entire process would just be limited to waste sorting without any processing.
	• Since the firm proposes developing a new facility, there could be a lengthy regulatory process before the facility could be operational.
	• Inherent challenges include zoning land availability, distance to service area, public acceptance in the neighborhood, regulations and State permitting
	• Uncertainties with managing 2.4 million tons using the proposed solution.
	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats

3.3.5 GRAVITAS INFINITUM (CARBOTURA)

Response Summary:

- Gravitas claims to provide zero disposal with 100% material recovery and recycling.
- It is unclear if they have any existing facility demonstrating the technology they are proposing
- Offers to invest $200M-42B to build a production facility in MDC without any P3 support.
- Carbotura offers four different processes: Exogenesis, Pregenesis, Regenesis and Regenesis MAX. They all aim at resource recovery and can process MSW.

Strengths	Weaknesses

• Eliminates reliance on landfill disposal
• Less climate change impacts
• Contaminant destruction
• Appears to achieve substantial landfill diversion would ensure meeting targets
• It is reported to handle MSW and process to different outputs
• High level project financial structure provided
	• Requires guaranteed waste supply agreement.
	• Lack of confirmed off-takers for outputs
	• Non implemented supply chain failures
	• Delivery program delays due to lack of experience and complexity
	• Operation failures due to complexity
	• Under performance, as no project references provided
	• Waste streams not processed - limited inputs
	• Complex permitting and consents
	• The respondent has not provided a specific site for the proposed facility. It is critical that a suitable site be established early and a site suitability study be conducted early to make sure the facility can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats

Opportunities	Threats
• Innovative technology, if scaled up can do technology development • Can be integrated into a waste management system • Potential increased resource recovery • Environmental benefits with potentially reduced emissions	• A sophisticated technology with undocumented literature and/or unknown commercial success and availability for handling such a large quantity of waste. • Lack of confirmed off-takers for outputs • Supply chain failures • Delivery program delays due to lack of experience and complexity • Operation failures due to complexity • Under performance, no project references were provided • Securing a large enough and appropriate from a planning and consents perspective site. • Developer may not have financial standing and resources to deliver projects, no relevant information found on public domain

3.3.6 AMP ROBOTICS

Response Summary:
DBO model
AMP process has 2 modules:
AMP ONE SPOKE: processes 25 or 50 tph of MSW
AMP ONE HUB: processes 25 tph of mixed recyclables

Strengths	Weaknesses

• Global experience
• Modular design
• Compatible with ATC technology and AD
• Revenue to come from gate fee and sale of outputs
• AMP has built and operated facility-scale solutions in the following US locations…
  ○ Denver, Colorado
  ○ Lithonia, Georgia
  ○ Solon, Ohio
  ○ Portsmouth, Virginia
  ○ Currently building a system in Commerce City, Colorado
• Deployed advanced robotic sortation systems and vision technologies in over 100 facilities across North America, Asia, and Europe.
	• The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats
	• Specific knowledge required for operations
	• Costs not provided

Opportunities	**Threats**
• Innovative: AI powered • Can be integrated into existing waste system • Potential increased resource recovery	• 18-30 month installation timeline • Delivery program delay • Operation failures due to complexity

3.3.7 UPLAND ROAD

Response Summary: SMART-UR Separation System 50-60 tph (2400 TPD) sorting lines operating 20 hours a day, 6 days a week 4 separation facilities will be required to handle the amount of waste 300 employees required Global use-cases Capital expenditure will be $2250-2750 million. 150 acres required (site has been identified) Timeline of 4 years until phase 2 operation	
Strengths	**Weaknesses**
• Respondent has a clear understanding of the required environmental and construction Permits • Ability to handle mixed waste stream • Wide array of outputs	• Several funding possibilities provided but no fixed route given • Weekly 28-hour maintenance required • Long delivery period with potential delays
Opportunities	**Threats**
• Utilizes technology to identify dangerous items that could cause damage • Revenue potential via tip fee ($65-75 per ton) • Potential increased resource recovery	• Proposed site (Airport West) will require Utility extensions • Under SB 946/HB 1199, , the Airport West site is within 1-mile of the C-9 Impoundment area, authorized by the Water Resources Reform and Development Act of 2014 and could therefore be restricted from development of a solid waste facility (as defined in s. 403.703) On 5/3/2025, action was taken by the Senate and House to indefinitely postpone and withdraw the bills from consideration. However, the bills were not cancelled. • Relevant permits difficult and time-consuming to obtain

3.3.8 NOVASTUS

Response Summary: Off-the-shelf sorting equipment 320 TPD per train. 6 trains suggested for 1920 TPD. 14-22 full-time employees Capital expenditure will be $12-15 million per train. 0.8 acres per train required plus storage Timeline of 12 months to one operational train then 36 months for 6 trains.	
Strengths	**Weaknesses**
• Located at existing landfills. requires standard utility connections • No tipping pits or compost piles • 40% of waste processed becomes saleable fuel	• No existing commercial operations • No project references provided • No information providing understanding of systems performance • The recovered soft plastics, paper and card from MSW have very high levels of contamination and are extremely difficult to sell
Opportunities	**Threats**
• 14-22 full-time employees. Operated via a centralized SCADA • Fuel can be co-fired at existing coal plants • Company is active in R&D	• The respondent has not provided a specific site for the proposed facilities and prefers a site with existing permits or solid waste facility authority. • The very limited information on specific project references and performance can threaten project viability

3.3.9 ECOPODS MIAMI

Response Summary: Small modular waste treatment pods (shipping container size)
Public-private partnership model
Miami-grown initiative
MSW as main feedstock
Treatment sequence:
Automated sorting
Organic waste treatment
Energy recovery for residuals
Output and resource distribution
Timeline: 6-12 months for a pilot plant and 3-5 years for full network
Pilot plant costs between $2-5 million and can be funded through innovation grants and private equity

Strengths	Weaknesses
• Continuous service even during natural disasters • Variety of outputs • Multiple revenue streams including gate fees, P3 financing,	• Throughput to be provided • Specified location not provided • Complex operations due to number of locations that require monitoring
Opportunities	**Threats**
• Decentralized approach • Established relationships with local environmental leaders • Modular and scalable • Equitable distribution of waste facilities • Ability to expand	• Predicted 30-40 Ecopods needed. • Potential supply chain failures. • Increased permitting required due to variety of Ecopod locations • Limited on-site supervision • Potential supply chain failures.

3.3.10 FETCH WASTE SOLUTIONS

Response Summary:

Off-the-shelf sorting equipment, proprietary recycling and anaerobic digestion
400,000 + TPY. 10 hours/day operation
30-90 full-time employees.
Capital expenditure will be $75 million for 400,000 TPY.
Operating costs of $40-50 per ton and $5-10 per ton processed via recovered material sales.
6 acres required.
Timeline of 18-24 months to operation.

Strengths	Weaknesses
• The facility is anticipated to be permitted as a transfer station, which provides a straightforward regulatory permitting pathway for approval. • The facility will generate no air emissions or water discharges, and as such, no air or water permits will be required for facility operation	• does not process waste that cannot be sold or digested • 65% landfill diversion
Opportunities	**Threats**

• Partnerships with reputable recycling programs through Pepsi and Freepoint	• Markets for some recyclable outputs may not be secure and sale prices may be very low impacting on diversion rate and financial viability
	• The respondent has not provided a specific site for the proposed facilities, although several locations were identified as being suitable. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic Improvements
	  ○ Tariff Threats

3.4 ORGANIC WASTE, COMPOSTING & ANAEROBIC DIGESTION SWOT SUMMARY

This category specifically deals exclusively with source separated organic waste management which typically constitutes 30-40% of total MSW generated in a community. Therefore, remaining waste would still need to be managed through other processes. Generally, the approach to organic waste management is either through (a) aerobic processes which require oxygen to operate, and (b) anaerobic processes, which functions only in the absence of oxygen. There could be several variations to both processes and service providers sometime have their patent to their technology used for achieving the expected outcome from a process.

Aerobic processes have been successfully used for several decades for food waste and yard waste composting. However, anerobic digestion, although practiced but less commonly due to challenges with process control.

There were 4 respondents of which Orlando Bioenergy provides an Anaerobic Digestion facility and Your Soilmate and Envisions Holdings are composting facilities. All of these companies solely deal with organic waste. Therefore, the county will need to consider supplementary options.

None of the companies provided a full picture of what their throughput is, acreage, cost or staff required. From the information gathered Envisions Holding has the shortest timeline of just one year and has the highest throughput.

Envisions Holdings and Orlando Bioenergy are both global companies with experience in various countries. Your Soilmate on the other hand was borne out of South Florida and already has a composting facility set up in state.

Your Soilmate already has a site setup in Florida with plans to increase its size. Your Soilmate also identified that county and state regulations limit the processing capacity of composting plants to 100 cubic yards which should be taken into consideration.

Envisions holdings has also identified a site but still requires it to be rezoned to classify as industrial.

Revenue can be generated through the sale of compost from Your Soilmate and Envisions Holdings and from biogas which can be injected into the system for electricity generation for Orlando Bioenergy.

As mentioned in the section above anaerobic digestion is featured as a component of several companies' strategies for section 3.3; material recovery and recycling.

None of the solutions presented in this section cover all the needs of the county and a number of facilities would be needed to cover the organic waste requirements.

Table 3.4-1 – Organic Waste, Composting and Anaerobic Digestion Response Summary

Organic Waste, Composting, Anaerobic Digestion	Throughput (tons/hr) & (TPY)	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Sustainable Generation (Existing US Operations)	Can be designed and operated for any quantity of organic waste	4-5 acres but will depend upon organic waste quantity to be composted	Not provided.	Not provided.	Not provided but likely 4-5 personnel	Not provided.
Orlando Bioenergy (Project development in Orlando and North Carolina)	500,000 to 1,000,000 TPY organic materials	20 acres but flexible for smaller properties	100 Private Funding	3.5 years	Not provided.	Not provided.
Your Soilmate (Existing Service in Miami)	500 gal/week [approx. 37 tons per week] pick up and composting	7 acres	Private Funding	1.5 years	Not provided.	$592/month [approx. $4/ton]
Envisions Holding (Existing US Operations)	130,000 TPY mixed organics composting	30 acres [estimated from Everett, WA facility using Google Earth]	Private Funding	1 years	Not provided.	Not provided.

3.4.1 SUSTAINABLE GENERATION

Response Summary:

- SG is a supplier of GORE® Cover technology for organic waste composting. The technology is based on Aerated Static Pile (ASP) method for composting.
- Widely used across North America and is one of the trusted technologies for organic waste management.
- No limit to feedstock quantity that can be processed and can be designed and operated for any quantities of organic waste.
- No specific offering from the firm other that a proprietary remote monitoring and control systems provided to an existing established GORE® Cover technology.

Strengths	Weaknesses
• Transforms wide variety of organic waste for beneficial reuse as fertilizer and/or soil amendment – food and yard waste, biosolids, manures and beddings, animal, chicken, fish waste etcetera. • Trusted technology - with years of successful operation across the globe • Scalable, as needed - Does not require any costly infrastructure, and can be set up outdoors as well • Easy to operate without the need for significant manpower. • Consistent high-quality compost that satisfies most regulatory requirements for beneficial use of the end product.	• Suitable only for organic waste management. Typically, such technologies are part of Integrated Solid Waste Management (ISWM) and circular economy for efficient management of solid waste generated in a community.
Opportunities	**Threats**
• Provides opportunity for the county to co-digest biosolids with organic waste for beneficial reuse and avoid significant cost associated with their disposal currently being paid to EPIC for rail transport of biosolids.	• No threats observed with the technology.

3.4.2 ORLANDO BIOENERGY- BIGADAN

Response Summary:

- Danish biogas company with project development experience in the USA and Florida
- Expertise in diversion of organic waste
- Anaerobic Digestion system allows for extraction of methane and carbon dioxide.
- Large scale facility with capacity of 1,000,000 TPY
- 20 acres of land is ideal but there is flexibility for smaller properties
- Timeline is 3.5 years

Strengths	Weaknesses
• 40 biogas facilities globally with build, own, operate models at 12 facilities. • Privately-owned and will fund own facility providing capital investment of $80-$100 million per biogas plant • Large-scale biogas facility • Long-term collaborations with local partners	• Single-source separated feedstock
Opportunities	**Threats**

• Biogas can be injected into the natural gas grid and digested slurry used as fertilizer
• Revenue generated through proposed tipping fee, sale of gas, biogenic CO2 and bio-fertilizer as well as renewable identification numbers
• Typically design and build their own plants but are open to a public private partnership with various models already tried and tested.
	• Odor concerns at facility
	• The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats
	• Specific permits required identified

3.4.3 YOUR SOILMATE

Response Summary: Composting operation in the South Florida area using windrow composting
Focused on their customer service
Experienced with small to large scale commercial customers
Proposing 3 short-term initiatives and 2 medium-term initiatives
Short-term (1-3 years): community drop-off site, business and school composting programs
Medium-term (3-5 years): Curbside residential and commercial organic waste collection.

Offering:
2-week free composting service to analysis demand
Compost education programs for community
Each drop-off site has a monthly cost of $592. School composting estimated cost ranges from $432 to $792.

Strengths	**Weaknesses**
• Florida-based with multiple truck routes operating 6 days a week • Improvement of soil health • Location already acquired and in-use in Homestead. 10-year development plan has secured private financing	• Only processes organic waste • Time restrictions • Space and site restrictions • Funding models are mixed between private financing, public-private partnership, federal and state grants and county funds.
Opportunities	**Threats**
• Service the Miami-Dade and Broward counties with current expansion plans into Monroe County • Organic drop off sites identified • Final compost distributed to residential and commercial members. Additional compost is donated to local farms and nurseries • Immediate processing of 50 tons/month	• County and state regulations limit processing capacity to 100 yards^3 although site allows for 10x current volume due to location agricultural use zoning • The Organics Recycling Facility Regulations of the Florida Administrative Code exempts Your Soilmate from permit requirements

3.4.4 ENVISION HOLDINGS

Response Summary: Design, build, own and operate mixed organics composting facility can initially process 500 TPD which can be expanded up to 1,000 TPD.
SG Bunker System will be used to maximize throughput with 26 GORE Covers to process 130,000 TPY. This can expand to 52 GORE Covers and process 260,000 TPD.
GORE Cover technology is used with 400 installations globally and in the US.
12-month execution timeline

Strengths	Weaknesses
• Fully operational in under 12 months • No capital or land from the county is required • Reduction of GHG emissions • Global experience	• Current in-county site needs to be rezoned to industrial • Limited feedstock opportunities
Opportunities	**Threats**
• Can be integrated into the waste system • Ability to expand	• Time requirement for permitting process • Permitting and zoning requirements may be difficult to obtain • Possible location is still confidential pending award • No cost estimate provided

3.5 ADVANCED THERMAL CONVERSION SWOT SUMMARY

Seven respondents provided solutions based on Advanced Thermal Conversion (ATC) technologies. For this study these were primarily pyrolysis processes, with gasification also being included in the mix. There were several common themes between the offerings and the overall range of technologies could be considered uniformly.

The key reported strengths related with the ATC technologies are the production of multiple outputs including syngas, biofuels and aggregates. These technologies can impact less on the climate than common waste to energy processes, such as moving grate, while, if operated well they can potentially have relatively higher energy yields.

The weaknesses which were identified in the responses provided were, however, significantly more than the strengths and fully in line with what the current broader ATC market. Some costs were provided; however, these could not be benchmarked against similar projects with Miami-Dade. The respondents do not appear to be in a competitive long-established market which would drive down prices and allow for many options and value for money to the County. Pyrolysis and gasification have very complex operations with a limited pool of experienced operators, which can lead to substantial problems, cost overruns and availability issues and the provided responses did not include any information that would increase one's comfort that these risks would not materialize for Miami-Dade. These complexities are also causes of long delays in construction and commissioning, as we know from several ATC projects that we have been involved in.

More importantly, the offered options can only process very limited input and waste streams, which could render them inappropriate for Miami-Dade with its 4,000 tons daily of MSW which require treatment. Albeit in some cases, like TECAM, larger scales, similar with Miami-Dade project, can potentially be achieved, these would require installation of multiple units and lines, which would be very complex to operate and would also need larger areas. Moreover, the limited input waste streams require pre-processing in most cases, which would mean additional investment and land needed to implement them in Miami-Dade. Therefore, gasification and pyrolysis would not reasonably provide the sole solution for MSW process and resource recovery, based on the responses we have seen.

Apart from the limited waste stream feedstocks, scaling them to Miami-Dade requirements would be a potentially unsurmountable challenge: The unit sizes are small ranging from 3 to 50 tons/hr. Scaling these up to 4,000 TPD would require hundreds of units to operate simultaneously, and we know of no ATC plant that has achieved such capacity. Only in Japan there are operational gasification plants which are in the annual capacity range of 100 to 150,000 tons/annum, which is way below the Miami-Dade needs.

The key weakness that was identified was the lack of project references for ATC. Six out of seven respondents do not provide any operational project references on their websites or questionnaire responses. One provides several (over a dozen), however the largest project is

only 52,000 tons/annum and they appear to be providing packaged units, rather than develop large turnkey plants. Based on the responses we have seen, there was no ATC provider with a track record or financial standing and company size that would have a good risk profile for Miami-Dade.

The main opportunities that would be found in the selection of the alternative technologies offered for this study would be their inclusion in integrated waste management systems and the innovations that could be achieved, if successfully implemented.

These are outweighed by several and large threats. The complexity of these technologies typically leads to very arduous and risks planning and permitting procedures, which also delay significantly their implementation. This, coupled with the limited supply chains, can lead to development problems and operational failures. None of the respondents indicated that they could secure the land required to install their plants, which would entail several risks and threats to any project that they would undertake for Miami-Dade County.

The table below summarizes the SWOT overview for the advanced thermal conversion category.

Table 3.5-1 – SWOT Overview Advanced Thermal Conversion

Advanced Thermal Conversion	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Bradam Energies (Developing Projects in North America)	Each CER system is a process line @ 12.3 tons/hr	5 acres for north landfill, 17 acres for south landfill	Not provided. private or P3 funding	6mo. for contract development with MD, 6mo. for permitting, 36 months construction	Bradam responsible for O&M	Not provided.
Tritor Energy (No current US Operations)	600 TPD material sorting, recovery and RDF production	1.48 acres	$12 million per unit	0.75 years	Not provided.	Not provided.
Spartan Holdings (Existing US Operations)	150 TPD LDPE/plastic pyrolysis to syn fuel or power generation	<1 acre	$25 to $60M depending on feedstock public or private funding options	1.17 years	10 to 12	Not provided.
C6 Energy Services (Operating in many countries)	2750 TPD material sorting, option for syn fuel, electricity production	7.41 acres	$1,100 M	Not provided.	Not provided.	$420/ton
Wastaway (Existing US Operations)	15.98	50,000 sqft building	Not provided.	24 months	16 hours /day	Not provided.

Advanced Thermal Conversion	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
TECAM / BFS Spectrum Tech (No current US Operations)	30 tons/hr Thermal treatment plus cogen	4-6 acres	$230M process, balance of plant, and civil private and public funding option	Contract to operational in 18-24 months	two operation personnel required	Not provided.
Globe Guard Technologies / INTEC (No current US Operations)	Syngas production from organic waste 3.3 tons/hr conditioned waste per reactor, 4200 TPD total for two plants	29.6 acres	$1,518M at US$1.13/Euro	3.5 years	Not provided.	Not provided.

3.5.1 BRADAM ENERGIES

Response Summary: BRADAM offers its patented CER™ System and facility design which diverts carbonaceous materials from waste sent landfills. This process produces different biofuel outputs and byproducts like fertilizers and inert aggregates for construction materials. According to BRADAM, their CER™ System can process all MSW streams, as well as plastics and other carbonaceous materials. Metals, glass and inert materials can be pre-sorted and removed from the CER process.
BRADAM Energies has not provided any project references where its patented CER™ System has been applied, or any information on their performance.

Strengths	**Weaknesses**
• Potentially increased energy yield • Less climate change impacts • Production of syngas • Wide array of outputs (syngas, fertilizer, aggregate for concrete and recycled metals) • Contaminant destruction	• Typical cost considering lack of scale • Limited market competition • Complex operations • Highly specialized resources required-limited supply • Limited waste inputs possibility • Sensitive to waste composition fluctuation • Not proven (no project references found) • Small throughput capacity with 295 t/d, will be difficult to scale up to • Limited financing opportunities • Typically requires pre-treatment • Financing structure not provided
Opportunities	**Threats**
• Innovative technology, if scaled up can do technology development • Can be integrated into a waste system • Potential increased resource recovery • Environmental benefits with potentially reduced emissions	• Lack of confirmed off-takers for outputs • Supply chain failures • Delivery program delays due to lack of experience and complexity • Operation failures due to complexity • Under performance, as not project references provided • Waste streams not processed - limited inputs • Complex permitting and consents • The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated

	cost and addresses the following as a minimum: ○ Land acquisition costs, ○ Complex permitting and consents & regulatory hurdles, ○ Infrastructure requirements ○ Community impact ○ Traffic improvements ○ Tariff threats

3.5.2 TRITOR ENERGY

<table>
<tr><td colspan="2">Response Summary:
Italian based company
Decentralized, modular and mobile waste management platform. 65% reduction in waste volumes.
Designed to process 600 TPD of unsorted MSD generating 400 tons of refuse derived fuel (RDF)
6000 m2 required
Tritor Hurricane- mobile shredding and sorting unit
Tritor Energy Station- RDF and biomass processing system (up to 18 TPD)
Does not require a new WTE facility and can bridge multi-year capacity gap
Capital costs $12 million per unit</td></tr>
<tr><td>Strengths</td><td>Weaknesses</td></tr>
<tr><td>Deployment in 6-9 months</td><td></td></tr>
<tr><td>Opportunities</td><td>Threats</td></tr>
<tr><td>• Environmental benefits with potentially reduced emissions</td><td>• The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum:
○ Land acquisition costs,
○ Complex permitting and consents & regulatory hurdles,
○ Infrastructure requirements
○ Community impact
○ Traffic improvements
○ Tariff threats</td></tr>
</table>

3.5.3 SPARTAN HOLDINGS

Response Summary: ProMaxxx Advance Fuel specializes in the production of energy commodities from alternative hydrocarbon feedstock
Large units convert 150 TPD of LDPE to 17,837 gallons/day of distillation diesel and 18,000 lbs. of activated carbon
Small units convert 25 TPD of LDPE to 2973 gallons/day of diesel and 3000 lbs. of activated carbon
Made in the USA and have units in the USA
Pyrolysis conversion technology used

Strengths	Weaknesses
• Unit has flexibility to produce either diesel or electricity • 12-14 month build time • Less climate change impacts	• Feedstock is LDPE or plastic trash • Limited waste input possibilities • Will require pre-treatment
Opportunities	**Threats**

• Environmental benefits with potentially reduced emissions	• Permitting timelines expected to be 4-6 weeks
	• Multiple maintenance days required throughout the year
	• The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Permitting challenges & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats

3.5.4 C6 ENERGY SERVICES

Response Summary: Patented "STAR" steam treatment and regeneration technology that treats unsorted municipal, light industrial, commercial and agricultural wastes.
Separates metals, plastics, glass and batteries and converts remaining material to energy such as ethanol, diesel, electricity and syngas
Capacity of 1,150,000 TPY and 2,740 TPD
Modular design with 35-year life span
Proposed total project cost $941.6 million
Capital expenditure: $714.66 million
Operating costs: $226.9 million
Positioned as self-sustaining with strong revenue potential: funding structured through public-private partnerships and mix of federal, state and local grants and tax credits
Revenue streams through collection and gate fees, recycling income and conversion income with project annual income of $517.8 million. Projected break-even period of 55 months

Strengths	Weaknesses
• Mature technology proven in 18 countries • Technology is designed to handle various waste streams and compositions • Technology compliant with environmental standards in EU, UK and USA	• Specific health and safety requirements not provided
Opportunities	**Threats**
• Project estimated to be delivered in 12-15 months • Less climate change impact	• Requires 7.5 acres located adjacent to existing infrastructure but site not specified • Permits and EPA certification required • Custom-built facility using existing waste transfer stations • The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum: o Land acquisition costs, o Permitting challenges & regulatory hurdles, o Infrastructure requirements

	○ Community impact ○ Traffic improvements ○ Tariff threats

3.5.5 WASTAWAY

Response Summary: Wastaway offers a multi-patented waste-to-fuel process, which transforms MSW into biofuels and other sustainable products. A typical Wastaway plant receives 400 tons daily of MSW, it undergoes mechanical separation with recovery of metals and plastics for recycling. The waste streams undergoes further process in high pressure chambers with an output called cellulate, which is used as soil improved and generate biogas in digestion systems. The final output has high calorific value and can be used as biofuel in power plants, paper mills, cement kilns etc.
No project references were provided by Wastaway, or information on their performance and applicability of its technologies and processes.

Strengths	**Weaknesses**
• Potentially increased energy yield • Less climate change impacts • Production of biofuels • Contaminant destruction • Reported 85% landfill diversion would ensure meeting targets	• Typical cost considering lack of scale • Limited market competition • Complex operations • The process produces biofuels; however these still need markets to complete the waste process cycle • Highly specialized resources required-limited supply • Inadequately proven (only one project reference found) • Small throughput capacity with 140 TPY, will be difficult to scale up • Limited financing opportunities • Typically requires pre-treatment • Financing structure not provided • No site or requirements thereof identified for plant
Opportunities	**Threats**
• Innovative technology, if scaled up can do technology development • Can be integrated into a waste system • Potential increased resource recovery • Environmental benefits with potentially reduced emissions	• Lack of confirmed off-takers for outputs • Supply chain failures • Delivery program delays due to lack of experience and complexity • Operation failures due to complexity • Under performance, as only one project reference provided • Waste streams not processed - limited inputs • Complex permitting and consents • The respondent has not provided a specific site for the proposed facilities. It is

	critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum: • Land acquisition costs, • Permitting challenges & regulatory hurdles, • Infrastructure requirements • Community impact • Traffic improvements • Tariff threats

3.5.6 TECAM / BFS SPECTRUM TECH

Response Summary: TECAM is a turnkey plant developer, equipment supplier and technology provider. Its particular focus is on emission control systems. The pollutants that its equipment targets include:

- Volatile Organic Compounds (VOCs)
- NOx and SOx
- Chlorinated hydrocarbon
- Residual gases without oxygen
- Wet and corrosive residual gases
- Odors
- Particles, halogens and aerosols
- Hydrocarbons and carbon monoxide
- Dioxins and furans
- Alkaline compounds and particles

TECAM also provides equipment for management of solid and hazardous wastes, as well as for energy recovery. The systems that it offers for MSW include:

- Regenerative Thermal Oxidizer (RTO) system for emission controls
- Pyrolysis in rotary and static kilns for energy recovery and biofuel production
- Waste incineration with energy recovery

No project references were provided for MSW treatment from TECAM systems.

Strengths	Weaknesses
• Less climate change impacts • Contaminant destruction • Reported 90-95% landfill diversion would ensure meeting targets • TECAM is an experienced supplier and technology provider in emissions abatement systems, therefore would expect emissions to be low • High level project financial structure provided	• Typical cost considering lack of scale • Limited market competition • Complex operations • The process produces syngas and biochar, however these still need markets to complete the waste process cycle • Highly specialized resources required-limited supply • Inadequately proven (no project references found for specific technology offered) • Small throughput capacity with reported 700 TPD, however with an installation of multiple units and lines, they can reach capacity of 2.28 million TPY. • Limited financing opportunities • Typically requires pre-treatment

Opportunities	Threats

• Innovative technology, if scaled up can do technology development
• Can be integrated into a waste system
• Potential increased resource recovery
• Environmental benefits with potentially reduced emissions as TECAM specializes in emission abatement systems
	• Lack of confirmed off-takers for outputs
	• Supply chain failures
	• Delivery program delays due to lack of experience in WTE and complexity
	• Operation failures due to complexity for pyrolysis
	• Under performance, as no project references provided
	• Waste streams not processed - limited inputs
	• The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum:
	  ○ Land acquisition costs,
	  ○ Complex permitting and consents & regulatory hurdles,
	  ○ Infrastructure requirements
	  ○ Community impact
	  ○ Traffic improvements
	  ○ Tariff threats

3.5.7 GLOBE GUARD TECHNOLOGIES / INTEC

Response Summary: Globe Guard Technologies offers a process for Advanced Thermal Conversion. A typical system that it develops and operates would have a throughput of 3.3 t/h per reactor and 4200 tons/day total for two plants. It claims that it can achieve an energy yield of 1.8MWh per ton of organic waste. It generates syngas >99% and can achieve a thermal efficiency of 88% and high availability due to modular and redundant design.

INTEC ENGINEERING GMBH would be Globe Guard Technologies' partner and it plans, designs, manufactures and delivers power plants and systems for industrial process heat generation. For its waste to energy processes, INTEC recommends that feedstock waste is first pretreated with removal of recyclable materials, such as stones, glass, metals and ash. INTEC provides four project references, two have biomass inputs and one sewage and liquid wastes. The fourth one (Denizli) treats pre-sorted agricultural waste and chicken manure. INTEC has supplied and installed key equipment like boilers, economizers, grates and bag filters.

Strengths	**Weaknesses**
• Potentially increased energy yield • Less climate change impacts • Production of syngas • Contaminant destruction	• Typical cost considering lack of scale • Limited market competition • Complex operations • Highly specialized resources required-limited supply • Limited waste inputs possibility • Sensitive to waste composition fluctuation • Not proven (no project references found) • Small throughput capacity with 3.3 tons/hr per reactor will be difficult to scale up to 4,000 t/d • Limited financing opportunities • Typically requires pre-treatment • Financing structure not provided
Opportunities	**Threats**
• Innovative technology, if scaled up can do technology development • Can be integrated into a waste management system • Potential increased resource recovery • Environmental benefits with potentially reduced emissions	• Lack of confirmed off-takers for outputs • Supply chain failures • Delivery program delays due to lack of experience and complexity • Operation failures due to complexity • Under performance, no project references • Waste streams not processed – lim. inputs • The respondent has not provided a specific site for the proposed facilities. It is critical that a suitable site(s) be established early and a site(s) suitability

	study be conducted early to make sure the facilities can be built for the estimated cost and addresses the following as a minimum: ○ Land acquisition costs, ○ Complex permitting and consents & regulatory hurdles, ○ Infrastructure requirements ○ Community impact ○ Traffic improvements ○ Tariff threats • Developer may not have financial standing and resources to deliver projects, no relevant information found on public domain.

3.6 ALTERNATIVE TECHNOLOGIES SWOT SUMMARY

Four responses were provided, which would be classified as alternative technologies. These range from educational applications to greenhouse type facilities and baling equipment and plants. Apart from Cambridge Technologies, which is reported to have an extensive set of project references, the other three respondents did not provide adequate and credible project references or information which would demonstrate that their offerings would provide complete solutions for the totality of the 4,000 TPD that will be generated at Miami-Dade. The observed lack of references, scale of plant and company capacity for development and financial backing would pose very high risks to the Miami-Dade project.

Cambridge Technologies provides a specific type of equipment and process: balers, which can bulk waste and allow for them to be temporarily stored, easily transported and used as fuel for waste to energy plants. This respondent has reported substantial project references and an appropriate level of detail for initial consideration, which demonstrates good experience from application of their offered process. However, this is a pre-processing, storage and logistics solution, which does not cover the totality of the MSW management stages from collection to process and residuals disposal. This is an important weakness that needs to be kept in mind. This baling process could be considered as an initial stage of the overall waste management system for Miami-Dade, combined with waste transfer, disposal and waste to energy assets which will be developed and operated by other respondents. Several baling units can be installed in, potentially many different locations, in order to achieve the necessary capacity of 4,000 TPD for this management stage.

The following table summarizes the SWOT overview for the alternative technologies category.

Table 3.6-1 – SWOT Overview for Alternative Technologies Category

Alternative Technologies	Throughput	Acreage required	Capital Cost ($)	Timeline (years)	Staff required	Operating Costs ($/ton)
Cambridge Project Development (No current US Operations)	Scalable @ 420 TPD per unit - MSW baling for export	<1 acre	$1M per unit DWM funding	2 for 12 units	Not provided.	$5/ton plus transport
Green Energy Solutions LLC (No current US Operations)	700 TPD - hybrid with farm 500 TPD standard WTE	Not provided.	$230 M total project cost - hybrid	1.5	Not provided.	$72.01/TPY Hybrid w/farm
Skyscraper Farm (No current US Operations)	Not provided.	Not provided.	Not provided.	Not provided.	Not provided.	Not provided.
Scrapp (No current US Operations)	Software solutions	N/A	Not provided.	0.5	Not provided.	$150,000 per year

The SWOT analysis for the alternative technologies category is as follows:

3.6.1 CAMBRIDGE PROJECT DEVELOPMENT

Response Summary: Cambridge offers a baling system, which preprocesses and bulks waste, which can be sent to waste to energy as fuel. It is reported to have installed over 500 units currently operating in 45 countries.	
Strengths	**Weaknesses**
• Potentially increased energy yield with bale calorific value • Less climate change impacts due to efficient waste transfer	• It cannot handle large objects • Typical cost considering lack of scale • Limited market competition • Limited financing opportunities • Typically requires some pre-treatment • Financing structure not provided • Costs not provided • It required extensive development of process facilities, as it only bales the waste, it does not process it
Opportunities	**Threats**
• Can be integrated into a waste system • Environmental benefits with potentially reduced emissions	• Lack of confirmed off-takers for outputs • Under performance, as not project references provided • Waste streams not processed - limited inputs • Complex permitting for the remote disposal locations • Requires development of plants to process the baled outputs

3.6.2 GREEN ENERGY SOLUTIONS, LLC

Response Summary:
PEACE Bio-Dome
Decentralized management approach for MSW
500 TPD thermal treatment plant and 200 TPD green waste
Waste to Energy plant
Thermal units used to manufacture concrete blocks
Thermal energy used to pump water
Fish and shrimp feed is produced on site and food grown using fish and shrimp excrement.

Strengths	Weaknesses
• Turn-key setup within 12-18 months is located at existing landfill sites.	• Unproven integration of MSW thermal treatment, aquaculture, agriculture, and concrete production in one system is technically complex and not sufficiently demonstrated at scale • Decentralization inefficiencies (running multiple small or mid-sized facilities to accommodate 4,000 TPD) likely yields high per-ton processing costs • Water usage and contamination likely significant
Opportunities	**Threats**
• Multiple treatment plants located at the solid waste facilities • Environmental benefits with potentially reduced emissions	• Permit requirements are uncertain

3.6.3 SKYSCRAPER FARM

Response Summary: Ferry system management. Sea-scaping and transit infrastructure. Not a complete response. More information needed.	
Strengths	**Weaknesses**
• Partnership with policy experts to maximize grant funding	• Not sufficient information to evaluate the permit requirements.
Opportunities	**Threats**
• Environmental benefits with potentially reduced emissions	• More information is needed from the respondent, the County could then determine if a skyscraper farm could be a viable solid waste management solution.

3.6.4 SCRAPP

Offering: Educational app for citizens No waste processing technology solution provided $150,000 per year costs for Miami-Dade	
Strengths	**Weaknesses**
• 3-6 month timeframe required	• No solution for MSW processing or handling
Opportunities	**Threats**
• Technical assistance may be required	• Technology provider. The response does not address the handling and disposal of operational solid waste.

3.7 SINGLE-CONSTITUENT TECHNOLOGIES

Two respondents proposed solutions that specialize in one specific method for the waste management solution. Recycling Equipment Systems Corporation is the only company that can reportedly handle 4,000 tons of waste per day. However, it is noted that they only bulk and bale the waste, not providing a complete solution which would include process and disposal. The following are SWOT summaries for the two single constituent technology companies, Recycling Equipment Systems Corporation and EcoCa – Rubber Circular Solutions.

Table 3.7-1 – Single Constituent Technology Companies Summary

Single-Constituent Technologies	Throughput	Acreage required	Cost ($)	Timeline (years)	Staff required	Operating Cost ($/ton)
Recycling Equipment Solutions Corporation (Existing US Operations)	5,000 TPD baling and long-haul	<1 acre	$12-15M	0.5	Not provided.	$5/ton
EcoCa (No current US Operations)	1 tons/hr tires only	<1 acre	$4M	Not provided.	Not provided.	Not provided.

3.7.1 RECYCLING EQUIPMENT SYSTEMS CORPORATION

Response Summary:

- The company owns a waste baler and is engaged in making bales of MSW for transfer and landfill disposal. By bailing, the waste gets compacted and eases it transfer as well as no further compaction is required after it is landfilled.
- It can reportedly bale 4,000 t/d of MSW for transfer and disposal to landfills

Strengths	Weaknesses
• The baled and bagged waste saves airspace, reduces the need for daily cover and increases landfill lifespan. • Potentially increased energy yield with bale calorific value • Less climate change impacts due to efficient waste transfer	• It cannot handle large objects Typical cost considering lack of scale • Limited market competition • Limited financing opportunities • Typically requires some pre-processing before baling • Financing structure not provided • It requires extensive development of process facilities, as it only bales the waste, it does not process it
Opportunities	**Threats**
• Can be part of an integrated waste management system • Environmental benefits with potentially reduced emissions during waste transfer	• The biggest threat is that baled waste packed in plastics bags has the potential to create a slip surface when disposed in the landfill which may be prone to create slope instability in the waste mass. • Lack of confirmed off-takers for outputs • Under performance, no project references were provided • Complex permitting and consents • Requires development of plants to process the baled outputs • Requires additional land for plants that will process the baled outputs

3.7.2 ECOCA - RUBBER CIRCULAR SOLUTIONS

Response Summary: EcoCa - Rubber Circular Solutions is specialist technology provider for waste tires only. Their patented CRS process and equipment can be added as an expansion to existing tire production plants and add a recycling line, thus reducing the need for virgin materials. It is noted that this technology only applies to waste tires recycling, not the totality of MSW streams.	
Strengths	**Weaknesses**
• Waste tires are a polluting waste stream, whose appropriate treatment is environmentally beneficial	• It cannot process MSW, only tires • Limited financing opportunities • Not proven for MSW • Financing structure not provided • Costs not provided • Very small scale/capacity (1 tons/hr) • No solution for 4,000 t/d of MSW
Opportunities	**Threats**
• Can be integrated into a waste management system	• Waste streams not processed - limited inputs • Supply chain failures • Delivery program delays • Waste streams not processed - limited inputs • No solution for 4,000 t/d of MSW

4. SUBJECT MATTER EXPERT QUALIFICATIONS

4.1 WASTE-TO-ENERGY

Scott Morrison, Vice President of Engineering and Construction for Waste-to-Energy, has provided leadership, direction and oversight for all aspects of engineering and construction for 17 waste-to-energy facilities with a combined processing capacity in excess of 23,000 tons per day of municipal solid waste and an electric generating capacity of 669 megawatts (MW), together with five independent power plants with an additional generating capacity of 227 MW. Key responsibilities and achievements included the following: Provided construction management and oversight for all cap-ex projects between $1M and $50M. Managed all engineering and design utilizing in-house engineers and engineering consultants. Led technical evaluations and estimates for due diligence teams resulting in two major plant acquisitions. Led contract and commercial negotiations with EPC firms and technology providers for all major projects.

Abey Emmanuel has over Forty-two years of broad-based Project Management and engineering experience in power, Petro-chemical and pulp and paper industries. Mr. Emmanuel has executed multi-million-dollar Combined Cycle Power Projects (CCPP) in the US as well as globally in Poland and Peru working with owners, contractors, governmental agencies, equipment suppliers and each project stakeholder with the single-minded objective of successfully ushering the project to completion on budget while maintaining quality, managing risk, and meeting the targeted schedule. Mr. Emmanuel is currently a Senior Project Director and has worked on several wood burning, tire burning and other waste fuel projects during the earlier part of his career. other recent assignments included managing several capital improvement projects at multiple facilities for Florida Power and Light, work on a combined cycle facility for TSE in Brazil and working on the concept design for the WTE facility for the MD DSWM.

4.2 LANDFILLING AND DISPOSAL

Manoj Singh is a practicing Geoenvironmental Engineer with over 35 years of professional engineering experience in Integrated Solid Waste Management Planning, Design & engineering of municipal, industrial and oilfield waste management infrastructure, Closure/reclamation/decommissioning of waste management facilities. He is well versed with planning, design and engineering of landfills, LFG collection systems, Waste transfer station, organic waste management, and MRFs. Manoj possesses sound understanding of geochemistry and mechanism of subsurface transport of contaminants and their interaction with the environment. Further, he is experienced in conducting numerical/analytical modeling of subsurface contaminant transport and seepage through the containment systems.

4.3 MATERIALS RECOVERY AND RECYCLING, ORGANIC, ADVANCED THERMAL CONVERSION AND ALTERNATIVE TECHNOLOGIES

George Magklaras has 23 years of experience in the waste management, circular economy and energy sectors working as a consultant and as a waste contractor employee on several successful international projects. He has solid technical skills mainly focused on due diligence, feasibility studies, waste strategies, construction monitoring and certification, waste treatment technologies, waste collection systems, and transaction structuring. Notable recent projects with Alternative Waste Technologies which he has led include UKWIR's Advanced Thermal Conversion and Microplastics Research Program, Qiddiya PPP Technical Advisor, Bahrain National Waste Strategy and Curitiba Waste Management System Feasibility Study by the IFC.

4.4 ALTERNATIVE SOLID WASTE MANAGEMENT ROADMAP

Mikael Auger, P. Eng. Mikael is a highly accomplished Senior Professional with 18 years of experience in solid waste management across the environmental and industrial sectors. He has recently joined AtkinsRéalis as the incoming National Waste Subject Matter Expert. His extensive expertise in solid waste management encompasses overseeing operations at engineering landfills and eco-industrial parks and spearheading numerous innovative waste management and bioenergy projects. Mikael's proficiency includes waste planning (including technology reviews), feasibility assessments (including market analysis), waste characterization reviews, waste system improvements, waste gasification, anaerobic digestion, composting, reverse polymerization, and urban biomass pyrolysis. His leadership in managing diverse projects and ensuring exceptional outcomes has earned him a reputation as a trusted expert in his field. His prior experience includes projects or clients in Canada, the USA, Africa (Ivory Coast, Djibouti), and Europe.

Darren Dickson, M.A.Sc., P.Eng, is a Senior Environmental Engineer in his 26th year with AtkinsRéalis. He has been the designated National Subject Matter Expert for waste projects and provides various services from detailed design of landfills and waste facilities to waste management planning support, operational improvements, regulatory compliance, and approvals liaison. Darren has assisted County level organizations with assessments reviewing feasibility of source separated organics collection, modified collections vehicle review, long term waste management alternatives, and technology reviews. He has supported feasibility assessments as part of waste systems reviews and was the project director for the update of a Waste Management Master Plan for a city of 500,000. Current projects include a capacity review and comparison analysis for alternative transfer station locations and layouts for a major city, landfill design technical lead for the design and development of a hazardous waste landfill, and the technical waste lead for the rehabilitation and close out of a former industrial landfill at a bankrupt site. Darren is a registered Qualified Person with the Ontario Ministry of the Environment, Conservation and Parks.

4.5 PERMITTING AND CODE COMPLIANCE

Werner Reinefeld, PE, is a highly experienced Civil Engineer with over four decades of professional expertise in civil and infrastructure engineering, project management, construction design, permitting, and code compliance. Throughout his career, he has worked on a diverse range of projects, including industrial facilities, solid waste handling systems, and transportation and conveyance systems. Werner's extensive knowledge and skills have been instrumental in addressing complex engineering challenges and delivering innovative solutions to meet the needs of his clients. Over the past 25 years, Werner has focused his efforts on serving Miami-Dade County as his primary client. In this capacity, he has played a critical role in the design and permitting of various projects that have significantly contributed to the county's development and infrastructure. Werner's dedication and attention to detail have made him a trusted partner for Miami-Dade County, ensuring that each project aligns with local regulations and addresses the unique requirements of the community. As the Engineer of Record or Project Manager, Werner has been responsible for more than 200 projects exclusively for Miami-Dade County. His commitment to excellence and his ability to manage large-scale projects have earned him recognition and respect within the industry.

5. APPENDICES

5.1 APPENDIX A – TECHNOLOGY BACKGROUND INFORMATION

5.1.1 WASTE-TO-ENERGY (WTE)

Combustion of waste is not new, but the process is now more efficient and increasingly stringent controls are put in place to minimize the environmental impacts.

Conventional mass-burn WTE plants tend to be large scale (ranging from annual throughputs of around 90,000 tons up to in excess of 1,600,000 tons) and are designed to burn waste as efficiently as possible. Waste is burnt under controlled conditions and at high temperatures. The heat released from the combustion of the waste is recovered and used to generate electricity and/or to provide steam or hot water. The volume of waste needing disposal following large scale thermal treatment can be reduced by up to approximately 90%, therefore considerably reducing the need for landfill.

The resultant output of a conventional mass-burn WTE is energy and ash. The ash is far more stable than the mixed general waste input, mainly due to the oxidation of the organic component of the waste stream and typically equates to around 20-25% of the input tonnage. The ash requires disposal, usually to landfill, although there are options for further recycling of the incinerator bottom ash (IBA) into replacement or recovered aggregate where off-take markets exist. Reducing post-incineration waste from 20 percent to as low as 1-5 percent is an ambitious but technically viable goal. Making the process more efficient reduces the need for landfill space. Optimizing the process includes:

- Optimize Combustion Conditions by reducing unburned carbon content
- Sensors for Advanced Furnace Control of flue gas composition, temperatures, moisture content, and feedstock analysis)
- Post-Combustion Treatment (High-Temperature Vitrification of Ash)
- Ash Handling and Metal Recovery & Advanced Ash Separation
- Ash-to-Product Conversion i.e. Concrete production, ceramics, road-base materials
- Fly Ash Capture and Mineralization w/ Activated Carbon Injection and Baghouse Filtration. Mineral Carbonation (react fly ash with CO_2)

The majority of facilities currently operational around the world use an inclined moving (or reciprocating) grate design. Mixed waste (usually untreated) is delivered into a reception hall or tipping bunker. A mechanical grab then ‘mixes’ the waste (often on an automatic cycle) before depositing mixed waste into a feed hopper. From the hopper, the waste falls onto the moving grate system, which keeps it travelling down a slope (incline) through the furnace as it burns.

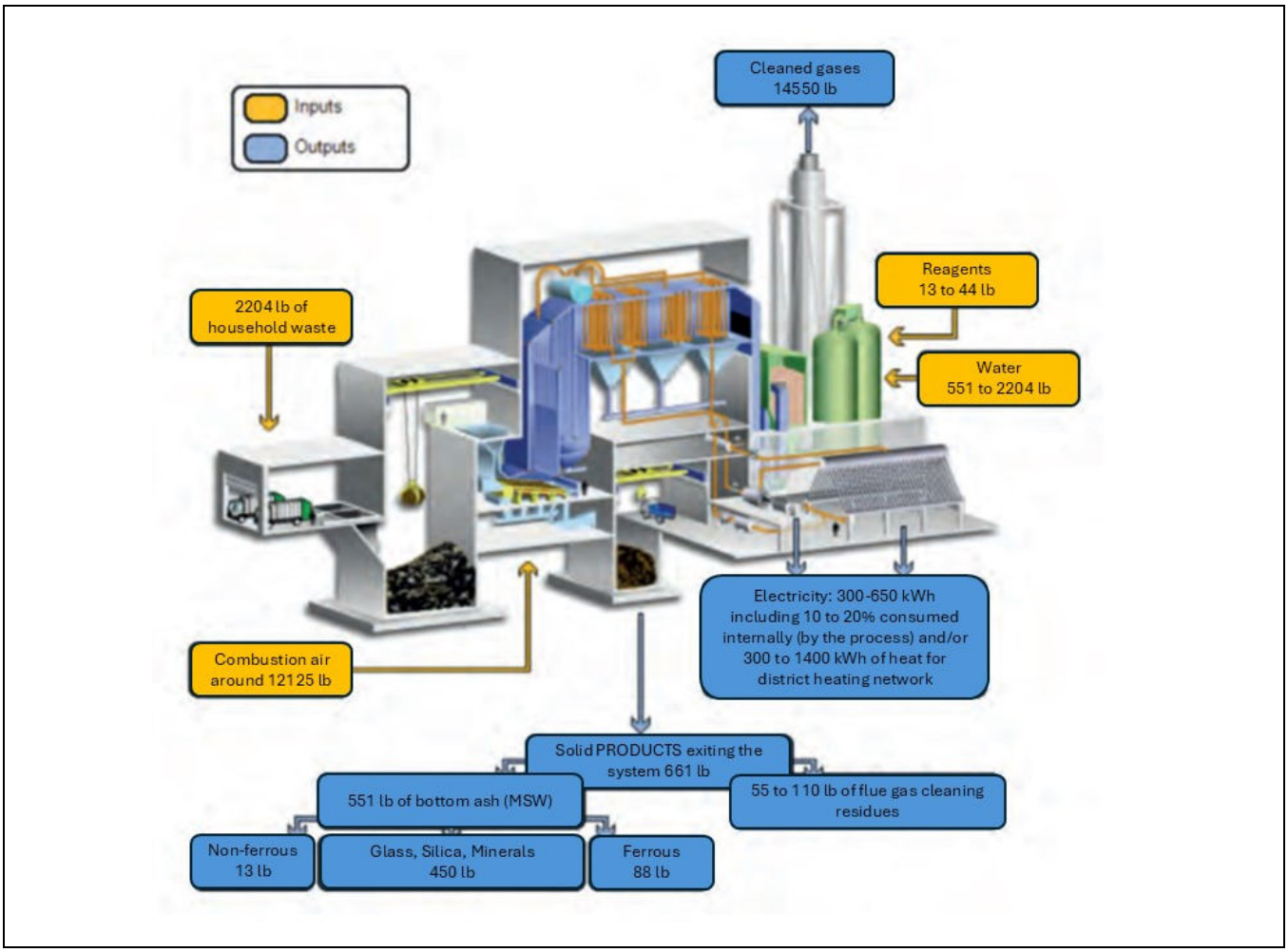

Figure 5.1-1 – Typical WTE Overview

All combustible material is burnt, and the unburned residue (bottom ash) is deposited into a quench tank. Primary air is pumped through from under the grate to aid combustion, while secondary air is delivered over the grate to enable good combustion in the gas phase. The hot gases from the combustion chamber are directed where heat is used to generate superheated steam through a series of heat exchangers.

Another alternative combustion method in mass burn facilities is the use of fluidized bed technology. Fluidized bed WTE plants use a combustion chamber containing a fluidized bed in place of a moving grate, which is created by air being forced up through a bed of inert material, for example sand, into which the waste is introduced. Because turbulence is created in the waste, this design generally enables more complete combustion of waste. It is also claimed that the lack of moving parts leads to fewer mechanical problems. Unlike mass burn 'grate' facilities, fluidized bed plants generally require some form of pre-processing of waste to enhance the calorific value of the feedstock.

Most modern large-scale plants are either fully or semi-automated using state-of-the-art computerized control systems. There is often a control room sited above the tipping hall to monitor the loading of the feed hopper and from where the waste feed grabs can be operated. Air emissions and plant performance parameters are continuously monitored with real time outputs displayed on computer screens in the control room.

The design of conventional combustion technologies, while proven and reliable, is constantly undergoing design and efficiency improvements. These typically include increasingly automated control systems and improvements in plant 'availability' and less downtime. To further reduce impacts on greenhouse gas emissions significant advances are being made into the capture of CO2 from the flue gases and subsequent Carbon Capture and Storage (CCS) systems. However, the cost implications are currently high, and CCS may only be viable for larger capacity facilities.

5.1.1.1 WASTE TO ENERGY SUMMARY

The table below summarizes the key aspects of mass-burn Waste to Energy technologies:

Table 5.1-1 – Waste to Energy Summary

Waste Materials Handled	Mixed general waste Municipal Solid Waste (MSW) Some existing facilities use Refuse Derived Fuel (RDF)
Nominal Annual Facility Capacity	Typically, between ~80,000 TPY and ~900,000 TPY but can be larger up to ~2,000,000 TPY
Footprint	Typical Large Waste to Energy facility range from 30 acres to over 60 + acres depending on plant configurations
Advantages	Can handle a range of waste types (general waste, industrial waste, hazardous waste and general yard waste). Waste feedstock requires little pre-treatment – although pre-treatment may be necessary for fluidized bed technologies. Can produce marketable energy and if equipped with CHP technology can produce heat and power Well proven technology – bankable and robust Demonstrable economies of scale with larger facilities. Relatively low maintenance costs compared to most other waste handling options including landfilling.

	Can market recovered metals from the incinerator bottom ash, and, if markets prevail, can reuse the ash as a recovered aggregate.
Disadvantages	Poor public perception Seen as prohibiting increased recycling

5.1.1.2 ATKINSRÉALIS WASTE-TO-ENERGY CONCEPT DESIGN (4,000TPD)

5.1.1.3 WASTE TO ENERGY - BACKGROUND INFORMATION

Waste-to-energy is a mature technology and increasingly becoming more efficient using advanced equipment and associated controls resulting in modern highly efficient facilities. There are many facilities currently operating in various parts of the world. Some of the leaders internationally include Japan, China, Sweden, and Germany with China leading the global capacity aiming to handle one-third of the country's waste with WTE facilities by 2030.

The benefits of a Waste to Energy facility are numerous and they include:

- Reducing residential solid waste from going to landfill
- Reducing greenhouse gas emissions
- Recovering and recycling ferrous and non-ferrous metal for reuse
- Generating electricity and supply to the local power grid
- Recycle and reuse ash for aggregate and road base
- Reducing impact on the environment and water quality from potential chemical contaminants

AtkinsRéalis USA Inc. under a mandate from Miami-Dade County, was tasked to prepare a preliminary design for a 4,000 TPD facility.

This Facility is originally envisioned for a nominal 4,000 tons per day mass burn Facility consisting of a Municipal Solid Waste (MSW) storage bunker, MSW cranes, and four boilers rated at 1,000 US tons per day (TPD) per boiler and a steam turbine. Steam generated by the boilers shall be utilized in the steam turbine generator (STG) for production of electric power. The net electrical power is proposed to be transmitted through an interconnection with Florida Power & Light Company (FPL). The Facility is proposed to be designed to operate for 30 years. The design shall be based on the site conditions and the applicable codes and standards. Additionally, the Facility shall be designed in compliance with sea level rise (SLR) projections Per IO 8-8.

The Facility shall be designed to utilize individual process trains, each consisting of a waste feed system and grate, natural circulation boiler, air quality control system equipment (AQCS), and supporting auxiliaries. The balance of Facility equipment shall be designed with sufficient redundancy to minimize single-point-of-failure or unplanned Facility shutdowns or outages. The Facility shall be designed to operate continuously and meet all Performance Guarantees, availability, and permit requirements.

The Project shall be designed to meet Envision Silver sustainability standards by integrating best practices for environmental, social, and economic benefits.

Additional details of the facility include the following:

The Miami-Dade Sustainable Solid Waste Campus shall burn, nominally, 4,000 tons per day of municipal solid waste to generate electricity. The Miami-Dade Sustainable Solid Waste Campus shall consist of, but not limited to, the following major equipment and processes:

- Waste fuel handling equipment and system including truck scale stations for tracking weight of incoming wastes and outgoing ash to landfill, waste fuel storage, cranes and waste fuel feed system, and all other associated equipment. The waste fuel handling equipment and system shall be used to feed waste fuel to all four boilers.
- Four (4) boilers, each boiler consisting of, but not limited to, the following:
- Waste fuel feed system to the furnace
- Combustion Air System
- Furnace with camera system, Auxiliary burners and flame detectors, Dynamic Grate System, Automatic Ash extraction, and required equipment for a proper and complete combustion process.
- Steam generation equipment and system including Economizer(s), steam drum, Steam Superheater(s), and Sections
- Automatic Retractable Sootblowers.
- Air Quality Control System (AQCS) train to meet air emission requirements including, but not limited to, Scrubbers, Bag house, Selective Catalytic Reduction (SCR) System
- Ash Handling System to handle bottom and fly ashes from all four boilers, The Ash handling system shall include metal recovery equipment.
- Steam, condensate, and boiler feedwater systems that shall support steam generation process of all four boilers.
- One steam turbine generator
- A complete electrical system to support Facility operation and to export power to Florida Power & Light (FPL) electrical grid.
- Raw water system that will treat the raw water from water well to provide water demand for Facility process operation.
- Reuse water system that will treat and recycle the Facility stormwater and reusable process wastewater.
- Wastewater treatment system that will treat the Facility process wastewater to meet the NPDES requirements before being discharged.
- Buildings and utility systems to support Facility operation.
- Instrumentation, control valves, remote and automatic devices, and control systems shall be designed and implemented as needed to meet the automation level requirement and to provide system operation properly, efficiently, and reliably.

The Facility will include an estimated staff of 70 personnel to operate continuously 24 hours per day and 7 days per week excluding any holidays and planned outages defined by the County.

A Graphical representation of the facility is illustrated in Figure 5.6-2 below.

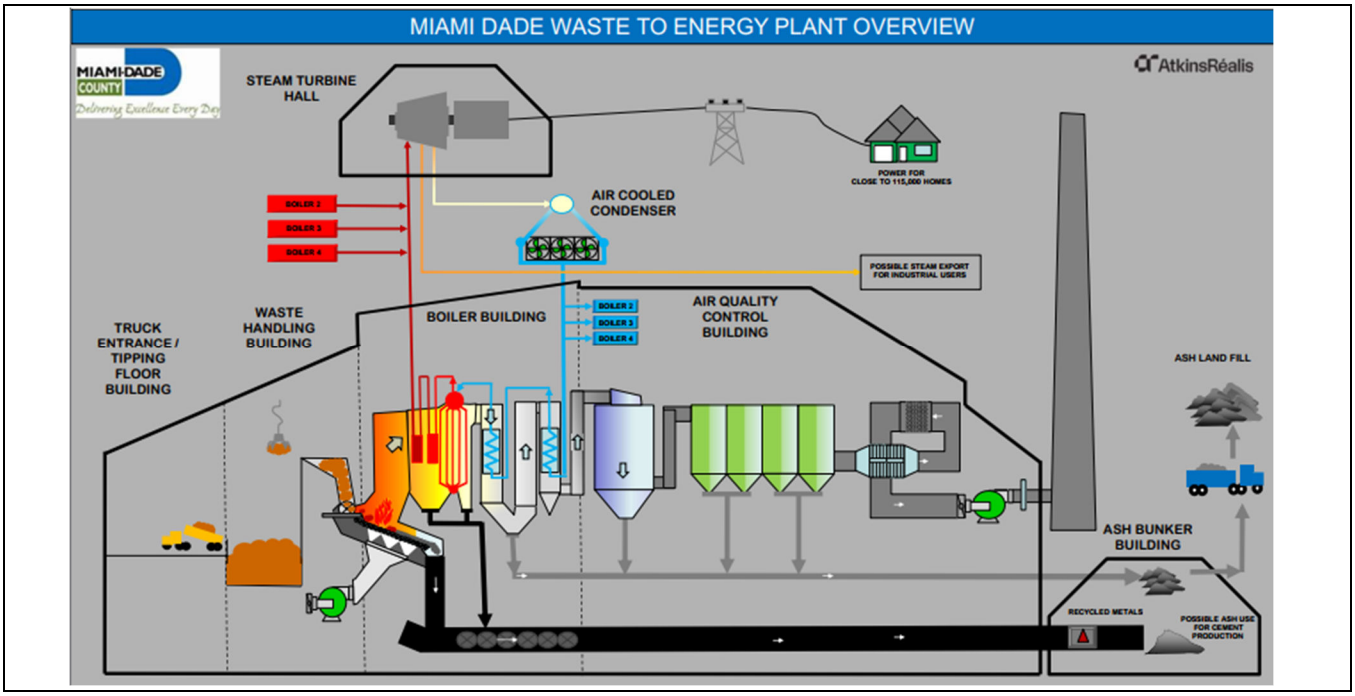

Figure 5.1-2 – Graphical Representation of Facility

To achieve ~90% waste reduction, the facility shall be designed to handle bottom and fly ashes from all four boilers, The Ash handling system shall include metal recovery equipment, and the majority of the ash shall be processed and used in construction materials, such as road base, concrete aggregates, or for soil stabilization. The remaining ash byproduct shall be directed to a landfill.

The Facility is designed in such a way to enable the retrofitting of amine-based carbon capture equipment should this be found to be reasonable in the future. This includes the interface or tie-in of duct ports, utility, auxiliary steam supply routings and installation space. Furthermore, the air quality control system (AQCS) system shall be designed in such a way as to allow for flue gas tie-in to carbon capture operations.

Facility sizing can be optimized to meet the needs of Miami-Dade County considering current needs, future demographics changes, and the effort to work towards a zero-waste solution by implementing enhanced recycling and reuse efforts.

5.1.1.4 WASTE TO ENERGY – PREVIOUS STUDIES

Data provided below from a presentation made by the County depicts comparative OPEX and CAPEX of a 4,000 TPD capacity WTE facility for the various sites that were under consideration with a range of $1.5B to $1.9B for the CAPEX and the respective OPEX range as shown in the table below.

Table 5.1-2 – Potential Sites and Estimated Time to Build with Costs

Site	Throughput (tons/year)	Capital Costs (Non-Recurring)	Annual O&M Costs	Time to Build
Doral RRF	1,300,000	$1.5 billion	$59 million	7 years and 9 months
NW 58th Street	1,300,000	$1.8 billion	$62 million	10 years and 3 months
Airport West	1,300,000	$1.8 billion	$81 million	9 years and 3 months
Medley	1,300,000	$1.9 billion	$75 million	10 years and 6 months
Okeechobee	1,300,000	$1.9 billion	$77 million	10 years and 4 months
Eitlejorge	1,300,000	$1.8 billion	$87 million	9 years and 3 months
Out-of-County Landfill with Railcars (2034)	3,000,000	$2.51 - 2.73 billion	$443 million	10 years
Landfill Contract Capacity (2035)	1,300,000	$0	$167 million	Option to Renew in 2035

Note: From County presentation in February 2025 (COW Presentation Final.pptx); Arcadis Out-of-County Landfill Analysis in March 2025.

Note: Landfill Contract Capacity based on 2% CPI for 2025-2034 and 10% CPI in 2035 per the County DSWM staff direction.

Refer to Section 5.1.2.6 for cost analysis for in-and-out of county landfill improvements as well as cost associated with landfill contracted capacity.

5.1.1.5 ASH MONOFILL DESIGN

With any Waste to Energy facility the ash produced from the incineration process needs careful planning and consideration in the overall development of the project. The landfill is an integral part of the overall waste to energy design. For a 4,000 TPD facility it is estimated that 1,000 TPD of ash will be generated using a 25% ash conversion rate. Below are items that need to be considered:

- Site selection and overall landfill size requirements are needed to determine site suitability
- Overall site development and coordination with Civil design, stormwater, drainage and water balances if a zero-discharge facility is desired.
- Overall coordination with truck weigh bridges and truck traffic for approx. 80 trucks/ day
- Metals recovery systems need to be incorporated into the landfill design to maximize over metal recovery yields/revenue. Stockpiling and drying of ash are planning aspects needed to integrate with the plant
- Aggregate production to support Envision goals and ash reuse will require integrated planning with the plant, production area and additional truck traffic
- Blending of Bottom ash with Fly ash to pass TCLP (Toxicity Characteristic Leaching Procedure) testing, mass balances will need to be coordinated with plant operations to calculate ash being landfilled and ash available for reuse.
- The overall procurement strategy can be a stand-alone process from the WTE plant but needs to be coordinated with the overall design and ash handling operations
- The landfill can be incorporated into the WTE or be kept separate based on the County's preference but doing the landfill in conjunction with the WTE is the most efficient way to proceed.

Preliminary reviews of site evaluations related to landfill volumes shall be considered and are subject to review and change but can be used for planning purposes. All calculations will need to be refined based on landfill grading. The estimates do not account for perimeter ditches and berms outside the waste boundary etc.

The estimated remaining life at Doral is 2 to 3 years. There is no ash recycling and no contingency.

The 30-year target landfill volume is about 13.8 MCY. We assumed no ash recycling and no contingency. Evaluation of site area requirements for a 30-year design life will range from 80-95 acres depending on configuration, height limitations and effective slope limitations

Landfill volumes can be reduced significantly with the implementation of Bottom Ash recycling and beneficial reuse programs. We have assumed in our Envision program a state-of-the-art metals recovery system that also segregates and prepares ash for secondary market reuse

The total ash produced (Bottom and Flyash) is calculated to be 340,000 TPY and the total bottom ash produced annually is calculated to be 272,000 TPY. We have calculated after metals recovery and ash processing that there will be 164,220 TPY available for secondary market reuse. It should be noted that to reach these targets there are several governmental, environmental, and regulatory processes to successfully complete.

The state-of-the-art metals recovery system and implementation of the proposed Envision ash reuse program will reduce the amount of ash being landfilled to approximately 175,780 TPY. This equates to approximately 13% of the incoming MSW processed in the mass burn boilers assuming a 93% boiler availability that will need to be landfilled. The required annual volume that will be required is approximately 7 MCY annually, reduced to almost half of the required space if no beneficial ash reuse program is put into place.

5.1.2 LANDFILL AND DISPOSAL

Modern landfills are evolving with technology to become more efficient and environmentally friendly. Smart landfills use IoT sensors to monitor conditions like gas emissions and leachate levels in real-time, allowing for better management and reduced environmental impact. Bioreactor landfills enhance decomposition by adding moisture and sometimes air, accelerating the breakdown of organic waste and stabilizing the landfill more quickly.

As per USEPA 2018 data, 4.9 pounds per person per day of municipal solid waste (MSW) was generated in the United States of America [1]. Out of this, approximately 32% was recycled and composted, 12% combusted with energy recovery, 50% landfilled, and 6% managed by other methods. Overall, a significant amount of waste is generated for management due to the fact that little emphasis is given to reducing waste generation, which is the fundamental and first step in the waste hierarchy framework.

Waste disposal by landfilling is one of the lowest cost methods; however, it is the least preferred option in the waste hierarchy framework due to inherent potential long term environmental impacts, including potential for greenhouse gas (GHG) emissions. Regardless of technological advancements, a portion of the solid waste generated would still require landfilling unless the remaining waste could be repurposed for some beneficial use. Therefore, landfills are expected to remain an integral part of an Integrated Solid Waste Management System (ISWM) for a foreseeable period.

Where the owners are able to operate landfills with efficiency like the private operators do (WMI, WC, Republic etc.), landfills are viewed as a lucrative business opportunity and a great revenue source. Whereas for the public entities, it is viewed as a perpetual liability. However, with proper design, operation and environmental controls, potential for any adverse impact could be mitigated effectively and the consequential liability could be largely managed. By utilizing contracted airspace, although the perpetual liability for owning the landfill could be avoided. However, where the landfills are already in existence and owned by public entities, it is generally beneficial to continue utilizing those infrastructure and optimize the land use

instead of adding liability by constructing landfill at a new location. This argument stems from the premise of not contaminating a pristine piece of land but instead containing contamination, if any, to the existing footprint.

The County currently owns a robust solid waste management infrastructure including collection, transfer and disposal systems. Additionally, agreements exist with private service providers (WMI and WCF) for handling a portion of waste generated within the County. Various options are being explored currently to decide the path forward for managing solid waste. Regardless of the option(s) implemented in the interim, knowing that the County is constrained in time, it could be beneficial to preserve any remaining capacity or airspace at the NDL and SDL for any emergency situation and make best use of the contracted airspace until an informed decision has been made for the path forward. Consideration should be made to expand existing landfill capacity which could be the lowest cost option for Miami-Dade County for waste management. Multiple vendors may be engaged to benefit Miami-Dade County from their competitive rates.

[1] https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials

5.1.2.1 WASTE MANAGEMENT INFRASTRUCTURE

Currently active facilities, owned and operated by Miami-Dade County include:

1. North Dade landfill (Class III): Accepts inert waste including trash, and construction and demolition debris
    a. Comprises two cells - eastern cell is currently active and the western cell is currently closed.
    b. Equipped with a leachate collection system. Leachate removed is processed through the sanitary sewer system.
    c. Landfill gas is burned off from a flare
    d. As of July 2024 - Total waste disposed ~ 13.6 million tons [1]. Remaining capacity approximately 880,000 tons based on waste density of 0.5 tons/ cubic yard, maximum approved waste design elevation of 138 feet above mean sea level, and waste slopes 4H:1V based on Arcadis (2025) dated March 14, 2025 – North Dade landfill Vertical Expansion Scenario.
    e. Expected remaining life – 5 years (projected for 2029, based on 170,000 tons annual disposal)
2. South Dade landfill (Class I): Accepts all types of non-hazardous waste including garbage
    a. Total 5 cells with cells 4 and 5 currently active
    b. Landfill gas is burned off from a flare at the landfill site

c. As of July 2024 - Total waste disposed ~ 21.7 million tons. Remaining capacity of approximately 3.2 million tons based on waste density of 0.55 tons/ cubic yard, maximum approved waste design elevation of 200 feet amsl, and waste slopes 3H:1V based on Arcadis (2024) dated Nov 6, 2024 - LANDFILL CAPACITY ANALYSIS FOR DSWM ACTIVE LANDFILLS AS OF JULY 1, 2024 – Refer to Figures 1C (NDL slope), Figure 2C (SDL slope) and Figure 3C (Ash landfill slope).

3. Ash Monofill

   a. 20 cells spread over 80 acres. Cells 1-19 closed and Cell 20 currently active

   b. Assumed to be no disposal since Feb 2023 after the RRF fire.

   c. As of July 2024 - Total ash disposed ~ 6.7 million tons. Remaining capacity approximately 1.2 million tons assuming waste density of 1.35 tons/ cubic yard maximum approved design elevation of approx. 125 amsl, and waste slopes 3H:1V based on Arcadis (2024) dated Nov 6, 2024 - LANDFILL CAPACITY ANALYSIS FOR DSWM ACTIVE LANDFILLS AS OF JULY 1, 2024 – Refer to Figures 1C (NDL slope), Figure 2C (SDL slope) and Figure 3C (Ash landfill slope).

4. Regional Waste Transfer Stations (WTS): Three WTS identified as Northeast, West and Central waste transfer stations. A portion of the solid waste generated in the County is delivered to the transfer stations by County, municipal, and private collection vehicles where it is reloaded into large transfer trailers for transport to one of the County's two disposal sites or contracted private disposal facilities.

5. Trash and Recycling Centers (TRC): Thirteen TRCs - provide authorized customers access for residential trash waste drop-off

6. Collection route assignments throughout the waste collection service area. Home Chemical Collection (HC2) Centers – Two facilities to allow disposal of household hazardous wastes

[2] Landfill Capacity Analysis for DSWM Active Landfills as of July 1, 2024, prepared by Arcadis dated Nov 6, 2024

5.1.2.2 WASTE GENERATION

The Department of Solid Waste Management (DSWM) manages approximately 40% of the total solid waste generated within the County with services provided to 10 municipalities. The remaining 60% is managed by open-market services provided by private haulers for commercial and industrial waste. The following information was obtained from DSWM Annual Comprehensive Financial Report [1] regarding total waste managed by DSWM from 2020-2023.

Table 5.1-3 – Total Solid Waste Managed by DSWM (tons)

Collection	FY 2020 (tons)	FY 2021 (tons)	FY 2022 (tons)	FY 2023 (tons)
Garbage	1,147,963	1,209,931	1,291,353	1,331,262
Clean Yard Trash	9,692	8,971	9,335	15,328
Trash	580,230	643,144	618,875	631,514
Miscellaneous	24,080	213,914	541,608	255,182
	1,761,965	2,075,960	2,461,171	2,233,286
(b) Disposal				
North Dade Landfill	227,540	248,438	200,532	126,059
South Dade Landfill	448,452	535,596	556,925	721,203
Ash Landfill	138,752	125,317	110,154	43,332
RRF (Total - ash landfill)	684,159	756,846	645,835	198,995
Contracted Disposal (Table IIIA)	414,332	354,316	531,243	1,003,172
	1,913,235	2,020,513	2,044,689	2,092,761
(c) Curbside Recycling	64,077	64,384	60,096	62,638

- C&D waste is collected exclusively by private firms and transported to either private facilities for recycling or disposal, or to County facilities for disposal.
- Waste recycling:
- DSWM currently administers one of the nation's largest curbside waste recycling programs (single stream, bi-weekly collection) for approximately 365,000 homes
- Currently, the County contracts with Waste Management Inc.at their Reuter Recycling Facility in Pembroke Pines, FL for the processing of recyclable materials.
- A new more advanced recycling facility is currently being developed by WMI to serve south Florida, set to be completed by 2025
- High Contamination rates - 39% in latest 2023 results
- A recycling contamination abatement program was implemented in 2023, with courtesy notices issued to residents with non-contract recyclables.

[3] Miami-Dade County (2023), Annual Comprehensive Financial Report, accessed through Solid Waste Management Publications and Reports

5.1.2.3 WASTE COMPOSITION

A waste composition study conducted by SCS Engineers (2024) observed the following three broad categories of waste (refer to Table 2 for details):

Table 5.1-4 – Waste Composition Categories

1	Organics/ Green waste	Biodegradable/ compostable waste	33%
2	Dry Recyclables	Salvageable materials	47%
3	Garbage	Landfill/ other process	20%

It is worth noting that organics and recyclables together comprise 80% of total waste generated within the County. With adequate programs and policies in place, it is feasible to divert a significant portion of waste from landfills. Based on proximate analysis conducted by SCS Engineers (2024), theoretical ash content of waste was estimated to be approximately 20%. Practically, it may be assumed to be a bit higher due to system inefficiencies. This would mean that should the County resort to mass-burn incineration for the entire mixed waste stream, 20-25% of total waste (generated as bottom ash/ fly ash/ inserts/ leftovers), would still need to be managed either by landfilling or repurposed, where feasible, depending on its physical-chemical composition and leachability of contaminants of concerns (TCLP testing required).

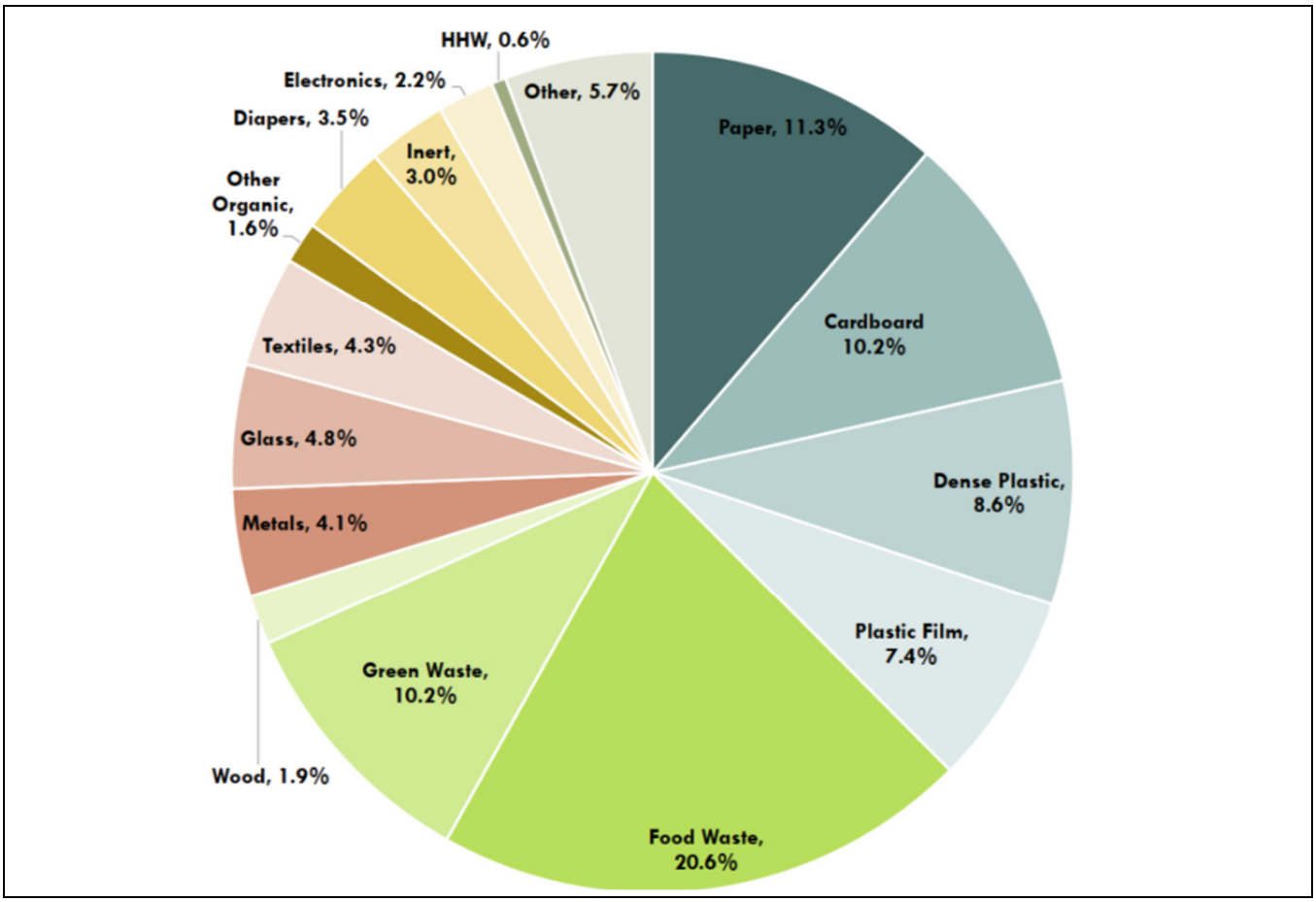

Figure 5.1-3 – Overall MSW Composition Summary (SCS Engineers Report 2025)

5.1.2.4 COUNTY LANDFILLING AND RECYCLING CONTRACTS

The following table provides an overview of existing agreements between the County and private service providers, i.e., Waste Management Inc. (WMI) and Waste Connections of Florida (WCF) for managing a portion of total waste managed by DSWM:

Table 5.1-5 – Existing Agreements b/w Miami-Dade County & Private Service Providers

Waste Management Inc. (WMI)	**Waste Connections of Florida (WCF)**
Agreement 1 (Third Amendment): **Dated September 4, 2024, valid through September 30, 2035, with two subsequent 10 years renewal periods**	**Agreement:** **Dated Feb 5, 2025, valid through October 2035 with two subsequent 10 years renewal periods**

Terms of Agreement:
• Landfills included in the Agreement:
  ○ Medley and Okeechobee Landfills owned and operated by WMI
• Annual minimum commitment of 100,000 tons at County's disposal rate.
• Annual Capacity Available of 2.7 million tons
  ○ WMI must provide airspace for 700,000 TPY at Medley landfill and 2 million TPY at Okeechobee landfill
• No commitment for County to deliver at Medley or Okeechobee landfills. However, the County must deliver 550,000 tons to WMI FEC Intermodal Facility until new WTE is established and after that minimum 250,000 tons annually
	Terms of Agreement:
	• Landfills included in the Agreement:
	• JED and Heart of Florida Landfills owned and operated by WCF
	• Annual Capacity maximum of 800,000 tons at WCF JED and/or Heart of Florida landfills.

Disposal and Transfer Fees: • Annually WMI must deliver 230,000 tons to Medley landfill and pay $2.77 per ton surcharge to County. • Disposal fee (subject to CPI adjustment) paid to WMI	Disposal and Transfer Fees: • Disposal Fee per ton - WCF to pay County - $74.4 for disposal at County's landfills • Beginning October 2025, County to pay WCF a disposal fee per ton of $

○ Medley landfill - $ 45.41/ ton ○ Okeechobee landfill - $37.98/ ton • Transfer fee paid to WMI $30.99/ ton	72.25 for disposal at JED landfill and Heart of Florida Landfill • Transfer Fee paid to WCF - $16.28 per ton for delivery • Beginning October 2025 WCF to pay County a disposal surcharge fee of $5 per ton for 50,000 tons annually.
Agreement 2: Waste Recycling (Contract No. EVN0000147) **Dated April 1, 2025, through April 2030 (5-year term) renewable to one additional five-year term**	
Terms of Agreement: • Every 12 months Processing fees and Contamination/ residue fees will be adjusted • To confirm waste composition of recyclables, WMI will hire and compensate a mutually agreed independent 3rd party to conduct recyclable material composition study once per year. 50% of the cost for such study to be borne by County. • Designated Recyclable Materials: ○ Aluminum canes and beverage containers ○ Glass bottles and food containers ○ Ferrous ○ Plastics (PET, HDPE) ○ Mixed residential paper	
Fees: • WMI to pay County the County' percentage share each month following the month the recyclables were processed. • WMI to receive a Processing fee for 100% tonnage delivered minus the Average Material Value (AMV) for the AMV for the respective month	

• For Jan 2024 Processing Fee was $145 per ton and AMV of ~ $ 44 per ton) • County gets AMV per ton	

5.1.2.5 SYSTEM ENHANCEMENT

5.1.2.5.1 GENERAL CONSIDERATIONS

- With the use of appropriate waste compaction equipment, airspace could be optimized to accommodate more waste within the same landfill footprint. Waste compaction of up to 0.75 tons/cubic yard have been attained at various large landfills across Norh America. Annual topographic surveys along with weigh scale data provide a good indication of waste densities achieved and making improvement thereof.
- Capacity enhancement is expected to reduce reliance on third party transportation and tipping fees for disposal at third party facilities.
- Vertical expansion for any design elevation is contingent upon suitability of geology and hydrogeological conditions underlying this site and whether it would support the proposed vertical expansion.
- Further, the final height of the proposed vertical expansion will be guided by slope stability analyses considering site specific geotechnical parameters, a minimum factor of safety of 1.5, and evaluation of leachate collection system and stormwater management system.
- Opportunities may exist to re-purpose ash monofil should WTE facility is not an option going forward.

5.1.2.5.2 REGULATORY FRAMEWORK

- The federal government encourages waste minimization and recycling efforts through EPA grants and other mechanisms, which provide financial assistance to states and municipalities to encourage development of alternative solid waste programs and facilities.
- The FDEP has suggested ways to potentially increase recycling in Florida, including options for focusing on markets, construction and demolition debris recycling, organics recycling, commercial recycling, and education and outreach. In 2020, the FDEP reported that Florida's overall recycling rate was 50%, well short of the 75% goal set by Legislature.
- The current practices in Florida are not expected to significantly increase the statewide recycling rate. However, through partnership with Florida recycling stakeholders, there is an opportunity to transform Florida recycling from an aspirational goal into a program that incorporates source reduction, diversion of waste, recycling, and consideration of the full environmental impact of materials used from cradle to grave.

- Florida Statute Ch. 403.706, counties in Florida are charged with “the operation of solid waste facilities that meet the needs of all incorporated and unincorporated areas of the county.” In 1977, the Florida Legislature enacted the Florida Resource Recovery Act, which mandated that the state’s 19 most populous counties study WTE as part of their Solid Waste Master Plans.

5.1.2.6 PATH FORWARD – COUNTY-CONSIDERED OPTIONS

The following provides a summary of various options explored by the County in an effort to define their path forward for managing solid waste.

5.1.2.6.1 NORTH DADE LANDFILL – CAPACITY ENHANCEMENTS

The following list includes information relating to the North Dade Landfill and its capacity enhancements for Miami-Dade County:

- NDL is a Class III landfill, and therefore, waste types disposed of is limited to inert waste.
- NDL provides an opportunity for both lateral and vertical expansion. Vertical expansion has been evaluated by Arcadis[1] considering (a) east cell alone and (b) both east and west cells for two different design elevations of 170 feet and 200 feet amsl (above mean sea level) from its current design elevation of 140 amsl.
- Assuming slope stability analysis supports the proposed vertical expansion up to 200 amsl for both east and west cells, it could provide additional capacity of up to 6.5 million tons and prolonging landfill lifespan for up to additional 36 years considering annual disposal rate of 180,000 tons and evaluation for leachate collection system and stormwater management system.
- The following considerations were made for NDL capacity enhancement:
- NDL only accepts inert waste which accounts for approximately 20% of waste generated in the County
- Final height of the proposed vertical expansion will be guided by slope stability analyses considering site specific geotechnical parameters and a minimum factor of safety.
- Prior approval from the Federal Aviation Administration already exists for a landfill height of up to 290 feet amsl.
- Approval from FDEP for lateral/ vertical expansion will be required and permit issuance could range from five to ten years.
- Vertical Expansion costs associated with NDL were conceptualized for four scenarios as shown in the table below which excludes landfill operation cost

[1] Landfill Capacity Analysis for DSWM Active Landfills as of July 1, 2024, prepared by Arcadis dated Nov 6, 2024

Table 5.1-6 – NDL Vertical Expansion Optimization based on County DSWM financial analysis

Optimization Scenario Description	**Airspace Gained in Tons**	**Additional Asset Life (Years)**	**Landfill Expansion** Net Revenue (Tip Fee Less CIP and Operating Expense)	**No Landfill Expansion** Net Haul Out Cost (Tip Fee Less Transportation and 3rd Party Disposal Cost)
East Cell 84 Acres +32'	1,540,186	8.6	$19,274,810	($29,710,187.94)
East Cell 84 Acres +62'	2,290,186	12.7	$43,719,810	($44,177,687.94)
East and West Cell 180 Acres +32'	5,040,186	28	$107,084,810	($97,225,187.94)
East and West Cell 180 Acres +62'	6,540,186	36.3	$155,874,810	($126,160,187.94)

5.1.2.6.2 SOUTH DADE LANDFILL – CAPACITY ENHANCEMENTS

The following list includes information relating to the South Dade Landfill and its capacity enhancements for Miami-Dade County:

- As of June 2024 - Total waste disposed ~ 21.6 million tons and remaining capacity approximately 3.2 million tons assuming waste density of 0.55 tons/ cubic yard, maximum approved design elevation of approx. 150 amsl, and waste slopes 3H:1V. Based on 750,000 tons annual disposal, remaining lifespan 4 years (projected for 2028)
- SDL provides opportunity for vertical expansion of Cell 4-5. Vertical expansion has been evaluated by Arcadis considering final design elevations of 250 feet amsl from its current design elevation of 150 feet amsl. Further, horizontal expansion is also available to design and permitted a new Cell 6 up to 150 feet amsl within the existing landfill property boundary.
- Vertical and Horizontal Expansion costs associated with SDL were conceptualized as shown in the table below.

Table 5.1-7 – SDL Landfill Vertical and Horizontal Expansion Optimization based on County DSWM financial analysis

Optimization Scenario Description	**Expansion Airspace (Tons)**	**Additional Asset Life (Years)**	**Landfill Expansion** Net Revenue (Tip Fee Less CIP and Operating Expense)	**No Landfill Expansion** Net Haul Out Cost (Tip Fee Less Transportation and 3rd Party Disposal Cost)
Horizontal Expansion (Cell 6) up to 140' NVGD	1,047,941	2.1	$24,170,099	($20,214,781.89)
Vertical Expansion (Cells 4 & 5, 106 Acres) +103'	3,887,427	7.8	$199,586,892	($74,988,466.83)
Combined Vertical and Horizontal Expansion	4,935,368	10	$233,627,726	($95,203,248.72)

5.1.2.6.3 OUT OF COUNTY LANDFILL (COUNTY-OWNED)

Arcadis (2025)[2] provided conceptual cost estimate for a hypothetical Out of County Class I Landfill considering the following assumptions:

- Ownership by County and Operation by third party including equipment
- CAPEX/OPEX including decommissioning – 20 years (conceptual costs)
- 10-years planning/ development phase
- 1,000-acre land @ $15,000/ acre | cell area ~ 50 acre | assumes site suitable for landfill construction per the regulations | annual waste disposal 3 million tons beginning 2034 for 20 yrs | Total capacity 60 million tons
- Haul cost 2024 - $34/ton by rail and $32/ton by road (200*0.16$ per ton-mile)
- Assumes site is suitable for construction of Class I landfill
- Conceptual site cost estimate for development of an Out of County landfill including its operation cost is shown in Table 5.1-8 below.
- Table 5.1-9 presents CAPEX for building infrastructure for rail transfer and Table 5.1-10 presents transfer cost by rail.

[2] Memo: Conceptual Out-of-County landfill prepared by Arcadis dated March 21, 2025

Table 5.1-8 – Conceptual Estimate Out of County Landfill (Arcadis,2025)

Estimated Cost	2024 Dollars	2034 Dollars	2054 Dollars
Capital Costs (9 Cells)	$1.06B	$1.43B	$2.58B
Operating Costs	$293M	$393M	$529M
Closure and Long-Term Care Costs	$142M	$191M	$256M
Total Year 1 Costs (Cell 1 Only)	$614M	$825M	---
Total Cumulative 20-Year Costs	$2.55B		

Table 5.1-9 – CAPEX for building Rail Transfer Infrastructure (Arcadis,2025)

Item	Qty	Unit Cost	Total Cost
Standard rail flatcar	8,400 – 9,600	$120,000	$1B - $1.2B
Standard 40-ft intermodal container	16,800 – 19,200	$5,000	$84M - $96M
Total Capital Costs			$1.08B - $1.3B

Table 5.1-10 – OPEX for waste transfer to Out of County Landfill (Arcadis,2025)

Facility	Est. Rail Haul Distance	Est. Annual Rail Haul Cost	Est. Rail Haul Cost Per Ton
Blue Sky Landfill, AL	830 mi	$249M- $374M	$83 - $125
Republic Services, Bishopville, SC	800 mi	$240M - $360M	$80 - $120
Taylor County Landfill, Mauk, GA	650 mi	$195M - $293M	$65 - $98
Okeechobee Landfill, Okeechobee, FL	110 mi	$50M - $83M	$17 - $28
Heart of Florida Landfill, Lake Panasoffkee, FL	260 mi	$117M- $195M	$39 - $65

5.1.2.6.4 CONTRACTED CAPACITY

The County currently has agreements with WMI and WCF for the next 10 years with the ability for the county to renew them for two additional terms of 10 years each. In total, these agreements provide a contracted airspace of approximately 3.5 million TPY. The table below provides an approximate cost for the contracted airspace estimated using the current agreements the County has with WMI and WCF.

Table 5.1-11 – County Cost of Disposal by Location before NDL/SDL Closures

Summary of County Disposal Costs with North Dade Landfill and South Dade Landfill

Contracted Airspace		Maximum annual contractual capacity (tons)	Minimum annual delivery (tons)	Assumed annual disposal (tons)	Disposal Fee	Transfer Fee	Fuel surcharge to be paid by County	Total fee per ton to be paid to WMI/WCF	Disposal to be paid to County	Surcharge to be paid to County	Expenses: Expenses to Operate SD/NDL/Transfer Station	Expenses: Paid by County for Contracted Airspace	Revenue: From surcharge and tipping Fee
Medley	WMI	700,000		650,000	$ 45.41			$ 45.41	$ 74.40	$ 2.77		$ (29,516,500)	$ 50,160,500
Okeechobee	WMI	2,000,000		568,000	$ 37.98							$ (21,572,640)	$ 42,259,200
FEC Intermodal	WMI		550,000	568,000		$ 30.99		$ 71.22	$ 74.40			$ (17,602,320)	$ -
Fuel Surcharge	WMI			568,000			$ 2.25					$ (1,278,000)	$ -
JED (by Road)	WCF		62,400	62,400	$ 72.25			$ 72.25	$ 74.40			$ (4,508,400)	$ 4,642,560
Heart of Florida (By Rail)	WCF	800,000	249,600	249,600	$ 72.25							$ (18,033,600)	$ 18,570,240
Surcharge Revenue	WCF	50,000								$ 5.00			$ 250,000
SDL	County			430,000	$ 74.40				$ 74.40	$ -	$ 37.66	$ (16,193,800)	$ 31,992,000
NDL	County			140,000	$ 74.40				$ 74.40	$ -	$ 37.66	$ (5,272,400)	$ 10,416,000
Transfer Fee	County			1,280,000	$ 16.28						$ 39.75	$ (50,880,000)	$ 20,838,400
Assumed Total Disposal Quantity (tons)				**2,100,000**								$ (164,857,660)	$ 179,128,900
Cost of Disposal per Ton to County												**$ (78.50)**	

Notes - County's collection cost from point of generation to the WTS not included

* Transfer fee paid by WMI/ WCF to the County for waste delivered to County transfer station.

Table 5.1-12 – County Cost of Disposal by Location after NDL/SDL Closures

Summary of County Disposal Costs without North Dade Landfill and South Dade Landfill

Contracted Airspace		Maximum annual contractual capacity (tons)	Minimum annual delivery (tons)	Assumed annual disposal (tons)	Disposal Fee	Transfer Fee	Fuel surcharge to be paid by County	Total fee per ton to be paid to WMI/WCF	Disposal be paid to County	Surcharge to be paid to County	Expenses: Expenses to Operate SD/NDL/Transfer Station	Expenses: Paid by County for Contracted Airspace	Revenue: From surcharge and tipping Fee
Medley	WMI	700,000		700,000	$ 45.41			$ 45.41	$ 74.40	$ 2.77		$ (31,787,000)	$ 54,019,000
Okeechobee	WMI	2,000,000		1,088,000	$ 37.98							$ (77,487,360)	$ 80,947,200
FEC Intermodal	WMI		550,000	1,088,000		$ 30.99		$ 71.22	$74.40				
Fuel Surcharge	WMI			1,088,000			$ 2.25						
JED (by Road)	WCF		62,400	62,400	$ 72.25			$ 72.25	$ 74.40			$ (4,508,400)	$ 4,642,560
Heart of Florida (By Rail)	WCF	800,000	249,600	249,600	$ 72.25				$ 74.40			$ (18,033,600)	$ 18,570,240
Surcharge Revenue	WCF	50,000							$ 5.00				$ 250,000
WMI Put Obligation	County		100,000	-		$ 16.28			$ 74.40				
WCF Put Obligation	County		250,000	-		$ 16.28			$ 74.40				
Transfer Fee	County			1,850,000		$ 16.28			$ 16.28		$ 39.75	$ (73,537,500)	$ 30,118,000
Assumed Total Disposal Quantity (tons)				**2,100,000**								$ (205,353,860)	$ 188,547,000
Cost of Disposal per Ton to County												**$ (97.79)**	

Notes - County's collection cost from point of generation to the WTS not included

* Transfer fee paid by WMI/ WCF to the County for waste delivered to County transfer station.

5.1.3 MATERIALS RECOVERY AND RECYCLING

5.1.3.1 CLEAN AND DIRTY MATERIAL RECOVERY FACILITIES

Material recovery and recycling involves the collection and processing of waste materials to create new products. Material Recovery Facilities (MRFs) play a crucial role by sorting and recovering recyclable materials, reducing the environmental impact of waste and promoting a more circular economy.

A MRF is usually made up of a series of conveyor belts and a mix of manual and automated machines to separate the materials and remove any items that cannot be recycled. Advanced sorting technologies, such as those using artificial intelligence (AI), robotics and infrared optical sorting, improve the efficiency and purity of recycled materials although the efficiency of a MRF is still dependent on the quality of the feedstock material. The non-recyclable fraction (or residual/ reject waste) is generally landfilled or sent for further treatment often at a Waste to Energy facility.

A distinction has been made in this section between facilities designed to take mixed unsorted general waste and facilities designed to process dry, source separated recyclables. A facility which is designed to process source separated dry recyclables is referred to as a 'clean Material Recovery Facility' (clean MRF) as distinct from a 'dirty MRF', which handles mixed household waste including putrescible materials with little to no curb side sorting.

Mechanical processing starts, where necessary, with a bag splitter to remove the waste from the collection bags. Materials can then be sorted by a combination of techniques which typically include hand picking, mechanical sorting/screening/sieving, magnetic separation, eddy current separation, optical and density separators arranged and sequenced to optimize the automatic segregation of the recyclable materials.

There is no such thing as a standard MRF processing facility. The nature of the processes and scale of operations will depend on various issues, including the nature of the waste strategy for the local area, local contractual issues, the nature of the feedstock resulting from upstream management operations and market requirements, including quality specifications.

There have been various trials and research programs that have sought to determine the best practicable recycling rates that can be achieved, and it is now commonly accepted that using multiple bin systems and encouraging waste producers to undertake their own separation of recyclables is the best way of achieving the highest levels of recycling.

Figure 5.1-4 – Internals of SUTCO Clean MRF

Figure 5.1-5 – Dirty MRF feed and output in Jeddah (Kingdom of Saudi Arabia)

An increasingly common feature of many recently developed clean MRF facilities is the exclusion of glass recycling. The reason for this is quality control, i.e., removing glass from the system prevents contamination of other materials (e.g., paper and cardboard) and helps to simplify the mechanical separation processes adopted to achieve the best quality product for onward sales to specialist re-processors. As a result, glass from source separation may be collected separately and bulked up (without entering the material recovery processing equipment) and transported to reprocessors.

The 'reject' rates from a clean MRF are typically in the range of 10 to 30% of the total input depending upon the technology used, the number of picking stations, public awareness and performance of the recycling schemes which all affect the quality of the feedstock waste (i.e., the waste has been well segregated at source with little to no material contamination).

Conversely, for a dirty MRF that receives "black bag" waste, only 10-15% of input waste can be recovered (hard plastics and metals) due to the unfavorable composition of incoming waste whereas MRFs that receive mixed or comingled recyclables have a recovery rate of 50-80% which is dictated by the contamination of incoming waste.

5.1.3.2 CHEMICAL RECYCLING FACILITIES

Chemical recycling is an advanced recycling process that converts polymeric waste at a molecular level back into raw materials that can be marketed and reused to manufacture new products. Typically, this process focusses on plastic and rubber waste but can also be undertaken on other materials.

The technology is more suitable for managing the plastic waste that cannot be easily recovered from an MRF or that which is more complicated to recycle e.g., polyethylene, polypropylene, and polystyrene. Chemical recycling typically provides two types of outputs; a 'base' material that can be reused as a product in manufacturing, and a fuel. The three primary technologies for chemical recycling are:

- Pyrolysis – which heats waste to high temperatures without the presence of oxygen to break down the polymer chains in plastic and create simpler hydrocarbons. This creates an oil which can be used as a feedstock to manufacture new plastic materials, solid char (that can be used as a building material) and combustible gases (that can be used to generate energy)
- Gasification – which heats the plastic material creating a synthetic gas (syngas) which can be sold as a fuel
- Depolymerization – a chemical process that breaks down polymers into smaller molecules that can produce monomers which can be subsequently sold and used to create and manufacture new polymer products.
- Chemical recycling is still not proven and is an emerging technology. While it has demonstrated an ability to treat some of the harder to recycle plastic waste and create usable and marketable products there are limited examples of plants operating on a large scale and commercial basis.

5.1.3.2.1 MATERIALS RECOVERY AND RECYCLING SUMMARY

The table below summarizes the key aspects of typical Materials Recovery and Recycling technologies:

Table 5.1-13 – Material Recovery and Recycling Summary

Waste Materials Handled	Mixed general waste (dirty MRF) Comingled recyclable materials such as paper, card, glass, plastics, textiles, and aluminum/steel cans (clean MRF) Typically, plastics and rubber (chemical recycling) Not proven at large scale
Nominal Facility Capacities	Typically, 20,000 to 330,000 tons per annum but with some dirty MRFs processing in excess of 800,000 tons per annum
Footprint	1 to 30 acres
Advantages	Proven, especially for clean MRF Bankable (especially for clean MRF – less so for dirty MRF and chemical recycling) High landfill diversion and high segregation from co-mingled recycling stream for clean MRF

	Higher revenue from commingled recyclable stream (clean MRF) Relatively small footprint for throughput
Disadvantages	Technology can be expensive (especially for chemical recycling and high levels of automation in clean MRF) Not all waste materials are recyclable Difficult to achieve high public participation in curbside recycling Material contamination reduces the yield of recyclables and plant efficiency significantly - in particular materials from Dirty MRF Material contamination affects value of material – dirty MRFs attract lower value for recyclates as compared with clean MRFs and chemical recycling

5.1.4 ORGANIC WASTE TREATMENT

Organic wastes include two broad types: food and green wastes and they are processed with types of treatment processes: Aerobic which produces compost (composting and aerated static piles) and Anaerobic Digestion, which produces digestate, liquors and biogas, which can be either sent to the gas grid or used for electricity generation.

Clean yard waste can be processed and mulched for resale.

5.1.4.1 AEROBIC TREATMENT - COMPOSTING

Composting is a natural process where micro-organisms aerobically (in the presence of oxygen) convert waste organic materials into a mixture of stable humic substances and inorganic plant nutrients to form ‘compost’. For composting to take place efficiently, five key factors need to be controlled, these are: temperature, moisture, oxygen, the porosity of the material, and the carbon to nitrogen ratio. By products of composting include the release of carbon dioxide, water and heat energy.

The environmental arguments in favor of composting and compost use are favorable, but principally the diversion of organic material from landfill will reduce the levels of leachate and methane (a potent greenhouse gas) and provide a more sustainable form of waste management. Another significant benefit is the wider use of compost in agriculture and landscaping that can improve soil structure and reduce erosion. Composting is also seen as an almost Carbon Neutral process. Composting refers to any system used to treat biodegrade organic waste without any physical manipulation during primary composting. Composting systems are either open systems or in-vessel systems. These systems are shown below.

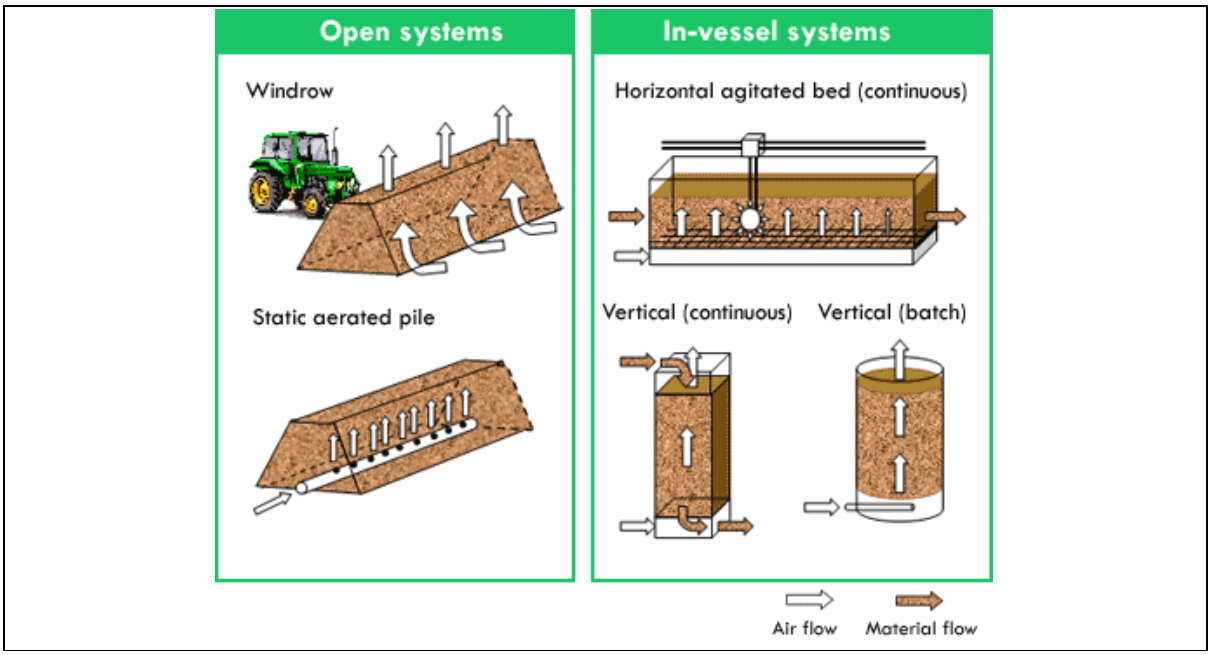

Figure 5.1-6 – Composting Systems

The open systems include either Windrow or Aerated Static Piles (ASP). Both open systems require larger land area compared to the in-vessel composting and are usually associated with odor problems. The Windrow composting is achieved by piling organic waste material in long rows (windrows). This method is suited to producing large volumes of compost. The rows are generally turned to improve porosity and oxygen content, mix in or remove moisture, and redistribute cooler and hotter portions of the pile. Composting process control parameters are ratios of carbon and nitrogen of the waste materials, the amount of bulking agent added to assure air porosity, the pile size, moisture content, and the turning frequency.

As a waste recovery and management tool for Miami-Dade County, composting technology has the advantage of being relatively simple technique. It can manage a large throughput of material but is also flexible and provides a return in the form of gate fees and sale of end-product. Composting can essentially be split into to two types of technology: Windrow composting & In-vessel composting. The difference in these two technologies is explained in more detail in the following paragraphs.

5.1.4.1.1 WINDROW COMPOSTING

Windrow composting is the simplest form of composting where green, garden and horticultural waste is shredded, to increase the surface area of the material, then placed in long rows (windrows) and allowed to compost under natural processes. Composting is often undertaken, but not exclusively, in the open air and conducted on a resilient foundation, such as, a reinforced concrete slab which also allows control of any drainage released as part of the natural degradation process. The windrows are regularly turned by a mechanical digger or specialist plant to ensure that air is supplied evenly to all areas of the compost. Depending on the surrounding environment, occasionally this type of facility is fully enclosed within a building.

A site has to be prepared with an impermeable base, usually concrete so that leachate is not allowed to enter local surface or ground water systems. The other capital costs are

the shredding and turning equipment, environmental control equipment such as dust suppression, leachate collection and possibly odor control. The volumes received at the site, shredding and turning of the compost will dictate the capital and operating costs of the process. The main operating costs are for the running of the equipment and the associated employees. Organic waste composting facilities do not accept mixed waste streams.

Windrow composting usually takes the longest amount of time to produce the compost (4-6 months) and can suffer from fluctuations in the quality of the final product due to pockets or organic waste not fully degrading due to the crude turning methods and seasonal variation in the feedstock and weather. The production times can be reduced with the use of special covers, which allow for faster processing together with forced aeration. Once compost is matured, it needs to be refined with the removal of large particles and non-organic items like stones. Examples of windrow, refinery and covered windrow composting systems are shown in the figure below.

Based on the latest information provided for this report, Miami-Dade generates more than 450,000 tons per annum of green garden waste. Windrow composting presents a good opportunity for Miami-Dade for managing this waste stream at relatively low capital and operational costs. In addition, compost is a valuable resource for expanding and maintaining the existing and planned green spaces, parks and gardens and could help Miami-Dade meet the 2030 targets of its Climate Action Strategy.

Figure 5.1-7 – Windrow composting examples (US Compost Association)

5.1.4.1.2 AERATED STATIC PILES

In the Aerated Static Pile (ASP) composting, the blended admixture is usually placed on perforated pipes, providing air circulation for controlled aeration. It may be in windrows, open or covered. The aeration system uses mechanical aeration such as fans to push and/or pull air through the composting mass. Rigid or flexible perforated piping, connected to fans, delivers the air. The pipes can be installed in channels, on top of a floor, or included throughout the pile during pile buildup. The ASP techniques may range from very small, simple systems to very large, capital intensive, industrial installations.

Aerated static piles offer process control for rapid biodegradation and work well for facilities processing wet materials and large volumes of feedstock. ASP facilities can be under roof or outdoor windrow composting operations, or totally enclosed in-vessel composting, sometimes referred to tunnel composting. Large scale aerated systems can also operate with augers which, together with the air injected through perforated floors and waster sprayed for moisture levels control, it can be used for relatively higher

throughputs and faster retention times. Examples of these systems are shown in the next figure.

Figure 5.1-8 – Aerated Static Piles Systems

ASP systems have the ability to maintain proper moisture and oxygen levels for the microbial populations to operate at peak efficiency to reduce pathogens, while preventing excess heat, which can crash the system compared to the Windrow system. However, aerated systems can dry out quickly and must be monitored closely to maintain desired moisture levels. ASP systems also facilitate the use of biofilters to treat process air in order to remove particulates and odors prior to venting.

5.1.4.1.3 IN-VESSEL COMPOSTING

In-vessel composting covers a wide range of composting systems from enclosed halls through to tunnels and containers. The common feature in these systems is the containment of material allowing a higher degree of process control than with normal windrow composting. The process is designed to increase aeration of the material and minimize the residence time of the material in the system. The process also usually requires the organic waste to be pre-shredded, to minimize residence time, via increased surface area for microbes to work upon.

The advantage of these systems is often that emissions can be captured and managed reducing the escape of odors and leachate. The capital costs are therefore higher than windrow composting due to the greater use of technical equipment. There is often a greater operating cost as well due to the use of enforced aeration, moving conveyors etc. However, this can be balanced against a more consistent product (due to automated control), higher throughput and year-round operation compared to windrow systems. A number of in-vessel composting technologies are also suitable for treating organic food/ kitchen wastes. Examples of vertical and box composting systems are shown below.

Figure 5.1-9 – In-Vessel Composting Systems

Some aerobic processes are also suitable for treatment and bio-stabilization of organics derived from mixed general waste fractions using waste treatment technologies such as Dirty MRF. The subsequent compost produced is of lower quality due to the lack of control on the physical and chemical properties of the incoming waste stream.

5.1.4.1.4 AEROBIC ORGANIC TREATMENT SUMMARY

The table below summarizes the key aspects of organic treatment technologies:

Table 5.1-14 – Aerobic Organic Treatment Summary

Waste Materials Handled	Organic garden waste (Windrow/ASP) or organic garden and kitchen waste (In-Vessel)
Nominal Sizes of Facilities	Typically, 5,000 to 50,000 tons per annum depending on technology
Footprint	2.5 to 10 acres (Windrows/ASP) 1 to 6 acres (IVC)
Advantages	• Proven • Bankable • Windrow has low CAPEX and OPEX as compared with IVC systems • Windrows and ASP have bigger footprints when compared with In-vessel systems • In-vessel systems have higher throughput per unit area and the ability to treat organic food waste.
Disadvantages	• Odor emissions • Need to establish a market for end products • Compost produced from mixed waste can be of low grade and therefore its main use is for land remediation or as landfill cover.

5.1.4.2 ANAEROBIC DIGESTION

5.1.4.2.1 PROCESS DESCRIPTION

Anaerobic Digestion (AD) is based on the degradation of organic substances by micro-organisms in the absence of oxygen to produce methane (CH_4), carbon dioxide (CO_2), water (H_2O), digestate and other minority products. AD is a globally proven technology, well-suited to treating the effluent arising from many industrial processes and produces valuable by-products for example, a soil conditioner/alternative fertilizer (digestate) and renewable fuels from Biogas and/ or renewable energy/heat from the burning of biogas produced.

AD is used to treat a wide range of biodegradable organic substances and especially in effluent treatment is used to reduce the Chemical Oxygen Demand (COD). Typically, AD can reduce the COD level of an effluent by up to around 90% thus reducing the costs of effluent treatment with the additional benefit of biogas production. AD can occur under cryophilic (<25ºC), mesophilic (25-45ºC) or thermophilic conditions (around 55ºC).

The higher temperature processes are typically faster but less stable and require a higher level of instrumentation and control in order to maintain process conditions. However, the typical operating conditions for these processes employed to process industrial and domestic residuals are:

- Temperature range of 32 to 42ºC (i.e. mesophilic conditions).
- Retention time up to 20 days, depending on feedstock and process.
- Neutral pH value (e.g. pH 6.7 to 7.7).
- Ready supply of organic and inorganic nutrients in the form of degradable carbon, nitrogen, phosphorous, potassium and essential trace metals.

Biogas generated in the process is typically rich in CH_4, (around 60%) and its chemical energy can be recovered using a gas engine, gas turbine or gas boiler. The biogas also contains other gases including CO_2, hydrogen sulfide (H_2S) and water vapor. Pre-treatment at either the pre-combustion or pre-digestion stage may be required to reduce H_2S and water levels to mitigate corrosion, operational problems and emissions to air resulting from combustion of the biogas.

Feedstocks for AD are source-separated and is commonly solid waste (biosolids) from wastewater treatment processes and/or municipal or industrial solid waste (from this point to be referred to as organic waste) for example waste food, fats, and oils. The AD of organic waste is undertaken at scale in both the water and waste industry across the globe. Co-digestion, mixing of organic waste with biosolids, is technically feasible and can enhance digestibility. Co-digestion is more practicable when municipal and/or industrial organic waste is pre-conditioned, for example screened and mixed to form an organic ‘soup’ like substance in order to minimize the impact of variances in digestibility from one waste feedstock to another. The basic principles of the process are outlined in the Process Flow Diagram (PFD) shown below:

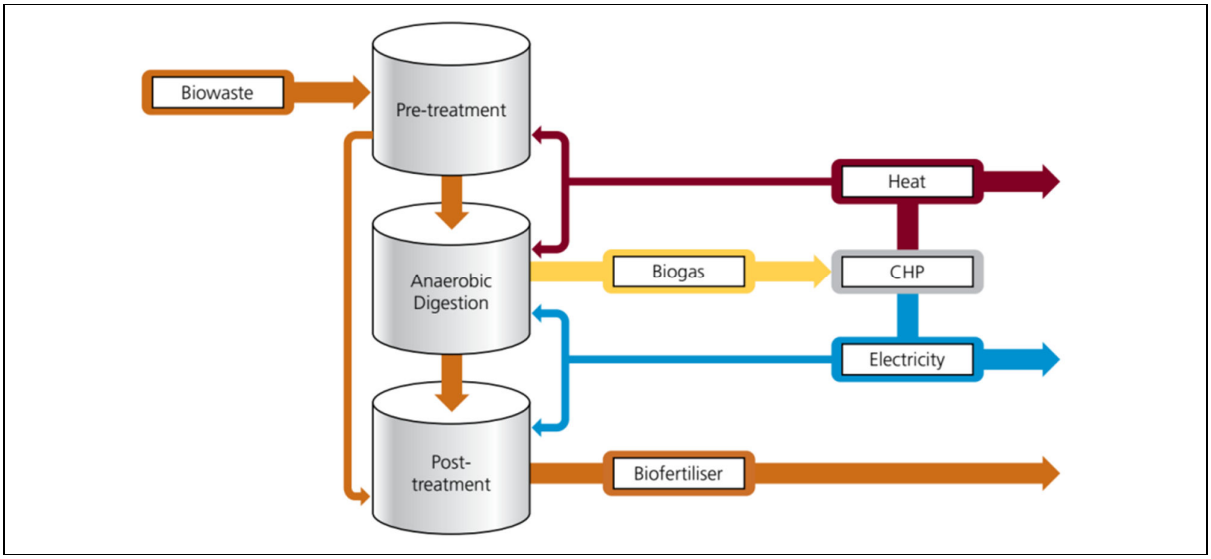

Figure 5.1-10 – Typical Anaerobic Digestion Process Diagram

*CHP (Combined Heat and Power) engines have been highlighted in the schematic. There are however alternative approaches which could be deployed; for example, gas turbines, gas to grid or biofuel production, especially if waste heat is not required in the treatment process.

AD produces digestate, which can be a valuable bio-fertilizer depending upon the feedstocks used and has potential to be used as a renewable source of critical fertilizer elements such as nitrogen and phosphorus. The nutrient composition of the digestate depends on the feedstock but generally speaking, the digestate would be rich in nitrogen, phosphorus, potassium and trace elements. Digestate contains nitrogen in a form that is readily available for crop uptake and can help reduce reliance on industrially produced sources of nitrogen.

Inorganic phosphate fertilizers are derived from non-renewable sources and will become more expensive as increasing pressures are placed on limited current supplies. The phosphate content of digestates is likely to become increasingly attractive in the near to medium term. Use of digestate as renewable fertilizers offers a potential saving in Greenhouse Gas (GHG) emissions from the mining of and the transport and production activities associated with the manufacture of inorganic fertilizers. The following list provides details on desirable feedstock properties for AD:

- Stable composition/properties- more consistent processing time, conditions and more reliable yield of biogas and consistent digestate.
- Steady and secure supply of feedstock.
- High energy content- the energy content will determine the biogas yield
- Low contaminants- ensures that bacteria in the AD are not poisoned and the digestate product is free from harmful contaminants.
- High organic content- sufficient organic content needs to be present for the process to be efficient.
- Controlled moisture content- there needs to be a minimum amount of moisture in the feedstock to sustain the moisture levels required for efficient AD to take place.

Co-digestion of biosolids, municipal and/or industrial organic waste is undertaken to varying degrees across the globe, this is primarily due to local waste collection strategies, National or Regional waste strategies and/or regulatory frameworks, rather than any specific barriers to the process. The figure below shows examples of dry and wet digesters, as well as a biogas storage bubble:

Figure 5.1-11 – Digester and gas bubble examples

5.1.4.2.2 ANAEROBIC DIGESTION OF ORGANIC WASTES SUMMARY

The table below summarizes the key aspects of anaerobic digestion technologies:

Table 5.1-15 – Anaerobic Digestion Summary

Waste Materials Handled	Mixed general waste (organic fraction)
	Mixed commercial waste (organic fraction)
	Source segregated organic waste
Nominal Sizes of Facilities	Typically, 50,000 to 200,000 tons per annum
Footprint	25+ acres
Advantages	Many already in operation
	Proven technology
	Proven bankability
	Achieves high rate of diversion from landfill
	Good public perception
	Can produce marketable energy
	Generates a marketable soil conditioner/ compost
Disadvantages	Requires pre-treatment
	Additional composting of fibers may be required
	Not fully proven on a large-scale commercial basis with general waste
	Requires outlets for liquid digestate and solid compost
	Production of wastewater

5.1.5 ADVANCED THERMAL CONVERSION

Advanced thermal conversion technologies, such as pyrolysis and gasification, offer controlled processing of waste and biomass at high temperatures. These methods convert waste into syngas, which can be used for energy production or as a chemical feedstock. This technology could potentially provide a more efficient and environmentally friendly alternative to conventional incineration, as it generates syngas which is considered as renewable, however it has a constrained array of feedstock

compositions and properties which would allow for this added value to be recovered. MSW based gasification projects are, hence, extremely rare and substantial performance and commercial issues have been reported on practically all of them.

Pyrolysis, Gasification and Plasma Arc technologies form part of a group of processes and techniques collectively known as Advanced (or novel) Thermal Conversion (ATC). In reality most of the processes are neither advanced nor novel. Pyrolysis and gasification, like normal combustion, involve a chemical reaction which takes place at high temperatures. This generally generates energy from organic or hydrocarbon containing materials. The application of these techniques to the treatment of mixed general waste stream is a relatively recent development, as they were previously confined to applications mainly in the oil and chemical industries.

The actual plant design and configuration of ATC plants will differ considerably between technology providers. However, an ATC plant typically consists of the following key elements:

- Waste reception, handling and pre-treatment.
- Thermal treatment reactor.
- Gas and residue treatment plant (optional).
- Energy recovery plant (optional); and
- Emissions clean-up.

In addition to pyrolysis and gasification there are a number of other high temperature thermal processes that are available on the market but have yet to make an impact. These include vitrification techniques, which have been applied to the treatment of EfW ash residues for example in Japan, and certain high temperature smelting technologies.

5.1.5.1 PYROLYSIS

Pyrolysis takes place in the complete absence of oxygen. Although the application and equipment might be new, the process is not. The production of charcoal from wood is an example of pyrolysis/gasification, where the wood is prevented from combusting in the usual way due to air starvation.

Conventional incineration technologies also involve phases of pyrolysis, gasification and normal combustion. The main difference with the specialist pyrolysis and gasification techniques is the control of the reaction to a single phase.

There are three products of pyrolysis: gas, liquid and a solid known as char. The chemical reaction takes place at temperatures of between 400°C and 800°C. At the higher end of this temperature range there is very little water produced with mostly gas (known as syngas) and char as the main products.

There are practically no operational pyrolysis plants which process municipal solid waste (MSW) and household waste on a worldwide basis right now, as none in the past has performed well. These plants are very sensitive to feedstock variations. On the other hand, there are several plants treating plastics or waste tires. A few examples are shown in the figures below.

Figure 5.1-12 – Tire and Plastic Pyrolysis Plant Examples (Source: Gemco)

5.1.5.2 GASIFICATION

Gasification, like pyrolysis, is a process that has had previous applications using feedstocks other than waste. For example, so called 'town gas' produced from coal using gasification was a very common process prior to the widespread availability of natural gas. Gasification is a thermal upgrading process, in which carbon is converted to a syngas leaving a solid residue. This takes place in the presence of air, or air enriched with oxygen. Temperatures employed are generally higher than pyrolysis at 900°C–1100°C when in air and 1,000°C–1400°C using oxygen.

Raw municipal waste is usually not appropriate for gasification and typically would require some mechanical preparation and separation of glass, metals and inert materials (such as rubble) prior to processing the remaining waste. Gasification plants can process Refuse Derived Fuels (RDF) and Solid Refuse Fuels (SRF) and tend to operate after mechanical pretreatment and mechanical and biological treatment plants receiving the abovementioned outputs.

The main product is syngas, which contains carbon monoxide, hydrogen and methane. Typically, the syngas generated from gasification would have a net calorific value (NCV) of 4-10MJ/Nm^3. The other main product produced by gasification is a solid residue of non-combustible materials (ash) which contain a relatively low level of carbon.

One key issue for use of syngas in energy recovery at ATC facilities are the problems related to tarring. The deposition of tars can cause serious blockages and other operational challenges and has been associated with plant failures and inefficiencies at several pilot and commercial scale plants. The application of a higher temperature secondary processing phase may be used to 'crack' the tars and clean up the syngas prior to application in energy recovery systems. This process is sometimes referred to as 'syngas clean up' or 'polishing' and could enable higher efficiency energy recovery than applicable through other waste thermal treatment processes.

Energy is generated from pyrolysis and gasification in one of the two ways below:

- The syngas is combusted, and the hot gases are fed through a heat exchanger where steam is produced; this is used to generate energy in a steam turbine
- The syngas is refined to a high quality and used in a gas engine to produce electricity

Examples from the Edmonton and Glasgow waste gasification plants are shown in the following figure:

Figure 5.1-13 – Edmonton and Glasgow Gasification Plants

Gasification is similar with pyrolysis in its sensitivity to feedstock fluctuation. There are very few operational plants right now, as the vast majority of the ones built in the past 10-15 years have had very significant performance problems, or they were not commercially viable. The only gasification plant in the US was closed in 2024 due to operational challenges.

5.1.5.3 OTHER ATC TECHNOLOGIES

About 15 years ago, Plasma Arc technologies were high in the industry's agenda. These are a heat-based destruction system and were thought to be suitable for municipal solid waste and hazardous waste. Plasma Arc processes are already operating in the metal refining industry. The technology avoids the large volumes of air required in traditional combustion; plasma-arc heating (the energy released by an electrical discharge in an inert atmosphere) is used to raise the temperature of the waste to anything between 3,000 and 10,000°C. This converts organic material to a hydrogen-rich gas and non - combustibles to an inert, glassy residue. The gas produced (which is relatively uncontaminated) is suitable for generating electricity to support the process. However, all Plasma Arc pilot projects failed to reach commercial stage and be proven. They have extremely high energy requirements, while there were serious problems with performance and output market sourcing and consistency in quality.

There is a wide range with varying degrees of commercial proof for ATC technologies in the water sector with sewage sludge and wastewater treatment plant output feedstocks. These include Hydrothermal Carbonization, Wet Air Oxidation (WAO) / Hydrothermal Oxidation (HTO), Super Critical Water Oxidation (SCWO), Hydrothermal Liquefaction (HTL) and Hydrothermal Gasification (HTG)/ Super Critical Water Gasification (SCWG). None of these has been reported to be applied on large scale plants in the solid waste management sector.

5.1.5.4 ADVANCED THERMAL CONVERSION TECHNOLOGIES SUMMARY

The table below summarizes the key aspects of ATC technologies:

Table 5.1-16 – Advanced Thermal Conversion Summary

ADVANCED THERMAL CONVERSION SUMMARY	
Waste Materials Handled	Solid Refuse Fuel (SRF) Refuse derived fuel (RDF) Selected materials like plastic and tires
Nominal Sizes of Facilities	Typically, 20,000 to 200,000 tons per annum
Footprint	7 to 12 acres
Advantages	Well-suited to handling of difficult waste streams such as hazardous and waste tires Production of sterile clinker Can produce marketable energy Potentially a better public perception than conventional incineration
Disadvantages	Significant performance problems Waste requires pre-treatment Technology can be expensive Technologies not yet widespread, very few suppliers in the market Sensitive to waste feedstock variations Difficulties in securing markets for outputs Syngas can have relatively low NCV

5.2 APPENDIX B – ALTERNATIVE SOLID WASTE PLANNING

AtkinsRéalis

Department of Solid Waste Management – Miami-Dade County

June 2, 2025

AtkinsRéalis Ref: 100088699-0000-30RM-00011

ROADMAP FOR WASTE MANAGEMENT PLANNING IN MIAMI-DADE COUNTY

Signature Page

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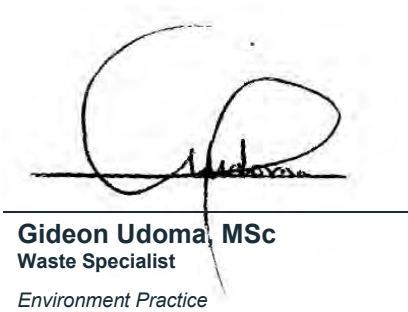

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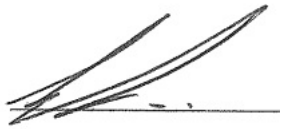

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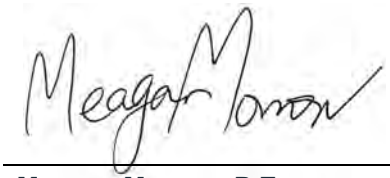

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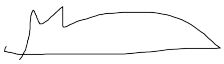

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List of Abbreviations

Acronym	Definition
APWA	American Public Works Association
AD	Anaerobic Digestion
ACFR	Annual Comprehensive Financial Report
BEBR	Bureau of Economic and Business Research
BLS	Bureau of Labor Statistics
CAPEX	Capital Expenditures
CBO	Congressional Budget Office
C&D	Construction and Demolition
DSWM	Department of Solid Waste Management
DRS	Deposit Return Schemes
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
FOG	Fats, Oils and Grease
FDEP	Florida Department of Environmental Protection
FORCE	Florida Recycling Center for Excellence
GHG	Green House Gases
IRR	Internal Rate of Return
KPI	Key Performance Indicators
MW	Megawatts
MDIA	Miami-Dade Innovation Authority
MWP	Mixed Waste Processing
NDLF	North Dade Landfill
OPEX	Operational Costs
PAYT	Pay-as-you-throw
PRO	Producer Responsibility Organization
PPP	Public-Private Partnership
RDF	Refuse-Derived Fuel
RRF	Resource Recovery Facility
SWANA	Solid Waste Association of North America
SWMMP	Solid Waste Management Master Plan
SSO	Source-Separated Organics
SDLF	South Dade Landfill

Acronym	Definition
TRCs	Trash and Recycling Centers
WMI	Waste Management Inc.
WTE	Waste-To-Energy
WbR	Waste-by-Rail

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Executive Summary

Miami-Dade County's solid waste system stands at a pivotal transition point. The closure of the County's Resource Recovery Facility (RRF), operated by the formerly named Covanta, has removed a key disposal outlet, placing immediate pressure on landfill capacity and future system resilience. The loss of the RRF eliminated the processing of approximately 900,000 tons of waste annually through energy recovery, reducing the County's reported diversion rate from approximately 37% (with WTE credits) to an estimated 22%–27%[1]. At the same time, the County is tasked with meeting rising public expectations for sustainability, cost control, and climate leadership.

This report responds to that challenge by presenting a long-term comparative evaluation of Waste-to-Energy (WTE), landfilling, and diversion-enhanced hybrid strategies. It provides a 30-year roadmap supported by local data, national benchmarks, and scenario-based modeling to inform the County's next major infrastructure decisions.

Key Takeaways

- **Post-RRF Closure Waste Management Gap Must Be Addressed**
  Waste generation is expected to rise 2% per year from 2.2 million tons/year in 2023 to over 4 million tons/year by 2053. A proposed 4,000 TPD WTE Facility would stabilize disposal capacity while enabling energy recovery and reducing the need to collect source-separated material at each residence to increase recycling results.
- **Use Increased Diversion to Optimize Infrastructure Sizing**
  Expanded diversion initiatives—such as source-separated organics (SSO), Anaerobic Digestion (AD), and Mixed Waste Processing (MWP)—could reduce WTE needs by 30–50%, lower required processing to 1,900–3,300 TPD, and delay or reduce capital outlays. These strategies are within the County's control and can be locally implemented.
- **Landfill-Only Strategy Carries High Risk**
  Continued reliance on out-of-County landfilling would require 500-1000 new acres and over $2.51 to 2.73B in capital, exposing the County to transportation risks, rising NIMBY opposition, regulatory scrutiny, siting delays, and long-term liabilities. The two existing third-party landfill disposal contracts are subject to similar risks and future pricing leverage as the only options.
- Mitigation of Long-Term Disposal Risks
- Current third-party waste disposal contracts are subject to rising costs when they expire, limited term control, and vulnerability to market shifts. The County faces long-term exposure to economic and waste management uncertainty if no new County-controlled disposal capacity is secured. Establishing a County-owned landfill would reduce reliance on external providers, improve cost predictability, and offer a secure contingency if WTE development is delayed. While not an immediate solution, planning to develop this option further enhances system resilience and mitigates critical infrastructure risk

[1] The RRF processed roughly 900,000 tons/year (about 43% of the County's total waste) prior to its closure in 2023. Miami-Dade's reported recycling rate was approximately 31%, increasing to 37% when WTE credits were included under Florida DEP reporting standards. Sources: https://www.fitchratings.com/research/us-public-finance/fitch-affirms-miami-dade-county-fl-solid-waste-revenue-bonds-at-aa-outlook-stable-11-09-2023

and https://www.lovejustice.com/looming-landfill-crisis-prompts-action/

- **WTE Delivers Predictable Capacity and Energy Offsets**
  Though higher upfront capital costs ($1.5–$1.9B), WTE provides base-load disposal and energy generation (0.5–0.8 MWh/ton) - Recent public contracts in Florida (e.g., Pasco County) have shown PPA rates for WTE energy between $9.75 and $26/MWh, depending on contract terms and facility ownership[2]
- **Previous Analyses did not Include Unforeseen Developments and Some Long-term Risks/Uncertainty/Opportunities**
  Earlier studies could not have accounted for the unexpected, early RRF closure and the resulting changes to waste management. Inputs such as landfill lifecycle costs, carbon market exposure, or the system impacts of scalable diversion were also excluded.

Strategic Direction

This report recommends that a comprehensive Solid Waste Management Master Plan (SWMMP) be developed for the County. This plan will assist with the **phased implementation** of the transition toward a **diversion-centered waste system**, supported by a combination of:

- Enhanced organics and recycling infrastructure.
- Policy and program reforms.
- Scalable residual treatment (WTE or landfill), sized according to need following assessment of diversion improvement outcomes.

[2] Based on the Covanta-Pasco County agreement (2023), as reported by WasteDive. This rate reflects a publicly negotiated PPA, not an open market rate.

1. Introduction

Solid waste management is a universal issue affecting every person on the planet. Its safe, efficient, and sustainable management directly affects the health and cleanliness of our entire community.

A Solid Waste Management Master Plan (SWMMP) provides the framework for how a County or city can elect to address challenges with waste generation, segregation, management, and disposal. It ensures that the most cost-effective and environmentally sustainable approaches to providing waste management services can be met in the manner best suited to the population that the plan applies to and for the period that the Management Plan covers.

An SWMMP does not try to apply a single solution or even a small series of solutions to address deficiencies in waste management practices definitively. Instead, it provides multiple potential approaches that can be utilized in various combinations to minimize the impact of waste generation within the County. A comprehensive SWMMP reviews a combination of regulation or policy alternatives, waste collection management methods, and emerging technologies. These also require a social license from the resident population to implement changes that can result in long-term behavioural changes.

The original Solid Waste Management Master Plan (SWMMP), developed in 2014, provided input for a 50-year planning horizon and included the County's Resource Recovery Facility (RRF) as a key system component. The plan was intended to be updated regularly, and Scenario 2 was identified as the preferred approach for long-term waste system development. These included options for at-source waste reduction, improvements to the recycling and reuse programs, changes to curbside collection methods, and modifications to operations at transfer stations and Trash and Recycling Centers. The plan also addressed landfill management and operations, recommending a ban on new landfill construction in favor of maximizing private site use, as well as enhancements to energy recovery infrastructure, including the construction of a new Waste-to-Energy (WTE) facility.

The most recent SWMMP update was prepared by HDR and issued in early 2020. The update's focus was to re-evaluate the originally recommended preferred scenario for alternative waste management options that could be implemented within ten years of issuing the report[3]. It also generally discussed an evaluation of potential waste management strategies for consideration for the 30 years following the initial 10-year focus period. The evaluation included assumptions on the continued operation of the existing RRF plant, residual waste volumes after energy generation, and landfilling capacity usage. A high-level cost comparison between WTE and landfilling was generated, and three bridging scenarios to fill the time gap between 2020 and the first estimated date that a new WTE Facility could be commissioned was also provided. Findings and recommendations indicated that a limited period was available to confirm the waste strategy to be followed, and that a new WTE Facility was recommended for construction in combination with maximizing the tonnage of waste sent to private landfills to bridge the period until commissioning.

Study constraints which limited the HDR evaluation to the options included as part of the preferred Scenario 2 from the original SWMMP. The HDR report provided limited assessments of alternatives that could be used to minimize overall waste generation, and did not evaluate disposal options beyond different combinations of a WTE plant, County-owned landfills, and privately owned landfills. However, the continued use of the RRF was one of the core assumptions in the HDR study, though the facility was taken offline shortly after the report was issued due to a fire. The HDR report did, however, recommend

[3] HDR. Miami-Dade County Solid Waste Master Plan. Retrieved February 2020. https://www.miamidade.gov/

that the 2019–2028 period be used to complete the necessary studies to enable the County to implement a long-term disposal and management strategy.

This report does not itself represent a new SWMMP, instead it provides a snapshot of the emerging waste management culture in North America, the status of waste management within the County, and describes a number of potential alternatives that can be studied to determine if they are plausible for implementation by the County, in the near, medium and long-term, including an assessment of what their potential impact could be on the County's waste stream.

2. Evolving Waste Management Culture in North America

The waste management culture in North America is evolving rapidly, driven by technological advancements, regulatory changes, and a growing emphasis on sustainability. Different geographic areas have elected to approach waste management philosophies differently, influenced by variation in population distribution, local climate, proximity to sensitive receptors, population affluence, regional and State-level policies/regulations, and cultural acceptance.

The variety of combinations of these factors highlights the need for tailored waste management strategies considering local conditions and challenges.

2.1 Fundamental Approach to Solid Waste Management: Zero Waste, Circular Economy and Waste Hierarchy

The North American approach to solid waste management has increasingly evolved toward integrating sustainability concepts, **with many communities voluntarily prioritizing** reduced environmental impact, more efficient use of materials, and overall waste reduction.

Zero waste initiatives are being adopted in diverse forms, advocating for waste elimination through prevention, reuse, and recycling, with the goal of minimizing landfill use and environmental harm. The circular economy model supports this direction by promoting the continuous use of resources through recycling, repair, and regeneration—creating adaptive, closed-loop systems that reduce reliance on virgin materials and support resource efficiency. Progress toward a zero waste model varies by jurisdiction, and success typically requires locally tailored policies, public engagement, and cross-sector coordination.

The waste management hierarchy is widely used as a **strategic framework** to guide environmentally preferable methods for handling waste. At the top of the hierarchy are waste prevention and reduction, focusing on minimizing material use through conscious consumption and efficient resource deployment. Reducing consumption leads to fewer materials being extracted, processed, and transported—thereby lowering pollution, habitat disturbance, and GHG emissions. Furthermore, waste reduction avoids downstream management costs. Closely aligned with this is reuse, which encourages extending product life through repair, repurposing, or donation rather than disposal.

Recycling and composting follow as widely supported waste management strategies. These processes transform discarded materials into new products or soil amendments, reducing raw material demand and lowering the volume of waste requiring final disposal. Energy recovery—such as through WTE or Anaerobic Digestion—is **increasingly considered for** residual waste that cannot be otherwise diverted.

Landfilling remains the least preferred option in the hierarchy due to its environmental footprint and long-term liabilities. While this hierarchy is not binding, it is widely referenced to help communities structure waste policies that align with sustainability and public health goals.

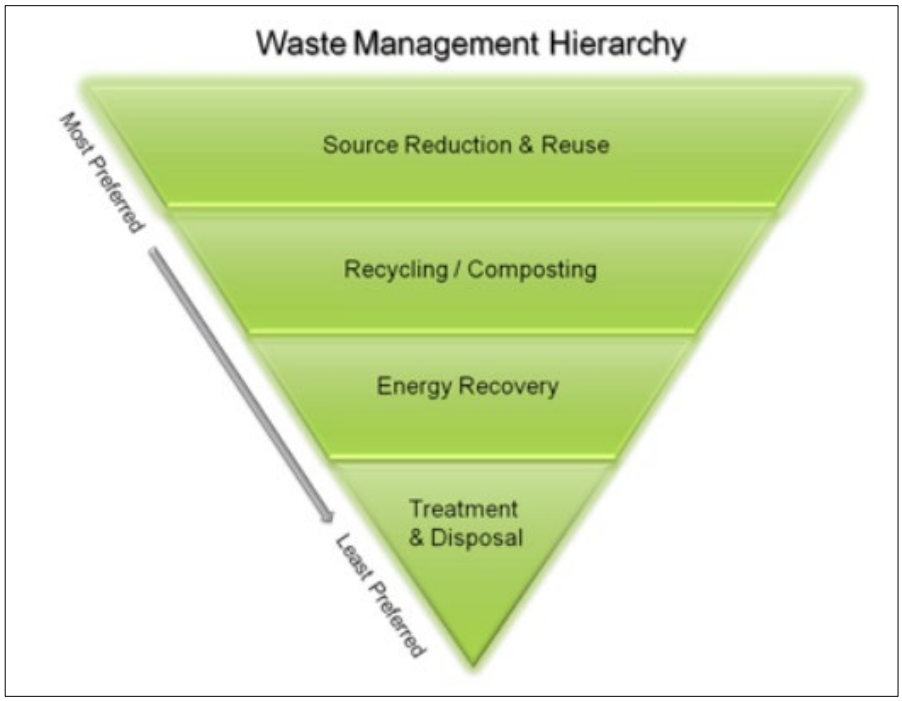

Figure 2-1: Waste Management Hierarchy

These frameworks emphasize the importance of integrating environmental, economic, and social considerations into long-term waste planning. They are **increasingly recognized as opportunities to support** ecological protection and economic development through innovation, circular business models, and green job creation.

While the U.S. EPA has not yet released a formal update, discussions within the waste management community increasingly highlight the need to integrate more proactive tiers into the hierarchy, such as 'Rethink/Redesign' and 'Materials Recovery'. These concepts reflect circular economy strategies and are gaining traction as jurisdictions seek to shift away from traditional disposal-centric models.

Some more subdivided hierarchies that have been developed include levels like Rethink/Redesign as the most preferred, and Materials Recovery and Residuals Management immediately above Energy Recovery/Disposal. Moreover, Florida Statute Ch. 403.706, Counties in Florida are charged with "the operation of solid waste facilities that meet the needs of all incorporated and unincorporated areas of the County." In 1977, the Florida Legislature enacted the Florida Resource Recovery Act, which mandated that the state's 19 most populous Counties study WTE as part of their Solid Waste Master Plans.

2.2 Stakeholder Awareness, Expectations, and Engagement

Public and stakeholder engagement shapes and sustains effective waste management systems. Across North America, there has been a significant increase in public awareness campaigns aimed at educating communities about waste reduction practices and the environmental and ultimately financial consequences of improper, inefficient or sub-optimal waste disposal practices. Tools such as social media, workshops, and public events are being employed to foster dialogue and encourage active participation.

Stakeholder expectations have evolved, with communities demanding more transparent and inclusive decision-making processes. Many jurisdictions have incorporated participatory frameworks, such as advisory committees and open forums, to ensure that diverse perspectives are represented. This collaborative approach builds trust and strengthens the collective commitment to achieving waste management goals.

Efforts to engage the public have also extended to behavioral nudges, such as pay-as-you-throw (PAYT) programs and recycling incentives, aligning individual actions with broader sustainability objectives. These initiatives reflect a growing recognition of the critical role that societal awareness and engagement play in driving the success of waste management policies and practices.

Completing a meaningful engagement process prior to implementing changes to waste practices can ensure that they reflect both what the community needs and what it's residents desire. Using a fully comprehensive engagement system generates the social license for the overall implementation plan for amendments to the waste program that the community (single-family and multi-family residences, commercial businesses and institutional facilities) can collectively leverage for positive change.

2.3 Solid Waste Management in Comparably Sized Municipalities and Counties: Successful Technologies

2.3.1 Reduction of Waste Generation

Municipalities across North America that are comparable in size to Miami-Dade County have adopted diverse strategies to address solid waste management challenges. Emerging philosophies, such as "designing out waste," are gaining traction. While state- and province-level legislation sets the foundation, many municipalities have driven waste system transformation through their own ambitious programs. For example, Toronto's mandatory Green Bin program combined with variable costs for different sized waste bins and San Francisco's Zero Waste ordinance have led to diversion rates in the range of 50% to 80%, showcasing how local enforcement and community engagement can turn high-level policy into measurable outcomes. These and other examples of municipal programs can be used to identify scalable strategies relevant to Miami-Dade County's planning process.

Municipalities that lead in waste diversion and management encourage the creation of systems and products that focus on minimizing all waste generation associated with their production, use, and disposal. The "designing out waste" philosophy focuses on preventing waste generation rather than managing it after it has been created.

Collaborative models, where municipalities partner with private enterprises and non-governmental organizations, have been used effectively to expand waste reduction programs and increase public engagement. Miami-Dade County has already implemented several initiatives targeting plastic waste reduction including internal policies to limit single-use plastic procurement, guidelines for plastic-free public events, and public education efforts encouraging residents to reduce consumption of single-use items. These are examples of actions that support the County's broader Zero Waste goals and demonstrate local leadership on plastic reduction. In comparison, Hillsborough County's "Reduce Your Use Tampa Bay" campaign emphasizes pledges and public-facing outreach focused on individual behavior change. While the two initiatives differ in approach, they reflect a shared objective among Florida municipalities to reduce plastic waste at the source.

In 2024, Massachusetts passed legislation to reduce plastic use, barring state agencies from purchasing single-use plastic bottles. The legislation also banned the use of carry-out plastic bags at retailers and required stores to charge for recycled paper bags. Straws and plasticware can only be made available to customers by request, and a program was initiated to recycle larger plastic items like car seats. Similar bans have been promoted in a number of other jurisdictions across North America.

Other, larger than municipal tier governments such as the provinces of Ontario and British Columbia in Canada, have implemented extended producer responsibility (EPR) policies that hold manufacturers accountable for the end-of-life management of their products. This approach leverages free-market innovation to generate improvements in waste reduction, such as sustainable packaging and product design, to minimize waste management costs for the product manufacturers.

2.3.2 Recycling

The Florida Legislature established the Energy, Climate Change, and Economic Security Act in 2008, which included a statewide recycling goal of 75% by 2020. Notwithstanding this, Florida's statewide recycling rate has remained steady at just below 50%. The Florida Department of Environmental Protection has suggested ways to increase recycling in Florida, including options for focusing on markets, construction and demolition debris recycling, organics recycling, commercial recycling, and improving education and outreach to the general public.

An optimal municipal curbside collection recycling system is designed to maximize efficiency, participation, and environmental benefits. The key components of an effective system include:

Maximizing Collection Efficiency: This usually involves automated or semi-automated collection vehicles to improve efficiency at the curbside, reduce labor costs, and reduce user injuries.

Standardized Information: Provide clear instructions to residents and reinforce with consistent information reminders on what materials are accepted and how to prepare them for recycling to support a stable, high quality incoming recycling stream that minimizes contamination and residuals.

Universal Guidelines: Adopt standardized recycling guidelines across all municipal areas to reduce user confusion, increase participation rates, and improve the quality of materials collected.

Educational Programs: Conduct regular educational campaigns to inform residents about the benefits of recycling and proper practices.

Community Involvement: Encourage community participation through events like recycling drives and workshops.

Advanced Sorting Technologies: Utilize advanced sorting technologies at Material Recovery Facilities (MRFs) to efficiently separate recyclables into appropriate streams and reduce end product contamination.

EPR: Collaborate with other large municipalities and State-level governments to promote the adoption of EPR which encourages businesses to improve packaging and improve recycling commercial operations.

System Evaluation: Continuously evaluate and fine-tune the recycling system to address waste management practices and community needs changes.

C&D Recycling: Some municipalities, such as San Francisco have high diversion rates that are also supported by mandatory Construction and Demolition (C&D) debris recycling programs, which requires most job sites to recover a large portion of generated materials such as wood, concrete, metal, and drywall.

By integrating these components, municipalities can create efficient, effective, and sustainable curbside recycling systems that benefit both the community and the environment.

2.3.3 Organic Waste

Several jurisdictions, including San Francisco, Seattle, Vancouver, Toronto, and New York City, have implemented comprehensive organics diversion and management programs, investing in composting facilities to convert food waste into a valuable resource. While early adopters such as San Francisco and Toronto often lead organics programs, more recently, cities like **San Antonio** and **Austin, Texas,** have emerged as strong examples of scalable composting infrastructure in diverse regions. Austin's Universal Curbside Organics program, launched in 2018, provides green carts to nearly all single-family homes and contributes to their aim to achieve Zero Waste by 2040[4]. San Antonio collects yard trimmings and food waste weekly and converts them into compost at its organics recycling facility, one of the largest municipally owned composting operations in the United States.[5] Organic waste is a prime contributor to methane generation in landfills. By reducing the volume of organic waste that must be managed municipalities can obtain significant reductions of greenhouse gas emissions and minimize airspace consumption rates at local landfills. This also applies to municipalities that make use of energy from waste facilities, as household organic waste is typically considered a less desirable component due to the high-water content and relatively low-caloric-value.

Composting is one of the most common methods for processing organic waste and converts it into nutrient-rich soil amendments. The Florida Department of Environmental Protection reported that for 2022, organic waste comprised approximately 25 percent of the 50.7 million tons of municipal solid waste generated in the state.

Composting initiatives typically utilize source-separated organics (SSO) programs to manage the waste at curbside. Organic materials, such as food scraps and yard waste, are sorted by the residents and stored separately from other household waste/regular household trash. They are collected separately from waste and recycling as part of the residential curbside collection process.

Many municipalities collect, manage, and compost leaf and yard waste separately from household organic waste. Aerobic decomposition is most typically used for this. Leaf and yard waste has different rates of decomposition and nutrient profiles (yard waste is high in carbon, while household organics tend to be high in nitrogen) in comparison to household food waste. Composting in different streams, using different methods that are each focused on the specific needs of the organics streams can result in fewer operational and nuisance issues. This is particularly true when open-air composting is utilized. For example, leaf and yard waste can be composted in windrows with fewer problems related to odour, vermin, and leachate runout compared to systems that are more frequently used for household organics. Composting methods that are applicable to household food waste more typically utilize specialized techniques tailored to the handling and processing of food scraps. Mixing the two waste streams into a single composting operation can sometimes create nutrient imbalances and reduce the overall efficiency of the processes.

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[4] City of Austin. "Curbside Composting." *Austin Resource Recovery*. Retrieved April 2025. https://www.austintexas.gov/curbside-composting

[5] City of San Antonio. "Organics Recycling Program." *Solid Waste Management Department*. Retrieved April 2025. https://www.sanantonio.gov/swmd/Organics

The Florida Recycling Center for Excellence (FORCE) is a comprehensive initiative dedicated to advancing organic recycling and sustainable waste management practices in Florida. The program emphasizes the importance of diverting organic waste from landfills and incineration to achieve the state's 75% recycling goal.

FORCE provides specialized research, development, education, and training for composting facility operations in Florida. Diverse composting methods address the challenges posed by its tropical climate and varied types of organic waste.

Aerobic composting uses microbes to break down organic materials in the presence of oxygen. It is governed by oxygen, water content, and nutrient components. Aerobic composting often makes use of windrows, open piles, vermicomposting, or some in-vessel technologies. This is an exothermic process, and the heat generated has the benefit of killing undesirable pathogens. It is a relatively quick process, with lower odour emissions, that generates a high quality compost product. Anaerobic composting also uses microorganisms, but these only thrive without oxygen. Anaerobic composting more typically uses vessels or buried piles to prevent oxygen intrusion. It is a slower process that does not generate the same internal temperatures but has the additional benefit of generating biogas as a byproduct. Anaerobic composting requires less manipulation of the waste once composting has been initiated (i.e., no turning of piles) but is more often associated with producing undesirable or nuisance odours.

Sequential composting allows for optimal compost maturity levels through combinations of staged processing. This may include aerobic composting followed by Anaerobic Digestion and then maturation. Sequential composting systems can be particularly beneficial for operations that process large volumes of material, when maintaining a suitable quality of the end product is also critical.

When combined, these different strategies can collectively support sustainable organic waste management across the County. However, even in isolation, they could be used to promote waste diversion from landfills and improve the overall feedstock for an energy plant by reducing the need to manage high-water content and low-caloric-value inputs.

2.3.4 Anaerobic Digestion

Anaerobic digestion is a complementary process to composting. Digestion breaks down organic matter and is commonly used to treat wastewater sludge and residue. It generates methane as a byproduct and occurs within vessels or facilities to allow significant controls. Co-digestion can involve adding fats, oils, and grease (FOG), or other food waste to Anaerobic Digestion systems. This material can accelerate methane production while reducing organic waste conveyed to landfills. The methane is captured and used to produce heat, electricity, or biofuel (renewable natural gas).

Several jurisdictions across North America, including San Francisco, Toronto, Vancouver, and Halifax, have adopted Anaerobic Digestion to process organic waste to different degrees.

The Central Florida Energy Garden, located near Orlando, processes over 120,000 tons of organic waste annually via an anaerobic digester. The organic material feedstock is converted into renewable biogas and nutrient-rich fertilizers. Using the biogas as fuel, the facility can produce 5.4 megawatts of renewable energy, which is used to support local electricity needs, including powering local businesses.

2.3.5 Other Waste-to-Energy Conversion

Energy recovery from waste, or Waste-to-Energy (WTE) conversion, involves converting non-recyclable waste materials into usable heat, electricity, or fuel.

According to the Environmental Protection Agency, as of December 2024, there are 75 WTE facilities in the United States, with Florida hosting ten of them. Benefits of implementing WTE as part of waste management include a significant reduction in volume from pre-combustion to post-combustion material, enhanced recovery of metals and other desirable materials, reduction of fugitive emissions of greenhouse gases from landfills, and green energy generation.

Most WTE facilities utilize advanced incineration/combustion, which generally consists of a mass-burn system with effective emissions controls and uses the heat produced to power a steam-driven electrical generation system. A notable example is Hillsborough County's expanded WTE Facility, which is reported to reduce the volume of processed waste by 90% while generating 47 megawatts (MW) of electricity each day, which is used to power thousands of homes and the adjacent wastewater treatment plant. This facility can process up to 200,000 tons of municipal solid waste annually after a recent increase to its daily processing capacity from 1,200 tons to 1,800 tons.

Notwithstanding the current dominance of advanced incineration facilities, several other technologies are in development or early use, including:

Gasification, which uses extremely elevated temperatures (including with plasma arc technology) to convert organic material into a syngas that can be sold or used directly to fuel a power generation plant; and

Pyrolysis combines high temperatures with the absence of oxygen to generate gases (including methane), bio-oils, and combustible char.

The successful implementation of these and other emerging technologies in North America has been mixed, but WTE is a continually evolving sector and changes in technology may result in more opportunities for adoption as governments work to reduce waste material volumes to protect shrinking landfill capacity.

3. Current Solid Waste Management Practices in Miami-Dade County

3.1 Overview of Current Waste Management System

Situated in Southeast Florida, Miami-Dade County spans approximately 2,400 square miles with a diverse population of around 2.7 million residents spread among unincorporated zones and 34 incorporated municipalities. The County contains a cross-section of businesses and industries, including several corporate headquarters, foreign operations, and entertainment facilities, with tourism being the principal industry. Governance of waste management in Miami-Dade County is primarily conducted under the Florida Department of Environmental Protection (FDEP) and the County's own Department of Solid Waste Management (DSWM). As indicated on Figure 3-1 the DSWM operates several facilities distributed across the County, including:

- 3 Waste Transfer Stations;
- 2 Landfills (North Dade, South Dade);
- 13 Trash and Recycling Centers;
- 2 Household Chemical Collection Centers.

Until early 2023, the County operated a large WTE Facility in Doral, which was subsequently destroyed by fire. This resulted in the need to significantly adapt waste management methods.

DSWM maintains contracts with external landfill providers such as Waste Management Inc. and Waste Connections of Florida.

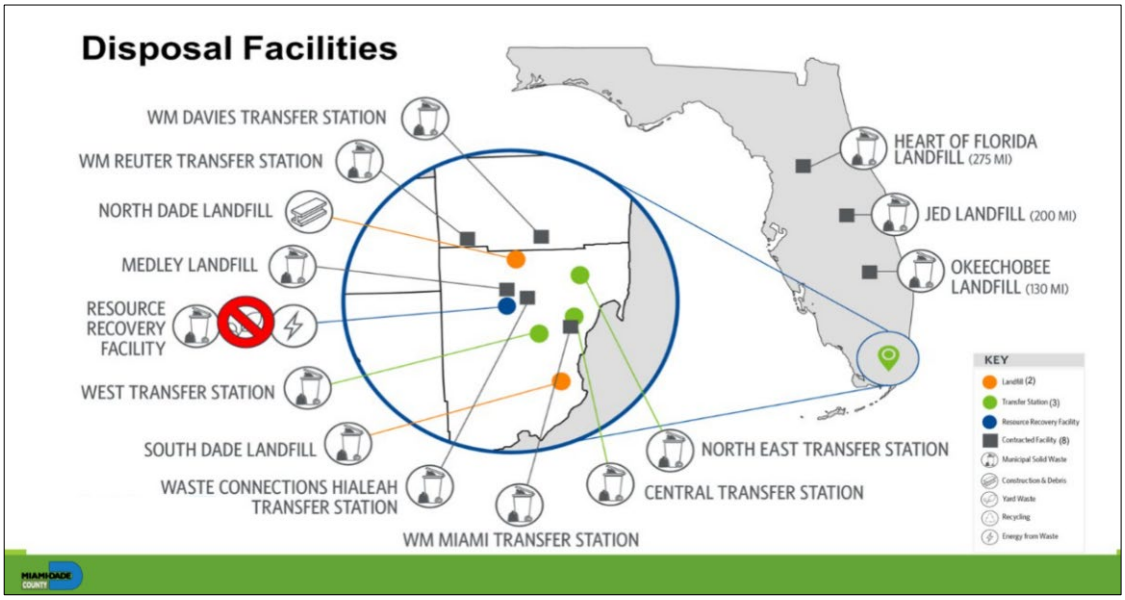

Figure 3-1: Disposal Facilities throughout Miami-Dade County

DSWM manages code enforcement, litter collection, storm debris removal, and mosquito control programs. They continue to provide leadership in transitioning to more sustainable waste management solutions, including considerations associated with developing a new WTE Facility.

3.2 Existing Infrastructure and Operations

The DSWM collects and processes waste from over 350,000 households and several municipalities, offering various services that include automated and manual curbside collection, bulky waste pickups, and recycling. Solid waste generated by residents within the County is subdivided into three key categories: garbage, bulky waste, and source-separated recyclables that use a single-stream system. Waste collection services are also extended to some commercial locations.

1. **Garbage**: The DSWM provides three types of garbage collection services—automated, manual, and dumpster-based. Regular garbage is collected twice-weekly, with extra days scheduled as needed. In some areas, local municipalities handle their garbage services through agreements. Automated pickup involves using wheeled green carts compatible with side-loading trucks, while manual collection is designated for areas with limited street access. The waste collection cart is designed to hold all household garbage, including leaf and yard waste.
2. **Bulky Waste & Trash[6]:** Bulky items are collected by appointment. Residents are allowed two scheduled pickups per year, each up to 25 cubic yards, or a single combined pickup of 50 cubic yards. Items such as furniture, appliances, and yard debris are accepted; however, materials like tires and electronic waste are not.
3. **Recyclables**: Single-stream recyclables are picked up every two weeks and taken to a MRF for processing. Through its “Recycle Right” campaign, DSWM encourages residents to focus on seven specific recyclable items. This is a proactive attempt to help reduce contamination, affecting about 40% of recyclable materials collected. In 2023, a contamination reduction initiative was launched, including enforcement penalties for repeat offenders.
4. **Commercial Waste**: Approximately 1,100 commercial locations receive waste collection services, which fall into two categories: minimum collection and container (dumpster) service. The basic service includes twice-weekly pickups using a single 96-gallon cart per billed unit, while the container service offers various dumpster sizes and collection schedules. Most commercial waste, however, is managed by private hauling companies[7].

Miami-Dade County's waste management infrastructure includes various waste processing and disposal facilities: three regional waste transfer stations, two landfills, two Home Chemical Collection Centers, and 13 neighborhood Trash and Recycling Centers (TRCs). Until its closure following a fire in February 2023, the RRF facility converted 43% of the garbage tonnage managed by the County into energy.

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[6] In the context of bulky waste collection, “**trash**” includes large household items unsuitable for standard curbside collection, such as furniture, appliances, yard debris, and other non-hazardous materials. However, items like **tires, electronic waste, automotive parts, and construction debris** are explicitly excluded from this service. Miami-Dade County Department of Solid Waste Management. *Bulky Waste Pickup Guidelines*. Retrieved from: https://www.miamidade.gov/global/service.page?Mduid_service=ser151854372423323

[7] Commercial waste is generally categorized as **Class I – Municipal Solid Waste (MSW)**, which includes non-hazardous solid waste generated by businesses and institutions, consistent with Florida Department of Environmental Protection (FDEP) classifications.

The three transfer stations, Northeast, Central, and West, handle different types of waste and collectively manage about 780,000 tons in 2023. Other transfer stations are located around Miami-Dade County but are contracted facilities, and their utilization requires specific arrangements from the County. Waste from all transfer stations is transported to landfills or other facilities for final disposal.

The major landfill in operation is the North Dade Landfill (NDLF), which processes non-hazardous waste, including yard debris and construction waste. It is projected to reach capacity in 2029. The South Dade Landfill (SDLF) accepts a broader range of waste, including garbage, trash, and yard debris. It is expected to reach capacity in 2028 and 2029.[8]

The County currently has agreements with WMI and WCF for the next 10 years, with the ability to renew them for two additional terms of 10 years each. In total, these agreements provide contracted airspace of approximately 3.5 million tons per year.

To reduce the reliance on private waste disposal service providers and to follow the recommendations included in prior SWMMPs, the County has initiated planning works that may lead to the development of a new WTE Facility. Current design specifications under consideration include the ability to process up to 4,000 tons of waste daily.

3.3 Infrastructure Deficits

The closure of the RRF directly affected Miami-Dade's disposal strategy, increasing reliance on landfilling and expanding the use of privately owned landfills.

Key projected infrastructure needs have been recently documented as including:

- Transfer Stations: Estimated of $50 million per station.
- Leachate and Methane Management Upgrades: Projected at $6–10 million for compliance improvements at existing landfill facilities.
- New Infrastructure for waste reduction or management. This includes a WTE Facility and may also include new or improved MRFs, composting facilities, etc. The currently recommended WTE is estimated to cost $1.5 to $1.9 billion in capital, depending on siting and commissioning costs.
- Optimized landfill vertical and/or horizontal expansion at existing County-owned facilities can cost $25 to $40 million per development phase. New capacity will allow for operational flexibility to mitigate third-party disposal risks and capacity available for the disposal of residual ash from the WTE, rejects from MRFs or composting operations, or direct landfill of any waste not redirected to a private facility.
- A separate, new out-of-County landfill development project is also under consideration. It would require an estimated capital investment of $2.51 to 2.73 billion and annual operating costs of $443 million.

Developing new waste infrastructure to support final disposal, such as County-owned new or expanded landfill capacity, to replace the additional volume that has been consumed following closure of the RRF, can be cost-volatile and capital-intensive.

[8] Arcadis ‘Landfill Capacity Analysis for DSWM Active Landfills as of July 1, (2023)

3.4 Waste Generation Projections

3.4.1 Population Growth

The overall waste generation rate is highly correlated with the population. Between 1990 and 2023, Miami-Dade County's population increased from approximately 1.94 million to nearly 2.77 million, according to the Bureau of Economic and Business Research (BEBR), reflecting a generally steady growth over three decades of approximately 1.1% per year. From 2010 to early 2020, growth rates began to slow, with an average below 1% annually in many years. The lowest growth rate over this period was for 2023 at just 0.4%. Population estimates were sourced from both United States Census data (1990, 2000, 2010, and 2020) and BEBR interim projections.

The BEBR has also provided population projections for Miami-Dade County through 2050, with three scenarios: low, medium, and high growth. These projections account for uncertainty in future growth, with the medium series being the most reliable based on past forecasts. The projections show:

- Low growth: An average annual change of -0.26%, potentially decreasing the population to 2.5 million by 2050.
- Medium growth: An average annual change of 0.42%, potentially increasing the population to 3.1 million by 2050.
- High growth: An average annual change of 0.96%, potentially increasing the population to 3.75 million by 2050.

With this data, the population is projected to either decrease slightly under the low growth scenario or increase under medium and high growth scenarios

3.4.2 Waste Generation Projections

Historical waste tonnage data sourced from Miami-Dade County’s Annual Comprehensive Financial Report (ACFR) includes information on various waste streams, including: Clean Yard Trash, Garbage, and Trash. Total waste managed by Miami-Dade County in 2023 was 1,978,104 tons. It can be broken down into categories into the following categories: Garbage (1,331,262 tons), Trash (631,514 tons), and Clean Yard Trash (15,328 tons). These tonnages exclude commercial waste, which is predominantly dealt with through private contracts. County waste generation data over time is provided in Table 3-1.

Table 3-1: Historical Waste Generation Data (2014-2023)

	Clean Yard Trash		Garbage		Trash		Total	
Year	Waste Generated (tons)	Growth Rate (%)	Waste Generated (tons)	Growth Rate (%)	Waste Generated (tons)	Growth Rate (%)	Waste Generated (tons)	Growth Rate (%)
2014	9,978	25.89	1,106,235	5.39	501,340	11.86	1,617,553	7.42
2015	11,427	14.52	1,120,854	1.32	542,244	8.16	1,674,525	3.52
2016	10,627	-7.00	1,091,352	-2.63	550,474	1.52	1,652,453	-1.32
2017	13,024	22.56	1,094,340	0.27	535,060	-2.80	1,642,424	-0.61
2018	14,739	13.17	1,065,015	-2.68	555,229	3.77	1,634,983	-0.45
2019	10,133	-31.25	1,096,245	2.93	553,537	-0.30	1,659,915	1.52
2020	9,692	-4.35	1,147,963	4.72	580,230	4.82	1,737,885	4.70
2021	8,971	-7.44	1,209,931	5.40	643,144	10.84	1,862,046	7.14
2022	9,335	4.06	1,291,353	6.73	618,875	-3.77	1,919,563	3.09
2023	15,328	64.20	1,331,262	3.09	631,514	2.04	1,978,104	3.05
Average	**11,325**	**9.43**	**1,155,455**	**2.45**	**571,165**	**2.70**	**1,737,945**	**2.81**

The forecast for Miami-Dade County future waste volumes based on historical waste generation data from 2014 to 2023, would imply a 2.8% growth rate should be applied. However, it is also expected that the County may be able to reduce the waste generation rates which will fluctuate over time due to changes in disposal habits and commercial practices and in accordance with long-term waste planning. It is estimated that these two influences will act to offset each other to at least some extent. For simplicity, it is assumed that at least a constant per capita waste generation rate will be achieved over time. This is considered achievable depending on what waste reduction/diversion actions are adopted by the County. The resulting population and waste growth projections are provided in Figure 3-2.

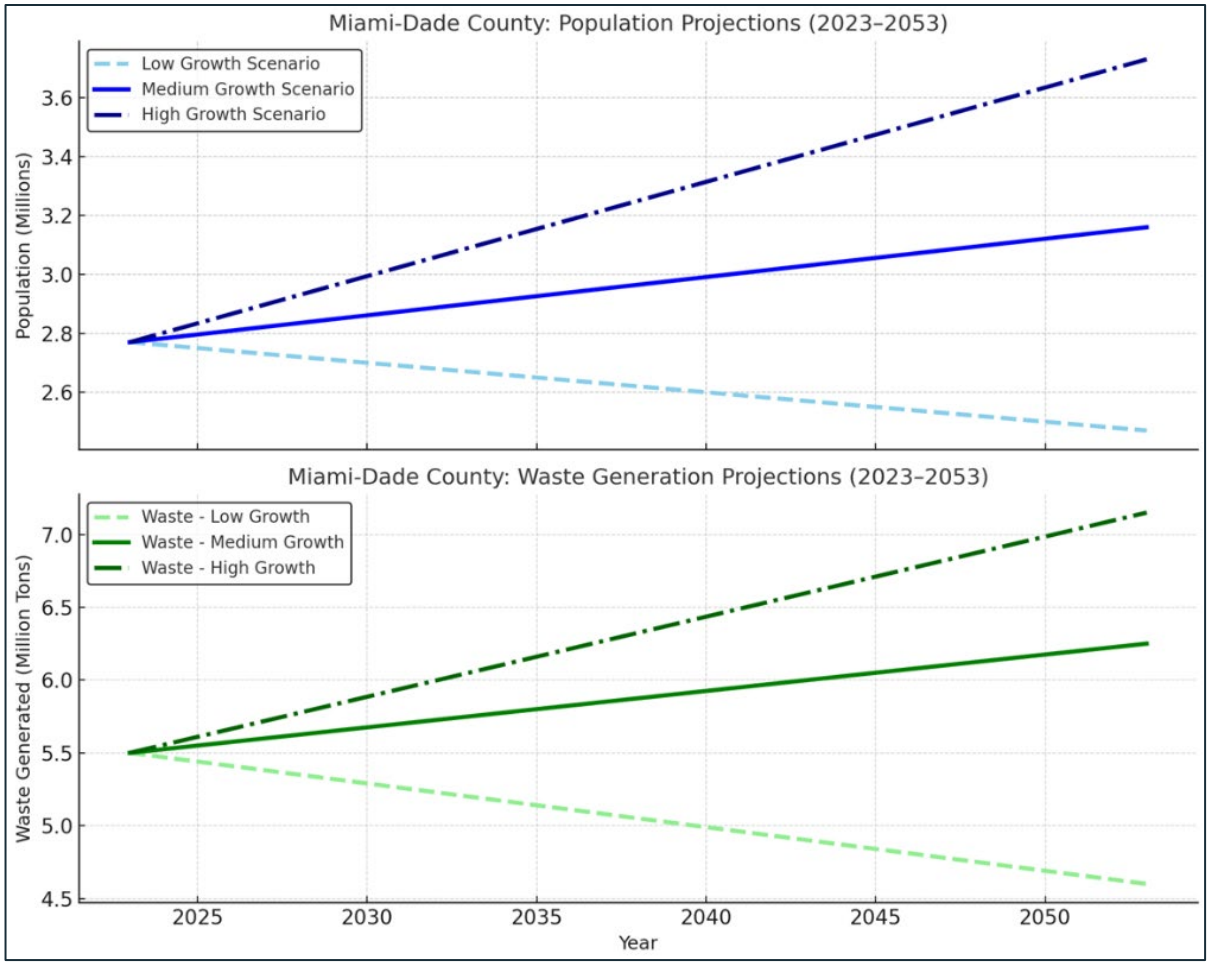

Figure 3-2: Waste Generation Projection

3.4.3 Waste Composition

Figure 3-3 illustrates the composition of residential garbage generated by **single-family homes**, based on a waste audit conducted in **2021 by the University of Florida**. The chart breaks down material types by mass percentage, providing a snapshot of current disposal patterns for curbside-serviced households, which include detached homes, duplexes, triplexes, and quadplexes.

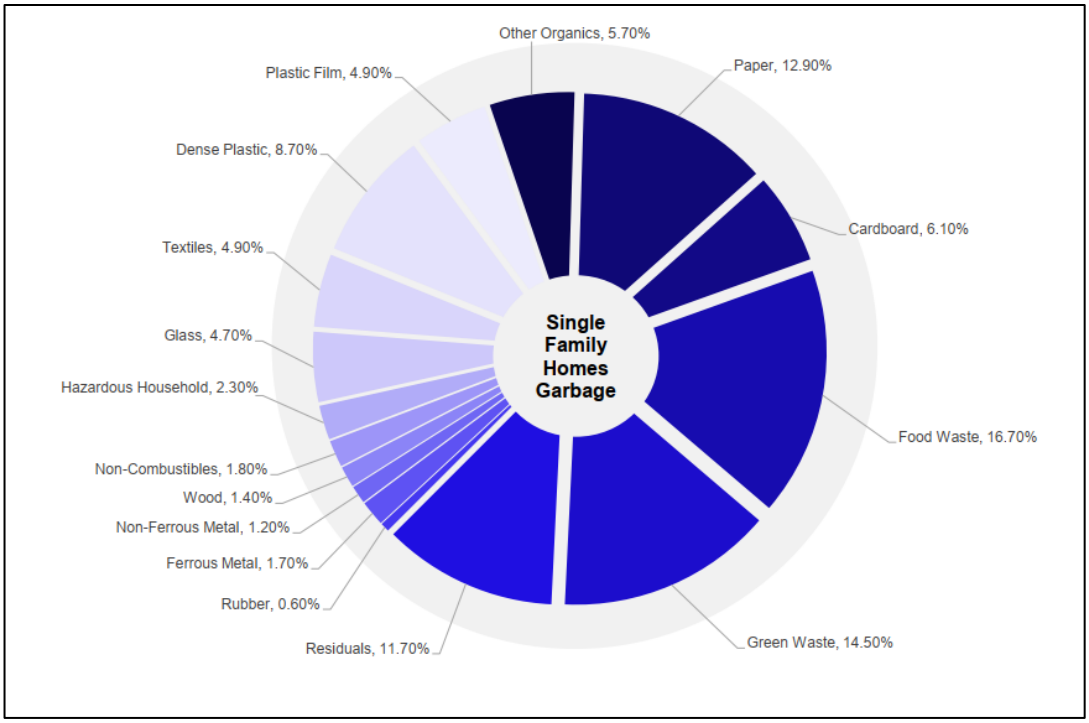

Figure 3-3: Average Mass Percentage of Garbage from Miami-Dade Single-Family Homes in 2021[9]

This data helps identify key opportunities for improving waste diversion. As shown in Figure 3-3, food waste (16.7%) and green/yard waste (14.5%) together make up more than 30% of the single-family garbage stream, suggesting strong potential for diversion through enhanced organics collection. Paper (12.9%) and cardboard (6.1%) also remain significant components, representing opportunities to strengthen recycling efforts. Other materials such as dense plastics, residuals, textiles, and glass appear in smaller but notable proportions.

Figures 3-4 present results from a broader waste characterization study conducted in 2010 to better understand how waste composition has evolved over time. This study includes not only single-family households but also multi-residential and commercial sources and is, therefore, not directly comparable to the 2021 waste audit of material generated from single-family homes. Nonetheless, it offers useful insights into material trends across Miami-Dade's overall garbage stream.

[9] AtkinsRéalis, Miami-Dade Waste to Energy Project, Waste Characterization (2024).

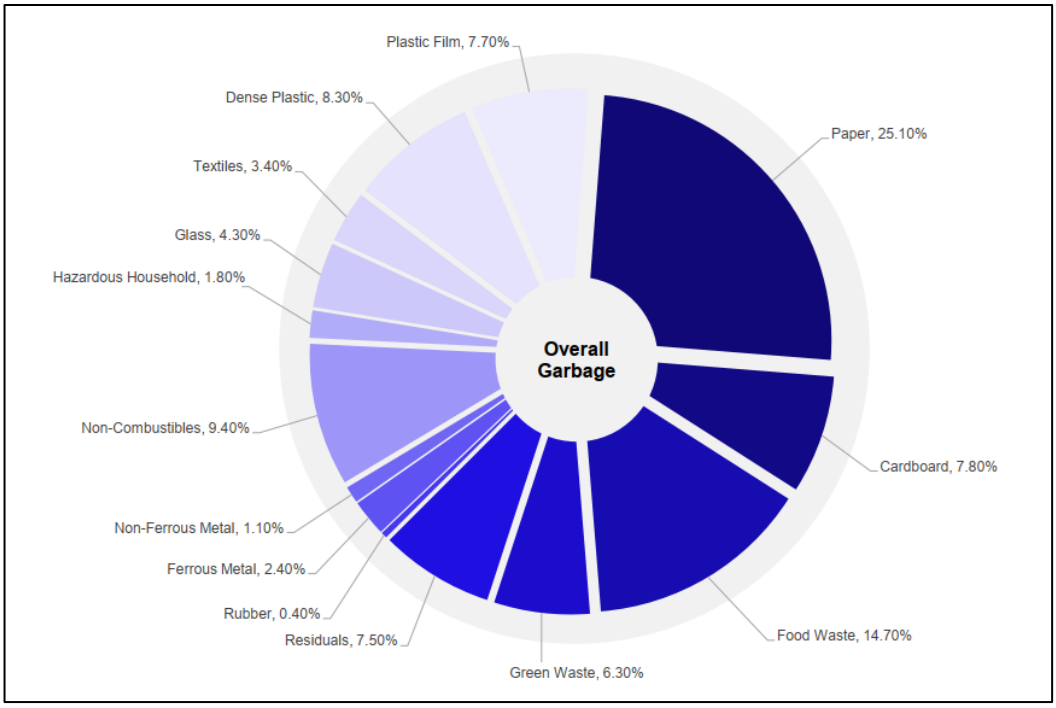

Figure 3-4: 2010 Waste Composition Single-Family Homes, Multi-residential and Commercial Sources[10]

Compared to the 2010 data, the 2021 audit shows a **decline in paper and non-combustible materials**, offset by **increases in green waste and other organics**. These trends reflect changing consumption habits, waste generation behaviors, and the need for more targeted diversion strategies in residential programs.

3.5 Recent Waste Diversion Rates

Miami-Dade County began implementing programs to reduce the waste sent to landfills or utilized for energy generation in 1990 by launching a residential recycling program that required residents to sort recyclables into designated bins provided by the DSWM. Early initiatives like this established the groundwork for broader waste diversion in the area. DSWM adopted a single-stream recycling system in 2008 to simplify the recycling process for users. The efficiency and diversion potential of the current recycling system is impacted by a previously estimated contamination rate of 35.3%, in addition to non-contract materials deposited erroneously into the recycling stream at a rate of 4.7%. A 2023 report by SCS indicated that contamination levels have recently improved, with a nearly 9% reduction in the recyclable contamination rate between 2020 and 2023.

[10] AtkinsRéalis, Miami-Dade Waste to Energy Project, Waste Characterization Retrieved June (2024).

Six years of data, from 2017 to 2022 inclusive, summarizing the Miami-Dade Countywide Waste Collection Tonnages and Recycling Rates were reviewed. It indicates that the percentage of total waste diverted to recycling has fluctuated from a low of 15.5% of the total waste stream in 2018 to a high of 30.6% in 2022. For comparison, the 2022 recycling rate for other counties within the state with populations greater than 1 million has been estimated to range from 26% to 55%, as indicated in the following table.

It is important to note that the reported diversion rates (15.5%–30.6%) reflect countywide data provided by FDEP[11], which includes contributions from both DSWM-serviced areas and municipalities served by other waste contractors including private haulers. These figures represent total County performance, not just the diversion performance of DSWM's residential household customers. The specific performance of DSWM-serviced areas may vary.

Table 3-2: Estimates of Recycling Rates for Other Florida Counties

County	Population	Total MSW Collected (tons)	Traditional Credits (tons)	Traditional Recycling Credits
Miami-Dade	2,757,592	5,122,475	1,568,715	31%
Broward	1,969,099	4,657,341	1,457,098	31%
Hillsborough	1,520,529	3,395,741	1,508,955	44%
Palm Beach	1,518,152	3,966,088	2,013,893	51%
Orange	1,481,321	3,646,696	935,096	26%
Duval	1,033,533	2,983,424	1,627,292	55%
Average				**40%**

This data uses the FDEP assessment methodology and may include construction and demolition material that is not related to household waste production. If that data were excluded, the overall recycling rates of these counties would be lower than indicated.

3.6 Active Waste Diversion and Processing Practices

Miami-Dade County is actively expanding its waste diversion efforts through a variety of targeted programs. The Home Composting Program teaches residents how to divert food scraps and yard waste, although this has a limited ability to reduce the total volume of organic material sent for final disposal. Participants who attend workshops receive a free compost bin, which supports behavioral change at the household level.

[11] The Florida Department of Environmental Protection (FDEP) calculates recycling rates using data reported by all solid waste entities operating within the county, including municipal programs, private haulers, commercial generators, and permitted facilities. These figures represent total county diversion and are not specific to the performance of Miami-Dade County's Department of Solid Waste Management (DSWM) residential customers.

The County has also strengthened its special waste recovery programs. Used oil collection has been expanded at Trash and Recycling Centers, and e-waste collection services have been improved at Home Chemical Collection Centers. The Chem Again initiative promotes reuse by allowing residents to take home partially used household chemicals donated by others. Additionally, a major appliance recycling program helps recover valuable materials while reducing landfill inputs.

In partnership with other County departments, the Department of Solid Waste Management (DSWM) is exploring the feasibility of large-scale composting infrastructure, which would further support organics processing and circular resource management.

To enhance service delivery, DSWM is also working with the Miami-Dade Innovation Authority (MDIA). As reported by *Waste Advantage Magazine* (2025)[12], new recycling contracts effective April 1, 2025, will deploy GPS- and camera-equipped collection trucks, improving contamination monitoring and enabling more targeted community education and outreach efforts.

3.7 Plans that Support Future Waste Diversion/Management Programs

As Miami-Dade County advances toward its long-term Zero Waste goals, the Department of Solid Waste Management (DSWM) continues to assess new opportunities to improve program efficiency, reduce landfill dependency, and support system-wide waste recovery.

Two key initiatives recommended in the under conceptual development are intended to form the foundation for future program enhancements:

- The preparation of a Zero Waste Master Plan and,
- Planning for a Sustainable Solid Waste Campus.

Although a preliminary report outlining these initiatives was developed by HDR in 2022[13], it has not been formally adopted by the County. Instead, its findings serve as guiding recommendations to inform future planning and feasibility assessments. Both initiatives remain in the early planning stages and are described further in the following paragraphs.

Conceptual Zero Waste Master Plan

In 2023, DSWM initiated baseline studies and technology reviews to explore viable strategies for achieving zero waste. The conceptual Zero Waste Master Plan focuses on identifying alternatives to landfilling and energy recovery, aiming to implement solutions that emphasize reuse, repurposing, recycling, and resource recovery. These strategies are evaluated based on environmental sustainability, economic viability, and community alignment.

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[12] *Waste Advantage Magazine*. (2025). *Miami-Dade, FL Innovation Authority Launches Fifth Public Innovation Challenge to Optimize Waste Diversion*. Retrieved from https://wasteadvantagemag.com/miami-dade-fl-innovation-authority-launches-fifth-public-innovation-challenge-to-optimize-waste-diversion/wasteadvantagemag.com

[13] *Source: HDR. (2022). Miami-Dade County Solid Waste Master Plan. Retrieved from https://www.miamidade.gov/solidwaste/library/miami-dade-county-solid-waste-master-plan-final-04-08-22.pdf*Miami-Dade County

Proposed Sustainable Solid Waste Campus

The proposed Sustainable Solid Waste Campus envisions a centralized site designed to accommodate both traditional and emerging waste management technologies. Its role would be to support long-term diversion, energy recovery, and innovation in material handling.

While still conceptual in nature, current planning would have the campus include:

- A WTE Facility capable of meeting U.S. EPA air quality emission standards and reducing the volume of landfilled waste by up to 90%, while generating enough electricity to power an estimated 70,000 homes;
- Organics processing infrastructure, materials recovery facilities, and, potentially, biogas harvesting systems, depending on final technology selection;
- A Public Education Center to help residents understand zero waste principles and technologies, fostering community awareness and participation.

Together, these initiatives are expected to serve as platforms that will support innovation, stakeholder engagement, and strategic program development. Further feasibility assessments, stakeholder consultations, and funding evaluations will be required before advancing to the implementation phase.

3.8 Challenges, Mitigation, and Opportunities

The following sections provide input on the challenges associated with the current waste management system, as well as potential mitigation measures and identified opportunities.

3.8.1 Potential Increases in Waste Generation Rates

Without changes, it is possible that Miami-Dade County will experience a rise in waste generation rates and total waste generation tonnages due to higher consumption patterns, urban development, and population growth. As residential, commercial, and industrial activities have expanded in the past, the volume of solid waste generated has exceeded available processing capacity, limiting the available options for disposal.

Challenges:

- Strain on collection, transfer, and disposal infrastructure.
- Increased operational costs.
- Limited landfill space and increased pressure to generate appropriate waste diversion strategies.
- Greater need for sustainable materials management and education initiatives.

Mitigation:

- Focus on enhancing waste reduction programs.
- Encouraging responsible consumption.
- Expand recycling and composting initiatives to reduce the amount of waste sent to landfills.

Opportunities:

Increase public outreach and transparency regarding the actual costs of waste management services, including environmental and economic impacts, to build support for long-term system improvements.

Leverage this awareness to **foster structural behavioral change**, moving beyond individual awareness campaigns toward more integrated approaches—such as incentive-based programs, community-level waste reduction targets, and institutional partnerships.

Embed waste reduction principles into schools, local ordinances, and procurement policies to reinforce long-term habits and expectations around sustainable materials management.
Population Growth.

Rapid population growth in Miami-Dade County would intensify the demand for public services, including waste management. BEBR's population range projections suggest a wide range of potential population changes, from an essentially flat population to a significant increase by the year 2050. With more residents generating more waste, infrastructure must scale accordingly.

Challenges:

- Increased volume of residential waste and demand for collection services.
- Greater pressure on existing landfill capacity and recycling systems.
- Need for additional routes, staff, and equipment.
- Planning for long-term sustainability in waste management.

Mitigation:

- Evaluate future infrastructure needs, optimization of route efficiency, and promotion of community education to minimize per capita waste generation.

Opportunities:

- Population shifts can result in increased densities in some areas, making different opportunities more feasible for implementation.
- Potentially adopt increased services for rural areas.
- Incorporate efficiencies for waste collection and management and/or the trial various pilot projects for comparison against the status quo in urban areas.

3.8.2 Loss of Waste-to-Energy Facility

The closure of the RRF has added significant pressure to the remaining waste management alternatives and has resulted in roughly 750,000 to 1,000,000 tons of waste that was previously processed at the RRF requiring disposal at other facilities and increasing the County’s dependence on landfills.

Challenges:

- Decreased local waste processing capacity and increased transportation costs.
- Increased landfill usage and accelerated capacity exhaustion.
- Loss of energy recovery from waste combustion.
- Elevated greenhouse gas emissions due to increased landfilling.
- Financial uncertainty due to a new and private contracting landfills.

Mitigation:

- Explore long-term solutions, through the planned Sustainable Solid Waste Campus.
- Consider adoption of new waste processing technologies and expanded recycling programs.
- Explore potential for regional partnerships.

Opportunities:

- Redesign of waste processing systems/options.
- Reconsideration of the most appropriate waste management options for the County, rather than being limited by the presence of existing infrastructure.
- Longer-term optimal facility redesign.

3.8.3 Recycling and Waste Diversion

Recycling and waste diversion programs are critical to sustainability, but face persistent challenges including contamination, resident participation, and market instability.

Challenges:

- High contamination rates in recycling streams (around 35%).
- Public confusion about recyclable materials.
- Unstable recycling markets and rising processing costs.
- Limited composting and reuse activity to date, largely due to lack of infrastructure and processing capacity.

Mitigation:

- Continue DSWM's "Recycle Right" campaign and expand it with new public-facing materials and multilingual outreach.
- Deploy contamination detection technologies (e.g., GPS and camera-equipped recycling trucks starting in 2025).
- Strengthen regional collaboration with municipalities and contractors to expand reuse networks and shared processing infrastructure.

Opportunities:

- The deployment of advanced MRF technologies, including AI-driven optical sorters, is slated to come online in late 2025/early 2026.
- Expansion of organics diversion programs, including large-scale composting and residential food waste collection initiatives.
- Development of local or regional markets for recovered materials, reducing dependence on volatile international recycling markets.
- Strengthened public-private partnerships to innovate waste diversion strategies and create new green jobs within the circular economy.

3.8.4 Landfill Capacity Exhaustion and Early Closures

The closure of the RRF has added significant consumption pressure to the design capacities of the County's owned landfills and local privately operated facilities.

Challenges:

- Closure of facilities on a schedule that has not been accounted for in planning/scheduling.
- Increased transportation and operational costs from redirecting waste to more distant receiving sites.
- Greater reliance on private landfills.
- Cost increases when current contracts expire.
- Difficulty building and permitting new facilities due to regulatory approvals.

Mitigation:

- Extend the lifespan of existing landfills through diversion and volume reduction programs.
- Where practical, adopt alternatives to landfilling such as composting or advanced waste processing technologies.
- Assess the potential for public-private infrastructure partnerships to support new facility development

Opportunities:

- Optimize existing landfills with vertical and/or horizontal expansions for additional capacity.
- Accelerate waste minimization initiatives and alternative waste treatment technologies to reduce future landfill dependency.
- Redevelopment of closed landfill sites into community assets such as parks, solar farms, or environmental education centers.
- Opportunity to modernize new facility planning processes by integrating climate resilience and community consultation components.
- Potential for regional collaboration with neighboring counties to develop shared advanced waste processing facilities.

3.8.5 Environmental and Public Health Concerns:

Improper operation of waste management systems or facilities can lead to serious environmental and health issues, including pollution, greenhouse gas emissions, and vector-borne diseases.

Challenges:

- Odors, noise and vermin affecting adjacent communities.
- Leachate and gas emissions from landfills.
- Risk of illegal dumping and open burning.
- GHG emissions from waste management activities—including methane and CO_2.

Mitigation:

- Work with environmental agencies to ensure standards are clear and achieved.
- Enhancing pollution and/or impact monitoring systems.
- Invest in green infrastructure.

Opportunities:

- Investment in renewable energy projects at landfill sites, such as landfill gas-to-energy systems, to displace greenhouse gas emissions.
- Deployment of smart environmental monitoring systems (e.g., real-time gas and leachate sensors) to ensure compliance and early detection of risks.
- Strengthening community engagement programs to enhance public trust and encourage citizen reporting of illegal dumping activities.
- Integration of nature-based solutions, such as green buffers and wetland restoration, to mitigate environmental impacts while enhancing biodiversity around waste management facilities.

3.8.6 Social Behavioral Barriers

Public behavior significantly influences the success of waste reduction and recycling efforts. Misconceptions, lack of awareness, and resistance to change remain major obstacles.

Challenges:

- Limited information is available on overall resident engagement in diversion programs, highlighting a need for improved monitoring and evaluation tools.
- Misunderstanding of proper waste sorting expectations.
- “Out of sight, out of mind” mindset regarding waste disposal.
- Inequities in service access and educational outreach across communities.

Mitigation:

- Developing improved participation tracking mechanisms (household surveys, set-out studies, or digital participation analytics) to gain insight.
- Targeted education campaigns and incentive-based initiatives to fill resident knowledge gaps and increase their desire to actively participate.

Opportunities:

- Use incentive-based programs (such as rewards for proper recycling participation) to positively reinforce sustainable behaviors.
- Expansion of targeted education campaigns using social media, community influencers, and school partnerships to build recycling culture at a young age.
- Development of mobile apps and gamified platforms to engage residents interactively in waste reduction and proper sorting efforts.
- Tailored outreach initiatives for underserved communities to ensure equitable access to information, waste management infrastructure, and participation incentives.

3.8.7 Siting and Zoning for New Waste Infrastructure

Waste infrastructure projects are susceptible to Not-in-My-Backyard (NiMBy) challenges. Misconceptions, lack of awareness, and resistance to change regularly present major obstacles to development of waste management infrastructure. The sheer size of properties that can be required to implement some disposal or treatment alternatives in an effective manner may limit technological alternatives.

Challenges:

- Public opposition due to concerns about odor, pollution, and property devaluation.
- Lack of awareness regarding modern waste management technologies/programs/processes can fuel misconceptions.
- Strict zoning laws can slow project approvals.
- Local political leaders may hesitate to support projects due to concerns raised by their voters.
- Competing interests, such as residential or commercial development, can make securing land for waste management infrastructure difficult.
- Permitting regulations may require extensive environmental impact assessments prior to development and evolving standards may impact on the feasibility of some options during early to mid-development.

Mitigation:

- Early and transparent communication with residents can build trust.
- Using education campaigns to inform the public about the benefits of different waste management infrastructure, and regulations and/or safety measures that will be followed can reduce opposition.
- Offering economic benefits, such as job creation, community improvements, or a reduced need to increase tax rates can encourage acceptance.
- Coordinating waste management with urban development plans as part of an integrated development system can reduce the opportunity for conflicts.
- Implementing sustainable design initiatives including odor control, noise reduction, and aesthetic improvements to directly address nuisance concerns.

Opportunities:

- Integrating waste management into broader sustainability initiatives.
- Adopting innovative or advanced technologies like WTE plants or automated waste collection can improve efficiencies and reduce environmental impact.
- Promoting recycling and resource recovery or other circular economy initiatives can shift public perception from waste disposal to a sustainability focus.
- Collaboration between industry and local governments via Public-Private Partnerships can streamline project implementation and manage risks.
- Stronger regulations and incentives for sustainable waste management can help integrate new infrastructure smoothly.

4. Recommendations for Implementing a Comprehensive SWMMP

As identified in Section 1, this document does not represent a new SWMMP. The SWMMP update completed by HDR had recommended that the period from 2019 to 2028 be used to fully assess alternatives to allow the County to implement a long-term waste management and disposal strategy. However, the constraints on that report, such as limiting alternatives to the preferred alternative strategy from the initial SWMMP prevented a full assessment of the available options.

The following sections describe the typical steps that are completed as part of developing a comprehensive SWMMP. The County should consider utilizing some or all of these steps to ensure that optimal solutions are selected to minimize waste generation and divert as much material from the residual waste stream as possible.

4.1 Proposed Strategic Objectives

To support Miami-Dade County's transition toward a more resilient and sustainable waste management system, the SWMMP should prioritize a review of options that can meet the following strategic objectives:

- **Waste Reduction at the Source**: While local implementation of EPR or similar programs is pre-empted under Florida law, the County could consider other policy levers to promote waste reduction. For example, local ordinances could restrict the use of certain single-use items on County-owned property or establish green procurement standards for municipal operations. These measures, while narrower in scope than EPR, can still drive upstream impact and demonstrate leadership in waste management.
- **Organics Diversion**: Incorporate composting and/or Anaerobic Digestion infrastructure to divert food waste, yard waste, and biosolids prior to disposal.
- **Recycling System Optimization**: Improve MRF performance through updated contracts, with clearer performance metrics and incentives to enhance recovery and reduce contamination. Utilize new technologies to increase recycling capture rates at County facilities. Work with residents to continue to reduce contamination rates.
- **Energy Recovery**: Develop a new WTE Facility to offset landfill dependency and allow recovery of energy from non-recyclable materials.
- **Landfill Capacity Preservation**: Delay the need for new landfill development through aggressive diversion, pre-processing, and waste volume reduction strategies.

4.2 Phases of SWMMP Adoption and Implementation

The development of the full SWMMP should follow a phased approach:

- **Policy Review**: Complete reviews of policies and programs that have been identified as having the greatest potential for impact on the waste stream or that are identified as preferred by the public:
  - Review existing municipal bylaws for opportunities to improve the support for/enforcement of policies or programs such as at-source separation, mandatory recycling, and organic waste diversion. Develop new policies that can be implemented to fill legislative gaps.
  - Assess permitting barriers to implementing solid waste infrastructure, including innovative technologies, and update/amend where appropriate.
  - Assess whether County SWMMP objectives can be advocated at the State-level or combined with initiatives in adjacent Counties/Cities.
- **Technical Review**: Complete technical studies to review the feasibility of preferred alternatives:
  - Improved waste generation/characterization.
  - Cost/benefit assessments.
  - Required siting/approval/planning requirements.
  - Assessment of existing technologies, implementation schedules.
- **Proof of Concept**: Begin early implementation of pilot projects:
  - Target selected and representative neighborhoods.
  - Utilize established infrastructure outside of the County to demonstrate compatibility with the County waste stream.
  - Review residential participation rates in trials before full adoption of new infrastructure/systems/policies.
- **Full-scale Adoption**: Full-scale deployment of preferred technologies or policies, accompanied by facility upgrades and implementing regional partnerships.

4.3 Key Knowledge Gaps and Data Needs

Several critical knowledge gaps remain that could impact the successful adoption and implementation of alternative waste management strategies in the Miami-Dade County:

4.3.1 Waste Composition Data

Updated and advanced waste stream characterization data is needed to optimize sorting, processing, and recovery systems. Differences in waste generation between single-family and multi-residential dwellings, and across urban and rural areas, are not fully captured in currently available data. Additionally, post-COVID trends have altered the waste stream. While PPE volumes have declined from peak pandemic levels, they remain modestly elevated compared to pre-COVID baselines—particularly in high-density or health-focused areas. Increases in single-use packaging and residentially generated C&D materials have also been observed.

Population growth, climate change, and behavioral shifts will impact the total volume of waste generated and its composition. Post-COVID trends indicate an increase in total waste generation, driven by population growth, urbanization, and changes in consumer behavior. Residential waste now includes higher volumes of single-use packaging and plastics due to online purchases and deliveries. Medical waste (e.g., PPE) and e-waste also remain above pre-Covid levels in most communities, reflecting the longer-term adoption of personal protection measures.

Construction and demolition waste generated from private residences is projected to grow in the future due to new housing development and disaster recovery efforts.

Key limitations include the absence of detailed information showing shifts in waste composition over time and uncertainty around whether County-level data aligns with peer jurisdictions. Public participation trends, climate-related impacts on waste profiles, and the scalability of emerging technologies remain under documented. Addressing these gaps will be essential to inform effective 10-, 20-, and 30-year planning decisions

4.3.2 Public Acceptance & Behavior

Limited insight is available on the public's willingness to participate in diversion programs such as source-separated organics or to adopt reuse initiatives.

Implementing alternative waste management strategies, including source-separated waste collection programs (particularly source-separated organic waste), presents various public and behavioral challenges. Key barriers include knowledge gaps regarding the public's willingness to engage with such systems. A lack of awareness and education about the benefits of source separation, combined with confusion surrounding sorting guidelines, makes it challenging to predict participation rates and identify effective outreach strategies. Further uncertainty exists around how established habits and social norms may influence behavior, as resistance to change and skepticism about system effectiveness often hinder widespread adoption.

Convenience and accessibility are critical considerations, but gaps remain in understanding how logistical challenges, such as collection frequency or the provision of specialized bins, impact public adoption of alternatives. Economic concerns further complicate planning, as there is insufficient information about the public's willingness to absorb potential costs, such as fees for additional services or policies such as purchasing compostable bags. Additionally, limited insights exist on how alternatives for enforcement or using incentives will influence compliance and participation.

Addressing these knowledge gaps is essential to ensure the viability and effectiveness of new waste collection programs. This includes researching public attitudes, behaviors, barriers to participation, testing education campaigns, and piloting programs highlighting the environmental and economic benefits of the proposed changes to the waste management system. By closing these gaps, municipalities can better align waste management strategies with public expectations and achieve meaningful participation rates.

4.3.3 Cost-Benefit Benchmarks

Comparative lifecycle costing across different diversion technologies, such as source-separated organics, Mixed Waste Processing (MWP), and Anaerobic Digestion is a critical component of cost-benefit analysis supporting decisions to implement alternative waste management strategies. Lifecycle costing involves evaluating the total cost of each technology over its operational lifespan, including capital expenditures, operational and maintenance costs, and end-of-life considerations like equipment decommissioning or disposal. It should also incorporate indirect economic impacts, such as environmental benefits or

drawbacks, energy recovery potential, and greenhouse gas reduction, which play a significant role in determining long-term viability.

4.3.4 Technology Readiness & Scalability

The County should evaluate the feasibility of both emerging and conventional waste processing technologies over short-, medium-, and long-term horizons. Technology readiness levels (TRLs), capital requirements, operational complexity, permitting considerations, and scalability potential will vary widely between options. A description of some technologies that could be considered follows.

Thermal Conversion Technologies

Advanced thermal treatments such as **pyrolysis** and **gasification** remain largely unproven at commercial scale for mixed municipal solid waste (MSW) in North America. While demonstration projects are ongoing (e.g., in Ontario, California, and Japan), few facilities have achieved proven sustained operational and economic viability. Barriers include feedstock inconsistency, high capital intensity, and complex regulatory pathways, especially regarding air emissions and byproduct management. These technologies require precise control environments and produce synthetic gases and char materials that require further treatment or use pathways[14].

Refuse-Derived Fuel (RDF)

While not considered an emerging technology, RDF has historically been used as a transitional strategy in waste management. Unlike pyrolysis or gasification, **RDF is not a processing technology but a prepared fuel product**. RDF involves mechanically separating, drying, and densifying waste streams to produce a fuel suitable for combustion in cement kilns, industrial boilers, or advanced WTE systems. **.** Its viability depends on market access to compatible end-users, consistent fuel specifications, and favorable permitting. RDF is widely deployed in Europe (e.g., Germany, the Netherlands), where thermal recovery infrastructure is integrated with landfill diversion mandates. In the United States, its application remains limited due to infrastructure gaps, transportation costs, and permitting hurdles for co-firing applications[15]. Incorporating RDF into a waste management system can complicate design, absorb space, and increase operational complexity. However, it is suitable for use where specific conditions can be met, such as co-location with industrial thermal users and clearly defined environmental and economic benefits. Its best use is in combination with systems that benefit from a fuel stock being generated. This is less compatible with modern mass burn facilities that may not benefit from pre-processing the waste stream. RDF is currently used in Florida at the Palm Beach Renewable Energy Facility, an older facility in operation since 1989, and at the CEMEX cement plant in Hernando County, where RDF is used as a more environmentally friendly fuel source.

Biological Treatments and Organics Processing

Anaerobic digestion (AD) and **in-vessel composting** are established technologies that can be employed to process the organic fraction of the waste stream. Their scalability depends on implementing strong source separation programs, maintaining low contamination rates, and developing market outlets for the resulting compost or digestate. Several municipalities (e.g., San Francisco, New York City, and

[14] IRENA (2021). *Advanced Thermal Conversion Technologies for Waste Management.* International Renewable Energy Agency. Available at: https://www.irena.org/publications/2021/Mar/Advanced-Thermal-Conversion-Technologies-for-Waste-Management

[15] U.S. EPA (2021). *Energy Recovery from the Combustion of MSW.* Available at: https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw

Toronto) have piloted or scaled AD facilities with varying success. Local regulatory frameworks (e.g., biosolids classification, nutrient regulations) also play a critical role in determining project viability[16].

Landfill Mining

Landfill mining is the process of excavating waste that has been previously landfilled, processing it to recover recyclables such as metals and sorting the remaining material to remove cover soil and fully biodegraded organic material. The residual waste often has a significantly reduced volume, and can be re-landfilled at the same site, or a different one, or used as a feedstock for a WTE facility. This process results in new air-space capacity at the mining site, or allows for redevelopment of the former landfill and opportunities to improve management of formerly contaminated sites. In 2018, Durham Region in Ontario, Canada, initiated a landfill mining project at its smallest closed landfill site to reduce leachate impacts to groundwater quality and temporarily generate additional feedstock for its WTE facility. Following mechanical separation and material recovery, the non-combustible fraction of the material represented 40% of the original mass and was trucked to an alternate landfill allowing full re-naturalization of the site.

The Ocean Landfill site in New Jersey has been actively mining an older 60-acre portion of the site since 2014, and this is expected to continue to 2030. The project has resulted in savings due to a reduced need to import daily cover soil, and is expected to extend the landfill operational lifespan by 12 to 13 years from its original closure date. The Perdidio Landfill in Escambia County, Florida, conducted Phase I of a planned 3-phase mining project from 2009 to 2011, but discontinued the work prior to the initiation of Phase II in 2019. The goal for Phase II was to extend the lifespan of the next landfilling cell by recovering as much as 443,000 m^3 from a previously filled area. Other examples, such as a $2.5 million landfill mining project completed in Putnam County in 2014, or City of Barrie, Ontario's project initiated in 2009 have been used to reduce environmental impacts from non-engineered landfill sites and/or recover air-space capacity to allow extension of a landfill's operating life, however these projects are still relatively infrequent.

Overall, the County should prioritize technologies with strong track records and clear alignment with long-term policy goals. Technologies such as those described in the preceding paragraphs present opportunities for innovation but also carry risks. A phased implementation strategy grounded in proven systems (e.g., composting or RDF if suitable end-users can be identified) — and supported by pilot testing and lifecycle analysis — would allow Miami-Dade County to de-risk investments while exploring future-ready solutions.

4.3.5 Policy Impacts

Prior to the adoption of new infrastructure or programs, it is necessary to understand the effect that legislative changes could have on the viability of individual alternatives and the evolution of the waste stream. Policies will have varying direct impacts on the waste stream and drivers of change for residents can be as simple as a new policy reducing the number of days waste is collected or reducing the size of waste containers. These or similar policies may encourage households to adapt ingrained behaviors an increase source-separated diversion at home to maintain their waste storage capacity. Typically, these types of policy changes are coupled with complementary program changes, such as separate household organics and leaf and yard collection, implementing pay-as-you-throw (PAYT) systems or expanding use of MWP to increase the overall capture rate for recyclables.

[16] EPA (2022). *Anaerobic Digestion Facilities Processing Food Waste in the United States.* Annual EPA Report. Available at: https://www.epa.gov/anaerobic-digestion

Reconsideration of existing policies and planning restrictions that create barriers to waste infrastructure development can be considered, or alternatively, changes to municipal building codes implemented. For example, building code requirements that require condominium and apartment developments or retrofits to include multiple waste chutes for different materials, or to design building storage to accommodate multiple types of segregation is also possible.

Policies that would need to be implemented at the State-level can also be considered for advocacy targeting. Understanding the likely effect of EPR legislation on local collection, sorting, and disposal systems is essential for planning an optimal recommended timing for implementation. When assessing the policy impacts of EPR legislation, several typical knowledge gaps arise, and there is a need to consider broader changes to municipal waste management strategies. EPR often requires municipalities to adapt existing systems to align with producer-led responsibilities, leading to challenges in coordinating roles, funding, and logistical efforts. Local governments may need to reconfigure collection routes, enhance public education campaigns to improve sorting practices, or invest in infrastructure upgrades for facilities like sorting and recycling centers to handle producer-driven material standards.

4.4 Recommended Timeline and Phasing for Additional Studies

4.4.1 Recommendation for a 30-year Planning Period

A 30-year planning horizon is usually adopted to effectively guide the development of a resilient, adaptable, and sustainable waste management system. This long-term vision aligns with best practices observed in leading municipalities across North America. It is also consistent with the projected evolution of key drivers such as population growth, waste generation, infrastructure needs, and policy shifts.

4.4.1.1 Rationale for a 30-Year Timeframe

The 30-year timeframe offers a strategic window for:

- **Capacity to Anticipate and Address Emerging Trends:** The waste sector is transforming rapidly due to technological innovation, circular economy models, producer responsibility frameworks, and climate-related policies. While looking ahead and anticipating these trends is essential, projections beyond 30 years become increasingly speculative. A 30-year timeframe strikes a balance between vision and realism, allowing enough foresight to prepare for transformational change while remaining within the bounds of actionable planning.
- **Adequate Time for Preparation and Feasibility Assessment:** Adopting an extended assessment timeframe allows the opportunity to appropriately assess the various options available for waste management and allows a focus on developing and assessing alternatives in the early years of implementation. This can prevent recommending commitments to infrastructure, projects, or policy options that are only suitable for short-term objectives, and that may not be optimal over a longer time frame.
- **Consistency with Long-Term Growth Projections:** Population and economic forecasts used by regional and municipal planning bodies typically extend across a 30-year horizon. These forecasts can be used to develop critical information such as expected waste volumes, service demand, land use changes, and transportation needs. Aligning the waste management strategy

with these timelines enables cohesive planning across sectors and supports integrated regional development.

- **Infrastructure Planning and Investment:** Waste management infrastructure, such as transfer stations, MRFs, composting facilities, landfills, anaerobic digesters, and WTE technologies, requires substantial capital investment and long lead times for design, approval, construction, and commissioning. These facilities often have operational lifespans exceeding two decades. A 30-year timeframe allows full lifecycle planning of these assets to be completed, ensuring efficient use of resources, alignment with growth projections, and the ability to adapt to shifting regulatory or market conditions.
- **Addressing the Long-Term Nature of Environmental Impacts:** Waste management decisions today have environmental consequences that can extend far beyond a few years. Landfill capacity, greenhouse gas emissions, and resource depletion are long-term issues. A 30-year horizon compels planners to consider these enduring impacts and prioritize sustainable solutions.
- **Attracting Innovation and Fostering Research & Development:** A clear long-term vision can stimulate innovation in waste management technologies and practices. Knowing that there is a commitment to long-term investment can encourage research institutions and private sector companies to develop and deploy cutting-edge solutions.

4.4.1.2 Rationale for Dividing the 30 Years into 10-year Segments

The division of the 30-year overall timeframe into three 10-year phases creates manageable divisions that will allow regular benchmarking against the original objectives and metrics to determine what is working and what may need to change. It also provides a flexible and responsive approach to implementation, allowing the opportunity to adopt other emerging alternatives that may not have been originally considered.

Phase 1 (0–10 years)

This initial phase focuses on actionable, near-term priorities that strengthen the current system, formalize successful pilots, and build momentum toward broader transformation. While some prior studies, such as the HDR 2020 report, have been generated, as previously noted, it was constrained to only a few alternatives.

Key operational actions should include completing feasibility studies for recycling and organics processing, launching targeted education and behavior change campaigns, and optimizing performance at existing facilities through enhanced maintenance, monitoring, and contract updates. Initial policy actions may also include updating local ordinances, incentive structures, and service models to support source separation and diversion goals.

Critically, Phase 1 should also be used to initiate implementation of projects that have already been approved for applicability to the County's waste management system.

Infrastructure projects that may require early assessment could include projects to develop organics processing capacity, transfer station improvements, potential energy recovery or advanced treatment facilities, or new landfill development. Given the long timelines associated with permitting and construction, early-stage project development will be essential to mitigate prolonged reliance on out-of-County disposal, which carries significant cost, operational, and environmental implications. These preparatory steps are necessary to ensure that major capital assets are ready for implementation in the next decade and beyond.

The County should review policies that can be implemented without involving State-level government agencies or that would require coordination with neighbouring municipalities. Options such as material use bans or implementing green procurement initiatives may be considered.

These early efforts will stabilize the system, demonstrate progress, and establish a solid base for deeper investment and transformation in Phases 2 and 3. They will also incorporate infrastructure development that has already reached the implementation phase.

Phase 2 (10–20 years)

Phase 2 builds directly on the preparatory work completed during Phase 1. This period should focus on the **execution of critical infrastructure projects**, including detailed design and associated permitting, procurement, and construction of new waste processing and diversion facilities. Projects initiated for feasibility assessment or preliminary design in Phase 1 should be transitioned to implementation.

In addition to infrastructure development, Phase 2 should also ensure that service delivery models are appropriate to reach underserved areas and enhance system integration across the County. This may include new transfer capacity, optimized collection routing, or regional partnerships to manage specialized waste streams (e.g., C&D, bulky waste, or e-waste).

The County should also assess what, if any, larger impact policy mechanisms should be supported that can advance circular economy objectives, such as extended producer responsibility (EPR) or recycled content requirements, in coordination with state and regional efforts.

Importantly, this phase must serve as the County's primary infrastructure development and/or commissioning window. Deferring capital buildout or commissioning beyond this period would risk extended reliance on out-of-County disposal, with escalating financial, environmental, and social costs. Success in this phase will depend on maintaining continuity from Phase 1 planning and fostering cross-agency collaboration to secure siting, financing, and public support.

Phase 3 (20–30 years)

Phase 3 marks the maturation of the County's solid waste system and a strategic shift toward deeper adoption of **innovation, circularity, and climate-aligned operations**. By this stage, core infrastructure should be fully operational, providing a reliable backbone for advanced resource recovery, carbon reduction, and economic development initiatives.

Key objectives may include:

- Supporting the Implementation of any remaining large impact policies that may not be directly under the County's control.
- Integrating circular economy strategies that go beyond diversion (e.g., reuse platforms, remanufacturing partnerships, local market development for recovered materials).
- Leveraging real-time data systems and digital tools to optimize operations and transparency.
- Embedding equity and resilience principles across services, infrastructure, and community engagement.

This final phase also provides an opportunity to revisit long-term contracts, governance models, and performance metrics to ensure alignment with evolving community values and policy targets (e.g., zero waste, net zero emissions, regional harmonization).

Phase 3 is not an endpoint, but a pivot toward continuous system adaptation. By this time, Miami-Dade County will be positioned as a national leader in sustainable materials management — provided that decisive planning and investment occur in the earlier phases

4.5 Recommended Phased Implementation Details

This section expands on each of the 10-year divisions and outlines recommended strategies that can be used to support Miami-Dade County's transition toward a more sustainable, circular, and resilient solid waste system over a 30-year timeline. Each phase is designed to build upon the previous achievements, creating a dynamic pathway toward zero waste, GHG reductions, and economic optimization through resource recovery and infrastructure evolution. Individual recommendations can be shifted to earlier or later timeframes, depending on the County's priorities and information that may already be available. This is intended to provide general guidance, not a prescriptive schedule.

When discussing potential impacts on waste quantities, the outcome will depend on the method of implementation, degree of adoption by residents, and level of education/enforcement. As such, the terms None, Minor, Moderate, and Major are used, which are estimated to have the potential to reduce waste quantities to be disposed of by insignificant amounts, 0 to 2.5%, 2.5 to 10%, or >10%, respectively.

4.5.1 Phase 1 (0-10 Years): Laying the Foundation

This phase focuses on foundational policy development through behavior change, public education, feasibility studies, and piloting of innovative waste management systems. Key milestones will support the development of long-term systems while reducing risk. Priority items that should be considered for implementation as soon as practical have been identified within this phase.

Immediate Priority – Decision on WTE/County Landfill/Private Contracted Operations

- Determine a path to follow for immediate implementation to advance waste management system changes using existing data and studies. Delays in adopting a path will impact the timeline for commissioning.

Impact on waste quantities to be managed – none, but this will direct the implementation of the main waste management infrastructure pathway.

Immediate Priority - Community and Stakeholder Engagement:

- Conduct targeted outreach to ensure that the wants and needs of all users of the Couty's waste services are considered. This would include demographic splits such as single-family residences vs. multi-family residences, urban vs. rural, and various geographic subdivisions within the County. Typically, this includes the use of surveys, small focus groups, and public meetings.
- Launch an interactive online platform for feedback on proposed SWMMP scenarios.

Impact on waste quantities to be managed – none, but sets the stage to select alternatives that will impact waste quantities and would be expected to have a reasonable adoption rate.

Immediate Priority – Review Existing Waste Management Targets

- Develop and adopt KPIs to measure waste diversion rates, GHG reduction, cost per ton, and program participation rates.

Impact on waste quantities to be managed – none, but will provide a pre-set method of measuring how adopted alternatives are meeting objectives.

Immediate Priority – Advanced Waste Characterization

- Review all current waste characterization data and initiate waste audit programs to fill the gaps.

Impact on waste quantities to be managed—none, but it will provide sufficient data to generate a more detailed assessment of the potential for waste reduction.

Immediate Priority – SSO / Leaf and Yard Waste Feasibility Study:

- The 2021 Yard Waste Management Practices Report conducted by the University of Florida[17] provides an important reference point, including yard waste characterization data, information on collection volumes, existing practices, and necessary processing infrastructure considerations. While FDEP's primary role[18] is to permit and regulate organics processing facilities, they also provide general guidance and statewide data that can inform local siting and infrastructure planning efforts. However, detailed cost and logistics assessments are typically the responsibility of local governments or their consultants. Building on this foundation, the proposed feasibility study would evaluate how yard waste could be integrated into a broader organics recovery strategy, including source-separated organics (SSO) collection, to support more comprehensive diversion outcomes.
- In parallel, the County should collaborate with the Florida Department of Environmental Protection (FDEP) to assess the permitting, cost, and logistical implications of scaling composting infrastructure. Community engagement will remain a critical component in assessing public willingness to participate in new collection programs and informing service model design.

Impact on waste quantities to be managed – none initially, but the results will be used to translate planning insights into implementable actions — aligning with the County's organics diversion goals, resilience priorities, and system-wide operational needs.

Immediate Priority – Recycling Improvements Assessment

- The proposed assessment will explore whether certain changes, such as modifying the list of accepted materials, developing advanced recovery infrastructure, or evaluating the feasibility of reintroducing dual-stream or hybrid collection models, could improve material recovery, reduce contamination, and enhance the value of marketed recyclables. While the County transitioned to single-stream in the past, this assessment does not presume it to be the optimal long-term model. In fact, emerging strategies — including the use of covered containers and better community guidance — may mitigate some of the challenges historically associated with dual-stream.
- Since the MRF is privately operated and undergoing upgrades, the County's focus would be on collection strategies, contract alignment, and ensuring that infrastructure and practices reflect its broader diversion and equity goals. The assessment should incorporate community engagement findings to understand public receptivity to any changes and ensure programs remain accessible and effective across all neighborhoods.

Impact on waste quantities to be managed – none initially, but the results may inform more effective and cost-efficient recycling strategies that reduce disposal needs over time.

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[17] University of Florida. *Yard Waste Management Practices Report: Miami-Dade County*. Prepared for Miami-Dade County Department of Solid Waste Management, 2021. https://earthjustice.org/wp-content/uploads/miami-dade_county_2021_yard_waste_mang._report_final.pdf

[18] FDEP provides permitting, oversight, and general guidance for organics processing facilities in Florida. Florida Department of Environmental Protection – Solid Waste: Composting https://floridadep.gov/waste/permitting-compliance-assistance/content/solid-waste-composting

Immediate Priority – Collection System Modernization Review:

- Investigate what improvements in waste collection operations may be required to allow for Organics collection or changes to Recycling collection. These can include split-body trucks for collection (such as those adopted in Palm Beach County) coupled with changes to collection schedules. Policies such as clear bag mandates to assist with compliance efforts for recycling may also be considered. More medium-term options may be completing technology pilots that use RFID or GPS tracking and telematics to optimize routing and monitor contractor performance.

Impact on waste quantities to be managed – none, but may lead to adopting more efficient collection methods, which would likely be necessary to implement organics collection or major changes to recycling.

Organics Infrastructure Development:

- Based on organics collection feasibility study findings, develop and commission a site capable of composting leaf and yard waste and/or household organics. Consider aerobic, anaerobic composting models that require lower levels of infrastructure to allow for early adoption.

Impact on waste quantities to be managed – potentially major as organics are estimated to comprise >30% of the waste stream by weight.

Behavioral Change Management:

- Develop a countywide behavioral change strategy. The intent is to develop a consistent plan that can be used to promote the adoption of solid waste management initiatives. This should be coupled with the findings from the community outreach and engagement plans to ensure that rollouts are best aligned with resident expectations. The strategy should evolve over time based on findings and feedback. Activities may include social marketing development, targeted education pilots, and testing public messaging to reduce future rollout risks.

Impact on waste quantities to be managed – none directly**,** but this effort will be required to ensure future programs are understood, accepted, and adopted by as many residents as possible.

Waste Literacy & Public Education:

- Launch a general education program on waste reduction, reuse, and recycling—targeting schools, community events, and media outlets to build a waste-conscious culture before introducing behavior-specific programs.

Impact on waste quantities to be managed – none directly, but similar impacts expected from behavioural change management.

Inter-Regional Partnerships Policy:

- Develop a framework to investigate cost-sharing partnerships with neighboring municipalities for high-capex projects like MRFs or AD facilities. The framework should set investigation thresholds that staff can work toward before direct council approvals are required.

Impact on waste quantities to be managed – none in short-term but discussions could lead to agreements that allow earlier adoption of waste management infrastructure with shared risks.

C&D Diversion Feasibility Study:

- Analyze opportunities to enhance residential construction & demolition waste diversion.

Impact on waste quantities to be managed – none, but will identify future opportunities and fill a data gap.

Reuse & Circular Initiatives:

- Launch community-based reuse initiatives such as tool lending libraries, textile recovery events, bulky item exchange days, and C&D reuse pilot zones.

Impact on waste quantities to be managed—minor, potentially 1% to 2%, but it may raise population awareness and support the first steps toward adoption of a circular economy.

Mixed Waste Processing Feasibility Study:

- Conduct a technical and financial study of MWP to recover organics and/or recyclables from garbage.

Impact on waste quantities to be managed—minor to moderate. It could increase diversion rates by an additional 10% to 20%, but would also generate contaminated organics residuals and low-value contaminated recyclable material that may ultimately require landfilling.

Small-Scale Organics Reduction Pilots:

- Continue/expand programs deploying low-capital pilots like backyard composters (rural areas) and complete anaerobic co-digestion of food pilot studies (if Anaerobic Digestion of water treatment sludge is already occurring locally).

Impact on waste quantities to be managed – minor unless it leads to major anaerobic digestor infrastructure development.

4.5.2 Phase 2 (10-20 Years): Infrastructure and System Expansion

This phase involves scaling up infrastructure and adopting more complex systems. It may include implementing advanced organic processing infrastructure, advanced thermal recovery technologies, and robust performance monitoring systems to track progress and adapt strategies.

Items that may be appropriate for implementation during this phase include:

Carbon Capture Planning and Evaluation:

- A carbon capture feasibility study has identified several technologies that are suitable for pilot-scale deployment. Planning during this phase may include: technical and site-specific feasibility assessments, evaluation of permitting and regulatory pathways, and exploration of funding opportunities such as federal incentives, grants, or carbon markets. This approach ensures Miami-Dade remains positioned to act strategically when implementation becomes viable.

Impact on waste quantities to be managed – none.

Advanced Organics Infrastructure Development:

- Based on the advanced organics feasibility study findings, initiate development of Anaerobic Digestion facilities, if practical. If an earlier payback on investment could result, consider hybrid or co-digestor models with water treatment sludge, animal waste, etc., depending on inputs such as local feedstock, land use, and end-market needs.

Impact on waste quantities to be managed – minor to moderate depending on success of organics management programs already in use.

RDF and Thermal Processing Pilot Studies:

- Launch pilots or public-private partnerships to explore Refuse-Derived Fuel (RDF), pyrolysis or gasification for residuals, if additional technologies to the planned WTE are required.

Impact on waste quantities to be managed – minor unless full-scale infrastructure is developed.

Material Recovery Optimization:

- Encourage the contractor to continue adopting/utilizing advanced MRF technologies and backend processing facilities. The current recycling collection practices result in a high contamination rate and residuals that must be managed. Reducing residuals could improve diversion rates and the value of the end product.

Impact on waste quantities to be managed – moderate with significant potential to reduce contamination rates and increase net diversion across the system**.**

Cross-County Border and/or Inter-Municipal Integration:

- Assess the potential to develop cross-County and State-level agreements to trade material flows and optimize regional infrastructure.

Impact on waste quantities to be managed – major if it leads to incorporating shared infrastructure that would not be viable for a single organization.

Circular Economy Policy Implementation:

- Implement binding procurement and planning policies based on circular economy principles, coupled with changes to local building codes, development permitting requirements, etc.

Impact on waste quantities to be managed – major if it leads to incorporating shared infrastructure that would not be viable for a single organization.

Landfill Mining and Reclamation Feasibility Pilots:

- Complete feasibility assessments and begin pilot-level trials on landfill mining projects focused on recovering metals, reusable soils, and clearing space for new infrastructure.

Impact on waste quantities to be managed – could increase the waste material to be managed if landfill mining is adopted on a large-scale.

4.5.3 Phase 3 (20-30 Years): Long-Term Strategic Planning

The final phase prioritizes long-term planning or renewal and innovation opportunities, including longer-term policy reforms, infrastructure replacement planning, and advanced materials recovery through emerging technologies. The following are the recommended strategies that the County can utilize to position itself as a national leader in zero waste innovation.

- Innovation Committee on Emerging Technologies:
- Establish a permanent working group to monitor global innovations in materials recovery and develop funding for pilot-scale assessments to investigate adoption potential. Pilots would focus on new, emerging, or evolving technologies.

Impact on waste quantities to be managed – none, unless new technologies are identified that are adopted.

Next-Gen Infrastructure Renewal Plan:

- Identify the lifecycle endpoints for Phase 1–2 assets and plan replacements that are aligned with emerging technologies and new regulations.

Impact on waste quantities to be managed – potentially major, will define the longer-term waste management infrastructure that is preferred for implementation.

Carbon Capture Deployment Strategy

- If early-stage feasibility assessments conducted in Phase 2 confirm technical and economic viability, the County should initiate full deployment of **carbon capture systems** at high-emission waste management infrastructure. Activities may include final technology selection, site-specific engineering, integration of post-combustion capture solutions, and exploration of funding mechanisms such as carbon markets or federal incentives.

Impact on waste quantities to be managed – none, but implementation could reduce greenhouse gas emissions and support the County's climate goals.

Landfill Mining and Reclamation:

- If pilots are successful, implement full capability landfill mining projects focused on recovering metals, reusable soils, and clearing space for new infrastructure.

Impact on waste quantities to be managed – could increase the material required to be managed but could also provide significant feedstock to a WTE Facility and may lead to new landfilling capacity or alternative development opportunities following completion of mining.

Promotion/Implementation of State-Level Policy Changes

- Recognizing it may take time for full adoption, the County should continue promoting visionary changes to how Florida regulates and manages waste and implement as/when possible.

Impact on waste quantities to be managed – none to major depending on policy changes that may be adopted – i.e. EPR could remove all recyclable management responsibilities for the waste stream.

4.6 National or State-Level Regulatory Landscape Changes

Not all potential influences on the waste management system must be, or can be, driven by the County. A number of structural level changes to waste management could be implemented at a State-level that would have a broad impact on the waste management systems for everyone. These include:

1. **Extended Producer Responsibility (EPR):** EPR aims to reduce waste by requiring companies to take responsibility for the products they place on the market — thereby incentivizing the design of longer-lasting products that can be reused, recycled, or composted more easily, while shifting waste management costs from municipalities to producers.

   Producers are required to join a Producer Responsibility Organization (PRO), which collects data regarding the volume of materials, such as single-use packaging, that are being sold into the State. The PRO then uses information to estimate total costs to manage the waste, and sets fees based on each producer's contribution to that waste stream. The funds generated are used to contract management of that waste, generally using a private waste company to collect, manage and recover any value from those materials. At present, only a small number of states (Maine, Oregon, Colorado,

California, and Minnesota) have proceeded with the legislation and will implement pending larger adoption. In Canadian provincial jurisdictions where EPR has been adopted, the PROs are financially and logistically responsible for the lifecycle of their products. Typical products covered by EPR include:

- **Municipal Hazardous or Special Waste**: This includes items like paint, antifreeze, batteries, fertilizers, and other hazardous materials.
- **Waste Electrical and Electronic Equipment (WEEE)**: Products such as computers, televisions, and stereos fall under this category.
- **Blue Box Program Materials**: Such as printed paper and packaging materials like plastics, paper, glass, aluminum, and steel.
- **Deposit Return System (DRS) Containers:** Beverage containers — including aluminum cans, glass bottles, and plastic bottles — are commonly managed through bottle deposit systems to ensure high recovery rates and closed-loop recycling.
- **Bottle Deposit Return Programs**: Beverage and alcohol containers are included here.
- **Used Tires**: Ensuring the proper collection and recycling of used tires.

The following material categories are periodically covered under emerging EPR or stewardship programs, and may offer models for future policy expansion in Florida:

- **Bulky and Hard-to-Recycle Items (e.g., Mattresses):**
  Mattresses, box springs, and similar bulky items are increasingly being addressed through specialized EPR or product stewardship programs, particularly in jurisdictions facing landfill capacity constraints. These items are costly to manage in the traditional waste stream and pose challenges due to their size, weight, and mixed material composition.
- Several states[19] — including **California, Connecticut**, and **Rhode Island** — have implemented mandatory mattress EPR programs, requiring manufacturers to fund the collection, transportation, and recycling of used mattresses. These programs have diverted millions of units from landfills, enabling the recovery of polyurethane foam, steel springs, wood, and textiles. Miami-Dade County may explore these models as a pathway to manage high-volume bulky waste more sustainably.

Once these materials have been determined to fall under the responsibility of a PRO, municipalities are no longer obligated to collect or manage these wastes, although they may choose to partner with a PRO to allow collection/storage at their facilities in return for direct compensation.

2. **Landfill and Incineration Regulations:** Changes in state or federal rules about building, running, and closing landfills could affect Miami-Dade's landfill space and management. Health related concerns may result in more strict emissions rules at WTE facilities. Limits or bans on landfilling specific waste types (e.g., organics, textiles, construction and demolition waste) can require changes in acceptance, increased enforcement, and the need to develop alternate management and/or disposal methods, such as composting.

[19] California Department of Resources Recycling and Recovery (CalRecycle). (n.d.). *Mattress recycling information.* Retrieved from https://www.calrecycle.ca.gov/mattresses

3. **Net Zero and Circular Economy:** Regulations aimed at achieving Net Zero or adopting a circular economy and result in mandated higher diversion targets, or the inclusion of more materials in the recycling stream, even if there is no potential for financial recovery of costs. Government (state or federal) incentives may be provided to promote their preferred practices which can range from modifying designs to increase product longevity to improved material reuse programs.

5. High-Level Financial Risk Analysis and Mitigation Strategies

5.1 Economic and Environmental Impact Assessment

This section presents an integrated economic and environmental impact assessment framework, building upon the identification of key data gaps and the feasibility analysis of potential strategies. This approach supports transparent and data-driven decision-making by comparing waste management alternatives across various financial, environmental, and community-based performance indicators.

The metrics and evaluation criteria will evolve as the County continues to refine its understanding of local waste streams, infrastructure conditions, and community priorities. This framework is intended as a flexible decision-support tool, adaptable to new data inputs, regulatory developments, and stakeholder feedback. Future iterations may incorporate additional indicators, such as lifecycle cost assessments or resilience metrics, to strengthen scenario comparisons and long-term planning efforts.

5.2 Overview of Current Financial Framework

Miami-Dade's DSWM operates under an enterprise fund model, primarily financed through user fees (residential and commercial service charges) and tipping fees collected at disposal facilities. These revenues are occasionally supplemented by general municipal funds and state or federal grants dedicated to capital improvements.

Operational expenditures encompass a broad range of services, including:

- Residential and commercial waste collection;
- Transportation to disposal or recovery facilities;
- Landfill operations;
- Personnel salaries;
- Fleet and equipment maintenance;
- Contracted service agreements.

Capital expenditures are allocated toward infrastructure development projects, such as:

- Landfill expansions;
- Leachate and stormwater management systems improvements;
- Vehicle replacements;
- Transfer station upgrades;
- Infrastructure Development (i.e., Sustainability Campus, etc.).

The County employs a long-term financial planning horizon, typically 20 to 30 years, to forecast investment needs, accommodate infrastructure renewal cycles, and ensure service continuity amid demographic and regulatory changes.

While Miami-Dade's solid waste system maintains a stable funding model, it is currently experiencing significant financial pressure driven by major infrastructure investment needs, operational impacts of the RRF closure, and long-standing deferred maintenance — with additional challenges posed by market volatility and evolving regulatory requirements.

Current pressures are generated from**:**

- Aging infrastructure and deferred maintenance;
- Recycling market cost volatility, which has reduced predictable revenues and increased processing uncertainty, though it remains a secondary financial driver;
- Policy and regulatory shifts;
- The RRF closure, which eliminated a critical waste management asset, increased reliance on landfilling.

In response, the County is evaluating new infrastructure projects, including:

- A proposed out-of-County landfill development estimated at $2.51 to 2.73 billion in capital costs with projected annual operating costs of approximately $443 million;
- A future Waste-to-Energy facility, with preliminary cost estimates reaching $1.5 to $1.9 billion.

These financial challenges highlight the importance of proactive risk management, cost control, and infrastructure reinvestment strategies to sustain the County's solid waste services over the long-term.

5.3 Cost Drivers Overview

A review and assessment of the most likely cost inputs that can impact the overall assessment has been generated. This framework supports capital planning, rate setting, and long-term service continuity.

The following assumptions have been applied:

Table 5-1: Cost Drivers - Assumptions

Assumption	Methodology Basis	Primary Source(s)
Annual Inflation Rate (2.5%–3.0%)	Long-term U.S. inflation forecasts for public sector planning.	U.S. Congressional Budget Office (CBO) Long-Term Economic Outlook; Florida Office of Economic and Demographic Research.
Labor Cost Escalation (3.5%–4.5%)	Average wage growth in municipal services adjusted for labor market pressures.	Bureau of Labor Statistics (BLS); American Public Works Association (APWA); HDR consulting insights.
Fuel Price Variability (±20%)	Historical fuel price volatility for municipal diesel and LNG/RNG fleets.	U.S. Energy Information Administration (EIA); Solid Waste Association of North America (SWANA).
Infrastructure Cost Index Escalation (4%–6%)	Historical escalation rates for heavy civil infrastructure construction costs.	Turner Building Cost Index; RSMeans Construction Cost Indices.

These assumptions provide a conservative yet realistic framework for financial modeling, consistent with industry practices for infrastructure projects over a 25- to 30-year horizon. They align with the assumptions utilized in the other Miami-Dade County solid waste reports and are corroborated by general economic forecasts for public sector capital projects.

Several categories of expenditures are expected to drive financial pressure over the forecast horizon:

Collection and Transfer Costs

- Inflationary pressures on fleet maintenance, replacement, and route expansion.
- Fuel price fluctuations are impacting operational costs.
- Labor shortages are increasing wage demands and staffing costs.

Landfilling and Disposal Costs

- Tipping fees at County and external disposal sites.
- Construction and maintenance of new landfill cells.
- Long-haul transportation contracts for out-of-County waste disposal.

Infrastructure Renewal

- Major capital projects are required to replace or upgrade aging facilities.
- Leachate and landfill gas management system enhancements.

Administrative and Regulatory Costs

- Environmental permitting and compliance monitoring.
- Public education and outreach initiatives.
- Increased reporting requirements under evolving state and federal regulations.

Sector reporting and County financial disclosures indicate that Miami-Dade County's recycling program faces operational deficits projected to exceed $17 million over the next two years, driven by unfavorable commodity markets and legacy contract terms.

5.4 Key Financial Risks

5.4.1 Identified Risks

Miami-Dade County's solid waste management system, like those of other Counties or cities in the United States, will face several financial risks over the next 25–30 years. These risks stem from operational volatility, infrastructure investment pressures, labor market dynamics, and evolving regulatory frameworks.

Understanding these risks and their potential impacts is critical to ensuring financial resilience and long-term service continuity.

Table 5-2: List of Identified Financial Risks

Variable	Description	Potential Financial Impact
Fuel Prices Volatility	Diesel and RNG/LNG fuel price variations might impact fleet operating costs.	Higher operational expenditures for collection and transfer operations.
Labor Costs Market Instability	Wage inflation, labor shortages, and increased recruitment costs.	Increased staffing costs and potential service disruptions.
Construction Costs Escalation	Rising costs of materials, labor, and equipment for infrastructure projects.	Higher capital expenditure requirements and potential project delays.
Environmental Regulations	Stricter federal or state regulations requiring additional compliance investments.	Unplanned capital or operating costs to meet new standards.
Land Acquisition Costs	Limited availability and escalating prices for suitable landfill or facility sites.	Increased capital costs for securing and developing new infrastructure.
Recycling Market Volatility	Fluctuating commodity prices are affecting material recovery revenue streams.	Higher net costs for operating MRFs and maintaining recycling programs.

5.5 Potential Costs Fluctuations Over 30 Years

Throughout a 30-year planning horizon, the County's waste management system will be exposed to various external pressures that could significantly influence capital and operating costs. Five key areas have been identified as primary drivers of potential cost fluctuations: energy market volatility, evolving climate regulations, labor market dynamics, instability in construction material supply chains, and the pace of technological innovation. These factors should be closely monitored and integrated into long-term financial modeling and scenario planning to ensure system resilience and cost-effectiveness.

Energy Market Shocks: Diesel and LNG/RNG market volatility:

- Volatility in fuel prices, particularly diesel and liquefied natural gas (LNG), can significantly impact waste management operations, especially in transportation and facility energy consumption. For instance, the COVID-19 pandemic led to drastic fluctuations in energy prices, affecting the cost structures of waste management systems.

Climate Regulations: Carbon pricing or methane emission penalties:

- Evolving climate policies, such as carbon pricing mechanisms and penalties for methane emissions, can introduce new financial liabilities for waste management entities. Waste Management, Inc. (WM) has acknowledged the impact of climate-related regulations on its operations, emphasizing the need to mitigate and adapt to these risks.

Labor Shortages: Higher wages, hiring costs, and retention investments:

- The waste management industry faces challenges related to labor shortages, leading to increased wages, hiring costs, and investments in employee retention. WM's investor relations report highlights the constrained labor market and its effects on operational costs and service delivery.

Construction Materials: Supply chain instability and global demand resulting in cost escalation:

- The construction industry, integral to waste management infrastructure development, is experiencing rising material costs due to supply chain disruptions and heightened global demand. KPMG's 2023 Global Construction Survey discusses the volatile environment, with supply chain disruptions and inflation affecting material costs.

Technology Shifts: Capital investment in automation or AI-based diversion systems:

- Advancements in technology, including automation and AI-based systems for waste diversion, necessitate significant capital investments. The construction industry's adoption of new technologies transforms operations, with companies investing in digital tools to enhance efficiency and sustainability.

5.6 Proposed Mitigation Strategies and Risk Management Approaches

Miami-Dade County can adopt proactive strategies to mitigate the financial risks identified in Section 4. The following table outlines recommended mitigation approaches and associated control mechanisms, prioritized based on expected risk impact.

Table 5-3: Identified Risks and Mitigation Strategies

Risk	Mitigation Strategy	Control Levers (County-Level)
Fuel Price Volatility	Fleet transition to electric or RNG, fuel hedging, route optimization, and development of LFG-to-RNG production at County landfills to reduce exposure to RNG market volatility	High
Labor Cost Escalation	Workforce development, union collaboration, and automation investments	Low
Construction Cost Overruns	Contingency budgeting, phased design-build contracts	High
Capital Cost Inflation	Modular/phased construction, early procurement, public-private partnerships	Low to Medium
Regulatory Changes	Active participation in state/federal consultations; reserve funds	Medium
Equipment Downtime	Preventive maintenance, asset redundancy	High
Environmental Risk	Regulatory engagement, reserve funds for compliance upgrades	Medium
Landfill Capacity Constraints	Accelerated permitting, vertical expansion, diversion strategies, and regional disposal agreements	High
Recycling Instability	Local market development, long-term contracts, and dynamic MRF operations	Medium

To build fiscal resilience over the next 30 years, Miami-Dade County must align its waste infrastructure investment with financial risk forecasting. Leveraging landfill gas to produce renewable natural gas (RNG) could further insulate the County from external fuel price fluctuations and support a clean fleet transition strategy. By adopting scenario-based budgeting, engaging with policy and technology trends, and leveraging strategic partnerships, the County can mitigate volatility and achieve long-term cost efficiency.

6. Comparative Costs of WTE and Landfilling

6.1 The Strategic Role of WTE

Miami-Dade County is projected to experience continued growth in municipal solid waste generation, with total tonnage rising from approximately 2.2 million tons in 2023 to over 4 million tons by 2053, assuming a conservative 2% annual increase. This growth trajectory, driven by population increase and consumption patterns, underscores the need for scalable, long-term disposal and processing infrastructure.

To address this rising demand, a WTE Facility has been accepted as one preferred waste management alternative. Current design specifications include a throughput capacity of up to 4,000 tons per day (TPD), equivalent to roughly 1.46 million tons per year assuming a continuously operating schedule. This capacity drops to 1.2 million tons per year based on reasonable operating windows and incorporating maintenance shutdowns.

As of May 2025, Miami-Dade County has not confirmed an official timeline for the construction or operation of a new waste management facility. A decision on the preferred approach is expected in the summer of 2025.

Once a WTE Facility is operational, it would provide immediate relief to the waste management system, which is expected to utilize either an expanded or new County landfill or private waste contracting operations, by processing a significant share of the waste stream, resulting in only residual ash for disposal. This relief will be particularly critical given that both North Dade Landfill (NDL) and South Dade Landfill (SDL) are anticipated to be closed or nearing closure, barring any significant expansion by the time the WTE Facility is commissioned. This facility would play a pivotal role in reducing long-term landfill dependency while recovering energy and stabilizing disposal capacity over time.

The overall impact that adopting a WTE Facility strategy could have on the waste stream is indicated in Figure 6-1.

In this scenario, even with an operational WTE the County would not be fully relieved of the need to secure some landfilling capacity. The projected facility throughput would be insufficient to fully manage all of the waste that could be generated in the County, and the residual post-combustion ash will still need to be disposed of.

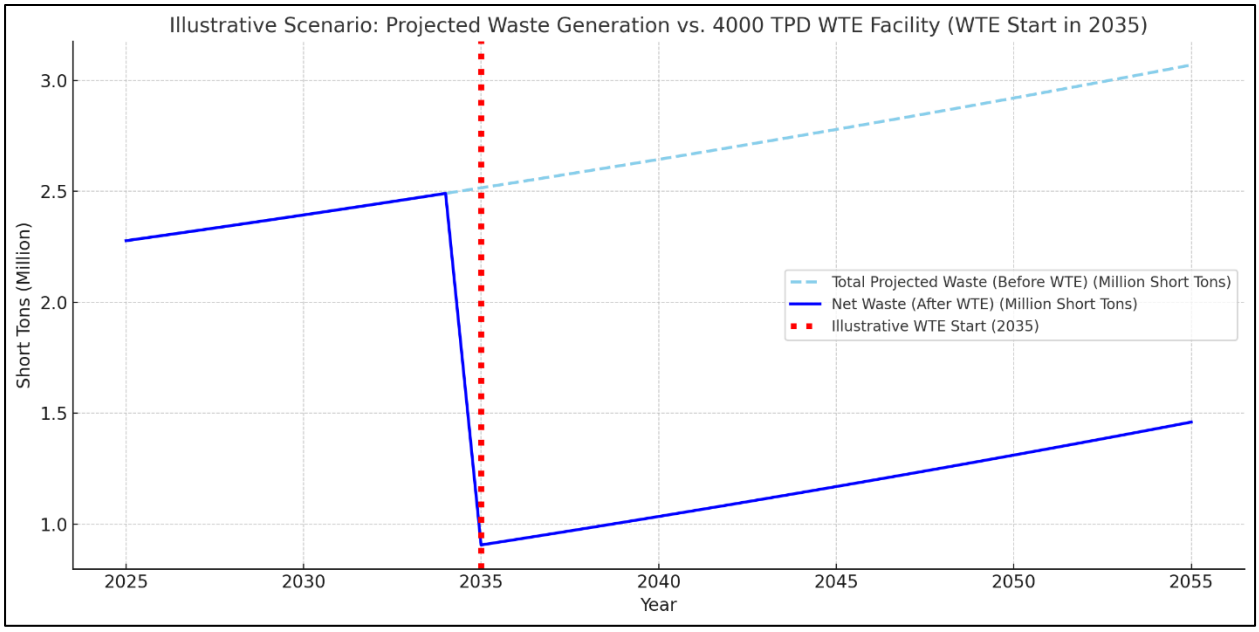

Figure 6-1: Projected Impact of Proposed WTE Facility on Waste Tonnage[20]

6.2 Impact of Diversion Strategies on WTE Needs

Complementary diversion initiatives can substantially reduce the volume of waste requiring thermal processing. Several realistic strategies were assessed for their potential to reduce MSW volumes before WTE or landfill treatment:

Table 6-1: Estimated Diversion Potential Rate by Diversion Method

Diversion Method	Realistic Diversion Potential (% of total waste)	Notes
Source-Separated Organics (SSO)	20–30%	Depending on the rollout scale & degree of participation
Mixed Waste Processing (MWP)	10–20%	Especially useful for capturing missed recyclables/organics
Anaerobic Digestion (AD)	5–10%	Can overlap with SSO feedstock
Small Volume Organics	2–5%	Seasonal or interim solution
EPR & Circular Initiatives	10–30%	Packaging, HHW, etc.

[20] Showed for exploratory analysis only.

Even accounting for overlapping implementation, cumulative diversion could reduce the waste stream requiring management by **30% to 50%** over time. Applying this to the current 2.2 million tons/year of waste, fully implemented diversion programs could reduce the tonnage of residuals to be managed by **660,000 to 1.1 million tons/year**. The impact that successfully implemented diversion programs could have on the required capacity is provided in Table 6-2. This table utilizes the current waste after diversion tonnages but does not incorporate the impact of potentially increasing waste stream tonnage due to population changes. This would result in greater WTE capacity needs for the 30% and 50% diversion scenarios than indicated.

Table 6-2: Estimated Impact of Diversion Scenarios on WTE Facility Sizing

Scenario	Waste After Diversion (Tons/year)	WTE Need (Tons/year)	Equivalent TPD (at 365 days)
No new diversion	2.2M	~ 1.46M	4,000 TPD
Moderate diversion (30%)	~1.54M	~1.0 -1.2M	~2,750–3,300 TPD
Aggressive diversion (50%)	~1.1M	~700K–1M	~1,900–2,750 TPD

A hybrid strategy — integrating some combinations of SSO, AD, MWP, and right-sized WTE — presents a resilient, phased solution. It is often speculated that a waste management system that incorporates robust recycling programs may not be compatible with a WTE Facility due to competing controls. Specifically, the removal of plastic and paper products via recycling decreases the overall caloric value of the waste stream, resulting in less energy generation potential. Despite this, other jurisdictions such as Portland (ME), Lancaster County (PA), and Pinellas County (FL) have successfully implemented integrated models, demonstrating that high-performing recycling programs and WTE facilities can operate successfully in tandem.

6.3 Landfilling as the Primary Disposal Alternative

Without WTE infrastructure, Miami-Dade will need to continue to rely extensively on landfilling. Continuing this practice introduces new risks related to land availability, environmental impacts, and long-term financial burden.

Key Implications of Landfill-Only Strategy:

- Requires at least a 1,000-acre property for new or expanded landfill development.
- Accelerates depletion of existing and future permitted landfill capacity.
- Will increase methane and leachate production, with associated regulatory and environmental costs.
- Continued reliance on long-haul contracts — already in place to meet concurrency requirements — will continue to result in increased long-term costs, vehicle emissions, and logistical risks if no in-County alternative is developed.
- Requires implantation and management of a landfill gas collection and utilization system to produce energy directly or to generate RNG as a revenue offset.

Reducing the quantity of waste to be managed through diversion can reduce the required size of a landfill, or extend its useful lifespan, but will not fully alleviate the need for a landfill. Waste disposal will always be required for some residuals, including those generated from a WTE Facility.

6.4 Comparative Analysis: WTE vs. Landfilling

Building on the previous sections, this comparative analysis presents a structured evaluation of the two primary long-term waste management options for Miami-Dade County: WTE and landfilling. By examining each option across multiple performance criteria—including financial costs, land use, energy recovery, environmental footprint, and permitting complexity—support for strategic infrastructure decisions is provided.

Table 6-3 highlights key trade-offs and underscores the importance of selecting a pathway that balances cost-effectiveness, resilience, and long-term sustainability.

Table 6-3: Comparative analysis: WTE vs. Landfilling[21]

Criteria	Landfilling	WTE
Throughput (tons/year)	3,000,000	1,400,000
Capital Cost (CAPEX)	$2.51-2.73 B	$1.5B – $1.9B
Land Requirement	1000 acres (rural)	3 to over 60 acres (urban/suburban)
Permitting Timeline	2-5 years	4-7 years
O&M Costs (Annual)	$443 million	$55-87 million
Haul Distance	Potential doubling if a new regional landfill is needed (assumed railcars are used for hauling)	Typically shorter, with more flexibility to locate at a central site
Energy Generation	None without the addition of methane capture and cogeneration or landfill gas to the RNG infrastructure.[22]	0.5-0.8 MWh/ton
Energy Revenue (est.)	None (see above)	Depends on Power Purchase Agreement (PPA) rate
GHG Emission	High – driven by methane. Transport-related emissions are minimal given that MDC already uses Waste-by-Rail (WbR) for out-of-County disposal.[23]	Moderate – GHG emissions are regulated and partially offset through energy recovery.

[21] Data taken from the 2025 Miami-Dade County Solid Waste Management – Market Research Report.

[22] Miami-Dade County is currently developing a landfill gas-to-renewable natural gas (LFG-to-RNG) system to improve energy recovery from landfill operations. A similar system is under development at the Okeechobee landfill, highlighting the growing role of landfill-based RNG in Florida.

[23] Miami-Dade County's use of Waste-by-Rail (WbR) significantly reduces transport-related GHG emissions compared to long-haul trucking. As a result, methane emissions remain the dominant source of GHG impacts from landfilling.

Criteria	Landfilling	WTE
Residual Waste Volume	100% - no reductions in volume/tonnage until the waste degrades in place	15–25% ash (landfilled)

7. Alignment with the HDR 2020 Solid Waste Master Plan

The prior HDR SWMMP report[24] reviewed alternatives from a previously selected preferred Scenario. These included source reduction measures, recycling and reuse improvements, changes to curbside collection methods, changes to public waste drop-off facilities and transfer stations, expansions to landfills, and construction of a new WTE Facility. The focus was to review those alternatives and recommend a plan for implementing waste infrastructure improvements within a 10-year period.

Other than landfilling or a new WTE, the alternatives included in the preferred scenario were judged to have the ability to deliver a maximum 2% reduction in the waste stream. Based on a recalculation of expected waste tonnages to be managed and incorporating a review of the remaining capacity of both County-owned and private landfills, a waste reduction technology in conjunction with landfill expansion was recommended. A review of available technologies and an assessment of their maturity and capacity management resulted in a recommendation for the development of a mass-burn WTE Facility to replace the aging RRF mass-burn facility.

A high-level costing analysis of the average disposal cost per ton of managed waste using landfills and a WTE Facility was generated, concluding that the cost of disposal at a privately owned landfill would be the same as the disposal costs at a new WTE Facility.

A typical comprehensive SWMMP includes:

- Detailed analysis of what the public desires and what they will support;
- Detailed characterization and analysis of the waste stream;
- Assessment of the influence of implementing alternatives on the waste stream;
- State of technology assessment;
- Comparative analysis of comparable municipal programs/infrastructure.

They can also include costing implications, risks vs opportunities, recommendations for implementation, and an associated schedule. **Generating a comprehensive SWMMP can take 1 to 2 years to complete**.

As such, this report focused on a roadmap of recommended steps for how to obtain the required information to complete a comprehensive SWMMP. This document also includes high-level reviews of the potential influences of various alternatives on the waste stream and is not constrained by the requirement to restrict considerations to those in a previously identified preferred Scenario.

Table 7-1 summarizes thematic alignments and differences between the 2020 and 2025 planning efforts.

[24] HDR. Miami-Dade County Solid Waste Master Plan. Retrieved February 2020. https://www.miamidade.gov/

Table 7-1: Alignments / Differences Between 2020 SWMMP and the 2025 Roadmap for Solid Waste Management Planning

Topic	2020 Plan – from HRD	2025 Roadmap	Notes
Landfill Capacity	Includes expansion plans for North and South Dade; capacity estimates through 2035	Incorporates RRF closure impact; new landfill proposal ($556M); mentions capacity stresses	The 2025 report includes new information (early closure of RRF) but both reports had similar objectives
Organics Diversion	High-level composting mentions, no detailed SSO/AD consideration	Detailed feasibility study suggestions for SSO, MWP, AD, including high-level estimates of impact on the waste stream	Major additional options considered that enhance the potential implementation strategy
Waste-to-Energy (WTE)	Focuses on maintaining existing WTE (RRF) via capital improvements in the near-term and outlines requirements for new facility	Reviews WTE capacity requirements, coupled with potential impacts of alternate diversion strategies	Reflects potential shifts in the waste stream that could result from implementing diversion alternatives
Anaerobic Digestion (AD)	Mentioned as potential tech, minimal operational detail	Considered as an option to improve diversion within a 10 to 20-year timeframe	Expands consideration beyond the original preferred Scenario 2 limitations
Alternative Technologies	Limited to superficial review of: • Mass-burn • Refuse-derived fuel • Gasification • Pyrolysis • Plasma Gasification • Waste-to-energy	Also includes additional details on • Source-separated Organics (SSO) • Mixed waste processing • Anaerobic Digestion • Hybrid SSO + MWP • Short-term Organic recovery	Expands consideration beyond the original preferred Scenario 2 constraints
Financial Risk Management	Broad mention of risks; no mitigation tools	Includes high-level cost forecast models, risk and mitigation framework	2025 recommends appropriate feasibility studies that should be completed for this assessment

Topic	2020 Plan – from HRD	2025 Roadmap	Notes
Circular Economy Principles	Mentioned conceptually, not central to planning	Central to framing waste-as-resource, reuse culture, and system redesign	Recommends reframing of the waste system approach in the longer-term
Extended Producer Responsibility (EPR)	Not detailed	Described with legislative context, impact planning, and compliance noted	Provides context for potential significant impacts out of the County's direct control
Infrastructure Planning	Infrastructure needs mentioned (landfills, transfer stations)	30-year roadmap recommendations provided	2025 added timelines for funding integration
Public Engagement + Stakeholder	Outreach campaigns and recycling education are mentioned	Online tools, school programs have also been added with specific study recommendations	Stronger focus on the need for and potential advantages of implementing a robust consultation program
Waste Projections / Forecasting	Use of forecast data in infrastructure planning	Includes feasibility assessments and high-level financial planning	Expanded and tied to decision-making models

8. Strategic Action Framework

This section translates the report's strategic findings into a concrete set of recommendations to guide Miami-Dade County's solid waste management decisions in the near, medium, and longer-term. Each recommendation includes a supporting rationale, lists required studies and describes implementation pathways.

They are structured to reflect the County's overarching goals: reducing landfill reliance, improving infrastructure resilience, enhancing diversion and circularity, and aligning with long-term sustainability targets.

Recommendations have been designed to be integrated into policy, procurement, or capital planning processes. Together, these actions form a cohesive roadmap towards a more sustainable waste management system.

It is important to note that this framework is preliminary in nature. Further discussions, consultations, and technical evaluations will be necessary to refine the recommendations and confirm sequencing, responsibilities, and funding strategies. This document is intended to support dialogue and enable future decision-making, not to prescribe final solutions.

8.1 Recommendations

8.1.1 Implement a Phased 30-Year Strategy Centered on Diversion and Circularity

- **Objective**: Guide system evolution across a 30-year period with three subdivided timeframes (0–10 years, 10–20 years, 20–30 years).
- **Actions**: Commission an Integrated Solid Waste Master Plan (ISWMP), with an implementation roadmap and governance model.
- **Milestones**: Annual diversion reviews; regular review and SWMMP updates (5-year intervals); mid-term infrastructure re-evaluation (Year 10, Year 20).

8.1.2 Position Organics and Recyclables Management Improvement as System Cornerstones

- **Objective**: Maximize the use of low-cost, low-carbon diversion streams (SSO, AD, recyclables).
- **Actions**: Conduct feedstock and processing feasibility studies; design and commission new local composting infrastructure; optimize MRF operations; reduce contamination through education and enforcement.
- **Impact**: Reduces residual tonnage, defers capital investment in landfills, supports local green job generation.

8.1.3 Adjust Planned Infrastructure Sizing to Reflect Diversion Performance (or Expected Performance)

- **Objective**: Review waste disposal infrastructure capacity requirements based on plausible reduction scenarios, coupled with real-time verified data. This would include composting, MRF, transfer stations, landfills, and thermal treatment facilities.
- **Actions**: Initiate residual flow tracking; create scenario models to adjust new infrastructure sizing based on real-world data; and consider impacts to the waste stream from longer-term future alternatives such as landfill mining.
- **Trigger Points**: Detailed capital planning reviews on 5-year intervals.

8.1.4 Strengthen Regulatory Tools and Market Signals

- **Objective**: Effect systemic shifts in behaviors and create durable diversion incentives.
- **Actions**: Policy gap analysis (EPR, PAYT, landfill bans); circular economy market scan; pilot pricing reforms.
- **Governance**: Link to procurement standards, municipal codes, and regional policy alignment.

8.1.5 Secure Long-Term Funding and Governance Models

- **Objective**: Ensure sustained investment capacity and cross-agency alignment.
- **Actions**: Financial modeling; public-private partnership (PPP) viability assessments; climate fund readiness review.
- **Leverage**: Federal infrastructure grants, carbon markets, regional co-investment.

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5.3 APPENDIX C – FEDERAL TAX CREDIT OPPORTUNITIES

ROESSLER
& ASSOCIATES

TECHNICAL MEMORANDUM

To: Miami-Dade County, Department of Solid Waste Management

From: Justin Roessler, PhD, PE
President, Roessler and Associates

Date: May 9, 2025

Subject: Inflation Reduction Act – Clean Energy Tax Credit Opportunities

EXECUTIVE SUMMARY

Roessler and Associates (R&A), under subcontract with AtkinsRealis, was engaged to evaluate opportunities for Miami-Dade County to pursue federal tax credits in connection with its proposed Sustainable Solid Waste Campus. Following its assessment, R&A believes that the planned Waste-to-Energy (WTE) facility has the potential to qualify for the Clean Energy Credits established under the Inflation Reduction Act (IRA), provided the project satisfies key thresholds applicable to tax-exempt entities for use of domestic materials. Eligibility for the credits also requires the electric generating technology to be classified as zero-greenhouse gas (GHG) emissions. Based on R&A's analysis, WTE should meet this zero-GHG requirement based on the framework established in the final regulations. Unless WTE is explicitly listed, Miami-Dade will be required to complete the emissions determination process prior to submitting its credit tax return.

Using current project estimates ranging from $1.5 to $1.9 billion, the Clean Energy Investment Tax Credit (CE-ITC) could reasonably be expected to generate between $63 million and $535 million in tax credits for the County. These are issued to the energy property owner in the year following the facility's start of commercial operations. Credit values increase in a tiered manner if the project satisfies federal prevailing wage, apprenticeship, and domestic content requirements. Compliance with these provisions would also increase the project's overall cost. To evaluate the cost and viability of meeting the bonus requirements, R&A recommends that Miami-Dade include these criteria in their procurement documents and require proposers to provide the incremental costs. The County should engage tax counsel to support this effort.

The final Clean Energy Tax Credit regulations direct the Treasury to provide exemptions from the domestic content requirements for tax-exempt entities. Exemptions are available if the use of domestic products increases overall costs by more than 25%, or if domestic products are not available. While Treasury has issued initial guidance, it currently only applies to projects beginning construction before 2027. If the costs of pursuing the domestic content bonus are deemed prohibitive, properly documenting the basis for an exemption during procurement could allow Miami-Dade to pursue the base credit and prevailing wage bonus, totaling between $315 to $400 million, pending the issuance of additional guidance, as required under the final regulations.

*This report does not analyze the impact of proposed legislation on the current regulations. Miami-Dade should continue to monitor legislative developments related to the Clean Energy Tax Credits.

1.0 BACKGROUND AND INTRODUCTION

Miami-Dade County (Miami-Dade) has entered into a professional services agreement with AtkinsRealis USA, Inc. for Design Criteria Professional and Owner's Representative Services for a new Sustainable Solid Waste Campus. The new campus is currently planned to include a 4,000 ton per day, mass-burn WTE system with design and construction costs expected to be on the order of $1.5 billion dollars. Miami-Dade seeks to explore and analyze available funding sources including federal tax credits to contribute to or defray the costs of the County's proposed WTE facility. Currently nearby WTE construction projects are pursuing federal Investment Tax Credits made available as a result of the Inflation Reduction Act (IRA). To support its WTE construction project, Miami-Dade has engaged Roessler and Associates to assess the viability of pursuing similar tax credits, summarize the potential reimbursement available, outline credit requirements and risks, and present recommended next steps.

In August of 2022 the IRA was signed into law. The IRA modified the Internal Revenue Code (IRC) creating the potential opportunity for Miami-Dade to leverage federal tax credits in support of its WTE construction project by creating an elective pay mechanism for local governments and other tax-exempt entities to claim the Clean Energy Tax Credits. Under the elective pay mechanism the tax credit is treated as an overpayment on a tax return submitted by the tax-exempt organization and issued as a refund. This tax return would be submitted in the calendar year following the initial commercial operation of the facility.

In addition to elective pay, the IRA created new Clean Energy Tax Credits, replacing the current Energy Tax Credits which sunset for projects beginning construction after 2024. The Clean Energy Credits created under the IRA extend the tax credit window for projects commencing construction on or before 2032. The final regulations for *Section 45Y Clean Electricity Production Credit and Section 48E Clean Electricity Investment Credit* were published in the Federal Register on January 15, 2025.

2.0 CLEAN ENERGY TAX CREDITS

2.1 Credit Summary

Miami-Dade's WTE project could qualify for two of the clean energy tax credits created by the IRA. The Clean Energy Production Tax Credit, memorialized in Section 45Y IRC or the Clean Energy Investment Tax Credit (CE-ITC), memorialized in Section 48E of the IRC. These credits cannot be claimed simultaneously. The County would need to elect to claim either the CE-PTC or the CE-ITC. The CE-ITC and CE-PTC are referred to as technology neutral tax credits and require that taxpayers seeking to claim the credit met the definition of qualified facility in the final regulations. To be

deemed a qualified facility, eligible for the CE-ITC or CE-PTC, the facility must be owned by the taxpayer and:

- **(i)** Be used for the generation of electricity,
- **(ii)** Must be placed in service after December 31, 2024, and
- **(iii)** have a greenhouse gas emissions rate not greater than zero – determined in accordance with applicable requirements

The CE-PTC allows qualified facilities to claim a tax credit (or elective pay) on a dollar per kilowatt hour (kWh) basis for the power generated by the facility and sold to another party over a 10-year term. The CE-ITC provides a one-time credit based on the qualified facility's total eligible costs.

Both credits have a two-tiered system, with a base credit rate and a "bonus rate" that is based on meeting additional requirements. The bonus rate includes three categories, each with its own additional credit, that can be compounded with the base credit and the other bonus credits. Bonus credits are available for:

1. Paying federal prevailing wage and apprenticeship rates to all project laborers
2. Using a certain percentage of domestic materials and products to construct the facility
3. The project being located in an "Energy Community" as defined in the final rules.

For Miami-Dade who would seeking elective payment, the Domestic Content requirements associated with the bonus rate are likely to be required for receipt of the base credit as there are further requirements established specifically for entities seeking elective pay.

2.2 Defining the Start of Construction

One of the key considerations for claiming Clean Energy Credits is establishing when the project satisfies the definition of Start of Construction. Start of construction is used to establish the required percentage of materials for the domestic content bonus, assess applicable guidance, and determine if the project has commenced construction before the clean energy credit phase out dates.

Federal Register Notice 2022–61, applicable to the Clean Energy Credits, provides guidance around the requirements for establishing the start of construction. There are two methods that the taxpayer may use: 1) starting physical work of a significant nature (Physical Work Test) or 2) paying or incurring five percent or more of the total costs of the facility (Five Percent Safe Harbor). The physical work test is satisfied when the facility construction begins physical work of a significant nature. The physical work test does not include preliminary activities, even if these activities are recoverable costs under facility construction. The IRS defines these preliminary activities to include, but not be limited to: planning and design, securing financing, exploring, researching,

obtaining permits, licensing, conducting surveys, environmental and engineering studies, or clearing a site. Physical work does not need to occur on the project site to satisfy the definition of start of construction. The requirement can be met once the manufacturing of project components begins at an off-site location but only if the manufacturer's work is done pursuant to a binding written contract and these components are not typically held in the manufacturer's inventory.

Under the Five Percent Safe Harbor provision construction of a facility is considered to have begun if the taxpayer pays or incurs five percent or more of the total of cost of the facility and makes continuous efforts to advance completion of the facility. For both the Physical Work Test and Five Percent Safe Harbor the IRS requires that the project has a continuous program of construction that advances efforts towards completion of the facility. This is described in further detail in IRS Notice 2013-29 and is referred to as the Continuity Requirement. This IRS notice also establishes a Continuity Safe Harbor under which a taxpayer will be deemed to satisfy the Continuity Requirement provided that the facility is placed in service no more than four calendar years after the calendar year during which construction began.

To develop a high-level projection of the project's start of Construction Date, Roessler and Associates utilized the *Preliminary Project Schedul*e provided AtkinsRealis and included in this memo as Exhibit 1. Presently the schedule illustrates notice to proceed (NTP) in May of 2027 with site mobilization in April of 2028 and a 2033 completion date. At this preliminary phase of the project, limited information is available to outline project spend between FNTP and mobilization. Given the magnitude of projected construction costs, and the fact that the construction timeline exceeds the four-year construction safe harbor, commencement of construction is assumed to begin in 2028 for the purposes of this analysis. In the event Miami-Dade elects to pursue the credit, it should retain tax counsel to assist in making an official determination of the project's start of construction.

2.3 Credit Phase Out Date

The CE-ITC and CE-PTC are available to taxpayers with a qualified facility placed in service after December 31, 2024. The Clean Energy Tax Credit begins to phase out annually, on a percentage basis, starting in the applicable year, which the final regulations define as the later of 2032 or the year in which U.S. greenhouse gas emissions from electricity fall below 25% of 2022 levels, whichever is later. Based on a review of the preliminary schedule, the facility is expected to commence construction prior to the phase-out date outlined above

2.4 Elective Pay Requirements

Under the IRA, an elective pay provision was established allowing eligible entities that do not owe Federal income tax to receive a payment equal to the total value of the CE-ITC or CE-PTC. 26 USC §

6417 governs the elective payments of these credits. Section 6417 specifically highlights that any State or political subdivision thereof, would be eligible for elective pay. Miami-Dade, as the project owner, would be eligible for elective pay. Entities electing to pursue elective pay are not eligible to transfer tax credits under the requirement outlined in § 6418.

The IRA establishes additional requirements for entities seeking to claim elective payment for the CE-PTC and CE-ITC. Most notably, it introduces a ***Phased Domestic Content Requirement*** applicable to entities pursuing elective pay. This requirement reduces the base credit for facilities that do not met requirements for the use of domestic materials (domestic content is also a bonus credit) or meet one of two statutory exemptions around increased cost or non-availability of materials. For tax exempt entities seeking elective pay, the base credit is reduced in accordance with the schedule below:

I. if construction of such facility began before January 1, 2024, 100 percent,
II. if construction of such facility began in calendar year 2024, 90 percent,
III. if construction of such facility began in calendar year 2025, 85 percent, and
IV. if construction of such facility began after December 31, 2025, 0 percent.

Given that the start of construction of a Miami-Dade WTE facility would not begin until after December 31, 2025 this rule effectively requires that either the domestic materials or statutory exemptions be met to receive even the base credit. The IRA did recognize that procurement of these domestic materials could create challenges, and the final regulations state that the Secretary shall provide exceptions to the Phased Domestic Content Requirement, based on meeting one or more of the exemption criteria listed below:

I. the inclusion of steel, iron, or manufactured products which are produced in the United States increases the overall costs of construction of qualified facilities by more than 25 percent (increased cost exemption), or;
II. relevant steel, iron, or manufactured products are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality (non-availability).

Presently the IRS has issued Notice 2024-9 and Bulletin 2024-28 which created and then extended guidance for *Statutory Exceptions to Phaseout Reducing Elective Payment Amounts for Applicable Entities if Domestic Content Requirements are Not Satisfied*. This guidance requires an attestation from the taxpayer that, under penalties of perjury, that the taxpayer has reviewed the requirements for the increased cost exception and the non-availability exception and has made a good faith determination that the qualified facility qualifies for either the increased cost exception or the non-availability exception, or both. Under this IRS guidance, if a taxpayer provides an attestation and follows the applicable recordkeeping requirements the IRS will treat the attestation as establishing

that a phase domestic content exception has been met. The current guidance is applicable for facilities beginning construction prior to 2027.

Given that no further guidance has been issued Miami-Dade should plan to satisfy the domestic content requirements to qualify for elective pay as it pursues the Clean Energy Tax Credits. If Treasury extends the previously issued guidance Miami-Dade may be able to claim either the increased cost or non-availability exemptions. Capturing the domestic content requirements in the project procurement documents will allow Miami-Dade to document the cost associated with meeting the requirements for domestic content. These are discussed in detail in section 3.1 of this memo.

3.0 CREDIT BASE RATES AND BONUS PERCENTAGES

3.1 Credit Amounts

A key difference between the CE-ITC and CE-PTC is that the CE-ITC is a one-time credit awarded in the year following commercial operation of the facility. The CE-PTC is a 10-year credit which is based on electric generation sold to another party in the prior tax year. Both the CE-ITC and the CE-PTC include a base credit and bonus tiers. For the CE-ITC base credit rate is 6% of Qualified Facility costs, the bonus tiers increase the credit above the 6% based on the number and type of bonus credit met. Table 1 illustrates the possible base/bonus credit scenarios for the CE-ITC.

Table 1: Summary of Clean Energy Investment Tax Credit Base and Bonus Credit Amounts

Total Credit as a Percentage of Qualified Facility Costs			
Base Credit	6%		
Prevailing Wage & Apprenticeship (PWA)	30%		
Domestic Content (DC)	8% if PWA not met	40% if PWA met	
Energy Community	8% if no PWA/DC	10% if DC	50% if PWA & DC

The CE-ITC requires a determination of the cost of the qualified property to be used in the calculation of the credit. This requires an evaluation of what percentage of the total project costs would be designated as qualified property and included in the cost basis for calculation of the CE-ITC. For the purposes of a WTE facility, qualified property can be summarized as equipment and structures used in the processing of waste for the generation of electricity that is owned by Miami-Dade County.

The final regulations do include specific examples of what would and would not be considered qualified property under the definition. Examples of ineligible property include roads that are used primarily to access the site or for employee or visitor vehicles; buildings that don't house

components of the property integral to electric generation (e.g. administrative or office space); interconnection property, and fencing. Structures that house components of the property that are integral to the intended function of the facility would qualify.

For the purposes of the credit calculation conducted in section 3.3, Roessler and Associates used an eligible cost basis of 80% of the total project costs. This is based on previous experience and preliminary data provided by AtkinsRealis with the goal of providing a reasonable estimate of the available credit. If Miami-Dade elects to move forward with pursuit of the Clean Energy Credits they should retain a tax professional to perform the detailed cost segregation analysis required to refine these estimates and support submission of their return.

For the CE-PTC, the base credit rate is 0.3 cents per kilowatt-hour of electricity sold by the taxpayer to an unrelated party. This amount may be increased through applicable bonus credit tiers, depending on the number and type of bonus requirements met. The CE-PTC does include a provision for cost escalation. Table 2 illustrates the possible base/bonus credit scenarios for the CE-PTC.

Table 2: Summary of Clean Energy Production Tax Credit Base and Bonus Credit Amounts

Total Credit in Cents (¢) per kWh-sold[1]			
Base Credit	0.3 cents		
Prevailing Wage and Apprenticeship (PWA)	1.5 cents		
Domestic Content (DC)	0.33 ¢ if PWA not met	1.65 ¢ if PWA met	
Energy Community	0.33 ¢ if no PWA/DC	.36 ¢ if DC	1.8 ¢ if PWA/DC

[1]The above credits are subject to annual price escalation following 2024. For the purposes of the credit analysis in section 3.3 a value of 1.5% was used for the GNP price deflator index adjustment referenced in the final rule

Roessler and Associated conducted a preliminary analysis of the credit available to Miami-Dade under both the CE-ITC and CE-PTC. Because the CE-ITC is based on a percentage of eligible costs, a range of values is presented using the $1.5 to $1.9 billion dollar project cost range provided in the *Second Update on Directive No. 241676*. The analysis does not include the Energy Community Bonus Credit, which would require the selected site met the definition of a Brownfield under 42 U.S.C. 9601(39)(A), (B), and (D)(ii)(III). For the WTE energy generation rates used in calculating the credit due under the CE-PTC Roessler and Associates used the Facility Performance Guarantees developed in AtkinsRealis Design Criteria Package. To appropriately compare the two credits Roessler and Associates used a net present value approach to discount the total CE-PTC credit to the year the CE-ITC is received.

3.2 Tax Exempt Financing

Both the CE-ITC and CE-PTC provide for a reduction of the overall credit by up to 15% if the project is financed with tax-exempt bonds. The specific reduction is calculated using the proportion of the project's financing that comes from these tax-exempt sources. For example, if the project was financed with 50% tax exempt debt ($750 million out of a $1.5 billion dollar overall cost), the total reduction would be 7.5%. The credit amount is then reduced by that percentage. For example, a project able to qualify for a 30% credit under the ITC, financed with 50% tax exempt debt, would be reduced to 27.75%. This concept applies in the same fashion to both the ITC and PTC. For the scenarios outlined in section 3.3 Roessler and Associates has assumed the project would be financed using 80% tax exempt bonds.

3.3 Potential Credit Available to Miami-Dade

The results of the credit analysis are shown below in Table 3, the data is presented as a range, with the $1.9 Billion project cost estimate being the basis for the high end of the range and the $1.5 Billion estimate the low end. In all instances, the CE-ITC provided a higher total credit. Based on this analysis and the fact that the zero-GHG emissions and bonus credit requirements for the CE-ITC and CE-PTC are effectively the same under elective pay, its Roessler and Associates' opinion that Miami-Dade should focus on pursuit of the CE-ITC. The remainder of the memo addresses the requirements associated with qualifying for the CE-ITC.

Table 3: Summary of Potential Credit Available to Miami Dade

Credit Tier	**Clean Energy Investment Tax Credit (CE-ITC)**	**Clean Energy Production Tax Credit (CE-PTC)[1]**
Base Credit	$63 to 80 Million	$ 28 Million
Prevailing Wage	$316 to 401 Million	$113 Million
Prevailing Wage & Domestic Content	$422 to 535 Million	$125 Million
[1]Represents 10 year NPV for the CE-PTC using a 4% discount rate		

4.0 CLEAN ENERGY CREDIT BONUS TIER REQUIREMENTS

4.1 Domestic Content

Because Miami-Dade would be seeking elective payment, the domestic content bonus credit requirements outlined in Section 45Y(g)(11), and incorporated by reference into Section 48E, would apply. The domestic content bonus credit provides an additional 10% credit for the CE-ITC

and is a requirement for projects seeking elective pay, absent further guidance from Treasury extending the non-availability and increased cost exemptions. To satisfy the domestic content bonus credit requirements there are two main criteria that must be met:

1) All structural steel and iron used on the project needs to be manufactured domestically
2) For facilities beginning construction after December 31, 2026, 55% of the Manufactured Product costs (determined in accordance with applicable rules) must qualify as domestic in nature.

4.1.1 Structural Steel and Iron Requirements

Similar to the requirements contained in Dade County Code Section 2-8.2.6.1, Section 48E references the Buy America Steel and Iron requirements in 49 CFR 661. This requires that all construction materials that are made primarily of steel or iron and are structural in function, be domestic in nature. The domestic steel or iron requirement is met if all manufacturing processes with respect to any structural steel or iron items take place in the United States, except metallurgical processes involving refinement of steel additives.

Facility components subject to the requirements are construction materials made primarily of steel or iron that are structural in function, examples of these would include beams, girts, and rebar. Non-structural items including: nuts, bolts, screws, washers, cabinets, covers, shelves, clamps, fittings, and other similar items that are made primarily of steel or iron but are not structural in function would not be subject to the steel or iron requirement.

4.1.2 Manufactured Product Requirements

The second component of the domestic content bonus requires that a specified percentage, 55 percent in the case of Miami Dade, of a facility's manufactured products be of domestic origin. Although the CE ITC regulations established this threshold, they initially lacked clarity regarding the calculation methodology. Treasury addressed this issue in IRS Notice 2023-38, which provides domestic content guidance applicable to Sections 45, 45Y, 48, and 48E. The notice clarifies that the domestic content percentage for manufactured products must be calculated based on the **direct material and direct labor costs** paid or incurred by the manufacturer.

A formula for calculation of the project's domestic content is provided below along with relevant definitions from the notice:

$$Domestic\ Content\ Percentage = \frac{Domestic\ Manufactured\ Products\ and\ Componets\ Costs}{Total\ Manufactured\ Product\ Costs}$$

- Manufactured Product - means an item produced as a result of the manufacturing process.

- Manufacturing Process - means the application of processes to alter the form or function of materials or of elements of a product in a manner adding value and transforming those materials or elements so that they represent a new item functionally different from that which would result from mere assembly of the elements or materials.
- Manufactured Product Component. - means any article, material, or supply, whether manufactured or unmanufactured, that is directly incorporated into an Applicable Project Component that is a Manufactured Product.

For the Miami-Dade project to meet the domestic content requirement the calculated percentage using the formula above needs greater than or equal to 55%. For a manufactured product to be deemed domestic, all manufactured project components must be produced in the U.S. and the product must be manufactured domestically. In this scenario, both the component and labor costs can be included in the domestic content calculation. For manufactured products where all of the manufactured product components are not of U.S. origin, but the product is manufactured in the U.S., the Treasury guidance does allow for inclusion of the costs of the domestic manufactured product components in the percentage, but not the direct labor costs. An example calculation of the domestic content percentage is provided below:

Table 4. Example Domestic Content Calculation

Product	**Cost**
US Manufactured Product 1 – Total Cost (Labor + Components)	**$100**
Component 1A (Domestic)	*$30*
Component 1B (Domestic)	*$45*
Labor (Domestic)	*$25*
US Manufactured Product 2 – Total Cost (Labor + Components)	**$200**
Component 2A (Domestic)	*$30*
Component 2B (Domestic)	*$50*
Component 2C (Non-Domestic)	*$100*
Labor (Domestic)	*$20*

Because all of the components of Manufactured Product 1 are domestic in nature the total cost can be counted (materials + labor). For Manufactured Product 2, only the component costs of US origin are included in the calculation. In the simplified example above the domestic content percentage would be 60%.

$$Domestic\ Content\ Percentage\ (60\%) = \frac{(\$100 + \$30 + \$50)}{(\$100 + \$200)}$$

4.1.3 Domestic Content Summary

Determining the project's domestic content percentage will require that equipment suppliers provide their direct cost and labor information to tax counsel and likely Miami-Dade County. This data would be required to develop the necessary cost segregation and calculate the overall percentage, as well as to support the County in the event of an audit.

Because the domestic content percentage is based on the total cost of each manufactured product, it is necessary to collect direct material and labor cost data for all manufactured products, including those not produced in the U.S. Given the proprietary nature of this data, Roessler and Associates recommends that Miami-Dade work with legal counsel to incorporate requirements around receipt of equipment supplier direct cost data into project procurement documents and to address issues around disclosure of direct cost information by use of an NDA or other mechanism.

4.2 Prevailing Wage and Apprenticeship

The PWA bonus credit represents the largest of the available bonus credits, increasing the CE-ITC from 6 to 30%. To meet the requirements for the PWA bonus credit there are three primary criteria that need to be satisfied:

I. All laborers and mechanics (craft labor) working on the Qualified Facility must be paid federal prevailing wage determined in accordance with the final regulations.
II. The project craft labor must meet the apprenticeship requirements outlined in section 4.2.2 of this memo. There are three discrete requirements for project apprenticeship: the Labor Hours Requirement, Ratio Requirement, and Participation Requirement
III. Maintain sufficient records to demonstrate compliance with items I and II.

4.2.1. Prevailing Wage Requirements

To receive the PWA bonus credit, the taxpayer must ensure that federal prevailing wage is paid to all craft labor employed by any contractor or subcontractor in construction of the Qualified Facility. Federal prevailing wage must be paid in accordance with the requirements of subchapter IV of chapter 31 of title 40, United States Code (Davis-Bacon Act). In addition to paying prevailing wage during facility construction, this requirement is extended to cover facility alteration or repair for a 10-year period after construction completion, this excludes routine maintenance. The final

regulations define *laborer and mechanic* to mean those individuals whose duties are manual or physical in nature.

Prevailing wage rates applicable to the CE-ITC are published on SAM.gov and are categorized by location (state and county), construction type (e.g., heavy, highway, residential, building), and job classification (e.g., electrician, ironworker). These rates include both hourly wages and a fringe benefit component, which may be satisfied through equivalent additional hourly pay under the combined wage test allowed by the final regulations. Wage rates for a given location may be updated multiple times per year. If a specific job duty is not listed, taxpayers may request a wage determination from the U.S. Department of Labor.

Under 26 CFR § 1.45-7(b)(2) the applicable prevailing wage rate is generally fixed once a contract for construction of the facility is executed, this fixed rate would apply throughout the project. Roessler and Associates recommend that Miami-Dade retain tax counsel to assist with the formal wage determination process. However, the final regulations should allow for a prevailing wage rate to be established on the date of execution of the Design-Build Agreement.

If a contractor or employee fails to meet the project's PWA requirements, the final regulations establish a cure payment and penalty process. The contractor must make restitution for any wage shortfall by paying the difference between the wages paid and the applicable prevailing wage rate, including interest. Additionally, a penalty of $5,000 per noncompliant employee, per year, may apply depending on the duration of the noncompliance. This penalty can be avoided if the following criteria are met:

- The employee was paid less than the prevailing wage rate for < 10% of their pay periods
- The difference between the actual rate of pay and the prevailing wage rate is < 5%
- A cure payment is made by the end of the month following the calendar quarter in which the failure occurred

The final regulations outline further penalties and cure payments for “intentional disregard” of the prevailing wage requirement, increasing the cure payment by a factor of three and the penalty to $10,000 per employee.

4.2.2 Apprenticeship Requirements

To receive the prevailing wage and apprenticeship bonus credit, Section 48E requires that 15% of the total labor hours for construction of the qualified facility be performed by qualified apprentices. Section 48E defines qualified apprentices as being from a registered apprenticeship program which requires approval from the Department of Labor or state apprenticeship agency. The final regulations do allow for contractors to submit a “Good Faith Effort Exemption” if qualified

apprentices for a particular trade are unavailable. The apprenticeship requirements under section 48E are broken into three categories.

> **Labor Hours Requirement** – Not less than 15% of the total labor hours of the construction, alteration, or repair work (including such work performed by any contractor or subcontractor) shall be performed by qualified apprentices.
>
> **Ratio Requirement** – To be designated as a qualified apprentice and counted in the labor hours requirement above, apprentices are subject to applicable state or federal requirements ratio requirements. These ratio requirements outline the number of journey workers required to supervise each qualified apprentice. For example, a particular apprenticeship agreement may require that 4 journey workers are onsite for each qualified apprentice. If this provision is not satisfied the apprentice labor hours over the required ratio are converted to journey worker hours for that time period.
>
> **Participation Requirement –** Under the participation requirement each, taxpayer, contractor, or subcontractor who employs four or more individuals to perform construction on the project must have one or more qualified apprentices.

The apprenticeship requirements impose penalties of $50 per hour for each labor hour that fails to meet either the required apprentice-to-journey worker ratio or overall participation thresholds. However, the final regulations provide a good faith effort exception. Under this exception, penalties may be waived if the contractor has requested qualified apprentices from a registered apprenticeship program and either: (i) the request was denied, provided the denial was not due to the refusal of party to comply with the standards of the apprenticeship program; or (ii) the program failed to respond within five business days of receiving the request. Contractors must submit requests at least once every 180 days to maintain eligibility for the exception.

4.2.3 Recordkeeping

The final regulations require taxpayers to maintain adequate records demonstrating compliance with prevailing wage and apprenticeship requirements, including any cure payments and penalties incurred. To meet these obligations, Miami-Dade must collect prevailing wage and apprenticeship data from all project contractors and subcontractors. This data should be gathered continuously throughout the project to ensure timely cure payments, where applicable, and to avoid gaps in documentation as subcontractors complete their scopes of work.

4.2.4 Prevailing Wage Summary

To comply with the PWA requirements under the CE-ITC, Miami-Dade will need to establish clear wage, apprenticeship, and reporting requirements for its design-builder. It is recommended that

Miami-Dade engage tax counsel to assist in developing a digital wage and apprenticeship reporting system to serve as the official system of record for the project. Miami-Dade should also conduct periodic reviews of the design-builder's submissions, including any associated cure payments and penalties. Since the prevailing wage rate is fixed at the start of the project, the design-builder should be able to estimate the incremental cost of compliance as part of its proposal.

5.0 ENERGY COMMUNITIES

The CE-ITC provides a bonus credit increase of up to 10% if the Qualified Facility is located within an Energy Community. Similar to the domestic content bonus, this incentive can be combined with other bonus credits to increase the overall return. Under Section 48E, the base credit rate increases by 2% if the PWA requirements (outlined in Section 4) are not met, and by 10% if those requirements are fully satisfied. To qualify as an Energy Community, the project must meet at least one of the following three criteria:

I. The Qualified Facility is built on a Brownfield Site – as defined in 42 U.S.C. 9601(39) subparagraphs (A), (B), and (D)(ii)(III)
II. The Qualified Facility is located in an area that has (or had at any time after 2009) 0.17% or greater direct employment or 25% or greater local tax revenues related to the extraction, processing, transport, or storage of coal, oil, or natural gas; and has an unemployment rate at or above the national average unemployment rate for the previous year
III. The Qualified Facility is located or directly adjoining a census tract in which a coal mine has closed after 1999; or in which a coal-fired electric generating unit has been retired after 2009.

In March 2024, the U.S. Treasury released a list of areas that satisfy the fossil fuel employment threshold under Criteria II. Based on a review of that data, along with publicly available information on coal-fired generating units in Florida, none of the proposed sites identified in the Second Update on Directive No. 241676 appear to qualify as Energy Communities under Criteria II or III. For Criteria I, Miami-Dade would need to engage tax counsel to evaluate specific project sites for compliance with the Brownfield definitions referenced in Section 48E to determine eligibility for the Energy Community bonus credit under the CE-ITC.

6.0 GREENHOUSE GAS EMISSIONS RATES

6.1 Zero Greenhouse Gas Emissions Technology

The final regulations state that to be classified as a Qualified Facility under the CE-ITC or CE-PTC the technology used must be designated as having a greenhouse gas emissions rate of not greater than zero (zero-GHG). The final regulations divided potential zero-GHG technologies into two groups: combustion and gasification facilities (C&G) and non-combustion and gasification (non-

C&G) facilities. WTE is explicitly identified as a C&G facility in the final regulations, while non-C&G examples include wind and solar. The final regulations establish a tiered framework for determining if a technology qualifies as zero-GHG, with separate assessment procedures for C&G and non-C&G technologies. The process for evaluating C&G facilities is summarized in the sections below:

6.1 Annual Table

The final regulations require the U.S. Treasury to publish an *Annual Table* specifying the GHG emissions rates for various types or categories of facilities. Taxpayers must use this Annual Table to determine the GHG emissions rate of any technology that is included in the table. This table may categorically designate technologies as zero-GHG or explicitly exclude them. It is updated annually, and Treasury may issue a notice of no change in lieu of an update. For the purpose of claiming the CE-ITC, the applicable Annual Table is generally the one in effect during the year the taxpayer seeks to claim the credit. However, the regulations allow taxpayers to instead rely on the table in effect during the year the facility began construction.

If under the Provisional Emissions Rate (PER) petition process, the Annual Table is subsequently updated on or before the taxpayer files a return claiming the CE-ITE to include or exclude WTE, that update would govern. The first Annual Table was published by Treasury on January 15, 2025. It did not explicitly list or exclude WTE or other combustion and gasification (C&G) technologies. The final regulations require that changes to the Annual Table be supported by expert analysis. For C&G technologies, this must include a lifecycle assessment LCA consistent with the CE-ITC regulatory framework.

6.3 Provisional Emissions Rate

If a technology is not listed in the Annual Table, taxpayers may initiate a *Provisional Emissions Rate (PER)* petition. Because the Annual Table does not currently provide a specific emissions rate for WTE, Miami-Dade would need to submit a *Provisional Emissions Rate (PER)* petition to support the classification of the technology as zero-GHG, unless further updates to the Annual Table are made. The PER petition is submitted as an attachment to the tax return for the year in which the credit is claimed, this is the year following the facility's commercial operation date. Acceptance of the taxpayer's return by the IRS constitutes acceptance of the PER petition.

The petition must include a quantified GHG emissions value and, if applicable, a supporting emissions determination letter from DOE. If, during the time a PER petition is under review, an emissions value for the relevant technology is added to the Annual Table, the PER petition will be automatically denied. The PER process allows for two pathways to determine a GHG emissions value, which are outlined in further detail in the sections below.

6.4 Lifecycle Assessment Model

A Lifecycle Assessment (LCA) is a desktop analytical exercise used to evaluate the environmental impacts of a product, process, or activity across its entire lifecycle from raw material extraction through end-of-life disposal. In issuing the final regulations, the Treasury declined to designate a specific LCA model for use in the PER process stating that there was not a clear and obvious model for use under all scenarios and that they would continue development and selection of a model in coordination with Federal industry experts.

While the Treasury declined to designate a specific LCA model, the final regulations do establish a series of boundary conditions and technical criteria that an acceptable model must satisfy. These requirements are set forth in Section 45Y(b)(2)(B) of the Internal Revenue Code and further detailed in 26 CFR § 1.45Y–5(d) and (e). In addition, before an LCA model can be formally designated by the Secretary for use in GHG emissions evaluation, it must undergo an expert analysis conducted by one or more National Laboratories, in consultation with other federal agency experts, as appropriate.

6.5 Department of Energy (DOE) Emissions Determination

The final regulations provide that if a technology is not listed in the Annual Table and no Treasury-designated LCA model is available for evaluating emissions, the taxpayer may request an emissions determination from the DOE. This determination must be based on an analytical evaluation of the facility's emissions rate, conducted by one or more National Laboratories in consultation with other federal agency experts, as appropriate. The analysis must be consistent with the technical requirements outlined in the final regulations.

To initiate this process, the final rules require the project to have reached a sufficient level of development—typically demonstrated through a Front-End Engineering and Design (FEED) study or other comparable indicator of project maturity, as determined by DOE. The regulations also direct DOE to publish guidance and procedures governing the emissions determination process, including a mechanism for taxpayers to request reevaluation of DOE's initial assessment. To date, there has been no further guidance published from DOE on the emissions determination process.

6.6 Lifecycle Assessment Feasibility Analysis

While the final regulations do not explicitly address WTE or other C&G technologies status as a zero-GHG emissions technology they did establish a set of boundary conditions and technical requirements that must be applied in a detailed emissions assessment. The Annual Table, Treasury-designated LCA, and DOE emissions determination process, must each adhere to the emissions determination requirements outlined in the final rules and be supported by expert analysis to justify inclusion or exclusion of technologies.

Because of these factors, it is possible to conduct a screening analysis to provide a level of confidence on if WTE will be classified as a zero-GHG emissions technology under the framework outlined in the final regulations. This analysis was performed by Innovative Technical Solutions (ITS), a subcontractor to Roessler and Associates. The analysis employed the technical requirements conditions memorialized in the final regulations, WTE design information included in AtkinsRealis Design Criteria Package, and publicly available data from the US-EPA and other scholarly sources around WTE emissions.

The analysis supports the conclusion that WTE should be classified as a zero-GHG technology under the technical requirements established in the final rules. The primary driver of this outcome is WTE's ability to offset methane emissions that would otherwise result from landfilling the scenario used as the baseline for comparison. While the analysis did consider that much of the methane from the baseline landfill source was flared, the remaining methane, and its high global warming potential (more than 20x carbon dioxide), was the deciding factor in the evaluation. ITS's analysis of variable parameters, such as transport distance, found that they were likely unable to have a large enough impact to materially alter the overall emissions comparison between technologies.

A full report detailing the methodology and results is attached as **Appendix 1** to this memorandum.

6.7 Waste to Energy Greenhouse Gas Emissions

The boundary conditions and technical requirements outlined in the final rules demonstrate that, consistent with the LCA screening analysis, there is a high degree of confidence that WTE will be designated a zero-GHG emissions technology. However, to meet the requirements as a Qualified Facility with respect to GHG emissions, Miami-Dade would still need WTE to either be listed in the Annual Table or a designated through the PER petition, as described above. Given the project's timeline, further guidance regarding an approved LCA model and the DOE's emissions determination process is likely to be issued during design and construction, and prior to submission of the credit return. If WTE is not designated as zero-GHG through one of these pathways, Miami-Dade would be precluded from qualifying for the CE-ITC.

7.0 CLEAN ENERGY CREDITS AND OTHER WASTE PROCESSING TECHNOLOGIES

As Miami-Dade is evaluating numerous technologies for inclusion in its Sustainable Solid Waste Campus Roessler and Associates has provided a high-level summary around the ability for other waste processing technologies to qualify for a Clean Energy Tax Credit. Examples of alternative technologies considered include: MSW composting, pyrolysis, and anaerobic digestion.

For a technology to qualify for the Clean Energy Tax Credits it must first meet the definition of a Qualified Facility (see section 2.1 above). The key components of this definition are that the facility

must generate electricity and be classified as a zero-GHG emissions source. With respect to the technologies mentioned above MSW composting would not be able to qualify for a Clean Energy Tax Credit because it does not generate electricity. For MSW anaerobic digestion and pyrolysis it is reasonable to assume that if successful, both technologies would produce and sell electricity, and as such it is possible that both would be able to meet the electrical generation component of the Qualified Facility definition. Assessing MSW anaerobic digestion and pyrolysis designation as a zero-GHG emissions technology would require that Miami-Dade follow the process outlined in section 6 of this memo. It is challenging to conduct a screening level GHG analysis of these technologies in the context of the zero-GHG definition of a Qualified Facility, given the limited data available, however if the GHG analysis is able to employ an offset of methane emissions as a baseline scenario it is possible that it would have the potential to qualify.

Once designated as a Qualified Facility, the total credit amount for the CE-ITC is based on the dollar value of the Qualified Property, or the overall energy generated and sold to a third party for the CE-PTC. The final regulations did provide clarity around the definition of qualified property with respect to other forms of anaerobic digestion. The regulations stated that anerobic digester and gas conditioning equipment were generally used to produce fuel that may be used part of a qualified facility to generate electricity, but that they themselves are not part of a qualified facility for the purposes of Section 45Y and 48E credits. Much of the capital cost of an MSW anaerobic digestion facility would be the costs of the anaerobic digesters and gas conditioning equipment. This would not be able to be counted in the cost basis for calculation of the CE-ITC credit.

8.0 PROJECT COMMERCIAL CONSIDERATIONS

There are several near-term steps that Miami-Dade can take to maximize its opportunities for receiving the CE-ITC. The most critical step during the planning and procurement phase is for Miami-Dade to integrate the appropriate language around pursuit of the CE-ITC into its procurement documents. Roessler and Associates recommend that Miami-Dade incorporate option pricing for the CE-ITC's Domestic Content and Prevailing Wage and Apprenticeship Requirements into the project procurement documents. Option pricing would require proposers to outline the incremental cost of compliance associated with each of these requirements during the procurement phase. In the case of the domestic content requirement, this should include having the bidder certify that in the event they did not provide pricing they were unable to achieve these requirements due to non-availability of materials. The County should engage tax counsel to assist in the development of this procurement language to ensure that the scope of work to be provided by the design builder meets the requirements of a future tax return submitted for the CE-ITC.

The cost and domestic material availability data obtained during the procurement process will enable Miami-Dade to perform a cost-benefit analysis regarding pursuit of the CE-ITC and its

associated bonus credits. Clearly outlining the CE-ITC requirements, with the support of tax counsel, will help preserve the County's flexibility should it choose to proceed with pursuing the credit. Given the expected timeline for design-builder procurement, it is also likely that additional regulatory clarity will emerge, including updates to the statutory exemptions under the Domestic Content requirement and further guidance on the zero-GHG emissions determination process.

Roessler and Associates recommend that Miami-Dade consider incorporating a performance-based fee or similar incentive structure into the procurement documents to encourage the design-builder to meet the CE-ITC requirements. The administrative burden of tracking domestic content direct cost data and ensuring prevailing wage compliance is substantial and failure by the design-builder to satisfy these requirements could jeopardize eligibility for the credit. An incentive mechanism would help align the design-builder's interests with those of the County, reducing the risk that compliance oversight falls solely on the County and its representatives. Additionally, Roessler and Associates recommends that tax counsel remain engaged throughout the project to monitor design-builder compliance and support the recordkeeping obligations associated with the CE-ITC.

A risk to Miami-Dade in pursuing the CE-ITC is the potential for increased costs associated with meeting the domestic content bonus requirements, many of which must be committed prior to the start of construction. This creates exposure to the risk of a change in law that could prevent the County from receiving the credit after some costs have already been incurred. Changes to the CE-ITC or CE-PTC would require federal legislation.

While it would be challenging for Treasury to classify Waste-to-Energy (WTE) as a non-zero GHG emissions technology, Miami-Dade remains reliant on a formal designation of WTE as zero-GHG to qualify for the credit, and because such a designation has not yet been made, and further guidance on the DOE or LCA determination process is still pending, the emissions determination may not occur until after execution of the design-build contract. By receiving incremental pricing for the domestic content and prevailing wage costs, Miami-Dade will be able to better quantify these risks and the potential benefits.

9.0 RECOMMENDATIONS AND CONCLUSIONS

9.1 Recommendations

The final regulations for the Clean Energy Tax Credits, issued in January of this year, have helped to better clarify the pathway for Miami-Dade to pursue the Clean Energy Investment Tax Credit as part of its Sustainable Solid Waste Campus. While certain components of the final regulations are still evolving, the recommendations below outline steps that Miami-Dade can take during the project planning and procurement phase:

1. Miami-Dade should work to incorporate option pricing for the ITC's Domestic Content and Prevailing Wage and Apprenticeship requirements into its procurement documents. These provisions should make potential design builders aware of the need for equipment suppliers to provide direct cost data and provide protection around information disclosure. Option Pricing preserves Miami-Dade's opportunity to purse these credits as guidance around zero-GHG and the Domestic Content exemptions are finalized. Using a procurement mechanism that specifically indicates the incremental cost of the domestic content requirements should allow Miami-Dade to capture sufficient documentation around the Increased Cost or Non-Availability exemptions should further federal guidance extend the current policies. Option pricing reduces the risk of requiring proposers for WTE design-build project to comply with these requirements wholesale which could significantly increase project costs and/or reduce the number of responding entities.
2. Miami-Dade should retain tax counsel to assist in drafting CE-ITC related procurement language and support project recordkeeping. While Miami-Dade can leverage existing subject matter experts in drafting of procurement language Miami-Dade County will need to directly engage tax counsel to develop IRS exam level documentation, project cost segregation, and to assist in drafting and submission of Miami-Dade's CE-ITC tax return. To facilitate these initiatives and to ensure the procurement language is consistent with what will be required to support Miami-Dade's tax return, Tax Counsel should be engaged for the duration of the credit pursuit to include the initial procurement.
3. Miami-Dade should monitor future federal legislation for impacts to the CE-ITC & CE-PTC.
4. Miami-Dade should track updates from Treasury related to the CE-ITC. There should be a specific focus on the process for claiming Statutory Exceptions to the Elective Payment Phaseouts (domestic content), designation of an LCA model for emissions value calculations, and DOE guidance for determining preliminary GHG emissions rates.

9.2 Conclusions

The Clean Energy Investment Tax credit represents a potential revenue stream for Miami-Dade County of up to $535 million dollars (using the available cost estimates). Receiving the credit at this level would require that the project meets the domestic content and federal prevailing wage bonus requirements. Because Miami Dade is seeking direct payment of the credit, meeting domestic content requirements or obtaining an exemption is required. To assess the cost of these options the procurement documents should be updated to require that the design builder provide an incremental costs for these items. Because the domestic content provision requires supplier commitments, a decision on domestic content would need to made in conjunction with the execution of a design-build agreement. A change order to meet federal prevailing wage requirements be issued at the time of construction. Even if incremental costs of pursuing the

domestic content bonus or the prevailing wage and apprenticeship requirements are deemed prohibitive, appropriately documenting the domestic content exemptions as part of the procurement could allow Miami Dade to pursue the base credit and prevailing wage bonus, a total of up to $400 million, as further federal guidance is issued.

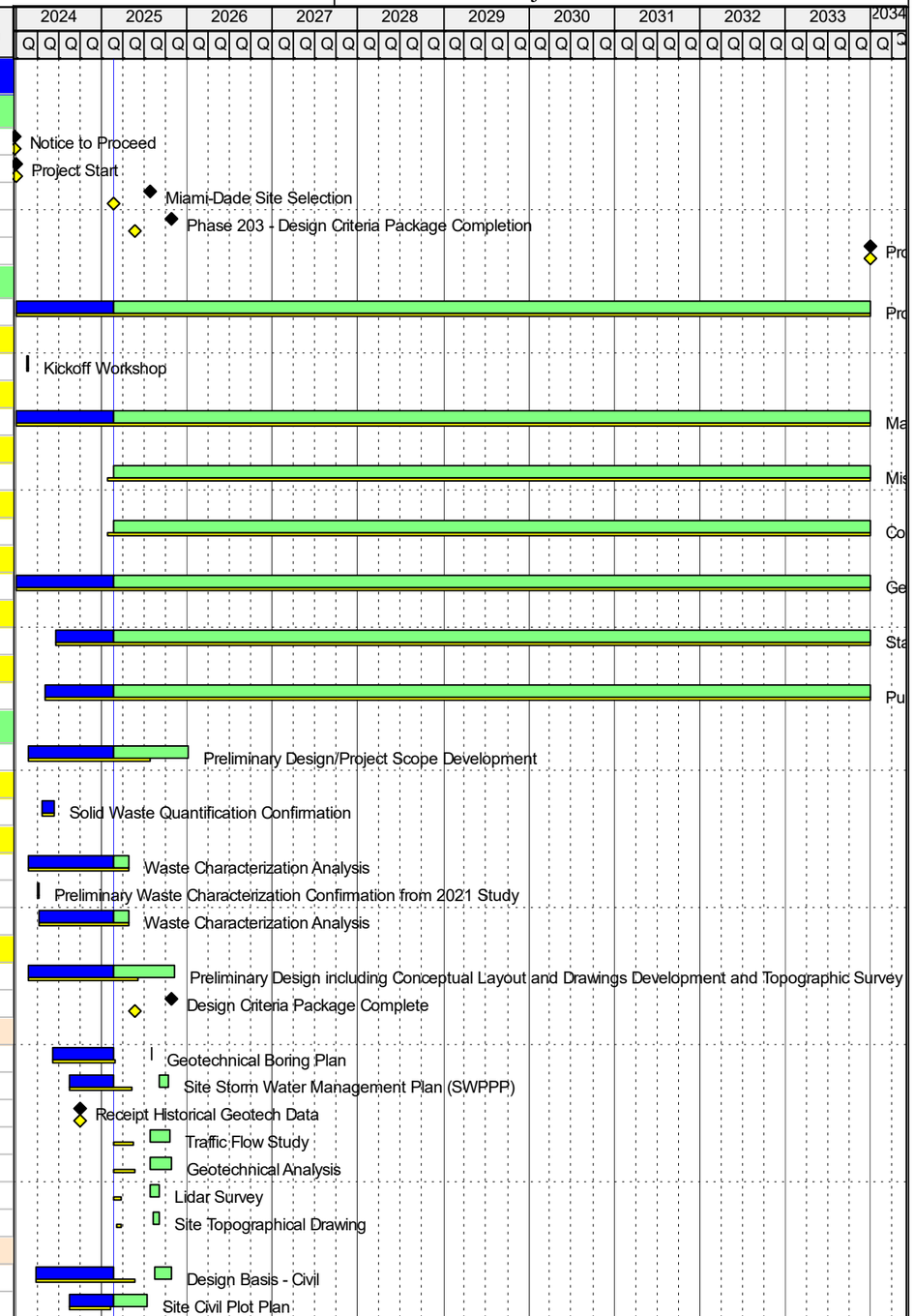
EXHIBIT 1 –

ATKINSREALIS PRELIMINARY PROJECT SCHEDULE

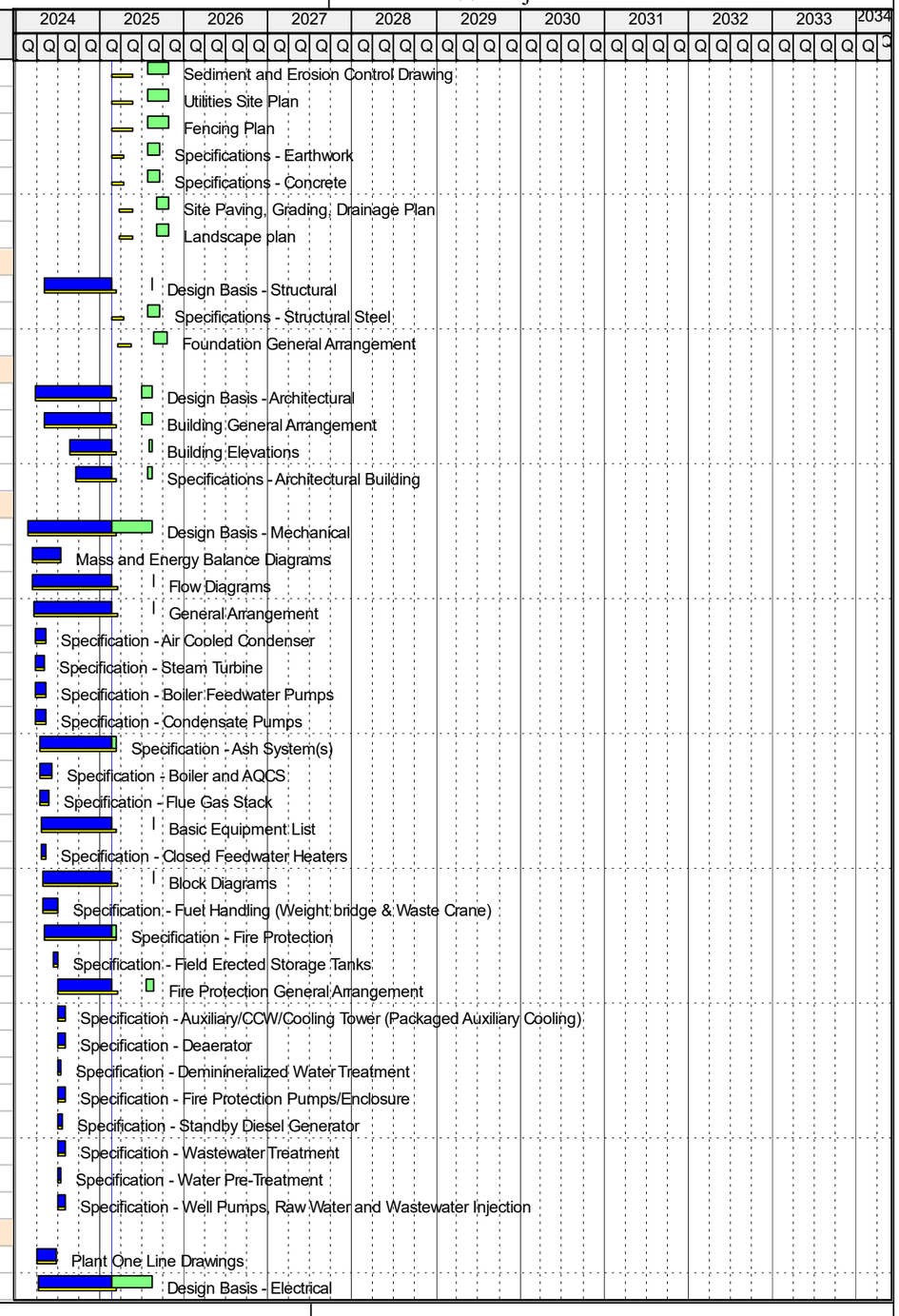
Miami-Dade WTE DCP Owner's Representative

00. Project Schedule - w Variance

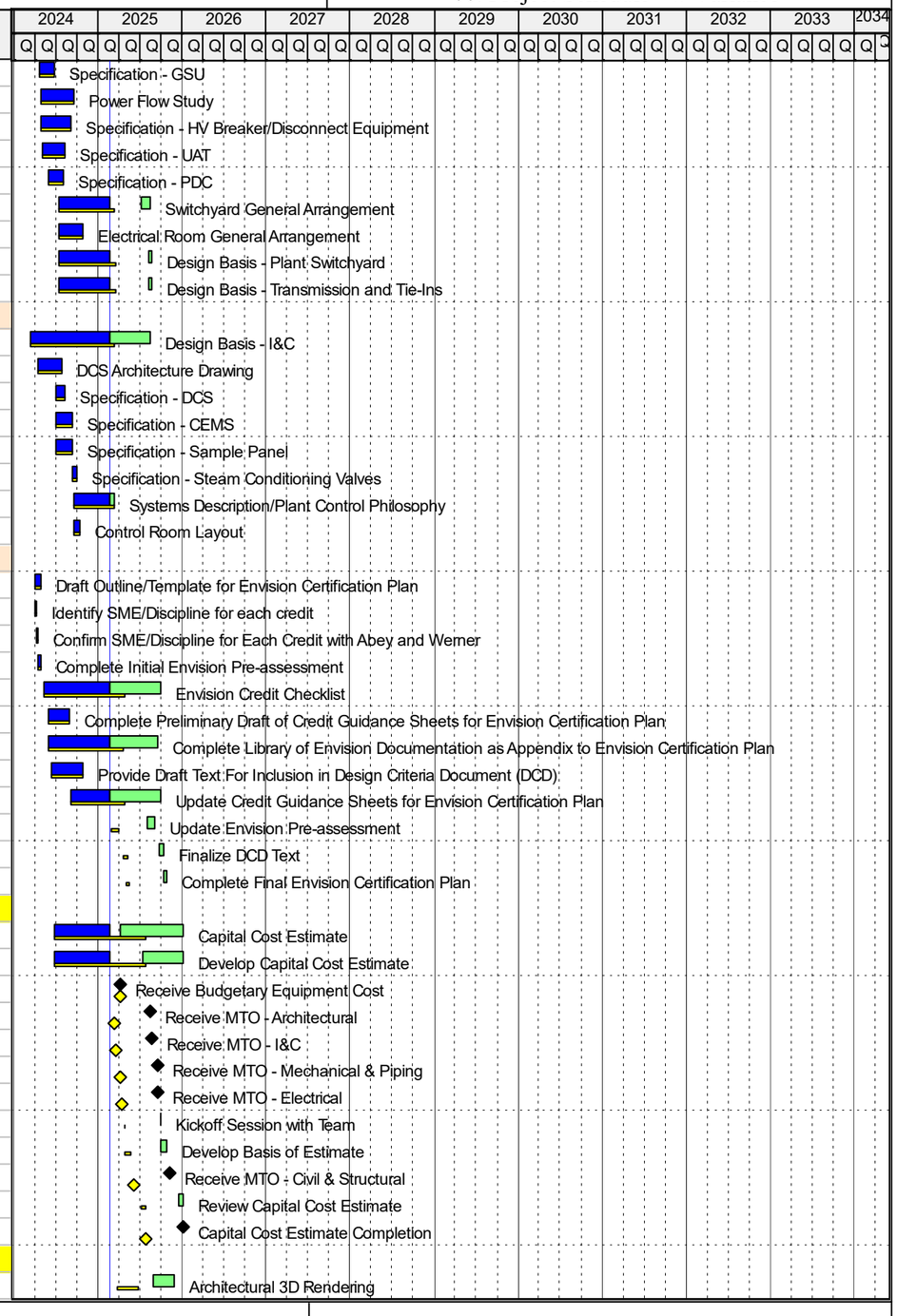
#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
1	**Miami-Dade WTE DCP & Owner's Representative**						
2	**Project Milestones**						
3	PM000.00.00	Notice to Proceed	0	27-Dec-23 A		0	0
4	PM000.00.01	Project Start	0	02-Jan-24 A		0	0
5	PM000.00.10	Miami-Dade Site Selection	0		25-Jul-25*	-113	-113
6	PM203.00.10	Phase 203 - Design Criteria Package Completion	0		27-Oct-25*	-113	-113
7	PM000.00.99	Project Complete	0		30-Dec-33*	0	0
8	**Phase 100 - Program Management Activities**						
9	P100	Program Management Activities	2634	02-Jan-24 A	30-Dec-33	0	0
10	**Phase 101 - Kickoff Workshop**						
11	P101	Kickoff Workshop	1	19-Feb-24 A	23-Feb-24 A	0	0
12	**Phase 102 - Master Project Schedule Update and Control**						
13	P102	Master Project Schedule Update and Control	2609	02-Jan-24 A	30-Dec-33	0	0
14	**Phase 103 - Miscellaneous Meeting (Board, Project Status)**						
15	P103	Miscellaneous Meetings	2310	24-Feb-25	30-Dec-33	-20	0
16	**Phase 104 - Coordination with County Departments**						
17	P104	Coordination with County Departments	2310	24-Feb-25	30-Dec-33	-20	0
18	**Phase 105 - General Project Coordination**						
19	P105	General Project Coordination	2609	02-Jan-24 A	30-Dec-33	0	0
20	**Phase 106 - Status Reports**						
21	P106	Status Reports	2440	18-Jun-24 A	30-Dec-33	0	0
22	**Phase 107 - Public Involvement**						
23	P107	Public Involvement	2480	01-May-24 A	30-Dec-33	0	0
24	**Phase 200 - Preliminary Design/Project Scope Development**						
25	P200	Preliminary Design/Project Scope Development	488	22-Feb-24 A	05-Jan-26	0	-113
26	**Phase 201 - Solid Waste Quantification Confirmation**						
27	P201	Solid Waste Quantification Confirmation	25	22-Apr-24 A	12-Jun-24 A	0	0
28	**Phase 202 - Waste Characterization Analysis**						
29	P202	Waste Characterization Analysis	310	22-Feb-24 A	30-Apr-25	0	0
30	P202.00.100	Preliminary Waste Characterization Confirmation from 2021 Study	6	03-Apr-24 A	10-Apr-24 A	0	0
31	P202.00.110	Waste Characterization Analysis	261	08-Apr-24 A	30-Apr-25	0	0
32	**Phase 203 - Design Criteria Package**						
33	P203	Preliminary Design including Conceptual Layout and Drawings Development and Topographic	448	22-Feb-24 A	10-Nov-25	0	-113
34	P203.00.100	Design Criteria Package Complete	0		27-Oct-25*	-113	-113
35	**General**						
36	P203.30.120	Geotechnical Boring Plan	40	03-Jun-24 A	01-Aug-25	0	-113
37	P203.30.100	Site Storm Water Management Plan (SWPPP)	49	19-Aug-24 A	16-Oct-25	0	-113
38	P203.30.250	Receipt Historical Geotech Data	0		30-Sep-24 A	0	0
39	P203.30.110	Traffic Flow Study	62	25-Jul-25	20-Oct-25	-113	-113
40	P203.30.230	Geotechnical Analysis	67	25-Jul-25	27-Oct-25	-113	-113
41	P203.30.240	Lidar Survey	27	25-Jul-25	01-Sep-25	-113	-113
42	P203.30.130	Site Topographical Drawing	17	08-Aug-25	01-Sep-25	-113	-113
43	**Civil**						
44	P203.30.140	Design Basis - Civil	100	25-Mar-24 A	27-Oct-25	0	-113
45	P203.30.170	Site Civil Plot Plan	86	19-Aug-24 A	15-Jul-25	0	-113



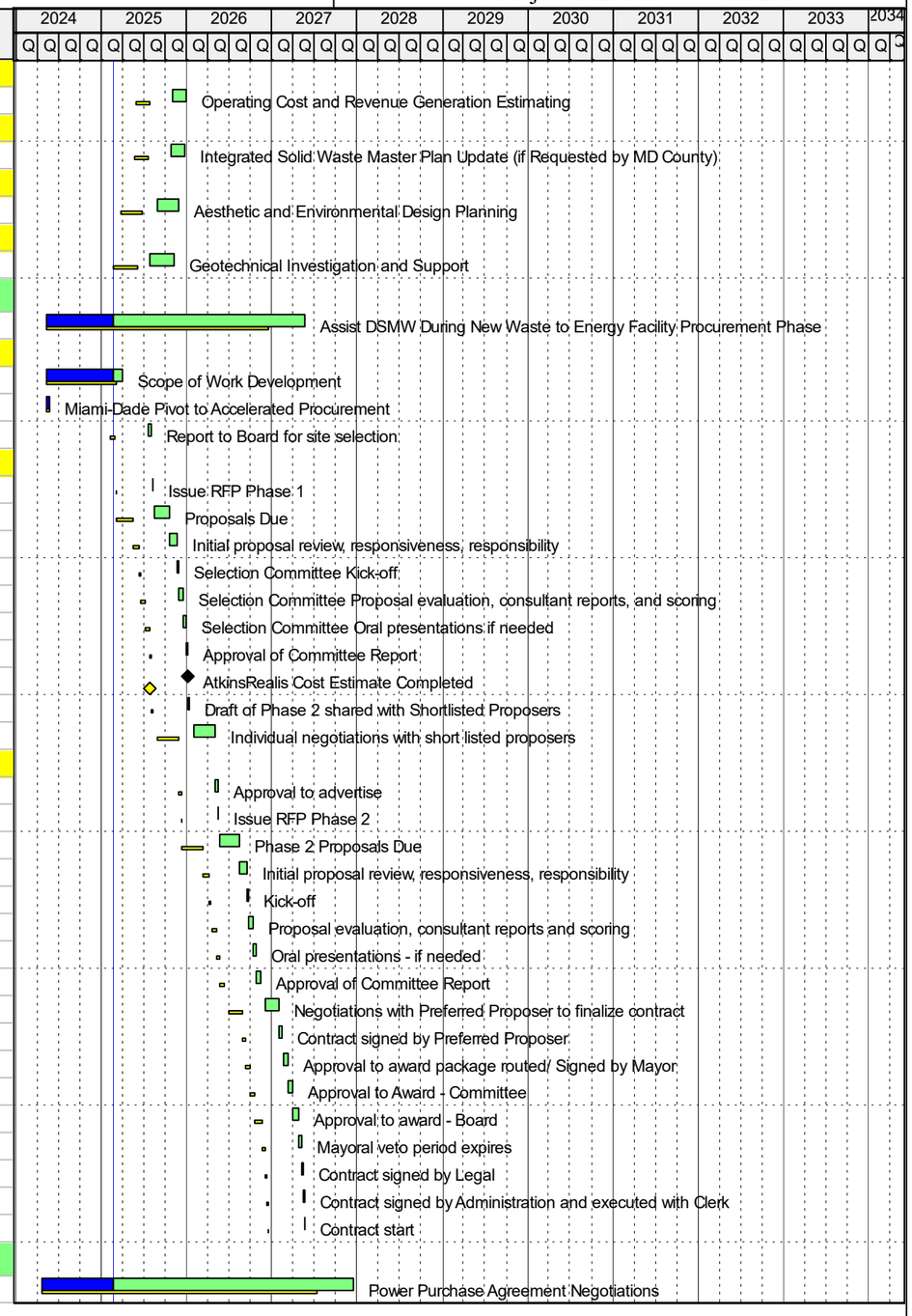
#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
46	P203.30.180	Sediment and Erosion Control Drawing	67	25-Jul-25	27-Oct-25	-113	-113
47	P203.30.200	Utilities Site Plan	67	25-Jul-25	27-Oct-25	-113	-113
48	P203.30.210	Fencing Plan	67	25-Jul-25	27-Oct-25	-113	-113
49	P203.30.150	Specifications - Earthwork	40	25-Jul-25	18-Sep-25	-113	-113
50	P203.30.160	Specifications - Concrete	40	25-Jul-25	18-Sep-25	-113	-113
51	P203.30.190	Site Paving, Grading, Drainage Plan	40	02-Sep-25	27-Oct-25	-113	-113
52	P203.30.220	Landscape plan	40	02-Sep-25	27-Oct-25	-113	-113
53	**Structural**						
54	P203.36.100	Design Basis - Structural	137	06-May-24 A	14-Aug-25	0	-113
55	P203.36.110	Specifications - Structural Steel	40	25-Jul-25	18-Sep-25	-113	-113
56	P203.36.120	Foundation General Arrangement	44	22-Aug-25	23-Oct-25	-113	-113
57	**Architectural**						
58	P203.37.100	Design Basis - Architectural	85	25-Mar-24 A	14-Aug-25	0	-113
59	P203.37.110	Building General Arrangement	125	06-May-24 A	14-Aug-25	0	-113
60	P203.37.120	Building Elevations	86	20-Aug-24 A	14-Aug-25	0	-113
61	P203.37.130	Specifications - Architectural Building	40	19-Sep-24 A	14-Aug-25	0	-113
62	**Mechanical**						
63	P203.44.100	Design Basis - Mechanical	115	24-Feb-24 A	14-Aug-25	0	-113
64	P203.44.110	Mass and Energy Balance Diagrams	70	12-Mar-24 A	15-Jul-24 A	0	0
65	P203.44.120	Flow Diagrams	90	12-Mar-24 A	22-Aug-25	0	-113
66	P203.44.130	General Arrangement	110	19-Mar-24 A	22-Aug-25	0	-113
67	P203.44.140	Specification - Air Cooled Condenser	36	26-Mar-24 A	08-May-24 A	0	0
68	P203.44.160	Specification - Steam Turbine	36	26-Mar-24 A	07-May-24 A	0	0
69	P203.44.200	Specification - Boiler Feedwater Pumps	30	26-Mar-24 A	10-May-24 A	0	0
70	P203.44.250	Specification - Condensate Pumps	30	26-Mar-24 A	10-May-24 A	0	0
71	P203.44.180	Specification - Ash System(s)	48	15-Apr-24 A	10-Mar-25	0	0
72	P203.44.150	Specification - Boiler and AQCS	66	15-Apr-24 A	06-Jun-24 A	0	0
73	P203.44.220	Specification - Flue Gas Stack	48	15-Apr-24 A	24-May-24 A	0	0
74	P203.44.190	Basic Equipment List	80	22-Apr-24 A	22-Aug-25	0	-118
75	P203.44.270	Specification - Closed Feedwater Heaters	20	22-Apr-24 A	10-May-24 A	0	0
76	P203.44.170	Block Diagrams	85	29-Apr-24 A	22-Aug-25	0	-113
77	P203.44.210	Specification - Fuel Handling (Weight bridge & Waste Crane)	35	29-Apr-24 A	03-Jul-24 A	0	0
78	P203.44.230	Specification - Fire Protection	50	06-May-24 A	10-Mar-25	0	0
79	P203.44.300	Specification - Field Erected Storage Tanks	20	10-Jun-24 A	03-Jul-24 A	0	0
80	P203.44.240	Fire Protection General Arrangement	30	01-Jul-24 A	21-Aug-25	0	-113
81	P203.44.260	Specification - Auxiliary/CCW/Cooling Tower (Packaged Auxiliary Cooling)	20	01-Jul-24 A	01-Aug-24 A	0	0
82	P203.44.280	Specification - Deaerator	20	01-Jul-24 A	01-Aug-24 A	0	0
83	P203.44.290	Specification - Deminineralized Water Treatment	20	01-Jul-24 A	17-Jul-24 A	0	0
84	P203.44.310	Specification - Fire Protection Pumps/Enclosure	20	01-Jul-24 A	01-Aug-24 A	0	0
85	P203.44.330	Specification - Standby Diesel Generator	20	01-Jul-24 A	24-Jul-24 A	0	0
86	P203.44.340	Specification - Wastewater Treatment	20	01-Jul-24 A	01-Aug-24 A	0	0
87	P203.44.350	Specification - Water Pre-Treatment	20	01-Jul-24 A	17-Jul-24 A	0	0
88	P203.44.360	Specification - Well Pumps, Raw Water and Wastewater Injection	20	01-Jul-24 A	01-Aug-24 A	0	0
89	**Electrical**						
90	P203.40.150	Plant One Line Drawings	78	02-Apr-24 A	26-Jun-24 A	0	0
91	P203.40.100	Design Basis - Electrical	80	08-Apr-24 A	14-Aug-25	0	-113



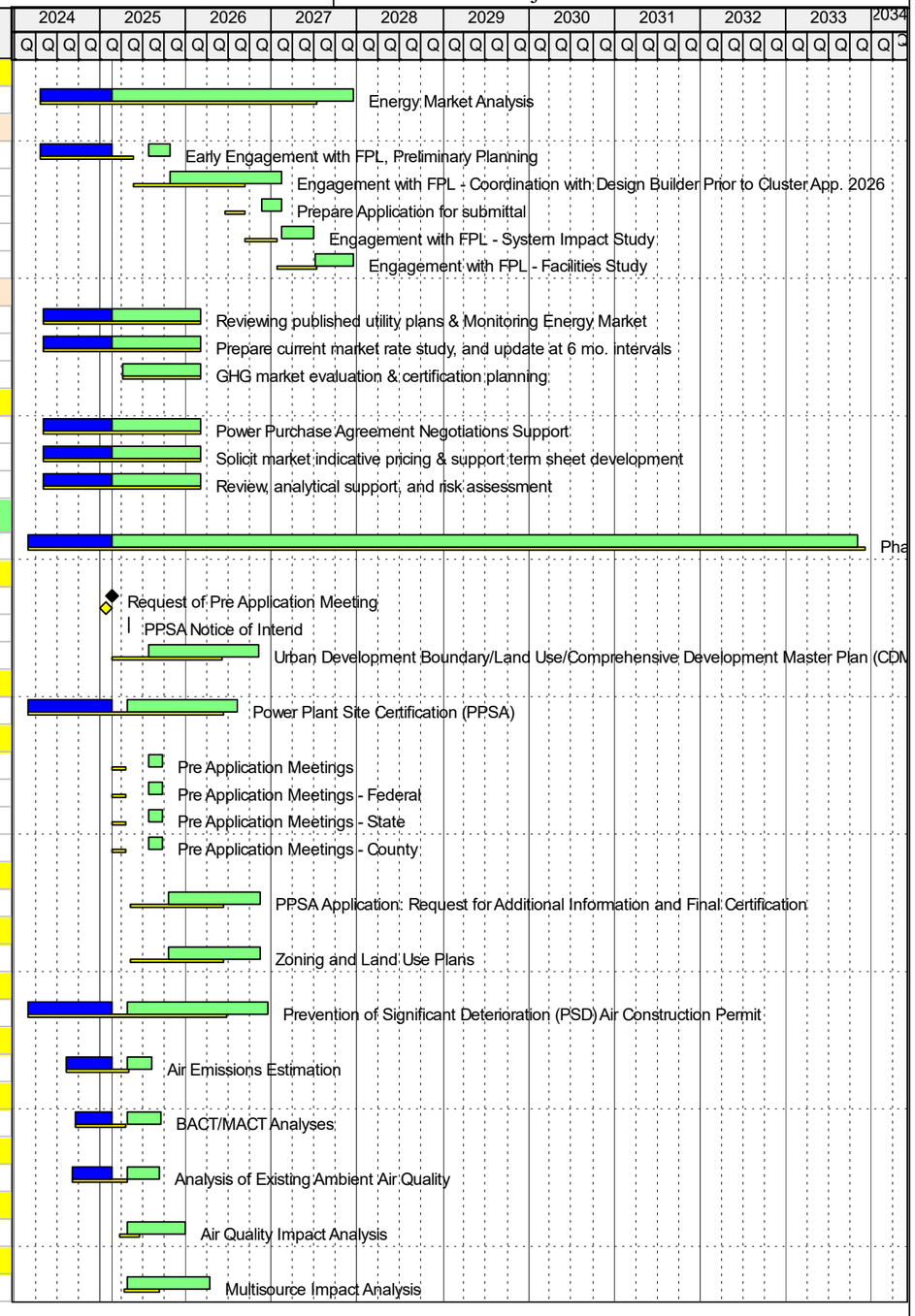
#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
92	P203.40.160	Specification - GSU	48	19-Apr-24 A	26-Jun-24 A	0	0
93	P203.40.140	Power Flow Study	20	25-Apr-24 A	17-Sep-24 A	0	0
94	P203.40.210	Specification - HV Breaker/Disconnect Equipment	20	30-Apr-24 A	05-Sep-24 A	0	0
95	P203.40.190	Specification - UAT	44	01-May-24 A	09-Aug-24 A	0	0
96	P203.40.200	Specification - PDC	40	31-May-24 A	05-Aug-24 A	0	0
97	P203.40.170	Switchyard General Arrangement	26	15-Jul-24 A	14-Aug-25	0	-113
98	P203.40.180	Electrical Room General Arrangement	26	15-Jul-24 A	28-Oct-24 A	0	0
99	P203.40.120	Design Basis - Plant Switchyard	40	15-Jul-24 A	21-Aug-25	0	-113
100	P203.40.130	Design Basis - Transmission and Tie-Ins	65	15-Jul-24 A	21-Aug-25	0	-113
101	**Instrumentation and Controls**						
102	P203.41.100	Design Basis - I&C	115	11-Mar-24 A	14-Aug-25	0	-113
103	P203.41.120	DCS Architecture Drawing	57	15-Apr-24 A	26-Jul-24 A	0	0
104	P203.41.130	Specification - DCS	10	01-Jul-24 A	08-Aug-24 A	0	0
105	P203.41.150	Specification - CEMS	21	01-Jul-24 A	09-Sep-24 A	0	0
106	P203.41.170	Specification - Sample Panel	21	01-Jul-24 A	13-Sep-24 A	0	0
107	P203.41.160	Specification - Steam Conditioning Valves	25	09-Sep-24 A	04-Oct-24 A	0	0
108	P203.41.110	Systems Description/Plant Control Philosophy	30	16-Sep-24 A	10-Mar-25	0	0
109	P203.41.140	Control Room Layout	19	19-Sep-24 A	16-Oct-24 A	0	0
110	**Envision Certification Plan**						
111	P203.50.110	Draft Outline/Template for Envision Certification Plan	2	02-Apr-24 A	26-Apr-24 A	0	0
112	P203.50.100	Identify SME/Discipline for each credit	3	03-Apr-24 A	08-Apr-24 A	0	0
113	P203.50.120	Confirm SME/Discipline for Each Credit with Abey and Werner	2	08-Apr-24 A	15-Apr-24 A	0	0
114	P203.50.130	Complete Initial Envision Pre-assessment	10	12-Apr-24 A	26-Apr-24 A	0	0
115	P203.50.230	Envision Credit Checklist	120	13-May-24 A	30-Sep-25	0	-109
116	P203.50.140	Complete Preliminary Draft of Credit Guidance Sheets for Envision Certification Plan	70	27-May-24 A	30-Aug-24 A	0	0
117	P203.50.200	Complete Library of Envision Documentation as Appendix to Envision Certification Plan	106	31-May-24 A	19-Sep-25	0	-110
118	P203.50.180	Provide Draft Text For Inclusion in Design Criteria Document (DCD)	13	12-Jun-24 A	24-Oct-24 A	0	0
119	P203.50.170	Update Credit Guidance Sheets for Envision Certification Plan	38	02-Sep-24 A	30-Sep-25	0	-109
120	P203.50.160	Update Envision Pre-assessment	24	05-Aug-25	05-Sep-25	-113	-110
121	P203.50.210	Finalize DCD Text	15	22-Sep-25	10-Oct-25	-110	-110
122	P203.50.220	Complete Final Envision Certification Plan	10	13-Oct-25	24-Oct-25	-114	-114
123	**Phase 204 - Capital Cost Estimate**						
124	P204	Capital Cost Estimate	290	26-Jun-24 A	05-Jan-26	0	-113
125	P204.00.180	Develop Capital Cost Estimate	70	26-Jun-24 A	05-Jan-26	0	-113
126	P204.00.110	Receive Budgetary Equipment Cost	0		07-Apr-25	0	0
127	P204.00.130	Receive MTO - Architectural	0		14-Aug-25	-113	-113
128	P204.00.160	Receive MTO - I&C	0		21-Aug-25	-113	-113
129	P204.00.140	Receive MTO - Mechanical & Piping	0		18-Sep-25	-118	-118
130	P204.00.150	Receive MTO - Electrical	0		18-Sep-25	-113	-113
131	P204.00.100	Kickoff Session with Team	1	30-Sep-25	30-Sep-25	-113	-113
132	P204.00.170	Develop Basis of Estimate	20	01-Oct-25	28-Oct-25	-113	-113
133	P204.00.120	Receive MTO - Civil & Structural	0		10-Nov-25	-113	-113
134	P204.00.190	Review Capital Cost Estimate	15	16-Dec-25	05-Jan-26	-113	-113
135	P204.00.200	Capital Cost Estimate Completion	0		05-Jan-26	-113	-113
136	**Phase 205 - Architectural 3D Rendering**						
137	P205	Architectural 3D Rendering	66	29-Aug-25	28-Nov-25	-113	-113



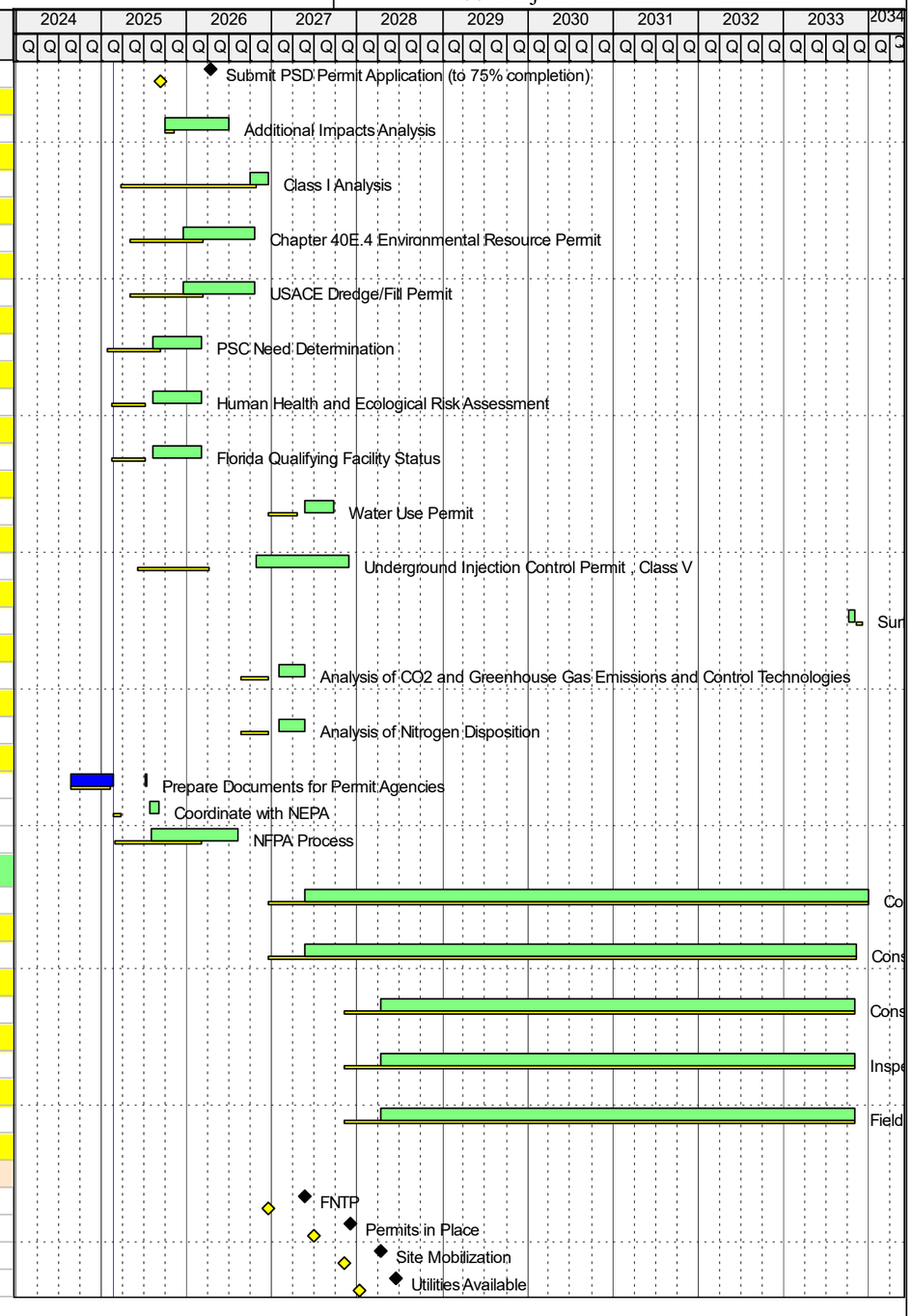
#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
138		**Phase 206 - Operating Cost and Revenue Generation Estimating**					
139	P206	Operating Cost and Revenue Generation Estimating	44	31-Oct-25	31-Dec-25	-113	-113
140		**Phase 207 - Integrated Solid Waste master Plan Update**					
141	P207	Integrated Solid Waste Master Plan Update (if Requested by MD County)	43	28-Oct-25	25-Dec-25	-113	-113
142		**Phase 208 - Aesthetic and Environmental Design Planning**					
143	P208	Aesthetic and Environmental Design Planning	66	29-Aug-25	28-Nov-25	-113	-113
144		**Phase 209 - Geotechnical Investigation and Support**					
145	P209	Geotechnical Investigation and Support	76	25-Jul-25	07-Nov-25	-113	-113
146		**Phase 300 - Assist DSWM During New Waste to Energy Facility Procurement Phase**					
147	P300	Assist DSMW During New Waste to Energy Facility Procurement Phase	779	10-May-24 A	21-May-27	0	-113
148		**Planning**					
149	P302.00.110	Scope of Work Development	40	10-May-24 A	31-Mar-25	0	-20
150	P302.00.100	Miami-Dade Pivot to Accelerated Procurement	9	10-May-24 A	22-May-24 A	0	0
151	P302.00.120	Report to Board for site selection	10	18-Jul-25	31-Jul-25	-113	-113
152		**Phase 1 - Qualification to Short List**					
153	P303.00.100	Issue RFP Phase 1	3	08-Aug-25	12-Aug-25	-113	-113
154	P303.00.120	Proposals Due	50	13-Aug-25	21-Oct-25	-113	-113
155	P304.00.100	Initial proposal review, responsiveness, responsibility	20	22-Oct-25	18-Nov-25	-113	-113
156	P304.00.110	Selection Committee Kick-off	5	19-Nov-25	25-Nov-25	-113	-113
157	P304.00.120	Selection Committee Proposal evaluation, consultant reports, and scoring	15	26-Nov-25	16-Dec-25	-113	-113
158	P304.00.130	Selection Committee Oral presentations if needed	10	17-Dec-25	30-Dec-25	-113	-113
159	P304.00.140	Approval of Committee Report	5	31-Dec-25	06-Jan-26	-113	-113
160	P305.00.110	AtkinsRealis Cost Estimate Completed	0		05-Jan-26	-113	-113
161	P305.00.100	Draft of Phase 2 shared with Shortlisted Proposers	5	07-Jan-26	13-Jan-26	-113	-113
162	P305.00.120	Individual negotiations with short listed proposers	67	30-Jan-26	04-May-26	-113	-113
163		**Phase 2 - Proposals from Short Listed Proposers**					
164	P306.00.100	Approval to advertise	8	05-May-26	14-May-26	-113	-113
165	P306.00.110	Issue RFP Phase 2	3	15-May-26	19-May-26	-113	-113
166	P306.00.120	Phase 2 Proposals Due	63	20-May-26	14-Aug-26	-113	-113
167	P306.00.130	Initial proposal review, responsiveness, responsibility	22	17-Aug-26	15-Sep-26	-113	-113
168	P306.00.140	Kick-off	5	16-Sep-26	22-Sep-26	-113	-113
169	P306.00.150	Proposal evaluation, consultant reports and scoring	15	23-Sep-26	13-Oct-26	-113	-113
170	P306.00.160	Oral presentations - if needed	10	14-Oct-26	27-Oct-26	-113	-113
171	P306.00.170	Approval of Committee Report	13	28-Oct-26	13-Nov-26	-113	-113
172	P306.00.180	Negotiations with Preferred Proposer to finalize contract	44	03-Dec-26	02-Feb-27	-113	-113
173	P306.00.190	Contract signed by Preferred Proposer	10	03-Feb-27	16-Feb-27	-113	-113
174	P306.00.200	Approval to award package routed/ Signed by Mayor	15	17-Feb-27	09-Mar-27	-113	-113
175	P306.00.210	Approval to Award - Committee	14	10-Mar-27	29-Mar-27	-113	-113
176	P306.00.220	Approval to award - Board	21	30-Mar-27	27-Apr-27	-113	-113
177	P306.00.230	Mayoral veto period expires	10	28-Apr-27	11-May-27	-113	-113
178	P306.00.240	Contract signed by Legal	2	12-May-27	13-May-27	-113	-113
179	P306.00.250	Contract signed by Administration and executed with Clerk	5	14-May-27	20-May-27	-113	-113
180	P306.00.260	Contract start	1	21-May-27	21-May-27	-113	-113
181		**Phase 400 - Power Purchase Agreement Negotiations**					
182	P400	Power Purchase Agreement Negotiations	945	22-Apr-24 A	17-Dec-27	0	-113



#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
183		**Phase 401 - Energy Market Analysis**					
184	P401	Energy Market Analysis	945	22-Apr-24 A	17-Dec-27	0	-113
185		**Phase 401A - Interconnection**					
186	P401A00	Early Engagement with FPL, Preliminary Planning	80	22-Apr-24 A	27-Oct-25	0	-113
187	P401A10	Engagement with FPL - Coordination with Design Builder Prior to Cluster App. 2026	339	28-Oct-25	12-Feb-27	-113	-113
188	P401A01	Prepare Application for submittal	60	23-Nov-26	12-Feb-27	-113	-113
189	P401A20	Engagement with FPL - System Impact Study	100	15-Feb-27	02-Jul-27	-113	-113
190	P401A30	Engagement with FPL - Facilities Study	120	05-Jul-27	17-Dec-27	-113	-113
191		**Phase 401B - Marker Discovery & Monitoring**					
192	P401B00	Reviewing published utility plans & Monitoring Energy Market	480	06-May-24 A	06-Mar-26	0	0
193	P401B10	Prepare current market rate study, and update at 6 mo. intervals	480	06-May-24 A	06-Mar-26	0	0
194	P401B20	GHG market evaluation & certification planning	240	07-Apr-25	06-Mar-26	0	0
195		**Phase 402 - Power Purchase Agreement Negotiations Support**					
196	P402	Power Purchase Agreement Negotiations Support	480	06-May-24 A	06-Mar-26	0	0
197	P402A00	Solicit market indicative pricing & support term sheet development	480	06-May-24 A	06-Mar-26	0	0
198	P422A10	Review, analytical support, and risk assessment	480	06-May-24 A	06-Mar-26	0	0
199		**Phase 500 - Permitting**					
200	A1910	Phase 500 - Permitting	2485	01-Mar-24 A	04-Nov-33	0	20
201		**General**					
202	P500.00.14	Request of Pre Application Meeting	0		24-Feb-25*	-20	-20
203	P500.00.2	PPSA Notice of Intend	1	02-May-25*	02-May-25	0	0
204	P500.00.12	Urban Development Boundary/Land Use/Comprehensive Development Master Plan (CDMP)	338	25-Jul-25	10-Nov-26	-113	-113
205		**Phase 501 - Power Plant Site Certification (2-17, Part I, F.A.C)**					
206	P501	Power Plant Site Certification (PPSA)	374	01-Mar-24 A	11-Aug-26	0	-44
207		**Phase 501.1 - Pre Application Meetings**					
208	P501.1	Pre Application Meetings	45	25-Jul-25*	25-Sep-25	-113	-113
209	P501.11	Pre Application Meetings - Federal	45	25-Jul-25	25-Sep-25	-113	-113
210	P501.21	Pre Application Meetings - State	45	25-Jul-25	25-Sep-25	-113	-113
211	P501.31	Pre Application Meetings - County	45	25-Jul-25	25-Sep-25	-113	-113
212		**Phase 501.2 - PPSA Application: Request for Additional Information and Final Certification**					
213	P501.2	PPSA Application: Request for Additional Information and Final Certification	282	17-Oct-25	16-Nov-26	-113	-113
214		**Phase 501.3 - Zoning and Land Use Plans**					
215	P501.3	Zoning and Land Use Plans	282	17-Oct-25	16-Nov-26	-113	-113
216		**Phase 502 - Prevention of Significant Deterioration (PSD) Air Construction Permit**					
217	P502	Prevention of Significant Deterioration (PSD) Air Construction Permit	307	01-Mar-24 A	18-Dec-26	0	-127
218		**Phase 502.1 - Air Emissions Estimation**					
219	P502.1	Air Emissions Estimation	225	12-Aug-24 A	06-Aug-25	0	-66
220		**Phase 502.2 - BACT/MACT Analyses**					
221	P502.2	BACT/MACT Analyses	62	16-Sep-24 A	19-Sep-25	0	-110
222		**Phase 502.3 - Analysis of Existing Ambient Air Quality**					
223	P502.3	Analysis of Existing Ambient Air Quality	48	03-Sep-24 A	12-Sep-25	0	-99
224		**Phase 502.4 - Air Quality Impact Analysis**					
225	P502.4	Air Quality Impact Analysis	181	25-Apr-25*	02-Jan-26	-21	-142
226		**Phase 502.5 - Multisource Impact Analysis**					
227	P502.5	Multisource Impact Analysis	254	25-Apr-25*	15-Apr-26	-9	-155

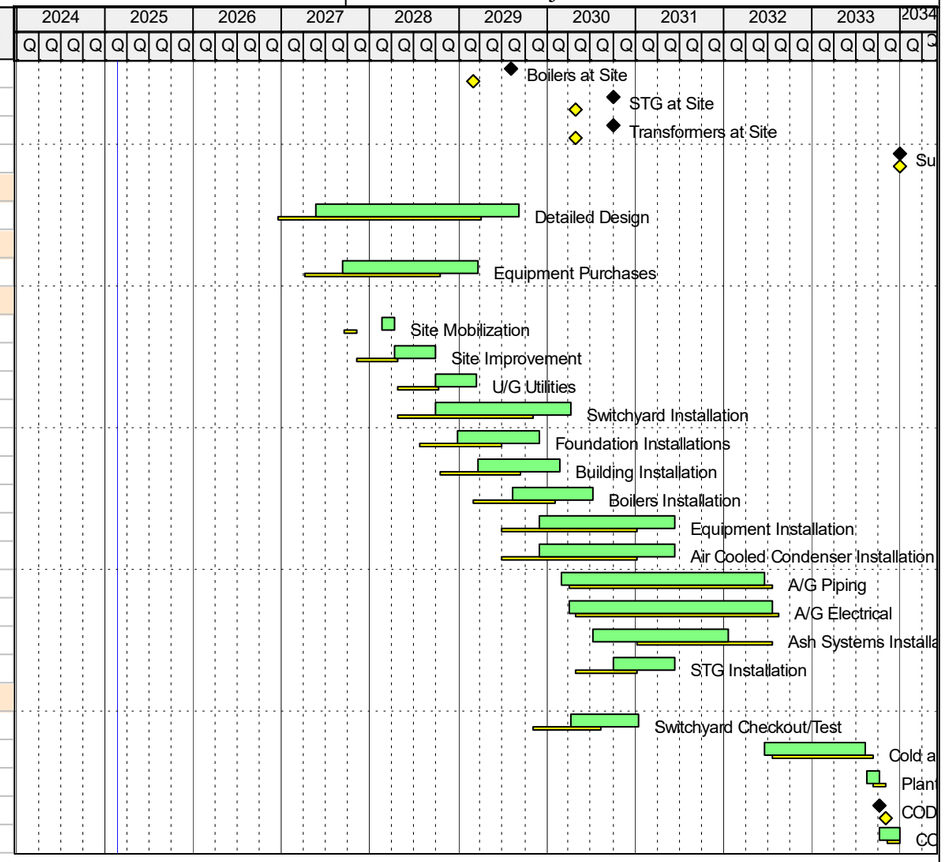


#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
228	P502.5.100	Submit PSD Permit Application (to 75% completion)	0		16-Apr-26	-156	-156
229	**Phase 502.6 - Additional Impacts Analysis**						
230	P502.6	Additional Impacts Analysis	194	03-Oct-25*	01-Jul-26	0	-169
231	**Phase 502.7 - Class I Analysis**						
232	P502.7	Class I Analysis	56	02-Oct-26*	18-Dec-26	-396	-39
233	**Phase 503 - Chapter 40E.4 Environmental Resource Permit**						
234	P503	Chapter 40E.4 Environmental Resource Permit	224	15-Dec-25*	22-Oct-26	-161	-159
235	**Phase 504 - USACE Dredge/Fill Permit**						
236	P504	USACE Dredge/Fill Permit	224	15-Dec-25	22-Oct-26	-161	-159
237	**Phase 505 - PSC Need Determination Data Compilation and Review**						
238	P505	PSC Need Determination	149	11-Aug-25*	05-Mar-26	-141	-126
239	**Phase 506 - Human Health and Ecological Risk Assessment**						
240	P506	Human Health and Ecological Risk Assessment	149	11-Aug-25*	05-Mar-26	-126	-173
241	**Phase 507 - Florida Qualifying Facility Status**						
242	P507	Florida Qualifying Facility Status	149	11-Aug-25	05-Mar-26	-126	-173
243	**Phase 508 - SFWMD Water Use Permit/Water Balance**						
244	P508	Water Use Permit	90	21-May-27	23-Sep-27	-113	-113
245	**Phase 509 - Underground Injection Control Permit/Process Discharge**						
246	P509	Underground Injection Control Permit , Class V	284	26-Oct-26*	25-Nov-27	-365	-424
247	**Phase 510 - Surface Water Management Systems Operation**						
248	P510	Surface Water Management System Operation	20	10-Oct-33	04-Nov-33	20	20
249	**Phase 511 - Analysis of CO2 and Greenhouse Gas (GHG) Emissions**						
250	P511	Analysis of CO2 and Greenhouse Gas Emissions and Control Technologies	80	29-Jan-27	20-May-27	-113	-113
251	**Phase 512 - Analysis of Nitrogen Deposition on Nutrient.Rich Waterbodies**						
252	P512	Analysis of Nitrogen Disposition	80	29-Jan-27	20-May-27	-113	-113
253	**Phase 513 - Coordinate with NEPA**						
254	P513.1	Prepare Documents for Permit Agencies	22	26-Aug-24 A	17-Jul-25	0	-113
255	P513	Coordinate with NEPA	29	25-Jul-25	03-Sep-25	-113	-113
256	P513.4	NFPA Process	266	05-Aug-25*	11-Aug-26	-113	-113
257	**Phase 600 - Construction Monitoring**						
258	P600	Construction Monitoring	1726	21-May-27	30-Dec-33	-113	0
259	**Phase 601 - Construction Monitoring Coordination and Resident Project Representative Services**						
260	P601	Construction Monitoring Coordination and Resident Project Representative Services	1687	21-May-27	07-Nov-33	-113	0
261	**Phase 602 - Construction Monitoring**						
262	P602	Construction Monitoring	1447	14-Apr-28	31-Oct-33	-113	0
263	**Phase 603 - Inspection Reports**						
264	P603	Inspection Reports	1447	14-Apr-28	31-Oct-33	-113	0
265	**Phase 604 - Field Office Administrative Support**						
266	P604	Field Office Administrative Support	1447	14-Apr-28	31-Oct-33	-113	0
267	**Phase 600 Construction EPC**						
268	**Milestones**						
269	P600.06.10	FNTP	0	21-May-27		-113	-113
270	P600.06.32	Permits in Place	0		02-Dec-27	-113	-113
271	P600.06.50	Site Mobilization	0	14-Apr-28		-113	-113
272	P600.06.52	Utilities Available	0		15-Jun-28	-113	-113



Miami-Dade WTE DCP Owner's Representative

#	Activity ID	Activity Name	Duration	Start	Finish	Var - Start	Var - Finish
273	P600.06.58	Boilers at Site	0		09-Aug-29	-113	-113
274	P600.06.56	STG at Site	0		03-Oct-30	-113	-113
275	P600.06.72	Transformers at Site	0		03-Oct-30	-113	-113
276	P600.06.54	Substantial Completion	0		30-Dec-33	0	0
277	**Engineering**						
278	P600.06.60	Detailed Design	600	21-May-27	06-Sep-29	-113	-113
279	**Procurement**						
280	P600.06.62	Equipment Purchases	400	10-Sep-27	22-Mar-29	-113	-113
281	**Construction**						
282	P600.06.12	Site Mobilization	40	18-Feb-28	13-Apr-28	-113	-113
283	P600.06.14	Site Improvement	120	14-Apr-28	28-Sep-28	-113	-113
284	P600.06.16	U/G Utilities	120	29-Sep-28	15-Mar-29	-113	-113
285	P600.06.20	Switchyard Installation	400	29-Sep-28	11-Apr-30	-113	-113
286	P600.06.18	Foundation Installations	240	29-Dec-28	29-Nov-29	-113	-113
287	P600.06.22	Building Installation	240	23-Mar-29	21-Feb-30	-113	-113
288	P600.06.40	Boilers Installation	240	10-Aug-29	11-Jul-30	-113	-113
289	P600.06.24	Equipment Installation	400	30-Nov-29	12-Jun-31	-113	-113
290	P600.06.48	Air Cooled Condenser Installation	400	30-Nov-29	12-Jun-31	-113	-113
291	P600.06.36	A/G Piping	600	05-Mar-30	21-Jun-32	20	20
292	P600.06.38	A/G Electrical	600	02-Apr-30	19-Jul-32	20	20
293	P600.06.46	Ash Systems Installation	400	12-Jul-30	22-Jan-32	127	127
294	P600.06.42	STG Installation	180	04-Oct-30	12-Jun-31	-113	-113
295	**Commissioning & Start-Up**						
296	P600.06.26	Switchyard Checkout/Test	200	12-Apr-30	16-Jan-31	-113	-113
297	P600.06.28	Cold and Hot Commissioning	299	22-Jun-32	12-Aug-33	20	20
298	P600.06.30	Plant Testing	40	15-Aug-33	07-Oct-33	20	20
299	P600.06.34	COD	0		07-Oct-33	20	20
300	P600.06.44	COD Contingency	60	10-Oct-33	30-Dec-33	20	0



APPENDIX 1 –

INNOVATIVE TECHNICAL SOLUTIONS

Evaluation of Life-Cycle Analysis Feasibility for Clean Energy Tax Credit Program for the Proposed Miami Dade County Waste to Energy Facility

Evaluation of Life-Cycle Analysis Feasibility for Clean Energy Tax Credit Program for the Proposed Miami-Dade County Waste-to-Energy Facility

Date:

May 9, 2025

Prepared for:

Miami-Dade County

Prepared by:

Innovative Technical Solutions

1. Scope and Objectives

The Miami-Dade County Department of Solid Waste, in cooperation with AtkinsRealis USA, Inc. is developing a design criteria package for a proposed waste-to-energy (WTE) facility. The County is evaluating the viability of pursuing the elective pay option of the Clean Energy Investment Tax Credit (CE-ITC) to offset a portion of the project costs. To qualify for the credit, the CE-ITC requires that the electric generation technology being claimed results in greenhouse gas (GHG) emissions of "not greater than zero". The final regulations present a tiered approach for demonstrating zero-GHG emissions. For technologies utilizing combustion or gasification (C&G) processes for electricity generation, a lifecycle assessment (LCA) comparing the baseline conditions to the proposed scenario serves as the technical method for evaluating GHG emissions. Unless Treasury explicitly designates WTE as a zero-emissions technology, an emissions determination process will be required to qualify for the credit.

Innovative Technical Solutions (ITS) has reviewed the language in the final Clean Energy Tax Credit regulations, *Section 45Y Clean Electricity Production Credit and Section 48E Clean Electricity Investment Credit (TD 10024),* to evaluate the project's eligibility for CE-ITC funding based on a designation as zero-GHG through an LCA process. Historically, the EPA & DOE have recognized WTE as zero-emissions when compared to landfilling as the baseline condition with other LCA models developed for these purposes. This technical memorandum includes an assessment of whether WTE could qualify as a zero-emissions technology under the LCA framework as outlined in the final regulations and provides a preliminary evaluation of the expected outcome of such an LCA.

2. Lifecycle Assessment Model

2.1. LCA Background

A Life Cycle Assessment (LCA) is a methodology used to evaluate the environmental impacts associated with a product, process, or service throughout its entire life cycle, from raw material extraction to final disposal. LCAs rely on an inventory (life cycle inventory, or LCI) of inputs and assumptions, including transit distances, energy and water consumption for a given process, labor costs, taxes, and emissions corresponding to those processes. LCA allows practitioners to provide an "apples-to-apples" comparison between alternatives, taking into account all associated variables. The precision and accuracy of an LCA are determined by the quality and granularity of the input data, which may be derived from site-specific information or using national, regional, or local averages.

Publicly accessible LCA tools including the US EPA Waste Reduction Model (WARM; US EPA, 2023), and the Municipal Solid Waste Decision Support Tool (MSW-DST; RTI International, 2012) are commonly used to compare end of life options such as landfilling, composting, recycling, or combustion. Using default assumptions with both tools, WTE does show a less than zero-GHG reduction in comparison to landfilling. Each of these models and other LCA tools rely on slightly different assumptions and inputs which can impact LCA outcomes. LCA may be used to compare outcomes like cost, labor, emissions, and other environmental impacts such as global warming potential, eutrophication, and acidification. The CE-ITC does not specify which LCA tool/model is to be used, but does set forth specific requirements for the LCA, boundaries, and lists emissions sources which are to be included and excluded from the comparison. For the purposes of the LCA required by the CE-ITC, only GHG emissions, reported as grams of carbon dioxide equivalents (CO_2e) per kWh, are considered. CO2e are calculated based on the global warming potential of air emissions; for example, methane is a more potent greenhouse gas than CO_2, as one ton of methane presents the same global warming potential as 28 tons of CO_2 (or up to 87 tons of CO_2, depending on the timeframe considered). Table 1 to §1.45Y–5(b)(1) of the Federal Register provides global warming potentials for four gases, and §1.45Y–5(g)(1) and (2) state that the Secretary shall publish emissions rates for types or categories of facilities annually ("Annual Table"). WTE was not included in the first annual table, published concurrently with the final regulations. The preamble for the final regulations stated that no single LCA model currently available was appropriate for evaluating all C&G energy generation technologies. Under §1.45Y–5(d) for technologies to be added to subsequent iterations of the annual table, an LCA prepared by a National Laboratory that complies with the requirements set forth in the final regulations must be completed.

2.2. Carbon Sources in LCA Modeling

LCA models consider different carbon sources differently. Biogenic carbon refers to carbon derived from organic sources, such as food waste, yard waste, and wood waste; CO_2 emissions from these sources are not considered in the global warming potential analysis because the assumption is that these materials would decompose and release CO_2 with or without the scenario that is being evaluated (e.g., WTE, landfilling, etc.). Other emissions derived from biogenic carbon (e.g., methane) are included in LCA analyses because it is assumed that there would be no methane emissions from natural decomposition. Non-biogenic carbon sources are derived from fossil fuels such as coal, oil, natural gas, and, by extension, plastics. Emissions from non-biogenic carbon sources are included in most LCA comparisons.

As a result of the way these different sources of carbon are handled in LCAs, waste composition can have a significant impact on LCA outcomes when comparing different MSW management scenarios. LCA tools utilize assumptions about MSW waste composition which result in differing results between alternative models, and using site-specific waste composition data will produce a more accurate global warming potential estimate.

2.3. LCA to Determine Eligibility for CE-ITC Funding

The final regulations provide specific requirements for the LCA in §1.45Y–5(d) and (f). Section (d)(2) lists those requirements, which are summarized here. Table 1 below outlines the emissions sources which are listed in the final regulations (from §1.45Y–5(d)(2)(v) and (vi)), either to be included or excluded from the LCA, and whether each emission type is included in the US EPA WARM or MSW-DST LCA tools. Neither US EPA WARM nor MSW-DST align completely with the requirements of the CE-ITC.

Table 1. LCA Emissions Sources Specified in the Final Regulations

Emissions Source	Included in LCA – Clean Energy Credits	Excluded from LCA – Clean Energy Credits	Included in US EPA WARM	Included in MSW-DST
Facility construction		✓		
Facility maintenance and repairs		✓		
Infrastructure construction for the facility		✓		
Proposed feedstock and baseline feedstock production	✓		✓	✓
Feedstock and fuel transportation	✓		✓	✓
Handling, processing, storing feedstock	✓			✓
Combustion and gasification of feedstock and additives	✓		✓*	✓
Electricity production by back-up or auxiliary generators		✓		✓
Transmitting electricity		✓		
Management of waste/byproducts/coproducts	✓		✓	✓
Alternative fates of feedstock and avoided emissions (vs. baseline)	✓		✓	✓

* WARM v16 does not include emissions from the combustion of additives.

In addition to the emissions sources shown above, the final regulations also outline additional requirements for the LCA:

1. **LCA Starting Boundary:** is specified as feedstock generation, including transportation distances.
2. **Timescale:** 30 years, starting when facility first enters service or first qualifies for the credit.
    - For WTE, because emissions would be generally consistent over the lifecycle of the facility this can be accomplished by multiplying the annual generation by 30.
    - For the baseline landfill scenario, the 30 year time horizon is different than is traditionally considered under WARM and MSW-DST where a 100-year horizon is employed.
3. **Market-Mediated Effects Analysis:** under the final regulations this must be considered. In simple terms, market-mediated effects consider how markets respond to changes in demand or supply triggered by a project how those responses generate additional emissions or emissions savings elsewhere.
    - Under this category, MSW disposal in WTE may impact waste hauling and landfill disposal markets, however this is not likely to have ramifications on other markets.
4. **Products: Co-products, Byproducts, and Waste Products from the Technology**
    - LCA models treat each of these differently and the classification may impact results. With respect to WTE, the ash may be considered either a byproduct (economic value >0, not an economic driver) or waste product (economic value < 0, no market). Metals may be considered a coproduct (economic value >0, economic driver of the process) or a byproduct. The economic value would need to be considered in the above market mediated effects.
5. **LCA Ending Boundary:** Electric meter at the point of production
6. **Required Documentation:** Substantiation of GHG rates required to be produced annually by an unrelated party

3. Preliminary Evaluation

3.1. Approach

For this preliminary evaluation of estimated GHG emissions associated with the baseline and proposed MSW management scenarios, information from the design criteria package, data from governmental and inter-governmental agencies, along with emissions factor estimates from the US EPA WARM were used to calculate GHG emissions. These data and

the assumptions upon which they are based may be refined in the full-scale LCA conducted for the proposed project and represent an initial estimate. This preliminary LCA model uses MS Excel to quantify GHG emissions, and, while not the explicit model that would be used in the future evaluation, was designed to use the available inputs to provide a preliminary answer to the question: would the proposed WTE facility be considered to produce GHG emissions not greater than zero?

3.2. Facility Information

The design criteria package specifies the facility capacity (1.33 million tons of MSW per year) and electricity output (103 kW, or approximately 825 GWh/year), this takes into account anticipated down time for repairs and maintenance. The package also specifies the requirements for an on-site ash management process and metals recovery. All of the required emissions data and other LCA inputs are available for existing WTE facilities, along with detailed site and waste composition data to support a customized LCA and comparison for the proposed facility.

3.3. Inputs and Assumptions

This LCA compares the proposed scenario, managing 1,330,000 tons of municipal solid waste (MSW) annually through mass-burn WTE, generating approximately 825 GWh of electricity per year, with baseline scenarios in which the same quantity of MSW is landfilled using two common landfill gas (LFG) management approaches: flaring, and capture with combustion for energy recovery. In the baseline, the 825 GWh of electricity is assumed to be supplied by natural gas-fired generation.

Using data and LCA models from the Energy Information Administration (EIA), International Energy Association (IEA), and the US EPA, GHG emissions for the baseline and proposed scenarios can be estimated. The inputs used in this preliminary evaluation and the sources of each input are included in Table 2, and assumptions made as part of the preliminary evaluation are included in Table 3. A sensitivity analysis of emissions factors as a function of transit distance and LFG collection efficiency is included in Table 4.

Table 2. Inputs and Sources for Preliminary LCA Comparison

Input	Value	Source
WTE Facility Capacity	1,330,000 tons/year	Design criteria package
WTE Facility Generation	825 GWh/year	Design criteria package
GHG emissions from landfill MSW – Landfill gas flaring	0.43 MTCO2e/ton MSW	WARM v16
GHG emissions from landfill MSW – Landfill gas energy recovery	0.15 MTCO2e/ton MSW	WARM v16
GHG emissions from WTE MSW management	0.02 MTCO2e/ton MSW	WARM v16
GHG emissions from WTE electricity generation	367 MTCO2e/GWh	IEA, 2003
GHG emissions Natural gas electricity generation	435 MTCO2e/GWh	EIA, 2024

Table 3. Assumptions Used to Determine Total Emissions in Preliminary Evaluation

Variable	Assumption	Impact
Waste type	Mixed MSW	Default waste composition within existing LCAs will differ from actual composition. Miami-Dade waste composition data could be used to customize the model.
Baseline scenario – Landfill gas collection	Final regulations state that for evaluations where the baseline involves MSW being disposed of in a landfill, uncontrolled LFG venting shall not be used. A comparison with LFG collection and flaring, as well as LFG collection and reuse was included in the preliminary analysis.	The GHG emissions associated with LFG significantly impact the outcome of this evaluation. The collection efficiency assumptions built into the models will have a significant impact on LCA outputs. Many models assume 75% lifetime collection efficiency. Higher efficiency will result in lower GHG emissions, lower efficiency will result in higher emissions. Recent studies have found that landfill gas collection efficiencies less than approximately 85% will result in scenarios where WTE is more favorable in terms of GHG emissions (Anshassi et al., 2021) WARM v16 allows the user to select LFG collection aggressiveness ("worst case", "typical", and "aggressive"). Emissions estimates can vary significantly based on which collection efficiency is selected. See Table 4 for emissions as a function of this variable.
Baseline scenario – Fuel type	Assume that electricity generated by the proposed facility will replace natural gas.	Based on the current mix of fuel types used to generate electricity in Miami-Dade County, it is most likely that WTE electricity will replace natural gas combustion generation.
Travel distances	Assume travel distances for scenario comparison (e.g., transit distance to landfill vs. waste-to-energy facility) are equivalent.	Transportation distances can sometimes have a significant impact on GHG emissions. For the scenarios compared here, different transit distances were used to determine the sensitivity of each calculation to differences in transit distance. Transit distances within reasonable ranges for our evaluation did not have a significant impact on baseline emissions or change the outcome of our preliminary comparison (0.16 kgCO2E per additional mile). See Table 4 for emissions as a function of this variable.
Metals Recovery	The existing LCA models do not account for metals recovery and recycling in the WTE scenario.	Metals recovery is not included in the WARM v16 emission factors when modeling combustion as the disposal method. The avoided emissions from the recovery and recycling of aluminum and iron would be a GHG emissions reduction source for the WTE scenario. For the purposes of this screening level assessment this was not considered but this would be expected to move the model more towards WTE during a final assessment as metals recovery is specified in the design criteria package.
Products	Assume recovered metals are a process byproduct, and ash is a waste product.	We did not include any assumptions about ash reuse in this evaluation, this could offer additional GHG offsets; for example, when used in place of virgin aggregate in road base. The design criteria specify that ash management will include processes to generate ready-to-reuse ash. The same is true for metals recovery (see above).
Market-mediated Effects	Feedstock (MSW) generation will not be impacted by the proposed facility.	In the baseline scenarios, MSW is hauled to an MSW landfill. The landfills charge tipping fees (as do WTE facilities), but it is not likely that the proposed WTE facility would have significant impacts on waste generation. It may have ramifications for competing MSW hauling and disposal facilities.

Table 4. Greenhouse Gas Emissions GHG Emissions Sensitivity Analysis – Gas Collection and Transit Distance ($MTCO_2E$/ton)

MSW Disposal Scenario	LFG Collection	Transit Distance (miles)				
		10	20	40	70	100
		GHG Emissions ($MTCO_2E$/ton of Waste)				
Landfill - LFG Flare	Worst case	0.519	0.521	0.524	0.529	0.534
Landfill - LFG Flare	Typical	0.425	0.427	0.430	0.435	0.440
Landfill - LFG Flare	Aggressive	0.403	0.405	0.408	0.413	0.418
Landfill - Recover LFG for Energy	Worst case	0.243	0.244	0.248	0.252	0.257
Landfill - Recover LFG for Energy	Typical	0.153	0.154	0.158	0.162	0.167
Landfill - Recover LFG for Energy	Aggressive	0.120	0.122	0.125	0.130	0.135
Waste to Energy	n/a	0.020	0.021	0.025	0.030	0.034
*Transit distance and LFG collection efficiency estimated by the US EPA WARM v16.						

3.4. Emissions Estimates

Simplified flow diagrams of inputs and outputs associated with the baseline and proposed scenarios are included in Figure 1. For all cases the same mass of MSW is being disposed of (1.33 million tons/year) and the same amount of electricity is being generated (825 GWh/year). Each of the scenarios includes estimated emissions derived from the generation of electricity (i.e., natural gas or MSW combustion), plus emissions from the waste management options (i.e., landfill disposal with gas collection and flaring or combustion and energy recovery).

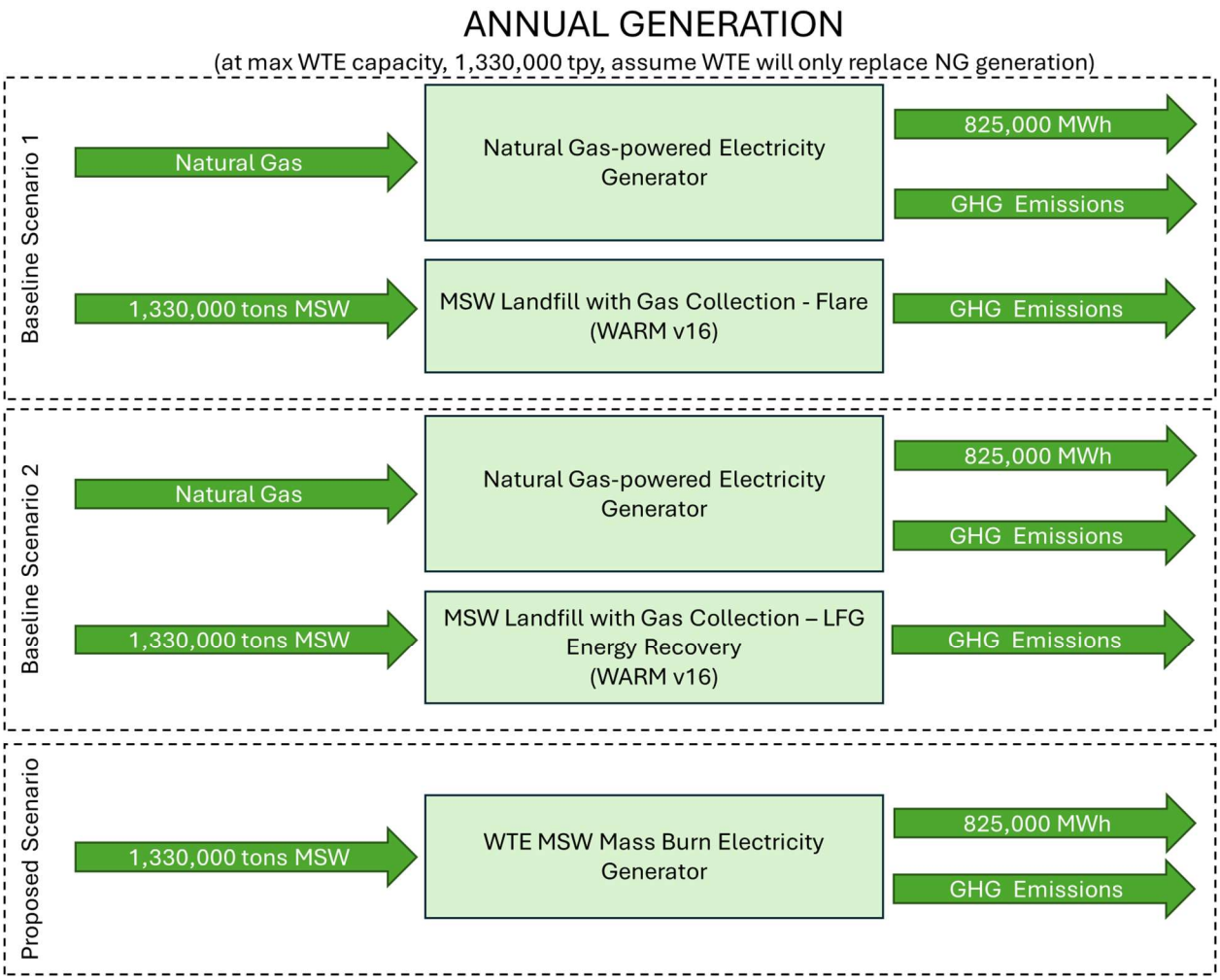


Figure 1. Simplified Flow Diagrams of Inputs and Outputs Included in Preliminary LCA

The estimated GHG emissions ($MTCO_2E$) per year for both baseline scenarios and the proposed WTE facility are included in Figure 2. The emissions associated with electricity generation from natural gas are the same in both baseline scenarios (359,000 $MTCO_2E$/year). The emissions from landfill disposal of MSW are highly dependent on the landfill gas management at the landfill, uncontrolled venting without landfill gas collection results in high emissions and the final regulations prohibit using this as a baseline comparison. Modeling landfill disposal with LFG collection and flaring resulted in GHG emissions of approximately 572,000 $MTCO_2E$/year, and modeling with LFG collection and reuse (e.g., to produce RNG or electricity) added just under 200,000 $MTCO_2E$/year.

The GHG emissions estimates for WTE used per-GWh-generated emissions factors from the literature (IEA, 2003) and per-ton-managed emissions factors from the US EPA WARM v16. These do not include emissions associated with waste handling and the combustion of additives (e.g., lime and ammonia) which are required in the final LCA. These inputs,

which are not included, are not likely to result in significant changes to the LCA results. Also, WARM v16 assumes mass burn processes and there may be elements of the proposed facility which slightly deviate from the baseline mass-burn WTE assumptions provided in WARM. This, again, is not expected to result in significantly different LCA results. Based on the available data, WTE produces less GHG emissions than the combined emissions from natural gas electricity generation and landfill disposal. The final emissions estimate produced using the LCA described in the CE-ITC will depend heavily on detailed inputs which reflect the actual waste composition and site details for the proposed facility.

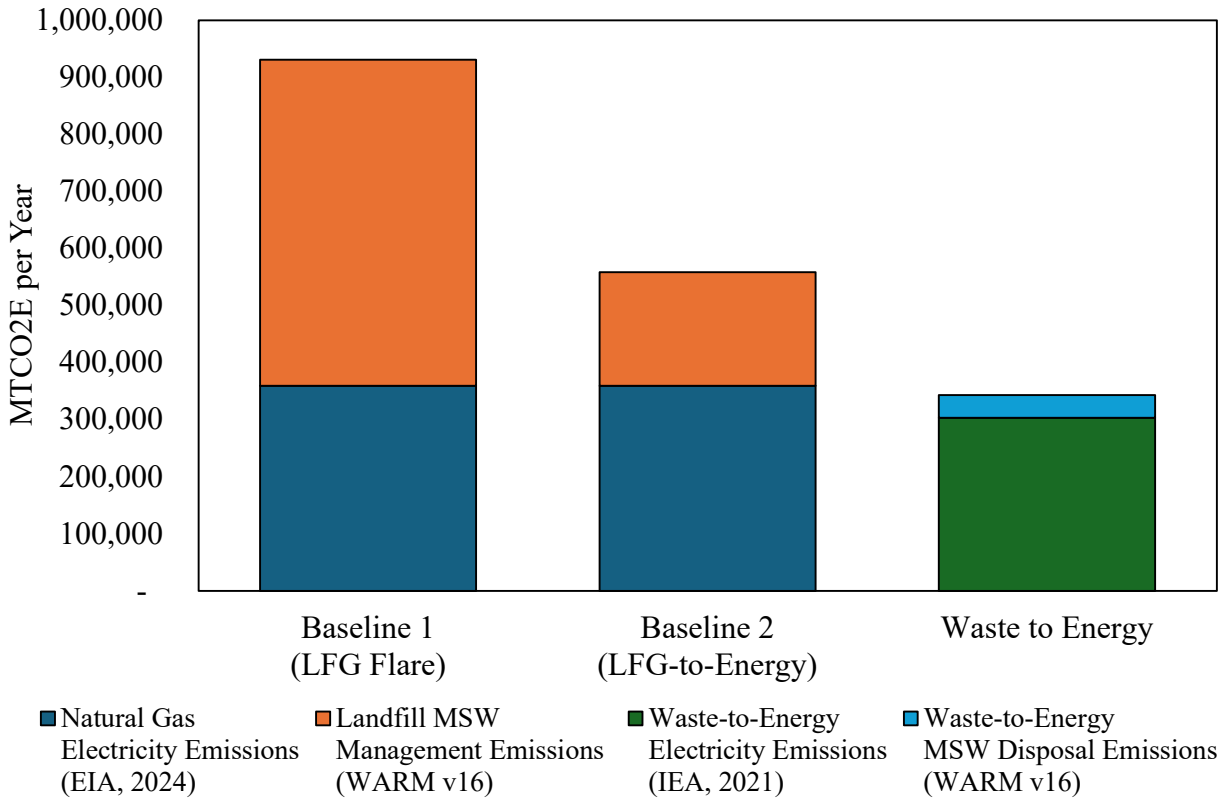


Figure 2. GHG Emissions from Preliminary LCA ($MTCO_2e$ per year) - Two Landfill Baseline Scenarios and the Proposed WTE Facility.

3.5. Other Factors

The most significant factor impacting the estimated GHG emissions factor for each of the evaluated scenarios is waste composition, which is used to determine potential electricity output, combustion emissions, methane potential, carbon sequestration, metal recovery potential and other factors. The preliminary estimates described here were made using the

WARM default assumptions about waste composition for "Mixed MSW", with high fractions of non-biogenic carbon, which typically results in a comparison which estimates lower GHG emissions for landfill disposal scenarios (Anshassi et al., 2021). Miami-Dade County conducted a waste composition study which was published in 2021 (Townsend et al., 2021) which will allow for a more fine-tuned evaluation of these factors. Metals recovery and recycling from WTE can also provide significant GHG offsets that were not considered in the preliminary analysis. Based on the 2021 Miami Dade County waste composition, recycling recovered metals (2.9 % of the waste stream, or approximately 39,000 tons per year) could be projected to offset an additional 170,000 $MTCO_2e$ per year, or approximately 50% of the total WTE GHG emissions (this offset is not included in Figure 2). A determination of the exact offsets based on Miami-Dade's waste composition and the efficiency of similar metals recovery systems will provide an accurate assessment of the mass of different types of metals which will be recovered and the extent of GHG offsets.

While waste composition can provide data about biogenic and non-biogenic carbon as a fraction of MSW, another significant aspect of LCA modeling is the assumption used in each model about the rate at which carbon in a landfill is converted to CO_2 and methane. This variable is referred to as the decay rate, and depends heavily on conditions at the landfill (moisture based on local climate). A high decay rate means more of the carbon will be converted to GHG in a shorter period of time. US EPA WARM allows the user to select a decay rate based on climate (i.e., wet, arid, etc.). For the preliminary assessment, a decay rate was selected based on a wet climate (greater than 40 inches of precipitation per year), however, recently published studies suggest that those default decay rates (also referred to as k-values) likely underestimate emissions in both dry and wet climates (Jain et al., 2021). In a full-scale evaluation, the most appropriate decay rate based on the most current science can be used to estimate landfill GHG emissions. Additionally, US EPA WARM assumes that 100% of collected LFG will be either flared or converted into energy (whichever option is selected in the model), however, most LFG-to-energy systems still operate a flare at times, resulting in higher GHG emissions than estimated in US EPA WARM and Baseline Scenario 2 in Figure 2.

4. Conclusions

Per the final CE-ITC regulations, the net GHG emissions of any proposed C&G facility which is to receive the CE-ITC tax credit must not be greater than zero (i.e., must have lower GHG emissions, as determined by an LCA, than the baseline/alternative process). The CE-ITC provides specific requirements for the LCA, including starting and ending boundaries, emissions to be included or excluded, timescale, and others (see Table 1 and Section 2). Innovative Technical Solutions has reviewed the requirements for the LCA in final

regulations and conducted a preliminary evaluation of the baseline and proposed scenarios and found that 1) there is enough available data to meet the LCA requirements of the CE-ITC, and 2) it is likely that the net emissions associated with WTE in this scenario will not be greater than zero.

This assessment is supported by published studies finding that, except for in cases where overall landfill gas collection efficiency is very high in the baseline scenario (greater than 85-95%), WTE typically has lower GHG emissions. For reference the "aggressive" gas collection scenario in the WARM model, using default or wet climate decay rates, provides for a landfill gas collection rate of less than 85% (Barlaz et al., 2009). A full LCA, using site-specific waste composition and process information, will provide a more accurate estimate of GHG emissions under both the baseline and proposed scenarios.

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5.4 APPENDIX D – INDIVIDUAL MARKET RESEARCH RESPONSES

Full List of Organizations which were sent the Market Research Questionnaire

Company Name	Contact Name	Email	Industry
Itochu International Inc.	David Friedlander	david.friedlander@itochu.com	General Product Trading
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FCC Environmental	Guerlin Escar	luly.escar@fccenvironmental.com	Waste Solutions
United Industries Group, Inc.	Laura Berry	lberry@unitedind.com	Bolted Steel Tanks
Southern Industrial Contractors	Sam Estis	samestis@sicllc.net	Construction
Morin Process Equipment	Matt Saul	msaul@morinprocess.com	Industrial Equipment Supplier
Norris & Son Inc.	Jeff Oxford	jeff@norrisrefractory.com	Refractory Services
GH Cranes	Ted Rusky	trusky@ghcranes.com	WTE Cranes
Hunt Industries	Jody McSwain	jmcswain@hunt-construction.com	Construction
Equipment Fabricators, Inc.	David W. Komives	Davek@equipmentfab.com	Bridge Cranes
Deshazo	Kevin Calma	kcalma@deshazo.com	Cranes
Proinver GP S.A.	Jose Poch Riba	proinveratlantico@gmail.com	Alternative to WTE
Redtail Renewables	Jeff Allison	jeff@redtailrenewables.com	Renewable Natural Gas
FCC Environmental	Luly Escar	luly.escar@fccenvironmental.com	Waste Solutions
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Noresco	Charles Wheeler	cwheeler@noresco.com	Developer / Operator
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Bechtel	Ebony Wiley	ebony.wiley@bechtel.com	General Contractor
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DTE Energy	Greg Martin	gregory.martin@dteenergy.com	Developer / Operator
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Fagen	Rick Cantor	rcantor@fageninc.com	General Contractor
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TOTAL ENVIRONMENTAL ALTERNATIVES, LLC	Victor Sziky	gabbyvrip18@gmail.com	Environmental
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Van Dyk	General	info@vdrs.com	Waste Solutions
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Closed Loop Partners	General	nextgen@closedlooppartners.com	Waste Solutions
Waste Management	Alex Gonzalez	agonzalez@wm.com	Waste Solutions

AMP Robotics

Market Research Response

1875 Taylor Avenue,
Louisville, CO 80027

ampsortation.com
1-888-402-1686

April 10, 2025

Saba Musleh, CPPB
Negotiator
Strategic Procurement Department
111 NW 1st Street, Suite 1300
Miami, FL 33128

Re: Market Research for Municipal Solid Waste Management Solutions

Dear Saba,

AMP Robotics Corporation ("AMP") is pleased to present this response to Miami-Dade County's request for Market Research for Municipal Solid Waste Management Solutions. We appreciate the County's commitment to advancing sustainable waste management and believe AMP's industry-leading recycling and sortation technology can contribute meaningfully to the future of Miami-Dade County.

AMP designs, builds, and operates state-of-the-art material sortation systems that extend landfill life by recovering recyclables and organic materials from municipal solid waste ("MSW"). When deployed at landfills or within existing transfer stations, AMP's AI-powered MSW sortation systems can reduce the volume of waste destined for landfills or waste-to-energy incineration by 60 percent or more. Our systems offer an efficient, highly-automated alternative to traditional disposal methods, with total operating costs that are competitive with both landfilling and incineration.

As waste streams continue to evolve, AMP remains at the forefront of innovation by expanding its AI capabilities to enable sortation of an increasing variety of materials, not just traditionally recyclable commodities. Our technology and operational expertise enable lower-cost, faster-to-implement, and more sustainable solutions than the six waste-to-energy ("WTE") options presented in the County's January 2025 report in response to Directive No. 241676.

We are excited to discuss how AMP can support Miami-Dade County Solid Waste's mission to protect, preserve and improve its environment and the quality of life in the community it serves for years to come. We welcome the opportunity to engage further, whether through discussions of a pilot program or by hosting site visits to our existing facilities.

Please do not hesitate to contact me at sarah.daschbach@ampsortation.com with any questions.

Sincerely,

Sarah Daschbach, Senior Manager, Commercial Origination & Business Development
(888) 402-1686

AMP™

MARKET RESEARCH RESPONSE

Miami-Dade County, Florida

MARKET RESEARCH FOR MUNICIPAL SOLID WASTE SOLUTIONS

Response Due Date:
April 14, 2025

Respondent

Respondent's Name: AMP Robotics Corporation ("AMP")
Address: 1875 Taylor Avenue, Louisville, CO 80027
Contact Person: Sarah Daschbach, Senior Manager, Commercial Origination & Business Development
sarah.daschbach@ampsortation.com
(888) 402-1686

AMP designs, builds, and operates best-in-class material sortation systems that maximize recovery of recyclable materials and organics from municipal solid waste ("MSW") and offer a highly cost-effective method for managing MSW. With hundreds of deployments across North America, Asia, and Europe, AMP's material identification and advanced automation technology establishes new standards of safety and reliability while increasing material recovery and landfill diversion.

Chief Technology Officer Matanya Horowitz founded AMP in 2014 after his studies in robotic systems–for his PhD in controls and dynamical systems from the California Institute of Technology–introduced him to then-recent results in the field of deep learning. These developments, which fueled breakthroughs in autonomous driving, artificial intelligence systems, and more, allowed machines to "see" as well as humans for the first time. Horowitz realized these developments in computer "vision" could help overcome issues that hindered the use of automation and robotics in recycling. The convergence of machine learning and robotics offered compelling opportunities to automate tasks in waste diversion that had been, up until that point, labor intensive, dangerous, costly, and, as a result, limited the importance and impact of recycling in the waste industry.

By bringing digital intelligence to recycling, AMP sorts waste streams and extracts value beyond what is otherwise possible. AMP ONE™ is the company's highly-automated, facility-scale sortation solution. AMP ONE offers a modular design capable of recovering over 90 percent of target materials using AI-powered sortation technology. It transforms MSW, single-stream, residue, mixed plastics, and other feedstocks into saleable materials with minimal labor and cost. These next-generation material recovery systems enable communities to increase recycling access and effectiveness by lowering capital and operating cost barriers.

AMP launched its first facility in 2020 and has since launched and/or operated systems that process MSW, single-stream recyclables, and secondary materials.

Waste Management Solutions

Solution

AMP's cutting-edge technology and operational expertise enable lower-cost, faster-to- implement, and more sustainable solutions than the six waste-to-energy ("WTE") options presented in the County's January 2025 report in response to Directive No. 241676.

AMP's MSW sortation solutions can typically divert 60 percent or more of the material that would otherwise go to landfill, helping Miami-Dade County meaningfully extend the life of the North and South Dade landfills and reduce hauling costs to third-party landfills.

Our solutions can be implemented in two years or less, which is significantly faster than the minimum of seven years typically required to deploy a WTE facility. Additionally, AMP's technology offers a much more environmentally sustainable approach than incineration, which, in turn, can reduce the risk of timeline delays that often plague WTE projects subject to public and regulatory challenges.

AMP uses AI, automation, and innovative design to keep operating costs low and performance high. Our systems are designed to integrate within existing solid waste infrastructure, which further drives down costs for our customers. For example, an AMP solution for Miami-Dade County could be deployed at multiple County-owned sites, including existing transfer stations, the Resource Recovery Facility, and the North and South Dade landfills. AMP's technology could recover commingled recyclables and organics at each of these locations for further processing into useful end products.

By creating MSW processing capacity at multiple locations, rather than concentrating processing at a single site, we are able to decrease operational risk by increasing processing redundancy, ensuring reliable landfill diversion. Downtime events at one site–due to extreme weather, fires, or other disruptions–would not bring down the overall network of AMP MSW-processing systems.

Effectiveness

AMP's proprietary sensing and sorting equipment enables the extraction of valuable commodities from MSW. Our sorting systems are all built upon AMP's AI sensing platform. We have pioneered and leveraged this technology for more than a decade, unlocking high throughput, recovery rates, and offtake purity, all at low cost. AMP's unique AI-based capabilities also help overcome historical MSW processing challenges, such as inconsistent material identification and extraction of lower quality commodities due to contamination. When paired with our jet-based sortation system, this technology allows us to outperform traditional equipment, which often struggles to meet uptime goals and respond to material composition changes.

AMP developed and manages its own plant control software, leveraging both controls and vision-system insights to optimize the flow of the entire facility. Ownership of the entire control stack also enables the system to react in real time to plant issues related to throughput, offtake purity, recovery rate, jams, hazards identified, and more.

Our solutions also feature internal redundancy; by including parallel lines of sorting equipment—from infeed through processed commodity management—we ensure that a single downed processing line will not take an entire facility offline. This type of strategic redundancy is critical for any solution that proposes to reliably process Miami-Dade County's significant solid waste volumes.

AMP is also unique in that we provide an expert operations team to run our systems. By combining our proprietary software and unique system design with a team of experienced operators, we optimize system value for our customers and are able to guarantee performance.

AMP has built and operated facility-scale solutions in Denver, Colorado; Lithonia, Georgia; Solon, Ohio; and Portsmouth, Virginia. We are currently building a system for Waste Connections in Commerce City, Colorado, and will begin operating it in 2026. We have deployed advanced robotic sortation systems and vision technologies in over 100 facilities across North America, Asia, and Europe.

Quantity

AMP's solution is capable of processing all of the County's MSW. Further, given the modularity of our sortation equipment, we would be able to integrate additional volume in the future with minimal downtime.

By using AI-based sorting technology in place of the legacy equipment typically deployed by the industry, AMP systems can adapt to changes in commodity form factor and material type while identifying non-processable waste. MSW composition varies seasonally and over time due to a combination of consumer behavior and supplier trends. AMP systems can adapt to these changes by pairing AI-based vision technology with multi-purpose jets.

Technologies

AMP's waste processing technology can be segmented into two distinct modules, one that processes MSW and one that processes recyclables. These modules can be deployed in separate locations or integrated into one, single-location system.

AMP ONE SPOKE™ ("MSW Module"): Our standard MSW Module designs process 25 or 50 tons of MSW per hour, and can be customized to accommodate customer-specific needs (e.g., higher volumes). The MSW Module quickly removes non-recoverable residue and extracts ferrous materials, generating a blend of mixed recyclables for downstream separation. The 2" minus

fraction of material (where most of the organics are typically located) is separated from the mixed recyclables stream. We do this by pairing our proprietary sorting technology with traditional screens, magnets and hazard identification and removal where appropriate. We invite the County to observe an AMP ONE SPOKE in operation in Portsmouth, Virginia, where it has been processing MSW since late 2023.

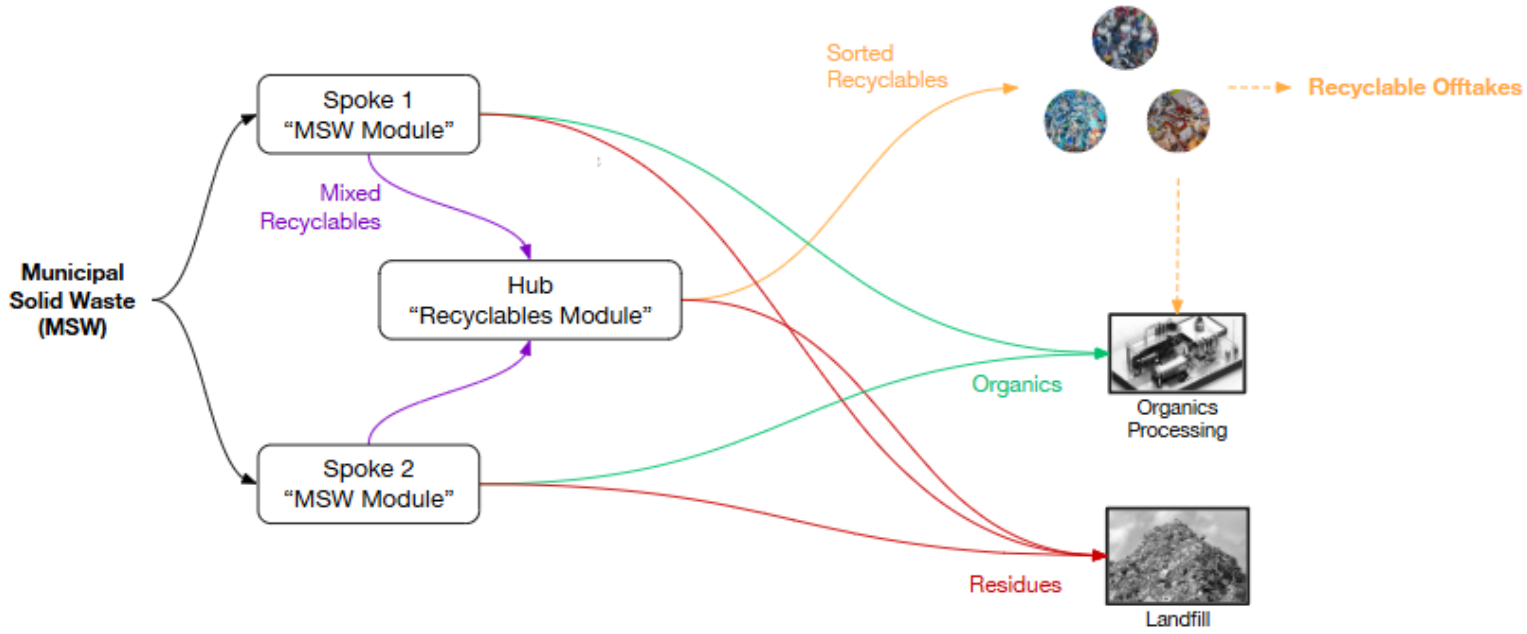
AMP ONE HUB™ ("Recyclables Module"): Each Recyclables Module is capable of processing up to 25 tons of mixed recyclables per hour, which it separates into streams of individual commodities for sale. We invite the County to observe an AMP ONE HUB in operation at AMP's Cleveland facility, where it has been processing mixed recyclables for over three years.

An AMP solution for the County could incorporate multiple MSW Modules within the County's existing infrastructure (e.g., transfer stations, Resource Recovery Facility). Commingled recyclables extracted by the MSW Modules could then be transported to an AMP-operated Recyclables Module or a third-party material recovery facility (e.g., WM Pembroke Pines MRF).

AMP's technology can enable, and is compatible with, various organics solutions (e.g., anaerobic digestion, gasification, biochar). For example, by efficiently sorting and cleaning organic waste before processing, AMP's technology ensures a high-quality feedstock for biochar production. AMP's biochar production process uses a pyrolysis-based system to convert organic waste into a stable, carbon-rich material. Unlike traditional waste-to-energy incineration, pyrolysis operates in an oxygen-free environment, significantly reducing greenhouse gas emissions.

While more information can be provided to Miami-Dade County upon request, a high-level process flow diagram is provided here:

Conceptual Miami-Dade County Process Flow



Benefits

An AMP solution operating within Miami-Dade County's existing infrastructure will have immediate benefits and can continue to create value for the County even as waste streams change over time. The key benefits are listed below:

- AMP can divert 60 percent of the County's processable MSW, meaningfully extending the life of the North and South Dade landfills and reducing hauling costs to third-party landfills.
- By extracting mechanically and chemically recyclable commodities from MSW (which often comprises as much as 30 percent of inbound materials), AMP can help the County meaningfully increase its overall recycling rate.
- AMP can produce a wide range of MSW-derived material outputs, as informed by the inbound material composition and offtakes available in specific locations or regions.
- AMP solutions can deliver industry-leading 90+ percent uptime.
- AMP can minimize project costs by making use of Miami-Dade County's existing infrastructure (e.g., facilities, hauling assets). AMP's compact designs can fit into small spaces where traditional equipment cannot.
- Deploying MSW-processing solutions in multiple strategic locations can reduce hauling costs, minimize downtime risk, and accommodate fluctuations in seasonal waste volume.
- AMP solutions utilize AI for continuous characterization of inbound waste and outbound materials, including sorted commodities and residue. The valuable insights derived from this data enhance customer visibility with respect to the waste stream and the effectiveness of its management. This feature is built into each solution at no additional expense. In contrast, traditional waste audits are costly and often unreliable because they only look at small samples, which can lead to inaccurate or incomplete results.
- AMP Jet units are central to the effectiveness of our solutions. Our ability to sort multiple material streams at high throughput levels using a single AMP Jet unit dramatically improves the safety, uptime, and material recovery of MSW processing. AMP's commercially-proven technology provides a dynamic counterpoint to other MSW-sorting equipment, which is typically bulky, expensive, and unable to adapt to changing waste streams or commodity markets.

Challenges

AMP's solutions are designed to be flexible, enabling navigation of challenges with which a traditional MSW-processing solution would struggle. Our solutions are capable of deployment in several small existing sites (e.g., transfer stations in a network of facilities) as well as consolidation in a single larger location. In either instance, AMP will work with Miami-Dade County to accommodate space and logistical constraints.

AMP designs its solutions to produce recyclable material and organics offtakes that align with regulatory and permitting requirements and customer cost and timeline projections. For the County, AMP can take a phased approach, quickly deploying solutions that send the organic

fraction of processed MSW to existing local offtake pathways, then layering in new processing capabilities (e.g., anaerobic digestion, biochar production) once the requisite permits have been secured. In all cases, the regulatory and permitting burden associated with AMP solutions is lower than that of a WTE facility or new landfill.

Financial Approach

Costs

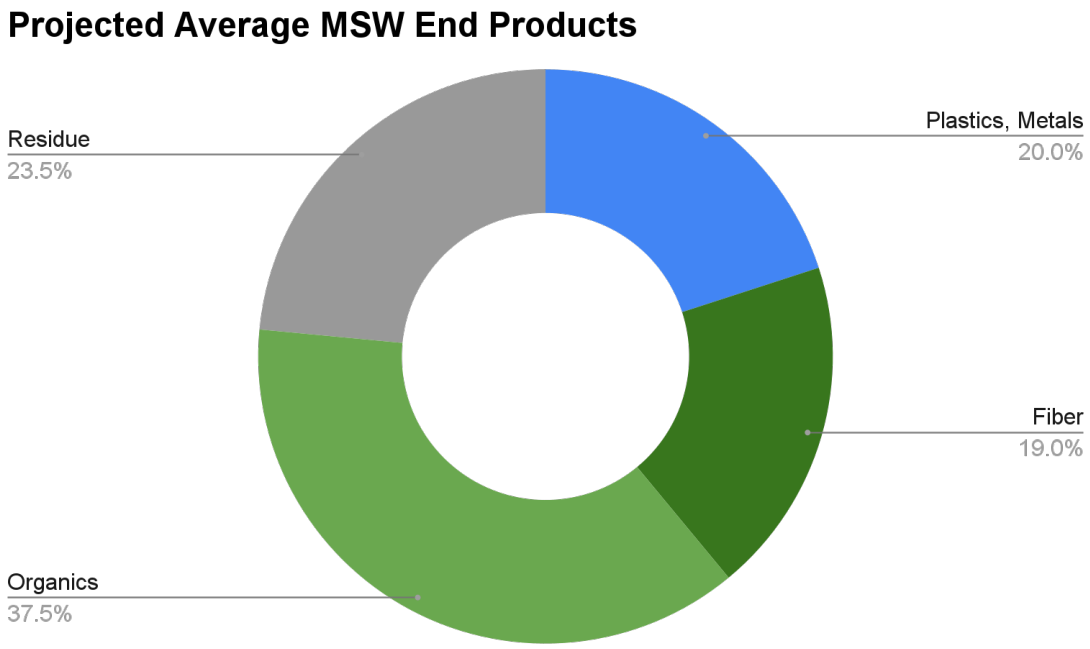
The capital investment associated with an AMP solution would depend on several factors, including preexisting infrastructure availability, diversion targets, recyclable commodity targets, and preferred organics processing solution. Regardless, the capital investment associated with an AMP solution will be a fraction of the estimated costs associated with a new WTE facility.

AMP's operational costs are dependent on the scope of work assumed by AMP and its customer, respectively. Typically, we seek to pair our core competencies (e.g., technology, operation and maintenance) with those of the customer to ensure delivery of a cost-effective solution. This approach will yield operational costs that are competitive with those of a landfill or WTE facility.

Funding Model

AMP's solution may be financed, in full, by private or public debt and equity. AMP has deep experience in capital formation and an existing investor base that represents trillions of dollars in total investable assets under management. Additionally, private activity bonds may be available for this project.

Revenue



Caption: Approximately 75 percent of the material stream is projected to include recoverable commodities, AMP typically targets recovery of 90 percent of those commodities, a percentage that accounts for material contamination and other factors that impede recovery and subsequent sale. As a result, and depending on the inbound material stream composition and quality, AMP systems are typically able to target diversion rates of 60-70 percent.

Revenue to the project will come from a per-ton processing fee paid by the County and the sale of recovered materials to various offtakers.

In general, the organics element of the waste stream is composed of two core components: food waste and yard waste. AMP can send all of this organic material to a single offtake or separate it for different end uses (e.g., compost for yard waste, anaerobic digestion for food waste). The fiber materials extracted from MSW, including cardboard and mixed paper, can be sent by AMP to organics-processing pathways, or can be sorted and sold as a commodity if the material quality is high enough. Most often, AMP suggests commingling fiber materials with other organic materials to minimize fiber marketability risk. Within the fiber stream, AMP can produce offtakes that meet multiple specifications, including mixed paper, OCC, Sorted Residential Papers & News ("SRPN"), and cartons. We have the unique ability to make proprietary blends of these materials without major plant reconfigurations.

Plastic and metal commodities derived from MSW are more reliably marketable and saleable than their fiber-based counterparts. AMP maximizes metal diversion by targeting used beverage cans (UBCs), mixed ferrous commodities, and off-spec aluminum. For plastics, AMP first targets commodity pathways for materials like natural high density polyethylene (NHDPE), colored high density polyethylene (CHDPE), polyethylene terephthalate (PET), polypropylene (PP), and mixed plastics, and retains the ability to create custom commodity blends for advanced recycling processes like methanolysis and pyrolysis where such offtakes are available. A pyrolysis offtake, for example, increases the overall project diversion rate by converting mixed thin films into a valuable commodity for sale. As with the fiber products, AMP can create custom blends and vary offtake choices without hardware changes – a critical feature for any MSW-processing solution given changing material streams and end markets.

Depending on the organics solution, there could be opportunities to produce material for sale in the form of biochar, solid recovered fuel (SRF), or renewable natural gas (RNG).

AMP seeks to establish long-term offtake contracts for end products produced by its MSW-sorting solutions and tests offtake material with prospective purchasers. We have existing offtake relationships that we bring to new projects.

Implementation Approach

Infrastructure

The project-specific infrastructure requirements will depend on the ultimate solution, or combination of solutions, that the County would like AMP to deploy. AMP's goal is to leverage our technology's flexibility to use as much existing County infrastructure as possible, ranging from transfer stations to existing offtake processing sites. For a project capable of accommodating Miami-Dade County's MSW volumes, we anticipate deploying multiple processing systems co-located on one site, or distributed across multiple sites, to reduce hauling requirements and optimize the transfer of material between sites.

At a minimum, AMP would be responsible for designing, engineering, procuring equipment for, constructing, installing, commissioning, operating, and maintaining the solution.

Size

AMP requires storage space for inbound materials (e.g., on a tip floor), and offtake materials (e.g., baled, in roll-offs). Space requirements will depend on final project specifications, including processing volume, operating hours, and material offtakes.

Site Ownership

Site(s) and site ownership will depend on final project specifications. AMP's goal is to use as much existing County infrastructure as possible, ranging from transfer stations to existing offtake processing sites, to manage costs, timelines, and any associated project risk.

AMP has experience working with regulators to ensure accurate classification of its facilities and satisfaction of reporting requirements, where applicable. AMP evaluates land use requirements early in the pre-development process and seeks sites with permissive zoning and complementary adjacent uses. AMP has successfully obtained use permits and conditional use permits for its facilities in the past, where necessary.

Permitting

AMP has experience identifying and satisfying the regulatory and permitting requirements applicable to its solutions. Depending on the scope and nature of a given solution, AMP or its customers may be required to seek state-level solid waste and air emissions permit approvals.

Timing

Upon completion of contract negotiations, and in partnership with Miami-Dade County, AMP is capable of installing a complete solution consisting of multiple sites in as few as 12-18 months. If we were to develop an on-site organics processing system (rather than send organic materials to a third party for off-site processing), and an air emissions permit is required, installation could take 18-30 months from contract execution. The overall project timeline will be shaped by several important factors, such as permitting, building procurement, and other logistical considerations. This will require coordination and partnership with Miami-Dade County to ensure all regulatory, infrastructure, and site requirements are timely met.

O&M

AMP would perform all operations and maintenance for the duration of the contract with the County, but specific operational and maintenance requirements will depend on the final project specifications.

Unlike most waste processing facilities in which the workforce is concentrated in manual sorting roles, our solution relies on production operators who will be trained to optimize the technology and automated systems they manage. These are often skilled roles that can rely on programming knowledge, mechanics, engineering, data science, and other core competencies.

Health/Safety/Environmental

AMP is committed to meeting and exceeding industry safety standards and devoted to maintaining a safety culture that enables an incident-free environment. To that end, we adhere to all applicable rules, regulations, and laws while striving to adopt best practices articulated by professional industry organizations aligned with our specialized work. Our environmental, health, and safety (“EHS”) program lays the foundation for our employees by setting operational safety expectations and establishing guidelines for our work. We foster a culture of personal responsibility, not only for our own individual safety, but also for the safety of our teammates through shared values, behaviors, and beliefs. When incidents do occur, no matter how minor, we look to learn from them to prevent future occurrences by driving in-depth root cause analyses of near-misses, hazardous observations, and accidents and incorporating these learnings into our EHS policies, procedures, and training content.

Our internal safety program covers employees and contractors, including those working at our sortation facilities, traveling installation technicians, production team members, and those undertaking the innovative work done onsite and at our headquarters-based research lab. Training begins on the first day of employment for all employees and covers hazard awareness, injury and incident prevention, emergency operations procedures, and other technical skills applicable for specific roles. Our training addresses the specific risks presented by the handling

of MSW. This includes appropriate personal protective equipment, industrial hygiene policies, and providing certification training from OSHA's 30-hour outreach courses for construction and the American Red Cross's first responder program. All EHS policies are reviewed and updated regularly.

The ultimate environmental benefits of a project led by AMP will be determined by a number of factors. Diversion of waste from the landfill, the associated reduction in greenhouse gas emissions (or the requirement for recapture equipment), and a reduction of long-haul trucks or route trucks traveling to the landfill contribute to the environmental benefits of AMP's MSW-processing solutions, particularly when compared to a WTE facility. The most significant input with respect to local and global environmental benefits will be selection of an organics processing pathway. More information on this point can be provided to Miami-Dade County upon request.

Other Information/Advice

Procurement Model

We recommend issuing a single request for proposals ("RFP") addressing the design, build, operation, and maintenance of an MSW processing solution. By soliciting a single bid for all of these components, the County stands to benefit from proposals strengthened by bidder familiarity with and ownership of all phases of procurement, implementation, and performance. This drives efficiencies as well as accountability more directly than a model in which equipment vendors and re-sellers design and build a system, only to hand it off to a separate and distinct staffing agency less familiar with optimal operation and maintenance practices for that system. This model also serves to enhance performance, reduce operational disruptions, and maximize the effectiveness of the entire solution.

Partnerships

We believe co-locating an MSW processing solution with existing waste infrastructure (e.g., landfills, transfer stations) will offer the County meaningful time and cost savings.

Additional Insights

If the County opts to issue an RFP for MSW management solutions, AMP recommends that the County consider how certain threshold qualification criteria will affect the responses it receives.

AMP has built transformational technology based on more than a decade's worth of waste characterization data. Because AMP launched its first facility-scale solution in 2020, however, any threshold operating history requirement that exceeds five years could present a challenge for AMP and other advanced technology providers.

Large bonding requirements, if made a threshold requirement for bid submission, would pose a somewhat similar challenge for advanced technology providers like AMP. Such requirements are just as effective, and far easier to manage for advanced technology providers, when incorporated during the contracting stage rather than as a precursor to the bid submission stage.

To ensure the County has a broad array of viable MSW management solutions to consider, we would discourage inclusion of the above as threshold bid submission qualifications.

Bradam Energies

Market Research Response

REQUEST FROM MIAMI-DADE COUNTY ON MSW PROCESSING SYSTEMS
MARCH 31, 2025

1. **RESPONDENT**

BRADAM Energies
13641 Parker Commons Blvd, Fort Myers, FL 33912
Contact Mr. Rick Finkbeiner
Email: rickf@bradamenergies.com

2. **HISTORY OF BRADAM ENERGIES CARBON ENERGY REFORMING (CER™) SYSTEM** (include history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides).

   a. BRADAM Energies team of engineers and scientists have a combined total of approximately 120+ years experience in the design, construction and operation of waste to energy systems and facilities that produced Syngas from organic and/or nonorganic waste materials.
   b. The BRADAM CER™ Process for production of Syngas from MSW, was developed and operated in a private-sector Demonstration Facility over a five-year period. The results of which were witnessed and validated by SNC Lavalin and Battelle.
   c. The BRADAM CER™ Process is a defined modular product and can be installed in single or multiple process lines to process all the waste into energy and other valuable commodities, at each facility.
   d. BRADAM is currently developing projects to produce RNG or bio-methanol from a variety of different organic wastes in several locations across North America.

3. **The BRADAM CER™ System** (Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. – see report document).

   a. The BRADAM CER™ System can process all the carbonaceous waste produced by Miami-DADE County. This includes organic food waste, biosolids and MSW in mixed or as dedicated feedstocks. The CER™ process is cost-efficient in the production of renewable energy from MSW.
   b. BRADAM Energies will finance, own, and operate the CER™ Systems for production of renewable energy from Miami-DADE's MSW or if appropriate, potential private-public partnerships can be arranged.
   c. BRADAM would continue to rely on the current private contractors employed by Miami-DADE County, who have proven specific historical experience and expertise in the collection and haulage of MSW for Miami-DADE County to the County's existing North and South landfills.
   d. BRADAM proposes siting CER™ Systems at the existing permitted North and South Miami-DADE landfills with sufficient processing capacity at each site to process the MSW delivered to each site. This approach would maintain current delivery logistics and utilize the existing environmental permitting in place for the receipt of MSW, minimizing requirements for additional operational permitting required by the CER™ System *per se*.
   e. There are no waste residuals from the production of renewable energy by the CER™ System which would require landfill disposal. (see 4a.v).

f. The CER™ System destroys PSAFs (forever chemicals) and other Substances of Concern (SOCs, such as pesticides, herbicides, pharmaceuticals or drugs) that contaminate MSW. Their destruction eliminates potential legal liabilities associated with their release into the environment and their possible negative impacts on the environment and human health.

4. **EFFECTIVENESS OF THE CER™ SYSTEM** (include effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.)

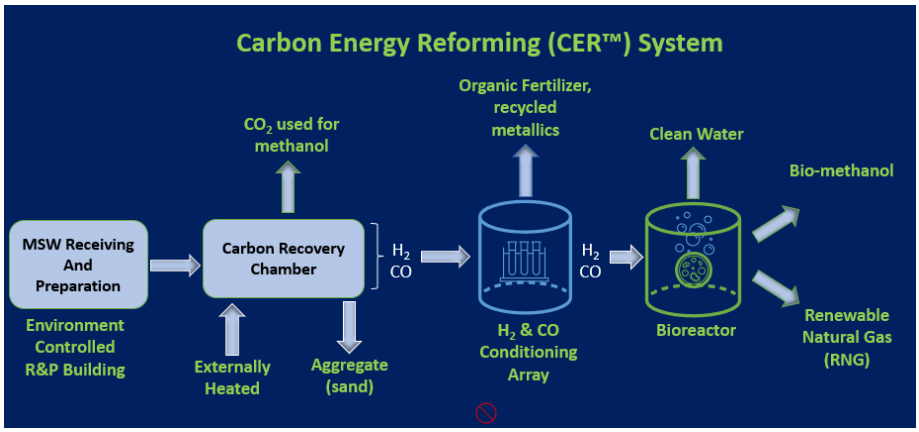
   a. Implementation of the CER™ System to process MSW from Miami-DADE County effectively:
      i. Eliminates landfill disposal of MSW and all the negative attributes associated with landfill disposal of wastes.
      ii. Eliminates environmental impacts from landfill emissions such as methane and leachate produced from MSW.
      iii. Eliminates environmental contamination and potential legal liability by destruction of PSAFs (forever chemicals) and other SOCs that are contained in MSW.
      iv. Provides financial certainty in MSW disposal costs through long term tipping fee agreements.
      v. Produces by-products (*e.g.,* aggregate, fertilizer, metallic elements, clean water) from processing MSW in the CER™ System.
      vi. Produces commercially significant quantities of renewable energy from MSW that displaces fossil fuels on a one-for-one energy basis thereby reducing negative impacts on global climate change from fossil-CO_2 emissions.

5. **QUANTITY OF WASTE TO BE PROCESSED BY THE CER™ SYSTEM** (include quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.)

   a. Each CER™ System is a Process Line with an operating capacity of 107,500 tons of MSW per year.
   b. BRADAM proposes that the CER™ System process 100% of the carbonaceous MSW from Miami-DADE County.
      i. Processing the quantities of MSW received in 2023/2024 at the North Landfill (about 95,000 tons/year) would require one CER™ System Process Line.
      ii. Processing the quantities of MSW received in 2023/2024 at the South Landfill (about 679,000 tonnes/yr.) would require 7 CER™ System Process Lines.

6. **CER™ SYSTEM TECHNOLOGY** (include waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.)

a. SCHEMATIC OF CER™ SYSTEM FOR PROCESSING MSW To Renewable Energy



b. MSW RECEIVING AND PREPARATION BUILDING (RPB)

i. MSW delivery trucks unload in the RPB which is under negative air pressure to prevent any odors from escaping the facility.
ii. The front-end loaders transfer the MSW to shredder systems that are equipped with magnetic and Eddy Current separators to remove ferrous and non-ferrous items from the MSW prior to shredding. The separated items are recycled through existing recycle programs.
iii. The CER™ System, from the Carbon Recovery Chamber (CRC) through to the transfer of the renewable energy product is a closed system with no emissions (gaseous or solids) into the environment.

c. CARBON RECOVERY CHAMBER (CRC)

i. The CRC is a sealed rotating commercial calciner with in-direct heating where reforming of the natural energy in the MSW occurs to produce syngas.
ii. There is no combustion (burning) of the MSW in the CER™ System.
iii. The residence time and temperature within the CRC exceed those specified by the US EPA for the destruction of PFASs (forever chemicals) and other SOCs.
iv. The residual is a sand-like material sold to third parties for use in the cement industry. This aggregate qualifies as a LEED accepted product in bricks and concrete.

d. SYNGAS CONDITIONING ARRAY (SCA)

i. The Syngas exiting the CRC is cooled and non-syngas components are separated, as the Syngas passes through the SCA to the bioreactors.

e. BIOREACTORS

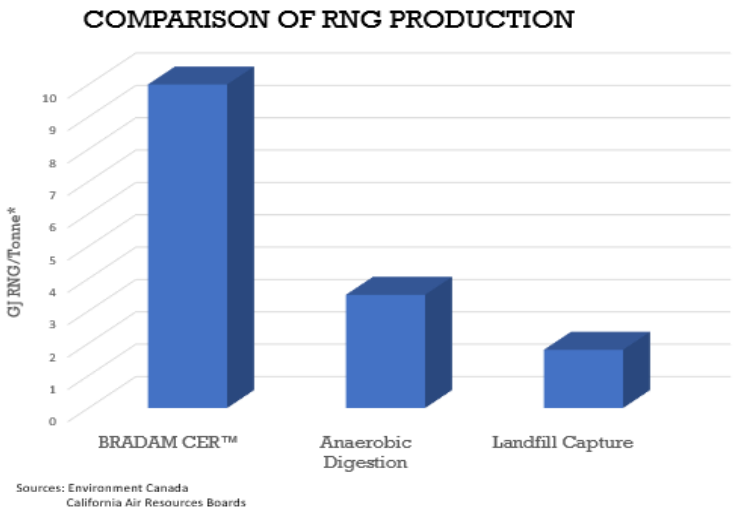
i. The patented strain of methanogenic microorganisms in the bioreactors convert the syngas into biogas and water.

ii. Biogas is piped into a Biogas Conditioning System that removes the excess water to produce pipeline grade natural gas which is exported in existing natural gas pipeline infrastructure.
iii. As an alternative, the biogas can be directly processed into bio-methanol using existing commercial methanol production systems.
iv. The water produced by the system is distilled water and is simply sterilized with UV light to produce exceptionally clean water for multiple uses.

7. **BENEFITS FROM PROCESSING MIAMI-DADE COUNTY'S MSW IN THE CER™ SYSTEM**
(include key benefits of the respondent's solution as compared to the other waste processing technologies that are available)

a. Benefit of processing Miami-DADE County MSW in the CER™ System:
    i. No landfill disposal of MSW.
        1. Ability to mitigate future liabilities associated with long term landfill management.
            a. No future landfill emissions (especially methane) or leachate issues.
            b. No future landfill expansion issues and expense.
            c. No future landfill operating costs to receive or bury MSW.
        2. Recover funds from landfill reserve accounts.
        3. Current landfill employees can simply move over to BRADAM, operators, scale house etc.

    ii. BRADAM CER™ is an environmentally superior solution to safely and completely process all carbonaceous waste into recoverable energy.
        1. 2x the energy production (without emissions) vs incineration or burning of the garbage.
        2. 3x the energy production with no PFAS concerns vs anerobic digestion.
        3. BRADAM is a completely scalable product vs custom engineering.
        4. The BRADAM Process is carbon neutral.



iii. No process residuals, typical to other technologies, that require landfill disposal or land application such as:
    1. Incineration ash or slag to landfill
    2. No Anerobic digestion digestate to landfill or land application contaminated with PFAS chemicals
iv. No capital investment required by Miami-DADE
v. Production of renewable energy from Miami-DADE County's MSW.
    1. Allows replacement of industrial and residential use of fossil natural gas with RNG.
    2. Or replacement of bunker C fuels with bio-methane a marine industry fuel. This is particularly relevant to Miami's large cruise ship industry.
    3. The fossil fuel displacement with RNG or bio-methane reduces fossil carbon emissions from combustion of the fossil fuels and results in a positive impact in reducing green house gas emission from combustion of fossil fuels.

8. **CHALLENGES IN IMPLEMENTING THE CER™ SYSTEM** (include any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.)
    a. Agreement between BRADAM and Miami-DADE County on use of the land at the North and South landfill sites.
    b. Permitting of the CER™ System on the two landfill sites. Permitting is not anticipated to be a significant challenge; however, it is a regulatory process that must be addressed.
    c. Securing off-takers for either the RNG or the bio-methane, and the by-products (*e.g.*, aggregate, metallic elements, ammonium sulfate fertilizer, water) produced by the CER™ System. This challenge would need to be met before BRADAM could proceed.

9. **FINANCIAL MODELINGFOR APPLICATION OF THE CER™ SYSTEM** (include capital investment and 30-year operational costs associated with the respondent's solution.) (include funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and include potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.

    a. The BRADAM CER™ system financial model is designed to support institutional funding.
    b. To properly model the opportunity for Miami-Dade several assumptions we would make need to be better understood prior to an effective 30-year financial model being produced for review.
    c. Our goal is to deliver a long-term solution that addresses the environmental and financial challenges of Miami-Dade to properly resolve current and future landfill issues.
    d. Clarifying the following items will provide the basis for producing a reliable model to ensure financial support for the project:
        i. Confirm existing landfills can accommodate the process.
        ii. Confirm infrastructure – electrical service, gas line proximity, sewer availability, etc.
        iii. Understand current tipping fees.

iv. Understand desired ownership structure – private or 3P.
v. Operating profile of the current waste system.
    1. Days receiving.
    2. Understanding the current recycling programs.
vi. Off-take customers for the renewable energy and by-products.

10. INFRASTRUCTURE (include infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.)

a. BRADAM Energies is the technology provider, operator, and applies a design build methodology to the projects we develop. Therefore, BRADAM would be responsible for the infrastructure of all CER™ Systems required for processing the 2023-2024 reported MSW produced by Miami-DADE County.
    i. The operational unit of the CER™ System is a Process Line for processing 107,500 tons MSW per year. Therefore, 1 (one) Process Line is required to process the 94,798 tons MSW per year for the North Landfill, and 7 Process Lines are required to process the 678,858 tons MSW per year for the South Landfill.
    ii. Infrastructure required:
        1. Access to 3 phase Electrical Grid
        2. Natural gas pipeline

b. Site Footprint (include recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution)
    i. A single CER™ Process Line Facility has a footprint of approximately 5 acres, which includes, receiving/shredding building, maintenance, employee well fare, etc. and sufficient area for haulage truck traffic and an in/out scale system.
    ii. Operation of the single CER™ Process Line at the Miami-DADE County North Landfill would require about 5 acres.
    iii. About 7 CER™ Process Lines will be required to process the MSW received at the South Landfill, based on the information on MSW deposited at the South Landfill for 2023-2024. There will be economy of scale regarding the footprint required for the South Landfill that would require site-specific assessment. For discussion purposes, an estimated footprint of about 17 acres would be required for the 7 CER™ Process Lines.

c. SITE OWNERSHIP (include plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site)
    i. BRADAM Energies (or a special purpose entity) would own and operate the CER™ Systems for processing Miami-DADE County's MSW into renewable energy.
    ii. BRADAM would prefer to lease the land at the Miami-Dade landfills.

d. PERMITTING (include any necessary permitting or regulatory processes necessary to implement the respondent's solution)
    i. For this presentation it has been assumed that appropriate permits are in place and would be remain in effect for the collection and delivery of MSW to the North and South Landfills.
    ii. BRADAM would be responsible for the permitting of the CER™ Process Lines.

e. TIMING (include the estimated timeframe for the implementation of the respondent's solution.)
    i. BRADAM has the financing 'in place' for the CER™ Process Lines at the North and South Landfills.
    ii. An estimated 6 months is considered sufficient for the execution of specific agreements with Miami-DADE County for the land lease to accommodate the CER™ Process Lines footprints, and for the 20-year guaranteed supply of MSW.
    iii. An estimated 6 months will be required for permitting for the CER™ Process Lines at the North and South Landfills. Permitting would start as soon as Item ii above is completed.
    iv. An estimated 18 months, from permitting, will be required for the construction and commissioning of the CER™ Process Line at the North Landfill.
    v. An estimate 36 months, from permitting, will be required for the construction and commission of the 7 CER™ Process Lines for the South Landfill.

11. O&M (include anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution)
    a. BRADAM would be responsible for all O&M for the CER™ Systems.
    b. Bradam facilities contain equipment redundancies which allow our facility to maintain production levels through our maintenance periods. These redundancies coupled with our predictive maintenance program assures that MSW processing capacity is available 365 days/year.

12. **HEALTH/SAFETY/ENVIRONMENT** (include solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).)
    a. The CER™ System includes a comprehensive, computerized monitoring system that monitors the performance of all system components using a 'performance flag' system to identify when any system component's operating parameters change well before any point of crucial operations. The 'flag' system notifies the operators and initiates inspection and, if required, operator actions to bring the system back to specified parameters. This system is critical to meeting specified health, safety and environmental operating criteria and maintaining the name-plate processing and renewable energy production of the CER™ System.
    b. In addition to monitoring equipment and operating parameters the system also monitors for potentially hazardous substances such as carbon monoxide, methane, ammonia, etc.
    c. As previously outlined, the CER™ System is a closed loop process and the only emissions from the facility are from natural gas used to heat the Carbon Recovery Chamber.

13. OTHER INFORMATION/ADVICE

a. PROCUREMENT MODEL (include advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).)

i. The CER™ Systems will be owned and operated by BRADAM or a special purpose entity.
ii. BRADAM is the provider of technology, operator of the facility, and will utilize a design build methodology to erect the facility.
iii. The project is insured by a World class reinsurance company backed by Lloyds of London, for quantity and quality of energy produced.

b. PARTNERSHIPS (include any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.)

i. In all cases we would consider joint ventures or partnerships with other Counties or waste providers to optimize operations and take advantage of any synergies possible.
ii. Public-Private partnership options can be discussed and arranged if desired.

c. ADDITIONAL INSITES (include any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.)

i. The CER™ System effectively and economically processes any carbon-based material into either RNG or bio-methanol. Examples of potential relevance to Miami-DADE County include:
    1. Biosolids from sewage treatment systems. The heat collected from the process can be used in the sewage treatment system.
    2. Leaf and Yard wastes, including damaged vegetation from weather events such as hurricanes.
    3. Seaweed from management of recreational beach properties.
ii. The CER™ System can be readily expanded by adding additional Process Lines to existing facilities, increasing MSW capacity by 107,000 tons each time.
iii. Prevention of negative environmental impacts, and associated legal liabilities from Substances of Concern, including PSAFs (forever chemicals) as a major issue that must be addressed by modern MSW management systems.
iv. Regulations of these PFASs are either in place or scheduled in many regions today. The CER™ System will have site-specific documentation of the destruction of PSAFs.

C6 Energy Services

Market Research Response

Miami-Dade Florida MSW Waste Project

C6 ENERGY SERVICES

4000 TONNE/DAY

RECYCLING SYSTEM &

RENEWABLE ENERGY

GENERATOR

APRIL 2025

GREEN FUTURE, NEW VISION

WHAT WE DO

C6 ENERGY SERVICES HAS DEVELOPED A PROCESS THAT USES STEAM TO TREAT UNSORTED WASTES
(MUNICIPAL, LIGHT INDUSTRIAL, COMMERCIAL & AGRICULTURAL)

TO PRODUCE A CELLULOSE-BASED FIBER FROM WHICH RECYCLED PRODUCTS
(METALS, PLASTICS, GLASS AND BATTERIES)

CAN BE MECHANICALLY EXTRACTED

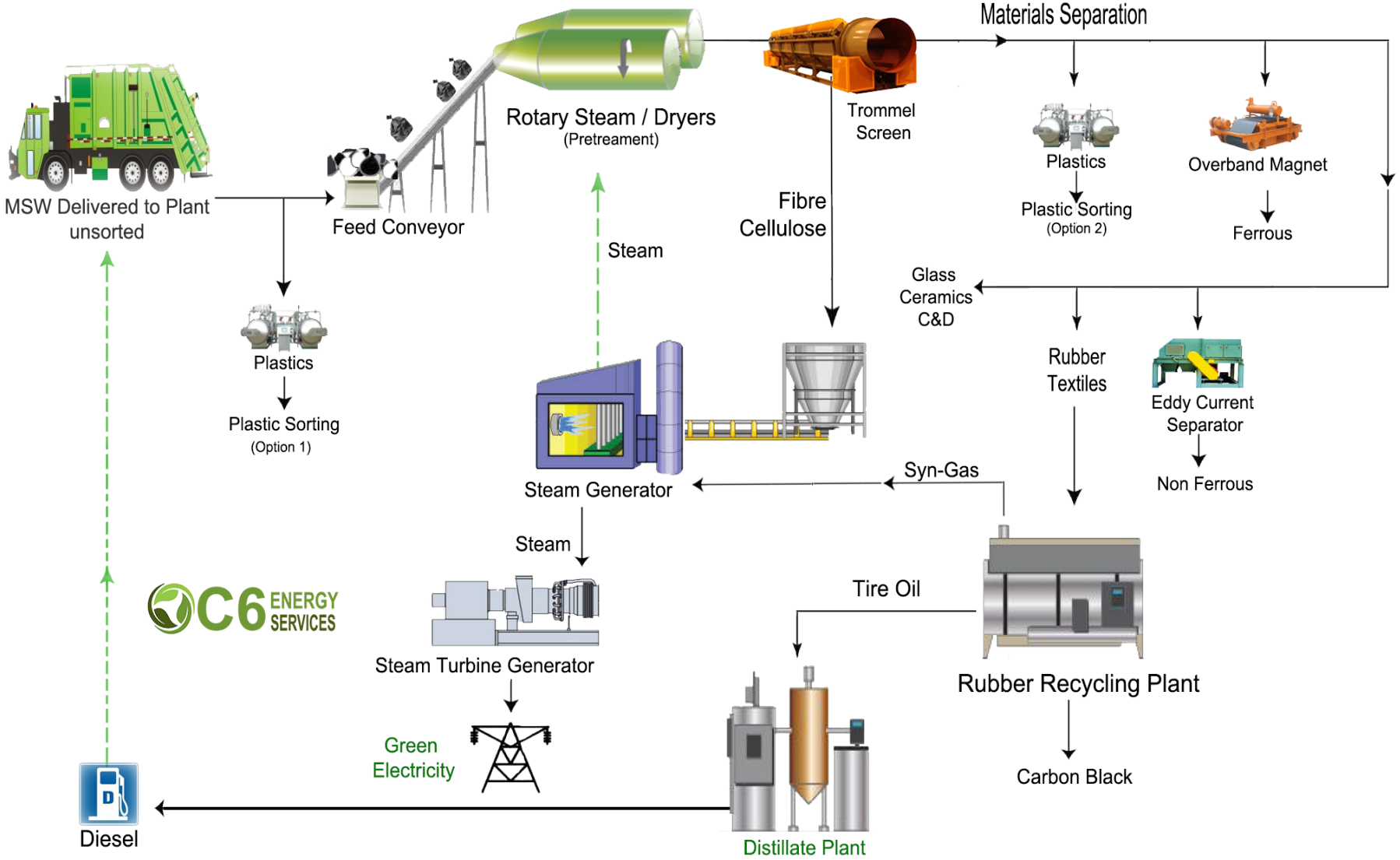
AND SOLD FOR PROFIT.

THE REMAINING FIBER IS THEN TURNED

INTO SEVERAL ENERGY PRODUCTS
(ETHANOL, DIESEL, ELECTRICITY AND SYNGAS)

THAT ARE VERY PROFITABLE.

C6ES MSW to Power Schematic



- MSW has many unique and challenging characteristics and often presents a disposal problem to municipalities and other relevant entities

- MSW starts out as a complex mixture of food waste, glass, metals, yard trimmings, woody waste materials, non-recyclable paper and plastic, construction and demolition waste, rags, and sludge from wastewater treatment. Traditionally, it was dumped into local landfills that are extremely expensive to maintain.

- Not to mention the fact that these landfills are using valuable land, and come with their own potential environmental hazards which must be mitigated.

- C6 Energy has developed waste preprocessing and handling strategies to reduce feedstock variability of MSW streams. This allows for the most economical optimization of specific streams toward recycling, heat, power, fuels, and products.

STEAM TREATMENT AND REGENERATION TECHNOLOGY

'STAR' TECHNOLOGY

UNIQUE PATENTED TREATMENT

- CONTROL WASTE GENERATION

100% ENVIRONMENTALLY SAFE

- PRESERVE NATURAL RESOURCES & THE ENVIRONMENT

100% RECYCLE RATE

- RECYCLE, CONSERVE AND REUSE

RECLAIM LANDFILLS

- ALTERNATIVE TO INCINERATION & LANDFILL

Unique, Patented Treatment

- Mature Technology
- Modular 35-Year Life Span
- Self-Sustaining & profitable project
- Eliminate Costly Segregated Collections
- Wet-Dry Capable Processing
- Grade A Outputs & Green Electricity
- Achieves >98% Recycle Rate

100%
ENVIRONMENTALLY SAFE

- Kyoto compliant Solution for MSW
- Conforms to stringent EU, UK and US air quality standards
- Results Far Exceed IPPC Limits
- 100% recycling & re-use of all process water & steam condensate
- Substantial improvement of air, marine & groundwater quality
- No more land grabbing landfills or expensive incinerators

100% RECYCLE RATE

WTE RECYCLING OPTIONS

- Biodegradable Fibre – Biomass
- Renewable Electricity
- Plastics to Premium Low Sulphur Diesel
- End Of Life Tire Conversion - Gas, Steel, Diesel Fuel & High-value Carbon Black

RECLAIM LANDFILLS

REMEDIATION AND REMOVAL OF LANDFILLS

- Recovery, removal of existing dumpsites and removal of toxic and medical wastes dumped with regular wastes
- Landscaping former landfill sites
- Introducing waste drop off centres with static compactors, regular pick-up, recovery and recycling and transfer stations

C6ES COMPLETE RECYCLING OPTIONS

- Treatment of household hazardous wastes (HHW)
- process hard-to-handle, heat sensitive and viscous materials
- Sanitised metals for full recovery and recycling
- Recovery of all batteries for managed recycling
- avoidance of landfilling heavy metals

C6ES STAR LOCATION REQUIREMENT

- Ideal if adjacent to landfill or electricity grid or existing incinerator
- Requires 3 hectares of land
- Retrofit existing incinerators for pollutant free feedstock and extracted value from recovered recyclates
- Location can easily obtain EPA certification and necessary licenses
- Fully compliant to all EU Directives

C6ES STAR PLANT LAYOUT

Custom built facility designed to satisfy all local needs OR utilization of existing Waste Transfer Stations for fast track start. NIMBY issues of MSW sorting and materials recovery traffic and noise issues already zoned and permitted.

Public drop-off using the static compactors reduce MSW build-up, litter, vermin, odour, disease and harmful scavenging activities by the young, poor and disadvantaged.

CONCLUSION

- Best Alternative to Landfill and Incineration
- Up To 95% Landfill Diversion
- Highest Possible Recycling, Recovery and Reuse Rates
- Renewable Green Electricity & Grade A recyclables
- Creates Socially Responsible, Pollution-Free Environment
- Reduce GHG & Carbon Allowances for landfill diversion
- The city enjoys the Best Available technology (BAT) Best Practical Environmental Option (BPEO), Best Public Value Comparator (BPVC)
- Audited profit share mitigates cost of collection & disposal.

MIAMI-DADE COUNTY WASTE Background

- Miami-Dade County contains 2.7 million residents, divided among unincorporated zones and 34 incorporated municipalities

- The Miami-Dade County government (the County) collects municipal solid waste from approximately 350,000 single-family homes. Current collection fee is $509 / household

- County laws require Miami-Dade have the landfill space and disposal facilities to absorb five years of projected growth in trash collection in order to approve land-use changes needed for new residential and commercial projects outside of city limits.

- The fire that shut down the incinerator plant in Doral forced Miami-Dade to divert garbage to landfills in and out of the county, accelerating the timeline of when the department will run out of space for more trash.

C6ES's approach to producing biodiesel and ethanol rather than focusing primarily on electricity is driven by several factors:

1.Higher Revenue Potential:

The proposal indicates that liquid fuels like biodiesel and ethanol generate significantly higher revenue per unit compared to electricity. This higher revenue stream makes them more attractive from a financial perspective.

2.Process Optimization:

The patented "STAR" steam treatment process is specifically optimized to extract a cellulose-based fiber and valuable chemical components ideal for conversion into liquid fuels. This process naturally aligns with biodiesel and ethanol production rather than electrical energy conversion.

3.Lower Capital Expenditures (Capex):

Producing liquid fuels requires a lower initial capital investment compared to the additional infrastructure needed for electricity generation, such as grid interconnections and storage systems. This reduced Capex makes biodiesel and ethanol production a more cost-effective option.

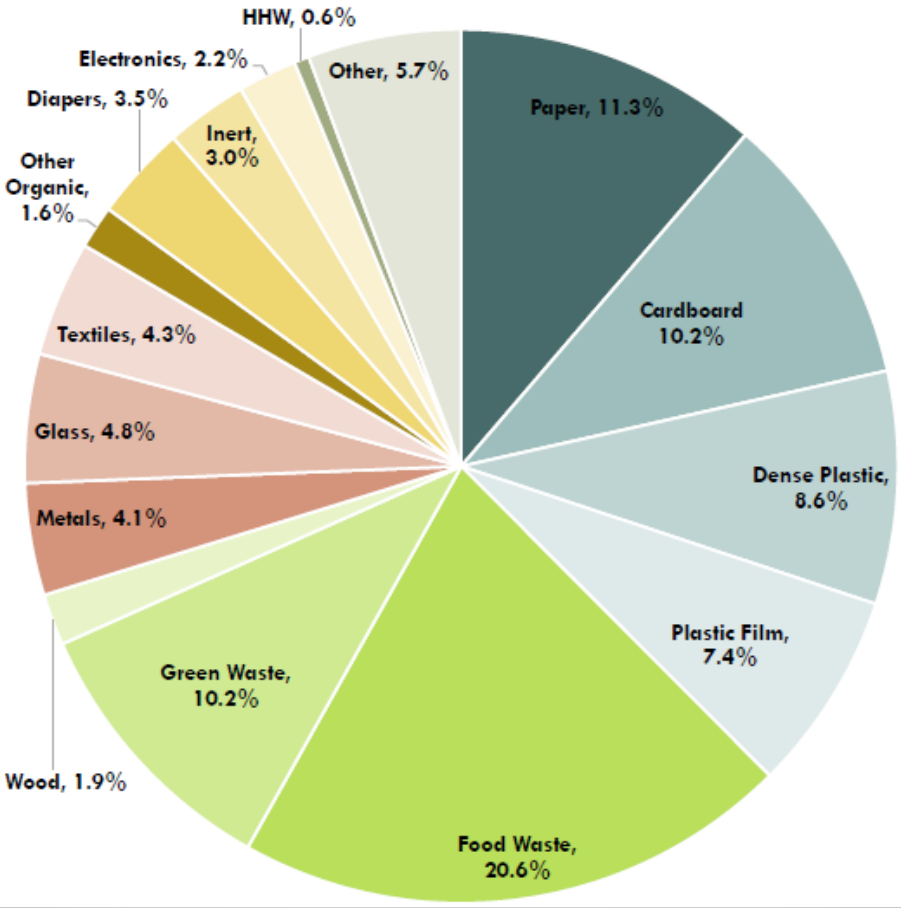
4. **Market and Infrastructure Considerations:**
   Biodiesel and ethanol have established markets and distribution networks, which further reduce the need for additional, capital-intensive infrastructure. Electricity, on the other hand, often demands extra investments for grid integration and energy storage, potentially lowering the overall profitability.

5.Energy Conversion Efficiency:
Liquid fuels offer higher energy density and are easier to store and transport. These factors make biodiesel and ethanol more practical and profitable products in the context of a waste-to-energy facility.

Overall, by prioritizing biodiesel and ethanol production, C6ES leverages their optimized technology to secure higher revenue, reduce upfront costs, and capitalize on existing market structures—making it a strategically sound decision over generating electricity.

2024 MIAMI-DADE COUNTY WASTE COMPOSITION STUDY

Figure 1. Overall MSW Composition Summary



waste composition study was conducted AtkinsRéalis for Miami-Dade County Dec. 2024 Waste Characterization Study www.scsengineers.com

2024 MIAMI-DADE COUNTY WASTE COMPOSITION STUDY

Table 4. Overall MSW Composition Detailed

Material Components	Mean Composition	Standard Deviation	95% Confidence Limits Lower	Upper
PAPER				
Newspapers	0.5%	0.6%	0.4%	0.6%
Magazines	0.4%	0.6%	0.3%	0.5%
Books, Directories, and Catalogues	0.3%	0.9%	0.1%	0.5%
Other Papers	3.3%	1.8%	2.9%	3.6%
Tissue Paper & Napkins	6.5%	2.6%	6.0%	7.0%
Paper Packaging	0.3%	1.2%	<0.1%	0.6%
Total Paper	**11.3%**			
CARDBOARD				
Corrugated Cardboard	4.3%	5.5%	3.2%	5.3%
Non-corrugated Cardboard	5.6%	2.1%	5.1%	6.0%
Composite Cardboard (tetrapack, etc.)	0.4%	0.5%	0.3%	0.5%
Total Cardboard	**10.2%**			
DENSE PLASTIC				
PET #1	2.1%	0.7%	1.9%	2.2%
PVC #3	<0.1%	<0.1%	<0.1%	<0.1%
PP #5	1.9%	0.7%	1.8%	2.1%
HDPE #2	1.3%	0.8%	1.1%	1.4%
LDPE #4	<0.1%	<0.1%	<0.1%	<0.1%
PS #6	1.1%	0.5%	1.0%	1.2%
Other Plastics #7 or unidentifiable	2.2%	1.8%	1.8%	2.6%
Total Dense Plastic	**8.6%**			
PLASTIC FILM				
Plastic Bags	3.6%	1.4%	3.3%	3.9%
Plastic Film Packaging	3.5%	1.8%	3.1%	3.8%
Other Plastic Film	0.3%	0.7%	0.2%	0.4%
Total Plastic Film	**7.4%**			
ORGANICS				
Food Waste	19.4%	7.6%	17.9%	20.9%
Edible Food	1.2%	1.6%	0.9%	1.5%
Green Waste/Garden	10.2%	11.1%	8.0%	12.4%
Animal By-product	0.8%	1.5%	0.5%	1.1%
Other Organic	<0.1%	0.2%	<0.1%	0.1%
Total Organics	**31.7%**			

Material Components	Mean Composition	Standard Deviation	95% Confidence Limits Lower	Upper
WOOD				
Furniture	<0.1%	0.5%	<0.1%	0.2%
Packaging Wood, Pallets, Crates	<0.1%	<0.1%	<0.1%	<0.1%
Other Untreated Wood	0.3%	1.5%	<0.1%	0.6%
Other Painted, Stained Wood	1.5%	2.4%	1.1%	2.0%
Total Wood	**1.9%**			
FERROUS METALS				
Ferrous (Steel)	1.5%	2.7%	1.0%	2.0%
Food and Beverage Cans	0.8%	0.5%	0.7%	0.9%
Aerosol Cans	0.1%	0.2%	0.1%	0.2%
Other Ferrous Metals	0.2%	0.5%	<0.1%	0.3%
Total Ferrous Metal	**2.6%**			
NON-FERROUS METALS				
Food and Beverage Cans	<0.1%	<0.1%	<0.1%	<0.1%
Aluminum Cans	0.7%	0.4%	0.6%	0.8%
Aluminum Foils	0.7%	0.8%	0.5%	0.8%
Aerosol Cans	<0.1%	0.1%	<0.1%	<0.1%
Other Non-Ferrous Metals	<0.1%	0.4%	<0.1%	0.1%
Total Non-Ferrous Metal	**1.5%**			
GLASS				
Green Glass	0.8%	1.0%	0.6%	1.0%
Brown Glass	0.9%	1.2%	0.7%	1.2%
Clear Glass	2.9%	2.2%	2.5%	3.3%
Other Glass	0.1%	0.6%	<0.1%	0.2%
Total Glass	**4.8%**			
TEXTILES				
Clothing, Rags, Sheets, Curtains	3.5%	2.9%	2.9%	4.0%
Shoes, Bags, and Belts	0.4%	0.7%	0.3%	0.6%
Carpets	0.3%	0.8%	0.1%	0.4%
Mattresses	<0.1%	0.5%	<0.1%	0.2%
Total Textiles	**4.3%**			
LEATHER				
Cloth	<0.1%	0.4%	<0.1%	0.1%
Shoes, Bags, and Belts	0.1%	0.4%	<0.1%	0.2%
Other Leather	<0.1%	<0.1%	<0.1%	<0.1%
Total Leather	**0.2%**			

AtkinsRéalis for Miami-Dade County Dec. 2024 Waste Characterization Study www.scsengineers.com

waste composition study was conducted AtkinsRéalis for Miami-Dade County Dec. 2024 Waste Characterization Study www.scsengineers.com

Waste Profile — Miami-Dade FL

Annual Waste Volume	1,460,000 tonnes
Annual Plant Capacity	1,679,000 tonnes
Daily Waste Volume	4,000 tonnes

C6 ENERGY SERVICES

	Item	Percentage	Tonnes
1	Plastic	8.60%	125,560 tonnes
2	Plastic Film	7.40%	108,040 tonnes
3	Paper	11.30%	164,980 tonnes
4	Cardboard	10.20%	148,920 tonnes
5	Waxed Cardboard	0.00%	0 tonnes
6	Textiles	4.30%	62,780 tonnes
7	Rubber	0.50%	7,300 tonnes
8	Leather	0.20%	2,920 tonnes
9	Wood	1.90%	27,740 tonnes
10	Yard Waste	10.20%	148,920 tonnes
11	Furniture/Household	0.00%	0 tonnes
12	Used Oil	0.00%	0 tonnes
13	Carpet / Underlay	0.00%	0 tonnes
14	Cotton	0.00%	0 tonnes
15	Synthetic Fiber	0.00%	0 tonnes
16	Diapers	3.50%	51,100 tonnes
17	Ferrous Metals	2.60%	37,960 tonnes
18	Aluminium	1.40%	20,440 tonnes
19	Copper	0.00%	0 tonnes
20	Lead	0.00%	0 tonnes
21	Non Ferrous Metals - other	0.10%	1,460 tonnes
22	Tin Cans	0.00%	0 tonnes
23	Organic (wet)	0.90%	13,140 tonnes
24	Food Waste	20.60%	300,760 tonnes
25	Hard Vegetable Fiber	0.00%	0 tonnes
26	Expanded Polyester	0.00%	0 tonnes
27	Polyurethane	0.00%	0 tonnes
28	WEE (White Goods)	0.00%	0 tonnes
29	C&D	1.50%	21,900 tonnes
30	Hazardous Chemicals	0.60%	8,760 tonnes
31	Batteries	0.00%	0 tonnes
32	Medical Waste	0.00%	0 tonnes
33	Electronic Waste	2.20%	32,120 tonnes
34	Ash	0.00%	0 tonnes
35	Fine residue	0.00%	0 tonnes
36	Glass - Clear	2.90%	42,340 tonnes
37	Glass - Coloured	1.80%	26,280 tonnes
38	Ceramics, clean inerts	1.50%	21,900 tonnes
39	Kitty Litter	0.00%	0 tonnes
40	Bone / Slaughterhouse	0.80%	11,680 tonnes
41	Dirt (from yard waste)	0.30%	4,380 tonnes
42		0.00%	0 tonnes
43		0.00%	0 tonnes
44	Other	4.70%	68,620 tonnes
	TOTALS	100.000%	1,460,000 tonnes
		40%	Moisture

C6ES WTE RECYCLING PLANT Miami-Dade FL

PROJECT & CAPITAL COST: - CAPEX

Miami-Dade FL

Annual Waste Volume	1,460,000 tonnes
Annual Plant Capacity	1,679,000 tonnes
Daily Waste Volume	4,000 tonnes

C6 ENERGY SERVICES

Plant and Machinery

		US$
1	Freehold Land	
2	Infrastructure Costs	
3	Engineering & Design	
4	Building	
5	Granulation Plant	
6	Processing Plant	
7	Power Generation	
8	Densified Cement Facility	
9	Hazardous Waste Plant	
10	Rubber Processing Plant	
11	Ethanol Biorefinery Plant	
12	Plastics to Diesel Plant	
13	Water Purification	
14	C&D Reformation Plant	
15	Construction Supervision	
16	Miscellaneous	
	Total Plant & Machinery	**US$ 760,705,687**

Service Equipment

		US$
1	Cars	
2	Pickups	
3	Trucks	
4	Fork Lifts	
5	Front Loaders	
6	Collection Vehicles	
7	Static Compactors	
8	Waste Water Plant	
9	Urban Electrification	
10		
11	Miscellaneous	
	Total Service Equipment	**US$ 49,866,708**

Total Capital Expenditures US$ 810,572,395

Operating Cost

	Personnel Cost	US$
1	Operative Plant Staff	
2	Administration	
3	Welfare & Pensions	

Operation Cost

Overheads and Administration

4	Insurance	
5	Standing Charges	
6	Fuel Oil Plant & Vehicles	
7	Chemical Agents & Acids	
8	Plasticisers	
9	Sundry Disposal Costs	
10	Water Purification	
11	Finance Costs on Capital	0%

Operating & Maintenance Costs

12	Routine Replacements	
13	Service Equipment - Opex	
14	Power Generation - Opex	
15	Hazardous Waste - Opex	
16	Rubber Deconstruction - Opex	
17	Ethanol Biorefinery - Opex	
18	C&D Opex	
19	Miscellaneous	
20	EPCM	

Subtotal Operating Cost US$

Interest Cost on CapEx

Total Operating Cost US$ 288,475,966

Summary

Plant and Machinery	US$	760,705,687
Service Equipment	US$	49,866,708
Plant Operating Cost	US$	288,475,966
Total Project Cost	**US$**	**1,099,048,360**

Income-Cost Table

C6ES WTE RECYCLING PLANT **Miami-Dade FL**

Income Stream		Units Produced	Price US$	Per year US$	TOTALS US$
Tonnage based Income					
Gate Fees (all avenues)		1,460,000 tonnes	22	31,426,500	
Collection Fees (all avenues)		1,460,000 tonnes	11	15,490,600	46,917,100
Recycling Income					
Plastic		74,898 tonnes	372	27,862,056	
Glass		68,620 tonnes	8	548,960	
Ferrous Metals		37,960 tonnes	160	6,073,600	
Non Ferrous Metals - other		1,460 tonnes	650	949,000	
Aluminium		20,440 tonnes	1,100	22,484,000	
Purified Water		125,560 tonnes	50	6,278,000	64,195,616
Conversion Income					
Diesel Revenues		282,156 tonnes	950	268,048,153	
Hazardous Waste Revenues		125,560 tonnes	50	6,278,000	
Rubber Process Revenues		7,300 tonnes	1,193	8,706,546	
Ethanol Biorefinery Revenues		358,757 tonnes	950	340,818,901	
Green Electricity	0.0 MW	0 MWh	180	-	
CO2 Allowance Credits		1,387,000 tonnes CO2	25	34,675,000	
C&D Processed Revenues		21,900 tonnes	100	2,192,203	660,718,802

Total Income	US$	771,831,518
Total Cost	US$	336,811,521
Net Income	**US$**	435,019,997

C6ES WTE RECYCLING PLANT

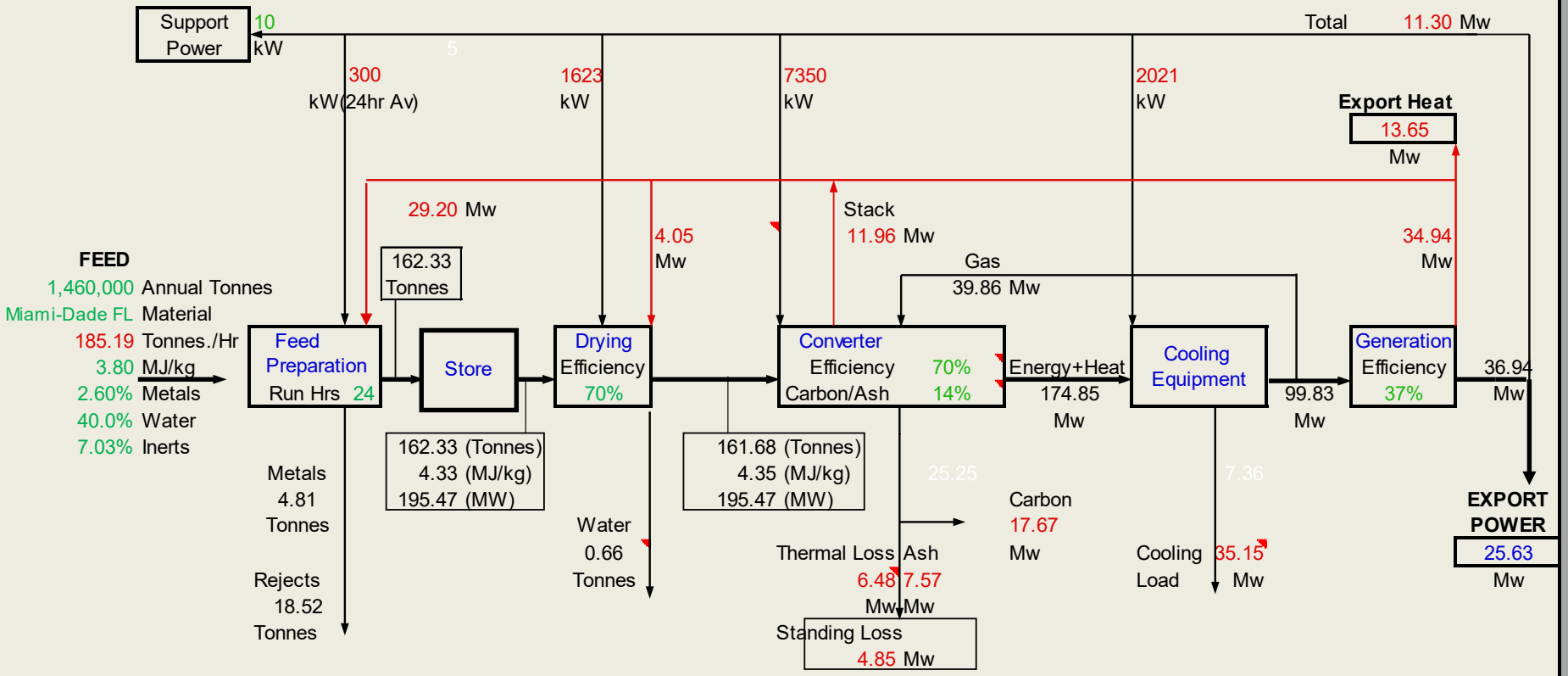
Financial Overview / Summary	Miami-Dade FL	
		April 2025
Plant, Machinery Engineering & Construction	USD 760,705,687	
Service Equipment	USD 49,866,708	
Plant Operating Cost	USD 288,475,966	
Total Project Cost	**USD 1,099,048,360**	
CASH FLOW - 1st Year		
Yearly Earnings	USD 771,831,518	$529 per tonne
Total Yearly Costs	USD 336,811,521	$231 per tonne
EBITDA	USD 435,019,997	$298 per tonne
EBITDA Margin	56%	
Months to Break-even	35 months	2.9 years

MASS ENERGY BALANCE

C6ES WTE RECYCLING PLANT	Energy Balance Sheet	Miami-Dade FL

Number of Units	98

Feed Material	161.68	Dry Tonnes/Hr



Annual Data

			Service Factor	90%			
Energy Conversion	71.5%	(Excluding Parasitics)	Total Dry Feed	1274653	Tonnes	Gas Parasitic	28.5%
Plant Efficiency	13.1%	(Electrical Export)	Total Plant Feed	**1460000**	Tonnes	Elect Parasitic	30.6%
Conversion	0.16	MWe Export/Tonne Input(Dry)	Total Export Power	**202092**	MweHrs		

EXECUTIVE SUMMARY

- LOCATION: - MIAMI-DADE FLORIDA
- CAPITAL COST: - USD $1,100 MILLION
- ANNUAL REVENUES: - USD $771 MILLION
- UP TO 98% RECYCLED
- DAILY TONNAGE OF MSW: - 4,000 TONNES (FUTURE GROWTH)
- AVERAGE EBITDA OVER 12 YEARS
  USD 612 MILLION OR $420 PER TONNE

THE WAY FORWARD

- A TRIED AND TESTED, PROVEN TECHNOLOGY ADOPTED BY 18 COUNTRIES WITH KYOTO CARBON ALLOWANCES TRADING
- THE INTRODUCTION OF A REGULAR SCHEDULED SOLID WASTE COLLECTION SERVICE
- NO MORE LAND ALLOCATION FOR LANDFILL USE
- MAY IT LEAD TO A MORE SUSTAINABLE WORLD,. IT IS, AFTER ALL, THE OBLIGATION OF MAN TO ACCEPT CHANGE….. GUARANTEED TRANSPARENCY AND PROFIT SHARE
- MITIGATION AND OFFSET OF MOST OF MSW COLLECTION & DISPOSAL COSTS
- TIME IS OF THE ESSENCE
- 100% INVOLUNTARY PARTICIPATION
- 98% RECYCLING RATE FOR REAL CASH
- MUTUAL COMMITMENT
- DELIVERY 12-15 MONTHS

C6 Energy Services Inc
2221 Suffron Hills Court,
Nevada 89044, USA
Paul McGuire +1 702 254 9771

Email: paul@c6es.com
Web: www.c6es.com

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C6 ENERGY SERVICES has developed a process that uses heat to treat unsorted wastes (municipal, industrial, commercial & agricultural)

to produce a cellulose-based fibre from which recycled products (metals, plastics, glass and batteries)

can be mechanically extracted and sold for profit.

The remaining fiber is then turned into several energy products (Ethanol, Diesel, Electricity and Syngas)

that are VERY profitable.

Solid Waste Management Solutions

Responses Miami-Dade

Paul McGuire

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Phone: +1 702 254 9771

Brian Wilson

brian@c6es.com

Phone: +61 413 930 863

Responses

Responses should address the requested information below and indicate "not applicable" when a particular item cannot or will not be addressed by respondent. Responses should be submitted to the County's contact person indicated below via email no later than **April 14, 2025**.

C6ES expressly welcomes and is fully prepared to consider and enter into a Public-Private Partnership (P3) contract with the State of Florida or Miami-Dade County for the design, financing, construction, and operation of the proposed waste-to-energy facility. This approach aligns with the company's experience in collaborating with public entities and supports the County's goal of implementing sustainable, high-performance infrastructure through innovative delivery methods.

A. Respondent

Name and Contact Information

- **Name:** C6 Energy Services Inc.
- **Address:** 2221 Suffron Hills Court, Nevada 89044, USA
- **Contact:**
  - **Name:** Paul McGuire
  - **Phone:** +1 702 254 9771
  - **Email:** paul@c6es.com
  - **Website:** www.c6es.com

Brief Description:
C6 Energy Services specializes in an innovative waste-to-energy approach using its patented "STAR" steam treatment and regeneration technology. This process treats unsorted municipal, light industrial, commercial, and agricultural wastes to separate a cellulose-based fiber (from which recyclables such as metals, plastics, glass, and batteries can be extracted) while converting the remaining material into valuable energy products such as ethanol, diesel, electricity, and syngas. This technology is mature, has been proven in 18 countries, and is designed for high recycling efficiency and environmental compliance.

B. Waste Management Solutions

1. **Solution**
   C6ES's solution is a comprehensive waste-to-energy recycling system that employs its unique "STAR" steam treatment process. The system is designed to process unsorted municipal solid waste (MSW) by:
   - Separating a cellulose-based fiber from which recyclable materials are extracted.
   - Converting the residual fiber into multiple energy products (ethanol, diesel, electricity, and syngas).
   - Providing an alternative to conventional incineration and landfilling by achieving a recycling rate of over 98% and diverting up to 95% of waste from landfills.

2. **Effectiveness**
   - **Proven Technology:** The process is already in use in 18 countries, demonstrating its reliability.
   - **High Performance:** It offers significant landfill diversion and effective recycling of complex waste streams.
   - **Flexibility:** The technology is designed to handle various waste compositions efficiently.

3. **Quantity**
   - **Annual Processing:** The plant is designed to process approximately 1,000,000 tonnes of waste per year.
   - **Capacity:** It has an annual plant capacity of 1,150,000 tonnes, with a daily throughput of around 2,740 tonnes.

4. **Technologies**
   - **Core Process:** Patented steam treatment and regeneration ("STAR" technology)
   - **Recycling Technologies:** Mechanical extraction of recyclables (metals, plastics, glass, batteries) from a cellulose-based fiber.
   - **Energy Conversion:** Production of renewable energy products such as ethanol, diesel, electricity, and syngas.

5. **Benefits**
    - **Environmental Impact:** Achieves a >98% recycling rate and significantly reduces landfill use, lowering greenhouse gas emissions.
    - **Economic Advantage:** Generates multiple revenue streams from both recyclable materials and energy products, offering attractive profit margins.
    - **Sustainable Design:** Modular design with a 35-year life span, self-sustaining, and compliant with stringent environmental standards (EU, UK, and US).

6. **Challenges**
    - **Site Requirements:** Implementation ideally requires a site of approximately 3 hectares, located adjacent to existing infrastructure (landfill or incinerator) or near an electricity grid.
    - **Regulatory and Permitting:** Obtaining necessary permits and EPA certification while meeting local zoning and air quality standards.
    - **Mitigation Strategies:** Plans include retrofitting existing facilities (e.g., waste transfer stations or incinerators) and leveraging proven waste preprocessing strategies to manage feedstock variability.

C. Financial Approach

1. **Costs**
    - **Capital Investment:** The proposal estimates a total project cost of approximately US$941.6 million.
    - **Breakdown:**
        - **Capital Expenditures:** About US$714.66 million, covering plant machinery, engineering, design, and construction.
        - **Operating Costs:** Approximately US$226.9 million per year for operations, maintenance, and service equipment.

2. **Funding Model**
    - **Structure:** The project is positioned as a self-sustaining, profitable venture with strong revenue generation potential.
    - **Options:** Funding may be structured through **public-private partnerships (P3s)**, private financing, or a mix of federal, state, and local grants and tax credits.

- **Profit Sharing:** The proposal emphasizes an **audited profit share** model to help offset waste collection and disposal costs.
- **Partnership Intent:**
  C6ES expressly welcomes and is fully prepared to consider and enter into a **Public-Private Partnership (P3)** contract with the **State of Florida** or **Miami-Dade County** for the design, financing, construction, and operation of the proposed waste-to-energy facility. This approach aligns with the company's experience in collaborating with public entities and supports the County's goal of implementing sustainable, high-performance infrastructure through innovative delivery methods.

3. **Revenue**
   - **Revenue Streams:**
     - **Gate and Collection Fees:** Income derived from waste handling on a per-tonne basis.
     - **Recycling Income:** Revenue from recovered recyclables including plastics, glass, ferrous and non-ferrous metals, and purified water.
     - **Conversion Income:** Earnings from energy products such as diesel, ethanol, green electricity, CO_2 allowance credits, and processed construction & demolition (C&D) materials.
   - **Financial Performance:** Annual revenues are projected at around US$517.8 million with a net income (EBITDA) of approximately US$261.8 million, resulting in an EBITDA margin of 51% and a break-even point at about 55 months.

D. Implementation Approach

1. **Infrastructure**
   - **Facility Options:** The solution can be implemented as a custom-built facility or through retrofitting existing waste transfer stations/incinerators.
   - **Role:** C6ES would serve as the technology provider, design-builder, and operator throughout the project lifecycle.

2. **Size**
   - **Site Requirements:** The recommended facility footprint is around 3 hectares, sufficient to accommodate the modular plant layout and associated infrastructure.

- **Location Considerations:** Ideally sited adjacent to a landfill, incinerator, or the electricity grid to maximize operational synergies.

3. **Site Ownership**
   - **Approach:** The proposal favors retrofitting existing facilities to minimize the need for new land acquisition. This may involve partnerships with local authorities or lease arrangements.

4. **Permitting**
   - **Regulatory Compliance:** The project will require obtaining EPA certification and meeting local, state, and international (EU/UK/US) air quality and environmental standards.
   - **Mitigation:** A proactive approach to permitting is planned, including leveraging the technology's track record of compliance with stringent standards.

5. **Timing**
   - **Implementation Timeline:** The project is estimated to be delivered within 12-15 months from commencement, ensuring a rapid start of operations.

6. **Operations & Maintenance (O&M)**
   - **Requirements:** The facility will require dedicated plant staff, routine maintenance of plant machinery, and ongoing adherence to environmental and safety standards.
   - **Design Life:** The modular system is designed for a 35-year operational lifespan with planned routine replacements and upgrades factored into the operating costs.

7. **Health/Safety/Environmental**
   - **Environmental Safety:** The process is 100% environmentally safe, with complete recycling of process water and condensate, and it eliminates the need for new landfills or incinerators.
   - **Public Health:** It is designed to minimize emissions, noise, and odor, thereby protecting human health and reducing environmental impacts.

E. Other Information/Advice

1. **Procurement Model**
   - **Recommendation:** C6ES recommends a **Public-Private Partnership (P3)** or a design-build-operate model to ensure both economic efficiency and operational accountability. This enables cost-effective implementation while

leveraging private-sector innovation and investment — to maximize economic and environmental benefits.
    - **Rationale:** This model helps align incentives, ensures transparency, and supports the audited profit-sharing mechanism inherent in the project.

2. **Partnerships**
    - **Regional Collaboration:** The proposal suggests that constructing a larger regional waste-to-energy facility in collaboration with neighboring municipalities or state agencies could yield economies of scale and further optimize waste management outcomes.
    - **Integrated Approach:** Alternatively, combining the facility with existing waste disposal methods (e.g., landfills or hauling) may offer additional flexibility and resilience in waste management strategies.

3. **Additional Insights**
    - **Proven Track Record:** The technology's success in 18 countries underscores its maturity and reliability.
    - **Economic and Environmental Benefits:** With rapid implementation (12-15 months) and a break-even period of roughly 55 months, the solution provides an attractive mix of financial viability and environmental sustainability.
    - **Call to Action:** Given the urgency in addressing waste management challenges, the proposal emphasizes that "time is of the essence" and encourages prompt action to secure both environmental and economic benefits.

Cambridge Project Development

Market Research Response

CAMBRIDGE
Project Development Inc.

Miami-Dade County Solid Waste Solutions
Market Research Request

Response Submitted April 14, 2025

SWEDISH TECHNOLOGY
ROUND BALING OF MSW

Minimizing Costs for:

- **MSW Export**

Contact:

"I am always available to respond to you, our esteemed Client, on any item, large or small…"

Leonard N. Enriquez, President & Founder
Cambridge Project Development Inc.
Tel: 305-926-3309
Email: LNE@cambridgeprojectdev.com

Representing Flexus Balasystem AB of Sweden in North America:

Flexus
BALASYSTEM

Cambridge Project Development Inc.
1232 Riverbend Drive, Labelle. Florida USA / Tel: 1-305-926-3309
Email : LNE@cambridgeprojectdev.com

VIA EMAIL

April 14, 2025

To:
Saba Musleh, CPPD
Negotiator
Strategic Procurement Department
saba.musleh@miamidade.gov

CC:
Ross Byers, Project Manager
AtkinsRéalis
ross.byers@atkinsrealis.com

Subject:

Swedish Technology Round Baling of MSW (Municipal Solid Waste)

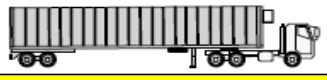
Dear Negotiator Musleh and Team:

Our solid waste planning & engineering firm, Cambridge Project Development Inc ("Cambridge") represents Flexus Balasystem of Sweden AB ("Flexus") here in the United States. Cambridge, founded in 2001, is a registered vendor with Miami-Dade County. I and our staff have been active in the Solid Waste sector in southern Florida since 1991.

On behalf of our Cambridge team and our partners at Flexus of Sweden, it is our genuine pleasure to submit to you this present Response to your Requirement for

MSW Solutions / Market Research. Flexus **Round Baling** has been implemented by solid waste executive teams at +500 facilities in more than 45 countries around the world as a result of its **immediate and relatively inexpensive benefits** for MSW Export and MSW Waste to Energy. **In consideration of the reader's time, the core strategies of our Response approach are summarized in the following two tables of Figure 1.0 and Figure 2.0:**

Figure 1.0	
For Transfer (Export Loadout) Facilities:	
Major Capital and O&M Savings: New buildings or other Civil Works are optional (they can be added much later, if desired):	
1.1	Flexus Round Balers **routinely operate out of doors** all over the world; Typical machine lifetime is over 1 million Bales prepared.
1.2	Flexus Round Bales are **routinely stored out of doors** all over the world (sometimes for decades).
1.3	Flexus Round Baling operations are "Plug and Play" (setup in less than 2 hours) and totally Mobile; **They can be moved quickly as needed between the multiple Transfer (Export Loadout) locations in the County System.**

Figure 2.0	
For Rail and Road Transport:	
Capital and O&M Savings-Maximum Carbon Emissions & Fuel Savings: Zero Shipping Containers to be Purchased, then continuously Hauled Back and Forth for decades:	
2.1	Round Bales save Fuel and Carbon emissions over hundreds of Rail round trips, **since the weight of Shipping Containers is absent**; weight of plastic wrapping is only about 3.5 lbs (0.18 %) (out of a typical MSW Round Bale of 2,000 lbs (one ton).
2.2	Round Bales save Fuel and Carbon emissions over hundreds of Tractor-Trailer round trips, **since the weight of the Walking Floors and Trailer Walls is absent**; a standard Flatbed Trailer works fine with the Round Bales.
2.3	Flexus Round Bales remain Odorless and Weathertight for years or decades; **Railcars & Tractor-Trailers can be staged in or pass in transit near populated areas without odor, vector, or leachate impacts.**

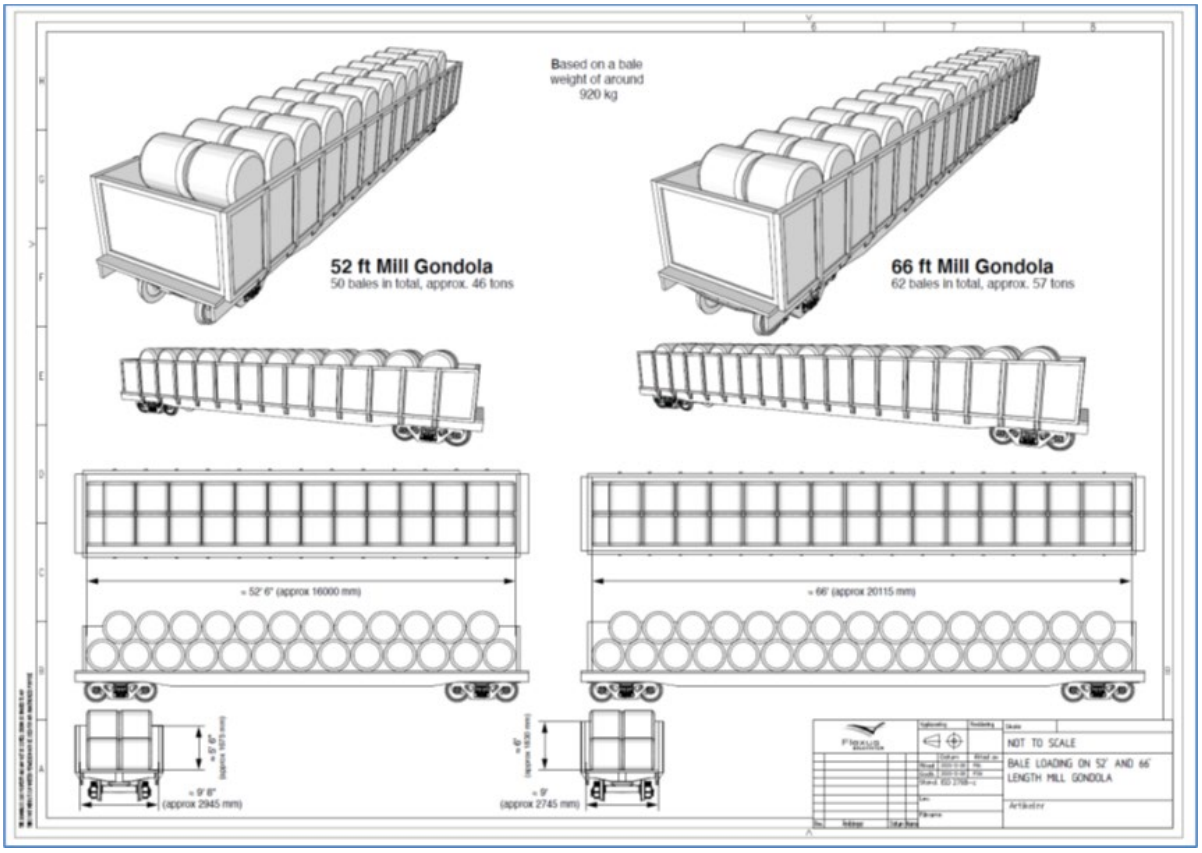


Figure 3.0-Loading Arrangement for up to 60 US short tons MSW per Gondola-Type Railcar with odorless Flexus Round Bales; no Shipping Containers or other covers are needed

Overall, our intent is to offer the County a rapid means of accelerating the export of MSW to points outside the County; there is no need to delay field deployment and implementation of the Flexus Round Baling solution for months or years.

There is an understandable sense of urgency in implementing new MSW Management Solutions within the County SW System, in order to preserve existing but rapidly depleting in-County landfill capacity, especially at the South Dade Landfill facility. We can begin to implement the Flexus Baler solution within months, not years. At the moment, export tonnage to points outside the County is limited by the speed with which Transfer (Loadout) Facilities (both Rail and Road) can be set up and put into full operations.

Some of these Road or Rail "Export" activities have already begun, but rapid export tonnage expansions are still needed in order to take advantage of existing

and new disposal agreements to facilities outside the County, thereby preserving rapidly decreasing landfill capacity within the County SW System, especially at the South Dade Landfill facility.

We propose to supply the **"World Gold Standard / Quality Swedish Steel"** Flexus Round Baler units directly to the County through the Strategic Procurement unit. Nevertheless, the County would have the option of operating the Flexus Round Balers with its own personnel, or through contractors to the County. Such County contractors can be required to utilize the Flexus Round Balers by County procurement / contracting specifications.

Rapid Implementation and Deployment of 6 months or less per Round Baling unit: Typical production lead time is 3 to 5 months per Baler Unit order production lead time + 2 weeks transport from Sweden to Port Miami + 2 to 3 days setup, training and commissioning); No need for new buildings or other Civil Works (these Civil Works can be added months or years later if desired).

The Baling operation served by Railcars can be set up quickly at existing Rail spurs, or for Truck (Road) export, can be set up at existing Transfer Locations or at newly identified Transfer Locations. The totally mobile Typhoon needs only a flat, non-flooding spot to set up. The goal is total flexibility for the County export system, which should allow for adjustments as the MSW flow can change from season to seas, year to year, or decade to decade.

We note here that the Flexus Round Balers are a "one of a kind product" (in the world), since no other Round Baler in the world was engineered and built from "day one" for use with normal, unsorted MSW. Other available balers are either "Square" (Rectangular) Balers using wires for shape retention, or they are much less durable Agricultural Balers retrofitted for use with MSW (but suffering lower reliability due to the materials used in their construction. We believe that this would justify a sole source / negotiated procurement process, especially considering the urgency of expanding Exports from current levels.

****

We at Cambridge and our partner Flexus of Sweden offer our sincere thanks to the County for this opportunity to contribute to the historic effort toward resolution of its large-scale Solid Waste Management needs. We certainly look

forward to meeting with the County team at the earliest opportunity in order to expeditiously advance this urgent procurement.

Most Cordially,

Leonard N. Enriquez, President
Cambridge Project Development Inc

Figure 4.0-Approximately 22,000 Tons of MSW in Neat, Stable Storage awaiting transport to a Waste to Energy plant (Switzerland)

This Response Document

We have followed the format provided by the County in its request for Market Research, as follows:

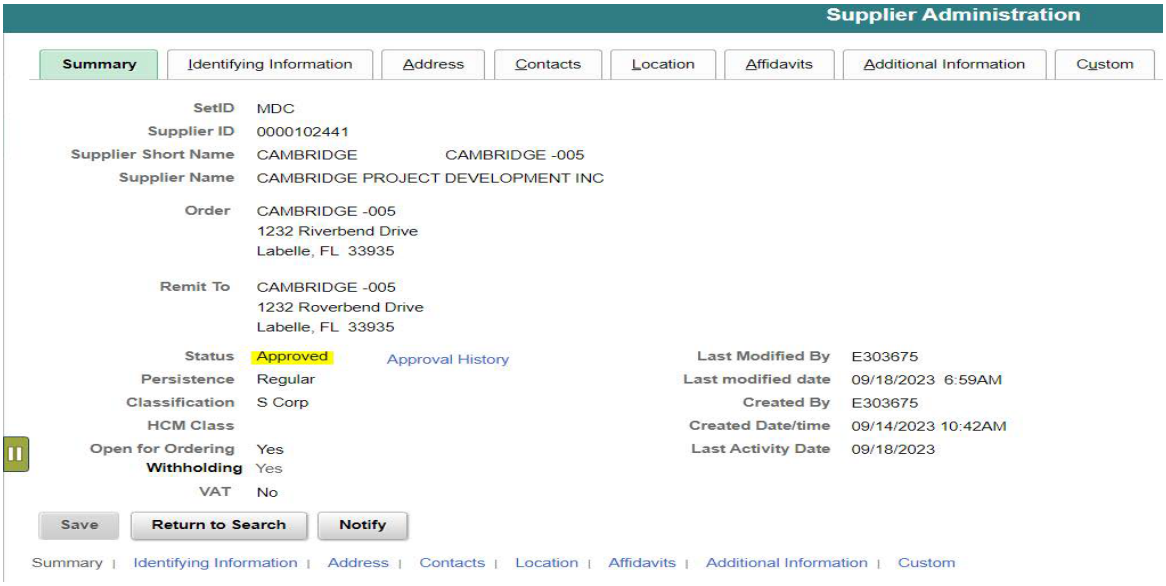
A. Respondent

Our respondent's name and address are:

Leonard N. Enriquez, President
Cambridge Project Development Inc.
LNE@cambridgeprojectdev.com
Tel. 1-305-926-3309

Attachment A hereto presents an overview slide set for the outstanding line of Round Balers engineered by our partner Flexus Balasystem of Sweden AB ("Flexus"). For a brief description of Respondent's history, years of experience, etc., please see **Attachment B** hereto, which contains a Statement of Qualifications (SOQ) for Cambridge. **Cambridge Project Development Inc is a certified vendor registered with Miami-Dade County** as reflected in the following record received from the County's Strategic Procurement Division effective
9/18/2023, as shown in Figure 5.0:

Figure 5.0



Our (Cambridge) categories for the County's MACV Pool are:

91832 Consulting Services (Not Otherwise Classified)
91843 Environmental Consulting
91846 Feasibility Studies, Consulting
91858 Governmental Consulting
91875 Management Consulting

B. Waste Management Solution

1. Solution

The Flexus Round aler (Typhoon model) produces about 30 Round ales per hour, depending on local operational conditions. Each ale of SW will weigh on the order of one (1) ton of 2,000 lbs.

Each Round ale is about 4 feet in diameter and 4 feet high. This gives each one a volume of about 1. cubic yards, as calculated below in Figure .0:

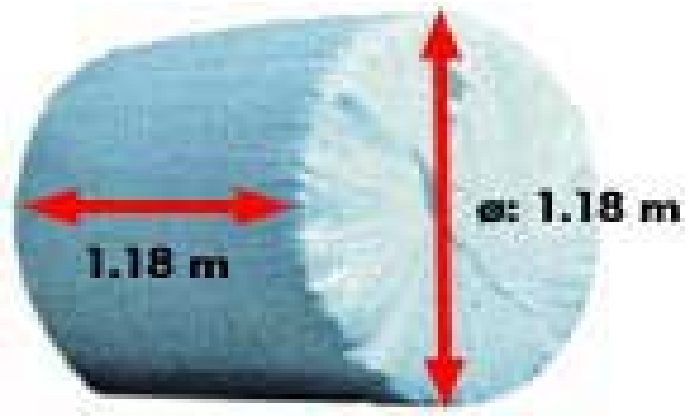


Figure 6.0

Bale Sizing:
Diameter = 1.18 meters (3.9 ft)
Height = 1.18 meters (3.9 ft)
Total Volume = 1.29 m3 (1.68 Cubic Yards)
Volume = Area * height of Cylinder
Area = * r2
Area = 3.14159 * (0.59 meters * 0.59 meters)
Area = 1.09 m2
Volume = 1.09 m2 * 1.18 m
Volume = 1.29 m3

The Flexus Typhoon can be set up and begin working in a few hours. It is truly a "plug and play" unit, which can be connected to a nearby power pole (or a generator) with minimal or no Civil Works. It is operated by only two individuals, one to load MSW into the infeed hopper, and one to move the completed bales to a stacking area.

An engineer from the factory in Sweden will come to the County facilities for a few days to unpack each unit, train local Operations and Maintenance personnel, and run final acceptance tests. Flexus is renowned worldwide for its excellent customer support after startup. Also, we at Cambridge, based in Southern Florida, will remain locally available to address any needs or adjustments over time as required from the County, as a key customer.

No specialized equipment is needed, and the unit comes from the factory in Sweden complete with a full set of tools and spare parts, as well as a Bale Grab unit to move the completed bales from the output roller type conveyor. MSW can be fed into the large infeed hopper by standard Wheel Loader, Telehandler, Excavator, or a Material Handler.

Figure 7.0-The Typhoon general arrangement during operations. Note large infeed (also levelling) hopper with wide incline conveyor on the right-hand side of the image, and the final infeed incline conveyor feeding directly into the unit's compaction chamber.

For removal of prepared (compacted and already wrapped) Round Bales from the output conveyor, a Telehandler (for taller stacking if desired to minimize storage area footprint) is recommended. Again, the Typhoon comes from the factory in Sweden with a two-piston (hydraulic) Bale Grab that ensure that the clean uniform shape of the Round Bale is not changed during handling. The Bale Grab can be fitted to many types of commonly available mobile equipment.

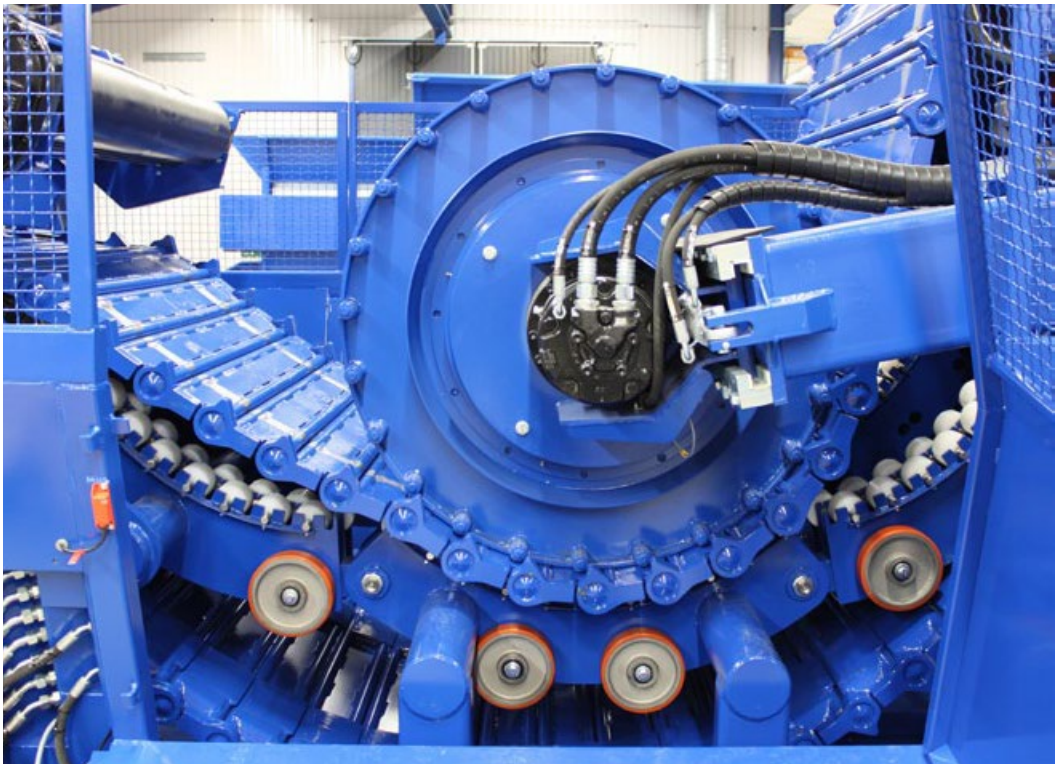


Figure 8.0- High MSW-Compacting pressures are developed by the Typhoon's special hydraulics just prior to wrapping: Highest quality Swedish Steel is used throughout the units for maximum durability.

Figure 9.0- Flexus engineering team from Sweden on setup and training of local personnel. Note wrapper rolls below the output conveyor.

2. Effectiveness

Perhaps the best measure of effectiveness of the Flexus technology is the large fleet of over 500 Flexus Round Baler units deployed around the world in over 45 countries. These units work continuously, day after day, often at 16 or more operating hours per day (with 8 hours on a third shift available for routine lubrication / maintenance. **This is not a theoretical / developmental technology**. Rather, the Flexus Round Baler line would bring a thoroughly proven technology to the County's Solid Waste Management System, with the added bonus of a very rapid implementation (of months, not years).

3. Quantity

Figure 10.0-Round Bale stack awaiting transport to a Waste to Energy facility.
Note standard Telehandler used for stacking to nine (9) bale rows high.
Square (Rectangular) bales will slide sideways if stacked over 3 to 4 rows high.

The Flexus "Typhoons" are the fastest and toughest MSW Round Balers in the world. Figure 11.0 below shows a scenario where a set of 12 Flexus Typhoon units could prepare for Transfer / Loadout / Export about 1.0 million tons per year. **This would of course take much of the pressure off the remaining airspace at the South Dade andfill facility and allow this precious commodity to be conserved:**

Figure 11.0

Flexus Units Deployed [a]	Baling Days per Week [b]	Baling Hours per Day [b]	Bales per Hour Prepared [c]	Tons per Bale [c]	Tons per Day Baled	Tons per Week Baled	Tons per Year @ 52 Weeks per Year	Tons per Year @ 52 Weeks per Year (Cumulative)
Parameter:	A	B	C	D	E = B * C * D	F = E * A	G = F * 52	Cumulative Across 6 Units
1	4.0	14.0	30.0	1.0	420	1,680	87,360	87,360
2	4.0	14.0	30.0	1.0	420	1,680	87,360	174,720
3	4.0	14.0	30.0	1.0	420	1,680	87,360	262,080
4	4.0	14.0	30.0	1.0	420	1,680	87,360	349,440
5	4.0	14.0	30.0	1.0	420	1,680	87,360	436,800
6	4.0	14.0	30.0	1.0	420	1,680	87,360	524,160
7	4.0	14.0	30.0	1.0	420	1,680	87,360	611,520
8	4.0	14.0	30.0	1.0	420	1,680	87,360	698,880
9	4.0	14.0	30.0	1.0	420	1,680	87,360	786,240
10	4.0	14.0	30.0	1.0	420	1,680	87,360	873,600
11	4.0	14.0	30.0	1.0	420	1,680	87,360	960,960
12	**4.0**	**14.0**	**30.0**	**1.0**	**420**	**1,680**	**87,360**	**1,048,320**

Notes

[a] Case assumes 2 units at each of up to 6 County Transfer / Export Loadout locations = 12 Units.

[b] Varies with tonnage throughput directed to each Transfer / Export Loadout location. Example case for parameters A and B is shown.

[c] Varies with local operating factors.

4. Technologies

The Flexus Round Balers have been included as a "Best Available Techniques" or "BAT" for waste management by the European Union:

COMMISSION IMPLEMENTING DECISION (EU) 2019/2010

of 12 November 2019

establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration

(notified under document C(2019) 7987)

(Text with EEA relevance)

The Typhoon units use proven technologies, probably less complex than a standard piece of heavy equipment such as a Caterpillar D8 dozer, commonly used at MSW handling facilities worldwide. The Flexus units come with the technology for the following straightforward items:

a. **Electric Motors driving Hydraulic Pressure Units** to efficiently generate very high compression values for incoming MSW, resulting in maximum achievable compaction (and therefore greatly increased storage and

transport efficiency.) Therefore, if the "loose" MSW density in the infeed to the Typhoon is, for example 500 kg / m3 (650 lbs / Cubic Yard or 24 lbs / Cubic Foot or 0.3 US tons per Cubic Yard), a Bale Density could be achieved of 1500 kg / m3 (1,941 lbs / Cubic Yard or 72 lbs / Cubic Foot or 1.0 US tons per Cubic Yard).

b. **Programmable Logic Controllers (PLC's) for fully automated / remote control operation.** Therefore, only two (2) individuals positioned in standard mobile equipment units (Telehandler, Wheel Loader, Grapple Excavator, etc.) are required to (a) feed the Typhoon and to (b) remove completed Bales from the output roller conveyor. The PLC is equipped with a control panel with an LCD display. Wile manual operation of the process is possible from the control panel, a remote control unit is included. The operator can select: (a) pressure in the compression chamber; (b) amount of initial (shape holding) PE or Polyethylene net, and (c) the amount of LDPE (Low Density Polyethylene) wrapping per Bale. An operating light is also included to alert operators when the process stops for any reason.
c. **Surface Treatments:** (a) Sand Blasting in accordance with Sa 2B, except for parts made from corrosion resistant materials; and (b) Painting with two-component, high solid finishing paint Duasolid is used, with paint thickness of 80 microns; standard colors are Blue (RAL 5017).
d. **Minimal Use of Plastic per Bale and No Wires** (as in Rectangular Square Bales); typical use per Bale is 6 layers with only about 1.3 kg (3.5 lbs per 2,000 lbs Bale). All wrapping material is readily available from sources within the United States. Removed plastic wrapping can be easily recovered and recycled.
e. **No need for high maintenance MSW "log" cutting blades** (as with Rectangular / Square Balers).
f. **Electrical Supply: 3-phase 400 V/ 60 Hz.**

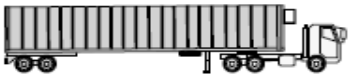
5. Benefits

We feel that Benefits of the Flexus Round Baling system are best summarized in Figures 1.0 and 2.0 from above, reproduced below:

Figure 1.0

For Transfer (Export Loadout) Facilities:	
Major Capital and O&M Savings: New buildings or other Civil Works are optional (they can be added much later, if desired):	
1.1	Flexus Round Balers **routinely operate out of doors** all over the world; Typical machine lifetime is over 1 million Bales prepared.
1.2	Flexus Round Bales are **routinely stored out of doors** all over the world (sometimes for decades).
1.3	Flexus Round Baling operations are "Plug and Play" (setup in less than 2 hours) and totally Mobile; **They can be moved quickly as needed between the multiple Transfer (Export Loadout) locations in the County System.**

Figure 2.0

For Rail and Road Transport:	
Capital and O&M Savings-Maximum Carbon Emissions & Fuel Savings: Zero Shipping Containers to be Purchased, then continuously Hauled Back and Forth for decades:	
2.1	Round Bales save Fuel and Carbon emissions over hundreds of Rail round trips, **since the weight of Shipping Containers is absent**; weight of plastic wrapping is only about 3.5 lbs (0.18 %) (out of a typical MSW Round Bale of 2,000 lbs (one ton).
2.2	Round Bales save Fuel and Carbon emissions over hundreds of Tractor-Trailer round trips, **since the weight of the Walking Floors and Trailer Walls is absent**; a standard Flatbed Trailer works fine with the Round Bales.
2.3	Flexus Round Bales remain Odorless and Weathertight for years or decades; **Railcars & Tractor-Trailers can be staged in or pass in transit near populated areas without odor, vector, or leachate impacts.**

6. Challenges

With such a proven technology worldwide, technical or operational risk is realistically negligible.

C. Financial Approach

1. Costs

For each Typhoon unit at 30 Bales per hour or more, capital investment, including transportation, minimal site preparation is probably on the order of $900 thousand to $1.1 million. Therefore, the scenario with 12 Typhoon units described above in **Figure 11.0** above would have a capital investment on the order of $12.0 million. Operating cost varies with local conditions, but can be targeted to be on the order of $5.00 per ton. Therefore, in the Figure 11.0 scenario above, Operating cost would be $5.00 per ton * 1.0 million tons per year = $5.0 million per year.

For context, we note here that this $5 million per year of operating cost would be offset by the value of the in-County disposal capacity saved, which would allow for savings on the order of: $35 per ton (possible minimum replacement value of in-County landfill capacity) * 1.0 million tons per year = $35.0 million per year. This savings would make for a payback period on the capital cost of approximately: $12.0 million capital / $35.0 million per year in capacity saved value = 0.34 of a year (a short 4 months payback period).

2. Funding Model

The relatively modest capital investment would probably be realized through use of DSWM capital funds. We believe that a key asset such as the Round Baler fleet would best be owned directly by the County, even if operated by contractors to the County.

Each unit's capital cost is paid for in three steps: (a) 30% at order; (b) 60% at shipment from the factory; (c) 10% at final onsite testing.

3. Revenue

Existing DSWM Enterprise Fund revenue streams would be used to fund the capital investment and annual operating cost. **However, we highlight here the substantial savings in the cost of MSW export (year after year) to remote facilities generated by the lack of heavy Shipping Containers.**

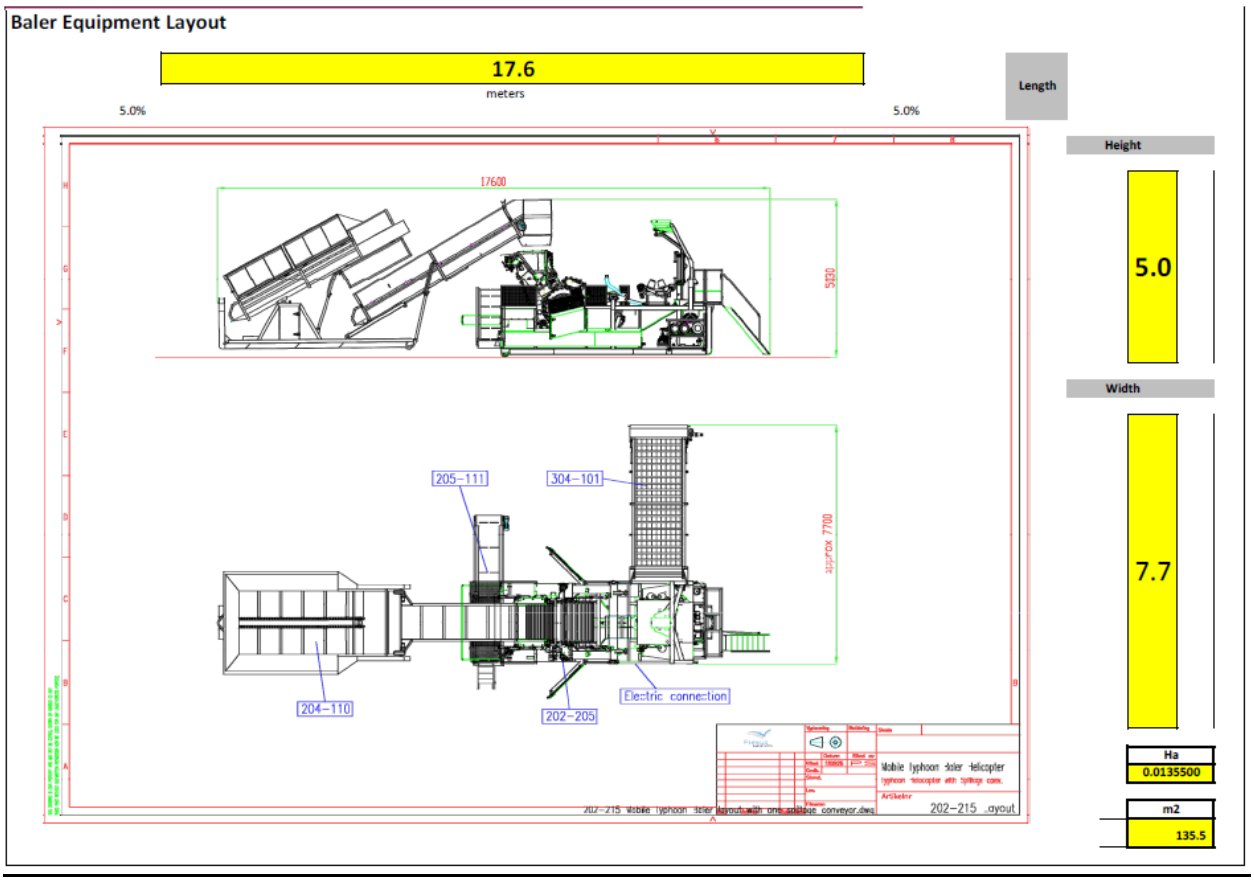
D. Implementation Approach

1. Infrastructure

Existing or new Transfer locations could be utilized for Road export. However, Rail export would utilize existing Rail spurs or newly added Rail spurs.

2. Size

Each Typhoon unit occupies a footprint of only 17.6 meters (58 feet) x 7.7 meters (25 feet), for a total machine footprint area of 135.5 square meters (1,453 square feet). The infeed stockpile could increase this footprint by about 30%, to approximately 176 square meters (1,900 square feet) per unit:



3. Site Ownership

Sites owned by the County (such as existing Transfer Locations) could be utilized, as well as Transfer / Loadout sites owned by contractors to the County.

4. Permitting

We would not anticipate any new permitting requirements being added to existing permit conditions at existing or new Transfer Locations. We also anticipate that MSW arriving at remote disposal locations outside the County would not be subject to any added permit conditions, since the MSW can be quickly opened by a Flexus-supplied Baler Opener mounted on any of several standard mobile equipment units. Once the Bales are opened at any remote disposal location, the MSW contents would become normal "loose" MSW being transported with heavy Shipping Containers or specialized Walking Floor Trailers today.

5. Timing

Figure 12.0 illustrates an implementation plan for 12 Typhoon units that would have a duration of 8 quarters (8 * 3 months = 24 months) overall. We note here that factory production lead times will be reduced for orders received early in the calendar year.

Figure 12.0

	Project Implementation Quarters: Bars Represent (indicative / projected) Order and Deployment Leadtimes for Each Typhoon Unit							
Flexus Units Deployed [a]	1	2	3	4	5	6	7	8
1	Contracting and Mobilization of the Overall Project							
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Notes

[a] Case assumes 2 units at each of up to 6 County Transfer / Export Loadout locations = 12 Units.

6. O&M

Each Typhoon unit comes with a full complement of Spare Parts, as well as a complete Tool Set. Local personnel will be fully trained onsite directly by Flexus factory engineers accompanying each machine deployed.

7. Health / Safety / Environmental

All Flexus units meet European Union (EU) standards for:

- Machine Directives 2006 / 42 / EC
  and
- Low Voltage Directive 2006 / 95 / EC

E. Other Information / Advice

1. Procurement Model

We believe that an expedited sole source / negotiated procurement model is called for, in order to slow down (as soon as possible) the depletion of airspace in the existing County landfills, especially the South Dade Landfill facility, which should probably be preserved as an absolute backup capacity reserve. As indicated elsewhere, the Typhoon units are a "one of a kind product" in the world, as the only MSW Round Baler engineered and produced with the capability of dealing with chemically and mechanically aggressive MSW, rather than Agricultural units adapted for handling MSW. t the same time, Rectangular (Square) bales cannot be stacked above 3 or 4 rows without sideways sliding also, Square bales are not weather-tight and require wires to retain their shape. Such wires impede (or make impossible) use of the Square bales at destination Waste to Energy or Recycling facilities.

2. Partnerships

We believe that a straightforward model of supply from Flexus-Cambridge directly to the County through the County's Strategic Procurement unit would expeditiously achieve the project benefits described in this Response document.

3. Additional Insights

We respectfully submit this offered option as entirely supportive compatible (and not competitive) with County export contracts for Waste to Energy, Recycling, or Landfilling.

Attachment A

Overview of the Flexus Line of Heavy-Duty Round Balers

FLEXUS BALASYSTEM
Swedish waste management technology since 1991

- Worldwide in 46 countries on 5 continents
- Designed and engineered for industrial heavy-duty applications
- Easy to service, lowest OPEX
- Suitable for all climates and locations

GLOBAL PARTNERS & KEY ACCOUNTS INCLUDE:

VEOLIA, Sumitomo, SUEZ, greenstar RECYCLING, Termomeccanica Pompe, VINCI ENVIRONNEMENT, Séché environnement, Hitachi Zosen INOVA, Panda, STRABAG, Novergie SUEZ, metso, geocycle, ENIM, EBARA, GFL

Agent for the Americas:

CAMBRIDGE
Project Development Inc.

Heavy-duty design – easy to operate & service

- The most energy-efficient baling system worldwide
- Conforms to new EU B A T directive: Best Available Technology
- Applicable for most waste materials
- Suitable for external use in all weather conditions
- Fast installation time – 5 to 8 hours
- Fully mobile system is easy transport to other locations - set up in 3 hours
- No civil works required
- Fully automatic operation with high productivity and no machine operator
- No metal wires - bales are sealed with incinerable PE net & film
- Easy to maintain and operate - lowest OPEX
- Long life - designed to exceed 1 million bales/20 years

FLEXUS – a Sustainable Solution for

MSW	Including highly organic/high moisture MSW
Landfills	Permanent, temporary, landfill remediation
RDF / SRF / Biomass	For renewable energy facilities
WTE Plants	Storage at Waste-to-Energy WTE plants
Transfer Stations	Temporary Storage and transport to landfill
Industrial Waste	Commercial, tires, wood-chips, ash, sludge
Tourist Locations	High Season waste, island communities
Transport Agriculture	Truck, Rail, Ship
	Animal feed, pulp, rice hull, beet pulp, etc.

FLEXUS CONFORMS TO NEW EU DIRECTIVE:

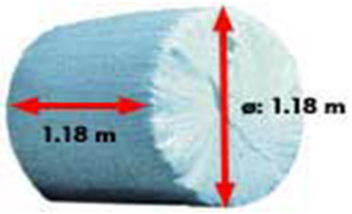
B A T : BEST AVAILABLE TECHNOLOGY

BAT – NEW RECOMMENDATIONS

- PREVENT OR REDUCE DIFFUSE EMMISSIONS
  - Store in enclosed pressure controlled buildings, with abatement system, re-routing waste deliveries
  - **Store waste in properly sealed bales**
- WASTE TRACKING SYSTEM AND INVENTORY
  - Aims to track the location & quantity of waste – date of arrival
  - Risk base considered – hazardous properties
  - Clear labelling of waste that is stored in places other than the waste bunker or sludge storage tank

BALING & WRAPPING APPROVED BY EU FOR PREVENTION & SAFE STORAGE FOR MSW/WtE

- Flexus approved for preventing and reducing diffuse emissions
- Flexible where to bale & wrap
- Up to 50 % increase of storage space
- Zero risk of fires & explosions; significant odour reduction
- Multiple transport modes: truck, rail, containers, ship
- Possibility to label bales to fulfil waste tracking system



Fully mobile for use at multiple sites – Easy and fast set up

Site to site installation: 3 hours

APPLICATIONS I

- **MSW Transfer Stations**

  high compaction of fresh incoming MSW bales are then moved to landfill/waste2energy

- **Landfill Sites**

  Volume reduction, increased life span

  Remediation of old landfills

- **Tourist sites, i.e. islands, seasonal waste**

  Waste capture during high season

  Clean storage for further transport

  Highly acceptable

APPLICATIONS II

- **RDF/SRF**
  Renewable Energy Industry
  Flexus bales can be safely exported

- **Biomass, Woodchips**
  Cement Kilns, Power Plants
  Renewable Energy Projects

- **Power Plants / Incineration/ Waste2Energy**
  compact on-site storage of baled fuels
  optimisation of fuel delivery
  absorbs incoming waste during down-time

APPLICATIONS III

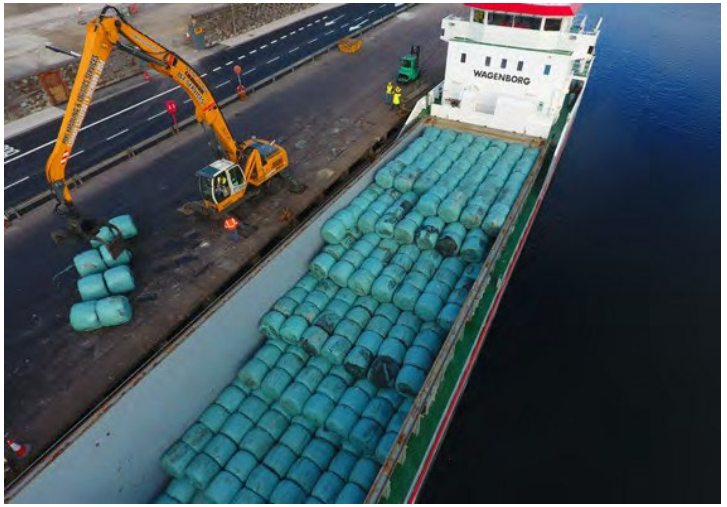
- **High Value Agricultural Materials** Sugar beet pulp
  Corn-cob, rice hull,

- **Special applications**
  Car Fluff, paper pulp rejects
  Agricultural film, wire mesh
  Ashes, sludge,

- **Light industrial Waste**
  Tyres, big bags
  Light C&D, shredded industrial materials

Efficient transport of bales by road, rail and ship

Flexus BALASYSTEM



Easy handling of round bales

Flexus BALASYSTEM

Standard bale size 1.18 Height x 1.18 m

Diameter =

Total Volume of 1.3 m3 (1.7 Cubic Yards)

Capacity of 30+ bales per hour

Bale weight 1000 kg to 2000 kg

Unlimited stack-height, space effective

Bales take on honey-comb shape, no bursting

Rapid handling & full maneuverability

SAFE STORAGE short, medium, long-term

- Safe storage of a wide variety of materials
- No fires, explosions, leachates, odours, birdfly
- Easy logistics and handling of bales
- High compaction = more volume on-site
- Sustainable technology component
- Confirmed by scientific studies since 1995

WASTE STORAGE AT WTE PLANTS

A calculation example below shows of cost savings that is for storing the waste stream by Flexus baling:
(Example of a back-up storage during shut down periods of an midsize incineration plant operation)

Landfill solution:

Cost of landfill: $100 USD/ton Normal shut down time: 25 days/year Daily waste stream: 250 tons/day

Waste to landfill: 6 250 tons/year Cost per year: 625 000 USD/year

Flexus baling solution:

Cost of baling: $5 USD/ton
Baling during shut down: 25 days/year
Daily waste stream: 250 tons/day

Waste to storage: 6 250 tons/year Cost per year: 31 250 USD/year

Conclusions:
= Tipping Fee Revenue is conserved inhouse during plant outages
= Savings per year by using Flexus baling is 598 750 USD/year.

INNER ROUND-BALE CHEMISTRY

Inner-bale free of air - anaerobic

Immediately after PE (standard polyethylene) wrapping

seal, inside the bale:

Remaining oxygen is consumed /
carbon-dioxide rises rapidly
pH low (5.6)

Build-up of fatty acids reaching threshold /
therefore: bacterial activities inhibited, - thus…
stopping the anaerobic process no methanogenic activity /
bales contents are rendered inert / calorific value is retained /
no odors

SCIENTIFIC STUDIES ON BALING & WRAPPING WASTE

Lund University, Sweden, 1995

Dekra Report, Germany 1995

Cylergie, France 1995

Storage of highly calorific waste, Germany: 1998

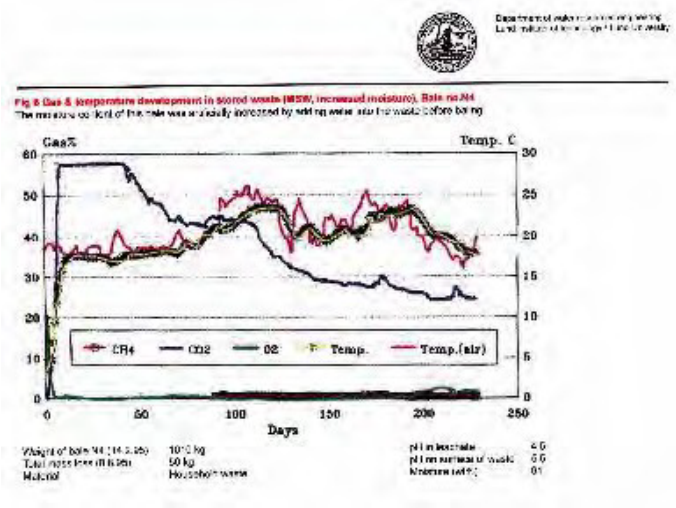
Ardlethan Commission of Enquiry, Australia 1999

Australian Museum, Sydney, Australia 1999

Disposal Plant, Asslar, Germany 1999

Storage of MSW in Spain, Spain, 2000

Env. Performance of baling waste, Prof Baldasano, Spain, 2003



FLEXUS – flexible & sustainable round bale solutions

Agent for the Americas:

CAMBRIDGE
Project Development Inc.

Leonard N. Enriquez, President / LNE@cambridgeprojectdev.com / Tel 1-305-926-3309

Attachment B

Cambridge SOQ

Cambridge Project Development Inc.
Statement of Qualifications

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Since its founding in Florida in 2001, nearly 25 years ago, by its President, Leonard N. (Len) Enriquez, "Cambridge" has become an internationally recognized **Solid Waste Consulting, Project Management** and **Project Development** company with world- class credentials in all aspects of Finance-Design-Build-Ownership-Operation/Optimization (FDBOO/O) of **Solid Waste Infrastructure Facilities**. Such facilities include **Technical Landfills, Remediation and Enhancement of Distressed Landfills, Waste-to-Energy (WTE) Facilities (both Mass Burn and RDF technologies); Transfer Stations and Fleets; and Material Recovery (MRF) Facilities**. In this document, we present highlights of our experience and capabilities in Solid Waste Facilities Project Development arenas:

Cambridge World-Class Performance: Stable, fire-free Providenciales (Turks & Caicos Islands-TCI) Landfill (previously distressed) with ordered waste placement; Operated by Cambridge for Three Years after Initial Stabilization

Cambridge World-Class Performance: SBRC Barbados: 30,000 Square Foot Transfer Station designed and EPC project-managed by Cambridge

Landfill Design-Build & Remediation: Georgetown – Grand Cayman Landfill: Capping Design-Build Peer Review and QA-QC: Permanent Cover System / Leachate Collection System / Gas Collection System

World-Class Performance: Design-Build of the Freeport, Grand Bahama, (new greenfield) Landfill and Weighbridge

Our Corporate Strengths and Core Values

Beyond expertise, and before continuing, we wish to emphasize here some fundamental aspects of our approach to all consulting engagements:

- **We keep honesty and integrity as the absolute, irrevocable foundations** of all our business relationships;
- **We keep our clients' interests and vision** at the center of all engagements;
- **We avoid jargon** and endeavor to **"keep it as simple as possible"** (KIASAP);
- **We listen a lot** and take a lot of notes, mostly to feed our intensive modeling;
- **We are conservative when it comes to technology choices;** as career operators as well as engineers and designers, we know at a rather deep, even personal level what "commercially proven" means in terms of 3:00 a.m. phone calls;
- **We lead by example**; our Principals and Associates never ask anyone to do a job they have not done themselves.

Camden, New Jersey: 1090 Ton/Day WTE Plant Acquisition Due Diligence

Cambridge In-House Capabilities

In-House Cambridge Capabilities: For solid waste management facilities: Engineering Design, Development, Financing, Construction, Startup-Commissioning, and Long-Term Operations for:
• Landfills new cells construction / Landfills old cells technical stabilization and closure
• Landfills leachate management / Landfills biogas management
• Energy from Waste (WTE or EfW) plants / Power Purchase Agreements
• Material Recovery Facilities (MRF) for Construction & Demolition Debris (CDD)
• Material Recovery Facilities (MRF) for Green Waste
• **Unique Strength in Design, Operations, and Maintenance of Waste Processing Equipment Process Lines (including Shredding / Screening / Baling)**
• Eco-Park (Recreational Use of Rehabilitated solid waste management sites)

Cambridge selected as Western Hemisphere representative for Sweden's Flexus Balasystem Cylindrical Baling Systems

***

Senior Contact:
Leonard N. Enriquez, President & Founder
LNE@cambridgeprojectdev.com
Tel 1-305-926-3306

END OF CAMBRIDGE SOQ

END OF RESPONSE DOCUMENT

EcoCa – Rubber Circular Solutions

Market Research Response

MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

Background

Miami-Dade County ("County") provides an integrated waste management system that provides collection, transfer, and disposal services to include landfills and historically included a waste-to-energy facility. The County's Department of Solid Waste Management (DSWM) provides waste collection services twice a week to more than 350,000 households in a 320-square-mile waste collection service area. DSWM operates 13 Neighborhood Trash and Recycling Centers and administers the contracted collection of household recyclables. Historically, the County produces over five million tons of waste annually, of which DSWM disposal system processes more than 2.4 million tons.

Objective

The County is conducting market research to garner industry comments and solutions regarding potential future projects for a comprehensive solid waste management approach. This effort is being undertaken by the County as part of a review and analysis to further explore all available delivery methods for the disposal of waste. Various items related to solid waste management were discussed by the Board of County Commissioners on February 19, 2025 and the agenda to such meeting can be accessed using the following link.

https://www.miamidade.gov/govaction/commminute.asp?cmbmeetdate=5227&file=false

The County is particularly interested in responses to this market research from industry experts from all available sectors of waste management. The requested information will assist the County to better understand the marketplace, gather information regarding the current state of the industry, and gauge interest in the projects and may also be used by the County for any other purpose.

Public Record

Respondents are hereby notified that all information submitted as part of, or in support of, this analysis will be available for public inspection in compliance with Chapter 119, Florida Statutes, popularly known as the "Public Record Law." Accordingly, do not submit any information in response to this analysis which the respondent considers to be a trade secret, proprietary or confidential, is competitively sensitive, or which violates any intellectual rights of a third party.

Responses

Responses should address the requested information below and indicate "not applicable" when a particular item cannot or will not be addressed by respondent. Responses should be submitted to the County's contact person indicated below via email no later than **April 14, 2025**.

Email to:
Saba Musleh, CPPB, Negotiator
Strategic Procurement Department
saba.musleh@miamidade.gov

With a copy to (CC line of email):
Ross Byers, Project Manager
AtkinsRéalis
ross.byers@atkinsrealis.com

Ben Chouchaoui, ME, BSc, MAsc, PhD
General Manager - EcoCa™ - Rubber Circular Solutions (www.ecoca.org) 1-226-350-8047 contact@ecoca.org

Respondents are encouraged to not limit their responses to any already-identified potential sites, locations, or assumptions as to the size or capacity of the respondent's solution. Respondents are encouraged to consider any combination of waste disposal methods such as, but not limited to, waste-to-energy, landfills, or hauling waste.

Requested Information

A. Respondent

Provide a brief summary of the respondent to include the following.

- Respondent's name and address Ben Chouchaoui, ME, BSc, MAsc, PhD
- Contact person, title, email address, and telephone number

General Manager - EcoCa™ – Rubber Circular Solutions (www.ecoca.org) 1-226-350-8047 contact@ecoca.org

- Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides

30 years of experience in rubbers and rubber product developments, that can be applied to rubber sustainability and rubber product circular economy, benefiting the County of Miami-Dade and Florida.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link.

   Turning scrap tires into engineered products

   https://documents.miamidade.gov/mayor/memos/01-25-25-second-update-on-directive-no-241676.pdf

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution. Burning tires wastes rubber and the energy recouped from such an undertaking is 1/3 of the energy to replace the rubber while depleting a finite resource (hydrocarbons) and generating emissions. The proposed solution recoups rubber in tires, treats it, and makes with it any engineered product (as in fenders for boats and marinas or ports). The respondent applied the technology in Canada. A bumper for parking passenger vehicles is a practical product on the market demonstrating the benefits of the technology (see attached flyer).

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

   I suggest starting with a pilot plant (capacity of a ton per hour) in Miami-Dade over one shift (2,000 hours), treating 2,000 tons of scrap tires a year or about 200,000 scrap tires. The plant could triple in a year to treat 600,000 scrap tires. It could triple again into a production plant treating about two million tires (about 20,000 tons) a year.

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution. Advanced recycling is the only path to rubber product circular economy.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

   Repurpose of rubber in tires (no incineration, no degradation, no waste, no landfilling, etc.).

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges. Challenge? Capacity (can do 20,000 tons of scrap tires a year, at best, in a facility: to do more, we need more facilities, spread-out, and proper logistics).

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

   Cost: 1. Land, 2. A facility, 3. Equipment, 4. Personnel. If the County of Miami-Dade can secure $4M between grants and loans, the respondent will start a pilot plant in Miami-Dade. This should self-sustain then self-finance to grow to a production plant (in year three of the operation).

Ben Chouchaoui, ME, BSc, MAsc, PhD
General Manager - EcoCa™ - Rubber Circular Solutions (www.ecoca.org) 1-226-350-8047 contact@ecoca.org

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.) The respondent is open to all funding arrangements.
3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).
   The main component of the revenues for the proposed solution is the sale of products (to sell at about $10 a kilo of recycled rubber as finished product).

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).
   Some of the machinery is high and a 40-ft clear ceiling is needed. The respondent is multi-talentted and will take care of land development, facility design, building, design and instalment of equipment, hiring and training of personnel, running the operations, and continually diversifying the product portfolio.
2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.
   We could start with a 120 x 120 pre-engineered facility (14,400 square feet) to then extend to the back, by 120 feet at a time.
3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.
   The respondent can work with a realtor to find a tract for a pilot plant to then grow to a production plant, turning scrap tires into engineered products, if the County of Miami-Dade secures the seed fund to start the process.
4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution. The operation should qualify as light industrial, rubber manufacturing
5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution. If the funding is secured (in monthly quarters) and the County of Miami-Dade assists in permits to service the land (sewer and water) and build, the respondent should be able to get an operation going in six months.
6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.
   Maintenance are part of an ordinary production facility.
7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).
   This operation benefits humans, animals, and the environment. The operation has no spills, emissions, noise, odors: It is a rubber product manufacturing operation (with the feedstock produced onsite).

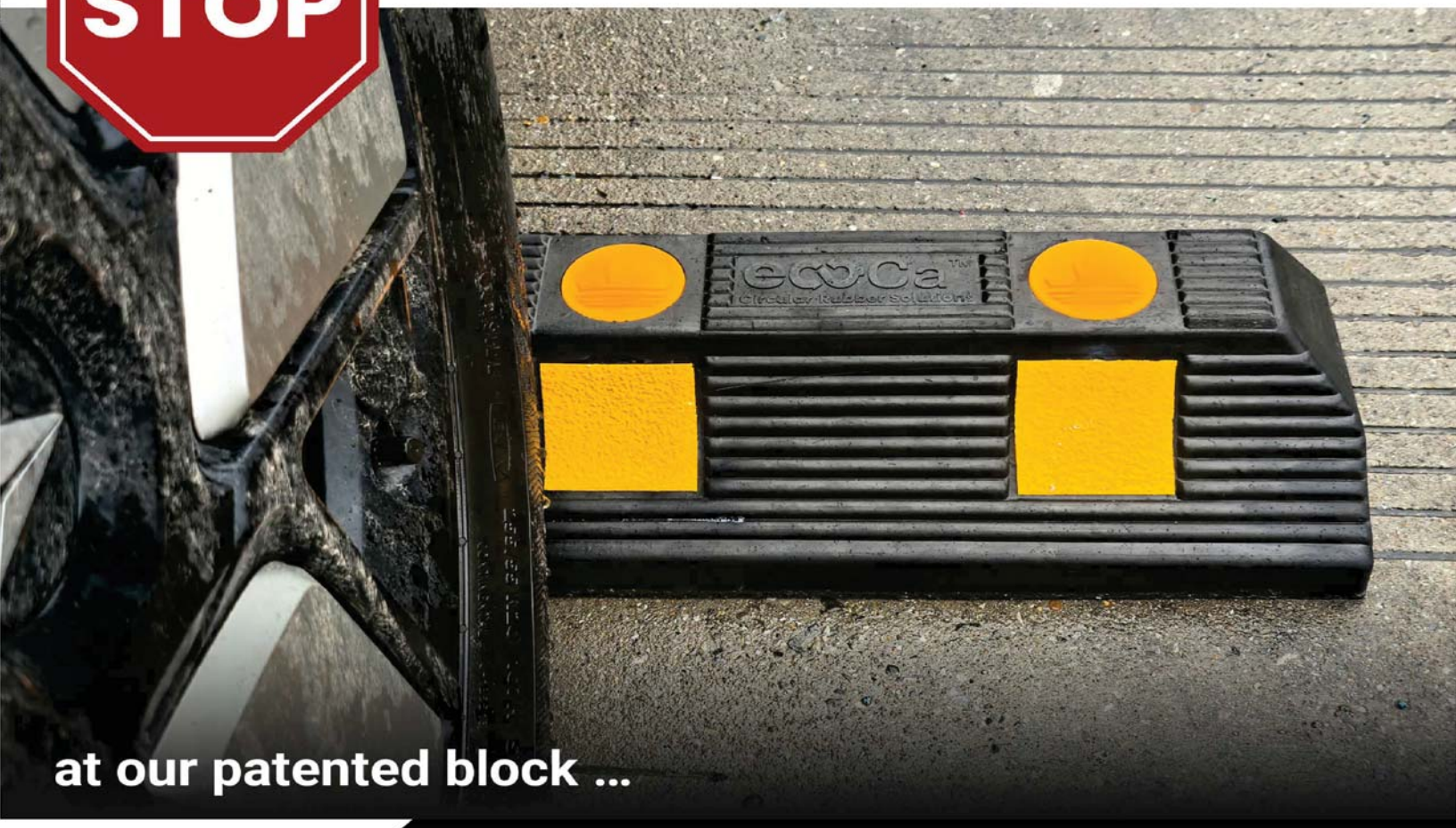
E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).
   With the county of Miami-Dade securing the finances, the respondent will be responsible to get a pilot plant operational. The respondent will then enter into an agreement with the County of Miami-Dade for the ascending delivery for scrap tires (1,000 tons for the first year of operation, then 3,000 for the second, and 10,000 for the third).
2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.
   We can work with landfills and take crumb rubber generated locally, but still expect an amount per ton of scrap rubber converted to engineered products.
3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.
   Turning scrap tires into engineered products is the best the County of Miami-Dade could do of such waste stream (saving on materials, time, resources, and the environment, while caring for the heath of its inhabitants).

Ben Chouchaoui, ME, BSc, MAsc, PhD
General Manager - EcoCa™ - Rubber Circular Solutions (www.ecoca.org) 1-226-350-8047 contact@ecoca.org

ecoCa™

Rubber Circular Solutions



at our patented block ...

... and avoid scratching your vehicle!

EcoCa™ is a Canadian manufacturing company

ALIGNING 4 PRODUCTION LINES

for 1. Rubber recovery, 2. Recovered rubber devulcanization, 3. Devulcanized rubber compounding, and 4. Manufacturing compounded rubber into engineered materials and products, locally, for many local end-uses.

WE ARE THE ONLY COMPANY IN NORTH AMERICA TURNING SCRAP TIRES INTO ENGINEERED MATERIALS AND PRODUCTS!

contact@ecous.org

226-350-8047

www.ecous.org

EcoPods Miami

Market Research Response

Created by Ryan Lucas

EcoPods Miami

A vision aligned with the 2030 Climate Goals designed for impact, scalability, and community.

Revolutionizing Waste Into Smart Urban Assets

An Independent Strategic Proposal for Miami-Dade County

Submitted – April 2025

EcoPods Miami: Turning Waste Into a Decentralized Asset for Miami's Future

EXECUTIVE SUMMARY

- **Vision**: Transform Miami-Dade's waste management with EcoPods Miami, a network of modular "mini" waste treatment pods **that divert up to 90% of recoverable waste from landfills** and convert it into valuable resources. Our solution directly addresses the County's urgent capacity challenges with an **original, decentralized approach** that is feasible, climate-friendly, and community-oriented.

- **Concept**: Each EcoPod is a self-contained unit that s**orts, processes, and recycles or recovers energy** from municipal solid waste locally. By treating waste **closer to its source**, EcoPods reduce hauling needs and emissions, **empower community engagement,** and create **localized circular economies .** The system integrates advanced technologies (automation, bioenergy, and AI) to maximize efficiency.

- **Fit for Miami-Dade:** With the county generating **over 5 million tons of waste per yea**r and recycling only ~**37%** (amid ~40% contamination in recycling) , EcoPods offer a timely solution to drastically improve diversion. Our approach can recover up to >**90%** of recyclable and organic materials, produce green energy, and **significantly reduce the need for new landfills or a massive incinerator.** This aligns with the County's sustainability goals and turning waste into an opportunity rather than a liability.

- **Economic & Strategic Value:** EcoPods Miami is **economically viable** – starting with a pilot and scaling up modularly means lower upfront costs and faster implementation than traditional facilities. The **public-private partnership model** we propose will leverage private innovation and funding alongside public support, ensuring shared benefits and minimized risk. By choosing EcoPods, Miami-Dade can become a **national leader in innovative waste management,** showcasing a solution that's scalable, financially sound, and environmentally transformative.

RESPONDENT INFORMATION

- **Who We Are:** EcoPods Miami is a local clean-tech venture founded by **Ryan Lucas**, a French entrepreneur with international experience, currently based in Medellín, and dedicated to sustainable infrastructure in South Florida. Our team brings together experts in waste management, engineering, and environmental policy to deliver cutting-edge solutions tailored to South Florida's needs. We are passionately committed to helping our community solve its waste crisis with innovation and integrity.

- **Experience & Expertise**: Ryan Lucas and the EcoPods team have **extensive industry knowledge** – including operational experience with recycling systems and renewable energy technology – ensuring our solution is grounded in real-world feasibility. We have consulted global best practices and conducted in-depth research on waste technologies to design the EcoPods system. Our approach is based on a proprietary system architecture that is currently under strategic review for intellectual property protection.

- **Local Commitment**: As a Miami-grown initiative, we understand the **local context, regulations, and community concerns.** We have established relationships with local environmental leaders and are aligned with Miami-Dade County's strategic vision (e.g. the **Zero Waste** goals and climate action plans). EcoPods Miami is not just a technology provider but a **long-term partner** invested in the County's environmental and economic success. We will work hand-in-hand with county officials, waste management staff, and residents to ensure the project's success and community acceptance.

- **Capacity & Partnerships**: Backed by a network of industry partners (for manufacturing, logistics, and finance), EcoPods Miami has the capacity to deliver from pilot through full-scale implementation. We are prepared to mobilize resources quickly for this project. Additionally, we are exploring collaborations with local utilities and universities to continuously improve the system's performance, and we will secure any necessary licenses or permits as a responsible proponent.

Solution Overview
EcoPods System

- **Decentralized Waste Processing:** The **EcoPods system** is a **decentralized network** of modular waste processing units (“EcoPods”) deployed at strategic sites across the county over time. Instead of hauling all trash to a single distant facility, waste is delivered to the nearest EcoPod unit. Each pod is designed to **accept mixed municipal solid waste** and internally separate and treat it. This localized approach yields numerous benefits: reduced transportation costs and emissions, quicker processing times, and more flexibility to adjust capacity where needed .

- **Modular “Pod” Design:** Each EcoPod is a **self-contained, containerized waste treatment facility** roughly the size of a shipping container (or series of containers). It can be installed at existing transfer stations or other strategic sites. The pods are **modular and scalable** – one pod can process waste for a small community; multiple pods can work in parallel for larger service areas. As waste volumes grow or shift, we simply add, relocate, or scale pods as needed, avoiding the long lead times of constructing new traditional plants. The **containerized design** also makes them relatively quick to deploy and designed for replication.

- **Integrated Process Flow**: Within each EcoPod, the waste undergoes a **comprehensive treatment sequence:**

1.**Automated Sorting:** Incoming mixed waste is first sorted by advanced machinery (conveyors with optical sorters, magnets, and AI-driven robotic arms). Recyclables (paper, plastics, metals, glass) are identified and separated for recycling markets. Hazardous items are removed safely. This maximizes resource recovery at the source.

2.Organic Waste Treatment: Biodegradables like food scraps and yard waste (which make up the largest portion of the waste stream, about **38%** on average) are diverted to an on-site **anaerobic digester or in-vessel composter** within the pod. Here, organics are broken down to generate biogas (methane) and nutrient-rich compost. The biogas is captured for energy and the compost can be used for local agriculture/landscaping.

Solution Overview
EcoPods System

3. Energy Recovery for Residuals: After removing recyclables and organics, the remaining residual waste (non-recyclable plastics, soiled materials, etc.) is processed through a **modular, compact waste-to-energy unit** in the pod – for example, a high-efficiency gasification chamber or pyrolysis system in an air-tight and odor-sealed enclosure. This unit converts residuals into a **syngas** (fuel) that is used to generate electricity via a micro-turbine, and a small amount of inert char/ash. Emissions are controlled with filtration to meet air quality standards. Result: very little waste remains – potentially **<10%** by weight – which can be landfilled or potentially reused (e.g., char in construction).

4. Output & Resource Distribution: The electricity produced can **power the EcoPod itself and supply the grid** (or even charge electric garbage trucks in the future). Recovered materials (metals, plastics, paper) are baled data-tracked and sent to recycling facilities or sold to industry. Compost is cured and made available for county parks or residents. In essence, each pod **creates a localized circular economy** – turning neighborhood trash into energy and useful products nearby.

- **Smart Monitoring & Control**: The EcoPods system is supported by a **digital platform** for monitoring and optimization. IoT sensors and software track waste input composition, energy output, and system performance in real-time. This data-centric approach allows for predictive maintenance (minimizing downtime) and dynamic routing of collection trucks (sending them to pods with available capacity, reducing idle trips). The county's waste managers can monitor all pods via a central dashboard and optionally the public through a public monitoring interface, giving **full visibility and control** over the distributed network.

- **Seamless Integration**: EcoPods are meant to integrate with **existing waste management operations.** Collection routes and schedules remain similar initially – except trucks will offload at local EcoPods instead of far-away landfills or the burnt-out incinerator. Our pods can also complement any future "Sustainable Solid Waste Campus" by handling waste closer to generation sites and thus **reducing burden on central facilities .** The system is also **compatible with source-separation initiatives:** if the County expands recycling or organics collection, EcoPods simply adjust by taking in already-separated materials (increasing efficiency even further). In summary, EcoPods provide a flexible backbone for current and future waste strategies.

Efficiency and Adaptability

- **High Processing Efficiency**: EcoPods maximize efficiency at each step. By sorting waste at the point of entry, we ensure that recyclable and compostable materials are pulled out before they commingle and contaminate each other, leading to higher recovery rates. The integrated energy unit is designed for **high thermal efficiency**, extracting energy from residuals with minimal losses. Also, **waste volumes are reduced on-site by ~85-90% (by weight),** meaning far less material needs final disposal. Overall, the energy recovered and materials saved per ton of waste make EcoPods extremely efficient in resource utilization.

- **Reduced Transportation & Quick Turnaround**: Because waste is treated locally, collection trucks spend **less time on the road** and can complete more trips in a day with shorter hauls. This not only cuts fuel use and carbon emissions but also saves operational costs (and reduces traffic congestion). The turnaround time from waste collection to processing is shortened dramatically – waste can enter a pod and within hours be converted to energy and sorted outputs, rather than sitting in a landfill for decades. This **just-in-time processing** improves the responsiveness of the overall system to daily waste fluctuations.

- **Scalable & Flexible Capacity:** The EcoPods network is inherently **adaptable to changing needs**. If waste generation increases in one area, we can deploy additional pods there or upscale certain pods (by adding extra modules). Conversely, if waste volumes drop due to successful reduction programs, pods can be downsized or redeployed elsewhere, preventing over-capacity issues. This scalability means the county never overbuilds or underdelivers – the system can **grow or contract in modular increments**. It's a future-proof design in contrast to a single large facility that might be oversized or quickly maxed out.

- **Multi-Waste Stream Adaptability:** While the initial focus is on municipal solid waste, EcoPods are versatile. They can be configured to handle **various waste streams** – for example, a pod could be specialized for **construction & demolition debris** sorting, or equipped with a module for **e-waste processing** (metals extraction) if needed. The architecture is plug-and-play, allowing new technology modules to be added as they become available. This adaptability ensures that as the waste landscape evolves (new materials, new recycling markets, etc.), the EcoPods can **adapt rather than become obsolete.**

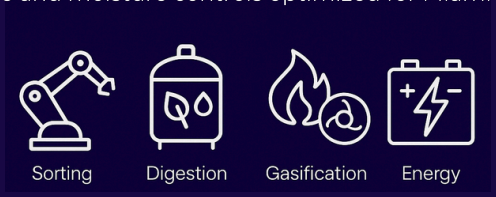
- **Resilience and Redundancy:** A decentralized system provides built-in resilience. If one EcoPod unit requires maintenance or upgrade, other pods in the network can pick up the slack temporarily – there's no single point of failure that can cripple the whole county's waste disposal (a stark improvement from the previous situation where a single plant's loss created a crisis). This redundancy is invaluable in emergencies; for instance, after extreme weather events, unaffected pods can continue operating and service areas of a down pod. The EcoPods are also designed with **hurricane-resistant enclosures** and can be quickly shut down or secured if needed, then brought back online, ensuring **continuity of waste services** under variable conditions.

- **Community and Site Adaptability:** The compact, enclosed design means EcoPods can be sited flexibly – in industrial zones, near large waste generation sites, or co-located at existing facilities – with **minimal nuisance** (noise and odor are contained with insulation and filters). We can adapt the aesthetic (external appearance) of pods if needed to blend into urban settings or add landscaping around them, making them more acceptable in different community contexts. This adaptability in placement helps ensure **equitable distribution** of waste facilities – no single community is overburdened, and each pod's impact is small and manageable.

Technologies Used (Full Technological Architecture)

- **Advanced Waste Sorting Technology**: Each EcoPod employs a **state-of-the-art sorting line.** This includes mechanical separators (shredders, trommels), **optical scanners** to identify different plastics and paper grades, magnetic and eddy current separators for metals, and **automated sorting systems** (including AI-assisted modules when appropriate) to pick specific items. The system is adaptive, learning from waste input patterns in Miami-Dade to improve sorting accuracy over time. Result: clean streams of recyclables are recovered, and organic material is isolated, improving downstream processing efficiency. (For example, metals and high-value plastics are recovered at rates far above current curbside recycling, because the controlled environment allows for greater precision.)

- **Anaerobic Digestion (Bioenergy Unit)**: For organic waste (food scraps, yard trimmings), we utilize a **compact anaerobic digester** inside the pod. This sealed, oxygen-free tank contains special microbe cultures that break down organics rapidly. The by-product is **biogas** (roughly ~60% methane) which is harvested continuously, and a nutrient-rich digestate. The biogas is piped to a small gas engine or microturbine in the pod to generate **renewable electricity** (and heat);
- Excess biogas can potentially be upgraded and used for fleet fuel in the future, depending on local infrastructure and feasibility. fuel for waste trucks. The digestate is dried and cured into a safe **compost or soil amendment.** This process not only generates energy but also **avoids methane emissions** that would occur if the organics rotted in a landfill – a major climate win. The digester technology we propose is proven (used in many cities at larger scale) but here it's been scaled to a modular level, with temperature and moisture controls optimized for Miami's waste composition.



- **Micro Waste-to-Energy Gasifier**: For the non-recyclable, non-compostable fraction, EcoPods include **a small-scale gasification unit**. Gasification is a cleaner, flameless thermal process where waste is heated in a low-oxygen chamber, producing **syngas** (a mixture of carbon monoxide and hydrogen). Our unit operates at high temperatures (above 800°C) to ensure nearly complete breakdown of complex molecules, and is equipped with a multi-stage scrubber to clean the resulting gas. The system's design prioritizes emission control and regulatory compliance, and would be piloted under close environmental oversight.

- The **syngas is then used to fuel an on-site generator,** producing electricity. Importantly, this technology **emits far less pollution** than traditional mass-burn incineration due to its controlled environment and emission controls – no visible smoke stacks in neighborhoods. The only solid residue is a benign ash/char (typically 5-10% of input volume) which can be disposed of safely or potentially used (in road fill or concrete after testing). By deploying many small gasifiers instead of one big burner, emissions are spread out and easier to manage within regulatory limits at each site.

- **Renewable Energy Integration:** Each EcoPod can be outfitted with **solar panels** on its roof or nearby area to supplement its power needs, making the unit even more self-sufficient and reducing draw from the grid. In fact, during normal operations, an EcoPod is expected to be a **net energy producer,** exporting surplus power. We will incorporate battery storage so that energy from biogas and gasification can be buffered and supplied to the grid during peak demand times, contributing to local energy resilience. The **smart grid connection** also means the County can potentially earn revenue from electricity or at least offset facility power costs.

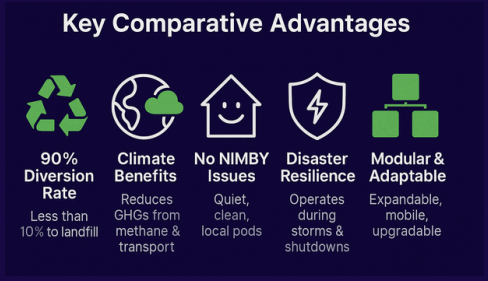
Technologies Used (Full Technological Architecture)

- **Water Recycling & Leachate Treatment:** Waste processing can produce liquids (like leachate from organics or condensate). Each pod has a built-in **water treatment module** that captures and filters these liquids. Using techniques like membrane filtration and UV disinfection, the system cleans water for reuse in the process (e.g., to maintain digester moisture or for equipment wash-down). **This closed-loop water system** means EcoPods won't discharge polluted water into sewers or the environment. In fact, they could potentially support treatment of certain organic liquid waste streams, complementing the County's water management efforts, integrating with the County's water management efforts (hence the "Sustainable Water" component of our infrastructure approach).
- **IoT Sensors and AI Optimization:** Throughout the EcoPod, **sensors** monitor temperature, composition (via spectroscopy), fill levels, and equipment performance. This data feeds into our central AI system that **optimizes operations in real-time** – adjusting conveyor speeds, tweaking digester conditions, or modulating the gasifier temperature to handle the specific mix of waste at any given time. The AI can also predict maintenance needs (e.g., when to service a motor or replace a filter) before a failure occurs. Additionally, **a machine learning model** analyzes the waste input over time to help the County understand trends (for example, detecting if certain neighborhoods have higher recyclable content, or if overall waste is spiking due to events). This predictive capability enables proactive management and continuous improvement of the system.
- **Modular Construction & Maintenance Tech:** The physical design of EcoPods uses **modular construction principles.** Each major component (sorter, digester, gasifier, generator, etc.) is on skids or frames that can be swapped in and out. If a new improved component is developed in the future, it can replace the old one without rebuilding the whole pod – keeping the technology always up-to-date. For maintenance, we utilize **augmented reality (AR) support** for technicians: wearing AR glasses, a technician can see overlays of schematics or step-by-step instructions while servicing the machinery, reducing errors and repair time. This modern approach to maintenance ensures high uptime for each pod.
- **Safety and Emissions Controls:** Safety systems are embedded throughout: fire suppression inside the pod, continuous emissions monitoring for the gasifier exhaust (with automatic shutdown if any parameter drifts out of spec), and fail-safe pressure release valves on the digester. Emissions control includes not just the gas cleaning, but also odor control – activated carbon filters scrub any odorous air from the waste intake and compost handling sections, meaning **no detectable smells** outside the unit. Noise dampening insulation keeps sound levels low. The EcoPods thus utilize a **suite of technologies working in tandem** to ensure they operate safely, cleanly, and efficiently as mini high-tech waste treatment plants.

Benefits and Comparative Advantages

- **Dramatically Higher Waste Diversion**: EcoPods will enable Miami-Dade to **divert a vast majority of its waste away from landfills,** far exceeding current practices. By capturing organics and recyclables that are currently lost, the system could achieve a total waste diversion rate well above the current ~37%. This means **conservation of landfill space** and prolonged life of existing sites. In fact, each EcoPod's output to landfill is minimal (mostly inert ash/char), directly supporting the County's goal of "reducing landfill waste and improving waste diversion" .

- **Environmental and Climate Benefits:** Our solution has a significantly **lower environmental footprint** compared to the status quo or a new incinerator. Locally processing waste cuts down on long-distance truck trips, thereby reducing **transportation emissions and fuel use** . By anaerobically digesting organics, **we capture methane** that would otherwise escape into the atmosphere from decomposition – a major greenhouse gas reduction. Small-scale energy recovery units, with advanced pollution controls, mean **lower air emissions per ton** than one big burner (which can create pollution hot-spots). Additionally, by maximizing recycling, we reduce the need for virgin material production (saving energy and reducing global emissions). All this helps the county meet its climate commitments. For example, avoiding landfill methane and saving on new material production cuts greenhouse gases significantly – a big step toward carbon neutrality for the waste sector.



Community Friendly – No NIMBY Issues: Large waste facilities often face public opposition (for instance, the proposed new incinerator faced **strong community pushback and political hurdles)**. In contrast, EcoPods are s**mall and neighborhood-friendly.** Their footprint is contained, operations are quiet and odor-controlled, and they can be unobtrusively sited in existing industrial areas or city-owned land. By distributing pods county-wide, we avoid concentrating pollution or traffic in one community – **environmental justice concerns are addressed.** Each community essentially manages its own waste sustainably, rather than exporting problems elsewhere. This approach is more acceptable and engaging for residents and officials, making implementation smoother and aligned with community interests

- **Resilience and Redundancy:** The decentralized network yields a more **resilient system.** A failure or downtime in one unit has limited impact on overall capacity, unlike a single central plant whose outage could paralyze the system (as experienced with the Doral facility fire). EcoPods ensure **continuous service** even in disasters; if a hurricane disrupts one area, pods in other areas remain operable and waste trucks can be rerouted. Also, modular units can be repaired or replaced much faster than fixing a huge damaged plant. This resilience is a major comparative advantage in an era of increasing climate uncertainties.

Benefits and Comparative Advantages

- **Faster Deployment and Adaptation**: Building a new large incinerator or landfill can take many years of planning, permitting, and construction. EcoPods can be deployed within **6–12 months** for a pilot, and a full network can be rolled out **progressively over 3–5 years** depending on County priorities. This means the benefits (capacity relief, energy generation) start accruing much sooner. The County can **adapt the rollout pace** based on results and feedback – speeding up if it works well, or pausing to adjust if needed. This flexibility is impossible with a monolithic facility. Essentially, EcoPods **de-risk the implementation:** we can start small, prove the concept, and scale up with confidence, rather than betting everything on one enormous project.

- **Economic Advantages:** Modular EcoPods require **lower initial capital investment** than one large facility. Rather than spending hundreds of millions upfront (for example, the Mayor's memo estimated a new landfill at **$556M plus $163M yearly O&M** , and a new WTE plant would likely exceed that), the County can invest incrementally. Each EcoPod unit has a manageable cost, and units can be financed in stages. This also opens the door to diverse funding (private capital, grants – see next sections) to share the burden. Over time, the **operational cost per ton** is competitive: savings from reduced transport and landfill tipping, plus revenue from energy and materials, offset the operational expenses. EcoPods **could become cost-neutral or generate savings** in the long run, when operational efficiencies and revenues are fully realized., whereas landfilling externalizes many costs (land use, long-term monitoring) to the future.

- **Innovation and Leadership:** Adopting EcoPods gives Miami-Dade a **technological leadership edge**. It demonstrates an embrace of innovation and could make the county a reference model for others. This comes with intangible benefits: attracting green industry, creating high-tech local jobs for operating and maintaining the pods, and boosting the County's reputation in sustainability. Moreover, the modular nature allows **continuous improvement** – as new technologies emerge (better recycling methods, improved converters), they can be integrated into pods, allowing the system to evolve and stay on the cutting edge, rather than being locked into one technology for 40+ years. This future-proofing means Miami-Dade's waste system can adapt to whatever the future holds, from changes in waste composition to new regulatory standards, far better than static legacy solutions.

- **Comprehensive Solution (One-Stop)**: EcoPods tackle the waste problem **holistically** – from waste collection logistics improvements to material recovery to energy production and final disposal of only inert residues. Many other solutions address a piece of the puzzle (e.g., just recycling or just energy recovery), leaving the County to figure out the rest. In contrast, EcoPods Miami offers an **all-in-one solution** that meets or exceeds all the requirements laid out by the County's market research request. It's a **turnkey approach** that can simplify the County's planning: with our system in place, the solid waste loop can essentially close within the county, advancing toward a circular economy model. Few alternatives can claim such breadth of benefit while remaining feasible and grounded in existing technology as we do.

Economic Model: Costs and Revenues

- **Cost Structure & Investment Phasing:** The EcoPods model is designed to be **capital-efficient**. Instead of a single massive outlay, costs are distributed over phases. An individual EcoPod unit (complete with sorting, digestion, and energy modules) represents a **discrete capital cost** – manageable on its own or via private investment. For example, initial pilot units might cost between $2M and $5M each, depending on configuration which can be funded through innovation grants or private equity. As we scale up to dozens of pods, investment can be staged year by year. This phased investment approach means the County can **start solving the problem now with limited funds** and scale as budget allows, rather than waiting to amass funding for a huge project.

- **Operating Costs:** Each pod will have operating costs (staff, maintenance, consumables) but these are o**ffset by savings and revenues.** Key operational savings include reduced transportation (fuel and labor from shorter hauls) and avoidance of landfill tipping fees or future liability. We anticipate that with optimized operations, the **cost per ton processed** by EcoPods could be competitive with or lower than , current tipping plus hauling costs. Furthermore, if the system replaces the need to export waste or pay outside contractors, those funds are retained in the local system.

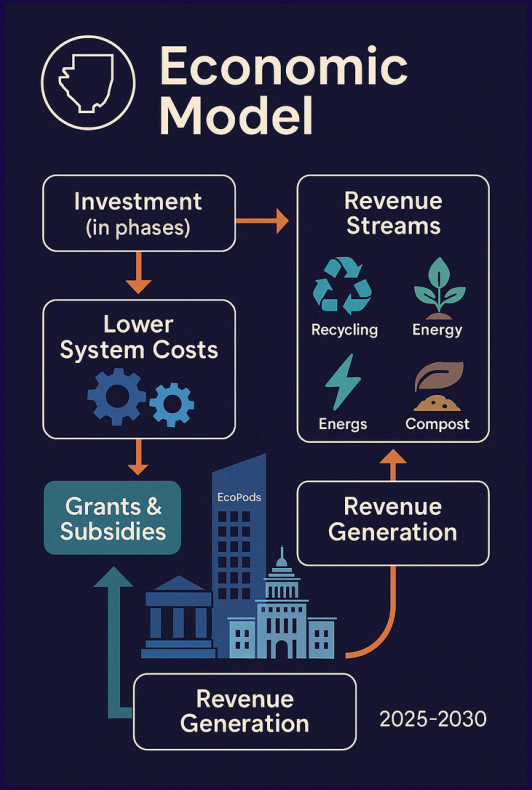
- **Revenue Streams:** EcoPods create **multiple revenue streams:**

  - **Energy Sales:** The electricity generated from biogas and syngas can be sold to the grid or used to offset facility power usage Revenue potential depends on interconnection approval, feed-in tariffs, and regulatory frameworks in place. If net metering or power purchase agreements are available with local utilities, the County (or operating entity) can earn income per kWh generated. Alternatively, if biogas is converted to vehicle fuel (CNG/RNG), it could be sold or used in County fleets, yielding fuel cost savings.

  - **Recyclable Material Sales:** The high-quality recyclables sorted out (metals, plastics, paper) can be sold to recycling processors or commodity markets. Given the sorting tech, we'll achieve clean bales that command better prices. These revenues will fluctuate with markets, but they provide a meaningful offset to costs.

  - **Compost/Product Sales**: The compost or soil amendment output can be used by the County (reducing the need to buy fertilizer for parks) or potentially sold to landscaping companies and farms. While not huge revenue, it adds value and offsets disposal costs.

  - **Carbon Credits & Incentives:** By significantly reducing methane emissions and generating renewable energy, the project could qualify for carbon credit programs or renewable energy credits. These credits can be monetized under state or federal schemes, adding an income stream. Additionally, federal tax credits for renewable energy and biogas may apply (for instance, investment tax credits for biogas power equipment).



Economic Model: Costs and Revenues

- **Revenue Streams:** EcoPods create **multiple revenue streams:**

- **Tipping Fees or Service Payments:** Depending on the partnership model, the County might pay a per-ton processing fee to the EcoPods operator (similar to a tipping fee at a landfill/WTE). We aim to set this fee comparable to current disposal costs, ensuring financial neutrality for the County while covering operational needs, making it budget-neutral for the County while covering operational expenses. Through efficiencies and revenues, we can keep this fee low.

- **Public-Private Partnership (P3) Financing:** We propose leveraging **P3 financing** to fund the rollout. Under this model, EcoPods Miami (with its investors) can fund a significant portion of the capital costs to build the pods, in exchange for a long-term operating agreement. The County's financial exposure is minimized upfront. For example, a concession could be structured where the private side finances and builds pods, and the County commits to supplying a baseline quantity of waste and pays a gate fee per ton processed. The private partner then recoups investment from those fees and revenue streams over time. This aligns with the County's interest in **exploring P3s and alternative funding** . Such arrangements can also tap into **green bonds or infrastructure funds** seeking sustainable projects. We will work with the County to identify the optimal finance structure that shares risks and rewards fairly, We are open to co-designing this structure in alignment with the County's procurement policies and risk tolerance.

- **Grants and Subsidies**: Given the innovative and environmental nature of EcoPods, we will aggressively pursue **grants** and subsidies to support the project. This includes federal and state grants for waste diversion, recycling, and renewable energy. For instance, the USDA and DOE have programs for biogas and energy-from-waste projects; the EPA supports innovative recycling infrastructure. Miami-Dade could collaborate with us to apply for grants under the Infrastructure Investment and Jobs Act or other initiatives targeting sustainable infrastructure. Preliminary assessments suggest that a portion of pilot costs could be grant-funded, reducing burden on local funds. We will also **seek state and federal tax credits** (e.g., Investment Tax Credit for renewable biogas, New Market Tax Credits if applicable for community benefits) and pass those benefits into the project economics.

- **Economic Viability and Return:** Over a projected project lifespan (say 20 years), our financial models indicate that EcoPods can achieve a **positive return on investment** when combining all revenue streams and avoided costs. The payback period is reasonable, especially with phased investment. By year [X] (to be determined in detailed study, but likely within 7-10 years of full operation), the net benefits could outweigh the costs, after which the system yields net savings to the County. Importantly, many "hidden" economic benefits are realized: avoided future costs for landfill expansions (saving hundreds of millions), stabilization of long-term waste management costs (since once pods are built, operating costs are more predictable than volatile landfill or hauling contracts), and job creation. The EcoPods initiative will create high-quality local jobs (operators, maintenance crews, drivers with shorter routes) contributing to the county economy. When factoring these in, the **economic case is even stronger.**

- **Comparative Cost Advantage**: In summary, while exact numbers will depend on final design and scale, the EcoPods system is designed to **meet or beat** the cost of traditional solutions when viewed holistically. Traditional landfill or incineration approaches often appear cheaper in the short term but carry long-term external costs and risks (land scarcity, methane emissions costs, environmental remediation). EcoPods internalize and solve those issues, delivering a financially and environmentally sustainable model. We are committed to full transparency in costs and performance, and we will work with the County to ensure the solution is not just environmentally superior but also financially prudent and sustainable for taxpayers.

Implementation Plan: Phases and Infrastructure

Our implementation plan is structured in **phases** to ensure a smooth rollout, risk mitigation, and continuous learning/improvement as we scale:

PHASE 1 – PILOT DEMONSTRATION (YEAR 1-2): "PROVE AND ADAPT"

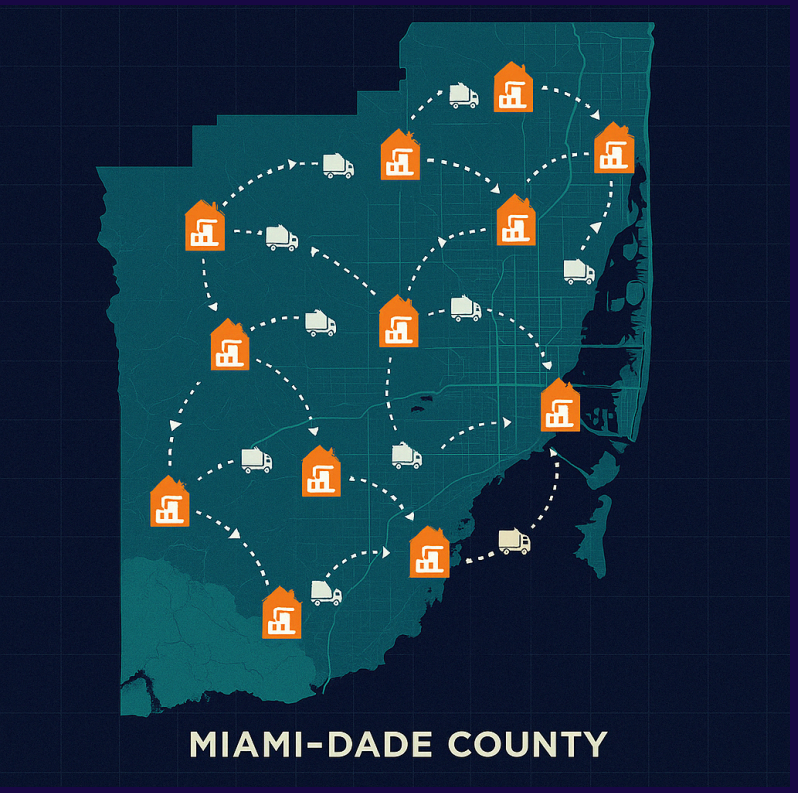
- **Site Selection & Setup**: In collaboration with the County, identify an optimal pilot site – e.g. an existing transfer station or a section of land at a closed landfill – to host the first EcoPod(s). We anticipate starting with a pilot **installation of one EcoPod**, initially processing up to **50 tons of waste per day**, with the ability to scale depending on observed demand and performance. (a small fraction of the total waste, allowing careful monitoring). Necessary site prep (foundation, utility hookups for water/power, etc.) will be minimal due to the modular design, but will be completed in this phase.

- **Pod Construction & Installation:** Manufacture the pilot EcoPods (likely off-site in modules) while site is prepared, then install on-site. Commissioning tests will be run to ensure all systems (sorting, digestion, WTE generator) work as intended in the local environment. Permits for pilot operation will be obtained with regulatory guidance (we expect a research/demo permit initially).

- **Operational Pilot Run:** Operate the pilot pods for a defined period (6-12 months) with County oversight. During this time, we will process real incoming MSW, fine-tune the machinery, and gather extensive data on performance: throughput, diversion rate, energy output, costs, and any community feedback (noise/odor – which we expect to be negligible). The pilot will demonstrate the concept's feasibility and provide the opportunity to **optimize settings for local waste characteristics.**

- **Community Engagement:** Concurrently, run a community outreach program around the pilot site – tours for officials and residents, education on how EcoPods work their benefits, and how they support the County's climate and zero-waste goals– to build public understanding and support. This phase ends with a thorough evaluation report delivered to the County, and the technology adjusted as needed based on pilot learnings.

Implementation Plan: Phases and Infrastructure



PHASE 2 – INITIAL SCALE-UP (YEAR 2-4): “SCALE AND INTEGRATE”

- **Expand Pod Deployment**: Upon successful pilot results, initiate scaling to handle a larger portion of the county’s waste. This involves deploying **additional EcoPods at multiple sites.** We will target strategic locations across the county, for example: North, Central, and South clusters, possibly co-located at existing waste facilities (North Dade Landfill area, South Dade landfill/campus area, etc.) or other County-owned industrial lands. By the end of Phase 2, aim to have **up to 10 pods operational**, with a target of processing **approximately 15–20%** of the county’s MSW, depending on pilot outcomes and available budget. This significantly reduces reliance on external landfills.

- **Infrastructure & Logistics:** Upgrade supporting infrastructure as needed – for instance, ensure each site has grid connections to export power, build small on-site storage for recyclables and compost curing areas. Adjust waste collection logistics: direct a portion of collection trucks from various service routes to the nearest pod instead of previous disposal destinations. Train additional staff to operate new pods (scale up workforce hiring and training program, possibly with local vocational schools or unions).

- **Integration with Waste System:** Work closely with DSWM to integrate EcoPods operations into the county’s daily waste management workflow. This might involve scheduling which portion of the waste stream (e.g. selected collection zones or specific waste types) is directed to pods versus legacy disposal, to gradually increase load on EcoPods as confidence and capacity grow. Maintain flexibility – if a pod needs maintenance, trucks can be temporarily diverted elsewhere, which will be coordinated via the smart routing system.

- **Ongoing Monitoring & Improvement:** Use the data from all operating pods to continuously improve performance. In this phase we will also refine the economic model in practice – tracking operational costs and revenue, validating that the projections hold true. We will implement any necessary tweaks (for example, if one type of waste proves troublesome, we’ll engineer a fix or adjust processes). By phase end, EcoPods will become **an integral and proven component** of the county’s decentralized waste infrastructure**,** with clear metrics showing its benefits.

Implementation Plan: Phases and Infrastructure

PHASE 3 – FULL DEPLOYMENT (YEAR 5 AND BEYOND): "OPTIMIZE AND EXPAND COUNTY-WIDE"

- **Maximize Coverage:** Based on Phase 2 outcomes and county decisions, proceed to roll out enough EcoPods to **manage the majority (if not all) of Miami-Dade's waste**. This could mean **up to 30–40 EcoPods**, depending on results and funding availability, distributed county-wide. The goal would be to gradually reduce the need for new landfills or large incinerators. By Year **6**, the system could handle **over half** of county waste, and by Year **10**, potentially **approach full coverage** depending on County priorities and broader integration.

- **Infrastructure Build-Out**: In this stage, any larger supporting infrastructure would be completed. For instance, if we decide to have a central control center or a maintenance hub for refurbishing pods, it will be established. Additionally, if energy production is significant, we might set up **power purchase agreements or grid injection points** at scale. Also, any required **recycling facilities partnerships** (to accept sorted materials) will be solidified via contracts – though since recyclables are baled, existing commercial recyclers can handle them, we just ensure the supply chain is in place.

- **Integration with County Long-Term Facilities:** If the County proceeds with a "Solid Waste Campus" concept, EcoPods can either form a key component of that campus (with many pods concentrated at one campus site to achieve economies of scale while still being modular) and/or serve as a pre-processing feeder that reduces the required size of any central facility. For example, a central campus might handle only the small residual output from pods or serve as an education center, potentially reducing or even eliminating the need for a large-scale incinerator. This phase will coordinate with any such broader plans to ensure synergy.

- **Continuous Community Engagement and Education:** As EcoPods become a regular fixture in waste management, continue the **communication plan** – keep the public informed of successes (e.g., "X tons of waste converted to energy, Y tons recycled – creating Z megawatt-hours of power for our community"). Engage schools and community groups with site visits or presentations to instill pride and cooperation (for instance, encouraging even better sorting at the source, if applicable, which further enhances pod efficiency). Public support will remain high as people see tangible benefits like cleaner neighborhoods (less litter, fewer trash trucks on highways) and perhaps even **rate stability or rebates** if the system saves money.

- **Review and Optimize:** Even in full deployment, a process of periodic review (say every year or two) will be in place. All stakeholders – County officials, EcoPods operators, community representatives – will assess performance versus goals. This ensures transparency and that any issues are caught early. Because of the modular nature, the County retains the flexibility to adjust how the system is configured. The final goal is a **fully optimized, countywide EcoPods network** that can serve Miami-Dade for decades to come, with continuous improvements along the way.

Throughout all phases, we will maintain close coordination with Miami-Dade County authorities, ensuring compliance with regulations, alignment with broader waste initiatives, and smooth adaptation of plans as needed.

Implementation Timeline (Milestones)

- **Q3 2025 – Project Kickoff & Approvals:** Upon receiving the County's go-ahead, immediately initiate detailed engineering and permitting for the pilot. Finalize partnership agreements (including any contracts or MOUs).
- **Target**: By end of 2025, have pilot site selected, project approved, and construction of pilot pods underway.

- **2026 – Pilot Launch and Evaluation: Q2 2026**: Install and commence operations of the Pilot EcoPods. The pilot runs through late 2026. By **Q4 2026**, collect performance data and community feedback, and deliver a comprehensive pilot evaluation report.
- **Decision Gate:** County and EcoPods Miami review results and consider scale-up based on demonstrated success (goal: meet or exceed diversion and cost targets in pilot).

- **2027 – Initial Scale Deployment:** Begin manufacturing additional pods in early 2027. **Mid-2027:** Deploy first wave of new EcoPods (perhaps 5-8 units at 2-3 sites). Ramping up operations in those sites by end of 2027. Meanwhile, secure any additional permits for expanded operations. Public outreach continues to herald the expansion.

- **2028 – Expanded Operations (Phase 2 continued): Early 2028:** Second wave of EcoPods installation (another 5-7 units), reaching the Phase 2 goal of ~15 total pods in operation. By **mid-2028**, these pods are fully integrated, handling ~25%+ of county waste. Begin to see measurable reductions in waste sent to landfills out-of-county. Also by mid-year, use data to refine operational protocols and training for a larger team. **Late 2028:** Conduct an interim review of system performance (efficiency, finances) – pending a positive evaluation, the system would be well-positioned for full deployment.

Implementation Timeline (Milestones)

- **2029-2030 – Full Deployment Rollout:** Commence Phase 3 scale-up. **2029**: Manufacture and deploy pods in batches continuously. Every few months, bring a new cluster online. By the end of **2029**, aim for roughly half of the eventual full network deployed (say ~25 pods running, handling about 50-60% of waste). The county's reliance on traditional disposal has more than halved at this point. **2030**: Complete deployment of remaining pods to reach full coverage. By mid-2030, the **target of near-100% waste processing by EcoPods** is achievable. This timeline aligns with critical County deadlines (notably, avoiding the need for a new landfill by 2026 was key; our solution has by now made the need for a new landfill increasingly unnecessary.

- **Beyond 2030 – Ongoing Operations & Expansion: 2031 and beyond**, the focus shifts to **optimization and expansion potential**. If population grows or waste changes, additional pods can be added on demand. The County can also explore **regional partnerships** – e.g., neighboring counties or cities might send waste to Miami-Dade EcoPods for a fee, effectively monetizing our capacity if we ever have excess, or duplicating the model in their locales with Miami-Dade's success as a blueprint. The timeline leaves Miami-Dade well-prepared for the future: by 2030 we have a robust, adaptable system, and thereafter the County enjoys decades of sustainable waste management with only incremental updates needed.

- **Q4 2030 – Project Review and Optimization:** At this point, the EcoPods network is effectively the backbone of Miami-Dade's waste management. A formal review is conducted to compare initial objectives with outcomes: diversion rate we aim for diversion and energy recovery rates significantly higher than current performance (potentially >80%), financial performance versus budget, environmental metrics (emissions reductions). Any adjustments (e.g., adding specialized pods, tweaking processes) are planned for continuous improvement beyond 2030.

(Note: The above timeline is aggressive yet achievable given the modular nature of the solution – it capitalizes on swift deployment ability. We will remain flexible to adjust pace as needed in consultation with the County.)

Legal and Environmental Aspects

- **Regulatory Compliance**: EcoPods Miami will ensure full **compliance with all local, state, and federal regulations** pertaining to solid waste processing, air and water quality, and zoning. Each EcoPod unit will operate under the necessary permits: Solid Waste Facility permits from Florida DEP, air emissions permits for the energy unit, and any required County approvals. We have already reviewed Florida's environmental regulations to design EcoPods within allowable limits (e.g., emissions control to meet Clean Air Act standards; digestate handling per state compost regs). Our approach is to **meet or exceed regulatory requirements,** providing a high margin of safety. We will work proactively with regulatory agencies from the pilot stage onward, making the permitting process smooth and addressing any concerns upfront.

- **Environmental Impact Mitigation:** An **environmental impact assessment** will be conducted (especially for larger deployment phases) to ensure all potential impacts are identified and mitigated. Key areas: **Air quality** – as noted, emissions are minimal and dispersed; modeling shows compliance even in sensitive areas. **Odor** – controlled via filters; we commit to zero nuisance odor at facility boundaries. **Noise** – equipment is enclosed and insulated; sound levels will be below typical urban background. **Traffic** – decentralized approach means smaller traffic increase at multiple sites rather than a big surge at one site; overall truck miles are reduced. **Climate impact** – the net effect is hugely positive (reduced GHG emissions). We will document these factors. In operations, we will continually monitor environmental performance (e.g., continuous emissions monitoring systems on each pod) and share data with the County to verify our low-impact claims.

- **Health and Safety:** Ensuring the health and safety of workers and nearby residents is paramount. Each pod will have strict safety protocols: confined space procedures for digester units, high-temperature precautions for gasifiers, personal protective equipment requirements for staff, etc. The processes occur in contained equipment, minimizing exposure to waste for workers compared to open landfill dumping. By removing garbage from neighborhoods quickly and processing it in controlled units, we also reduce public health vectors (less vermin, pests, or leachate that could affect groundwater). Overall, EcoPods will **improve public health outcomes** by handling waste more cleanly and promptly than current methods.

- **Intellectual Property (IP) and Licensing:** The EcoPods system architecture and certain process innovations are **proprietary to EcoPods Miami.** We are in the process of applying for patent protection on key components and process integration methods, and hold trademarks for our brand. This IP strategy ensures that the solution offered is **unique and cutting-edge**, giving Miami-Dade a first-mover advantage. From a legal standpoint, we are prepared to grant the County the necessary rights or licenses to use the EcoPods technology as part of our partnership. For example, if a long-term operating agreement is signed, it will include provisions for technology licensing, know-how transfer for local operators, and guarantees of performance. The County will benefit from our IP without having to worry about infringement or external restrictions, as we either own or have rights to all tech used. If the partnership ever transitions — for instance, should the County choose to internalize operations in the future, we will have a clear agreement on IP usage, ensuring **continuity of operations**. In summary, our IP protection strategy serves to secure the innovation while **enabling the County's use** through a fair partnership agreement.

Legal and Environmental Aspects

- **Insurance and Liability**: EcoPods Miami will carry comprehensive insurance throughout the project – covering liability, environmental impairment, and casualty risks. This means the County is protected in the unlikely event of incidents (e.g., an accident or environmental release – again, unlikely given our safeguards). Additionally, any subcontractors or partners we use will be required to be insured and to indemnify the County as appropriate. We will comply with all County risk management requirements, offering peace of mind that legal liabilities are addressed.

- **Environmental Equity and Justice:** Legally and ethically, we are committed to **equitable deployment** of EcoPods. We will engage with communities in site selection to avoid any perception of dumping burden on disadvantaged areas. The distributed nature inherently helps here, and each site will be chosen with fairness and local input in mind. We understand the County's obligations under environmental justice guidelines, and our plan will help fulfill them by reducing overall impact and spreading any facilities in a balanced way.

- **Waste Disposal and Byproducts:** Legally, the small fraction of residue from the process (ash/char) will be disposed of in accordance with regulations. We will test this material; if non-hazardous (expected to be non-hazardous inert), it can go to a regular landfill or possibly be reused under state beneficial use programs. If any hazardous components are present (unlikely, given removal of such items upfront), they will be handled by licensed hazardous waste contractors. By reducing waste to mostly benign byproducts, EcoPods significantly **lowers the County's long-term environmental liability** – there's less risk of future contamination or Superfund issues compared to continuing to pile up unprocessed garbage.

- **Legal Framework for Partnership**: We anticipate entering into a formal agreement or contract with the County following this proposal. **non-binding Memorandum of Understanding (MOU)** after the RFI stage to solidify the intent to collaborate, followed by a detailed contract (perhaps via a competitive RFP where we hope to be selected, or via negotiation under an unsolicited proposal allowance). This contract will outline performance guarantees (we will guarantee certain processing capacities and environmental performance), County obligations (waste delivery, etc.), payment terms, and ownership of assets (likely the pods could be owned by the operator or jointly, depending on financing). Our team, including legal advisors, has experience structuring such contracts and will ensure the County's interests are protected while enabling the project's success. All in all, we aim for a **transparent, accountable, and fair legal arrangement** that stands as a model for public-private cooperation.

Suggestions to the County – Partnership and Path Forward

- **Public-Private Partnership (P3) Model:** We recommend the County consider pursuing a **Public-Private Partnership** approach with EcoPods Miami to implement this solution. Under a P3, the County can leverage private-sector expertise and financing while retaining oversight and ensuring public goals are met. Specifically, EcoPods Miami can **Design, Build, Finance, Operate, and Maintain (DBFOM)** the EcoPods network under a long-term agreement. The County's role would be to provide the waste feedstock (and possibly sites or site leases) and to pay a service fee per ton or availability payment, while we handle day-to-day operations and capital upkeep. This model transfers significant risk to us (technology performance, construction, operations) and ties our compensation to meeting performance targets – aligning incentives.

We believe this approach offers the County **strong value** and **reduced risk**, and it follows the County's own directive to explore P3s and innovative funding for waste infrastructure . We stand ready to negotiate a detailed P3 agreement that includes performance guarantees, revenue-sharing mechanisms (for example, sharing profits if certain revenue thresholds from energy are exceeded), and eventual handback provisions if desired (e.g., after X years the County could take ownership of assets).

- **Contractual Framework:** As a next step, we suggest forming a joint working group to outline the terms of an agreement. This could result in a **Pilot Contract** for Phase 1 and a conditional **Master Services Agreement** for Phase 2 and 3 expansion. The pilot contract would allow both parties an "off-ramp" if expectations aren't met, but with a clear path to expansion if they are. Key contractual suggestions:
  - **Performance Metrics:** Define key performance indicators (KPIs) such as minimum throughput (tons/day per pod), minimum diversion rate (e.g. >85%), energy output targets, and compliance with emission standards. Tie a portion of payments to achieving these to ensure accountability.
  - **Payment Structure:** Perhaps a base tipping fee per ton (comparable to current disposal cost) for availability of the service, with bonuses for exceeding diversion or energy targets. The fee can be indexed to inflation for long-term stability. We will work to ensure the fee is affordable relative to the County's current budget (ideally cost-neutral or savings).
  - **County Support:** County to assist with permitting as the public sponsor, provide land or site access (possibly at nominal rent if county-owned), and consider dedicating or prioritizing waste streams to the EcoPods (to keep them fed with optimal material). Also possibly help in community outreach (lending official support).
  - **Risk Sharing:** Clearly delineate who bears what risk: e.g., technology risk largely on EcoPods Miami (if our system underperforms, we fix it at our cost), waste supply risk on County (County ensures that agreed tonnage is delivered so pods aren't starved), force majeure shared or negotiated, etc.
  - **Exit and Handback:** If the County ever wants to assume operations or ownership, terms can be built in for buying out the assets at fair value, or taking over at end-of-term. This gives the County long-term flexibility.

Suggestions to the County – Partnership and Path Forward

- **Funding and Grants Collaboration:** Web invite the County to explore partnering with us in pursuing external funding. Many grants look favorably on public-private collaboration. A united front – the County providing letters of support or co-filing applications – will strengthen our case to secure state and federal grants (for example, infrastructure grants, DOE pilot project funding, EPA materials recovery grants). We specifically suggest targeting programs in 2025-2026 that align with this project's scope. Together, we can **bring additional dollars to Miami-Dade** to reduce local cost. This includes exploring **federal tax credits** (which our private entity can monetize more easily; savings we can pass on in pricing) and new opportunities like green banks or resilience funds. Essentially, we ask the County to actively engage in seeking and supporting these funding avenues – it could dramatically improve the project's economics for all.

- **Site Provision and Zoning:** The County's assistance in identifying and providing suitable sites is crucial. We suggest using **county-owned properties** (wherever possible) to avoid land acquisition delays. Many existing facilities (transfer stations, closed landfill land, waste-to-energy plant site in Doral, etc.) could be leveraged. We propose a collaborative site survey soon to shortlist locations. County can expedite any necessary **zoning or land-use adjustments** since these will be public-purpose installations. Because EcoPods are relatively compact, we can fit into small parcels. A clear signal from the County that it intends to allocate space for EcoPods will greatly accelerate deployment.

- **Community Partnership and Communication Plan:** We recommend the County partner with us on a robust **communication and community engagement plan**. Having the County's endorsement and involvement in outreach lends credibility and authority. Tactics include: public workshops in communities slated for an EcoPod site (to explain the benefits and address questions), informational materials sent to residents county-wide highlighting how this innovation works, and media campaigns to build positive public perception. As the Waste Today Innovation Challenge notes, educating and engaging residents is key to waste diversion success . We will develop content (presentations, videos of the pilot, etc.), and we suggest that the County leverage its communication channels (social media, town halls, the Solid Waste newsletter) to disseminate that. This joint communication effort will ensure transparency and build public trust. It also dovetails with encouraging citizens to participate (e.g., if source separation programs are enhanced, or simply to instill pride in the new system).

Suggestions to the County – Partnership and Path Forward

- **Integration with County Programs:** We suggest integrating EcoPods deployment with existing County environmental and economic development programs. For example, coordinate with the **County's Zero Waste Master Plan** (as mentioned, our pilot can inform that plan) so that our efforts are part of the official roadmap. Also, consider linking with the **Miami-Dade Innovation Authority Challenge** outcomes – if any startups from that challenge complement EcoPods (e.g., apps for resident engagement or sensors for bins), we can collaborate with them in implementation. Aligning with County recycling campaigns (like reducing contamination) will further boost our system effectiveness. Essentially, we see EcoPods as a central pillar in a broader strategy, and encourage the County to weave it into all relevant initiatives, from climate action to green job training.

- **Flexible Contracting – Willingness to Iterate**: As this is an innovative approach, we suggest the County maintain a degree of flexibility in contracting. For instance, using a phased contracting approach (pilot MOU -> full contract) as mentioned, and including clauses that allow scope adjustments by mutual consent. The County could set up a **joint oversight committee** with EcoPods Miami members and County officials to meet regularly and manage the partnership. This collaborative governance will enable quick adjustments to the partnership or operations as needed, rather than getting stuck in red tape. We are committed to a true partnership spirit – working together to achieve the outcomes rather than a rigid vendor-buyer dynamic.

- **Long-Term Vision – Regional Leadership:** We also suggest the County consider the long-term regional potential. If Miami-Dade successfully implements EcoPods, it could lead the way for a South Florida or statewide revolution in waste management. The County could take credit and even potentially **license the approach to other municipalities** (with our support) as a revenue-generating endeavor or inter-county partnership. For example, perhaps a neighboring county might join the effort, sending waste to an EcoPods hub near their border, with cost-sharing arrangements. We mention this because thinking ahead, the County can position itself as a **leader and convener in waste solutions**, which may attract state support or additional funding. We as EcoPods Miami are open to making Miami-Dade a showcase that others follow, enhancing the County's stature. Our partnership could explicitly incorporate openness to expansion and collaboration beyond county lines, always ensuring Miami-Dade's needs are prioritized first.

- **Call for Action:** In conclusion of this section, our suggestion to the County is simple: **let's partner now to make this vision a reality.** By embracing a new model and working together through a smart contract and mutual commitments, Miami-Dade can avoid the pitfalls of the past (like expensive, contentious incinerators or endless landfill searches) and instead leapfrog into a sustainable future. We invite the County to consider moving forward with us from this RFI into a tangible pilot project in the coming months. The EcoPods Miami team is prepared to dedicate its full resources and attention to Miami-Dade's needs as a priority project.

Conclusion – Vision for the Future & Call to Action

- **A New Chapter in Waste Management:** Miami-Dade County stands at a crossroads in 2025 – faced with mounting waste and difficult choices, but also with an opportunity to reinvent how we deal with trash. **EcoPods Miami offers a bold new vision**: a future where waste is not a problem to be buried or burned far away, but a local resource continuously transformed into clean energy and recycled goods, right here in our community. This proposal has detailed how our innovative EcoPods system aims to meet all the key criteria of feasibility, originality, climate compatibility, community fit, and economic sense. The vision is clear: **a cleaner, smarter, and more self-reliant Miami-Dade** that turns today's waste into tomorrow's wealth, creating a showcase for the world.

- **Summary of Benefits:** By implementing EcoPods, the County will achieve drastically reduce landfill dependency**,** dramatically cut greenhouse emissions, and foster local green jobs and innovation. The comparative advantages over traditional solutions are stark – faster deployment, greater adaptability, and enhanced public acceptance. It's a solution that not only solves the technical problem of waste disposal but also aligns with the community's values and aspirations for sustainability. Miami-Dade's high per capita waste generation presents both a challenge and an opportunity , but with EcoPods, we convert that challenge into an asset – leading in waste-to-resource conversion.

- **Expansion Potential:** Our journey doesn't stop at managing today's waste. The EcoPods model is **scalable and exportable**. As mentioned, once proven here, it can expand to **serve the entire county's future growth** (ensuring capacity for decades without new mega-facilities) and even be replicated in other counties or cities. Miami-Dade can become the **epicenter of a new green industry**, potentially manufacturing EcoPods locally for other markets, training others, and reaping economic benefits as this innovation spreads. In essence, by acting now, the County can future-proof its waste system and take a leadership role in the global movement towards decentralized, sustainable waste management.

Conclusion – Vision for the Future & Call to Action

- **Community and Climate Legacy:** Adopting this solution will leave a positive legacy for generations. Imagine by 2035, Miami-Dade is renowned for its "**network of neighborhood resource hubs**" (formerly known as EcoPods) that have eliminated foul landfills and smokestacks. Our children see waste trucks deliver trash and soon later see electricity powering their school, or new products made from recycled materials – a direct, tangible cycle. The Bay and Everglades are cleaner because less waste runoff and fewer GHGs mean a healthier environment. This is the legacy the Commission and Mayor can create – a hallmark environmental achievement that aligns with global climate action and local quality of life improvements.

- **A Collaborative Path Forward:** We recognize that realizing this vision requires trust and collaboration. EcoPods Miami is fully committed to working side-by-side with Miami-Dade County officials, engineers, and the community at every step. We bring technology and passion; the County brings leadership and the mandate to serve its people. Together, we form a partnership of innovation and public service. We have meticulously planned and presented our approach, but we also remain flexible to refine details with your input – because co-creation will ensure the best outcome.

- **Call to Action:** We respectfully call on Miami-Dade County to **take the next step with us.** The recent RFI process has shown the County is open to new ideas – now is the time to turn ideas into action. We urge you to authorize moving into a pilot project agreement with EcoPods Miami, so we can demonstrate this solution at pilot scale on the ground as soon as possible. Every month of delay is more waste in landfills or being shipped away at high cost; every step forward is a stride towards sustainability and resilience. By choosing EcoPods, Miami-Dade's leaders will affirm their commitment to innovation, climate solutions, and fiscal responsibility. We stand ready to begin implementation immediately.

- **Closing Invitation:** In conclusion, EcoPods Miami thanks the County for the opportunity to present this proposal. We are excited about the prospect of helping Miami-Dade set a world-class example in solid waste management. Let's seize this moment and work together to turn this vision into reality. We invite you to join us in ushering in a cleaner, greener future for Miami-Dade – one EcoPod at a time.

Intellectual Property Notice:
The EcoPods Miami concept, design architecture, and integration model described in this document are proprietary innovations of EcoPods Miami. All visual, technical and operational elements are protected under pending intellectual property filings. No part of this proposal may be reproduced, implemented, or disseminated without written consent from the author. Any unauthorized use will be considered a violation of intellectual property rights.

THANK YOU
FOR YOUR ATTENTION

Together, we can build smarter, more sustainable cities for a better future.

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contact@lallee-royale.com

Medellin,Colombia

EnCAP-IT

Market Research Response

ENCAP-IT

***** VIA EMAIL - Saba.Musleh@miamidade.gov *****

April 14, 2025

Saba Musleh, CPPB
Negotiator
Strategic Procurement Department
Miami-Dade County

Re: Market Research for Municipal Solid Waste Management Solutions

Saba:

EnCAP-IT is pleased to submit information in response to Miami-Dade County's Market Research on Municipal Solid Waste Management Solutions. We understand the urgency of this request and offer, somewhat, an "pre-solution" to the *Path Forward: Options to Consider* listed in *Second Update on Directive No. 241676* or any "zero-waste" or landfill diversion programs Miami-Dade decides on.

I would advocate that maximizing the airspace at your existing landfill assets is essential to any of your disposal options. The timeframe of implementation for any outside option is the biggest hurdle Miami-Dade will face. Using existing landfill asset airspace is a minimally disruptive approach to give Miami-Dade additional time.

The Miami-Dade Opportunity

- Use eMSE Berms to maximize airspace capacity at both the North Dade and South Dade Landfills;
  - Up to ~ 8.5M cy of capacity at North Dade Landfill
  - Up to ~ 10.8M cy of capacity at South Dade Landfill

- Leverage existing landfill assets to provide a stop gap measure, allowing Miami-Dade more time to develop a long-term waste management solution;

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4507 Cedar Forest Road
Glen Allen, Virginia 23058

Phone: (804) 647-0952
jswenson@encap-it.net

  - Although the expansion of the Class III North Dade Landfill is not as prevalent as the South Dade Landfill Class I expansion, it can increase the remaining life multiple decades.
  - Based on current inbound waste volumes, expansion could increase the remaining life of the South Dade Landfill 9 to 10 years.

- EnCAP-IT provides TOOLS (safeBERM® designs) allowing Miami-Dade to develop a program re-purposing waste material into eMSE expansion structures.
  - Miami-Dade develops their own program to solve their own area remediation project challenges.
  - Because Miami-Dade's landfills are "soil poor", as an alternative Miami-Dade could utilize the incinerator ash at its Resources Recovery Facility for construction fill.

To further explain and provide you with more information about safeBERM® Landfill Expansion System I have attached the recent presentation I made to various members of the Miami-Dade County DSWM and our brochure.

Since EnCAP-IT licenses these safeBERM® solutions on a site-by-site basis through our Project Partnership Program and requires a tremendous amount of your inputs, I am not sure it fits the requested information format presented. I can certainly add to my response.

Conversations are free so we can schedule a Teams meeting with you, your staff, or your consultants. I can be reached at jswenson@encap-it.net or (804) 647-0952.

Sincerely,

John P. Swenson

Cc: Ross Byers, AtkinsRealis (email only)

An Innovative Approach to MSE Berms for Landfill Expansion

Encapsulated Mechanically Stabilized Earthen (eMSE) Berms

Miami-Dade County

Department of Solid Waste Management

ENCAP-IT SOLUTIONS

SAFER BETTER CHEAPER

Encapsulated Mechanically Stabilized Earthen (eMSE) Berms

Introduction

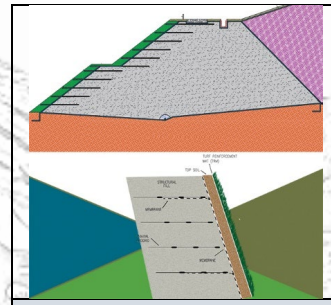
ENCAP-IT SOLUTIONS

PRESENTER:

John P. Swenson

Founder | Inventor | Owner

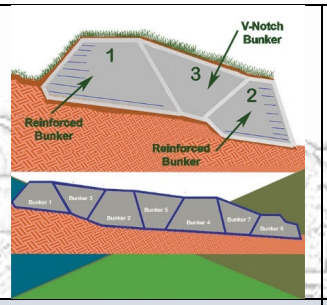
We consult with organizations, helping them in deploying EnCAP-IT's patented, green, innovative, solution TOOL platform that is designed to resolve environmental challenges.



*safe*BERM® Solutions

This solution promotes the use of Encapsulated Mechanically Stabilized Earthen ("eMSE") berms in which the berm fill is fully encapsulated using a geomembrane liner system to proactively control infiltration. The eMSE berm innovation allows the owner to configure the berm as deemed most technically and economically appropriate.

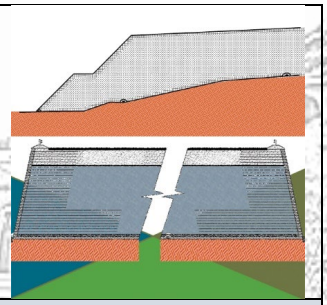
A safer, better and cheaper method to construct MSE berms, levees, dams and dikes than traditional methods.



*safe*STORAGE® Solutions

This solution promotes the use of Encapsulated Mechanically Stabilized Earthen ("eMSE") berm/bunkers in which the construction fill is fully encapsulated using a geomembrane liner system to proactively control infiltration. Especially useful in CCR Deposition Strategies; with limited space, abundance of ash and requires environmental safeguards.

A safer, better and cheaper method to construct MSE bunkers than traditional methods.



*safe*REUSE™ Solutions

This solution promotes the use of Encapsulated Mechanically Stabilized Earthen ("eMSE") structural fills in which the construction fill is fully encapsulated using a geomembrane liner system to proactively control infiltration. Increases future development opportunities by providing environmentally safe infrastructure from which green open space is created.

A safer, better and cheaper method to construct engineered structural fills than traditional methods.

Miami-Dade Opportunity

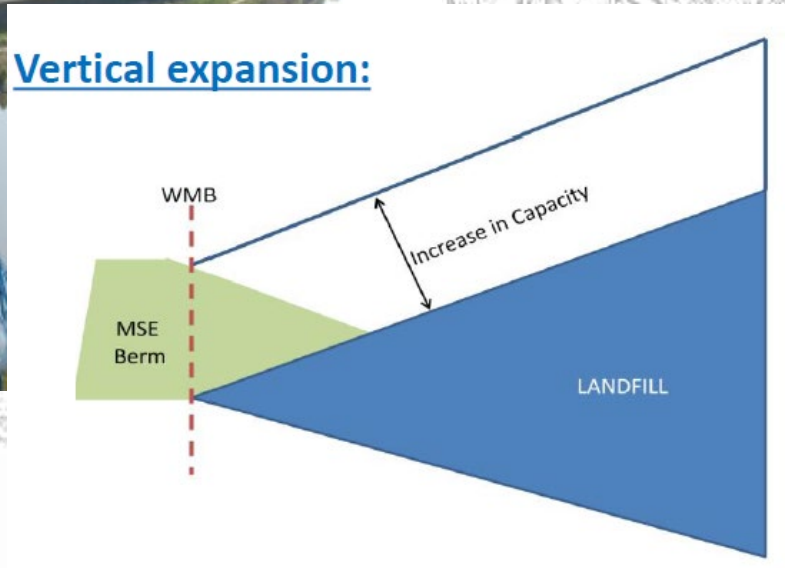
- Use eMSE Berms to maximize capacity at both the North Dade and South Dade Landfills
- Leverage existing landfill assets to provide a stop gap measure, allowing Miami-Dade more time to develop a long-term waste management solution.
- EnCAP-IT provides the TOOLS (safeBERM® designs) allowing Miami-Dade to develop a program re-purposing waste materials into eMSE expansion structures.

Traditional MSE Berm for Landfill Capacity Expansion (Notable Example)

Cherry Island Landfill – DSWA - Wilmington, DE (Traditional MSE Berm)

The Cherry Island Landfill expansion included the use of a berm that was built over very soft dredge spoils. The berm was built by installing wick drains and building the berm in a sequenced fashion to allow for consolidation and strengthening of the soft soils. Geotechnical instrumentation was installed to monitor the foundation soil consolidation and to inform the beginning of each successive sequence.

https://www.geosyntec.com/projects/item/757-innovative-landfill-foundation-improvement-technique-at-the-cherry-island-landfill-allows-a-major-vertical-expansion



Introducing the TOOLS to Construct Encapsulated Mechanically Structural Earthen (eMSE) Berms for Landfill Expansions

eMSE Berms vs Traditional MSE Berms

- Fully encapsulated with a geomembrane liner system -proactively controls infiltration - **SAFER**
- Flexibility in configuration – **MORE ECONOMICAL and PERMIT-ACCEPTABLE**
- Flexible in use of non-traditional structural fill – **LOWER CAPEX and EFFICIENT**
  - Less consumption and cost of natural materials
  - Recycling impacted materials as a revenue generating resource
  - Use as capacity-generating construction material vs capacity consuming waste
  - Conserves site resources and funds future CapEx

Encapsulated Mechanically Stabilized Earthen Structures (eMSE)

Safety as a Key Component

Proactive Control of Moisture: In an eMSE (encapsulated mechanically stabilized earthen) system application, the geomembrane liner system fully encapsulates the system, including the fill material, preventing the migration of stormwater run-on or run-off into the fill material, as well as seepage from within or outside of the existing waste mass. In addition to the encapsulation system, a toe drain collector at the bottom of the eMSE system collects water that enters the fill during construction.

Key aspect of eMSE structures: encapsulation and proactive control of moisture by "wrapping" the eMSE fill with geomembrane, reducing a major cause of structural failure.

Flexible Use of Materials and Configuration Improve Functionality

Flexible and Scalable: In an eMSE system application, the same protections used by the waste industry to isolate waste. However, the former waste materials (repurposed) are used for construction, are used to enhance facility disposal capacity and do not themselves consume needed, revenue-generating capacity. Under a traditional MSE approach, the design efficiency of the structure is challenged by the cost of construction; which in turn jeopardizes the economic justification of the project. Under an eMSE system application the use of alternative fill material enhances the flexibility of design configurations; which instead benefits project economics.

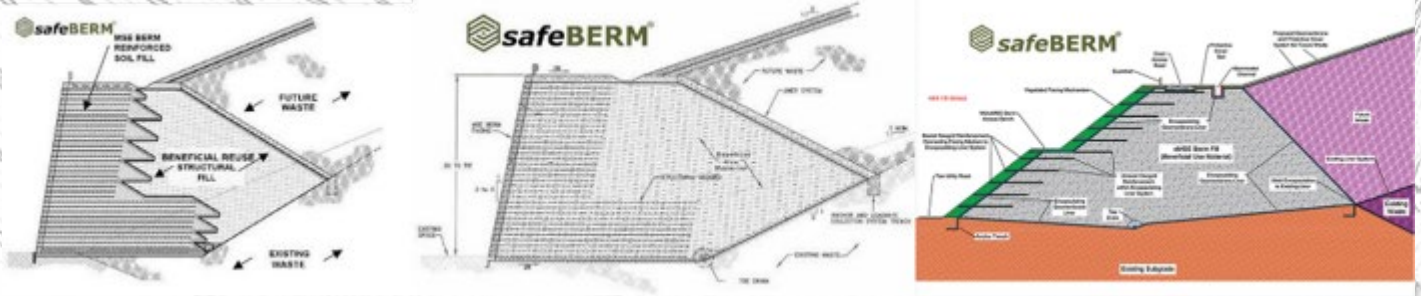
Key aspect of eMSE structures: encapsulation provides flexibility via economized design elements that are configured to address specific site requirements.

Flexible Use of Materials Improve Savings

Material Procurement: In an eMSE system application, flexibility in the selection of eMSE structural fill, recycling low-contaminated beneficial use materials in lieu of consuming expensive natural resources provides greater opportunity. The fundamental driver of repurposing an existing waste stream to a beneficial use material stream is a key economic result.

Key aspect of eMSE structures: material markets that could not be previously pursued (in both cases: onsite or offsite materials) can become a new source benefiting the project.

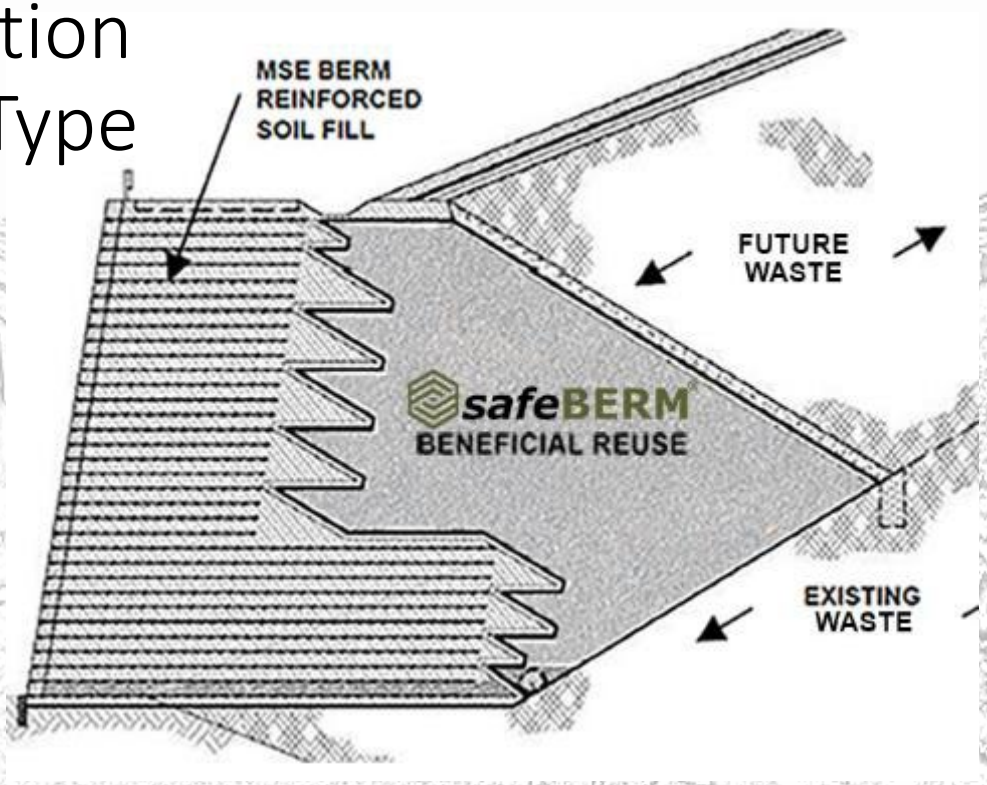
Developed to Improve Capital and Operational Efficiency for Waste Management Industry



Reinforced and encapsulated berms as the foundation for wide variety of applications

- Increasing disposal capacity and safety
- Maximizing Beneficial Use of Materials
- Enhancing closure and post-closure options

Partial Encapsulation "Burrito" Type



Metrics:

Acreage of Landfill:	83
eMSE Berm Length:	6,140 lf
eMSE Berm Height:	38-45 ft
# Construction Phases:	7
Beneficial Reuse Fill:	Impacted Soils/CCR
Capacity Gained:	4.1M cy

Beneficial Use Material - non-reinforced zone & 56% of overall fill requirement

Full Encapsulation

Metrics:

eMSE Berm Length:	3,532 lf
eMSE Berm Height:	52-65 ft
# Construction Phases:	3
Beneficial Reuse Fill:	CCR
Capacity Gained:	2.6M cy

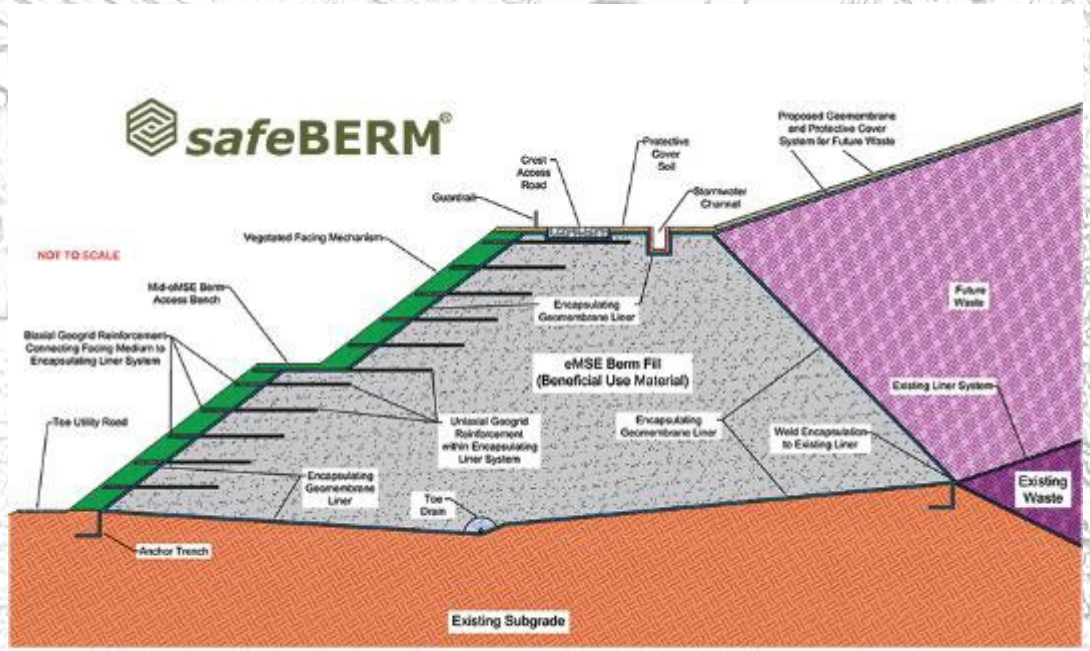
Beneficial Use Material – all berm zone, 99% of overall fill requirement

1:1 Outside Slope

Metrics:

eMSE Berm Length:	5,584 lf
eMSE Berm Height:	56 - 61 ft
# Construction Phases:	4
Beneficial Reuse Fill:	Impacted Soils
Capacity Gained:	3.3M+ cy

Beneficial Use Material – all berm zone, 99% of overall fill requirement



Proven Solution

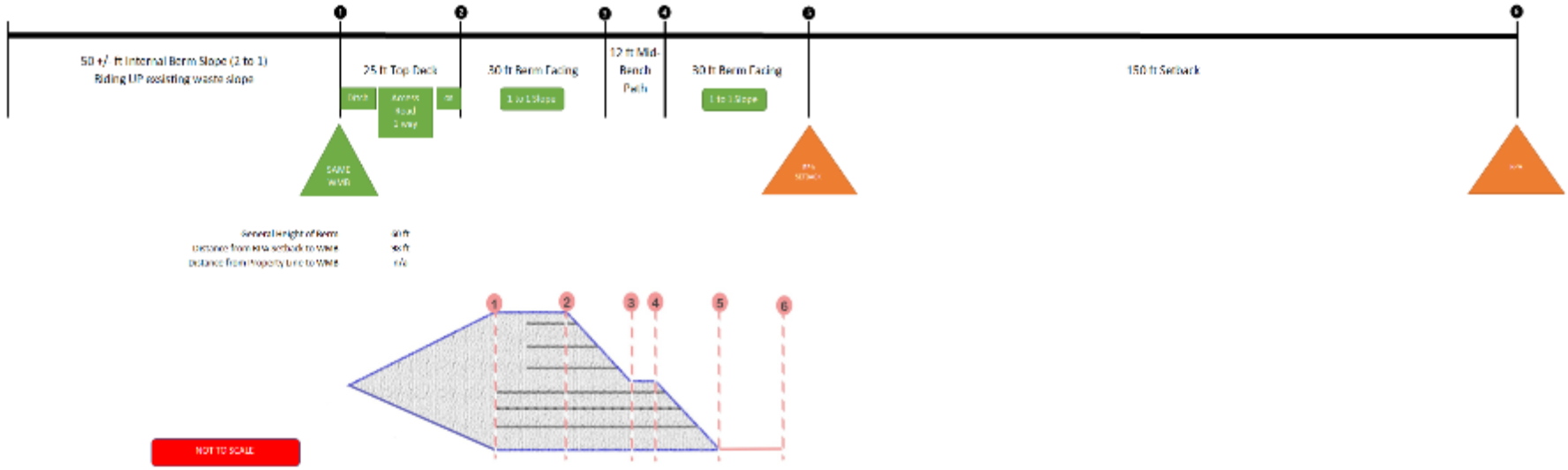
safeBERM®

Shoosmith Bros. Landfill, Chester, VA

Tri-City Landfill, Petersburg, VA

The Right Tools for the Job?

Depending on property lines, setbacks, existing infrastructure, existing waste management boundaries (WMB) determines the “type”, size, and maximum height & length. Lastly, length and height are determined by DSWM’s expectations. We use a simple horizontal tool after we determine the “pinch point” along a particular section of landfill perimeter. A sample is below;



Why should DSWM consider utilizing eMSE berms in its expansion?

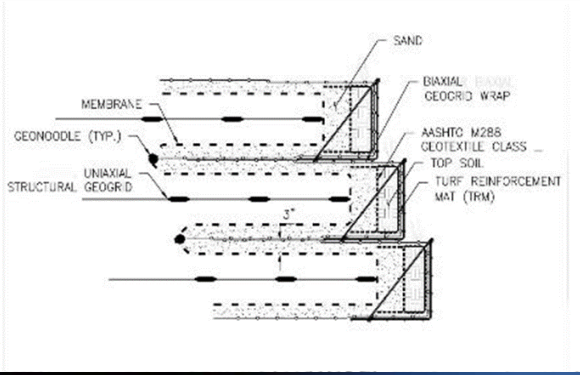
- SAFER
- BETTER
- CHEAPER

Introducing the Encapsulated Mechanically Stabilized Earthen (eMSE) Berm

Why consider?

Safety (addresses the challenges of moisture)

- Provides a Proactive Liquid Control system
- Provides engineering TOOLS that aid in design challenges



Introducing the Encapsulated Mechanically Stabilized Earthen (eMSE) Berm

Why consider?

Withstood

- 5.8 – 6.0 earthquake

Then

- Hurricane Irene:
  - 7-8” rain: 12-hours
  - 65 mph wind gusts / 45 mph sustained

NO IMPACTS

Introducing the Encapsulated Mechanically Stabilized Earthen (eMSE) Berm

Why consider?

Flexibility (configurations)

- Partial Encapsulation
- Full Encapsulation
- 1:1 Outside Slope

In a site centric landfill expansion process, situational fluency (flexibility) becomes paramount to project success. The TOOLS have been developed to ensure a successful pathway is implemented.

Introducing the Encapsulated Mechanically Stabilized Earthen (eMSE) Berm

Why consider?

Various Beneficial Use Materials
…. Reducing Costs

- CCRs
- Incinerator ash
- Impacted soils
- Foundry sands
- Dredge material
- Crushed concrete
- Crushed glass
- Drill cuttings
- Other approved materials

Putting it All Together

Benefit Summary for DSWM:

- SAFER - Enhances Safety & Slope Stability
- BETTER - Maximizes Existing Landfill Capacity
- CHEAPER - Reduces Construction Cost per Unit Disposal Volume

Increased Safety + Added Capacity + Reduced Costs =

Lasting Legacy & Good Public Policy

QUESTIONS?

ENCAP-IT SOLUTIONS

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https://encap-it.net/info/

Publisher	Date	Article Link
WasteAdvantage Magazine	**December 2021** *How to Lead in Landfill Design*	https://encap-it.net/wp-content/uploads/2021/12/Waste-Advantage-Magazine-December-2021-Issuepg.-50.pdf
WasteAdvantage Magazine	**September 2021** *Why You Should Consider Including Encapsulated Mechanically Stabilized Earthen (eMSE) Berms in Landfill Expansions*	https://encap-it.net/wp-content/uploads/2021/09/Waste-Advantage-Magazine-September-2021-Issuepg.-44.pdf
Ash at Work Magazine	**July 2021** *Functional Value of Coal Combustion Products for eMSE Structures*	https://encap-it.net/wp-content/uploads/2021/07/Ash-at-Work-Magazine-Issue-I-2021-pg.-18.pdf
WasteAdvantage Magazine	**October 2019** *The Benefits of an Encapsulated Mechanically Stabilized Earthen (eMSE) Berm*	https://encap-it.net/wp-content/uploads/2021/12/Waste-Advantage-Magazine-October-2019-Issue-pg.-42.pdf
Geosynthetics Magazine	**August 2017** *Macroencapsulation: Obtaining on-site clean closure*	https://encap-it.net/wp-content/uploads/2020/03/0817GS_Macroencapsulation.pdf

What's Next?

- EnCAP-IT's eMSE tools (designs) can assist DSWM in its existing strategies, contracts, and consultants. It is an add-on or improvement to the present course with the goal of meeting (or exceeding) all stakeholders approvals.
- How can EnCAP-IT best navigate the current evaluation process?

ENCAP-IT safeBERM® SYSTEM

Landfill Expansion

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Email: jswenson@encap-it.net
Website: https://encap-it.net/

ENCAP-IT

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OVERVIEW

EnCAP-IT is built on helping its project partners mitigate risk, manage and reduce environmental impacts, and maximize opportunities related to safety, sustainability, and economics.

Due to decreasing air space, landfill operators need to maximize the landfill space they have. EnCAP-IT has developed a patented approach to creating valuable landfill space in areas where the horizontal expansion of a landfill site is limited by site geography or permitting.

Our approach promotes the use of Encapsulated Mechanically Stabilized Earthen ("eMSE") berms in which the berm fill is fully encapsulated using a geomembrane liner system to proactively control infiltration. The eMSE berm innovation allows the owner to configure the berm as deemed most technically and economically appropriate. A safer, better and cheaper method to construct MSE berms, levees, dams and dikes than traditional methods.

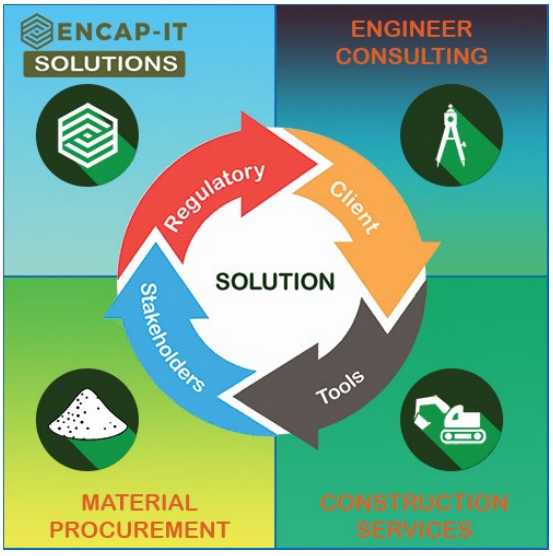
WE ARE IN THE BUSINESS of licensing these solutions on a site-by-site basis through our Project Partnership Program on an individual site license basis.

At EnCAP-IT, this is our passion, helping organizations manage waste and materials in locations with limited land areas more- efficiently.

Our patented construction approach results in better-operating characteristics of the landfill, such as steeper side slopes and better infiltration management. Being a partner gives you access to our toolbox of useful patents, market knowledge, and know- how to deliver practical and environmentally beneficial projects successfully.

As a partner of EnCAP-IT, we'll help implement our solution framework together for your site. You'll have access to a differentiated, proven approach for better-managing landfill projects and, in some cases, extending the lifetime of landfills. Being a partner gives you access to our toolbox of useful patents, market knowledge, and know-how to deliver profitable and environmentally beneficial projects successfully.

We invite you to evaluate this opportunity for **Partners** to join our unique and successful program. Let's meet! All good ideas start with a conversation.



OPPORTUNITY

The Landfill Capacity Issue

The waste market has tremendous near-term potential, with hundreds of millions of dollars being spent on expanding and closing landfills. All landfill sites are under specific environmental regulations. Increased regulations are driving the waste market.

The U.S. generates approximately **268 million tons of municipal solid waste each year, with approximately 139 million tons (52%) sent to landfills.** The U.S. is on track to have **18 years of remaining landfill capacity left** in 2020, according to a new report from the research firm Waste Business Journal (WBJ). Regional capacity estimates vary widely, from 10.5 years in the Northeast to 27.4 years in the West.[1]

> *"Conversion of Existing Landfills to Regional Based*
>
> *Closing one landfill means the expansion of another, resulting in an acceptance of a regional-based waste management system. However, this trend is constantly under attack because people do not want any trash in their community. landfills within this system need to be properly maximized, not closed.*
>
> *To fend off a trash crisis—at the national, state, county or community level—long-term landfill design becomes a much more important component. Traditional approaches need to be adjusted to anticipate the needs of the communities the landfill serves. It all starts with planning, communication and innovation to be successful."*
>
> John P. Swenson
> "*How to Lead in Landfill Design*"
> December 2021
> Waste Advantage Magazine

Landfill depletion and, more specifically, waste capacity loss, are inevitable for the foreseeable future. Landfill management becomes paramount when facing increasing challenges due to regulatory and public pressures. With the number of landfills **decreasing from over 7,600 in the 1980s to around 1,300 today**, it is time to leverage the landfills we have.

[1] https://www.epa.gov

The market is changing. Opponents of traditional expansion and closure of landfills are more informed and more organized. To combat this trend, your landfill capacity strategy needs innovative methods, like EnCAP-IT's solutions, to focus on the project's expectations.

Encapsulated Mechanically Stabilized Earthen Berms for Landfill Expansion

Traditional Mechanically Stabilized Earthen ("MSE") Berms have been around since the 1960s. These landfill expansion berms have created better use of airspace while also having a smaller footprint.

General Advantages of the MSE berm expansion method:

- Creates additional disposal capacity over top of an existing landfill footprint with minimal disturbance areas around the existing footprint
- Uses existing facility operations infrastructure
- Incorporates existing environmental management controls
- Sustainable solution
- Increases capacity without increasing closure costs and with negligible impact on post closure costs
- It is reliable

Unfortunately, traditional methods have not been kept up with the changing strategies around the waste industry. These traditional methods are also expensive. The capital costs of a traditional berm expansion are an average of $10 per cubic yard. In comparison, our Encapsulated Mechanically Stabilized Earthen Berms (eMSE) have capital costs of (**$2.50**) **to $4.15 per cubic yard**.

Stage	Capital Cost to Develop Air Space
First Cell	$10/CY to $20CY
Average Cell After the First	$2CY to $5/CY
Permitted Expansion	$5/CY to $10/CY
MSE Berm Expansion	$10/CY
safeBERM® Expansion	**($2/CY) to $4/CY**

Our partners don't have time to fit their needs around a solution. Instead, they are looking for a **solution that fits their needs**. EnCAP-IT's tools are flexible and

respond to the needs of the clients. Once our partners know the needs of the site, the solution's situational fluency is set up to respond to the unique needs of the client.

The eMSE (encapsulated mechanically stabilized earthen) Berm Project Plan is developed under two main perspectives.

Technical Perspective

Safety as a Key Component

Proactive Control of Moisture: In an eMSE system application, the geomembrane liner system fully encapsulates the system, including the fill material, preventing the migration of stormwater run-on or run-off into the fill material, as well as seepage from within or outside of the existing waste mass. In addition to the encapsulation system, a toe drain collector at the bottom of the eMSE system collects water that enters the fill during construction.

Key aspect of eMSE structures: encapsulation and proactive control of moisture by "wrapping" the eMSE berm fill with geomembrane, reducing a major cause of structural failure.

Flexible Use of Materials and Configuration Improve Functionality

Flexible and Scalable: In an eMSE system application, the same protection is used by the waste industry to isolate waste. However the former waste materials (beneficially) used for berm construction, are used to enhance facility disposal capacity and do not themselves consume needed, revenue-generating capacity. Under a traditional MSE approach, the design efficiency of the berm is challenged by the cost of construction; which in turn jeopardizes the economic justification of added disposal capacity. Under an eMSE system application the use of alternative fill material enhances the flexibility of design configurations; which instead benefits project economics.

Key aspect of eMSE structures: encapsulation provides flexibility via economized design elements that are configured to address specific site requirements.

Business Perspective

Flexible Use of Materials Improve Savings

Material Procurement: In an eMSE system application, flexibility in the selection of eMSE structural fill, recycling low-contaminated beneficial use materials in lieu of consuming expensive natural resources provides greater opportunity. The fundamental driver of converting an existing airspace depleting waste stream to a non-depleting beneficial use material stream is a key economic result.

Although a site might have an efficient source of fill material (incinerator ash, for example) the eMSE system allows for other material procurement. The need to shorten construction timeframes, regulatory challenges or general market conditions may justify some alternative material procurement programs. The eMSE system application allows for materials such as CCR, Impacted Soils, Non-Recyclable Materials such as crushed glass, Dredge Spoils, and other obtainable material streams. Other problematic materials that originate on site, such as excavated Miocene clay, could be potential construction material thus off-setting the costs of its management.

Key aspect of eMSE structures: material markets that could not be previously pursued (in both cases representing non-capacity diminishing revenue) can become a new source benefiting the landfill.

Favorable Business Models

EnCAP-IT's business models encompass all aspects of the eMSE solution for the landfill. As the landfill owner's expectations are determined, which dictate the facility design and permitting pathways, those key indicators are put into the business models. Material procurement and constructability factors are then added, producing a construction delivery strategy.

Key aspect of eMSE structures: flexibility to incorporate business or technical changes at any point in the process is paramount to the project's success.

We offer an innovative approach that is **Safer, Better and Cheaper**.

Is your organization prepared with the right tools?

The Right Tools for the Job

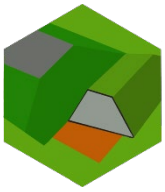
We've been involved in dozens of landfill site-level analyses. They all had common challenges and concerns: not enough available land to expand or not enough innovation to turn a closing landfill into an open space. While traditional expansion and closure methods lend, somewhat, to solving this dilemma, they often come up short. In every one of these analyses, using our tools provides a far safer, better, and cheaper way in which to expand or close.

With different project delivery methods like design-bid-build with cold RFPs, construction manager at risk, or design-build, our solutions give a competitive edge with more tools to solve a project's known and unknown challenges.

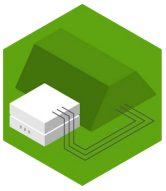
EnCAP-IT's patented solution offers the following benefits to your landfill site(s):

1. **Safer.** Proactive Control of Moisture.
2. **More Stability.** Our solution is more stable than traditional methods.
3. **Smaller Footprint.** Our solution lessens the irretrievable commitment of resources than the land commitment associated with a traditional lateral expansion.
4. **Uses Existing Facility Infrastructure.** Our solution incorporates and enhances existing environmental management controls.
5. **Cheaper.** Our solution provides an opportunity to recover costs through beneficial use, optimization, and provide a cheaper and cost controllable solution.
6. **Easier Future Land Use.** By linking a landfill reclamation project with an infrastructure-related excavation project that requires the deposition of large volumes of solid waste, impacted soils, and other materials, both projects benefit.

EXCAVATE



BUILD CAPACITY



MONITOR

SAFER

BETTER

CHEAPER

PROJECT PARTNER PROGRAM

If you become an exclusive project partner, we actively collaborate with you. You gain access to:

1. Patented Platform
2. Project Delivery Support
3. No Fee IP Licensing Rights

Our support, resources, and toolkit will help you find success for your landfill. Our solutions are cheaper than traditional methods and provide solutions that require a smaller land footprint.

1. *Patented Platform*

EnCAP-IT's solutions are known to be safer, better, and cheaper than the traditional methods used in caring for waste landfill space. **In short, you can store more waste into less space.**

Benefits include:

- **Controlling** moisture, using a geomembrane liner system to encapsulate the landfill fully, and preventing stormwater run-off migration.
- **Creating** additional disposal capacity on top of the existing landfill footprint, using the existing facility infrastructure
- **Aligning** with existing environmental management controls
- **Spending** less on land and materials for landfill capacity management
- **Employing** cost reductions by sourcing beneficial use material as fill material.

EnCAP-IT's platform focuses on environmentally friendly approaches. Our delivery approach focuses on creating a more durable, more sustainable solution to your solid waste needs. It is protected by 12 patents, almost 200 cross-sections, and nearly 400 claims. As a project partner, you get to apply the patented platform to your site(s).

2. Project Delivery Support

We support our partners by helping them write their engineering estimates and proposals. We approach it from a business model perspective. We will support you during the design & permitting of your eMSE berm system, assist in the materials procurement process and provide consulting services during the construction phase.

EnCAP-IT is usually involved early in the project, focusing on design review, regulatory review, construction phasing, operations, and tapering off during construction execution.

3. No Fee IP Licensing Rights

EnCAP-IT offers a Premium Solution Program for companies with multiple sites working across the country. Under this program, EnCAP-IT collaborates with the project team on justification, pricing, and strategies of our solutions on a site-by-site basis and provides multi-site discounts.

Under EnCAP-IT's "Share Program", EnCAP-IT does not charge for services, but rather shares in the cost savings with its Partners. All "upfront" fees for exclusivity rights are recoverable.

GETTING STARTED

Discovery Meeting

We'll meet and do a joint discovery meeting to discuss our collaborative process and Individual site opportunities. It involves two-way sharing of information:

- ***Collaborative Approach:*** *Our approach to projects are a collaborative approach known as the construction management at-risk (CMR). This approach keeps all stakeholders involved with a more positive experience than design-bid-build and design-build approaches. The waste market is moving to a more collaborative approach, and our partnership will give you the tools to compete in this market.*
- ***Your involvement and interest in the market:*** *We are excited to hear about your experience in the waste market and how you are looking to expand your landfill. Your interest and insights are valuable to our partnership.*
- ***How 1 + 1 = 3 when we collaborate:*** *The power you gain when you collaborate with us is that your team will only be stronger.*

Project Planning Review

In one or more meetings, we'll work together to do an initial project planning plan. We'll be making significant investments in one another, and as with any new partnership, we'll want to make sure we are a good mutual fit.

Contractual Commitment

You'll review and negotiate agreements.

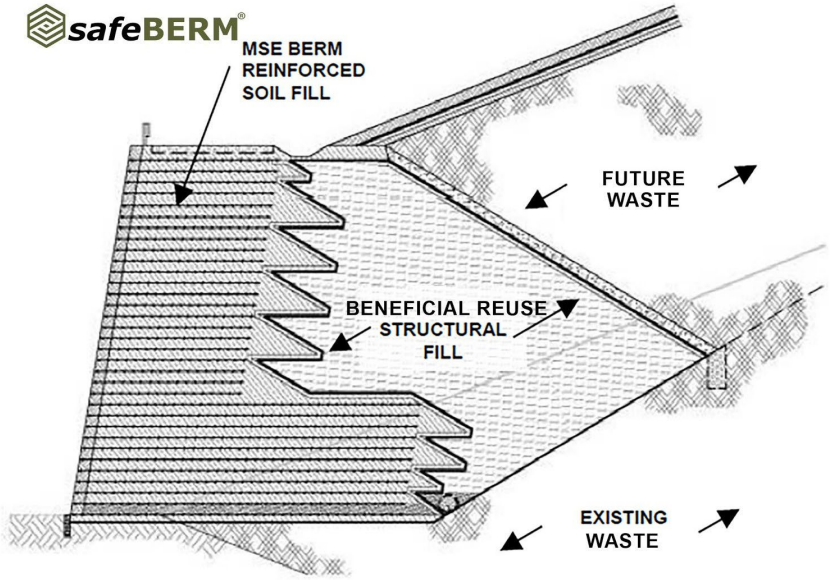
There is a substantial opportunity, and we want to win it with you.

If you see this too, let's get started. We are excited to see how EnCAP-IT can help you solve challenges in the landfill expansion market.

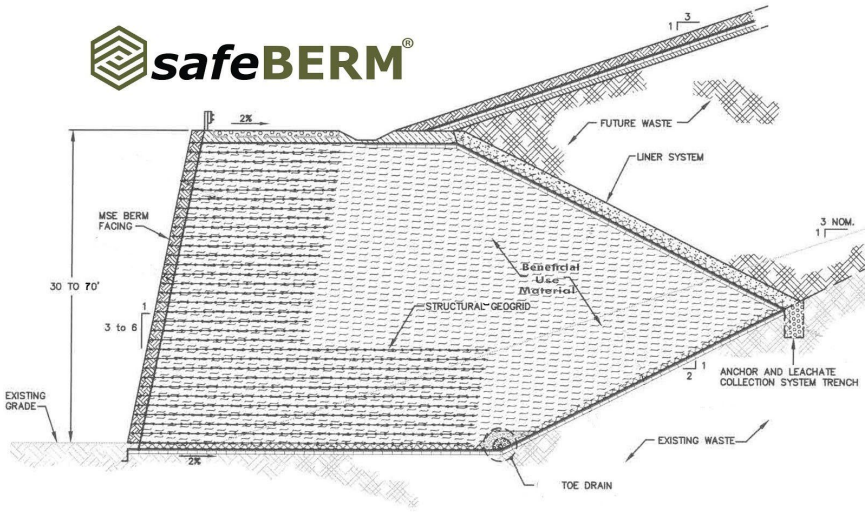
Let's meet.

Appendix A: Expansion Solution Platforms

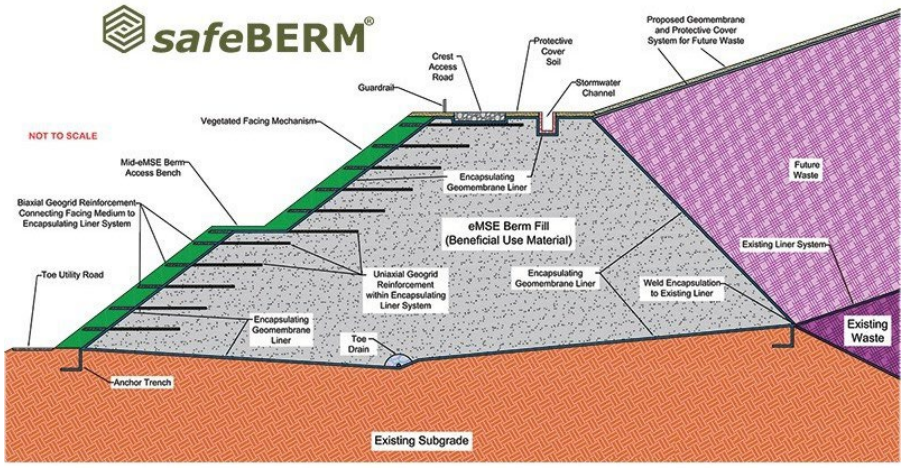
EnCAP-IT's solution platforms are not a singular solution where site's must be a perfect fit for it to work. Instead, the solution platforms are flexible and responsive to the unique needs of the landfill sites. Here is how a collaborative approach and our solutions platform has worked since 2009:



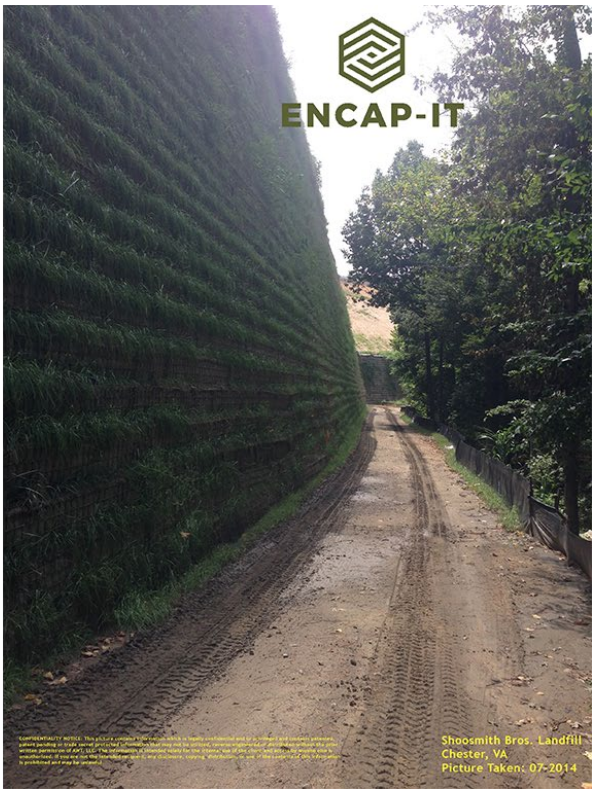
The first evolution of our solution is commonly referred to as the "berm burrito", the non-reinforced zone of the berm is encapsulated with geomembrane. This leads to an estimated beneficial use materials requirement between 50 and 60% of all construction fill. Provide greater safety and cost recovery.



At our client's request, we further developed our eMSE system to incorporate 99% beneficial use materials as construction fill. The entire berm is encapsulated. This increased safety factors and enhanced (maximized) cost recovery.



At our client's request, we further developed our eMSE system to "lay back" the outside facing from a typical near vertical to a 1 to 1 slope. We increased the base (strength), allowed for more beneficial use materials, weight of the berm (resistance) and added a mid-berm bench (access). This increased safety factors and further enhanced (maximized) cost recovery.



Appendix B: Core Tennant - Beneficial Use

Revenue-generating alternative fill materials can offset construction costs and eliminate off-site material purchase & transport costs.

- ☐ CCRs
- ☐ Incinerator ash
- ☐ Impacted soils
- ☐ Foundry sands
- ☐ Dredge material
- ☐ Crushed concrete
- ☐ Crushed glass
- ☐ Drill cuttings
- ☐ Other approved materials

> *"Source of Economic Benefit*
>
> *Much of the potential berm fill material classified as beneficial use material already comes to the same landfills seeking expansion for disposal. They may already be used within the waste management boundary as alternate daily cover or access road surface material on the landfill area.*
>
> *In addition, a formalized beneficial use material acceptance program offers an owner the opportunity to significantly decrease their project construction costs."*
>
> Jeffrey Crate, P.G
> "*The Benefits of an Encapsulated Mechanically Stabilized Earthen (eMSE) Berm*"
> October 2019
> Waste Advantage Magazine

Many states have implemented regulations to help ensure that secondary materials are used in a beneficial manner that is protective of human health and the environment. This list would depend on the individual state's beneficial use program.

Appendix C: Published Articles Reference Table

Publisher	Date	Article Link
WasteAdvantage Magazine	**December 2021** *How to Lead in Landfill Design*	https://encap-it.net/wp-content/uploads/2021/12/Waste-Advantage-Magazine-December-2021-Issuepg.-50.pdf
WasteAdvantage Magazine	**September 2021** *Why You Should Consider Including Encapsulated Mechanically Stabilized Earthen (eMSE) Berms in Landfill Expansions*	https://encap-it.net/wp-content/uploads/2021/09/Waste-Advantage-Magazine-September-2021-Issuepg.-44.pdf
Ash at Work Magazine	**July 2021** *Functional Value of Coal Combustion Products for eMSE Structures*	https://encap-it.net/wp-content/uploads/2021/07/Ash-at-Work-Magazine-Issue-I-2021-pg.-18.pdf
WasteAdvantage Magazine	**October 2019** *The Benefits of an Encapsulated Mechanically Stabilized Earthen (eMSE) Berm*	https://encap-it.net/wp-content/uploads/2021/12/Waste-Advantage-Magazine-October-2019-Issue-pg.-42.pdf
Geosynthetics Magazine	**August 2017** *Macroencapsulation: Obtaining on-site clean closure*	https://encap-it.net/wp-content/uploads/2020/03/0817GS_Macroencapsulation.pdf

Increased Safety + Added Capacity + Reduced Costs =

Lasting Legacy & Good Public Policy

Give us a call today!

EnCAP-IT is ready to partner with you so you can provide environmentally friendly solutions for your coal ash and solid waste sites that are safer, better, and cheaper than traditional methods.

FOR MORE INFORMATION ON
ENCAP- IT SOLUTIONS, VISIT
WWW.ENCAP-IT.NET

ENCAP-IT

Encina

Market Research Response

Municipal Solid Waste Sorting Facility
Miami-Dade County Proposal

To: Miami-Dade Mayor's Office
From: Encina Development Group
Date: February 21, 2025
Subject: Proposal: Municipal Solid Waste Sorting Facility

The Municipal Solid Waste ("**MSW**") stream presents a significant opportunity for value creation and cost savings. With landfill capacity being exceeded by double, a long-term waste minimization solution is essential to extend and optimize both current and future waste management capabilities. By recovering valuable materials from the MSW stream, Miami-Dade can reduce its dependence on incineration and landfills, thereby maximizing the value of the waste generated within the county.

Encina proposes to construct and operate an MSW sorting line strategically located at landfills or transfer stations in the Miami-Dade area. This facility will extract paper, plastic, metals, glass, and organics from MSW. The waste will be tipped at the facility and fed into an initial sorting process where recyclable materials are separated from the MSW. The remaining waste will be directed to the landfill, while the extracted valuable materials will undergo further sorting. Like Material Recovery Facilities, the diverted materials will be sorted by type and sold on the open market to mechanical recycling applications or utilized in Encina's processes.

Additionally, an MSW sorting system cultivates opportunities to expand curbside recycling in Miami-Dade County. While conventional mechanical recycling is the preferred application for resource recovery, not all materials can be efficiently and economically recycled. Our process offers a broader scope of opportunities to recycle underutilized, hard-to-recycle plastic streams such as Polystyrene.

Encina plans to apply our proprietary catalytic process to the plastic recovered from the MSW sorting. This process will break down the chemical bonds in polyolefin plastics to their monomer state, producing ISCC+ circular Benzene with significantly lower emissions than conventional pyrolysis oil production. Our chemical offtake partners, Covestro, BASF, and American Styrenics, will reduce the reliance on virgin plastics in their manufacturing process by utilizing our products.

If you would like to discuss the opportunity further, please contact Mylinda Jacobsen at mjacobsen@encina.com or (336) 552-7902

Miami-Dade County
Solid Waste Management Solution

A. Respondent

Mylinda Jacobsen
Senior Vice President, Global Purchasing, Plastics
Mjacobsen@encina.com
(336) 552-7902

Encina Development Group, LLC is a Houston-based company focused on the project development and execution of integrated recycling facilities from end-of-life and challenging mixed plastic streams. The company manufactures high-purity circular chemical products and materials utilizing mechanical recycling and chemical process industries to catalyze the transition to a sustainable, circular economy. The company's industry segments include mechanical recycling, advanced recycling, and circular chemical manufacturing.

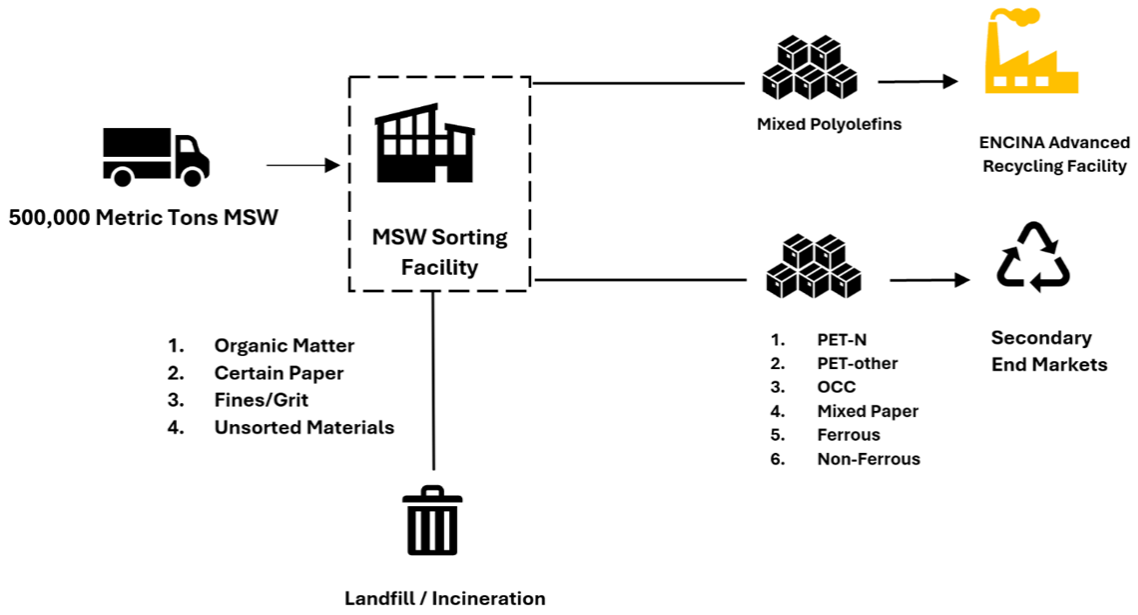
The company's mission is to catalyze the transition towards a circular, sustainable economy, with a core business to improve plastics management and recovery within communities through operating and manufacturing materials towards circular supply chains. Encina's global scope encompasses projects in multiple geographic areas, such as the United States, with ongoing developments in the Middle East and other countries.

Encina's business spans designing, developing, owning, and operating Plastics Recycling Facilities (PRF), combined with advanced recycling facilities to manufacture circular chemical products. The company utilizes mechanical recycling using Resource Recovery Facility designs and Encina's advanced recycling technology to maximize the diversion of plastics and other recycling streams from landfills and incineration, facilitating increased recovery and recycling rate beyond materials already collected. Using industry partners in mechanical recycling and chemical processing industries, the company develops world-scale projects to help companies and consumer brand groups meet their circularity and carbon-reduction objectives.

B. Waste Management Solutions

Solution

Encina proposes constructing and operating a Municipal Solid Waste sorting facility strategically located in the Miami-Dade area. This facility will sort and produce multiple product bale categories derived from the Municipal Solid Waste stream, including a polyolefin and polystyrene cut to be consumed by Encina, PET clear and other, mixed paper, Old Corrugated Cardboard (OCC), ferrous metals, and non-ferrous metals. In addition to the extracted material in the MSW stream, Miami-Dade residents will have access to a paper and plastic recycling drop-off site located at the facility, which will also be diverted to secondary end markets. Prepared bales have the widest acceptance across several markets beyond the described advanced recycling, nominal form factor and cost density through various modes of logistics and encompass the most robust enterprise. Organic matter, certain paper, and fines/not unsorted material that do not have a product market are processed to maintain their current end-of-life disposition (whether landfill, incineration, or composting, where acceptable). The diagram below shows the flow of material and end-of-life disposition of each material stream in the MSW sort system.



The system capacity will be designed to handle a throughput of up to 110 metric tons/hour, with an average of 100 metric tons/hour to meet the capacity of approximately 500,000 metric tons/year of processed municipal solid waste. Based on the 2021 Waste Composition

Study conducted by the University of Florida and the 2.4 million tons of waste processed by DWSM annually, we anticipate reducing landfill and incineration volume by between 30%-60% annually through the implementation of the sorting facility. While the volume of diverted material will vary according to the municipal solid waste composition, a 30%-60% reduction in total landfilled or incinerated material through pre-landfill sorting not only increases the useful life of the existing waste management infrastructure but also marginally increases economic viability through the sale of recovered commodities.

Effectiveness

The technology and equipment that will be utilized in the sorting system have been widely implemented throughout the waste and recycling industry. The system will sort the material based on size, shape, dimension, density, type, and color by integrating the most advanced sorting technology on the market, ensuring maximum value recovery and efficiency. By marrying conventional sorting techniques and recent innovations in Artificial Intelligence, sorting municipal solid waste has proven to be more efficient at maximizing the value within the stream, boosting economic efficiency, and diverting more material from the landfill to the circular economy.

Encina strategically works with system providers that create plant designs tailored to our understanding of incipient feedstocks for each project. Our approach is to first understand our feedstock, encompassing the perspectives of mechanical recycling, advanced recyclers, and chemical commodity markets, all of which require market access and a systematic framework of analyses to maximize product values and recovery. We have identified several proven providers with a vast portfolio of successfully implemented municipal solid waste and recycling sorting projects across the United States and internationally. Each provider has demonstrated a deep understanding of the requirements to successfully and economically sort municipal solid waste, testifying to the success of the equipment and technologies utilized in their existing projects, maximizing recovery value and high purity levels.

Quantity

The system will be designed to process 500,000 tons of municipal solid waste annually through a series of sorting equipment and techniques. Redundancies will be embedded within the design of the system to mitigate changes in waste compositions and quantities. Additionally, Artificial Intelligence integrated within the system will provide a comprehensive, real-time analysis of the waste stream, which will allow operators to

seamlessly adjust the system to real-time compositions, maximizing value recovery. The modular design of the system provides an additional opportunity to increase capacity through the addition of another line or constructing similar facilities within the Miami-Dade area.

Based on the Waste Composition Analysis performed by the University of Florida, we categorize the recoverable materials in Miami-Dade's municipal solid waste stream into four categories: Paper, Plastic, Metal, and Glass. Each stream and its respective weighted percentage are estimated to account for >30% of Miami-Dade municipal solid waste, translating to >1,000,000 tons of value being landfilled or incinerated annually. Furthermore, by processing 500,000 tons of municipal solid waste in our proposed sorting facility, we anticipate between 150,000 and 400,000 tons of material, or a 6% to 20% diversion rate from landfill and incineration to secondary end markets annually. Pre-Landfill sorting boasts high economic upside to the county through revenue generation of recovered material sales and extending the useful life of adjacent landfills and Waste to Energy operations.

Technologies

All technology in our proposed municipal solid waste sorting facility has been widely implemented across the waste and recycling industry. All technology is proven to achieve maximum recovery while maintaining a high throughput and high material purities. A combination of the following technologies may be utilized within the sort system:

- **Shredder**: A shredder may be utilized at the beginning of the line to liberate any material that is enclosed in a sack or film bag.
- **Splitter Screen**: Removes 2-inch minus material from the stream
- **Magnet**: Extracts ferrous material from various points within the system.
- **Eddy Current**: uses a rapidly rotating magnetic field to separate non-ferrous metals, typically UBC's
- **3D Trommel**: Separates 3D materials over and under 2 inches
- **OCC Screen**: A series of discs that separate 2D Fiber from 3D material.
- **Ballistic Separator**: An elliptical unit that separates 2D material, typically film, from 3D material.
- **Optical Sorter(s)**: A series of advanced imaging systems that are trained to target a specific material type. The optical imaging system will identify each piece of material on the belt and signal an air jet to extract the target material at around 500,000 picks per minute.

- **Robotic Arm(s)**: use an optical imaging system that identifies all material on the conveyor belt and signals a robotic arm to extract target material.

All equipment relating to the sorting and conveyance of feedstock material is contained inside an enclosed building. Each piece of equipment and sorting technique has a proven track record of generating high-value recovery and purities in both single-stream and municipal solid waste sorting. The system's design will rely on a current Miami-Dade municipal solid waste composition. Additionally, advancements in Artificial Intelligence integration into solid waste sorting facilities have expanded the capabilities of modern-day sorting systems. AI is implemented widely both domestically and internationally and has proven to boost the efficiency of both single-stream and municipal solid waste sorting. We fully intend to implement AI into this system, and by doing so, we will further maximize the value recovery and efficiency of ever-changing municipal solid waste composition and volume.

Benefits

While most waste processing technologies, such as landfilling, Waste to Energy, and processing recyclables at a traditional Material Recovery Facility, provide a means to manage Municipal Solid Waste, Encina is committed to not only managing but also maximizing the value of Municipal Solid Waste.

Volume lies at the heart of capacity, and by reducing landfill or incineration volumes, capacity will extend into the future. Additionally, future planned capacity will extend far beyond the typical useful life due to the volume reduction. By reducing program inefficiencies and extracting valuable materials currently locked in traditional MSW Management systems, Encina will enable Miami Dade to prolong its current MSW management systems and optimize future capacity.

An MSW sorting system through Encina's value chain also cultivates opportunities to expand curbside recycling in Miami-Dade County. While conventional mechanical recycling is the preferred application for resource recovery, not all materials can be efficiently and economically recycled. Encina's process offers more opportunities to recycle underutilized, hard-to-recycle plastic streams such as Polystyrene.

Furthermore, pre-landfill sortation promotes economic advantages to the county, ranging from job creation, the sale of recovered materials, and lower waste management expenditures. The positive correlation between population growth and waste management costs requires a solution to reduce disposal volumes and offset those costs economically.

Challenges

Like any project, we expect there to be both expected and unexpected challenges. All challenges will be mitigated through a robust execution plan during FEED and pre-FEED. While we understand that permitting and site selection could pose potential challenges to project execution, Encina has vast experience in both categories.

Solution to Overcome and Manage Challenges

Encina would need to work closely with Miami-Dade County to understand the solid waste landscape. It is crucial to have a reasonable and accurate understanding of the profile of the collected solids to build a robust design for further recycling and to support an economic model. The site and building would be owned by Miami-Dade County, which will house the Encina-owned Municipal Solid Waste sorting system that will be highly automated, reducing the exposure of employees to municipal solid waste. Ensuring the health and safety of our employees and the environment is our top priority while simultaneously maintaining a successful, economically viable operation. We will work with Miami-Dade County on permitting and site selection, as the site will be county-owned. Encina has vast experience in permitting facilities, and we will draw on our knowledge and the help of Miami-Dade County for any permitting-related items.

C. Financial Approach

Costs

Costs are to be determined based on several factors, including but not limited to an updated municipal solid waste composition, current economic environment, and overall project development.

Funding Model

Encina proposes a public/private partnership model wherein the municipality will own the building and land, and Encina will own the sorting line. Encina envisions a structure where there is a sorting fee collected per ton of MSW processed, and paying the County a fee for processed materials. Additionally, for those materials that are sold to the mechanical recycling industry (ex., Clear PET bales), Encina will offer a portion of the proceeds to the county.

Revenue

Sorting site revenues for the county will include profit sharing from the sale of recyclables sold to the mechanical recycling industry and fees paid to the county for “materials recovered from the MSW stream. Encina revenues will include their portion of the recyclable sales as well as sorting fees.

D. Implementation Approach

Infrastructure

Encina estimates the required total footprint of 150,000-200,000 square feet. The facility would be comprised of the following:

1. A Municipal Solid Waste sorting facility consists of a semi-enclosed structure that will house all sorting equipment, optical scanners, baling equipment, etc.
2. The sorting facility will be designed to process a volume of up to 500,000 tons of waste annually

Supporting and Auxiliary Infrastructure will include:

1. Dust management
2. Odor management, Air handling
3. Pest management
4. Noise Management
5. Containment

Encina's approach is partnering with demonstrated providers in their respective areas of development, technology, finance, construction, and project execution to bring forward integrated recycling projects. We have relevant experience in projects that develop both PRF and advanced recycling markets from residual materials. Our focus is de-risking project and enterprise execution by maximizing value within the recovered streams – from connecting markets in "other" materials like metals, paper, PET, and UBCs (used [aluminum] beverage cans), C&D waste while enhancing recovery of materials towards a circular supply chain for mechanical and chemical processes.

We strategically work with system providers that create plant designs tailored to our understanding of incipient feedstocks for each project. Our approach is to first understand our feedstock, encompassing the perspectives of mechanical recycling, advanced recyclers, and chemical commodity markets, all of which require market access and a

systematic framework of analyses to maximize product values and recovery. With a thorough understanding of project-relevant feed streams, we progress through various stages of engineering development (including mechanical and advanced recycling technologies) to increase the range of recovered products. Our focus is to create projects with a long-term vision that accommodates the evolving recycling markets.

Size

As Encina stated in the response to Implementation Approach Item 1, Encina estimates the required total footprint of 150,000-200,000 square feet. The facility would be comprised of the following:

1. Enclosed facility comprised of 70,000-100,000 square feet
2. Storage for truck parking while staging for loading
3. The site location for the Municipal Solid Waste sorting facility would need to have means for truck access for incoming solid waste and outbound recovered products.
4. Utility access for potable water for personnel consumption and electricity will be required.
5. Site location conducive to an acceptable permitting timeline. This will be one of the first evaluation tasks performed if Encina is selected to work with Miami-Dade County.
6. Ideally, the site location should be located in an area that allows for the economic transport of solid waste from the 13 Neighborhood Trash and Recycling Centers. We would need to better understand the volumes and composition of the Recycling Centers to aid in the site selection process.
7. It is possible that there could be some localized pre-sorting of solid material at the existing Recycling Centers once the composition is well understood.

Site Ownership

Encina will need to work closely with Miami-Dade County on the volumes and quality of the solid waste from the collection sources and existing Recycling Centers. This will then allow for an educated and strategic assessment of the preferred location of the sorting facility. While Miami-Dade will own the building and site, Encina will own the sorting system. We propose constructing the municipal solid waste sorting facility on an existing site, such as the Doral Waste to Energy facility or any local site.

The collected dataset will provide preliminary quality assumptions and requires further compositional definition from Miami-Dade County to further define the commodity volumes. Additional work regarding analysis of the solid waste material is required, such as:

- Resin Identification
- Color Identification
- Optical Sortation Performance
- Paper and Cardboard Fraction
- Metal Separation
- Contaminant Analysis
- Residue Analysis
- Organic Fraction Analysis
- Moisture Analysis
- Bale Grade Evaluation and Testing

Permitting

A major focus will be on the required permitting and zoning/re-zoning. In coordination with the third party, a permit schedule will be developed, including a timeline that addresses all permits and other investigations. Encina views the following major items will being investigated, while this is not an exhaustive list:

1. Air permits
2. Water use permits
3. SWWPP permit and plan
4. Weland identification and mitigation
5. Transportation studies that identify any road improvements and schedules
6. Zoning considerations or timeline for re-zoning (if applicable)

Timing

The documentation provided by Miami Dade County has very long timeframes for project development, >5 years. We need to understand this basis and then discuss it with agencies to see how we can do better to meet the economic and social needs for this project. We anticipate the project's commercialization to be executed between 3 and 5 years.

O&M

The O&M requirements are similar to existing facilities of similar size, such as municipal solid waste sortation facilities and Material Recovery Facilities. The proposed facility will require between 10 and 30 employees per shift to operate the sorting, conveyance, loading/unloading, and auxiliary equipment. Additionally, the maintenance team will consist of between 10 and 30 employees per shift to maintain the sorting system. The nature of the material being processed may require excess downtime and maintenance schedules. Between 5 and 10 employees will be responsible as support to handling logistics, equipment orders, and general support. An additional 5-10 personnel will be responsible for environmental, health, and safety, and management roles. We anticipate the total labor count to be between 30 and 100 employees.

A maintenance schedule for equipment repairs and cleaning will be scheduled along will robust preventative maintenance to reduce downtime. Once an updated composition is received, we will solidify our O&M requirements.

Health/Safety/Environmental

The design of this facility follows ISRI (Institute of Scrap Recycling Industries, Inc.) best practices and safety standards. ISRI is widely recognized in the plastics recycling industry to be a leader in the development and implementation of recycling technologies and health & safety standards. More details on the specific programs and training can be found on the following website: https://www.isri.org/safety/safety-management-program.

To minimize potential disamenities, Encina recommends enforcing good housekeeping standards as a preventative measure to maintain a safe work environment. This includes providing safety items such as first aid kits, bloodborne pathogen kits, eyewash stations, and lockout stations to employees of the facility. Personal Protective Equipment (PPE) will also be provided to all employees to include items such as safety-toe footwear, safety eyewear, everyday clothing, work gloves, earplugs, and weather-related gear. Plans include initial and ongoing training for employees to recognize, assess, and prevent hazards.

The facility will also follow strict industrial hygiene standards and local hygiene protocols. Systems to be considered are developing and setting mandatory occupational safety and health standards for employees. This includes monitoring and setting limits to the exposure of air contaminants and hazardous & toxic substances. Such practices include engineered and administrative control systems for substances like silica, construction dust, nuisance dust, and respirable dust. There is potential for this facility to encounter certain pests due to

the nature of where the feedstock comes from. There are certain preventative measures that we can take to minimize the presence of pests within the facility. This includes proper feedstock visual inspection before acceptance, timely maintenance of pest control devices, and following best practices for storing and handling feedstock materials. Additionally, the housekeeping is kept to a high standard with material in constant motion to move off the tip floor to reduce stagnant materials that draw pests to the space. The facility intends to contract with local pest management firms for preventative measures.

All equipment relating to the sorting and conveyance of solid material is housed inside an enclosed building with a dedicated dust control system. A combination of filter cartridges and baghouses is placed near or over areas where shredding occurs and over the initial trommel area where the 2D vs. 3D material is being separated. The building houses all rotating equipment and compressors inside to minimize noise impacts on the areas surrounding the facility. There will be increased noise levels from the movement of trucks into and out of the facility, but this will be limited to normal working hours.

Emissions from this facility are designed to be minimized and emanate primarily from particulate matter, road emissions from the increased truck traffic, and excess noise levels from inside the PRF building. During the equipment design process, several studies will be conducted to identify the expected fugitive PM (particulate matter), PM 10, and PM 2.5 emissions from the types of solids brought into the facility. There will be emissions from emergency generators and firewater pumps during emergency scenarios. The emissions include generated NOx, CO, and PM from the fuel source, and it depends on the rated capacity of the generation equipment to be finalized in the next engineering phase. Encina intends to use Best Available Technology to minimize emissions to the atmosphere and reduce impacts to the surrounding environment and community.

Envision Holdings

Market Research Response

RESPONSE TO MIAMI-DADE COUNTY'S REQUEST FOR "MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS"

Submitted to:
Saba Musleh, CPPB Negotiator, Strategic Procurement Department
Saba.musleh@miami-dade.gov

Ross Byers, Project Manager, AtkinsRealis
Ross.byers@atkinsrealis.com

Respondent:
Envision Waste Services, LLC, Steven M. Viny, CEO
sviny@envisionwaste.net, (216) 496-3496 (direct)

Thickets Contracting, Paul Yatsko, President
Thickets1@aol.com

Date: April 10, 2025

RESPONDENT

Envision Waste Services, LLC, 23250 Chagrin Blvd., Suite 310, Beachwood, Ohio 44022
www.envisionwaste.com, Steven M. Viny, CEO, 216-496-3486, sviny@envisionwaste.net

History: Envision Waste Services is an Ohio Based LLC incorporated in 2006.

Background – Envision Waste Services

Envision Waste Services, LLC specializes in processing waste for beneficial reuse and circular economy solutions.

Envision designs, builds, and operates mixed waste processing facilities and innovative composting facilities. Envision is recognized by the solid waste industry as an expert in mixed waste processing facility design and operation. Envision's experience sets the industry's benchmark, having achieved 21 continuous years of operation of a mixed waste processing facility serving a County government. In those same 21 years, Envision earned a perfect record for operations - having never missed a single day of operation nor having a single load of recyclables reject by its end markets for quality or any reason. Envision developed a portable mixed waste processing system in a joint venture with Novelis – the world's largest producer of aluminum rolled products. Envision developed an engineered fuel product extracted from waste to be used by cement kilns and utility boilers. Envision's engineered fuel was used by Cemex – a world leader in cement production, to successfully secure final air permits for its Demopolis, Alabama, Louisville, Kentucky, and Brooksville, Florida plants, by Akron Thermal for final air permit for its RES plant, by Dayton Power and Light for a final air permit for the Hutchings Station, and by First Energy for its Niles power plant. Envision CEO Steven M. Viny developed proprietary mixed waste processing IP including two US patents and over a dozen trade secrets for mixed waste processing technology.

Relevant to this RFI response is Envisions' experience in organic recovery. Mr. Viny designed, permitted, constructed, and operated for nearly two decades, the Medina County Class 1 compost facility (MSW Compost facility). To this day, the Medina Class 1 compost facility represents the only MSW compost site ever successfully permitted and operated in Ohio. Mr. Viny has also designed and operated 4 different green waste composting facilities (designed as "Class 4" by the Ohio EPA). Further, Mr. Viny created an equipment import business, serving as the master importer for Komptech equipment including shredders, screens, windrow turners, windsifters, and more. Mr. Viny sold the Komptech equipment to composting sites throughout the USA. Through this experience, Mr. Viny gained a deep and unique knowledge of advanced European composting equipment and advanced composting systems.

ENVISION WASTE SERVICES, LLC

Envision is the only firm in America that has 21 years of continuous mixed waste processing experience.

21 years of continuous mixed waste processing operations.

- only firm in the USA to design, build, and operate a mixed waste processing facility for over 20 continuous years

17 years of solid waste compost experience

- Only firm in Ohio to ever permit and operate a solid waste compost facility

21 years of waste transfer experience

- 4 different locations - 2 states

Technology leader

- Awarded 2 United States Patents for waste sorting equipment as well as many trade secrets

Exemplary Safety Record

- Statistically more than twice as safe as the industry average

ENVISION
Waste Services LLC

STEVEN M. VINY

Chief Executive Officer

Steven M. Viny is the CEO of Envision Holdings. Mr. Viny has 41 years of experience in the waste industry which has included the design, construction, operation of landfills, landfill gas systems, material recovery facilities, compost facilities, engineered fuel production, and waste hauling and transportation.

Mr. Viny was awarded 2 United States Patents for waste processing equipment design as well as several US Trademarks.

Mr. Viny formerly served as the International President of the SWANA (the Solid Waste Assn of North America) as well as a Director of ISWA (the International Solid Waste Association) where he represented the United States and Canada. Mr. Viny is the recipient of the SWANA Professional Achievement Award which is their highest honor. Mr. Viny is also the recipient of the SWANA Innovation of the Year award, the Ohio Dept of Natural Resources Achievement in Excellence Award, the Governor's award from the State of Ohio, the Green Business Award from Medina County, Ohio, and many other awards.

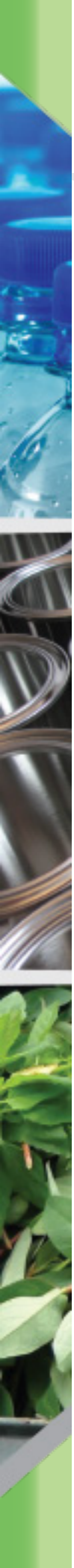
Mr. Viny holds SWANA certifications for Manager of Landfill Operations, Manager of Transfer Operations, Manager of Collections Operations, and he is a Certified Cogeneration Professional by the Association of Energy Engineers.

EXPERIENCE
41 Years
University

EDUCATION
BS, Arizona State

CERTIFICATIONS/PROFESSIONAL AFFILIATIONS
Certified Manager of Landfill Operations, Solid Waste Association of North America
Certified Transfer Station Manager, Solid Waste Association of North America
Certified Manager of Collection Systems, Solid Waste Association of North America
Certified Cogeneration Professional, Association of Energy Engineers
Director, Ohio Buckeye Chapter, Solid Waste Association of North America

PROJECT RESPONSIBILITIES
- Corporate responsibility for the overall project and project team
- Ensures that client objectives and project objectives are met or exceeded
- Directs staff to achieve project milestones and benchmarks
- Provides a corporate culture to ensure safety, public health, and environmental compliance



THICKETS CONTRACTING

PAUL YATSKO

President

EXPERIENCE

- Green Flatwork Contractor Sequestering C02 And Seawater for Commercial developments
- Sustainable Road design contractor Southeastern USA
- Disaster mitigation design contractor for commerce related roadways and egress
- Heavy Equipment Mobilization DOT certified contractor

- Florida Construction Development Business Since July 1996
- Florida Based Bonded General Contractor
- Florida Based Bonded Underground Site Utilities Contractor
- Southeastern US Based Bonded Commercial Building Contractor
- Southeastern US Based Bonded Site Developer
- Southeastern US Based Bonded Residential Site Contractor
- Blast Mitigation Contractor, High Explosives and Deflagration

CERTIFICATIONS

Six Sigma Black Belt

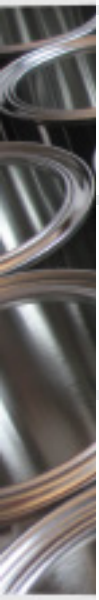
EDUCATION

Graduate - University of Florida - Agriculture Engineering

EXECUTIVE SUMMARY

The Envision Team understands that Miami-Dade County seeks impactful solutions for the long-term management of its solid waste. We appreciate that the County's WTE plant was destroyed by fire, causing its landfills to prematurely reach their final capacity. We also appreciate Mayor Levine-Cava's commitment to reduce the effects of Climate Change/Global Warming. ***As such, our response is designed to quickly help the County reduce its reliance on landfills while simultaneously reducing methane and CO2 emissions to combat the effects of Global Warming.*** The Envision Team's plan offers:

RAPID IMPLEMENTATION SOLUTION TO ACCEPT AND PROCESS MIAMI-DADE COUNTY'S ORGANIC SOLID WASTE



The Envision Team's solution can be fully operational in under 12 months

PRIVATELY FUNDED FACILITY INCLUDING PRIVATELY OWNED LAND SITE, EQUIPMENT, AND OPERATION.

No capital outlay is required by the County
No County owned land is required

OUR SOLUTION WILL REDUCE THE EFFECTS OF GLOBAL WARMING

Our plan is designed to compost organic materials. Composting of organics reduces/eliminates the formation of harmful greenhouse gases such as methane and CO2, which are otherwise released by landfills through the natural decomposition of organic material. Methane reduction is important as each ton of methane is responsible for an estimated 86 x more global warming than carbon dioxide over a 20-year time window

PROVEN TECHNOLOGY

The Envision Team will use GORE® Cover technology which is time proven with experience in more than 400 installations worldwide processing over 4M tons annually. In North America, there are more than 80 successful installations of the SG Bunker System with GORE® Cover, collectively processing over 2M tons annually.

SOURCE FOR COVER SOIL FOR MIAMI-DADE LANDFILL FINAL CLOSURE

According to the Miami-Dade County DSWM, the County lacks adequate soil volume for the construction of final landfill cover as required by Florida DEP regulation. The compost product produced can be used as a valuable source of cover soil and vegetative soil to help the County meet the existing landfill soil deficit problem.

IN-COUNTY SOLUTION

The Envision Team's plan represents an in-County solution which offers a logistical advantage over exporting organic waste outside the County to more distant landfills or WTE plants. Organic waste is heavy due to its high moisture content, thus making long haul transport of organic waste expensive on a volumetric basis.

TIME IS OF THE ESSENCE

An RFP process takes considerable time to develop, solicit response, evaluate responses, and award a final selection. Considering the recent destruction by fire of the WTE plant, and since our plan contemplates private ownership and operation, and since Miami-Dade operates its own waste collection fleet to deliver waste to both public and privately owned landfills, perhaps Miami-Dade County can consider a method to direct its source separated organic waste to the Envision Team's proposed organics composting facility on an emergency basis. Envision believes that our proposed organics composting facility can be operational in 12 months or less after contract execution.

Quick action will result in extending the life of the County's landfills, which will present a significant economic advantage to the County. Each day, 500 tons of organic waste could be diverted from the landfill to the Envision Team's proposed compost facility. For reference purposes, that represents about the same volume per day of waste accepted at the North Dade Landfill. And if Envisions' proposed organics compost facility is expanded, it can divert up to 1000 tons per day, or twice the volume of waste presently being sent to the North Dade Landfill. Note that the Arcadis report predicts Miami-Dade's landfills to reach their final capacity in 2028 and 2029 respectively. Therefore, time is of the essence.

WASTE MANAGEMENT SOLUTIONS

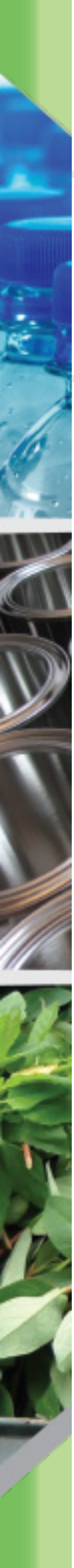
THE SOLUTION

The Envision Team proposes to design, build, own, and operate a mixed organics composting facility in Miami-Dade County. The facility is designed to accept green waste, food waste, wood waste, agricultural waste, and other organics for a total annual capacity of 130,000 tons per year. The facility can be expanded based on available feedstock to up to 260,000 tons per year. The facility will utilize the SG Bunker™ System designed to maximize throughput, provide system controls for superior final product, and reduce water infiltration and reduce odors. The site will manage stormwater run-on and run-off as well as capturing and managing leachate from the compost bunkers. Specialized shredding equipment will be employed with the capability to accept palm fronds and trunks, which otherwise can be difficult to handle. Once the organic waste has completed its composting cycle, the compost will be cured and screened, with the final end product marketed to local area businesses and residents. Miami-Dade County will need to import soils for final closure of its 3 landfills. As such, the County may elect to purchase compost to meet its cover soil requirements. The County can enjoy logistical benefits by delivering mixed organics to the facility and backhauling finished compost to create a cover soil stockpile.

EFFECTIVENESS - PROVEN TECHNOLOGY

Envision plans use SG Bunker® System which is covered by an engineered membrane cover, positive aeration, and oxygen controlled/monitored composting system for its proposed Miami-Dade plant. The technology is being used by some of the largest public sector entities including Department Sanitation New York, Kern County California, Santa Barbara County California, Prince George's County California and the City of San Diego. A full list of References is included in the Appendix section. The below picture is an example in Everett, Washington:

The Everett facility is of similar but slightly larger size to what we plan for Miami-Dade County. The Everett plant consists of 2 – 32 bunker systems for a total of 64 compost bunkers.



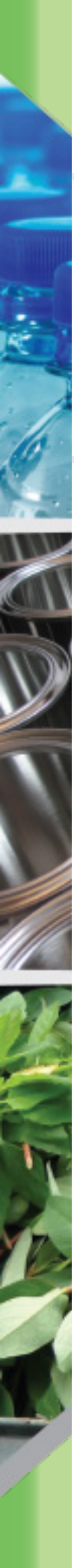
QUANTITY

Our plans for Miami-Dade are for a 26 SG Bunker® System with 26 GORE® Covers designed to accept 130,000 tons per year of mixed organics. Our site allows for the potential to double the capacity to up to 52 bunkers, which would increase the site to an annual capacity to 260,000 tons per year of mixed organics.

TECHNOLOGY

By utilizing the SG BUNKER® System with GORE® Covers, the project will have a sustainable and expandable solution capable of processing a wide variety of organic materials. The SG Bunker® System with GORE® Cover delivers:

- In-vessel performance without the need for roofed or enclosed building structures.
- Encapsulated aerated static pile process using an engineered membrane (GORE® Cover) fastened(sealed) to a concrete bunker and supplied with a controlled intermittent flow of air.
- The engineered properties of the air permeability of the GORE® Cover provides for positive pressurization of the bunker (vessel) that ensures complete and even distribution of air throughout the entire mass of organic material
- The engineered properties of the moisture barrier of the GORE® Cover membrane provide enhanced moisture control throughout the entire mass of organic material. The GORE® Cover reduces moisture loss from organic material while preventing excess rainwater infiltration from the exterior.
- Odor & VOC Emission Control: >90-99% control, as per 3rdparty validation and reported results.
- Storm Water and Leachate Control: Complete separation of stormwater from leachate.
- Temperature / Hygienization: Achieves temperatures according to global standards for pasteurization and reduction of pathogens and destruction of weed seeds.
- Moisture Control: GORE® Cover unique properties allows for better management of moisture in the process. No need for water system. No need for biolayer or compost cap. No need for roofed or enclosed building structures.
- High Variability of Feedstocks: proven success composting FOGO and Biosolids with mix ratio as high as 50% by weight (1:1 by weight or 1:3 by volume).
- Proven ability to break down compostable products referenced by 3rdparty validation and reported results.
- Climate Independent: proven success in most varied regions globally from extreme cold climates to hot arid climates, to intensive rain forest and tropical climate.
- The fully integrated commercialized engineered solution with proven repeatable, reproducible results for performance at the lowest total cost of ownership over the life of the facility.



BENEFITS

The key benefits of Envisions' mixed organics composting system are:

- **Reduced GHG emissions vs landfill or WTE options**
- **Compatible with Long-Haul Landfill and/or WTE Options**
- **Rapid implementation (will help preserve existing Miami-Dade landfill space)**
- **Ability to help solve Miami-Dade's landfill cover shortfall problem**
- **In-County Solution (reduced logistical expense)**

Reduced GHG emissions vs landfill or WTE options

Envisions' plan to compost Miami-Dade County's mixed organics will greatly reduce Greenhouse Gas emissions vs the current practice of burying the organics in landfills. In an article entitled "Using Life Cycle Analysis to Measure GHG Emissions from Composting", as written by **Theo Fehsenfeld**, of Green Mountain Technologies (GMT), the author compares the aerobic composing of 300,000 tons of mixed organics with the landfilling of the same using the USEPA WARM model. The author writes *"GMT Founder Michael Byan-Brown Michael ran the numbers using the WARM Model and found that landfilling 300,000 tons per year of mixed organics (2:1 yard trimmings to food waste) contributes ~ 18,000 MTCO2E into the atmosphere while composting the same amount of material removes ~ 46,000 MTCO2E from the atmosphere… The WARM model also found that composting stores more CO2 in the soil and produces very low methane production, while landfilling shows high carbon storage, and lower dinitrogen monoxide (N2O) release (a potent greenhouse gas)."*

It should be recognized that methane emissions are 28 times more potent than CO2 on a 100-year scale and ***86 times more potent on a 20-year time scale.***

The author's summarizes his key takeaways as follows: *"The results from the WARM model showed that composting is the superior method to process food waste when quantifying GHG emissions because it removes ~ 46,000 MTCO2E from the atmosphere and the process emits significantly less MTCO2E into the atmosphere compared to landfilling and anaerobic digestion."*

Source: https://compostingtechnology.com/using-life-cycle-analysis-to-measure-ghg-emissions-from-composting/

In the case of Miami-Dade County, the overall reduction in GHG's achieved through an in-County mixed organics composting facility are even greater than GMT's WARM model reduction as the GMT calculations do not consider the reduction in GHG's from the reduced transportation mileage afforded by an in-county organic waste solution vs the long-haul of organics to out-of-county landfills or WTE solutions.

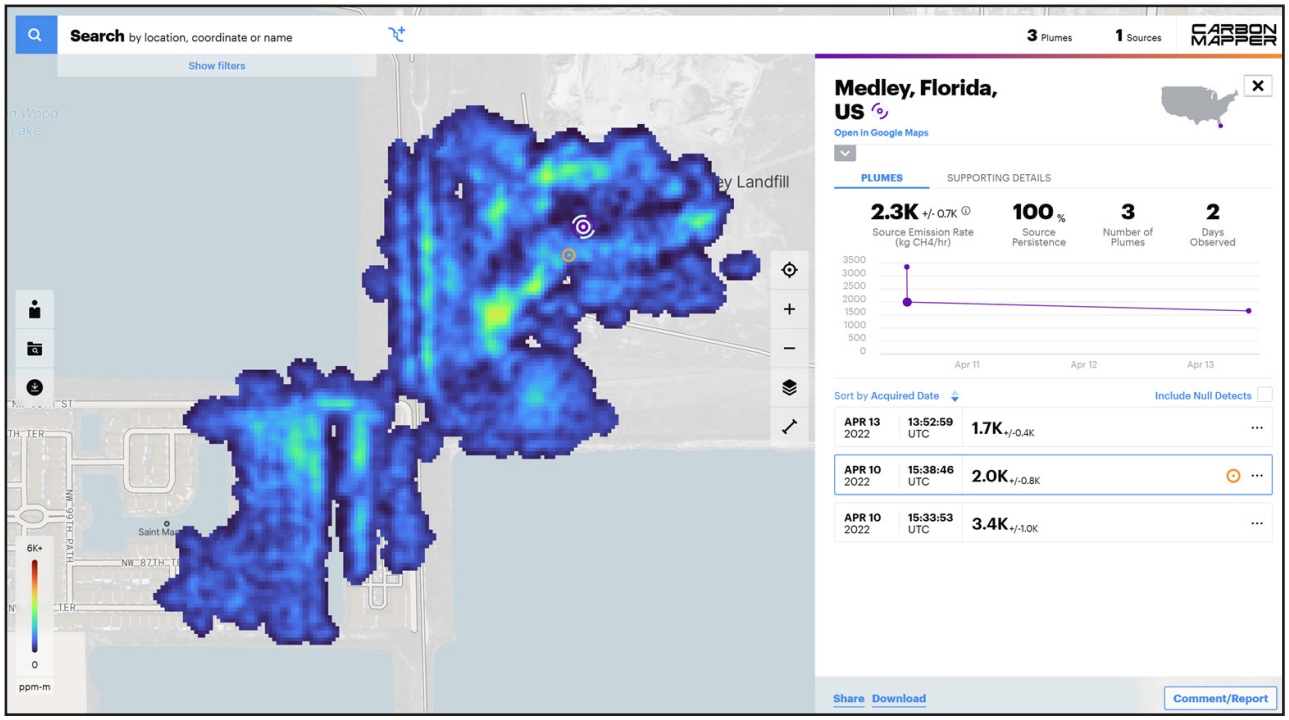
Miami-Dade County Mayor Levine-Cava has been an outspoken advocate for reducing the effects of Climate Change and GHG reduction, both at the local and state levels and internationally. Miami-Dade County published a Climate Action Strategy Plan document in which Mayor Levine-Cava states *"While the effects of climate change might still seem theoretical for many communities around the globe, in Miami-Dade County, we already clearly see the impact of rising seas, extreme heat and sunny day flooding. Now in our 11th hour with the clock rapidly ticking, we must take action immediately to dramatically reduce greenhouse gas emissions. Community input to this draft of our County's new Climate Action Strategy will transform how we use the proposed approaches to cut our footprint in half by 2030 and to zero by 2050 while also cleaning the air and water on which our economy depends, creating good-paying jobs, saving residents and businesses money, and improving public health for all."*

Further, in a January 1, 2025 article in the Floridian, Mayor Levine-Cava addressed how the county was preparing for a sustainable future.

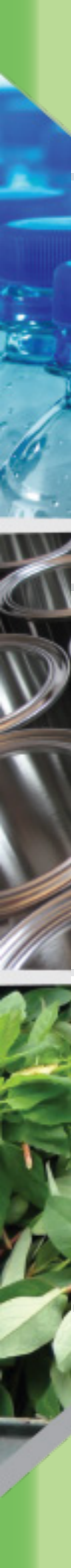
"South Florida was designated by our federal government as a tech hub and we're the only one in the country focused on climate tech. We're working with schools, other governments, and companies to create more green jobs and find more climate solutions,"

As such, the reduction in GHG's from the composting of organics vs the landfilling of organics as demonstrated by the USEPA WARM Model, would seem consistent with the position expressed by Mayor Levine-Cava and the Miami-Dade County Climate Action Plan.

CarbonMapper is a not-for-profit scientific organization comprised of NASA Jet Propulsion Laboratory, University of Arizona, Arizona State University, and other academic institutions focused on science-based solutions for the improving the global monitoring of methane and CO2. CarbonMapper uses innovative satellite technology to detect, pinpoint, and quantify methane and CO2 at the scale of individual facilities. CarbonMapper has proven that Methane and CO2 levels are actually 40% greater than currently reported to the USEPA. The exhibit below represents the methane plume captured by CarbonMapper for the Medley Landfill in South Florida.



This satellite image proves that even with landfill gas collection systems, a significant amount of methane continues to be released by the Medley Landfill. By contrast, and proven with the USEPA WARM model, the aerobic composting process removes methane, rather than releasing it to the atmosphere. Thus, Envisions' proposed mixed organics composting facility, should we be selected, will reduce the effects of Climate Change and Global Warming in South Florida.



Compatible with Long-Haul Landfill and/or WTE Options

Envisions' proposed mixed organics composting facility is designed to accept exclusively mixed organics, or about 10% of Miami-Dade's total solid waste volume. Therefore, the remaining 90% of the County's waste volume will still need to be disposed of in landfills or WTE facilities. There is an overall benefit to a combined compost/landfill solution or compost/WTE solution. In the case of a compost/landfill solution, organics are composted locally which reduces logistical expense. Further, the GHG emissions emitted by the landfill are reduced because the organics are composted vs buried in the landfill. In the case of a compost/WTE solution, the overall performance and economics of the WTE plant is improved by the prior separation and composting of the organics. Organic waste has a high moisture content which lowers the efficiency of the combustion unit, as the weight of moisture provides no calorific benefit. Furthermore, the organics putrefy in the waste pit, causing odors and serving as a feedstock for vectors. In conclusion, collecting and composting the organics adds value to Miami-Dade's overall solid waste solution, be it a landfill or WTE option.

Rapid implementation (will help preserve existing Miami-Dade landfill space)

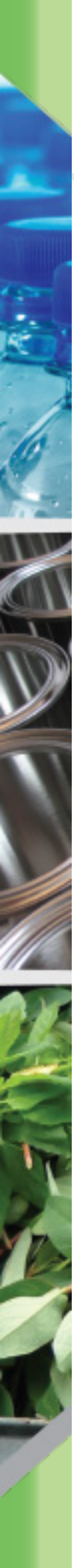
Envision can build out its proposed SG Bunker® System in about 12 months from contract execution. The Arcadis Report commissioned by Miami-Dade County shows the North Dade Landfill receives about 104,000 tons per year. That is slightly less than the initial design capacity for the Envision organics compost facility. As such, each year the Envision organics compost facility operates, it extends the life of the North landfill by another year. Extending the life of the North Dade Landfill allows for the site to benefit from additional settlement via dynamic compaction, which in turn creates additional usable landfill capacity. Also, it extends the period for the County's cash outlay for final closure, which adds economic benefit to the County (time value of money). And when the North Dade Landfill is finally closed, the Envision organics composting facility essentially replaces that same waste volume on a permanent basis. The Arcadis report predicts Miami-Dade's landfills to reach its final capacity in 2028 and 2029 respectively. Therefore, time is of the essence.

Ability to help solve Miami-Dade's landfill cover shortfall problem

Miami-Dade County hired Arcadis to prepare a Landfill Capacity Analysis Report which was completed on July 1 of 2024. The Arcadis findings show the North Dade Landfill reaching final capacity by 2029, and the South Dade Landfill reaching capacity in 2028. The report shows the combined remaining landfill capacity at 4,396,267 tons. Arcadis states the final cover soils required are about 5% of the remaining capacity, or about 220,000 tons. Miami-Dade County does not have a final cover soils stockpile. Therefore, all landfill cover soils will need to be imported. The Envision mixed organics compost facility will produce about 120,000 cubic yards of compost each year. Assuming the Arcadis numbers are correct, Miami-Dade County could utilize about 2 years' worth of Envision's total compost production to meet its soil cover requirements.

In-County Solution (reduced logistical expense)

Envisions' proposed mixed organics compost facility will be an in-county solution. By contrast, Miami-Dade looks to export its solid waste out of the County and perhaps even out of the state to more distant landfills or WTE facilities. Envisions' in-county mixed organics compost facility offers logistical benefits vs out of county or out of state solutions. Further, the economic development created by this project inures to Miami-Dade County.



CHALLENGES

Contractual Waste Volume

Envision will need a long-term commitment from Miami-Dade for its mixed organic waste to design, build, own, operate, and finance the proposed mixed organics composting facility.

Zoning

Envisions' in-county site will need to be rezoned to Industrial.

Permitting

Envision will apply for environmental permits and construction permits however we do not control the permit process. Therefore, the time required is not something that we can control.

Selection Process

The request for Market Research does not address the specifics of the ultimate selection process. Therefore, as a respondent, we do not have a clear understanding of what that selection process will consist of.

FINANCIAL APPROACH

COST

As this market research RFI is open to the public, and for competitive reasons, the Envision Team must refrain from providing pricing information to Miami-Dade County in a public forum at this time. What we can say, however, is that the tip fee should not represent a cost increase over current and future disposal practices, and in fact, it may represent an overall cost savings.

FUNDING MODEL

Envision anticipates privately funding its proposed composting facility. We will require a long-term contract with Miami-Dade County. To the extent that Federal or State grants are available, and to the extent that County economic development programs are available, we ask Miami-Dade to support our efforts in securing such programs.

REVENUE

As this market research RFI is open to the public, and for competitive reasons, the Envision Team must refrain from providing revenue information to Miami-Dade County in a public forum at this time.

IMPLEMENTATION APPROACH

INFRASTRUCTURE

Envision will create a special purpose entity to serve as the Master Developer, owner, and operator of the proposed facility.

SIZE

As this market research RFI is open to the public, and for competitive reasons, the Envision Team must refrain from providing land size and location information to Miami-Dade County in a public forum at this time. What we can say is that we have taken steps to secure property located in the County for our proposed project. Further, we can state that our land site will support a compost facility of 130,000 tpy input and may be expanded up to 260,000 tpy.

SITE OWNERSHIP

Envision has taken steps to secure property located in the County for our proposed project. The property will require rezoning. As this market research RFI is open to the public, and for competitive reasons, the Envision Team must refrain from providing land current ownership and location information to Miami-Dade County in a public forum at this time.

PERMITTING

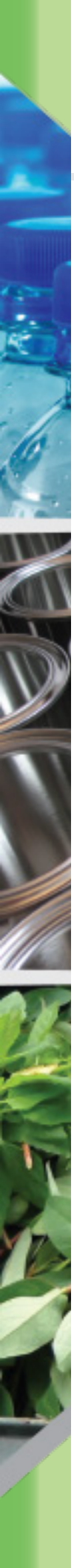
Envision will retain the services of AECOM to assist in the preparation of environmental permits required for the facility. AECOM is the largest engineering firm in the world and has offices in Florida. Envision will retain Hunt Construction (a division of AECOM) for construction work which includes obtaining all construction permits.

TIMING

We believe timing is of the essence. Therefore, we expect that all construction work and equipment deliveries can be completed within 12 months from contract execution and property rezoning.

O&M

As this market research RFI is open to the public, and for competitive reasons, the Envision Team must refrain from providing O&M cost information to Miami-Dade County in a public forum at this time. What we can say is that the SG Bunker™ system is well established, and its O&M costs are predictable based on past projects. The same holds true for the “yellow iron” such as loaders, shredders, and screens.



HEALTH/SAFETY/ENVIRONMENTAL

Envisions' proposed mixed organics composting facility will be designed to control water run on and run off and is also designed to contain leachate. Since the composting process is exothermic, we will plan to collect and reuse the leachate as a source to add moisture to the bunkers as required. The operation is generally quiet. The SG Bunker™ system is designed to reduce odors while simultaneously controlling vectors. From an air emissions standpoint, the SG Bunker™ system will reduce methane and CO2 emissions.

OTHER INFORMATION/ADVICE

PROCUREMENT MODEL

Time is of the Essence! Therefore, Envision believes Miami-Dade County should take emergency action and immediately negotiate and issue a contract to deliver mixed organics to the proposed facility. With the contract in hand, Envision can finance, permit, and construct the facility on an expedited basis to ensure the facility is up and operating in approximately 12 months. By comparison, an RFP process takes considerable time to develop, solicit response, evaluate responses, and award a final selection. Considering the recent destruction by fire of the WTE plant, and since our plan contemplates private ownership and operation, and since Miami-Dade operates its own waste collection fleet to deliver waste to both public and privately owned landfills, we ask Miami-Dade County to consider taking an emergency method to direct its source separated organic waste to the Envision Team's proposed organics composting facility. This will create the shortest path to ensure the facility is up and running as soon as possible.

Quick action will result in extending the life of the County's landfills which will present a significant economic advantage to the County. Each day, 500 tons of organic waste could be diverted from the landfill to the Envision Team's proposed compost facility. For reference purposes, that represents about the same volume per day of waste accepted at the North Dade Landfill. And if the facility is expanded, it can divert 1000 tons per day, or twice the volume of waste presently being sent to the North Dade Landfill. The Arcadis report predicts Miami-Dade's landfills to reach their final capacity in 2028 and 2029 respectively. Therefore, time is of the essence.

PARTNERSHIPS

Envision previously provided an unsolicited proposal along with a team of companies to Miami-Dade County designed to transform its waste into value. Our proposal provided for the recycling/diversion of nearly 90% of the County's waste while simultaneously creating significant economic development, reducing GHG's, and capturing and sequestering CO2. Each of the companies comprising our team has a plethora of prior experience at commercial scale. We understand that at the time of the submittal of our unsolicited proposal, Miami-Dade was pre-disposed to a WTE solution for waste management. However, the in-county WTE option to our knowledge is now off the table. Assuming that to be the case, Miami-Dade is welcome to re-review our unsolicited proposal for a Circular Green Economy and Sustainability Campus solution (CGESC) for the County's solid waste. That said, we would advise moving forward immediately with the organics composting facility approval (as contained in this response) as it is fully compatible with our CGESC unsolicited proposal. Immediate approval of our compost proposal would allow Miami-Dade County to extend the life of its County owned landfills and reduce GHG emissions while it reviews solutions for the ling-term management of its inorganic solid waste.

ADDITIONAL INSIGHTS

We reiterate that the County has an opportunity to reduce the effects of Climate Change, increase recycling, and extend the life of the County's existing landfills, all without capital investment by the County and without additional programmatic cost over the status quo simply by accepting our proposal. The County has a soil deficit for the final closure of its two County owned landfills. Moving forward on an emergency basis will help preserve the County's existing landfill space while simultaneously creating a compost product which can offset the County's soil deficit in a timely manner to be used as part of the final cover system for the County's landfills.

APPENDIX

The Sustainable Generation GORE® Cover Reference List

North America

The GORE® Cover technology is the most widely distributed composting system in the world with ***over 400 facilities located in more than 30 countries treating more than 4.0 million tons of organic waste annually***.

Sustainable Generation® (SG) is the authorized supplier of GORE® Cover technology in North America, Australia, New Zealand, and the Middle East. SG ADVANCED COMPOSTING™ TECHNOLOGY & GORE® Cover technology are used together, globally, to compost a wide range of organic materials, including but not limited to ***green waste, garden waste, residential food waste, commercial food waste, industrial food waste, biosolids, AD digestate, animal manures and animal mortalities. It is also used for stabilizing and bio-drying municipal solid waste***.

North America

Green-, Food- and Source Separated Organic Waste:

No	Country	Location	Tons / Year	Install/ Project
1	USA	Lynden, WA	18,000	2002
2	USA	Maple Valley, WA	40,000	2003
3	Canada	Arthur, ON	80,000	2004
4	USA	Oceanside, CA[P]	1,000	2005
5	USA	Everett, WA	160,000	2005
6	USA	Georgetown, DE	4,000	2006
7	USA	Wilmington, DE	160,000	2009
8	Canada	Kingston, ON	30,000	2009
9	Canada	Thorold, ON	50,000	2009
10	USA	San Diego, CA[P]	1,000	2009
11	Canada	Vancouver, BC[P]	1,000	2010
12	Canada	Pemberton, BC	5,000	2012
13	Canada	Abbottsford, BC	20,000	2013
14	Canada	Sechelt, BC[P]	15,000	2013
15	USA	Upper Marlboro, MD[P]	8,000	2013
16	Canada	Comox, BC[P]	5,000	2013
17	USA	Seaford, DE[P]	3,000	2013
18	USA	Queens (NYC), NY[P]	1,000	2014
19	USA	Bolin, TX[P]	1,000	2014
20	USA	Fontana, CA	30,000	2014
21	Canada	Belleview, ON	60,000	2015
22	USA	Kerman, CA[P]	60,000	2016
23	Canada	Terrace, BC	15,000	2016

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North America -continued

Green-, Food- and Source Separated Organic Waste:

No	Country	Location	Tons / Year	Install/ Project
24	USA	Oahu, HI	1,000	2017
25	USA	Dekalb County, GA[P,S]	1,000	2018
26	USA	Brooklyn (NYC), NY[S]	1,000	2018
27	USA	Belgrade, MT	1,000	2018
28	USA	Upper Marlboro, MD	45,000	2018
29	USA	Chula Vista, CA[P,S]	5,000	2018
30	USA	Islip, NY[P]	1000	2019
31	Canada	Saskatoon, SK	60,000	2019
32	USA	San Diego City, CA	45,000	2019
33	Canada	Regina, SK[P]	2,000	2020
34	Canada	Winnipeg, MB[P]	2,000	2020
35	Canada	ELS Vancouver Island, BC	2,000	2020
36	USA	Kerman, CA (Expansion #1)	90,000	2020
37	USA	Bozeman, MT	1,000	2020
38	USA	USVI St John	1,000	2021
39	USA	Chula Vista, CA Expansion #1	60,000	2021
40	USA	Maui, HI[S]	1,000	2022
41	USA	Staten Island (NYC), NY	60,000	2022
42	Canada	Arthur, ON Expansion #1	100,000	2022
43	Canada	Thorold, ON Expansion #1	10,000	2022
44	USA	Ukiah, CA	20,000	2022
45	Canada	Vancouver Island, BC	20,000	2023
46	Canada	Peterborough, ON	25,000	2023
47	Canada	London, ON[P]	5,000	2023
48	Canada	Calgary, AB	10,000	2023
49	USA	Eaton, CO	30,000	2023
50	USA	Fort Collins, CO	1,000	2023
51	Canada	Eastgate, BC	20,000	2023
52	USA	Helena, MT[P]	1000	2023
53	USA	Wildwood, GA[P]	1000	2023
54	USA	Baltimore County, MD[P]	1,000	2024
55	USA	Jacksonville, FL[P]	1,000	2024
56	USA	Nantucket, MA[P]	1,000	2024
57	USA	Chula Vista, CA Expansion #2	90,000	2025
58	USA	Kern County, CA[C]	120,000	Opening in Q4 2025
59	USA	San Diego City, CA [C]	270,000	Contracted. Permitting in process in 2025

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(P) Pilot, (S) Solar, (C) Construction

Biosolids:

No	Country	Location	Tons / Year	Install/ Project
1	Canada	Edmonton, AB	50,000	2002
2	Canada	Moncton, NB[P]	30,000	2005
3	Canada	Chemainus, BC[P]	15,000	2009
4	USA	American Fork, UT	60,000	2010
5	USA	Los Angeles, CA[P]	200,000	2008/2015
6	USA	Florence, OR[P]	2,000	2013
7	USA	Moorefield, WV	20,000	2013
8	USA	Albany, OR[P]	1,000	2014
9	USA	Chicago, IL[P]	1,000	2018
10	USA	Battle Creek, MI[P]	1,000	2019
11	USA	Winchester, VA[P]	1,000	2020
12	USA	Downers Grove, IL[P]	1,000	2020
13	Canada	Grand Forks, BC	20,000	2022
14	USA	Tremont, PA (NYCDEP)[P]	120,000	2023
15	USA	Dallas, TX[P]	1,000	2024
16	USA	Salisbury-Rowan, NC[P]	1,000	2024
17	USA	Middlefield, OH	1,000	2024

(P) Pilot, (S) Solar, (C) Construction

Anaerobic Digestion / Post Tunnel Curing & MSW Organics:

No	Country	Location	Tons / Year	Install/ Project
1	Canada	Caledon, ON[T]	60,000	2009
2	Canada	Arthur, ON[AD]	200,000	2004/2021
3	USA	Goleta, CA[AD]	100,000	2024
4	USA	Roseville, CA[MSWO, C]	30,000	Under construction 2025

(T) Tunnel Curing, (AD) Anaerobic Digestate, (MSWO) Municipal Solid Waste Organics, (P) Pilot, (C) Construction

Terms:

Confidentiality

"Confidential Information" means any information one party discloses to the other under this RFI / RFP / Invitation to Bid which is identified as confidential or proprietary. By way of example but not limitation, the content of this quotation and all other information in conjunction with Sustainable Generation® with GORE® Covers and its system components, which has been disclosed or will be disclosed by SG, is confidential. RECIPENT may not communicate Confidential Information to third parties. RECIPENT confirms to disclose Confidential Information to no more than those employees and contractors to whom disclosure is reasonably necessary for the operation of the Facility or for the evaluation of this RFI / RFP / Invitation to Bid. Confidential Information does not include information which: is rightfully obtained by the recipient without breaching any

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confidentiality obligations; is or becomes known to the public through no act or omission of the recipient; the recipient develops independently without using Confidential Information; or is disclosed in response to a valid court or governmental order if the recipient notifies the disclosing party and assists in any objections. The recipient may use Confidential Information only for the purposes for which it was provided under this RFI / RFP / Invitation to Bid, and shall treat it with the same degree of care as it does its own similar information, but with no less than reasonable care. The acceptance of this RFI / RFP / Invitation to Bid does not affect any existing confidentiality agreement.

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FCC

Market Research Response

environmental services

Honorable Daniella Levine Cava
Mayor
Miami Dade County
111 NW 1 Street
Miami, Florida

Dear Mayor Levine-Cava:

Subject: Response to County's Request for Waste Management Review Participation

At the February 19th, 2025, Board of County Commissioner's (Board) meeting, the Board adopted resolution #11(A)(19), sponsored by Chairman Rodriguez. During the consideration of this item, the Chairman and other commissioners informed that parties interested in solid waste issues, including Waste to Energy solutions, should contact the administration. FCC Environmental Services ("FCC") is writing to formally respond to this request for interested parties to submit expressions of interest to participate in offering suggestions and developing solutions regarding the county's solid waste system.

FCC is keen to participate in this review concerning the feasibility of constructing a new Waste-to-Energy (WTE) facility in Miami-Dade County. FCC is the US subsidiary of FCC Servicios Medio Ambiente, a global provider of waste collection and disposal treatment services. Our company operates in seven states, including Florida, and across Europe, utilizing the latest technologies and eco-friendly equipment to deliver tailored solutions that meet the needs of our partners.

FCC proudly stands as a world leader in environmental services, offering effective solutions to local governments for the management of municipal solid waste and recycling. Our extensive experience encompasses all aspects of waste management, including collection, financing, and the construction of recycling, composting, landfilling, and waste-to-energy facilities worldwide. We look forward to providing Miami-Dade County with options that will meet and exceed expectations.

The intent of this communication is to comply with the Chairman's directive to promptly express FCC's desire and intent to participate in this information sharing process, and to participate in any subsequent procurement process. Please let us know whether this expression of interest is sufficient to ensure inclusion in discussions or processes that will occur during the 120-day due diligence/information period, or if a more formal RFI process will be established.

Please feel free to contact us for any questions and we look forward to preparing and submitting our options to the County.

Sincerely,

Juan Gorriti
President

environmental services

Cc: Chairman Anthony Rodriguez
Vice Chairman Kionne L. McGhee
Board of County Commissioners

Market Research for Miami-Dade County Municipal Solid Waste 4.14.2025

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Executive Summary
A. Respondent
B. Resource Recovery Solutions
C. Financial Approach
D. Implementation Approach
E. Other Information/Advice

Executive Summary

- Best Partnership and experience in the Environmental Industry
- Advance resource recovery vision
- Strong commitment to technology & innovation
- New and flexible approaches to project management

Executive Summary

Solution Processable Waste – 1.8 M tons

Design, finance, build and operate

Service Length – 30+ years

Site Size – 65 acres

EcoPark Facility:

- Waste-to-Energy facility
- Material Recovery Facility
- Bulky Waste Processing Facility
- Composting Facility
- Bottom Ash Recycling Facility

Sustainability:

- Versatile long-term solution
- Diversion from landfill
- Reduce hauling costs
- Maximize recycling, recovery, and energy

A. Respondent – Consortium

With over 124 years of experience FCC is one of the world leaders in environmental services

Respondent's Name & Address
FCC Environmental Services
Juan Gorriti, President
1101 Brickell Ave., Suite n1601
North Tower
Miami, FL 33131
832-246-2064
Juan.Gorriti@fccenvironmental.com

Mastec is a highly ranked EPC contractor specializing in the power markets

Respondent's Name & Address
MasTec, Inc.
Ben Gilbert, Jr. Senior VP
800 S. Douglas Road
Coral Gables, Florida 33134
305-447-6459
Ben.Gilbert@mastec.com

B&W has been generating power safely and with an environmentally friendly focus for more than 150 years

Respondent's Name & Address
Babcock & Wilcox
Jimmy B. Morgan
President & COO
1200 E Market Street
Akron, OH 44305
866-330-4680
jbmorgan@babcock.com

FCC Environmental Services

One of the largest environmental companies in the world

Over **54,000 employees**

Working in over **5,600 municipalities**

Providing services to more than **78 million people**

More than **860 facilities** for recycling, recovery and waste treatment

$4.77B revenue in **2024**

23,000 unit most advanced technologies **fleet**

International Presence

USA

environmental services

Spain

Ámbito

Medio Ambiente

Ámbito

Meio Ambiente

Environnement

Environment

Rest of Europe

France

Portugal

United Kingdom

Austria

Czech Republic

Poland

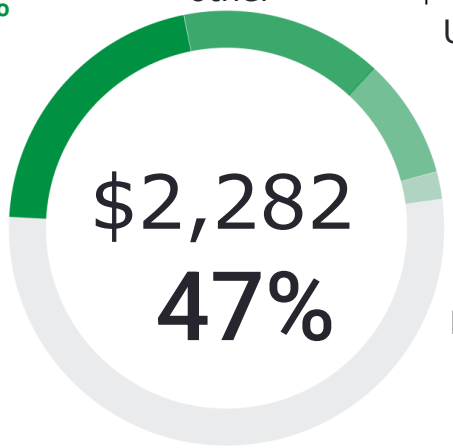
Slovakia

Hungary

Serbia

Romania

International Revenue



International Backlog

$6,225 M

40% of the total,

as of December 31, 2024

Environment – World Leader

Experience

Among the seven largest environmental companies in the world, we have been serving for over 124 years

Integral

Full range of environmental services, from waste collection and haulage to the most cutting-edge waste treatment and recycling systems

Innovation

In house R+D+i resources that allow us to offer the most innovative solutions to our customers. 21 projects registered to date in the internal UNE 166002 certified R+D+i system

Sustainability

Commitment to communities in providing socially, economically and environmentally sustainable solutions

Smart Solutions

We help cities become more effective and resource-efficient, more sustainable and more socially responsible

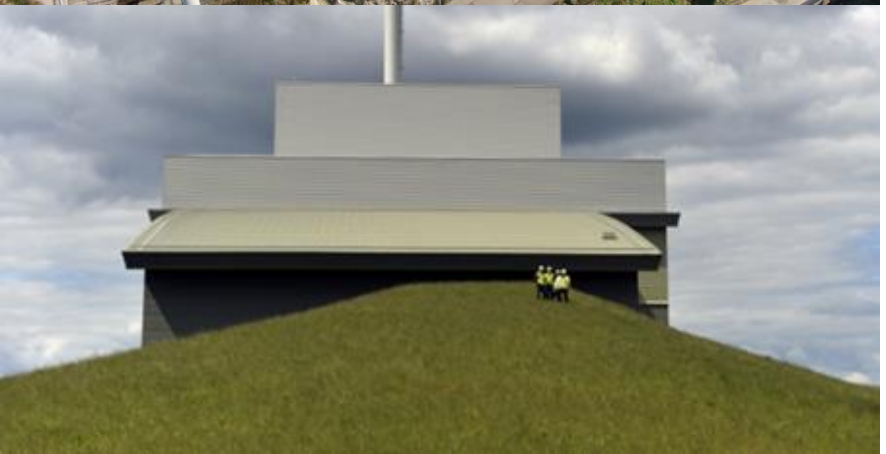
environmental services

Waste to Energy Experience

12 WtE thermal recovery facilities

410 MWe of renewable electrical power generated

4.2 million tons of municipal solid waste capacity annually



Relevant Experience

- **Barcelona Ecopark (Spain)** One of the **largest facilities in the world**. Recycling, anaerobic digestion and composting facilities
- **Las Dehesas Biomethanization Plant (Spain)** (Valdemingómez Technology Park / Madrid. **The world's largest anaerobic digestion facility**
- **FCC Buckinghamshire Ltd (UK)** The Facility recovers energy through the combustion of waste and **uses the recovered heat to generate steam**, which in turn produces power.

FCC Environmental Services is one of the **top 15 companies in the United States**. The company operates in Florida, Texas, California, Minnesota, North Carolina, Nebraska, and Iowa. Across these states, over 14 million inhabitants are served.

FCC Environmental Services is one of the **top 3 waste companies in Florida.**

Infrastructure Leader

MasTec is a highly ranked EPC contractor specializing in the power markets. Provides dedicated engineering and preconstruction support throughout project development, along with complete EPC delivery and self-performing construction capabilities

$12.3 BILLION
IN REVENUE

34,000
EMPLOYEE NETWORK

$3.3B
EQUIPMENT FLEET

NYSE
MTZ

NATIONAL Minority Supplier Development Council
MINORITY CONTROLLED COMPANY

$4.6 BILLION
BONDING CAPACITY

100+
YEARS EXPERIENCE

MasTec
Infrastructure that Delivers

Relevant Experience

- **Close to $2B in Miami-Dade County projects**

- **Pasco County**: MasTec served as the general contractor for the expansion of the facility, which involved installing a fourth boiler and its associated components. The project was extensive and included civil and site work, foundations, structural engineering, mechanical installation, piping, electrical work, and instrumentation for the stoker and boiler provided by the Original Equipment Manufacturer (OEM). Additionally, the project successfully included the installation of a steam turbine generator, condenser, cooling tower, air pollution control system, switchyard, ash handling building, and various other essential auxiliary equipment

- **Lee County**: Expansion of a waste-to-energy facility. Awarded **"Best Renewable Project of the Year"** by Power Engineering Magazine.

Babcock & Wilcox (B&W)

- **Headquarters:** Akron OH, USA
- **Founded:** 1867
- **Ownership:** Public (NYSE:BW)
- **Employees:** ~2,000
- **LTM Revenue December 2024:** ~$717.3M

Global leader in energy and environmental technologies and services, specializing in innovative power generation with a focus on clean and sustainable energy solutions.

Supporting sustainable power

- More than 500 waste-to-energy and biomass-to-energy units at 300+ facilities globally (consuming over 61 million tons of waste per year) and a leader in plant availability
- Serving utility, resource recovery, municipality and investment firm customers

Driving decarbonization

- Large worldwide installed base of wet and dry scrubbers for SOX reduction, particulate control equipment, NOX reduction technologies, and mercury control systems to meet environmental regulations
- Flue gas pre-treatment technologies for use with CO2 capture

Ensuring energy security

- More than 300 operating utility and industrial boiler units in the U.S. and nearly 200 operating utility and industrial boiler units across 40 countries around the world
- More than 5,000 industrial watertube package boilers and other waste heat recovery products installed in a variety of facilities
- Average more than 500,000 U.S. Boilermakers' construction manhours per year over last five years
- One of the top five Boilermaker employers in the U.S. utility industry

B&W Relevant Experience

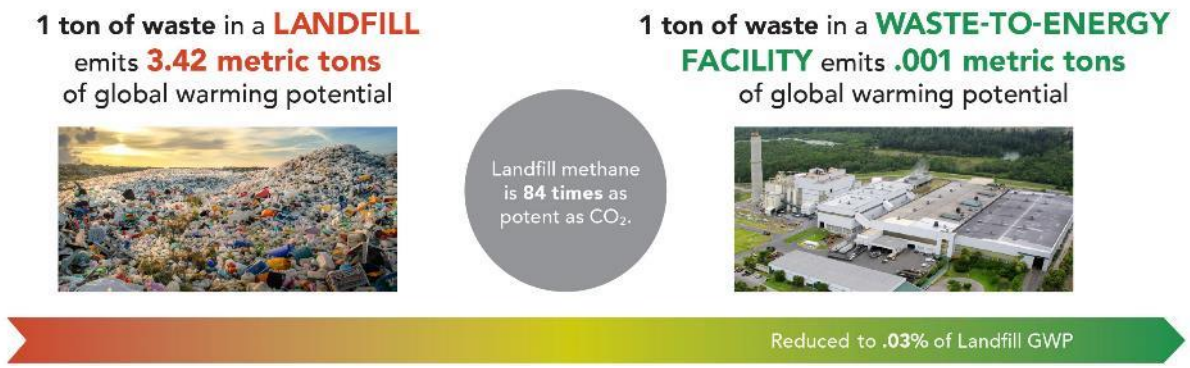
- B&W's WtE capabilities feature state-of-the-art technology, developed and improved over the last 80 years and used in **more than 650 installations**:
  - **West Palm Beach (US)** (1,000,000 TPY) **most advanced WtE plant in North America**, reduced landfill volume by 90% and metals recycling reducing GHG emissions
  - **Copenhagen's (DE)** (400,000,TPY) state-of-the-art Amager Bakke sets **new standards for environmental performance**, energy efficiency and waste treatment capacity
  - **Kelvin Waste-to-Energy Plant, (UK)** (395,000 TPY) **largest WtE boiler supplied by B&W**, utilizes state-of-the-art steam generation and combustion technologies
- **B&W also has a long history of providing industry-leading emissions control solutions**

B&W's WtE technology reduces methane emissions

- Methane has **84 times** the Global Warming Potential (GWP) of CO_2[i]
- **Annual additions to landfills** in the U.S.[ii] produce emissions equivalent to **10 million cars**
- **Landfills in the U.S.**[iii] emit more than 330 million tons of 20-year basis GWP each year, roughly equal to **70 million cars**[iv]
- Waste-to-Energy (WTE) avoids landfilling while producing **baseload clean energy**

- **B&W's state-of-the-art technology** has been installed in more than 500 units in more than 30 countries, including:
  - The most recent WTE facility in the U.S. (Palm Beach Renewable Energy Facility, Florida)
  - One of the world's largest waste treatment facilities in the world (Shenzhen East, China)

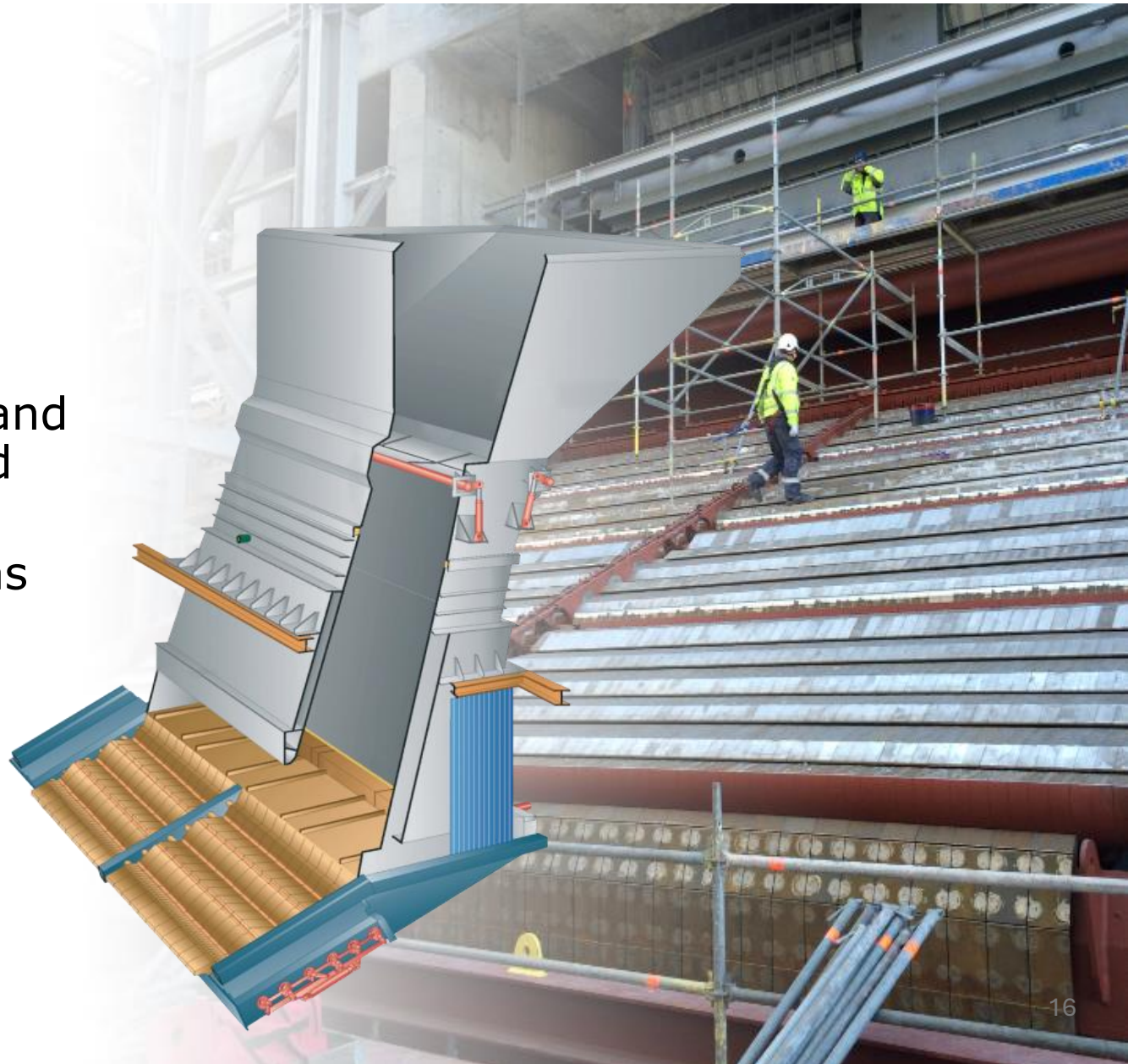
WTE TECHNOLOGIES
- Boiler/steam generation island
- DynaGrate® combustion grate
- Fuel handling systems
- Emissions control equipment



B&W IS ACTIVELY DEPLOYING TECHNOLOGY THAT CURBS THE GLOBAL WARMING IMPACT OF METHANE

B&W's DynaGrate® Combustion Grate Technology

- Large installed base with diverse set of customers
- Grate design allows for high availability and long operational time, leading to reduced O&M cost
- High thermal efficiency and low emissions
- High fuel flexibility
- Factory assembled modules reduce field construction



West Palm Beach Project Spotlight

West Palm Beach, FL United States

- Last waste-to-energy plant built in U.S.
- Combined U.S. and European technologies
- One of the largest, cleanest in the world (3,000 t/d)
- First SCR in U.S. WtE integrated into power cycle
- 3 x 1000 t/d lines
- Scope: WtE Boilers and Flue Gas Treatment
- Commissioned: 2015

B. Resource Recovery Solutions

- **EcoPark** complex able to treat **1.8 Million tons** from Miami-Dade County.
- **Sustainability** achieved by integrating the best technologies to maximize recycling and recovery of materials, overall system's energy efficiency, and identifying the most sustainable solution for each waste stream.
- With the goal of helping Miami-Dade County and its communities, our solution will create clean renewable energy, with **emission control solutions and increasing landfill diversion** to protect the environment.
- Education programs and a visitor center ensure **integration with the local community**.

The Solution

2.4 Million tons (MSW)
TRC's (13) Transfer Stations (3) and Garbage Haulers

600k M tons (MSW)

Landfill

60k tons (RCY)

1M tons

700k tons

EcoPark – 1.8Mt

Material Recovery Facility

Residues 24K tons

WtE Plant

Residues 150k tons

Bulk & C&D Waste 550k M tons

Residues 30k tons

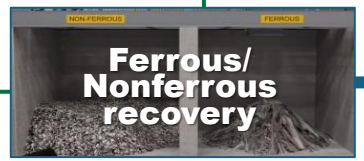
Compost 150k tons

Green transportation of product streams

Recycling of bottom ash

Electricity Production

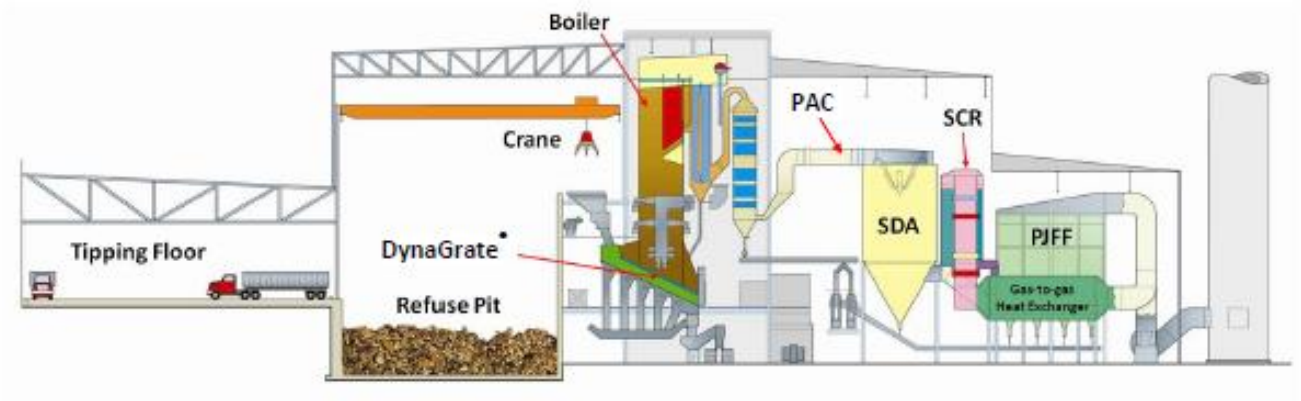
IBA recycling (landfill coverage, aggregates)



Green transportation of product streams

* Estimated and indicative volumes

The Technology: Waste to Energy



Waste incineration is one of the **most widely practiced resource recovery technologies** worldwide.

Energy Recovery: The boiler, turbine, and complete thermodynamic cycle are designed to maximize the recovery of energy from the processed waste, utilizing circular principles for all elements and ensuring all variations of energy transfer can be achieved.

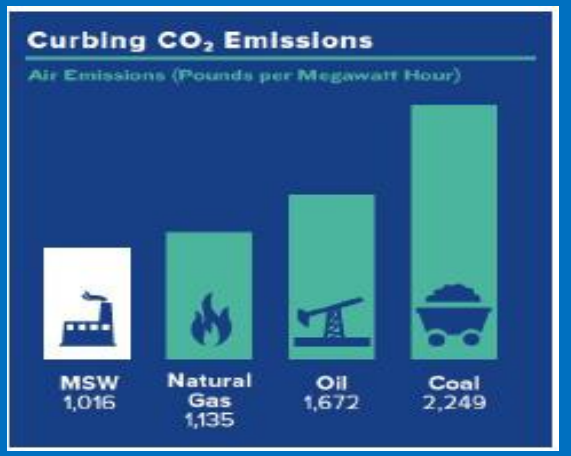
Materials Recovery: Ferrous and non-ferrous metals are recovered from the bottom ash after the combustion process, becoming a marketable recycled product. After this, the bottom ash has the potential to be re-used as an aggregate and marketed within the construction industry.

Water Conservation: designed around a better-than-net-zero discharge philosophy and minimum water usage.

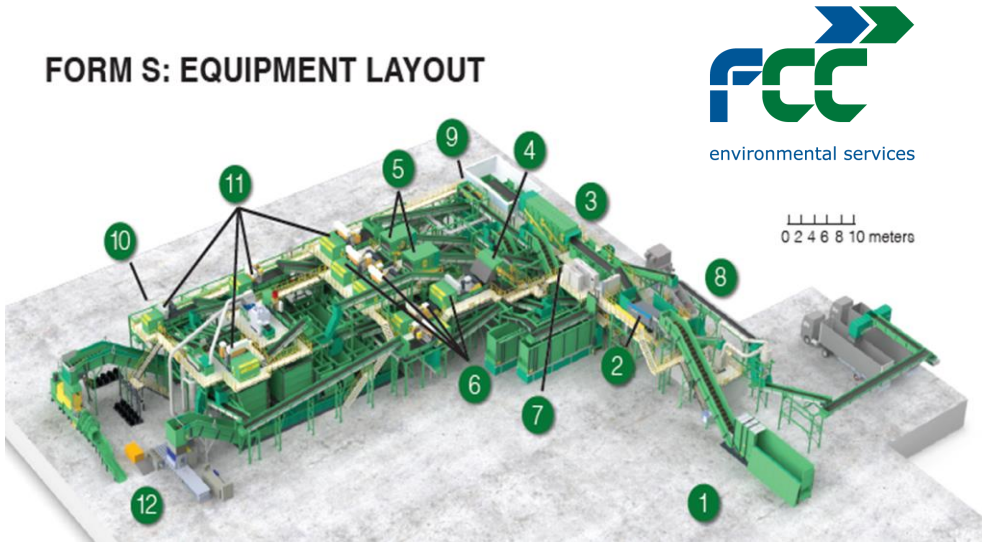
Innovation: Carbon Capture can be installed at the facility either from the outset or retrofitted to reduce CO2 emissions.

Inputs:
- Waste
- Oxygen
- Water
- Consumables

Outputs
- Power (and/or heat)
- Ashes and residue
- Flue gas



The Technology: MRF



New Standard of Material Recovery Facilities
- State-of-the-Art Educational Center
- Premium Office/Employee Space
- Modern & Sustainable Design

Sustainable Design for the Future
- Latest Innovations in Recycling Technology
- Proven Community Engagement & Education Programs

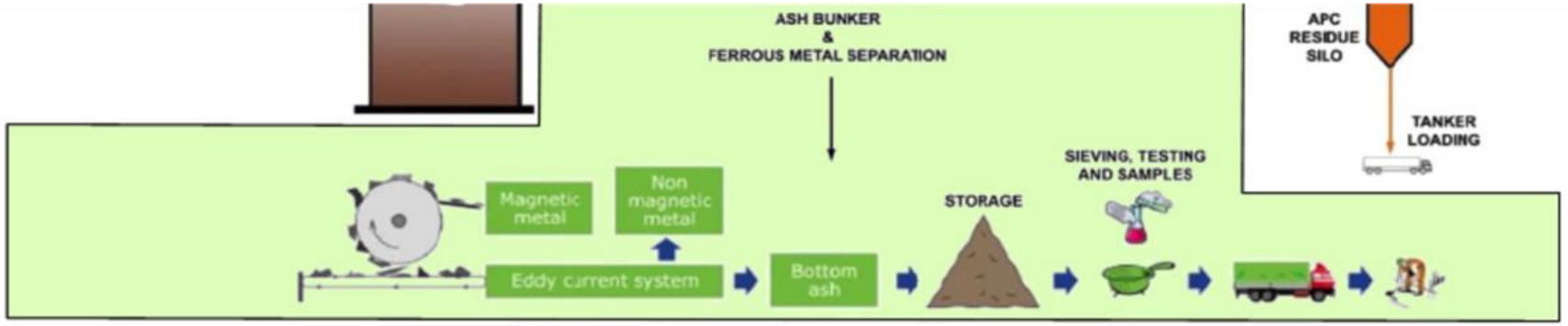
Dedicated to Accomplishing County's Sustainability & Diversion Goals
- Custom-Engineered with Miami-Dade County in Mind
- Requirement of Employee Safety
- Priority of High Capture Rates of Commodities
- Processes to Maintain Material Integrity

Inputs:
- Source separated waste material

Outputs
- Marketable Recyclables

The Technology: IBA Treatment

FCC's experience is derived from in-house Incineration Bottom Ash (IBA) recovery/treatment plants with various destinations ranging from disposal to recovery and reuse of these materials by removing pollutants to protect human and environmental health.

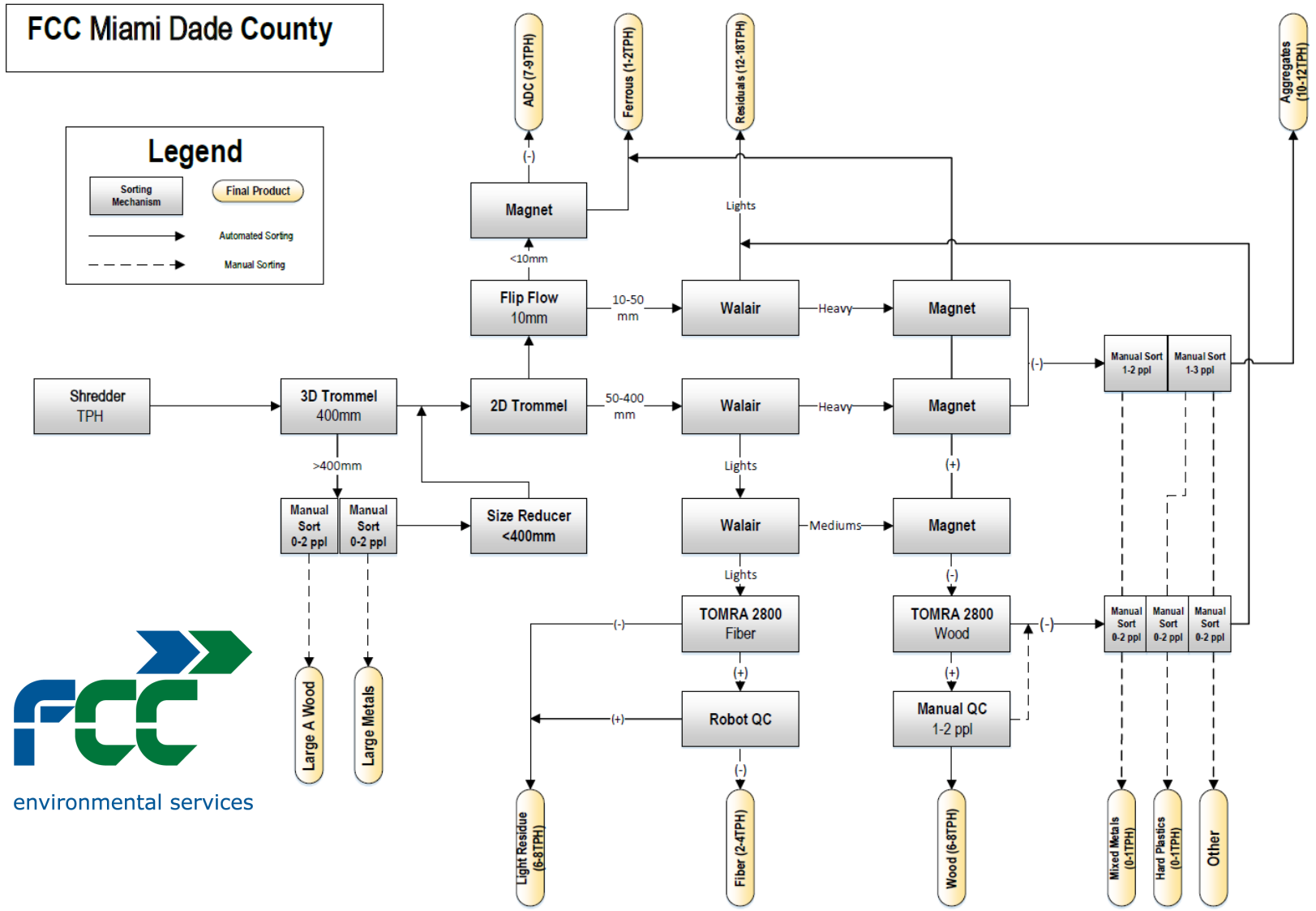


- **Marketable Recovered Metals and Aggregates**
- **Increased Revenue**
- **Further reduction in waste to landfill**

Inputs:
- Bottom Ash

Outputs
- Marketable Metals
- Aggregates

The Technology: Bulk & C&D Waste Processing



environmental services

Inputs:
- Bulk Waste
- C&D Waste

Outputs
- Marketable Recyclables
- Residues

The Technology: Composting

Inputs:

- Source separated green waste material

Outputs

- Marketable compost
- Residues

Benefits

Working together towards reaching the Miami-Dade Climate Change Strategy

- **Higher diversion rates compared to landfilling**
- **Scalable facilities to accommodate growth and new systems**
- **Increase revenues from the sale of the commodities**
- **Generated renewable power will be used to ensure EcoPark is self-sufficient, and excess power is sold to the grid**
- **Educational center for community engagement**
- **Promoting Recycling**

Challenges

	Details	Solutions
Regulatory Compliance	Ensuring alignment with Miami-Dade's Climate Action Strategy goals. Navigating stringent environmental regulations and obtaining necessary permits.	• Consortium's Local knowledge. • Work closely with regulatory bodies. • Conduct thorough environmental impact assessments.
Community Acceptance	Addressing public concerns about air quality and health impacts.	• Conduct public awareness campaigns to educate the community. • Engage in transparent communication and involve community leaders.
Financial Constraints	Securing funding for the high initial capital investment required. Balancing cost-effectiveness with project's revenues and environmental benefits.	• Explore various funding options including government grants, private investments, and public-private partnerships.
Technological Challenges	Implementing advanced waste-to-energy technologies that meet efficiency and emission standards. Managing the integration of new technologies with existing resource recovery infrastructure.	• Consortium's proven record and expertise. • Collaborate with technology providers for seamless integration.
Operational Issues	Ensuring consistent and reliable waste supply to maintain energy production. Addressing potential operational disruptions and maintenance challenges.	• FCC Environmental experience and track record. • Establish robust supply chain management practices. • Implement preventive maintenance schedules and contingency plans.
Environmental Impact	Ensuring sustainable resource recovery practices that align with climate goals. Minimizing greenhouse gas emissions and other pollutants.	• Adopt best practices for emissions control and resource recovery. • Regularly monitor environmental impact and make necessary adjustments.
Long-term Sustainability	Developing strategies for continuous improvement and adaptation to evolving climate policies. Ensuring the project contributes to long-term climate resilience and sustainability goals.	• Flexibility and adaptability of the EcoPark facility. • Develop a long-term sustainability plan with clear milestones. • Continuously review and update strategies to align with evolving policies.

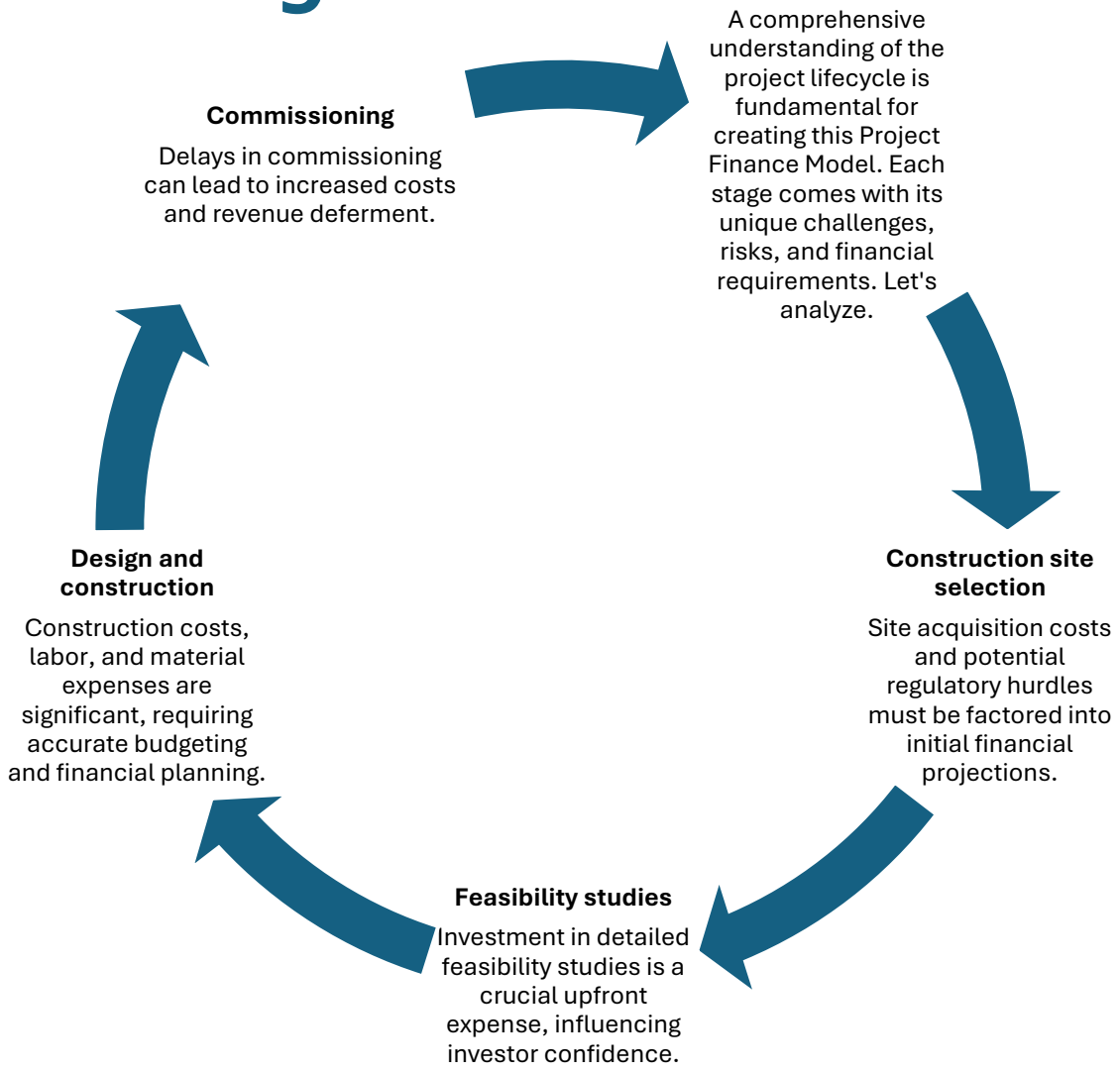
C. Financial Approach

- The following detailed analysis, including a practical discussion of the technologies and infrastructure, policy changes, and relative costs required to shift the County's current system of resource recovery toward a Sustainable strategy. It is essential to note that the estimates below pertain only to the portion of the waste stream managed by DSWM, which accounts for approximately 45% of the approximately 4.6 million tons of solid waste generated in Miami-Dade County.

- The consortium's considerations are preliminary in nature; additional and more detailed studies and site investigations will be required.

Material	Annual Inbound Tons	Operational Cost Per Ton (OPEX)	Capital Investment (CAPEX)	Revenue Share
Total Tons = 2.4 M tons (0.6 M tons delivered to the landfill under the current disposal agreement)				
MSW				**MSW**
Waste-to Energy Facility (Mass Burn)	1,000,000	$45 - $75	$1,500M - $1,900M	Net Revenue Shares could be be: Electricity Export % share Ferrous & Non-Ferrous Recovered Metals % share
Yard Waste / Organic Material				**Yard Waste / Organic Material**
Composting Facility	150,000	$35 - $50	$10M - $15M	Net Revenue % Share on Recovered Marketable Products
Recyclable Material				**Recyclable Material**
Material Recovery Facility	60,000	$60 - $100	$60M - $100M	Net Revenue % Share on Recovered Recyclables
Bulky Waste				**Bulky Waste**
Bulky Waste Recycling Facility	550,000	$40 - $60	$40M - $60M	Net Revenue % Share on Recovered Recyclables & Construction Material
TOTAL	**1,760,000**			

Funding Model



Facility operation

Operational costs, waste supply agreements, and revenue generation strategies are key considerations.

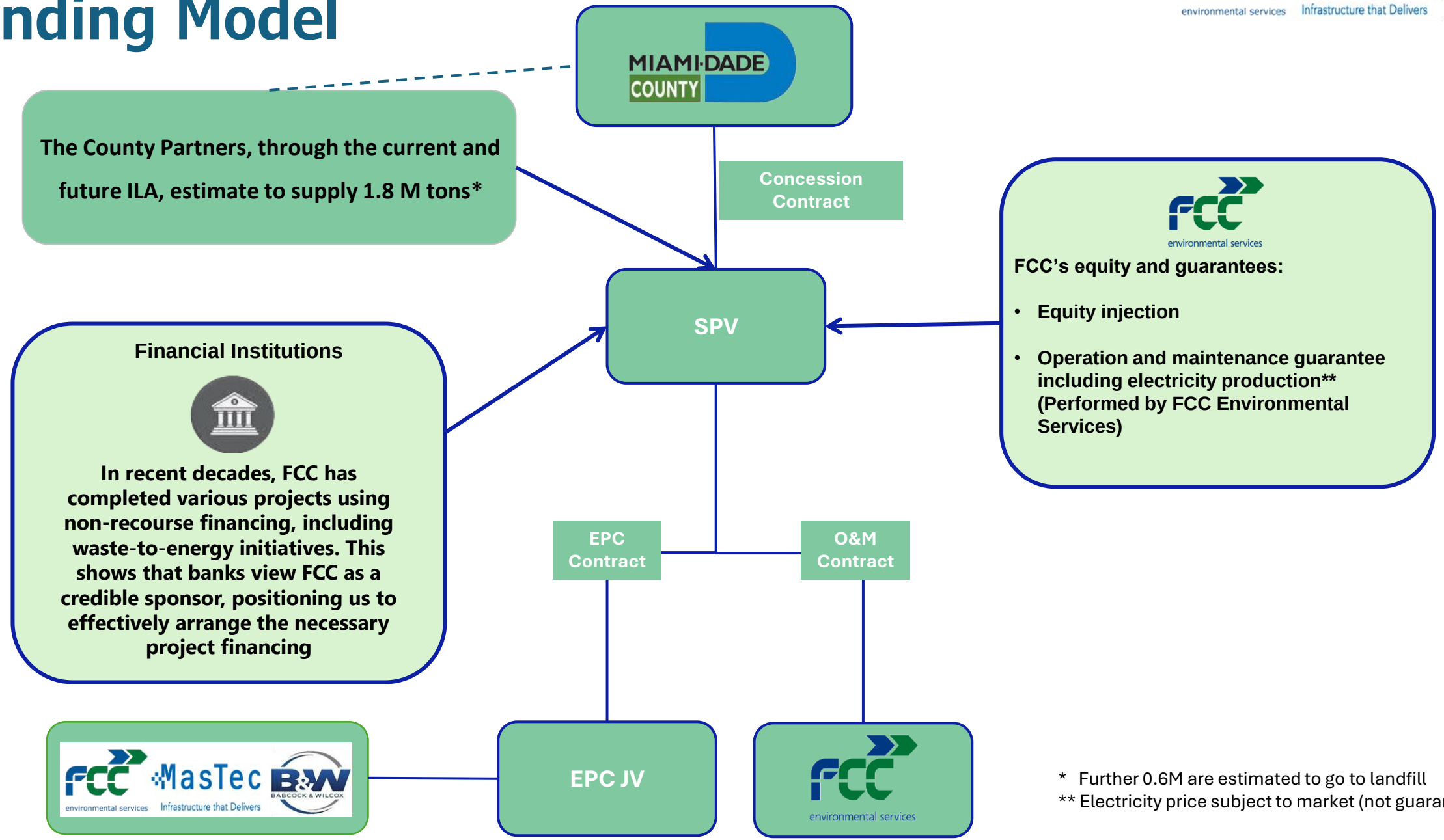
Project finance as Project Developers (PPP)

The project will be leveraging a **New-Build-Finance-Rates model.**

Key features of the PPP structure

- Consortium entity to design, build, finance, operate, and maintain the Campus via a concession agreement with the County.
- The Consortium acts as the implementation partner and is responsible for all activities related to the implementation, management, monitoring, and reporting of the project throughout the project's crediting period.
- Miami-Dade County and the Consortium entity can share the revenue from the recycled waste streams generated from the project.

Funding Model

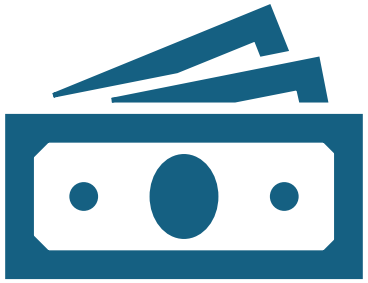


* Further 0.6M are estimated to go to landfill
** Electricity price subject to market (not guaranteed)

Funding Model

Potential Credits/Grants

- **Federal Grants**
- **Bipartisan Infrastructure Law** – Currently $591B invested in more than 72k projects
- **Production Tax Credits** – 2.6 cents per kilowatt-hour
- **Investment Tax Credits** – up to 30% for projects built by 2032
- **State Grants**
- **Municipal Solid Waste-to-Energy Program**
- The consortium is committed to **partnering** with the County to obtain as much Federal and State assistance as possible, thereby mitigating the overall project cost



Revenue

In partnership with Miami-Dade County, the consortium is willing to discuss a mutually agreeable revenue-sharing model, enabling the County to maximize the benefits from our solution.

Potential Revenue Streams:

- **Energy sales**: Revenue generated from selling the renewable electricity or heat produced through the WtE process to the grid or specific consumers. The sale of electricity will be the main driver of revenue for the WtE plant.
- **Recycling sales**: Revenue generated from selling the recyclables through the MRF and the other processing facilities.
- **Metals sales**: Revenue generated from selling the metals recovered through the WtE process.
- **Bottom ash**: Revenue generated from additional use of ash recovered through the WtE process.
- **Government incentives**: Financial support provided by governments in the form, tax credits, grants, or other incentives to promote the project.
- **Renewable energy credits**: Depending on the project's environmental impact, the sale of carbon credits in emissions trading markets can contribute to revenue.
- **Rates structure**: Revenue generated from the Sustainability Campus customers.

D. Implementation Approach

- **Infrastructure**
- **Size and Site Ownership**
- **Permitting**
- **Timing**
- **O&M**
- **Health/Safety/Environmental**

Infrastructure

Potential Infrastructure Needs:

- **Extension of Utilities**: Depending on the location of the Ecopark, utilities may need to be extended to support the solution properly
- **Additional ROW/Easements**: To ensure that the Ecopark receives the necessary utilities, rights-of-way, and Easements may be needed
- **Potential Expansion of the Current Road Network**: Due to the potential increase in vehicles delivering materials to the Ecopark, there may be a need to increase vehicular capacity around the site. Expanding the road network would be advantageous for modernizing the area and improving its efficiency for vehicle movement
- **Design, development, and construction of Ecopark**: To provide this solution to Miami-Dade County, each of the facilities will need to be designed, developed, and constructed so that both the consortium and the County can experience the synergies between the different processing facilities

The consortium will fulfill the role of Design, Build, and Operate for the entire Ecopark, providing the project with cohesion and enabling the process to be conducted efficiently

Size and Site Ownership

With FCC's extensive experience in developing large, comprehensive resource recovery campuses, combined with the strength of our consortium, we believe our proposal can be effectively tailored to meet Miami-Dade County's needs for the campus site.

The consortium doesn’t have a preference and understands that the County has dedicated time and resources to analyzing and classifying various potential sites for this comprehensive environmental campus.

The consortium is committed to providing a flexible solution for this project, which includes a site component.

The consortium can offer suitable locations that meet and exceed the criteria outlined by your consultants, or we can provide you with the option to select and own a site of your choice.
The consortium will customize the siting to align with our customers' needs.

Depending on the desired volume capacity and the final configuration of the different facilities of the Ecopark:
50-80+ Acres*

*Note – The Compost Facility can be expanded to accommodate the required volume of material.

Permitting

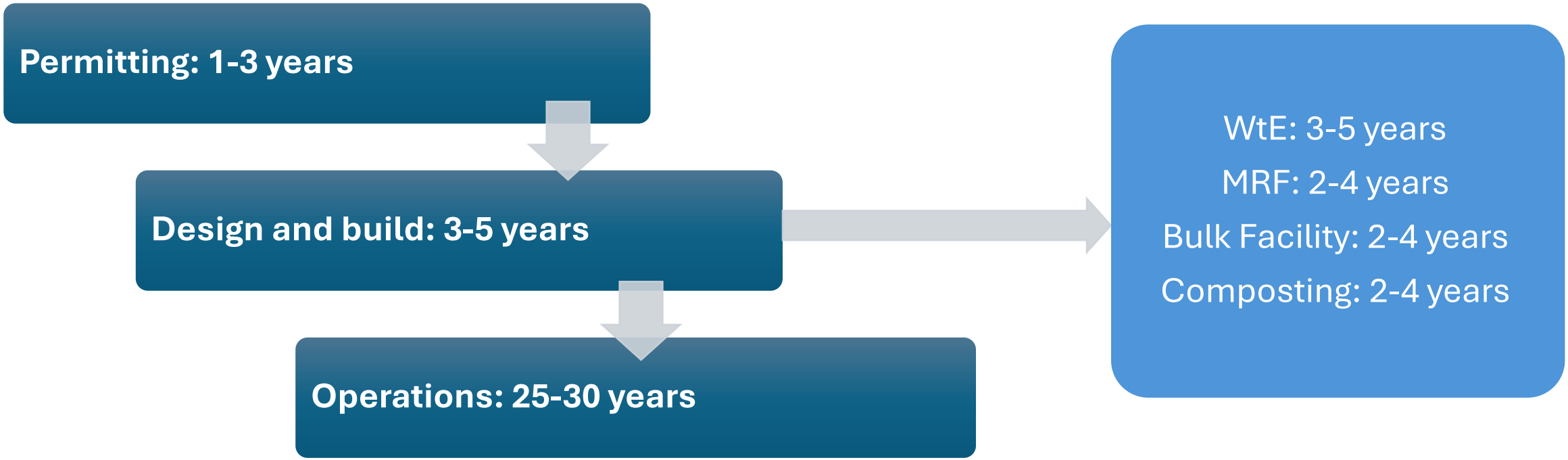
At a minimum, the following permits will be required in order to establish an Ecopark in Miami Dade County

- Power Plant Siting Act (PPSA) Certification
- Title V Air Emissions Permit
- Air Construction/PSD
- ERP
- National Pollution Discharge Elimination System (NPDES)
- Industrial Use Permit to Discharge Industrial Wastewater
- Stormwater Permitting
- UIC Permitting (if applicable)
- Prevention of Significant Deterioration (PSD) Permit

The consortium's exceptional expertise and resources will swiftly and effectively meet the outlined requirements, ensuring excellence at every turn

Timing

The Ecopark will take approximately 4 – 8 years to complete:



Operation & Maintenance

- **FCC Experience: sector leader** with more than 50 years experience operating WtE facilities
- More than **600 professionals** in the WtE division.
- Will require **200+ employees** to fully staff the Ecopark (local employment).
- **Fully-dedicated personnel** to Miami-Dade County
- **Qualified Candidates** experienced in the technologies
- Best Waste-to-Energy and Processing Systems technology to maximize **availability, efficiency** and comply with current and future environmental **standards**
- Scheduled **preventative maintenance** required to maximize the life of the facility
- **Lifecycle planning** for long-term operation

Health/Safety/Environmental

- Safety-focused **Leadership** driving best practices throughout the company.
- Specific **Training** for each level/position of employment.
- **Proactive** Observations from Management and Supervisory Teams.
- FCC first company within the environmental industry to be **accredited** ISO 45001 – Occupational Health and Safety and certified by the British Standards Institution.
- Several **safety programs** with the primary focus on proactive, reactive, and behavioral measures (monthly targets, compliance audits, hazard identification).
- FCC consistently strives to be the **best in class**, as a healthy and safe environment is a fundamental core attribute.

E. Other Information/Advice

- **Procurement Model**
- **Partnership**
- **Additional Insights**

Procurement Model

Our consortium's EcoPark proposal fully addresses the needs and interests of the County's long-term solid waste recycling and disposal objectives. We are prepared to handle financing, land acquisition, and other associated tasks with appropriate input and participation from the County. Therefore, to expedite the process, we recommend that the County begin negotiations with this consortium to reach a viable commercial agreement as soon as possible. Upon completion, the agreement would be brought to the Board of County Commissioners for ratification. This EcoPark proposal aligns with the standards of a genuine public-private partnership. It will facilitate a swift resolution of a critical public service function that Miami-Dade County needs to provide.

Alternatively, if the County chooses to pursue a different procurement process for the construction and operation of an EcoPark, or any of its associated facilities, this consortium will participate in such a process to be the County's partner for the long-term solid waste recycling and disposal operations.

Partnership

- As shown in previous sections, the consortium has extensive experience in providing a comprehensive range of environmental solutions, tailored to the specific needs of Miami-Dade County and integrating various technologies efficiently.
- Working in partnership with other resource recovery facilities in Florida will be key to the successful implementation of the County´s strategy and its delivery.
- FCC's presence in Florida as an environmental services provider and MasTec's local knowledge will facilitate the necessary network to partner with other Counties and private companies.
- These will include waste-to-energy (WtE) facilities, mechanical and biological recycling facilities (MRFs), and compost facilities, which, in conjunction with the EcoPark, will provide a comprehensive solution for all waste arisings and contingency options for planned outages.

Additional Insights

- **Extensive Experience**: Both from a global and U.S. standpoint, FCC has the experience to provide Miami-Dade County a premium resource recovery solution with an emphasis on safety, efficiency, and reliability.
- **Solely Dedicated Services**: All resources, including equipment and personnel, proposed will be fully dedicated to the County Ecopark.
- **Local, On-Site Personnel:** Personnel present on-site. Management is available to meet in person or respond to any inquiry that the County might have.
- **Environmentally Friendly:** An absolute commitment to providing comprehensive service to Miami-Dade County, extending beyond simple processing. Protecting the environment of the County is our responsibility.
- **Innovative Leader by Integrating Technology:** Careful selection of systems that promote a resource recovery solution for Miami-Dade County.
- **Leader in Customer Service:** Deliver the highest level of service to each of our partners. Willing to customize the services based on our partner's needs to reach that goal.
- **Community Stewardship**: Our goal is to participate in comprehensive community outreach to maintain our local partnership with the County.
- **Price:** FCC offers our customers the best level of service for the most competitive price.

Fetch Waste Solutions

Market Research Response

Response To Miami-Dade Market Research for Municipal Solid Waste Management Solutions

April 2025

Fetch.
WASTE SOLUTIONS

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A. Respondent

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About Fetch Waste Solutions, LLC

Fetch Waste Solutions, LLC ("Fetch") is a 50/50 joint venture between PepsiCo Inc. ("PepsiCo") and Freepoint Eco-Systems, LLC ("Freepoint" and together, the "JV Partners"), formed to deliver economically compelling, sustainable waste management solutions. Fetch develops advanced municipal solid waste ("MSW") sortation facilities that recover plastics, metals, old corrugated cardboard ("OCC"), and organics for beneficial reuse—diverting waste from landfills and incinerators, supporting circularity, and helping improve environmental outcomes for municipal partners.

Fetch's business model is strengthened by long-term offtake agreements with its JV Partners. PepsiCo purchases recovered aluminum and PET, while Freepoint buys hard-to-recycle plastics. Remaining recyclable materials are sold at spot prices to mechanical recyclers. This structure provides financial stability and price risk mitigation, generating dependable revenue to support long-term operations.

PepsiCo's investment in Fetch reflects its strategic vision, pep+ (PepsiCo Positive) – a business strategy that embeds sustainability into the core of its operations to deliver long-term success. PepsiCo is working towards creating a more circular supply chain and addressing global packaging challenges through targeted innovation, policy advocacy, and strategic infrastructure investment. This approach is defined by three core actions: Reduce, Recycle and Reinvent, each contributing to PepsicCo's overarching pep+ objectives.

Freepoint, Fetch's other JV Partner, is a subsidiary of Freepoint Commodities Holdings LLC ("Freepoint Commodities") — an established global commodities merchant with over $30 billion in annual revenue. Since its founding in 2011, Freepoint Commodities has built a reputation for excellence at the intersection of commodities, capital, and operations. Freepoint Eco-Systems was established in 2020 as part of Freepoint Commodities' growing portfolio of environmentally focused investments, with a core focus on advanced recycling and circular economy infrastructure.

Freepoint has constructed and is currently commissioning a $200+ million advanced recycling facility in Hebron, Ohio, designed to convert waste plastic into feedstock for new plastic products. The next announced facility is in Eloy, Arizona, which will convert 180,000 tons per year of waste plastic into feedstock for new plastic products.[1] Additional facilities are under development in the Southeast, Mid-Atlantic, Gulf Coast and Northeast regions of the United States. Its partnership with Fetch expands this vision, enabling Freepoint to integrate upstream MSW sorting capabilities into its broader global recycling platform.

[1] https://finance.yahoo.com/news/dow-partners-freepoint-eco-systems-102220264.html

B. Waste Management Solutions

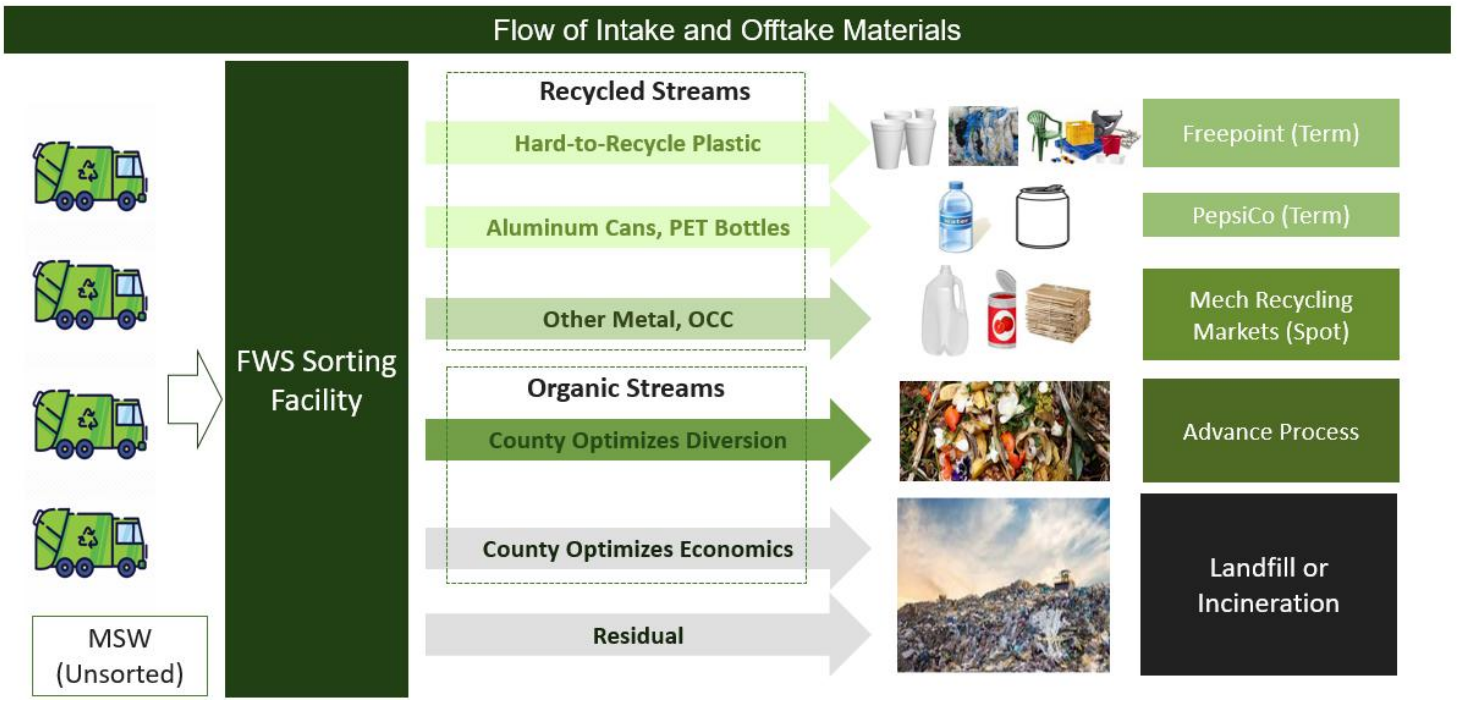
1. Solution

We believe Fetch's proposed solution effectively addresses Miami-Dade County's ("the County" or "Miami-Dade") waste disposal challenges. Our model not only supports the County in meeting its current and future disposal capacity needs, but also protects ratepayers by lowering costs. Beyond the financial benefits, our solution helps advance Miami-Dade's Zero Waste goals by increasing recycling rates and reducing reliance on landfilling. Importantly, Fetch's approach complements—and enhances—the environmental sustainability of both landfill and waste-to-energy ("WtE") strategies the County is currently evaluating, and it can be implemented in 18 to 24 months (vs. 8-10 years for a WtE facility).

Fetch specializes in the development, construction, and operation of Mixed Waste Processing Facilities ("MWPFs"). These facilities, funded entirely by Fetch, are designed to process between 400,000 and 1 million tons per year of MSW. Facilities should be located wherever waste is aggregated to minimize transportation costs. Multiple MWPFs can also be developed across one or more sites depending on the County's needs. The Fetch facility could also process the County's single stream recycling ("SSR") volumes or allow the County to eventually eliminate its SSR program altogether (if it so chooses) and save significantly on hauling and other costs associated with the program.

Our MWPFs use proven technologies to recover both traditional recyclables (e.g., metals, cardboard, plastics) and hard-to-recycle plastics (e.g., films, bottle caps, grocery bags). A residue stream remains for final disposal via landfill or WtE, per the County's preferred method. This means that the Fetch proposal works in concert with—not in opposition to—the two major disposal directions the County has been debating.

Fetch also offers optional organics separation, allowing for additional diversion through composting, anaerobic digestion, or conversion to biochar. While these paths increase diversion—from 20% -30% to potentially above 65%—they require additional capital and operating costs that may not be fully



offset by byproduct revenues. We'd also note that an organics solution could also be staged for development at a later time. Alternatively, the County may choose to optimize for cost savings by combining organics with residuals for disposal via its preferred disposal method.

Fetch's joint venture partners—PepsiCo and Freepoint—will purchase the majority of recovered materials under long-term, fixed-price offtake agreements with pricing escalators. Specifically, Freepoint will acquire all hard-to-recycle plastic bales, while PepsiCo will purchase PET and aluminum bales. These contracts will align in duration with Fetch's County agreement (proposed as an initial 10-year term with two 5-year extensions). Remaining recyclable materials (e.g., OCC, ferrous and non-ferrous metals) will be sold to the mechanical recycling market at spot prices. Fetch will remit 80% of recycling revenue to the County. In addition, the County will save from not having to dispose of the recycled materials. These benefits are offset by a processing fee paid by the County that we are currently estimating at $40-$50 per ton. **Our goal is to deliver net savings of $5-$10 per ton processed.**

Flow of Cash Receipts and Disbursements

The Fetch solution provides Miami-Dade County a scalable, privately funded, and operationally efficient path to achieve its long-term solid waste management, environmental, and economic goals.

2. Effectiveness

The Project will utilize state-of-the-art and proven solid waste sorting equipment readily available on the market. We have previously solicited proposals from five tier-1 international equipment vendors to design, manufacture, install and service the equipment necessary for the MWPF. We selected two vendors, Bulk Handling Systems ("BHS") and Van Dyk (together, "Design Build Vendors"), to scope Fetch's proposal to Miami-Dade County. BHS is an Oregon-based original equipment manufacturer with vast experience installing both inorganic and organic diversion solutions around the globe. Van Dyk is a Connecticut-based company that leads North America with over 340 Material Recovery Facilities ("MRF") and 2,400 recycling and sorting systems installed.

The sorting of MSW is neither a new concept nor reliant on new technology. It is a well-established process that has been successfully implemented in the U.S. and Europe by numerous equipment providers. Included below is a selected list of Fetch's Design Build Vendors' commissioned facilities. Importantly, our Design Build Vendors are currently actively constructing or commissioning additional facilities throughout the country with close to an aggregate 300 tons per hour of processing capacity. We also note that Freepoint's facility in Ohio has installed and commissioned a sorting line to prepare materials for their advanced recycling process. This sorting line, while not identical to that which would be used by Fetch in Miami-Dade County, shares many common functions and similarities.

Our Design Build Vendors will provide performance guarantees to ensure that the machinery is operating at or above expected levels for sortation success generally in the 85% to 93% range for our focus materials and bale homogeneity generally in the +90% range. With the worldwide increased focus on environmental impacts, there is increasing demand for MSW sorting solutions around the

world. As more MSW sorting lines are deployed, recovery rates are expected to increase with the continued maturation of optical scanners and robotics, providing the County with potential upside over time as machinery is replaced and/or upgraded.

Examples of successful third-party MSW sorting solution implementations are:

Facility Name	Capacity	Location	Description	Year of Construction
FCC Placer County MSW	110 tph	Lincoln, CA (near Sacramento)	Highly automated residential/commercial MSW MRF designed to recover recyclables and produce compost from organics with capacity of 110 tph. The construction is complete and will be operational in Q2 2025.	2023
MSW Facility in the Bay Area	100 tph	San Leandro, CA	A mixed waste facility that recovers recyclables & organics materials. This highly automated facility recycles materials from across the San Francisco Bay Area, recovering over 90% of recyclables and diverting more than 65% of waste from landfills.	2019
GreenWaste Recovery, Inc.	90 tph	San Jose, CA	GWR is a residential and multi-family MSW facility. It recovers >95% of available recyclables. The facility has received the SWANA Gold Award for Recycling Excellence in 2008 for its Mixed Waste Material Recovery Facility (MRF). Over a decade later, the facility has been upgraded to double its throughput and enhance recovery, product quality, and automation, featuring advanced robotic and optical sorting technologies.	2008
Fulcrum BioEnergy	80 tph	Reno, NV	Highly automated residential/commercial MSW MRF for recycling and gasifier feedstock production. The facility was commissioned and operated successfully, however the downstream SAF plant did not become operational.	2020
Mustang Dewey	65 tph	Santa Barbara, CA	Highly automated residential/commercial MSW and Single Stream MRF designed to recover recyclables and produce power from anaerobic digestion. Construction was started in Q1 2019 and became fully operational in Q3 2020	2019
RePower South, Moncks Corner	50 tph	Moncks Corner, SC	RePower South, Moncks Corner recovers recyclables and fuel feedstock. It operates the Berkeley County Recycling and Recovery Facility, the most advanced Mixed Waste Processing facility on the East Coast. The facility uses cutting-edge technology to recover recyclables and produce low-carbon fuel, significantly reducing landfill waste.	2019
WM Automated Single-Stream Systems	50 tph	New Braunfels, TX	The Automated Single-Stream System is a state-of-the-art residential sorting facility. It utilizes advanced automation and sorting technologies to efficiently process single-stream recyclables, enhancing recovery rates and operational efficiency.	2023
WM Fuel	50 tph	San Antonio, TX	A fully automated (zero manual sorters) mixed MSW MRF and PEF - Pellet Plant.	2011

Facility Name	Capacity	Location	Description	Year of Construction
Vexor Technology	50 tph	Gary, IN	Gray facility is fully automated (zero manual sorters) MRF residue processing plant to manufacture alternative fuel (PEF). Construction started in Q2 2016 and the plant has been fully operational since Q2 2017.	2016
Grupo CIP	50 tph	Puebla, Mexico	Fully automated (zero manual sorters) mixed MSW MRF for recycling and PEF production. Construction began in Q3 2016 and the plant has been fully operational since Q3 2017.	2016
CR&R	50 tph	Perris, CA	Highly automated mixed MSW MRF for recycling and PEF production. Construction started in Q1 2018 and fully operational since Q1 2019.	2018
DONGARA	40 tph	Ontario Canada	Facility was started in Q1 2009 and fully operational in Q1 2010. It has capacity of 40 tph with MSW Sorting plant and PEF pellet production. Build Design Partner was responsible for the design, engineering, manufacturing, project management, installation, start-up, training, service and support of the MRF equipment.	2009
WM Automated Single-Stream Systems	35 tph	Fort Worth, TX	The Automated Single-Stream System in Fort Worth, Texas, is a cutting-edge residential sorting facility. This highly automated system efficiently processes single-stream recyclables, enhancing recovery rates and operational efficiency. The facility utilizes advanced technologies, including air separation and optical sorting, to maximize the recovery and purity of recyclables. It requires minimal manual sorting, relying on sophisticated equipment to handle various materials such as plastics, metals, and fibers.	2024
Grand Central Recycling	35 tph	City of Industry, CA	An automated mixed waste MRF designed to recover recyclables from multi-family MSW and commercial MSW (OCC, mixed paper, ferrous metals, UBC, PET, HDPE). Construction was started in Q1 2011 & fully operational since Q1 2012.	2011
DFW-ECO Processing	25 tph	Dallas, TX	Fully automated (zero manual sorters) dirty commercial waste plant to manufacture alternative fuel (PEF). The facility became operational in Q1 2015.	2015
Vexor Technology	20 tph	Medina, OH	Fully automated (zero manual sorters) MRF residue processing plant to manufacture alternative fuel (PEF). Construction was started in Q2 2014 and fully operational since Q2 2015.	2014

3. Quantity

Fetch's MWPF can be engineered to handle any quantum of MSW ideally in excess of 400,000 tons per year. Should annual volumes exceed more than 1mm tons per year, the construction of an additional facility would likely be warranted. Increasing scale generally decreases the capital cost per processing ton, so our preference is to build facilities as large as possible. That said, assuming sufficient volumes, MWPFs can be built at different locations in the County to accommodate MSW flow patterns and reduce transportation costs.

The sorting line is highly adaptable, designed to handle fluctuations in waste composition over the course of a year. That said, the processing speed of the lines is relatively fixed. Any additional capacity to accept volumes beyond those contractually agreed upon with the County would be contingent on extending operating hours—up to two shifts running six days-a-week. The amount of flexibility in operating hours will depend on the final plant design based on volume commitments secured.

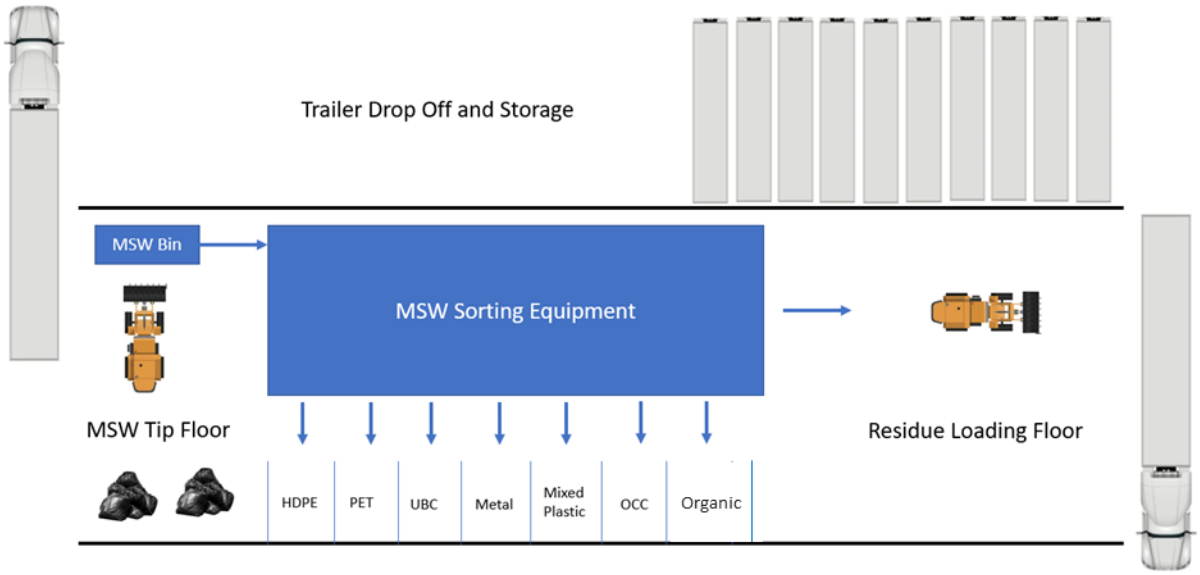
We'd also note that the Fetch solution can work in concert with the County's SSR program. Fetch would be excited to receive the County's SSR waste, even though it's not considered "clean" by traditional MRF's. Alternatively, should the County eventually decide to shut down its SSR program, Fetch's MWPF would be able to "catch" the recyclable material that had been going through SSR while the County saves materially on the additional hauling necessary to operate a SSR program.

4. Technologies

The MWPF functions as a combined transfer station and MRF in a new-build warehouse facility. The material flows through the MWPF are as follows:

1. The MSW arrives at the MWPF via truck/transfer trailer where the truck is directed to proceed to the tip floor of the MWPF.
2. The tipped MSW is then loaded into the MSW feed hopper for the MWPF with large items being removed manually by the loader operator via visible sight sortation (for example, mattresses would be removed and sent straight to residue and bypass the sortation equipment entirely).
3. Once input into the MSW hopper, conveyors transport the MSW through the various sort lines (discussed below) for segregation of the target commodities destined for recycling.
4. Recovered material directed to the mechanical and advanced recycling markets are loaded on trucks and exported off the site.
5. The organic stream is either, at the County's option:
    a. Mixed with the residue material and conveyed to incineration or landfill; or
    b. Conveyed to an additional organics processing system (discussed below).
6. Residue material (primarily unrecyclable inorganics) will be conveyed to the County's preferred disposition path (WtE or landfill).

A simplified schematic of the material flows is shown below.



The MWPF system creates a stream of organics-rich fines through the screening process. These organics can be either combined with residue materials and disposed or can be further processed. The three main forms of organics processing are (i) composting, (ii) anaerobic digestion ("AD") or (iii) creating biochar. Both composting and AD would require additional cleaning to strip the stream of partial contamination from non-organic fines, including glass, small plastics, textiles, diapers, etc. A biochar solution would need dewatering before using pyrolysis to create the biochar.

There are trade-offs to additional processing of the organics. While diversion would likely increase to +65%, revenue from the sale of byproducts (e.g., compost, natural gas, CO2, biochar, REC's) may not offset the additional operating and capital carrying costs of the organics system. Combining the organics with the residue stream would result in lower diversion rates in the 20-30% range but would maximize cost savings. Development of organics processing capabilities can also be done in a phased approach. Since the Fetch MWPF process will be producing an organics stream in any event, the County will have the option to implement organics processing at any point in the future.

The base design of the MWPF relies on similar equipment and technologies widely used in traditional single stream MRFs. The front end of the system, however, has several key differences. These differences include bag liberators, sizing screens, 3D trommels, and density separators to prepare the materials for final processing. Separation of material occurs with an OCC screen, eddy current for aluminum, several in-line magnets for ferrous metals, and a series of sensor-based sorters for containers. Plastic film is separated with the use of ballistic separators and air assisted optical sorters.

There is no new technology proposed for the MWPF. The technology deployed will be off-the-shelf, proven sorting line technology successfully operating at locations around the globe designed and installed by our Design Build Vendors who are world-class leaders in solid waste sorting facilities.

The MWPF will deploy a feed sorting line with equipment redundancy in the event of an equipment failure on critical equipment. Additionally, a robust maintenance program and on-site spare parts inventory will minimize unplanned disruptions and outages of the MWPF. The sorting equipment deployed has years of operating history which provides predictable availability of the equipment and performance. Our Design Build Vendors provide a full one-year warranty from commissioning as well

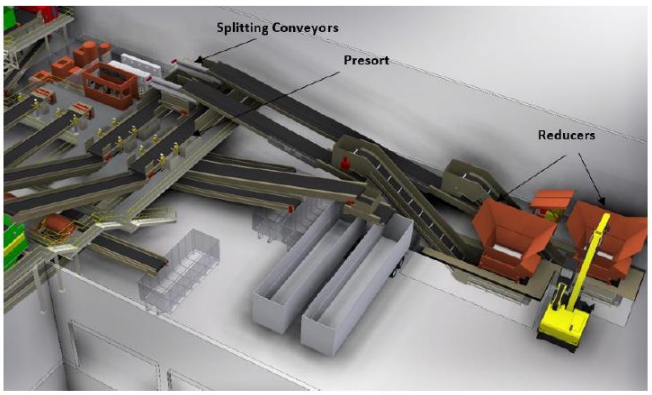
as annual maintenance services and emergency call-out services. The sorting equipment is designed to run at 90%+ up-time.

Indicative MWPF Design

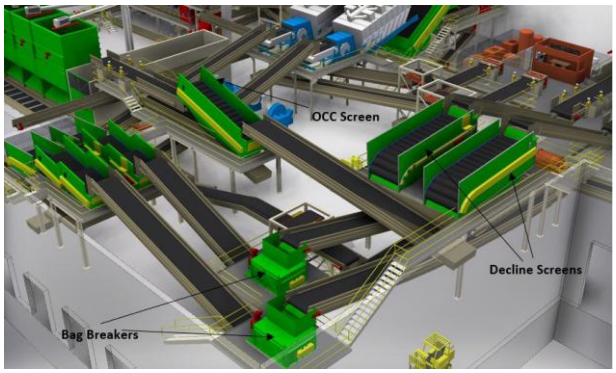
The design below is indicative of the type of design we will employ at the MWPF, but the exact final design to be used in Miami-Dade County may differ.

1. All MSW is first processed by a size reducer to segregate material over 18" from the remainder.
2. All material then passes through a pre-sort station where oversized material that is residue is manually removed from the MSW stream.

INFEED - 2 SIZE REDUCERS & PRE-SORT

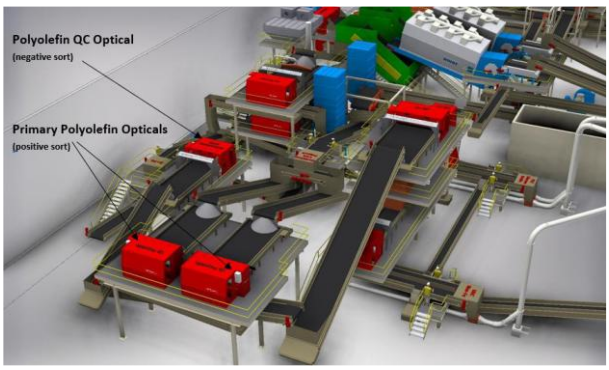


3. The remaining material is then passed over a scalping screen, which separates material 12" and greater ("12" Plus") from the remainder. This creates 2 streams of MSW: 12" Plus and 12" Minus.



4. The 12" Plus material then goes to a 15" OCC screen where the 15" Plus material is sent to a manual sorting station where large cardboard and plastic are separated and sent to bunkers. The remaining large items are sent to the residue conveyor. The 15" Minus material is conveyed to Step 6 below.

5. The 12” Minus material from Step 3 above is then passed through a drum magnet to remove ferrous metals for collection and to a bag breaker to liberate any bagged material.



6. From there, the material is further separated by size and type where it passes through a number of optical scanners, 2D-3D separators, eddy currents and quality control stations that separate the material into the following categories:

Inorganic Commodities Recovered for Recycling:

- OCC
- Ferrous Metal
- Non-Ferrous Metal
- Plastic #1 – PET
- Other Plastic – Mixed Polyolefins

Organics Recovered for Disposal or Advanced Processing

- Food waste
- Paper
- Yard waste

Residue for Disposal

- All remaining MSW not sorted in the above categories.

The recovered inorganic material will be delivered to the mechanical and advanced recycling markets. A brief description of these markets is below.

Mechanical Recycling

Mechanical recycling is applied to material classes like metals, OCC, and certain types of plastics. End-of-life materials are processed via collecting, sorting, shredding, melting and transforming it into secondary raw materials for a new application. These processes are generally economically attractive and environmentally beneficial versus production of these materials using non-recycled feedstocks. Recovered aluminum is melted back to its base metals for production of new aluminum. Plastic is shredded into fine powder-like granules and melted to form new products such as containers. OCC is re-pulped, and the fibers are then used to create new cardboard. Only about 20% of plastic waste is eligible for mechanical recycling with the vast majority being #1 PET. Other plastics can only be recycled via advanced recycling. Other than metals, mechanically recycling material has certain limitations. However, this material is environmentally superior to the original product and the price of the end product is typically sold at a premium to the original product.

The mechanical recycling market is a mature market that has existed for decades. Metals, OCC and #1 PET plastic recovered at the MWPF will be mechanically recycled.

Advanced Recycling

Advanced recycling is a proven recycling technology that provides a circular end-of-life for hard-to-recycle plastics. Hard-to-recycle plastics such as grocery bags, Styrofoam, car parts, and other flexible films (to name a few), which today cannot be circularly recycled via mechanical recycling processes, can be recycled via advanced recycling. Freepoint is a leader in advanced recycling technology and is currently commissioning its flagship facility in Ohio. Freepoint uses pyrolysis-based advanced recycling to transform plastic back into its basic building blocks that the petrochemical industry can use to produce new virgin-like plastics. Pyrolysis is a thermal process that, in the absence of oxygen, superheats plastic waste to return it to its basic building blocks such that it can be used to create new plastic.

Freepoint's Ohio Advance Recycling Facility

Pyrolysis-based advanced recycling is currently being commercialized around the globe. The technology converts hard-to-recycle plastics into basic building blocks which can then be used to produce recycled plastic resin which is chemically identical to and indistinguishable from virgin plastic resin. Furthermore, advanced recycling leverages existing petrochemical infrastructure in the production of these recycled resins. Accordingly, advanced recycling will be a key part of the suite of solutions needed to advance circularity of end-of-life plastic.

All plastic recovered at the MWPF that is eligible for advanced recycling (e.g., #2, #4, #5, #6, #7) will be purchased by Freepoint and sent to an advanced recycling facility where it will be converted to recycled feedstock to be used in the production of new prime plastic resin by a petrochemical business partner.

5. Benefits

We believe the Fetch proposal is highly compelling for the County from many perspectives: environmentally, strategically and fiscally. From an environmental perspective, the Fetch proposal is projected to take an additional 20-30% of waste away from a landfill or incineration, thus reducing greenhouse gas emissions and supplanting virgin oil extraction. This could potentially be increased to more than 65% diversion should the County decide to further process the organic waste stream as well.

Strategically, the Fetch solution would extend the life of the South and North Dade landfills, provides the County with additional leverage while negotiating with landfill and/or WtE facilities and puts the County at the forefront of prudent environmental stewardship. In addition, the Facility would bring significant investment into Miami-Dade, potentially building a +$100 million facility as well as creating ~30 to 90 secure, full-time jobs in the community with ranging skill levels.

Fiscally, we view this as a very low-risk financial win for the County. Since Fetch is putting up the money to build the facility, the County is not investing any risk capital while still providing jobs, environmental benefit and net cost savings. From a counterparty perspective, Fetch is a highly attractive partner given the active support of its JV Partners. Further, unlike most other recycling concerns that either push the pricing risk onto their customers or bear it themselves in a levered situation, our business model results in an estimated +85% of Fetch's revenue being generated under long-term contracts. This makes Fetch an attractive long-term counterparty for the County.

Finally, the Fetch proposal will result in a $5.00 to $10.00 per ton cost reduction for the County. These savings are driven by the County's sharing of revenue, plus the avoided cost of landfilling or incineration, less the cost of the processing fee paid to Fetch.

6. Challenges

With any solution to a waste challenge of this magnitude, there are numerous potential risks that need to be addressed. Enumerated below are the most significant risks likely to be faced by any solution, and how Fetch's proposal and business model addresses them.

- **Commodity price exposure.** The typical approach to recycling results in recycled materials being sold at prevailing market prices, exposing the seller to swings in commodity prices. These swings can be significant and can happen for myriad, uncontrollable reasons including changes in oil and natural gas pricing, changes in national and international recycling capacity, currency fluctuations, imposition of tariffs, changes in international sovereign recycling policy, etc.

These risks are typically borne by the owners of the material (i.e., municipalities) or the processors of the material (i.e., recycling operators). For municipalities, this creates budget variability, affecting services and costs for residents. For recyclers, small changes in commodity prices can severely impact profitability since operating costs are tied to intake volumes, not commodity prices. This cash flow uncertainty creates counterparty risk for waste generators, even if municipalities are not directly exposed to commodity price changes.

Fetch is taking a different approach by having its JV Partners take on the commodity pricing risk. Fetch will enter into long-term, fixed-price offtake agreements with its JV Partners for what we estimate to be about two-thirds of the commodity revenue generated. These agreements will have pricing escalators so we can maintain our profitability should there be rising labor, electricity and/or other rates.

- **Funding risk.** In typical public-private partnerships ("PPP"), businesses often focus on winning the proposal first and then seek capital to build the solution, which exposes the municipality to significant risk. If funding is unavailable, projects may stall; if funding is limited or costly, scope and economics can change; and if funding takes longer than expected, delays may occur.

  Fetch's approach eliminates this risk. The full cost for designing, purchasing equipment, and constructing the facility will be entirely covered by Fetch and its investors, with no financial responsibility for Miami-Dade County. Fetch's JV Partners will provide the necessary funds to complete construction. While PepsiCo and Freepoint are currently expected to be the sole funding sources, we will consider raising prudent levels of debt funding if it becomes available on favorable terms. If debt funding is not an option or is not desired, PepsiCo and Freepoint will fully equity-fund the facility construction.

- **Equipment / technology risk.** As discussed in Section B.2 and B.4, we will be using technology that has been in use for decades. While there have been incremental improvements in sorting speed and accuracy over time, the underlying techniques and equipment are well understood given previously built third-party MSW sorting facilities. This understanding will be even further progressed by the time a Miami-Dade facility is built given the multiple MSW sortation facilities currently under construction or being commissioned in the United States by our Design Build Vendors. Further, Fetch will benefit from performance guarantees from our Design Build Vendors for uptime, sortation rates as well as bale homogeneity.

  With respect to technology risk downstream of Fetch, PepsiCo will be using mechanical recyclers that have been generally operating the same way for decades. Freepoint will be using the mixed plastic it receives from Fetch to feed its advanced recycling process. Freepoint is currently commissioning its first commercial scale advanced recycling plant in Hebron, Ohio, the largest one of its types in North America. Based on the success of the Hebron plant, Freepoint is in the process of developing additional sites throughout the country.

- **Siting.** Fetch does not own land in Miami-Dade County. Our plan is to work with County officials to find a suitable location given existing waste-related infrastructure. This land would be leased to Fetch; the cost of the lease will need to be incorporated into the overall economics of the project. We expect to need between 150,000 to 250,000 sq ft per building (excluding outdoor activities), depending on contracted volumes. Site selection will need to consider transportation costs and potential congestion issues for the aggregation of waste volumes, as well as residue waste egress to the County's preferred ultimate disposal solution (either landfill or WtE). Suitable locations may be the South or North Dade Landfills, the former WtE site in Doral, a current transfer station, or the contemplated Miami-Dade Sustainable Solid Waste Campus.

- **Permitting.** Obtaining permits for building a landfill or WtE facility can be a long and difficult process. The MWPF is anticipated to be permitted as a transfer station, which provides a straightforward regulatory permitting pathway for approval. Further, siting the MWPF on existing infrastructure is expected to streamline permitting. These locations are likely to have already received Environmental Resource Permitting clearance and appropriate zoning thus eliminating the need for issuance of a Conditional Use Permit. However, Fetch will coordinate with the County to ensure that the MWPF is an allowable use on the selected site(s). Zoning clarification is the critical first step in the permitting process and a necessary prerequisite for all subsequent approvals. Additionally, the facility will generate no air emissions or water discharges, and as such, no air or water permits will be required for facility operation.

C. Financial Approach

1. Costs

Capital Investment Requirements

Given the wide range of potential paths available to Miami-Dade County and Fetch's desire to work in partnership with the County to devise an optimal solution, we are presenting a range of potential volumes processed: a 400,000 tons per annum case; and a 1,000,000 tons per annum case. We chose the 400,000 ton case because it is close to the lower bound of the scale necessary to make the facility economic. The 1mm ton case was selected because we'd likely build a second facility if we were to exceed 1mm tons. Increasing scale generally decreases the capital cost per processing ton, so our preference is to build as large a facility as possible. For the purposes of assessing this Market Research Response, the County should assume that facility sizes can be linearly extrapolated. For example, processing 2mmtpa would double the cost of a 1mmtpa facility, and a 700ktpa facility would be halfway between a 1mmtpa and a 400ktpa facility.

As discussed previously, we are engaged with two design, engineering and manufacturing firms. When location, desired size and waste composition assumptions have been finalized, we will solicit detailed final engineering proposals and select a single vendor with whom we will build the facility. As such a range of cost estimates are provided (as of April 1, 2025).

	1mmtpa		400ktpa	
	High	Low	High	Low
Equipment	90,000,000	80,000,000	45,000,000	36,000,000
Building	43,750,000	38,500,000	28,000,000	26,250,000
Contingency	4,375,000	3,850,000	2,800,000	2,625,000
Total	**$ 138,125,000**	**$ 122,350,000**	**$ 75,800,000**	**$ 64,875,000**

Operating Costs

The larger the system, the more efficiencies can be extracted. So, we expect costs per ton to decline with scale. Based on our engineering partners' extensive experience operating these types of assets, we understand our pro forma operating costs. Looking at bottoms-up build of costs, total operating costs are expected to be split into the following general cost categories.

	Operating Costs
Wages and Benefits	41.2%
Maintenance	15.9%
Consumables	15.1%
Electricity	12.1%
Equipment Lease	6.4%
Insurance	2.8%
Other	6.5%
Total	**100.0%**

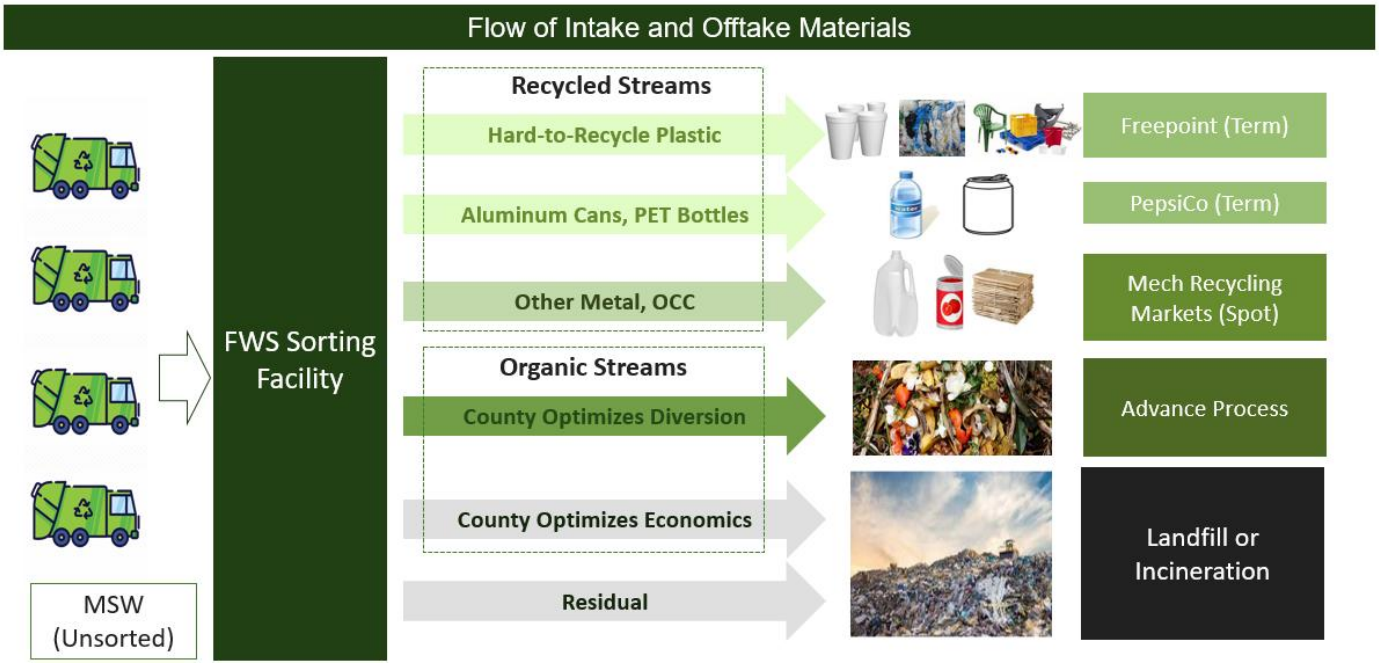
2. Funding model

Funds for the design, equipment purchase and construction of the facility will be 100% borne by Fetch. Miami-Dade County will not be responsible for any of the capital expenditures necessary to commission the sortation facility.

We currently anticipate PepsiCo and Freepoint being the sole source of funds for Fetch, however, if we are able to opportunistically and prudently raise debt funding, it would be considered. Should debt funding not be available (or desired), PepsiCo and Freepoint will 100% equity fund the construction of the facility.

3. Revenue

Once the Facility is commissioned, it will receive a minimum volume of MSW from the County. Fetch will sort the MSW into residual, organics and recyclable materials. The residue materials would proceed onto the County's preferred disposal method (WtE or landfilled). The organic stream can potentially undergo advanced processing such as compositing, anaerobic digestion and/or conversion to biochar. Doing so would materially increase waste diversion rates, likely above 65%; however, there would be additional capital and operating costs that are unlikely to be offset by the sale of byproducts from advanced organics processing. Alternatively, the County could optimize for economics and combine the organics with the residue materials that are sent to the County's preferred disposal method (WtE or landfilled).



The recyclable materials can be further subdivided into: hard-to-recycle plastics, aluminum cans, PET bottles, and all other (including other non-ferrous metal, ferrous metal, and OCC). Freepoint would take title to all hard-to-recycle plastic bales at the facility gate for a contracted price (subject to price escalators), while PepsiCo would similarly take title to all PET and aluminum can bales at the facility gate for a contracted price (subject to price escalators). These contracts are expected to have a 10-year term with two 5-year extensions. Importantly, these contract durations will be drafted to match that of the contract between Fetch and Miami-Dade County. The remaining recyclable materials will be sorted, baled and sold to the mechanical recycling markets at prevailing spot prices. Fetch would

invoice and collect these revenues and then remit 80% of the sales to the County. Offsetting this revenue is a processing fee of $40-$50/ton that the County would pay Fetch.

We believe the Fetch proposal is highly compelling for the County from many perspectives. The Fetch proposal would take an additional 20-30% of waste away from a landfill or incineration, thus reducing greenhouse gas emissions and supplanting virgin oil extraction. The Fetch solution also potentially extends the life of the South and North Dade landfills, provides the County with additional leverage while negotiating with landfill and/or WtE facilities and puts the County at the forefront of prudent environmental stewardship. In addition, the Facility would bring significant investment into the community through the potential building of a +$100mm facility as well as adding ~30 to 90 secure, full-time jobs in the community with ranging skill levels.

This proposal is also a low-risk financial win for the County. Since Fetch is putting up the money to build the facility, the County is not investing any risk capital while still getting jobs, environmental benefit and net cost savings. More importantly, the Fetch proposal **will result in a $5.00 to $10.00 per ton cost reduction** for the County. These savings are driven by the County's sharing of revenue, plus the avoided cost of landfilling or incineration, less the cost of the processing fee paid to Fetch. By our calculations, the real cost of disposal (including the carrying cost of capital to build a WtE facility) is between $122 and $163/ton.

	Capital Costs (bn)	Debt Service mm)*	Annual O&M (mm)	Total Annual Cost (mm)	Cost / Ton **
Doral RRF	$1.5	$105	$59	$164	$126.15
NW 58th Street	$1.8	$126	$62	$188	$144.62
Airport West	$1.8	$126	$81	$207	$159.23
Medley	$1.9	$133	$75	$208	$160.00
Okechobee	$1.9	$133	$77	$210	$161.54
Eitlejorge	$1.8	$126	$87	$213	$163.85
Outside Landfill	$0.6	$39	$163	$202	$155.32
Contracted Capacity	$0.0	$0	$158	$158	$121.54
Average					**$149.03**

** Page 22 of The State of the Solid Waste System: Challenges and Path Forward "… cannot sustain a $1.5 billion project over 20 years, with an annual debt service of $105 million." This implies a 7.0% debt service cost, which we have applied to the assumed capital costs.*

*** Assumes 1.3 million tons annually*

D. Implementation Approach

1. Infrastructure

Fetch will shoulder the entire cost of the MWFP's development, engineering, procurement, construction, and commissioning. Once the location, MSW throughput, and waste composition assumptions are finalized, we'll solicit detailed final engineering proposals and select a single vendor to construct the facility. We'll seek to ensure that the sortation line equipment supplier provides appropriate technology guarantees, including throughput, uptime, and commodity recovery rates. EPC contractor guarantees with Liquidated Damage provisions would guarantee timely and cost-effective construction. Fetch will also hire, train and pay the employees that operate the facility.

The County's role is to provide a suitable location on its property (e.g., at landfill, WtE, Sustainable Solid Waste Campus, transfer station) for the MWFP. The chosen location should be where a minimum volume of 400,000 tons of MSW can be aggregated. Ideally, the land use and zoning designations should be appropriate for the MWFP; and electrical, gas and sewer hookups available. Also, there should be no issues with wetlands or other types of latent environmental issues.

Fetch would lease land from the County with standard lease terms and conditions. The lease duration should align with Fetch's offtake contracts with PepsiCo and Freepoint: a proposed 10-year initial term with two 5-year extensions.

2. Size

Fetch estimates that a minimum of 150,000 square feet per building (excluding outdoor activities) is required for a MWPF capable of processing 400,000 tons of MSW per year. A building designed to handle up to 1 million tons annually would require approximately 250,000 square feet (excluding outdoor activities). Facility sizes between 400,000 and 1 million tpa can be linearly extrapolated. More than 1 million tpa would require a second facility. Final square footage will be refined in collaboration with our engineering partners, based on confirmed throughput capacity, future expansion potential, and waste composition assumptions.

3. Site Ownership

Fetch's business model assumes that the County leases property to Fetch at a location where at minimum of 400,000 tons/year of MSW can be aggregated. This land would be leased to Fetch; the cost of the lease will need to be incorporated into the overall economics of the project. The duration of the lease will match the duration of the recycling services agreement with the County and offtake agreements with PepsiCo and Freepoint, currently anticipated to be a 10-year initial term with two 5-year extensions. Fetch is open to alternatives to leasing County property, but County ownership of the land is the preferred approach.

4. Permitting

We anticipate locating the MWPF within Miami-Dade County's existing waste-related infrastructure. Depending on contracted volumes, the facility will require between 150,000 and 250,000 square feet (excluding outside working area). Site selection will consider transportation efficiency and potential congestion impacts related to waste aggregation, as well as residue waste access to the County's preferred final disposal solution—either landfill or WtE. Potential sites include the South or North Dade Landfills, the former WtE facility in Doral, existing transfer stations, or the proposed Miami-Dade Sustainable Solid Waste Campus.

Siting the MWPF on existing infrastructure is expected to streamline permitting. These locations are likely to have already received Environmental Resource Permitting clearance and appropriate zoning thus eliminating the need for issuance of a Conditional Use Permit. However, Fetch will coordinate with the County to ensure that the MWPF is an allowable use on the selected site(s). Zoning clarification is the critical first step in the permitting process and a necessary prerequisite for all subsequent approvals. The facility is anticipated to be permitted as a transfer station, rather than a manufacturing facility which provides a straightforward regulatory permitting pathway for approval. Additionally, the facility will generate no air emissions or water discharges, and as such, no air or water permits will be required for facility operation. We'd note that customary stormwater discharge and air emissions permits are likely going to be needed during the construction phase.

5. Timing

For the engineering, procurement and construction of the MWPF, we currently estimate a timeframe of 18 months to 2 years. A more detailed timeline will be drafted in conjunction with our engineering partners once all design parameters are finalized, including expected volumes as well as facility location.

6. O&M

Depending on agreed upon intake volumes, the MWPF will operate up to two 10-hour shifts per day, six days per week. Under lower volume scenarios, operations may scale down to a single 10-hour shift, five days per week. In all operating scenarios, the plant is expected to run approximately 50 weeks per year, with two-weeks of planned shutdown allocated for scheduled maintenance and OEM-led preventive servicing.

Operations and maintenance requirements have been structured to ensure high equipment availability and system reliability. A minimum of three hours of maintenance will be performed daily, generally during non-operational hours between shifts. In addition to daily maintenance, one full shift per week will be dedicated to maintenance activities on a day when the facility is not operating. Due to the inherent variability of municipal solid waste, unscheduled maintenance is anticipated and has been accounted for at an estimated 250 to 500 hours annually. The facility design includes redundancy and robust system integration to minimize downtime in the event of equipment failure or material handling issues.

The MWPF will be a highly automated operation, with conveyors transporting waste to a series of machines that size and separate materials by type. While the system is designed for efficiency and automation, human labor likely remains for pre-screening, manual sorting of oversized or non-processable items, and for quality control to ensure recovered materials meet applicable specifications. Depending on operating hours and throughput, it is anticipated that between 30 and 90 full-time employees in the community will be required to support plant operations, maintenance, and quality assurance functions.

7. Health/Safety/Environmental

At Fetch, protecting our people and the environment is integral to every decision we make and everything we do. We believe that each employee – starting with the Company's leadership – has a responsibility to ensure that our operations meet or exceed all government and Company standards. Our overriding goal is to eliminate injuries, prevent environmental and health impacts, reduce waste and emissions, and promote resource conservation.

Fetch is committed to being a responsible neighbor and proactively addressing any potential community impacts. Odor management, a common concern in MSW processing, will be addressed with state-of-the-art odor control systems designed to eliminate issues often associated with MSW processing. The sorting equipment, powered by electric motors, produces no emissions, and rolling stock emissions will be consistent with standard industry operations nationwide.

To maintain the safety of our people, stringent safety protocols will be implemented for each role within the facility. This is particularly important for floor operations using heavy rolling equipment.

Finally, we believe Fetch's MWPF proposal is strongly aligned with Miami-Dade County's stated sustainability goals. By removing recyclable materials from MSW, the County would take a significant and near-term step toward its Zero Waste objectives. Our facility not only diverts waste from landfills but also boosts recycling rates—both of which are core components of the County's environmental vision.

Moreover, our MWPF can work in harmony with a future WtE facility. While WtE construction is expected to take up to 10 years, a MWPF can be commissioned within just 18 to 24 months—delivering a near-term impact. Additionally, by removing plastics and metals from the waste stream before it reaches the WtE facility, combustion efficiency can be improved due to the reduced heat content of the remaining waste, enabling a higher throughput volumes for the WtE facility.

Goal ***(per Sustainable Solid Waste Campus and draft Scope of Services for a future solicitation)***	**Alignment**
Become a Zero-Waste county by 2050	●
Reduce the landfill waste per person by 50% by 2030 (as *per Environmental Risk and Resilience's Climate Action Committee*)	●
Achieve a 75% recycling rate by expanding recycling programs for single-family homes, businesses, & multifamily buildings (as *per Section403.7032, Florida Statutes*)	●
Develop and implement state-of-the-art sorting facilities as part of the Sustainable Solid Waste Campus to efficiently process and divert waste	●
Build a new Waste-to-Energy facility	●

E. Other information / Advice

1. Procurement model

Fetch is happy to work with Miami-Dade County in any procurement model they prefer. We suggest that a Public Private Partnership would best enable the County to harness the expertise, efficiencies, and financial strength of Fetch and its parent companies, PepsiCo and Freepoint.

2. Partnerships

The Fetch MWPF provides incredible flexibility for the County as it works with any ultimate disposal solution the County is considering.

For volumes intended to be landfilled, the Fetch process reduces the amount of waste the County must send to landfill by 20 – 30% on the low end, thus extending the life of the County's landfills, avoiding disposal and transportation costs and reducing GHG emissions. For volumes intended to be incinerated, Fetch's solution similarly reduces costs by avoiding high WtE facility tip fees and reduces GHG emissions associated with incineration. It can also make the WtE facility run at higher intake rates since Fetch would be stripping out high heating-content waste.

Should the County decide – either now or at some point in the future – it wants to increase diversion, an organic solution can be implemented with the organic stream coming from the MWPF. Fetch would be excited to design, develop and operate an advanced organics processing facility, but we could also work with any vendor the County selects to manage this waste stream.

We also note that the Fetch solution can work in concert with the County's SSR program. Fetch would be excited to receive the County's SSR waste, even though it's not considered "clean" by traditional MRF's. Alternatively, should the County decide to shut down its SSR program, Fetch's MWPF would be able to "catch" the recyclable material that had been going through SSR while the County saves materially on the additional hauling necessary to operate a SSR program.

3. Additional insights

A Fetch MWPF offers a significant contribution to Miami-Dade County's comprehensive solid waste management strategy—at no cost to the County. It represents a fast path to meaningful impact, with the facility capable of being built and fully operational in under two years. This is substantially quicker than the eight to ten years typically required to develop a new waste-to-energy (WtE) facility, or the lengthy process of siting and permitting a new landfill in Central Florida.

By removing recyclable materials from the County's MSW, the MWPF can reduce the volume of waste destined for landfills or WtE facilities by 20 to 30%, while substantially advancing the County's Zero Waste goals. Greenhouse gas emissions are also reduced—both by avoiding incineration and by decreasing the need for new oil and natural gas extraction to produce plastics.

The MWPF helps extend the operational lifespan of both the North and South Dade Landfills. It also gives the County the flexibility to remove and beneficially reuse organics in the MSW stream through methods such as composting, anaerobic digestion, or biochar production – either now or at some point in the future.

Importantly, the MWPF reduces the overall cost of MSW disposal while preserving the County's ability to pursue additional waste disposal options, including landfilling or WtE. Because the facility will be

built in Miami-Dade County, it brings with it significant local investment and the creation of secure, long-term jobs.

Donald Gerne
Chief Executive Officer
don.gerne@fetchwastesolutions.com
(917) 697-6174

Florida Power and Light,
Kanadevia Inova,
Reworld South
Market Research Response

A. Respondent

Provide a brief summary of the respondent to include the following.

- **Respondent's name and address**

  Florida Power & Light Company

  700 Universe Blvd., Juno Beach, FL 33408

- **Contact person, title, email address and telephone number**

  Timothy Oliver

  vice president, development

  Florida Power & Light Company

  Timothy.Oliver@fpl.com

  561-691-7072

- **Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry and any products and/or services the respondent provides.**

  ## ABOUT

  FPL

  This year, FPL is celebrating its 100th anniversary. Formed in 1925, FPL has evolved from an unlikely assortment of 58 ventures, including small electric plants, ice plants, water, telephone, sawmill and streetcar companies, an ice cream plant, a sponge fishing boat and 35 mules. The company's journey to become America's largest electric utility created an incredible culture of innovation and a relentless commitment to deliver value to every customer every single day. As a subsidiary of NextEra Energy, Inc., FPL serves its customers with reliable electricity in good and bad weather, while keeping bills low.

  In 2018, MDC and FPL began collaborating on two Joint Participation Agreements to innovate energy and water solutions in South Florida. As an example, the FPL Miami-Dade Clean Water Recovery Center, which began operations in December 2024, is designed to treat and reuse up to 15 million gallons per day of reclaimed water to cool the natural gas plant at FPL's Turkey Point Clean Energy Center, making it one of Florida's largest reuse projects. Other FPL-MDC partnerships include PortMiami shore power, Wynwood Energy Storage Project, the FIU-FPL Microgrid and a floating solar array at Miami International Airport.

FPL's renewable fuel expertise includes landfill renewable natural gas partnerships and Florida's first clean hydrogen facility, the FPL Cavendish NextGen Hydrogen Hub. Waste to energy (WTE) initiatives will further strengthen FPL's relationship with the county.

FPL has an unrivaled track record in developing major infrastructure projects with over 36 gigawatts of generating assets. The company has extensive experience assisting WTE operators in managing grid interconnections and energy transactions.

For this project, FPL will collaborate with industry leaders Kanadevia Inova Reworld and CDM Smith Inc. These partnerships provide the necessary expertise, cutting-edge technology and flexibility to meet the county's sustainable solid waste management goals.

If MDC issued a competitive solicitation for a public-private partnership (P3), FPL would propose a P3 with MDC to create a sustainable, long-term solution for solid waste disposal by developing, designing, building, financing, operating and maintaining a state-of-the-art mass burn WTE facility to process the county's municipal solid waste (MSW) while generating reliable and renewable electricity.

Kanadevia Inova (KVI)

Kanadevia Inova, formerly Hitachi Zosen Inova, is a global leader in waste-to-resource solutions, having built hundreds of WTE facilities all over the world, including one of the world's largest facilities in Dubai. The technologies and innovations that KVI has developed over nearly a century have enabled WTE to evolve to the point where modern facilities produce renewable energy and extract valuable resources from waste, while running safely and being environmentally friendly. KVI's headquarters is in Zurich, Switzerland. KVI has been in business for over 90 years, has 3,000 employees, 1,600 reference projects and offices in 17 countries.

There is no substitute for successful prior experience with WTE and MSW and KVI has this experience on hundreds of WTE projects around the globe. One of these projects is the 5,500-ton-per-day project recently completed in Dubai. KVI also designed and constructed the largest WTE plant in Europe, the 3,000-ton-per-day WTE plant Istanbul, Turkey. As a company with global reach and long held experience in the U.S., KVI is very familiar with the specifics of the market. KVI has the know-how to implement the most up-to-date, clean, reliable and efficient WTE plants.

Reworld™ Holding Corporation

Reworld, formerly Covanta Holding Corporation, is a sustainable materials management company that confronts the global waste crisis head-on, transforming waste into valuable resources through its innovative technologies. With a comprehensive portfolio of solutions designed to address the most complex challenges of waste management, Reworld is committed to achieving carbon-negative outcomes and supporting customers, communities and society on their sustainability journey. The company is North America's leader in sustainable waste solutions, generating over $2.5 billion in annual revenue, operating over

100 facilities and employing approximately 4,500 workers in North America. Reworld is a best-in-class operator of waste facilities with over 95% of its employees involved in delivering core asset management activities, including engineering, operations and maintenance.

For more than 40 years, Reworld has been at the forefront of sustainable waste solutions, trusted by municipal, commercial and industrial customers across North America. In July 2021, the company was acquired by EQT Infrastructure (EQT), one of the world's largest infrastructure investment funds with over $250 billion in assets under management. Based in Sweden, EQT is a purpose-driven private equity firm with a keen focus on driving sustainability. EQT is committed to supporting the company in developing and deploying the sustainable waste management solutions necessary for a thriving circular economy. EQT's purchase of Reworld was the first-ever leveraged buyout in the U.S. using sustainability-linked financing, ensuring a strong alignment between financial, business and sustainability objectives.

CDM Smith Inc.

CDM Smith Inc. is one of the nation's leading environmental consulting engineering firms. CDM Smith Inc.'s core team is supported nationwide by staff, which have evaluated, monitored, designed, permitted and/or implemented projects at more than 50 WTE facilities throughout the U.S. and Canada. Because of its experience in siting, permitting, contract negotiations, performance testing, construction oversight, operations monitoring and environmental compliance for WTE projects, CDM Smith Inc. knows how important it is that facilities operate as expected.

B. Waste Management Solutions

2. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found here.

Overview

FPL and its partners would deliver a new mass burn WTE facility capable of processing more than 1.3 million tons of MSW annually, with an anaerobic digestion system capable of processing over 180,000 tons of organic waste annually, and a resource recovery education center through a public-private partnership (P3) with the county.

FPL will cover all costs associated with the development, design, construction, operation and maintenance of the WTE facility. The county will provide the land and pay a tipping fee for each ton of waste accepted and processed by the new WTE facility.

Owner and project management

FPL

FPL has proven experience in engineering, construction oversight and project management for large-scale, capital-intensive energy projects. Beyond the company's in-house expertise, FPL has strategically aligned with top-tier partners to ensure the highest level of execution. FPL's longstanding relationships with leading engineering, procurement and construction (EPC) firms, many with extensive experience in WTE and mass-burn technology, further strengthen our ability to deliver a best-in-class facility. Over the last 20 years, FPL and its EPC partners have delivered more than 10,000 megawatts of generating capacity on schedule and under budget.

The WTE facility will be designed and constructed in accordance with applicable codes and regulations, sound engineering practices and applicable industry standards. The facility will be designed with sustainability in mind and FPL will look for opportunities to include sustainable features throughout the design process. Additionally, the facility can be designed to accommodate future expansion to grow with the county's MSW disposal needs.

Technology and equipment provider

Kanadevia Inova (KVI)

Kanadevia Inova is a global leader in waste-to-resource solutions, having built hundreds of WTE facilities worldwide, including one of the world's largest facilities in Dubai. Kanadevia Inova has been in business for over 90 years and has 3,000 employees, 1,600 reference projects and offices in 17 countries. The technologies and innovations that Kanadevia Inova has developed over nearly a century have enabled WTE to evolve to the point where modern facilities produce renewable energy and extract valuable resources from waste while running safely and being environmentally friendly.

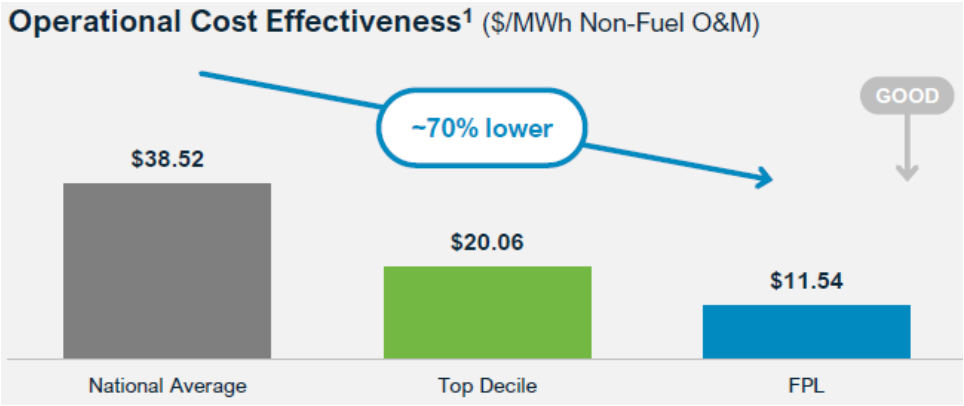
Kanadevia Inova's headquarters is in Zurich, Switzerland. Kanadevia Inova is a global and vertically integrated green-technology company developing circular economy solutions for managing waste. The company's proprietary technologies enable the conversion of solid and organic wastes to valuable commodities such as electricity, metals, aggregates, compost, liquid fertilizer, industrial salts, renewable methane and renewable hydrogen.

Operations management

FPL

FPL has a proven track record of owning and operating various comparable generating technologies to the proposed WTE facility. As of year-end 2024, FPL owns electric generating resources at 130 sites across its service territory. These generating facilities consist of nuclear, solar and natural gas. Combined, these units have a generating capacity of nearly 36 gigawatts. FPL also operates battery storage projects, which, when combined

with its solar projects, enhance its ability to meet customer needs. The WTE facility would seamlessly integrate with FPL's state-of-the-art centralized remote monitoring hub. FPL's experienced operations team has a safety-first approach and is committed to excellence. By using proven process control measures designed to monitor and adjust key facility systems, FPL ensures optimal operation while minimizing downtime. An operating partnership between FPL and Reworld streamlines operations and will position MDC as a role model in MSW management. As shown in the graph below, FPL delivers proven, safe and reliable operational solutions while maintaining disciplined cost-control management, allowing FPL to achieve operational costs significantly lower than the utility industry national average.



[1] FERC Form 1 non-fuel O&M; Industry 2023; Excludes injuries and damages, pensions and benefits and other power supply expenses; FPL excludes one-time storm impacts; Includes holding companies with >100k customers and utility-owned generation.

Operator

Reworld

For over 40 years, Reworld has been at the forefront of sustainable waste solutions, entrusted by municipal, commercial and industrial customers across North America. As the industry leader, Reworld owns and operates 60% of the WTE facilities (39 facilities) in North America and over 75% of the WTE facilities operating in Florida. Reworld has about 4,500 employees in North America who provide best-in-class delivery of sustainable waste solutions, with over 95% of the employees involved in core asset management activities, including engineering, operations and maintenance. Reworld's network of WTE facilities annually diverts over 20 million tons of waste from landfills, recovers and recycles 500,000 tons of metal (enough to build five Golden Gate bridges), recycles or reuses 280 million gallons of wastewater (equal to 570 Olympic-sized swimming pools) and generates 10 million megawatt-hours of clean renewable energy (enough to power nearly 1 million homes). These efforts reduce greenhouse gas emissions by 41 million metric tons each year, equivalent to the amount of carbon dioxide sequestered by 48 million acres of forest, an area that could fully cover eight U.S. states, removing 9.8 million gasoline-powered passenger vehicles from the road for a full year or an impact equal to half of the entire U.S. utility-scale solar installations.

Owner's engineer

CDM Smith Inc.

CDM Smith Inc. has supported over 50 successful WTE projects, with 13,000 tons per day (tpd) of WTE capacity and 5,000 megawatt-hours per day of renewable energy able to power 200,000 homes. CDM Smith Inc.'s project experience and expertise include several projects in Florida, such as the Solid Waste Authority of Palm Beach County Renewable Energy Facility 2, the Pinellas County WTE facility and the Hillsborough County WTE facility.

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented and any other information that would explain the benefit of the solution.

Waste to energy

WTE is a proven safe and effective solid waste disposal solution with approximately 65 WTE facilities in the U.S., nine of which are operating in Florida. WTE is widely deployed in Europe with nearly 500 operating facilities and approximately 2,800 WTE plants worldwide.

WTE is an effective means of solid waste management by reducing reliance on landfilling. The mass burn process reduces waste volume by 90% and leaves 10% as ash − fly ash and bottom ash. Studies are ongoing with respect to the uses and applications of bottom ash, including uses in road base and other concrete products. Best-in-class ash management can reduce up to 50% of ash volumes.

In addition to WTE effectiveness on reducing waste, WTE increases the recycling of ferrous, non-ferrous and other precious metals that otherwise would sit in landfills for decades, unrecovered. Recycled materials are not only monetized but carry environmental benefits by avoiding emissions related to metal production from virgin materials and ores. Finally, WTE converts MSW into reliable baseload renewable energy.

Anaerobic digestion and biogas upgrading

Anaerobic digestion (AD) is a process that involves breaking down biogenic waste, such as food, vegetation and agricultural waste, in an oxygen-free environment, resulting in the production of biogas and nutrient-rich fertilizer. AD supports sustainability and zero waste goals by providing a closed-loop system for managing organic waste, reducing the need for fossil fuels and reliance on landfilling.

With its parent company and affiliates, Kanadevia Inova (KVI) is the leading global provider of first-class technology with over 100 Kompogas dry AD plants, 350 wet AD plants and more than 110 biogas-upgrading systems.

3. **Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.**

WTE

FPL would construct four 1,000-ton-per-day-(tpd) combustion lines capable of processing 4,000 tpd or 1.3 million tons of MSW annually. To account for future growth in MDC, the facility will be designed to accommodate expansion, allowing for increased capacity.

A waste characterization study would be performed before the design of the WTE plant to understand the varying seasonal composition of the MSW. This study would be used to define the combustion operating range of the plant equipment and process.

Anaerobic digestion

KVI proposes to provide a continuously fed high-solids AD system with digesters based on the proven Kompogas AD technology capable of processing up to 500 tons per day (180,000 tons per year) and a state-of-the-art three-stage membrane technology biogas-upgrading system to meet the county's sustainable waste goals.

4. **Technologies - Describe the waste processing technologies (e.g., WTE, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.**

WTE mass burn

Mass burn facilities are the most preferred type of WTE facilities worldwide due to their simplicity and cost-effectiveness compared to other types of waste incineration. Mass burn is the most common type of WTE facility in the U.S. Newer facilities with improved furnace design generally achieve better burnout and reduce organic content in the ash product. At a typical mass burn facility, waste collection vehicles are weighed at a scale house and monitored for safety before unloading in the waste bunker. The waste delivery area incorporates numerous bays for unloading to receive multiple vehicle deliveries at a time.

An overhead crane with a grapple mixes the waste in the waste bunker to achieve homogeneous waste and then lifts it into a feed chute before entering the combustion chamber of the boiler to be processed. The crane also removes non-processable materials from the bunker for offsite disposal. The heat released from combustion converts water to steam inside the boiler tubes. The steam is then passed through a superheater before being sent to a turbine generator, which produces electricity. Bottom ash from the boiler grate is collected by conveyors and transported to metals separation equipment for the removal of recyclable metals. The ash is stored for reuse or disposal.

WTE technology has continuously improved and advanced over the last 30 years and is subject to strict emission regulations and reporting obligations, including continuous

emissions monitoring and annual stack testing. The proposed mass burn facility would be constructed with the best available control technology as required by federal and state regulations.

These state-of-the-art renewable energy systems have proven to be clean, reliable and environmentally friendly. By using non-recyclable MSW as fuel to generate electric power, this diverts garbage from landfills and significantly reduces greenhouse gas emissions from rotting garbage. Recognized as preferable to landfilling by the U.S. EPA, European Union and United Nations Environmental Programme waste management hierarchies, the efficient use of non-recyclable MSW as fuel helps to promote economic growth, energy independence and security. WTE facilities are widely recognized internationally as important sources of greenhouse gas mitigation.

Anaerobic digestion and biogas upgrading

Anaerobic digestion (AD) is a process that involves breaking down biogenic waste such as food, vegetation and agricultural waste in an oxygen-free environment, resulting in the production of biogas and nutrient-rich fertilizer.

Kanadevia Inova (KVI) proposes to provide a continuously fed high-solids anaerobic digestion system with four PF-2100 steel digesters based on the proven Kompogas AD technology. The system includes a state-of-the-art three-stage membrane technology biogas-upgrading system to meet the county's sustainable waste goals. The Kompogas AD plant is uniquely designed to efficiently process food waste and green waste from residential and commercial source-separated organics. The plant will process the materials in an economically and environmentally sound manner to create carbon-negative biogas. The biogas will be further refined into renewable natural gas by means of a membrane-based upgrading system. The raw biogas is converted to pipeline-quality biomethane, a renewable fuel and energy source, by cleaning and separating out carbon dioxide and other undesired gases. The result is a biomethane product that can be delivered to a commercial gas utility pipeline.

AD supports sustainability and zero-waste goals by providing a closed-loop system for the management of organic waste, reducing the need for fossil fuels and reliance on landfilling.

Composting

As an added benefit, the digestate from the Kompogas system is fully compostable material. For composting of the discharge from the dry AD system, the aeration and curing processes of the solid digestate are based on aerobic processing of the material. The material would be placed in specially designed aeration boxes or bays for 14 days to complete the active composting phase and create finished compost. Through the anaerobic digestion and subsequent composting stages, the compost will not reheat and will ensure that the facility produces compost that meets regulatory compost standards as well as end market requirements. For other cellulosic-based biomass materials such as yard and agricultural

wastes, composting can be used to create nutrient-rich soil amendments or mulch through natural decomposition.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

Benefits of WTE

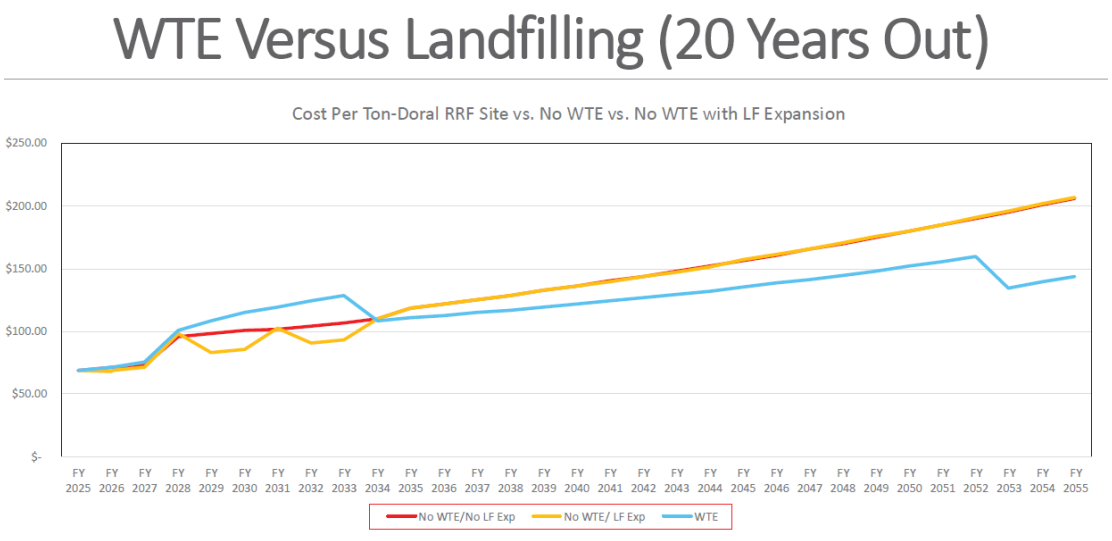
WTE and landfilling are two common methods used for MSW. There are several benefits of WTE compared to landfilling.

The EPA's solid waste hierarchy (2019) identifies WTE as the preferred management solution after recycling. The hierarchy has been recognized for decades and has been adopted by more than 30 states. The waste management hierarchy has been reconfirmed many times as the best way to manage MSW with the least environmental and human health impacts[1].

Financial sustainability

While WTE is a significant capital investment at the outset, it provides cost certainty over 30 to 40 years for municipalities and counties compared to private landfilling. The financial benefits and certainty can be enhanced by incorporating a P3 model, which effectively eliminates the upfront capital costs for MDC.

MDC's own analysis, as outlined in staff's response to Directive No. 241676 (Jan. 25, 2025), underscored the increasing cost disparity between landfilling and WTE over extended periods, reinforcing WTE's economic viability.



Key benefits of the P3 model include:

- Preserves county bonding capacity: Allows MDC to allocate financial resources to other critical infrastructure projects.
- Provides long-term cost predictability: Tipping fees can be set in advance, ensuring financial certainty for the next 40 years.
- Prevents taxpayer "double payment": Under a county-led approach, taxpayers would bear the costs of both landfilling and WTE construction, which can last anywhere from seven to 10 years. The P3 model eliminates this burden by seamlessly managing the transition.

Renewable energy generation

Energy production created from WTE is defined as renewable under state and federal law (Fla. Stat. §366.91 and 42 U.S.C. § 15852(b), respectively). The proposed 4,000 tpd facility produces approximately 110 megawatts of renewable energy annually, enough to power 70,000 homes. Renewable energy derived from waste is important because it provides energy from a diverse fuel source. Fuel diversity is critical because a more balanced fuel supply can enhance system reliability and help mitigate the effects of fuel price volatility. As an additional benefit, this project will increase power output in MDC, a densely populated coastal community in FPL's load pocket, where developing new generation and the necessary transmission can be challenging.

Greenhouse gas emissions reduction

WTE facilities, and others like them around the world, are widely recognized as a source of greenhouse gas (GHG) mitigation. They reduce GHG emissions, even after considering stack emissions from combustion, by:

- Diverting post-recycled solid waste from landfills, where it would emit the potent GHG methane for decades, even factoring in landfill gas collection.
- Generating energy that otherwise would have been produced by GHG-emitting fossil fuel power plants.
- Recovering metals for recycling, thereby avoiding GHG emissions and energy use associated with the production of products and materials from virgin inputs.

The GHG benefit of WTE technology is widely recognized, including by the U.S. EPA[2,3]; Columbia University, University of Buffalo and Berkely scientists[4,5,6] EPA scientists[7]; the Intergovernmental Panel on Climate Change ("IPCC") [8]; the World Economic Forum[9]; the European Union[10,11]; CalRecycle[12]; California Air Resources Board[13,14]; voluntary carbon markets[15] and the Joint Institute for Strategic Energy Analysis, part of the National Renewable Energy Laboratory (NREL) [16].

Landfills are a significant source of anthropogenic methane emissions, the third largest after agriculture and the oil and natural gas industry. Methane is an extremely powerful GHG. It is over 80-times more potent than carbon dioxide when measured over a 20-year time frame[17].

A recent UNEP report concluded landfill methane emissions are likely underreported by a factor of 2-3 times on the basis of recent measurements[18]. Most recently, EPA and NASA scientists published a comprehensive study in the journal *Science* that found actual emissions to be 1.4 to 2.7 times greater than those currently reported in inventories[19].

Waste volume reduction

When household waste is landfilled, it can take 100 years or more to degrade. In the U.S. alone, there are more than 2,500 landfills that collectively take up hundreds of thousands of acres, leaving ample opportunity for unsecured waste to contaminate soils, groundwater and surface waterways. While WTE does not eliminate the need for landfilling completely, WTE facilities significantly reduce the volume of MSW by approximately 90%. As a result, less space is required for waste disposal, and the landfill's lifespan is extended. Landfills are finite resources and finding new sites for waste disposal is becoming increasingly challenging. Continued reliance on and use of landfill space will only drive future landfill costs higher over time.

Metals recovery

Once reduction, reuse and recycling have been deployed, the remaining waste should be processed for energy recovery. Energy recovery from waste is consistent with the hierarchy and provides an opportunity for additional recovery of materials such as aluminum, iron, copper and other nonferrous metals.

Socioeconomic benefits

WTE provides several socioeconomic benefits to the community, such as reducing the need for additional landfill space and allowing the county to use that land for other beneficial purposes.

The WTE facility will also benefit the community by generating renewable energy to power homes and businesses using a resource that would otherwise be lost and avoiding the GHG produced by landfilling.

Air emissions within the county will be improved by replacing the old refuse-derived fuel WTE facility with the proposed state-of-the-art WTE facility.

Additionally, the WTE facility would include an education center to bring awareness to the community about recycling programs and waste reduction initiatives and support the county on the path to zero waste.

Throughout project development, FPL will look for opportunities to partner with the community and local contractors. The WTE facility will benefit the local economy by creating high-skilled, high-paying jobs within the community. Temporary job growth will be seen in the construction phase and permanent job growth throughout the life of the facility’s operation. A

4,000 tpd WTE facility creates nearly 100 permanent, highly skilled, high-paying jobs. WTE is a smart economic and socially responsible solution for the county's waste disposal.

Benefits of anaerobic digestion

- **Renewable energy production:** Biogas produced from anaerobic digestion can be used as a source of renewable energy for electricity generation and heating.
- **Waste reduction**: Anaerobic digestion helps to divert organic waste from landfills, reducing greenhouse gas emissions and the need for landfill space.
- **Nutrient recovery:** The fertilizer produced as a byproduct of anaerobic digestion is rich in nutrients, reducing the need for synthetic fertilizers and supporting sustainable agriculture.
- **Economic benefits:** Anaerobic digestion can provide economic benefits by creating new revenue streams from the sale of biogas, compost and fertilizer.

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

FPL and its project team provide a unique understanding of the challenges, constraints and opportunities related to critical infrastructure deployment. There are a couple of areas that pose a challenge to develop future waste management disposal options in the county: 1) changing regulations and 2) flow control.

Changing regulations

Changing regulations at both the state and federal level, including the advent of new regulations for emerging contaminants, could introduce some element of uncertainty during the construction and operation of the facility. However, WTE is well positioned regarding emerging pollutants. Already stringently regulated, WTE is very robust and has been recognized for its ability to destroy complex persistent organic pollutants, including non-hazardous pharmaceuticals, due to the high-sustained temperatures in the combustion process. The GHG benefits of both WTE and AD are well recognized, which positions the facility well relative to potential future regulations aimed at reducing GHG emissions.

Flow control

The county has the legal authority under state law to implement a local flow control ordinance, which requires waste to be transported to designated WTE facilities. The private ownership of the WTE facility by FPL would not prevent the county from achieving similar facility designation/flow control results.

Under the proposed P3 model:

- The county will direct waste to a site owned by the county, while FPL will own the WTE facility.

- Section 255.065, Florida Statutes encourages public-private partnerships (P3) and supports county ownership of the facility at the conclusion of the agreement.
- By leveraging the P3 model, MDC can ensure regulatory flexibility, legal security and a waste management solution that meets the community's long-term needs.

C. Financial approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

The nature and scope of a WTE infrastructure project involve numerous cost-influencing factors, including major equipment, skilled labor for construction and operation and external market forces like supply chain fluctuations, material cost volatility, site conditions, regulatory compliance, potential tariff risks, currency exchange rate variations and broader economic conditions. These elements all contribute to the financial considerations and timeline for project completion.

FPL offers the following observations:

- **The long-term cost of WTE is lower than the cost of landfilling**

  As the county administration effectively pointed out in its memorandum dated Jan. 25, 2025, the cost of a WTE solution could be marginally higher than the cost of landfilling for the first 10 years, but that trend reverses after approximately 10 years. Over time, the cost of WTE decreases steadily compared to the cost of landfilling. By year 25, the cost of WTE could be significantly cheaper than the cost of landfilling.

- **The cost of WTE depends on the site selected by the county**

  Site selection will significantly impact both financial outlay and project timelines, with key considerations including land acquisition costs, permitting challenges, infrastructure requirements and community impact. Based on our industry experience, the county's cost estimates for the identified sites are within industry standards and align with projections previously provided by the county's experts. If an alternative site beyond those currently identified is considered, a further cost analysis will be necessary to account for location-specific factors and ensure an accurate assessment of financial and logistical implications.

- **The P3 approach is the most cost-effective approach to WTE**

  FPL strongly believes that a public-private partnership (P3) model with FPL and its project partners represents the most cost-effective approach for delivering a WTE solution. Given the county's acknowledgment that interim waste disposal solutions—such as contracting landfill space—would be necessary during the construction of a new

WTE facility, a P3 model offers a strategic way to mitigate overlapping costs and reduce the financial impact on residents by leveraging private investment.

We recommend that the county evaluate WTE P3 options on a 30- to 40-year basis, as these facilities routinely operate for 40 years or longer. A long-term approach ensures financial sustainability, operational efficiency and the ability to maximize the facility's lifespan while maintaining cost-effectiveness for the county and its residents.

- **The FPL team is uniquely positioned to offer the most competitive price for a WTE solution**

  FPL and our partners have established strong commercial relationships with vendors across the industry, enabling us to secure the lowest costs for goods and services to serve our customers efficiently. As a result, we consider this cost information confidential and proprietary. The open nature of the county's request does not provide adequate protections for confidential business information, which could limit—or even jeopardize—our competitive advantage in a future formal county solicitation.

  While FPL is open to sharing relevant cost data, appropriate confidentiality protections must be in place. Specifically, the county would need to take the following steps:

  - Formally select WTE as the county's long-term waste management solution.
  - Determine and finalize the project site location.
  - Provide detailed project specifications.
  - Conduct a competitive procurement process for a long-term solid waste disposal option.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

Partnering with FPL, an investor-owned, state-regulated electric utility, in a P3 model provides unique benefits for MDC that may not be otherwise available:

Financial sustainability

Although WTE requires considerable initial capital investment, it offers municipalities cost certainty over 30 to 40 years, unlike private landfilling. In the P3 model, FPL will cover the upfront capital costs, manage operational expenses, revenues and maintenance while stabilizing county disposal fees. This approach benefits county residents and delivers cost-effective energy generation to all FPL customers.

Capital preservation

In the FPL P3 model, the county will have no out-of-pocket expenses related to the capital deployment of the WTE facility. The county will not be required to raise debt through bond issuance, nor be burdened with the related debt service and reporting obligations, allowing the county to reserve its available capital for other community projects. As described in the "Supplemental Information Regarding Financial and Operational Considerations for the Future of Solid Waste - Directive 241676" dated Feb. 8, 2025, if the county were to own the WTE facility, there would be a period of time that the county would be paying for contracted landfill space and concurrently paying construction interest/debt service on the new WTE facility. With the proposed P3 model, the county would not be required to pay any fees for using the facility until the site is commercially available to accept and process waste on behalf of the county. Once the facility goes into operation, county residents can expect seamless waste disposal services at stable costs and FPL customers will benefit from cost-effective generation.

Low-cost debt

Counties typically fund large infrastructure projects through the issuance of fixed-rate municipal bond debt. In a P3, FPL will have access to numerous other low-cost debt options that could deliver significant cost reductions to both MDC and FPL. FPL maintains investment-grade credit ratings, which afford access to markets that are not widely available.

Federal tax credits

FPL can monetize the value of federal tax credits associated with WTE without the need for a direct pay provision (which often includes more stringent requirements). If applicable, FPL will pursue tax incentives as a means to lower county tipping fees.

Energy sales

In the FPL model, there is no need for contracting energy sales (i.e., a power purchase agreement), as the value of the capacity and energy created by the facility is already factored into the tipping fee, removing any risk of energy sales price fluctuations over the long-term operation of the facility.

Insurance and risk

In this model, FPL takes responsibility for insuring the facility against the risk of loss and any associated premiums, claims and deductibles required, unless the county (or landowner) is liable for such claims, for the life of the facility. Given FPL's sizable portfolio of generating assets geographically dispersed around the state, FPL is able to do this at a competitive rate.

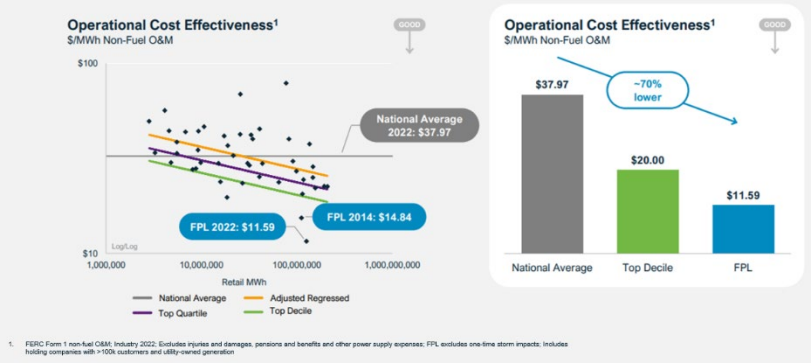
Owner/contractor relations

The FPL model alleviates county responsibility of contracting a design engineer, constructors, equipment providers and operator, as FPL is responsible for development and operation of the facility. This transfer of responsibility insulates MDC from changes in market conditions and future risk.

Capital contributions

WTE facilities provide numerous advantages for managing MSW. However, maintaining operational effectiveness throughout the lifecycle of a WTE facility requires ongoing financial investment. Partnering with FPL in a P3 model ensures that all planned system and equipment replacements are managed promptly, guaranteeing the efficiency of the WTE system. This collaboration also mitigates the risk of unexpected capital expenses for the county.

Operating contracts



Municipally owned plants typically contract operation with a third-party operator for a period shorter than the life of the plant. While a plant may operate for 30 or even 40-plus years, most operations contracts are for 20 years or less. This model puts the county in a difficult financial position in year 20 when prices are subject to change, or capital contributions may be requested. Partnering with FPL in a P3 model eliminates this process and provides cost certainty for the county over the life of the facility, particularly given FPL's proven track record of operational cost-effectiveness.

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Renewable energy generation

The revenues for electricity are estimated based on the value of the energy and capacity assigned by the FPL system. These benefits flow back to the county through a reduced tipping fee.

Recyclable materials

Revenues for ferrous and non-ferrous metals are estimated and then flow back to the county through a reduced tipping fee.

Renewable energy certificates (RECs)

FPL does not assume value for RECs at this time. RECs are often used to demonstrate compliance with regulatory renewable requirements. There is not currently a national renewable portfolio standards (RPS) program or other similar regulatory program that sets requirements for renewable energy, but states have the ability to set up voluntary programs. There is not currently a mandatory renewable program in Florida. If such a program were developed in the future, FPL is open to discuss sharing the benefits of RECs and future renewable attributes with the county, either through profit sharing or reductions to the tipping fee as part of the overall terms of a comprehensive agreement.

D. Implementation approach

1. **Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).**

   The construction of a modern WTE facility requires typical infrastructure such as natural gas (for boiler startup), process water, stormwater management, wastewater disposal, and electrical transmission lines to the grid.

   FPL has designed a simplified solution for WTE that provides several benefits to the county. FPL would develop, design, build, finance, operate and maintain a new state-of-the-art WTE facility. The county's responsibility will be to:

   - Select a site.
   - Conduct a competitive procurement process.
   - Direct a fixed amount of waste to the WTE facility.
   - Pay FPL an associated tipping fee for each ton of waste delivered.

2. **Size - Identify the recommended site, including any identifiable site information and footprint of the site that will be necessary to implement the respondent's solution.**

   The site footprint will be determined by a variety of project scope specifications, such as WTE processing capacity, space for future expansion, project location and need for ash monofill, stormwater management plan, scope of metals recovery operation, incorporation of anaerobic digestion, digestate management system and desire for an education center.

   Depending on the scope of the WTE project, it is estimated 40 to 60 acres should be sufficient to accommodate the MDC solution. However, FPL remains site-

agnostic and is prepared to adapt to the county's preferred location, ensuring the selected site meets all operational and regulatory requirements.

3. **Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.**

   Utilizing the framework for public-private partnerships under Florida law and the county code, FPL would seek a partnership with the county whereby the county would acquire and maintain ownership of the land and lease it back to FPL. FPL would develop, design, finance, construct and thereafter operate and maintain the WTE facility.

   The comprehensive agreement between the county and FPL would include provisions that allow the county to retain ownership of the WTE improvements at the conclusion of the agreement or at some point during the term of the agreement if the county were to be inclined. FPL will work in tandem with the county to secure all necessary permits and zoning entitlements.

   FPL has evaluated and reviewed reporting by the county's hired consultant Arcadis and determined the five sites shortlisted by the county and consultant are viable sites for WTE development.

4. **Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.**

   Being a good steward of the environment means making the right choices. FPL has been an industry leader in conservation for decades and continues to demonstrate commitment in all its projects. Environmental risk identification, mitigation and management are key drivers for ensuring safe and sustainable operations. Permitting a new WTE facility requires extensive permitting expertise in a wide range of subject areas. FPL has an experienced environmental permitting staff with deep knowledge and expertise of the permitting process, as well as engagements with major consulting firms for added support. The following section describes the state, local and federal permitting processes necessary for a new WTE facility and FPL's approach to acquiring permits.

   FPL understands the state, local and federal processes and works with regulatory agencies to acquire the necessary approvals in a timely manner. One of the major licenses necessary for construction and operation of a WTE facility 75 MW or greater is the Florida Electrical Power Plant Siting Act (PPSA) Site Certification and FPL's extensive PPSA expertise would be leveraged to acquire the necessary approval for the new WTE facility. FPL has successfully licensed 11 power generating facilities through the PPSA process.

In addition to leading the PPSA application process for FPL's own operating assets, FPL has experience participating in PPSA related processes for a WTE facility. As required through the PPSA process, FPL worked with Palm Beach County to petition the Florida Public Service Commission (FPSC) to obtain approval for a need determination for their WTE facility. The FPSC petition also sought approval of a purchase power agreement for FPL to buy power from Palm Beach County's WTE facility. In addition, FPL has a proven track record of obtaining other types of permits that would be necessary for a new WTE facility, including PSD, Title V federal air permits and Class I UIC well permits.

Water and wastewater

The new WTE facility will require consumptive water use for processing and cooling needs. Potential process needs of water could include air pollution control, boiler feedwater and cooling. This authorization for process water withdrawal will be included in the PPSA application and include descriptions of the water use, modeling to demonstrate that the use will not impact existing legal users and proposed water conservation measures to prevent wasteful uses. To meet the WTE facility's wastewater needs, FPL would pursue an underground injection control well (UIC) to dispose of all non-hazardous industrial wastewater. FPL has successfully permitted six Class I UIC permits at operational facilities for disposal of non-hazardous industrial wastewater. Underground injection control well permits can be used to safely dispose of non-hazardous industrial wastewater and are sometimes used at WTE facilities to dispose of cooling tower blowdown and other non-hazardous industrial wastewater sources.

Air emissions

Air emissions from the proposed WTE facility are regulated at the state and federal level. FPL has obtained multiple prevention of significant deterioration (PSD) and Title V federal air permits across the generating fleet necessary to regulate air emissions from combustion sources.

FPL and its partners will leverage their permitting expertise to ensure clean, safe and compliant operations of the new WTE facility using the best available emission control technology. Prevention of significant deterioration requires air quality analysis, which involves an assessment of existing air quality and dispersion modeling of emissions from the proposed source and effects on ambient concentrations.

FPL will conduct the required air quality analysis and prepare the PSD application for the new WTE facility, leaning on extensive permitting experience and FPL will ensure compliance requirements provide operational flexibility to the extent possible. FPL will analyze and recommend the emission control strategies for each

applicable regulated pollutant to limit air emissions at the site as required by state and federal law.

Requirements for review of new WTE facility capacity

The state requires applicants for WTE facilities to provide reasonable assurance that the construction of a new WTE facility, or the expansion of an existing WTE facility, will comply with the criteria as described in Chapter 403.7061(3), Fla. Stat. FPL will work with the county to conduct the required statutory evaluations to demonstrate the new WTE facility meets the criteria.

Material separation plan

In accordance with 40 CFR §60.1057, FPL will work with the county to prepare and distribute a material separation plan required for new WTE facilities. The process includes preparation of a draft material separation plan, which identifies a goal and approach for separating components of MSW for recycling prior to combustion. The draft plan will be made available to the public and a public meeting will be held to solicit feedback. Following the public comment period, a final materials separation plan will be submitted for FDEP review.

County permitting experience

FPL has worked closely for decades with MDC to permit, construct and operate nuclear, solar, battery and natural gas energy facilities within the county. FPL has experience working with the county's zoning, environmental, public health, public works, emergency operations and other departments to ensure FPL's operations are in accordance with all county regulations.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

Development of a new WTE facility typically occurs over a seven- to 10-year timeframe. The schedule is contingent upon several key milestones being achieved, including county site selection, county procurement process and reaching a definitive agreement between the county and FPL.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

WTE facilities require routine and non-routine maintenance over the life of the facility, including major equipment replacements, management of additives needed for air pollution control equipment, disposal of ash, management of recovered metals and disposal of oversized and non-compliant materials.

In the FPL ownership model, the final price will include all operating costs over the lifetime of the facility. FPL will manage all O&M requirements with its partners over the life of the facility. The P3 model reduces the county's risk of managing day-to-day and long-term operational requirements. The new WTE facility will employ between 90 and 110 highly skilled employees in supporting long-term operational and maintenance requirements.

Reworld's in-house team includes subject matter experts in engineering, compliance and operations, ensuring a level of reliability and efficiency that is unmatched by competitors and enables dynamic adaptability to complex regulatory and technical challenges.

Reworld employs a regional team model, where staff oversee multiple facilities within a geographic area, fostering collaboration across sites and enabling the efficient sharing of resources, knowledge and best practices. By leveraging regional expertise, Reworld ensures operational consistency, minimizes downtime and addresses challenges swiftly and effectively. The regional workforce model not only enhances operational flexibility but also optimizes cost-efficiency by reducing redundancy in staffing. Additionally, it supports the continuous improvement of operations, as lessons learned at one facility can be quickly implemented across others in the region. Reworld employees receive ongoing training in the latest emissions technologies, safety protocols and energy recovery methods, ensuring that they remain at the forefront of the industry. The strategic partnerships Reworld has with its technology providers allow for cutting-edge advancements in emissions control, positioning it as a leader in sustainable WTE operations.

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

See section B.2. for a full discussion of benefits of WTE as a solid waste disposal option including reduction in greenhouse gas emissions and broader discussion of environmental benefits of a WTE solution.

Emissions, odor and noise

FPL will comply with all local, state and federal regulations applicable to the facility. These rules include rigorous emissions control requirements established under state and federal law. The WTE facility will require a PSD air construction permit. Prevention of significant deterioration requires air quality analysis involving an assessment of existing air quality and dispersion modeling of emissions from the proposed source and effects on ambient concentrations.

Current PSD requirements include installation of the best available control technology with proposed regulation requiring maximum achievable control technology. The emissions technologies ensure that sources employ emission control strategies that limit impacts of the facility emissions on the ambient air

quality. FPL will conduct the required air quality analysis and recommend the emission control strategies for each applicable regulated pollutant to limit air emissions at the site as required by state and federal law.

The air construction permit will include facility-wide conditions, including restrictions on nuisance odors. Air emission controls and design of the WTE facility will limit odor from the site. To mitigate odors from escaping the facility, the tipping floor and waste pit are maintained at negative pressure during operation of the boilers, as combustion air fans draw air from these areas and use this air in the combustion of the waste fuel.

Noise restrictions are typically a requirement of municipal code. FPL will comply with the applicable noise ordinance of the municipality in which the site is located, using a variety of noise mitigation strategies including site layout optimization, source reduction and/or barrier installation.

Safety

Safety is FPL's most important value. The facility will comply with the applicable rules and standards of National Fire Protection Association 850 and requirements of the insurer and the authority having jurisdiction. This could include features such as a dedicated firewater storage tank with fire pumps, a perimeter fire loop with hydrants, water or gaseous suppression systems in specific areas, and building fire extinguishers and smoke/heat detection and alarm systems where required. Closed-circuit television will be provided for visual monitoring of all waste handling and storage areas. Thermal imaging cameras will be employed to create a continuous thermal map and to enable the plant operators to identify and react to hot areas in the waste bunker. Operational procedures will be implemented for waste management and storage practices, such as requiring empty floor space between the tipping floor and waste pit, not allowing waste storage on the tipping floor overnight, limiting height of waste in the pit and requiring frequent turnover of waste in the pit.

E. Other information/advice

1. **Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a WTE facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).**

   FPL recommends the county competitively solicit and evaluate the above referenced project delivery models, including P3 with private ownership as outlined in Section 255.065, Florida Statutes previously described.

2. **Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional WTE facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.**

   Financial modeling indicates significant economies of scale when considering building a larger WTE facility compared to a smaller facility. Economies of scale exist at all stages of project development, from design and construction to facility operations. Furthermore, a larger facility increases revenue opportunities with respect to renewable energy generation and recycling.

   It should be noted that FPL has partnered with KVI and KVI has experience on hundreds of WTE projects around the globe. One of these projects is the 5,500 tpd project completed in Dubai, the largest facility of its kind in the world. KVI also designed and constructed the largest WTE plant in Europe, the 3,000 tpd WTE plant in Istanbul, Turkey. FPL and partners would be open to exploring a regional facility with the county.

3. **Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know**.

   Positioning WTE as the cornerstone of the county's waste disposal infrastructure, within the context of a comprehensive waste management strategy, enables the county to explore and integrate solid waste disposal solutions that foster a sustainable ecosystem and adhere to the waste hierarchy. For example, WTE systems can be engineered to manage the disposal of biosolids alongside municipal solid waste.

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Frontline Waste

Market Research Response

Our Solution: Slow-Pyrolysis Waste-to-Energy Modular Systems for Recyclable Waste and Green Waste

I wrote this proposal because I am NOT proposing an all-encompassing system for all 2.5 million tons of waste created by residents and businesses in Miami-Dade county.

I am providing a solution that would be:

- High-profile globally
- Offer consequential and tangible ROI
- Be well received by the public
- Can be implemented within one year, and completely built out within 3 years, in total, and
- At a reasonable total cost!

I address a sizeable, highly-visible amount of waste – recycling waste -- the waste in those yellow and blue bins –in theory, 100% recyclable plastics and papers (which combine to be approximately 37.5% of all the waste collected by the county); and the green biomass waste from trimmed trees, landscape woody biomass, and storm-downed trees and branches, and general wood waste (an additional 12.1%) – almost 50% of all the waste, as characterized.

THE SOLUTION:
Modular, slow-pyrolysis waste-to-energy systems, built by Frontline Waste, headquartered in Delray Beach, FL. Each JF60 system could treat 100 tons/day (about 35,000 tons per years) and generate about 4MWhe.

This solution can be implemented within 12-18 months at a smaller-scale (say 10,000 tons/year) for under $4M as a pilot (the JF20 System), and could eventually be scaled up to divert between 300,000 tons and 450,000 tons of non-recyclable plastics, paper and green biomass waste per year.

It could use land, already at one or more of the existing landfill areas not yet used as landfill.

The total deployed CapEx cost would be between $70M to $120M for 10 to 15 JF60 Systemsm depending on actual waste tonnages. 10 JF60 Systems would have the capacity to produce approximately 40 MWs of power, and a total of 330,000 MWh's per year.

Full deployment of these modular systems would occur within 36 months, depending on a phased approach, as each new system has an estimated 12 month build time. This is far shorter than the 7-10 years of the all-encompassing solutions currently proposed.

Submitted April 14, 2025 by Rob Steir, Frontline Waste. Delray Beach, FL.
https://frontlinewaste.com; rob@frontlinewaste.com

As a resident of Delray Beach, I know exactly the types of waste I put into my yellow and blue bins once per week. I also know that contamination is a huge issue, and thus not as much plastics and paper waste is actually available for profitable recycling efforts. Thus, a high percentage is sent to the incinerator or landfill. I assume what happens in Palm Beach County would be what happens in Miami-Dade County, more or less.

Bonus: Ability to treat and destroy excess dried sargassum that Miami-Dade has leftover from 3rd Parties who will turn a small percentage of sargassum into value-added products.

With an assumption that drying sargassum could be contracted out to a 3rd party at a location away from residences, the JF60 System could pyrolyze the dried sargassum (dried to 10% moisture), and avoid sending to landfill. Most likely, electricity output would descrease slightly as the sargassum has lower BTUs compared to paper and plastics.

WASTE MANAGEMENT SOLUTIONS

1. Effectiveness

Assume all collected blue and yellow bin waste is brought to a large sorting facility. Non-contaminated waste is sorted out from the contaminated waste, and baled to be sold to recyclers. This is typically a small percentage due to how waste is collected and transported, and the wide variety of non-recyclables that people place in these bins that sometimes contaminate the entire collected waste haul of a truck.

An important point is the ability for Miami-Dade County to maximize revenues when it is clear that the baled non-contaminated recyclables can be sold to buyers at a price per ton exceeding their BTU value to turn the waste into electricity.

All contaminated recyclables would be pyrolyzed, as well as green biomass, which typically takes up a lot of landfill space.

In sum, 100% of the collected waste will either be baled for recycling sales, or be turned into renewable electricity.

2. Quantity

As our JF60 System is modular, the implementation can be completed in phases –basically to match the amount of recyclable waste and sargassum waste that can be collected and then treated.

Our solution is a solution for the following waste streams only: paper, cardboard, dense plastics, film plastics and wood. Based on the market research and waste characterization materials shared, our solution could address the following number of tons of waste.

Amount of waste addressed*

	Average Tons/Mo (t/m)	Applicable Waste For Solution***	Applicable Waste For Solution (t/mo)****
North Dade Landfill	60,000 t**	49.6% (assume 50%)	30,000 t (1000 t/day)
South Dade Landfill	9,000 t**	49.6% (assume 50%)	4,500 t (150 t/day)

*Our JF60 System is modular. We can scale up to match the amount of waste collected.
**Table 1 Appendix A; Landfill Capacity Analysis
***Miami Waste characteristic Study; Figure 1. P13 (Overall MSW % of paper, cardboard, dense plastic, film plastic, wood %s)
**** Assume 25% could be recycled. 75% would go to landfill or incinerator

3. Technologies

A JF60 Slow-Pyrolysis System, includes a pyrolysis reactor, drying cyclone system, and our bespoke power generator. Multiple modular JF60 systems can be housed together, with its configuration based on the number of systems ordered, best ways to built out the power generators, and shredder(s) needed for pre-treatment of the waste collected.

4. Benefits

Multiple benefits:

- The future "to-be-built" landfill system would be less expensive to build, and most likely need a smaller land and budget footprint as it would treat much less waste.
- Residents would see a direct correlation to the type of waste they placed in the yellow and blue bins and how much is then both recycled and converted to electricity – and how well they do comparatively over time, too.
- The yellow and blue bins can be rethought where the resident places what he or she considers non-contaminated plastic and paper materials into the yellow bin, and other materials they think can be "pyrolyzed" into the blue bin. Perhaps, they could be collected separately upon pick-up, or at least separated later.
- Kids would see how well their parents and community are doing at collecting these waste streams, and see the value of turning waste into an asset.

5. Challenges

- Having attended a recent Florida waste-to-energy conference this February, I realize the inclination of Florida, not only Miami-Dade, decision makers is to think BIG and, therefore, COSTLY. This bias is hard to overcome.

- Dealing with a portion of the waste –doing a pilot for a small portion of recyclable waste – is anathema to how a big city handles its waste.

- Frontline Waste hasn't built what is proposed. It has no track record. We would rather spend 10X the money on a sure thing.

FINANCIAL APPROACH

1. Costs

   Each JF60 System would cost approximately $7M to $8.5M, depending on what's included. It would be built in the United States. A full-study would be required to determine how many units would be needed, if the facilities could be added to existing landfill locations and how many units would be needed in each location to support the nearby waste collected.

2. Funding Model

Frontline Waste would be more than happy to put together P&L financial models for various 3-year implementation scenarios, going from 1 to 15 units ordered, and showcasing a payback period typically less than 5 years.

There are too many factors and assumptions that would need to be made. A typical funding model would be based on the CapEx of the JF System and its facility. An assumption would be made related to the cost of electricity (per KWh) and amount that would be saved if the county would directly use the electricity for its own buildings or EV charging station needs, as well as the amount they could sell directly to the utility for its grid, less all operating costs. Plus, revenues from the sale of baled recyclables that would not have been captured as effectively, as well as revenues from the sale of the charcoal as road aggregate, when the waste stream includes plastics, and revenues from the sale of biochar when the waste stream is 100% green biomass sent to one of the units.

3. Revenue

See funding model.

IMPLEMENTATION APPROACH

Frontline Waste is a manufacturer. We would sell our JF20 pilot unit as well as subsequent JF60 Units directly to Miami-Dade county. We would be open to partnering with another 3rd party waste management firm to put together a formal implementation plan.

1. Infrastructure

Not applicable at this time

2. Size

   Not applicable at this time

3. Site Ownership

   Not applicable at this time

4. Permitting

   Not applicable at this time

5. Timing

   Pilot operational in 12 months upon order. Entire solution within 3 years.

6. O&M

   Not applicable at this time

7. Health/Safety/Environmental

   Not applicable at this time

OTHER INFORMATION/ADVICE

1) Procurement model

   Not applicable at this time

2) Partnerships

   We are open to partnerships with other waste management companies.

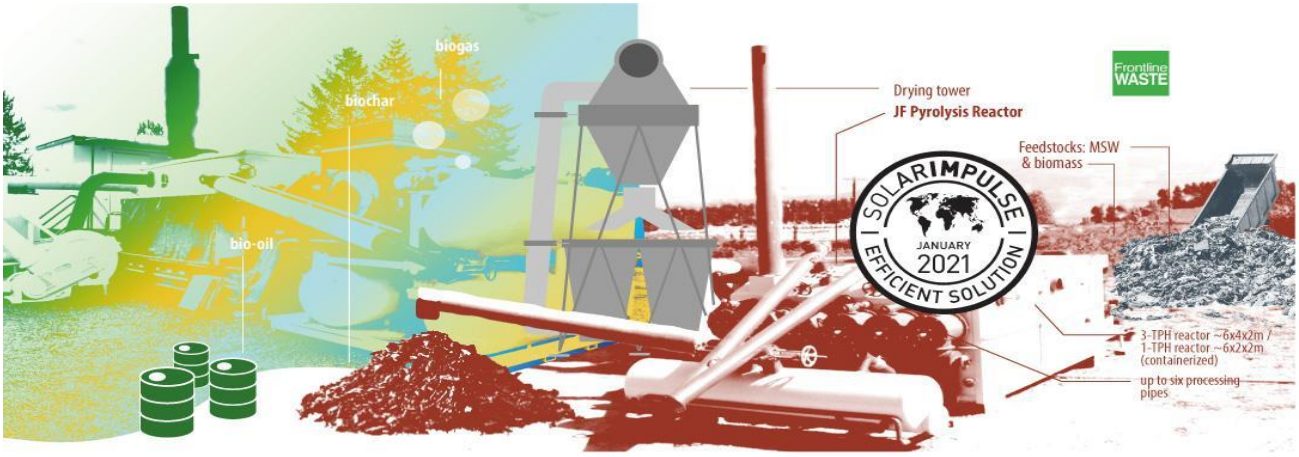
3) Additional Insights

   I have attached a RFI response sent related to Sargassum that the Miami-Dade county requested in 2023. I never heard from anyone. I include it as it is more detailed than this submission.

Submitted April 14, 2025 by Rob Steir, Frontline Waste. Delray Beach, FL.
https://frontlinewaste.com; rob@frontlinewaste.com

AN INNOVATIVE APPROACH FOR MIAMI-DADE COUNTY TO TREAT SARGASSUM AND ITS SINGLE-STREAM PLASTIC WASTE FOR OPTIMAL RECYCLING & 100% USE OF SARGASSUM - CREATING RENEWABLE ELECTRICITY (FOR ITS EV FLEET?) AND POSITIVE TOURISM PR

MAY 17 2023 RFI RESPONSE - SARGASSUM BENEFICIAL USE SERVICES FOR MIAMI-DADE COUNTY



An Innovative Approach

- Miami-Dade County can have a flexible "just-in-time" sargassum cost-effective processing solution for any amount of sargassum collected each day, and for years with larger or smaller amounts collected. The sargassum is sent to the JF Pyrolysis System for treatment, as the pyrolysis system handles other non-recyclable waste streams and operates all year.

- The County could also mandate that part of the sargassum collected be used for other beneficial purposes, say X tons for an algae solution; Y tons for a cosmetics firm: Z tons for XYZ use. The remainder would be delivered (or picked up) for use as intake waste fuel for the Frontline Waste JF Pyrolysis System that would be operating year-round. If not already delivered dry, the sargassum would be dried using the waste heat from another Frontline Waste piece of equipment, its Mobile Combustor as described in Steps A-E below.

- The JF Pyrolysis System (also described as a Recycle MRF, see below) would intake the dried sargassum, and all the single-stream recycling materials collected by the County from those ubiquitous residential yellow and blue recycling bins, as well as all plastic waste and paper waste collected from tourism hotels throughout the County.

- Simplistically, the JF Pyrolysis system would use these intake waste streams to generate electricity – approximately one MWh for every 20 tons per day or 24 MH per day). This also avoids sending this waste to either landfill or the incinerator. In fact, the valuable non-contaminated recyclable waste (such as PET) could be sorted out, baled and sold, or repurposed before sending the rest into the pyrolysis system. This would be a great improvement of current results: In 2020, 69% of the waste went to landfill and only 19.32% was recycled. Of the total collected waste, it is eye-opening that: (1) Only 1% (1500 tons of 116,000 tons) of plastic bottles, (2) Only 1% of other plastics (3989 tons of 379,000 tons); and (3) Only 7% of office paper (7313 tons of 99,000 tons) were recycled. Source: https://floridadep.gov/sites/default/files/Miami_Dade_2020.pdf

- Lastly, the electricity produced, which could be classified as renewable, can be used to power the Miami-Dade EV fleet -with charging to occur at all times of the day. If the Recycle MRF is scaled to treat the daily amounts of plastic waste and paper waste materials collected, imagine the

positive public relations (PR) that each municipality could broadcasts to tourists to showcase its zero-waste initiatives/efforts. What if Miami Beach could state in its promotional literature that "every electric bus is powered from the actions of every tourist and resident who properly recycles, and from the sargassum cleaned up daily by the county when, and as soon as, it appears." Note: Electricity could also be sent to the grid, alternatively, if powering EV fleet is too problematic or already solved through other solutions.

- And sargassum can be speedily collected each day and processed soonafter. The county would not have to worry about years when there is too little or too much sargassum –all can be sent to the pyrolysis system, if desired. In sum, Sargassum becomes one of the waste streams for the Recycle MRF, if and when it shows up. While the electricity generated may decline during intensive periods of sargassum collection, this negative economic impact pales when compared to the positive impact of sargassum disappearing as a public issue, as well as the positive PR that the implementation of the Recycle MRF could generate, too.

MORE SUPPORTING DETAIL

Solution For Treating Sargassum & Single-Stream Plastic Waste in Miami-Dade County

By combining its two waste treatment technologies (JF Pyrolysis System and Mobile Combustor) into one turnkey local solution, Frontline Waste (FW) can effectively:

- Lower the amount of non-recyclable waste (plastics, paper, woody biomass) sent to landfill, or the Covanta incinerator.
- Generate renewable electricity to pay back CapEx and operating costs, and, potentially to power fleet EVs.
- Have a way to both effectively dry and destroy the sargassum, and showcase the country's program to turn tourist plastic waste streams into renewable energy.
- Use as positive tourism PR.
- Minimize overall sargassum costs and mitigate potential lost tourism impact in South Florida from negative articles about sargassum (as currently seen today). Sargassum ceases to be an issue. It's always collected and turned into electricity, when it appears. Period.
- The pyrolysis system also would generate charcoal that can be used as road aggregate by the county and its hired paving companies.

The system is named the Recycle MRF. In sum, the Recycle MRF works as follows:

- The pyrolysis system treats landfill-bound waste streams (non-recyclable plastics and papers, woody biomass, certain types of other MSW) 24/7/365 per year.

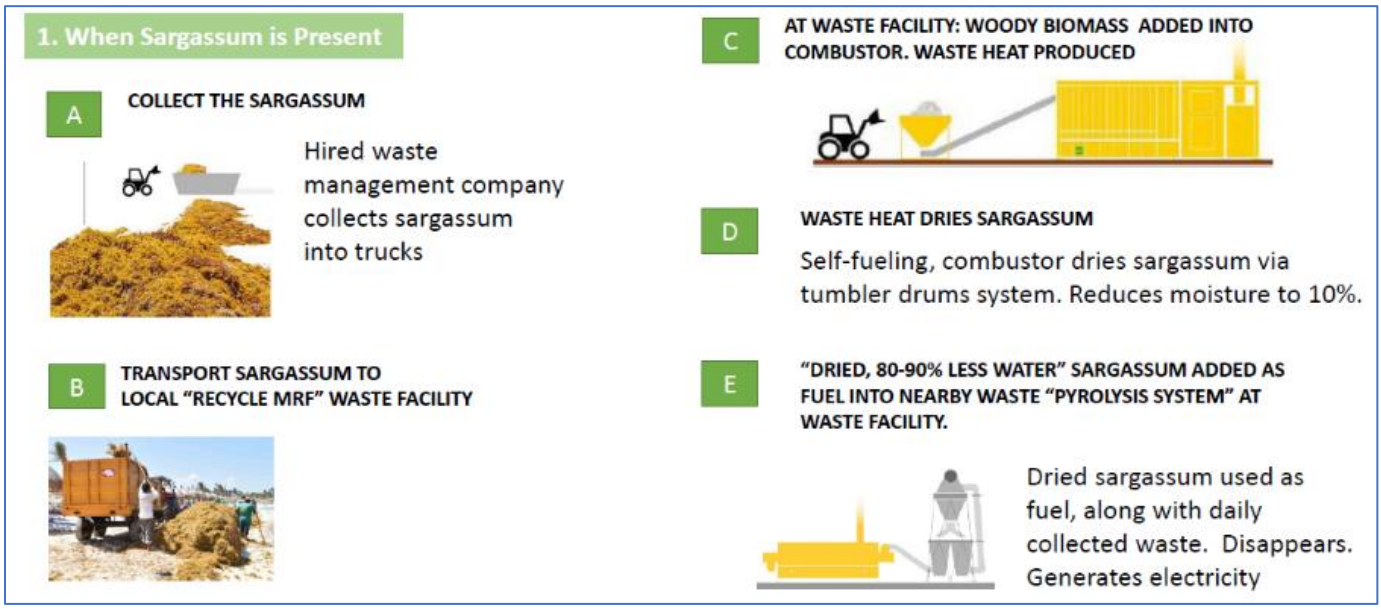
- For every 20 tons of waste, our JF System generates approximately 1 MW per hour, or over 8 million kWs per year. Electricity generated from pyrolysis is sent into the electric grid or, perhaps, used, with a microgrid, to power local EV municipal buses and fleet cars (potentially showcasing to residents a highly-visible circular story of using collected plastic non-recyclable waste as renewabe energy that powers their EV buses).

How Our Two-Treatment Solution Works

- Sargassum, when collected, is brought to the Recycle MRF waste facility. As described in the draft Scope of Services, it would be best if brought to the facility completely dried by the organization that is collecting the sargassum from both the beach and ocean. If so, Steps A through D below would not be relevant.

- If sargassum is brought each day to the Recycle MRF, freshly collected in its natural, wet state, then Steps A through D would be required.

  Steps A-E can be summarized as follows: First dried by sun for a short period of time, the sargassum is then sent into a specially-constructed dehydration tunnel that uses the FW Mobile Combustor's waste-heat (created from treating woody biomass sent into the combustor – up to 15-20 tons sent by the county to it per day). Once dehydrated by approximately 90%, it is shredded and fed into the JF Pyrolysis System along with the other non-recyclable waste. Depending on anticipated volume, Miami-Dade County may have a series of combustors/dehydration systems operating.



Why Our Two-Treatment Solution Works

When sargassum is present, the Recycle MRF prioritizes the intake of the dried sargassum, mixed into the intake waste stream to be pyrolized. At all other times, the Recycle MRF is operating as a waste-to energy pyrolysis facility, lowering landfill intake, sorting out recyclables that can be repurposed/sold, and creating electriicty.

The Recycle MRF system (pyrolysis systems and combustors) can be scaled to meet the daily demands of both landfill-bound waste streams that can be processed, as well as the anticipated amount of sargassum per day that can be reasonably expected each season. In sum, it would be easy to start small, and add units as required.

Performance Metrics - Waste and Electricity

The Recycle MRF, with our smallest 20 tons/day JF20 Pyrolysis System, mobile combustor and sargassum drying system, at maximum operations, would in-take approximately **15,000 tons of woody biomass (5000 tons) and single-stream plastics per year (10,000)**; and each combustor **could dry a projected 50 to 100 tons of sargassum per day** (based on developing optimal drying estimates, operating @24 hours/day during peak sargassum inundations, and required R&D).

The JF20 System could produce approximately 1MWh of electricity, or 24 MW/day that could be used, we envision, for EV charging stations for county fleet EVs, or sold to FPL via the grid. Note: With sargassum's low calorific value, the JF Pyrolysis System would produce lower electricity outputs –tbd.

Our larger JF60 60 ton/day system could effectively triple the above metrics, more or less, but this is not a proposal.

It would be fairly easy to operate two JF20 systems in the same facility, or three larger JF60's. It is a matter of scale and cost, and truly how much plastic waste, paper waste, and sargassum can eventually be collected -obviously, the amount of plastic used by people is expected to continue to exponentially grow. For example, it would be entirely possible to construct a series of JF60s to process all 116,000 tons of plastic captured in 2020, or 200,000 tons per year…. there would not be any scaling issue –and the sargassum could easily be added when it appears. It would also be fairly easy to start small, and scale-up as each of these modular systems operate independently.

IMPORTANT AND RELEVANT SARGASSUM RESEARCH

Sargassum Research Overview– Why Using Mobile Combustor to Dry Sargassum and Sending to Pyrolysis is a Valid Solution

- This is an equipment and operating solution that can be run by any vendor. It can be a stand-alone solution for a vendor that will hired to process Sargassum for beneficial solutions (Group B), or it can be part of a vendor's solution who wants to combine both the collection and beneficial uses (Group A and Group B).
- Composting the sargassum is problematic due to heavy concentrations of arsenic and other heavy metals per academic studies. Certain types of composting could occur, but the public perception may be extremely problematic if future research studies indicate worse results.
- Direct incineration requires too much energy for drying and may cause equipment damage. Incineration should not be an option.
- It takes more energy to dry sargassum than the energy derived from the sargassum, itself.
- By itself, our JF Pyrolysis System (slow pyrolysis) would not have enough energy to dry sargassum, and optimize energy output.
- Drying needs to be done prior to pyrolsyis. The FW Mobile Combustor can solve this problem by using the heat generated by treating woody biomass to dry the sargassum prior to sending to JF Pyrolysis System.

The Research Speaks for Itself (quotes directly from sources)

[A] New research suggests using sargassum in soils for farming and/or for animals is not advisable – too much arsenic

"A joint experiment between WWF-Mexico and STINAPA Bonaire found that vegetables grown in soil enriched with sargassum had higher levels of arsenic and cadmium, heavy metals that can be toxic to humans and animals. Researchers warn that sargassum should not be used to compliment animal fodder, nor used as a fertilizer for consumables until further investigated."

"Samples analysed at the Radboud University laboratory…**arsenic levels were higher in vegetables grown in soil with sargassum**. More specifically, bok choy had **37 times**, zucchini **21 times**, spinach **4 times** and soil **13.5 times more arsenic** than their counterparts grown in plain potting soil."

Source: **June 2022 Study announcement:** Sargassum Fertilizer Transfers Heavy Metals to Vegetables**. F**urther academic 2021 research mentioned in article provides details of sargassum containing heavy metals: Section 3.2 pages 19-29

[B] Direct Combustion (i.e. incineration) requires too much energy for drying, and not enough created energy; causes fouling and corrossion of boilers, as well as produces high-ash content that must be disposed (close to 50%)

"Direct combustion is, historically and currently, the main method by which energy from dry biomass resources is realised, providing heat or steam for household and industrial uses and for the production of electricity. Macroalgal combustion does not appear to have been greatly explored."

"However, the high energy required to dry seaweed, the relatively low thermal values, and the high ash and sulphur content can cause fouling and corrosion of boilers, and unacceptable emissions could preclude direct combustion as an economic method of exploiting seaweed."

Source: Golden Tides: Problem or Golden Opportunity? The Valorisation of Sargassum from Beach Inundations; Journal of Marine Science & Engineering; 2016; John J. Milledge * and Patricia J. Harvey

[C] Drying must occur first. Large-scale sargassum drying cannot be by the sun. It takes more energy to dry the sargassum than what can be derived from heat extracted. Need better method

"Many processes for the manufacture of fuels from biomass, such as direct combustion, pyrolysis, gasification and current commercial biodiesel production, require a dry feedstock and drying is required prior to energy extraction"

"Finding a more controllable and cost-effective method of large-scale seaweed drying, compared to that of sun-drying, is clearly key to establishing a viable seaweed-to-fuels processing industry"

"The energy to dry a seaweed with a moisture content of 88% has been calculated to be 0.7 MJ·kg−1 **higher than the** Lower Heating Value (LHV) of dry seaweed."

Source: Macroalgae-Derived Biofuel: A Review of Methods of Energy Extraction from Seaweed Biomass; Energies; 2014; John J. Milledge, Benjamin Smith, Philip W. Dyer, and Patricia Harvey

[D] Slow-Pyrolysis, like the JF System, could be a solution to treat dry seaweed, but there would be insufficient energy for drying
"The energy required to heat 1 kg of dry seaweed by 400° C for **slow pyrolysis** was estimated at 0.5 MJ. The HHV of syngas and biocrude produced from the pyrolysis totaled 2.9 MJ. There is **sufficient energy in the biocrude and syngas fractions produced by the pyrolysis** of seaweed to power the process and produce useful biochar, but **insufficient energy for drying."**
Source: Slow Pyrolysis as a Method for the Destruction of Japanese Wireweed, *Sargassum muticum;* Environment and Natural Resources Research, *2015;* John J Milledge, Alan Staple and Patricia J Harvey

[E] Drying is required prior to pyrolysis
"The removal of water from the algal biomass by evaporation often requires considerable energy. To heat and evaporate water at atmospheric pressure from a temperature of 20°C, requires an energy input of approximately 2.6 MJ kg^{-1} or over 700 kWh m^{-3} (Mayhew & Rogers, 1972; Weast, 1985). To produce one kilogram of dry seaweed from seaweed containing 79.9 % moisture will require the evaporation of 3.97 kg water and 10.3 MJ of energy."
Source: Slow Pyrolysis as a Method for the Destruction of Japanese Wireweed, *Sargassum muticum;* Environment and Natural Resources Research, *2015;* John J Milledge, Alan Staple and Patricia J Harvey

ABOUT FRONTLINE WASTE : A FLORIDA-BASED COMPANY, HQ IN DELREAY BEACH

Frontline Waste Holding LLC is based in Delray Beach, Florida. Frontline Waste is a waste-to energy company, with additional presenses in Spain and SE Asia. It is dedicated to solving local waste problems with its small-scale decentralized solutions. Its JF System uses slow-pyrolysis, a mature technology, to convert feedstock into biofuels by heating it in the absence of air. The system uses its own energy to power itself and to dry the feedstock. No fossil fuels are therefore required beyond ignition. **https://frontlinewaste.com**

In 2021 FW's pyrolysis technology is one of 1000+ technologies awarded the Swiss Solar Impulse Efficient Solution Label, a proof of high standards in profitability and sustainability.

Rob Steir is its U.S. partner (https://linkedin.com/in/robsteir) and is based in Delray Beach, Florida. Rob is a serial entrepreneur, with a strong focus in the last 5 years on plastic waste. He is a co-founder of CAPP.Global and main author of a UN-funded report on plastic waste.

Disclaimer: All numbers included in this RFI are indicative (and approximate) numbers to be used for illustrative purposes. This is not a proposal.

GFL Environmental

Market Research Response

Response to Miami-Dade County Market Research for Municipal Solid Waste Management Solutions

Prepared for:

Miami-Dade County
Department of Solid Waste Management

Prepared by:

Andy King
Vice President, Business Development
GFL Environmental Inc.
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T. 904-755-7344
E. andy.king@gflenv.com

April 11, 2025

Respondent Background

Contact Information

Respondent Name	GFL Environmental Inc.
Respondent Address	80 Fort Wade Rd., Suite 219, Ponte Vedra Florida, 32081
Respondent Contact Information	Andy King, Vice President Business Development **Email:** Andy.King@gflenv.com **Phone:** 904-755-7344 **Experience:** Over 25 years experience in executive roles in both public and private waste companies. 16 years as an operator of fully integrated waste companies in Florida including collection, disposal and recycling facilities. Roles include Area President of Florida for Republic Services, Vice President of Municipal Services for Republic Services, CEO of All American Roll off and Otis Road Landfill in Jacksonville Florida and current role of Vice President of Business Development for GFL Environmental based out Ponte Vedra, Florida.

Who We Are

GFL Environmental Inc. (GFL) is the fourth largest diversified environmental services company in North America, providing a comprehensive line of solid waste management services through its platform of facilities in 18 U.S. states as well as throughout Canada. Across its organization, GFL has a workforce of more than 15,000 employees.

We have secured our significant footprint and leadership position in the environmental solutions market through continual innovation, strategic and targeted growth, an inherent commitment to sustainability and investing in our employees and communities.

At GFL, our vision is to be Green for Life. It is the core of our corporate strategy and central to the work we do. We implement our vision by providing accessible, cost-effective, and sustainable environmental solutions to our customers and the communities we serve.

Since our inception, we have made significant investments in new technology and in the innovation of our management and operating processes. These investments reflect our commitment to providing sustainable solutions that are also value-enhancing initiatives for our business. Examples of these investments include:

- Material recovery facilities or MRFs that employ advanced sorting technologies and drive diversion from landfill, preserve virgin resources, reduce GHG emissions and contribute to a lower carbon future. GFL's Sustainability Action Plan includes our goal to increase recyclables recovered at our MRFs by 40% by 2030.
- Landfill gas to energy facilities that capture biogas and convert the captured gas into electricity or renewable natural gas (RNG) for use by households and commercial establishments or as a source of fuel for vehicles. Our Sustainability Action Plan includes our goal to double our beneficial use of biogas by 2030.

- A growing compressed natural gas (CNG) fleet that uses clean natural gas to power solid waste collection vehicles. CNG emits less greenhouse gas per mile than traditional diesel fuel. Our Sustainability Action Plan includes a goal to increase the percentage of CNG trucks in our fleet with at least 50% of our annual replacement of diesel solid waste vehicles with CNG or alternative fuel vehicles. In addition, by 2030, at least 85% of our CNG fleet will be powered by RNG fuel, including RNG produced from our landfills.
- Organics facilities that recycle organic waste to produce high-quality compost products, fertilizers, and other soil supplements. By providing a commercially viable environmental solution, communities are able to help reduce their GHG footprint by keeping organic waste out of landfills.

GFL has also been committed to giving back to our communities. Our community involvement goals increase and broaden our community outreach. This includes our Full Circle Project, GFL's charitable giving program, which allows GFL's customers to identify charitable categories for our annual giving commitment and our employees to build long-term relationships with local charities within the customer identified categories.

Our Facilities

Through GFL's strategically located network of 245+ collection operations, 175+ transfer stations, 30+ MRFs, 20+ organics facilities, 7800+ solid waste trucks, and 90+ active landfills owned managed or operated across North America, we have capabilities that can be mobilized to service our customers wherever they are. Our locations throughout North America are noted below:

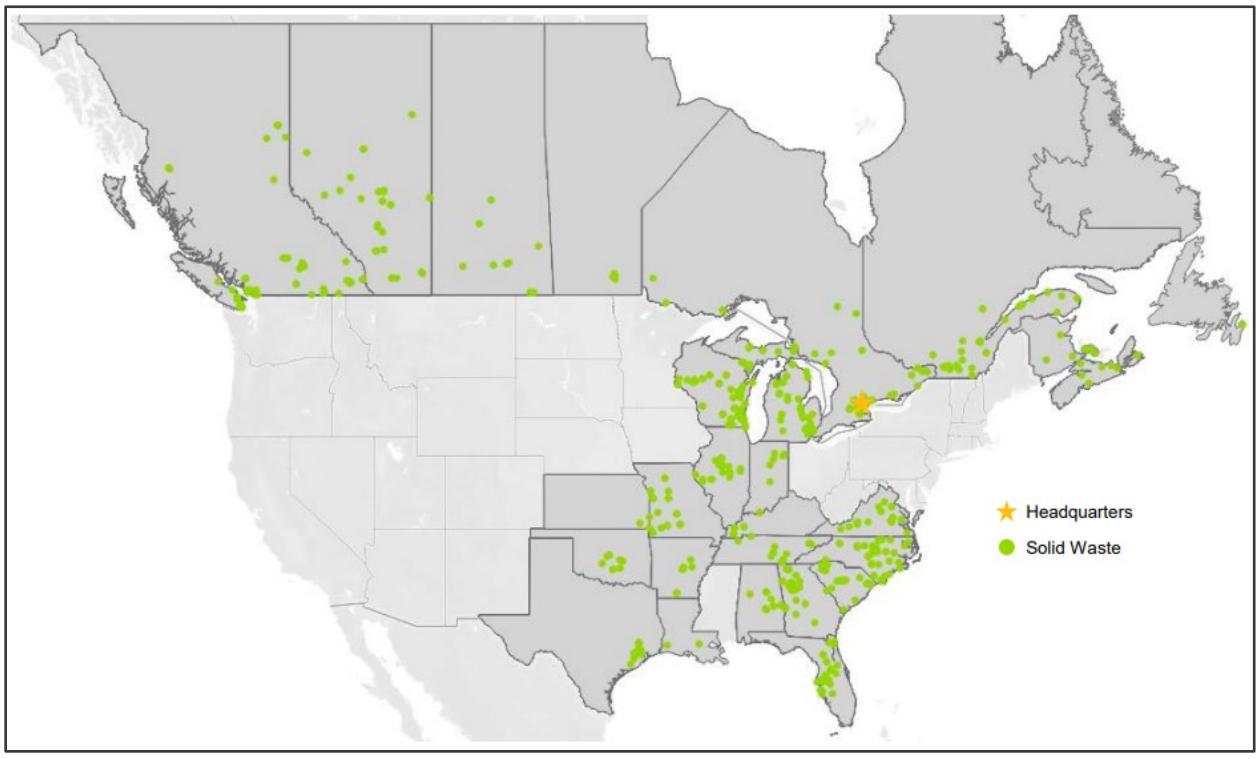

Figure 1. GFL Footprint

Waste Management Solutions

Solution

At GFL, we provide accessible, cost-effective and sustainable environmental solutions to our customers and the communities we serve. We partner with our customers and work with them to achieve their goals by providing them with a range of options to manage their growing waste volumes effectively and in a safe, reliable and sustainable manner.

GFL Environmental anticipates having landfill capacity to handle a portion of the disposal needs of Miami Dade County. Should Miami Dade pursue a competitive procurement process GFL Environmental can provide more detail as to site specifications and location of disposal facilities.

GFL would be amenable to a revenue share model with Miami Dade at one of our sites to build an environmental campus to include but not limited to composting, waste and recycling.

Landfills

Landfills play a critical role in ensuring the responsible management of waste materials that cannot be recycled. When diversion of waste materials from landfills is not an option, GFL offers safe, fully-regulated disposal solutions through our licensed facilities. Our landfills operate in strict compliance with all applicable environmental regulations, to ensure the proper management of permitted non-hazardous municipal (MSW), industrial, construction and demolition (C&D), and special solid waste.

GFL manages a number of different types of solid waste landfills. These include:

- Municipal solid waste landfills for everyday household and commercial garbage.
- Municipal solid waste landfills for non-hazardous special industrial waste, including asbestos materials and liquids.
- Inert debris landfills, for disposal of earth, concrete, curved asphalt, rock, bricks, etc.
- Construction and demolition (C&D) landfills for construction, renovation and demolition waste, some of which accept asbestos disposal.

GFL's modern landfill management systems work to protect soil and groundwater from impacts while limiting the release of landfill gas emissions. Our landfills are engineered to include environmental protection technologies such as:

- Impermeable High Density Polyethylene (HDPE) cell lining systems to prevent landfill gas migration and create barriers to protect ground water;
- Leachate collection and treatment systems to remove leachate from landfill cells to be transported to licensed off-site disposal facilities or directed to on-site treatment plants;
- Landfill gas collection systems to direct landfill gas to energy generation facilities or facility flares for combustion. These systems work to reduce odors and the release of air emissions including greenhouse gases.
- Daily and final cover to contain waste in place, minimize water infiltration, reduce landfill gas emissions and prevent vermin.
- Stormwater management systems including basins, drainage trenches, stormwater ponds and conveyance systems to prevent stormwater runoff from contacting the landfilled waste materials.

Our landfills also include sophisticated monitoring systems to ensure that the engineering technologies in place are working to protect the environment. Our monitoring systems include monitoring of odor, groundwater and surface water, leachate and landfill gas.

Effectiveness

Disposal of Solid Waste to multiple third-party landfills through long haul or rail from Miami Dade transfer sites will be the most cost-effective solution for Miami Dade. Soliciting pricing and using multiple vendors on long term contracts for transfer and disposal will not require additional capital expenditures by Miami-Dade and will provide clear cost visibility for future budgeting purposes if the contract allows for annual price increase methodology that is agreed upon by both Miami-Dade and the contractor.

Quantity

GFL anticipates having a disposal option for Miam/Dade that will meet the needs of Miami/Dade.

Technologies

Since our inception, we have made significant investments in new technology and in the innovation of our management and operating processes. These investments reflect our commitment to providing sustainable solutions that can also be value-enhancing initiatives for our customers.

Some examples of these technologies include:

- Landfill gas to energy facilities that capture biogas and convert the captured gas into electricity or renewable natural gas (RNG) for use by households and commercial establishments or as a source of fuel for vehicles.
- Material recovery facilities or MRFs that employ advanced sorting technologies and drive diversion from landfill, preserve virgin resources, reduce GHG emissions and contribute to a lower carbon future.
- Organics facilities that recycle organic waste to produce high-quality compost products, fertilizers, and other soil supplements.

Further details on GFL's involvement with each of these technologies follows:

RNG

GFL operates several landfill gas to energy facilities that capture biogas and convert the captured gas into electricity or renewable natural gas (RNG) for use by households and commercial establishments or as a source of fuel for vehicles.

One of our climate related goals is to increase by 2x the beneficial use of biogas from our landfills by 2030 through the development of renewable energy projects at our landfills. These projects convert landfill gas into renewable energy that is used as a direct use fuel for sale in the transportation and other voluntary markets or to produce electricity. Actions required to support the development of these projects also support our sustainability goal to decrease scope 1 and 2 emissions by 30% by 2030 by reducing fugitive GHGs from our landfills.

We have recently added 4 renewable energy facilities to our portfolio:

Figure 2: Recently added renewable energy projects (2023 Sustainability Report)

Diversion Facilities

As indicated in the County's meeting on January 28th, 2025, a top priority is meeting future disposal capacity needs while protecting ratepayers, keeping overall taxes and fees low, and safeguarding long-term fiscal health. If implemented appropriately, diversion programs can help to mitigate the significant capital expenditures associated with waste disposal and can offer another predictable choice for financial planning.

- Strategically located diversion facilities, such as composting and materials recovery facilities can reduce the distance that waste needs to be hauled, therefore reducing the County's transportation costs.
- These facilities can generate revenue from the sale of recovered materials such as papers, plastic and metal, but also high-quality compost products and recovered Construction & Demolition waste.

The chart below summarizes the materials recovered at facilities in 2023:

MATERIALS RECOVERED AT GFL FACILITIES

	2023 (TONNES)
RECYCLABLE MATERIALS RECOVERED AT GFL MRFS	1,300,862
Fibre	985,431
Plastics	156,318
Glass	81,748
Metals	77,365
RECYCLABLE MATERIALS RECOVERED AT OTHER GFL FACILITIES	572,358
Construction Materials/Wood	548,517
Other	23,841

Figure 3: Recovered Materials (2023 Sustainability Report)

Recycling and Material Recovery Services

GFL's expertise in diversion and recovery of recyclable materials supports the circular economy by providing solutions for our customers to divert reusable materials from landfills and allow us to recover higher rates of recyclable materials at our material recovery facilities. As part of our Sustainability Action Plan, we have committed to increase recyclables recovered at our MRFs by 40% by 2030. Our pathway to meeting this goal is through increasing the volume of recyclables received at our facilities while continuing to make investments in sophisticated sorting technologies and expanding our sorting capacity at existing and planned facilities that will increase our recovery rates.

Seen in the image below, our new single-stream Material Recovery Facility in Mayville, Wisconsin (constructed 2023 and commissioned in 2024) is a leading-edge facility equipped with seven optical sorters and capacity to process over 150,000 tons of single stream residential recycling material per year.

Figure 4. Mayville Wisconsin MRF

Organics Recycling (Composting)

GFL managed over 815,000 tons of organic material in 2023. To further support our customers' sustainability goals and the communities we serve, we continue to manage, process and divert food waste and other organic materials from landfill.

Examples of these projects include:

Triple S Compost, Conroe Texas	Compo-Haut-Richelieu Regional Composting Centre, Quebec, Canada
GFL's composting operations in Conroe, TX (north of Houston) have diverted over 235,000 tons of organic waste including vegetables, fruits, liquids, coffee, tea leaves, green waste, leaves and yard trimmings since being founded in 2017. This facility uses conventional composting methods to create a variety of nutrient-rich, high performance compost products that are used by the landscaping industry across southeast Texas as well as being sold to distributors and wholesalers under the brand name Triple- S Compost. These operations also play an integral role following extreme weather events as a place where storm debris like downed trees can be recycled into various premium mulch blends, helping local communities clean-up and restore their environments	Compo-Haut-Richelieu Inc. (CHR) is a joint-venture (PPP Project) between the Municipalité Régionale de Comté du Haut-Richelieu, its 14 municipalities and GFL. As part of this partnership, GFL helped develop, and now operates, the CHR Regional Composting Centre which opened in 2023. This facility, the first composting facility in Quebec, Canada with all operations entirely indoors, can process up to 55,000 tons a year of organic waste from residential, commercial, institutional and industrial sectors of the Haut-Richelieu and Jardins-de-Napierville regional county municipalities. It produces approximately 18,700 tons of high-quality compost each year. Compost from this facility is distributed to local citizens, municipalities for use in parks and green spaces, landscapers and garden centres and farmers in the region

Benefits

Cost effectiveness of using multiple 3rd party disposal sites will require minimal capital requirements by Miami Dade and will be the lowest cost solution. Contract terms could be used Miami Dade to provide long term annual cost visibility for annual budgeting purposes. Contracts could also provide for future waste diversion opportunities and revenue sharing opportunities for recycling of different waste streams and most large scale waste contractors have the capabilities to offer waste diversion opportunities and advanced technologies to help Miami Dade to reach its desired goals.

Challenges

GFL anticipates having available Class 1 landfill disposal capacity in the next 12- months.

Financial Approach

Costs

Transportation and Disposal Pricing to a GFL Environmental Class 1 landfill will be estimated at $70-$75 per ton. GFL Environmental anticipates having available landfill capacity to handle the solid waste disposal needs of Miami-Dade. Pricing to be adjusted annually for inflation using the U.S. Government Consumer Price Index for All Urban Consumers for the Southeast Region of

the United States ("CPI"). CPI increases can be capped at 5% per year for the term of the agreement, but at no time will any fee adjustment be less than zero.

Funding Model

Any waste solution for Maimi Dade outlined in this proposal will be privately funded by GFL Environmental.

Revenue

Should Miami-Dade wish to implement additional technologies with potential revenue streams, GFL has the expertise and experience to assist the County in building a program which provides revenue streams to maximize value.

Our strong market position gives us the capability to build upon our diversified domestic end markets and our portfolio of global mills simultaneously. With the ability to consistently maintain strong diversified outlets across the globe GFL is better able to adapt to the volatile and ever-changing commodities markets. This allows GFL to provide unparalleled logistic capabilities and commodity pricing.

Along with our expertise in MRF design and operation, we also have over three decades of experience marketing recyclable materials. GFL views contractual relationships with municipalities as partnerships, and we believe that collaboration is the best way to improve waste management programs. We are committed to partnering with municipalities to maximize diversion goals and increase the value of their recoverable commodities. One area where GFL can assist the County is in potential additions of material to diversion programs.

With our current and continually growing network of end use consumers nationally, paired with a robust logistics team, and the ability to adapt our material specifications in real time to ensure optimal sales for the dynamic commodities markets, GFL is positioned to offer world-class service from the collections, processing, transportation, and sales to end use markets in the recycling industry.

Implementation Approach

Infrastructure

N/A

Size

GFL anticipates having a disposal option for Miam/Dade that will meet the needs of Miami/Dade.

Site Ownership

GFL Environmental will procure the site and obtain zoning and regulatory approvals necessary to accept waste from Miami Dade.

Permitting

GFL Environmental will procure local and state level permitting in order to implement the solutions required by Miam Dade.

Timing

GFL anticipates having disposal capacity to handle the solid waste disposal needs of Miami Dade.

O&M

N/A

Health/Safety/Environmental

At GFL, the safety of our employees, contractors, visitors, and the communities we serve is our number one priority. Safe For Life is GFL's in-house, comprehensive health and safety program that, implements our Corporate Health and Safety Policy. Safe For Life is designed and implemented across GFL's operations with a goal to provide our employees with the best-in-class knowledge, training and tools that they need every day to perform their jobs safely and in compliance with all applicable regulatory requirements.

Through our Safe For Life program and the efforts of all of our employees, we lowered our Total Recordable Incident Rate (TRIR) by 12.5% in 2023. This is the third straight year we have lowered our TRIR since issuing our Sustainability Action Plan. This is a great achievement and one that we are extremely proud of.

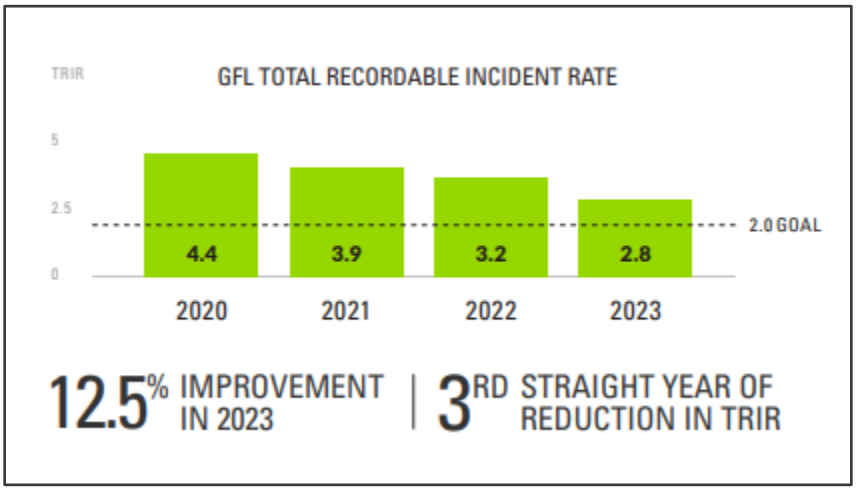

Figure 5. GFL Total Recordable Incident Rate (2023 Sustainability Report)

Assessment of health and safety risks are conducted within each business unit to drive continuous improvement in our Health & Safety programs:

- prior to construction or alteration of facilities and changes to equipment, controls, operating procedures, or activities;
- as a result of events, inspections, and audits; and

- to assess the impact of changes to legislation, industry best practices, and manufacturer's recommendations.

Mitigative measures to manage the identified risks are incorporated into operating procedures, safe work practices, emergency preparedness and response plans, as appropriate

GFL Environmental complies with all local, state and federal regulatory safety and health standards to ensure that all employees work in safe work places. GFL Environmental operates landfill and transfer station across the United States and will make sure that all waste is handled and disposed of to the highest level of industry standards and in compliance with all local, state and federal environmental protection regulations.

Other Information/Advice

Procurement Model

As the services which Miami-Dade is considering are quite complex, and as there is more than one solution that could be implemented, a Request for Proposal (RFP) process is suggested as it will allow for vendors to submit unique and tailored solutions.

To encourage multiple vendors and maximize competition, the County should consider the following:

- Allow for flexibility in the RFP process to encourage vendors to propose innovative solutions that may have more competitive pricing structures delivering the best value to Miami-Dade
- Ensure that any evaluation criteria is well-defined and communicated clearly in bid documents
- Engage in pre-bid dialogue with individual vendors to understand what solutions they have the ability to provide and how those solutions could be implemented in Miami-Dade
- To allow new entrants into the marketplace, for diversion facilities require the implementation of new equipment/specified capability
- When considering the addition of diversion facilities, a minimum volume guarantee is helpful, given the large capital investment

Partnerships

We are proud of our municipal partnerships across the United States and we have an extensive range of experience in partnering with municipalities for all aspects of their solid waste management programs. The number of long-term contracts and renewals which GFL holds is a testament to the pride that GFL has in fostering and maintaining relationships with municipal customers.

We believe customer satisfaction will determine our future existence. Therefore, we encourage our staff to be vigilant and cognizant of the present and future needs of our customers and we make every effort to acquire and maintain the technology necessary to ensure we can continually provide the innovative, cost effective, and high quality of service our clients deserve.

Through a contractual partnership with GFL, Miami-Dade could explore potential improvements to the waste management system such as unlocking revenue generating opportunities, strategic investment in diversion infrastructure through Public Private Partnerships or exploration of grant and alternative funding opportunities.

Additional Insights

Beyond the procurement process, Miami-Dade should consider having multiple vendors to perform the work to create a more resilient, innovative and cost-effective waste management system. Having multiple vendors provides benefits such as:

- Driving competition, which can lead to more competitive pricing and assist in achieving the County's priority of meeting future disposal capacity needs while protecting ratepayers, keeping overall taxes and fees low, and safeguarding long-term fiscal health.
- Assisting with contingency planning if one vendor experiences operational issues
- Providing flexibility as Miami-Dade continues to grow and the waste management system continues to evolve
- Provision of high-quality services, adaption of new technologies and efficient waste processing/disposal services

Giant Green Leaf (GGL)

Market Research Response

GGL

THINK DIFFERENT, THINK FUTURE

Universal Waste to Energy (UWtE) System for Miami-Dade County

Turning GARBAGE to clean energy

Solution Response to the Miami Dade County Research Questions.

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GGL

Giant Green Leaf (GGL) Energy

About Us

GGL is a dynamic technology sourcing and energy solutions company focused on delivering innovative, clean, and sustainable infrastructure systems. With a deep commitment to environmental responsibility and operational efficiency, GGL Energy's ambition is to deploy solutions globally that revolutionize waste management and energy production with our OEM (Original Equipment Manufacturers) partners VOsPS (**Value Optimized Sustainable Planet Solutions**). Our OEM Partners have decades of experience in the Waste to Energy industry.

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Waste Management Solutions

1. Solution Overview

The Universal Waste to Energy (UWtE) system is an advanced, modular waste-to-energy solution that transforms all categories of organic waste—including municipal solid waste (MSW), plastics, industrial, hazardous waste, sewage sludge, and agricultural refuse—into clean electricity and usable heat. Through high-temperature, flameless combustion at 1,350°C, the UWtE system produces zero methane, zero carbon monoxide, and sterilized ash with unprecedented ultra low emissions, making it a truly sustainable solution for Miami-Dade.

The Universal Waste to Energy (UWtE) system is a next-generation, closed-loop waste management technology that transforms virtually all categories of organics, including industrial wastes, into clean energy and valuable by-products. Through flameless high-temperature combustion reaching 1,350°C, the system operates without external fuel post start-up, producing zero methane, zero carbon monoxide, and **less than 26 mg / m^3 NO_2,**—making it a true breakthrough in sustainable waste management.

Versatility Across All Waste Streams

The UWtE system processes a broader and more diverse range of waste materials than traditional incinerators or digesters, including:

a. **Municipal Solid Waste (MSW):** General household waste, plastics, paper, packaging, demolition materials, and unsorted garbage.
b. **Industrial Waste:** Tires, rail ties, composite materials, upholstery, and end-of-life products like wind turbine blades.
c. **Hazardous & Chemical Waste:** Paints, solvents, automotive fluids, herbicides, pesticides, cleaning agents, PCBs.
d. **Hospital & Biomedical Waste:** Contaminated PPE, surgical waste, intravenous bags, diapers, medications, and anatomical waste.

e. **Sewage & Sludge:** Sewage sludge, landfill leachate, vacuum truck contents, washdown waste, and wastewater treatment residues.
f. **Agricultural & Forestry Waste:** Diseased grains, livestock mortalities, offal, manures, forestry slash, and organic farm waste.
g. **Disaster Waste:** Hurricane debris, flood-damaged materials, and emergency response refuse.
h. **Contraband or Illicit Waste:** Enables secure destruction of illegal goods, counterfeit products, or sensitive waste materials.

This broad compatibility eliminates the need for sorting, drying, or preprocessing except only for shredding down to 50mm maximum lump—a key operational advantage in a region like Miami-Dade, which produces over 5 million tons of waste annually across multiple sectors. Nonorganic feedstock fractions exit in UWtE ash.

Value-Added Benefits to Miami-Dade County

a. **Universal Processing Across Waste Types**

The UWtE system can be integrated seamlessly into Miami-Dade's diversified waste profile, including residential, industrial, medical, and agricultural sources. This universal capacity eliminates operational silos and maximizes waste diversion from landfills.

b. **Disaster Resilience**

Miami-Dade is prone to hurricanes and tropical storms, which create sudden surges in complex, hard-to-handle waste. The UWtE's ability to rapidly process unsorted and wet disaster waste positions it as a critical infrastructure asset for emergency recovery and resilience.

c. **Reduction of Landfill Dependency**

By converting daily and legacy landfill waste into energy, the UWtE system helps the County reduce landfill volumes, eliminate methane emissions, and reclaim valuable land. It also allows for landfill mining—safely recycling existing buried waste.

d. Environmental Compliance and GHG Reduction

By converting daily and legacy landfill waste into energy, the UWtE system helps the County reduce landfill volumes, eliminate methane emissions, and reclaim valuable land. It also allows for landfill mining—safely recycling existing buried waste.

e. Operational Simplicity & Automation

Unlike traditional WtE technologies, the UWtE is fully automated, requires minimal staffing, and has no moving parts in hot zones, reducing maintenance costs and ensuring long-term sustainability.

f. Circular Economy Opportunities

By-products such as: Electricity (scalable), thermal energy (scalable), clean water (via Multiple Effect Distillation) and reusable ash (used in bricks, roadbeds, and fertilizer) can be sold or reinvested into community services, infrastructure, or resilience programs.

g. Ideal for Multi-Scale Deployment

Whether deployed as a centralized mega-facility or a network of decentralized micro-plants, UWtE's modular architecture offers unmatched deployment flexibility. This fits perfectly with Miami-Dade's goal of exploring multiple delivery methods and technologies for solid waste processing.

2. Effectiveness

The Universal Waste to Energy (UWtE) system has been successfully proven and demonstrated by our OEM partners VOsPS in Manitoba, Canada, where a fully operational 3MM module has been installed on a private acreage west of Winnipeg. This pilot facility can process a diverse range of waste streams, including: Municipal Solid Waste (MSW), Sewage sludge, Agricultural waste (e.g., diseased grain, manure, livestock mortalities), Industrial and medical waste, Chemical and hazardous waste, Plastics and demolition materials.

This site operates under real-world rural conditions, demonstrating the system's reliability, flexibility, and emissions performance in handling unsorted and high-moisture waste, without pre-treatment or sorting.

Why This Matters for Miami-Dade

This real-world deployment proves that the UWtE system is not conceptual—it is a field-tested, commercially viable solution with a strong performance record in mixed-waste environments. If a 3MM unit can function autonomously on a rural Canadian acreage with no municipal infrastructure, it can be confidently scaled and deployed in modular arrays across Miami-Dade County to meet urban and industrial needs.

Key Takeaways for the County:

- The 3MM unit demonstrates how the system can serve remote, decentralized, or niche waste streams (e.g., agricultural districts, disaster relief sites, sewage treatment facilities).
- It validates the UWtE's ability to operate off-grid or on microgrid settings, offering resilience in the event of utility disruption or emergency scenarios.
- It proves the feedstock-agnostic nature of the technology, critical for Miami-Dade's diverse and dynamic waste profile.

3. Quantity and Flexibility

The Universal Waste to Energy (UWtE) system is engineered for modular, autonomous deployment, allowing it to be scaled seamlessly from small rural communities to large metropolitan waste hubs. Each 95MM (95 million British Thermal Units) UWtE module processes approximately 184 tons per day of unsorted, high-moisture municipal solid waste (MSW) and other hazardous organic inputs.

The system's modular design enables the installation of single units for lower-volume sites or multi-module arrays for high-demand operations. For instance, a full-scale 570MM configuration, comprising six 95MM modules, can process 1,100 tons per day with a potential to be scaled up or down as required.

To meet the needs of Miami-Dade County's 4,000 tons per day capacity, the UWtE system can be scaled up to 18-22 modules, deployed as a centralized hub or distributed across multiple strategic locations in the County. Its plug-and-play design and autonomous operating capabilities allow for rapid deployment and flexible operation with minimal operator intervention.

This flexibility makes the UWtE system ideally suited for:

- Municipalities with variable or seasonal waste volumes
- Decentralized waste processing centers near existing landfills
- Emergency or disaster waste recovery operations
- Future expansion or replication across South Florida

In all configurations, the UWtE system maintains full operational performance—handling unsorted, high-moisture, and diverse waste streams—without the need for pre-treatment or sorting, ensuring efficiency and cost-effectiveness at every scale.

4. Technologies Used

- Quiescent radiant energy vaporization of organic feedstocks
- Flameless High-Temperature Combustion (1,350°C)
- Multi-chamber vaporization with oxygen-deficient processing
- Steam turbine for electricity generation
- Modular, fully automated processing with real-time controls and emergency safety systems

5. Key Benefits Over Alternatives

- Zero methane production
- No sorting or pre-processing required except for shredding to 50mm lump
- Low NO_2 emissions (less than 26 mg / m^3 NO_2))—10x cleaner than incinerators
- Minimal O&M costs—no moving parts in hot zones
- Revenue generation from electricity, heat, water purification, ash, and carbon credits
- Carbon footprint reduction of approximately 63% per person

6. Challenges and Mitigation

While the Universal Waste to Energy (UWtE) system offers a transformative solution for solid waste management, its deployment—like any major infrastructure project—comes with a set of challenges. GGL Energy recognizes these challenges and has developed clear strategies for mitigation, based on past deployments and regulatory engagement in North America.

a. Regulatory and Permitting Complexity

Challenge:
Permitting a waste-to-energy facility in Florida requires navigating a complex landscape involving environmental, public health, land use, and utility regulations. Agencies such as the Florida Department of Environmental Protection (FDEP), U.S. EPA, and local planning boards must approve air quality, emissions, wastewater discharge, zoning, and hazardous waste handling protocols.

Mitigation Strategy:

- GGL will engage early with Miami-Dade County and regulatory stakeholders to create a comprehensive permitting roadmap.
- Our environmental consultants are experienced in obtaining Title V air permits, NPDES permits, and solid waste facility certifications.
- Emissions modeling, safety assessments, and public impact studies will be conducted proactively to facilitate transparent and timely regulatory approvals.
- GGL will propose pre-submittal meetings and coordinated reviews to reduce administrative delays.

b. Public Perception and Community Buy-In

Challenge:
Waste-to-energy facilities, despite being clean and technologically advanced, can face public skepticism due to legacy issues with incinerators (e.g., pollution, odors, noise). Misunderstanding of the UWtE's modern process may create opposition or concern from local communities.

Mitigation Strategy:

- GGL will launch a public education and engagement campaign tailored to Miami-Dade neighborhoods, using town halls, facility tours (virtual or physical), informational videos, and transparent FAQs.
- Data from existing case studies will be shared to demonstrate low emissions, no odors, and positive local outcomes.
- Real-time emissions monitoring dashboards may be offered to community stakeholders for transparency and trust-building.
- GGL is open to forming a citizen advisory board to provide oversight and input during construction and operation phases.

c. Siting and Zoning Restrictions

Challenge:

Identifying and securing an appropriately zoned site of ~35 acres (for a 4,000 tpd plant) within Miami-Dade's dense urban and suburban landscape may prove challenging, particularly when considering setbacks, traffic impact, and existing land use plans.

Mitigation Strategy:

- GGL is open to exploring multiple site configurations, including decentralized modular installations near existing landfills or industrial zones.
- The system's relatively low building height requirements and modular nature allow greater flexibility in site selection.
- Our team will conduct site suitability analysis across the County and provide zoning reclassification support where needed.

d. Utility Integration and Infrastructure Interconnection

Challenge:

Connecting the UWtE system's power and heat outputs to the local grid and infrastructure may present technical and bureaucratic obstacles, particularly regarding interconnection agreements, backfeed protection, and heat recovery systems.

Mitigation Strategy:

- GGL will employ the service of experts who will be dedicated to utility coordination who will manage grid interconnection studies, application filings, and compliance with FPL or other local utility providers.
- For heat and water applications, GGL will coordinate with County water and public works departments to maximize use of waste heat for district heating or water purification systems.

e. Financing and Long-Term Risk Allocation

Challenge:

Capital expenditures for large-scale UWtE systems can exceed $400M. Municipalities may face concerns about upfront costs, long-term returns, or the financial risks of new technology adoption.

Mitigation Strategy:

- GGL proposes a Public-Private Partnership (PPP) model to share capital burden and operational risk with private investors.
- We will explore federal and state funding, green bonds, tax credits, and carbon offset revenues to support financial sustainability.
- Detailed 30-year financial models, including revenue scenarios from tipping fees, energy sales, and ash reuse, will be presented to validate ROI.

f. Operational Readiness and Workforce Development

Challenge:

New systems require properly trained staff and operational continuity to avoid downtime or inefficiency.

Mitigation Strategy:

- GGL offers a turnkey training and handover program, including on-site training for local operators and facility managers.
- The UWtE system's automated controls and minimal moving parts reduce the need for complex technical expertise.
- We will collaborate with Miami-Dade's workforce development and vocational institutions to build a local green jobs pipeline.

Financial Approach

1. Capital and O&M Costs

(*This section is calculated based on a 570MM UWtE System*)

The Universal Waste to Energy (UWtE) system offers a competitive and scalable capital investment structure with long-term cost advantages over traditional waste processing facilities. A full-scale 570MM system, composed of six 95MM modules, is designed to process up to 1,100 tons of waste per day—and can be scaled further to match Miami-Dade County's target of 4,000 tons per day by deploying 18-22 modules.

a. Capital Expenditure (CAPEX) Breakdown

For a single 570MM UWtE facility (6-module system), the total estimated capital cost is approximately: ~USD $306.43 million. This estimate includes:

S.No	Description	Cost USD $
1	Complete UWtE system (modules with combustion air systems)	$90M
2	Main building (340’ x 360’, insulated structure)	$11.18M
3	Steam turbine, condensing system, evaporative cooling pond	$22.35M
4	Heat recovery boilers and condensate accessories	$11.9M
5	Site infrastructure, roadways, landscaping (6 acres)	$8.29M
6	40 MWe steam turbine generator and site electrical systems	$76.43M
7	Feedstock shredders and base installations	$5.77M
8	Sewage sludge/leachate/chemical injection systems	$3.46M
9	Ash bin system and positioning equipment	$1.8M
10	Project management, commissioning, testing, contingency	$59.12M
11	Total	$290.3M

Note: Cost estimates exclude the price of land and optional water purification systems (e.g., Multiple Effect Distillation).

b. System Output: What Does a 570MM Facility Deliver?

A single 570MM UWtE plant provides:

- Electricity Output:
  - Up to 40 Megawatts (MWe/hour) of continuous electrical power via steam turbine generation
  - Enough to power over 35,000 homes (based on average consumption)
- Thermal Output:
  - 70 Megawatts of thermal energy per hour (MWt/hr)
  - Ideal for district heating, desalination, or industrial use
- Ash Output:
  - ~73 tons of sterile ash per day, suitable for use as: Construction aggregate (concrete, roadbeds) and agricultural fertilizer (subject to lab testing and metal removal)
- Waste Processing Capacity
  - 1,100 tons/day of mixed waste (municipal, industrial, hazardous, medical, sewage, and agricultural)

This output can be doubled or tripled by constructing multi-line facilities or siting multiple modular clusters around the County, aligning with Miami-Dade's 4,000 tpd requirement.

c. Operational and Maintenance (O&M) Costs

One of the UWtE system's biggest strengths lies in its low operational complexity and maintenance requirements, thanks to:

- No internal moving parts in hot zones
- Self-sustaining combustion
- Fully automated system controls

Estimated Annual O&M Costs:

- Staffing (60 personnel, incl. operations, safety, and maintenance):
  - $6.7M USD/year
- System maintenance and support:
  - $8.3M USD/year

Total Annual O&M Estimate: ~$15 million USD

d. Cost-Effectiveness Over Time

When compared to traditional incinerators or landfill expansion, UWtE delivers:

- Reduced lifecycle costs due to minimal wear and tear
- Fewer emission control systems required, due to naturally low NOx and CO output
- Lower transportation and landfill operating expenses
- Revenue offsets from energy, heat, tipping fees, and carbon credits (see Financial Approach section)

With net annual revenues and cost offsets estimated at $91 million/year, the UWtE system pays for itself over time while delivering substantial environmental, social, and financial ROI.

2. Funding Model

Implementing a large-scale UWtE facility—such as a 570MM (1000 tpd) system or a larger 4,000 tpd plant—requires a flexible and innovative funding approach. GGL Energy proposes a **Public-Private Partnership (P3)** structure, leveraging both public oversight and private sector capital, expertise, and risk-sharing mechanisms.

Recommended Funding and Financing Structure

a. Public-Private Partnership (P3)

- County provides land, permitting facilitation, seed capital and infrastructure (e.g., grid connection).
- GGL and its private-sector partners lead on design, build, financing, and operations under a long-term concession or performance-based agreement.
- County retains long-term ownership and regulatory control while minimizing upfront capital burden.

b. Private Financing Options

- GGL can coordinate with infrastructure investment firms and impact investors to privately finance construction under a Build-Operate-Transfer (BOT) or Build-Own-Operate (BOO) model.
- Typical capital recovery period is 10–15 years based on projected revenues and operating margins.

c. Public & Green Financing Incentives: GGL will actively pursue a wide range of government-backed funding sources, including:

Federal and State Grants:

- U.S. EPA Solid Waste Infrastructure for Recycling (SWIFR)
- Department of Energy (DOE) Clean Energy Infrastructure Grants
- FEMA funding for disaster resilience infrastructure
- USDA rural utility grants (for decentralized modules)

Federal Tax Credits:

- Investment Tax Credit (ITC) and Production Tax Credit (PTC) for renewable energy
- Advanced Energy Project Credit (Section 48C)
- New Clean Electricity and Clean Fuel Incentives under the Inflation Reduction Act (IRA)

Carbon Market Instruments:

- Sale of carbon offset credits on voluntary or compliance markets
- GGL partners with certified registries to monetize landfill diversion and methane elimination impacts

d. Green Bonds & ESG Capital Markets

- UWtE qualifies as a high-impact green infrastructure project
- County or project SPV can issue Green Bonds or seek Environmental, Social, Governance (ESG)-linked loans from sustainability-focused lenders.

3. Revenue Streams

The UWtE system generates multiple diversified revenue streams, reducing reliance on any single funding source and improving overall financial stability. Total Estimated Annual Revenue & Offsets (570MM system): $67M USD

Table showing core revenue streams

S.No	Stream	Description	Estimated Annual Value (570MM System)
1	Tipping Fees	Disposal charge for waste delivered to the plant ($100/tonne avg.)	~$36.5 million
2	Electricity Sales	40 MWe to the grid or local users at ~$0.08/kWh	~$28 million
3	Thermal Energy Sales	Heat for buildings, industry, greenhouses, or water purification	~$14.8 million
4	Carbon Offset Credits	Revenue from methane elimination & CO_2e reduction (@$160/tonne)	~$31.8 million
5	Sterile Ash Utilization	Sale of clean ash for use in roadbeds, bricks, fertilizer, concrete aggregate	Market dependent (estimated ~$1M–$2M)

Additional/Optional Revenue Opportunities

- **Water Sales:** Heat can be used to power Multiple Effect Distillation (MED) units for producing potable water or purified water for industrial/agricultural use.
- **Landfill Mining:** Old landfill waste can be processed, unlocking additional tipping fees, reducing environmental liabilities, and creating new energy streams.
- **Emergency Waste Contracts:** Serve as rapid-response waste processor for hurricanes, floods, or pandemics—adding emergency service contracts to revenue sources.
- **Industrial Symbiosis:** Co-locate with facilities that can use excess heat, such as aquaponics farms, cement kilns, or packaging manufacturers.

Implementation Approach

The successful deployment of the Universal Waste to Energy (UWtE) system in Miami-Dade County requires a comprehensive and phased approach—one that ensures technical reliability, environmental compliance, financial sustainability, and community acceptance. GGL Energy alongside its partners and associates will bring strategic experience in delivering turnkey WtE infrastructure, with an implementation framework that covers everything from site development to long-term operations.

1. Infrastructure Requirements & Delivery Role

The UWtE system is a fully modular and scalable energy-from-waste platform, designed for rapid deployment with minimal civil infrastructure.

Key infrastructure components include:

- Waste receiving and shredding facility
- Modular vaporization and combustion chambers
- Heat recovery steam generator and turbine system
- Ash collection and handling zones
- Site electrical/control room and thermal energy recovery
- Optional: Multiple Effect Distillation (MED) water purification units

GGL's Role: GGL proposes to serve as the master developer, leading the end-to-end design, engineering, procurement, construction, commissioning, and operations. This includes:

- Technology Provider
- Design-Builder
- Long-Term Operator (O&M)
- Financial Structuring Partner (in PPP or BOT models)

2. Site Selection & Size Requirements

A typical 570MM UWtE system (1,100 tpd) requires ~12 acres for full operations. A system capable of processing 4,000 tpd (Miami-Dade's estimated need) would require ~ 28-37 acres, including:

- 6–8 acres for feedstock reception and processing
- 10–15 acres for UWtE modules, power systems, utilities
- 6–8 acres for stack infrastructure, vehicle access, and buffer zones
- Optional: 6+ acres for evaporative ponds or green landscaping

Site Flexibility:

- Sites can be centralized or decentralized (e.g., multiple smaller facilities near transfer stations or legacy landfills).
- The system's low structural height (30–55 ft) and minimal odor/noise footprint make it compatible with both industrial and peri-urban land use.
- Roof-mounted solar panels and green walls can be incorporated for added sustainability and community acceptance

3. Site Ownership and Zoning

Ownership Model Options:

- County-owned land with long-term lease or joint-venture agreement (not less than 30 year lease).
- Private land acquisition led by GGL (if County prefers zero land involvement)
- Co-location with existing waste transfer stations or retired landfills to optimize transport and leverage existing zoning

Zoning & Planning Considerations:

- Most suitable zoning classifications: IU (Industrial), GU (Government Use), or heavy utility zones
- GGL will lead all required rezoning applications, community input sessions, and site environmental assessments as part of a streamlined permitting roadmap

4. Permitting & Regulatory Compliance

Permitting for a UWtE facility involves multiple agencies and dimensions:

S.No	Permit/Approval	Agency/Requirement
1	Air Emissions (NOx, CO_2, PMs)	FDEP, U.S. EPA (Title V permit, if required)
2	Solid Waste Facility Certification	Florida DEP
3	Wastewater/Leachate Handling	Miami-Dade Water & Sewer Dept., NPDES permit (if applicable)
4	Zoning, Noise, and Land Use	Miami-Dade County Zoning and Planning Boards
5	Fire Safety and Building Codes	Local Building Departments and Fire Marshal

GGL will work with regulatory consultants and legal experts with deep Florida-specific experience to facilitate timely and cost-effective compliance.

5. Estimated Implementation Timeline

S.No	Phase	Duration	Milestones
1	Feasibility & Site Selection	3–6 months	Site analysis, land control, public input
2	Permitting & Approvals	6–9 months	All required local/state/federal permits
3	Design & Engineering	4–6 months (parallel with permitting)	Final layouts, grid/turbine specs
4	Construction & Equipment Install	12–18 months	Foundations, UWtE modules, turbines
5	Commissioning & Start-up	2–3 months	Testing, staff training, initial waste load
6	Total Time to Operation	24–36 months	Full-scale commercial operation

GGL can accelerate implementation via design-build overlap, early procurement, and use of pre-engineered UWtE modules.

6. Operations and Maintenance (O&M)

The UWtE system's design is inherently low-maintenance due to:

- No moving parts in combustion chambers
- Fully automated temperature, pressure, and gas control
- Modular layout allows isolated maintenance without full shutdown

Key O&M Features:

- ~60 on-site staff (operations, safety, maintenance, admin)
- Annual O&M budget: ~$15M USD (for 570MM system)
- Remote diagnostics and performance monitoring available
- On-site spare parts inventory and preventive maintenance schedules
- GGL provides full O&M staffing or can train and hand over operations to County personnel under a shared services or concession agreement.

7. Health, Safety, and Environmental Protection

The UWtE system is engineered to exceed environmental and occupational safety standards:

Air Quality & Emissions:

- NO_2 emissions: less than 26 mg / m^3 NO_2 (~10x cleaner than conventional incinerators)
- Zero methane or carbon monoxide emissions
- Meets or exceeds EU, U.S. EPA, and Florida DEP air quality thresholds

Odor & Noise Control:

- All waste handling occurs in fully enclosed structures
- Thermal oxidation and induced draft fans mitigate odors
- Noise kept below industrial standards via soundproofing and equipment insulation

Environmental Benefits:

- 63% carbon footprint reduction vs. landfilling
- Diverts 100% of organic waste from methane-producing landfill decomposition
- Converts hazardous and infectious waste into sterile by-products

Community Health:

- Eliminates vermin and leachate associated with landfill use
- Reduces local air pollution and particulate matter exposure
- Safe destruction of pharmaceuticals, hospital waste, and chemical residues

Other Information & Advice

Additional Insights:

- The UWtE system can mine old landfill sites, reducing legacy emissions.
- UWtE is ideal for disaster waste management, handling refuse from hurricanes or floods with no sorting required.
- With modular deployment, Miami-Dade can phase capacity growth to match future demand and urban development.

Contact Us

GGL is your trusted partner in navigating the complexities of technology/product sourcing and brokering. Join hands with us, and let's embark on a journey of technological transformation together.

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Globe Guard Technologies

Intec

Market Research Response

Outlook

Recommentations for Pre-Engineering Assesment on Landfills

From Laura Levey <2leveylaw@gmail.com>
Date Tue 4/1/2025 7:45 AM
To saba.musleh@miamidade.com <saba.musleh@miamidade.com>; Byers, Ross <Ross.Byers@atkinsrealis.com>; Harald P. Pies <harald.pies@gmail.com>

1 attachment (40 KB)
INTEC - Pre-Engineering Objects (1).pdf;

Good morning Mr. Musleh,

I am reaching out to recommend that a pre-engineering assessment be conducted on landfills that have been burned or require restructuring for potential implementation of Intec technology or other suitable solutions.

Conducting a pre-engineering assessment will help determine the feasibility of implementing Intec technology on affected landfills. Even if Intec is not ultimately used, the collected data can be valuable for other companies looking to rebuild or improve landfills sites.

I strongly suggest moving forward with an engineering assesment to evaluate the viability of this approach. This process can serve as a foundation for better waste management solutions across multiple sites.

Thank you for your time and consideration.

Best regards,
Laura Levey
Globe Guard Technologies
We find solutions to environmental issues
305.905.2680

Requested Information

A. Respondent

Provide a brief summary of the respondent to include the following.
• Respondent's name and address
• Contact person, title, email address, and telephone number
• Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides

Laura Levey
Globe Guard LLC
2leveylaw@gmail.com
305.672.5007 office
305.9052680 cell

Globe Guard Technologies, was founded in 2017 to find solutions to environmental issues. In 2019, Globe Guard Technologies and Plasma Energy Group started a Pilot Program at Miami Dade South Water Treatment Plant to process rags, fog, coke, leaching and biosolids. This program was concluded in 2021 and the findings were a success. This Plasma Machine could transform bio-waste, fog, rags and leaching into clean energy. The process eliminated the Covid-19 virus and nano plastics too. The creator of Plasma Energy passed right after the pilot program ended leaving the project on stand by. Right after this project, I focused my efforts on Waste to Energy solutions. In 2022, I met Mr. Harald Pies, who introduced me to INTEC Technologies. This is a new, quantum gasification technology that does not need combustion nor landfill to process solid waste and convert solid waste into clean energy. Since then I have tried to introduce the INTEC technology to different municipalities in the US. However, I am focusing on my hometown, Miami, where I am finding a solution to protect the water we drink, air we breath and the land we live in. INTEC, energy from waste technology, is an eco-friendly process with zero contamination to our environment.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link.
https://documents.miamidade.gov/mayor/memos/01-25-25 second-update-on-directive-no-241676.pdf

The synthesis gas systems of the INTEC-SG Series represent a world-wide unique solution for energy recovery from organic waste of any kind.
With the synthesis gas produced in the plants, generators are driven by gas engines for power generation. This allows, amongst others, the feed-in of electricity to public grids.

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

Exemplary energy yield of different processes for power generation
From the conversion of municipal and industrial waste:

Type of power plant	Efficiency	Input-Material
Coal-fired power plant	31 – 38 %	Purchase of fossil fuels
Waste incineration plants	22 – 26 %	Municipal and commercial waste (restricted)
Waste pyrolysis plants	25 – 30 %	Limited use of municipal and industrial waste
INTEC SG Series	**57 %**	**Utilization of waste and residual materials of all kinds**

- Unlimited use
- approx. 1.2 – 1.8 MW of electrical power is generated from one ton of organic waste
- Patent protection, Multi-stage patented
- Modular design – high availability, scalable and expandable
- High profit – very low production costs for electricity
- The efficiency of gasification is unique. Carbon Conversion into synthesis gas and Coke is more than 99%
- No flue-gases
- No dioxin or furan build-up during the gasification process
- Compliance of valid emission protection guidelines
- No undesirable substances like TAR etc.
- No external heat sources or energy supply necessary
- Application of the latest technologies of degassing and gasification
- Direct electricity generation in generators driven by gas engines
- The INTEC synthesis gas plant is not a pyrolysis plant
- The modular and redundant design with multiple production lines of the INTEC SG Series ensure continuous operation also during maintenance and repair
- The INTEC Thermolytic Cracking Process (INTEC-TCP®) technology is ecologically and economically superior to other methods of generating energy from organic waste

Between the year 2000 and 2011 in Germany was working a Test-Plant:

Overview on campaigns during operation

Year	Campaigns	Tasks
2000	Campaigns 01-04	Commissioning, evaluation compact gas scrubber
2001	Campaigns 01-09	Evaluation control algorithms and start-up chains, process air supply, carbon reefed, residues discharge, proof of continuous process guidance
2002	Campaigns 04-11	Commissioning of the waste conditioning facilities in automatic mode, evaluation of central devices, control engineering, performance tests thermal array
2003	Campaigns 05-11	Mechanic assessment of the input conditioning systems and dryer, stable process guidance, evaluation of safety routines
2004	Campaigns 04-10	Mechanic assessment of the input conditioning systems and dryer, stable process guidance, evaluation of safety routines, stress tests for the thermolysis chamber, gasifier, gas scrubbing, etc.
2005-2008	Campaigns 12-23	Conditioning improvements of input material and external dense-material separation to achieve a high-grade refuse derived fuel, examination of plant and device functionality during continuous operation
2009	Campaigns 24-27	Continuous operation evaluation, throughput increase, breakdown tests, alignment of process models
2010	Campaigns 28-30	Optimisations based on the findings of Campaigns 12-23, examination of plant and device functionality, further optimisation of the throughput to 3.3 t/h, increase of gas quality by amendments of the thermal array amongst others by oxygen supply
2011	Campaign 31	Completion of the long term evaluation, further continuous operation after the renewed operation approval according to the German Federal Emission Act (BImSchG)

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

The INTEC-Gasification-Plant has a modular design - high availability, scalable and expandable.
Each reactor has a throughput up to 3,3 t/h conditioned organic waste.

Utilisable input materials - for example		
Household waste Hospital waste Plastic, also PVC Industrial waste	Waste oils Waste rubber Waste tyres Hazardous waste	Sewage sludge Bio-waste Residues from paper industries, etc.

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

The INTEC-SG Plant is a Gasification Plant working with different temperatures:

- **Synthesis Gas Plant:**

  In the INTEC Thermolytic Cracking Process (INTEC-TCP®), all types of organic substances, substitute fuels and biomass are converted into a high-quality synthesis gas in several process steps.

  In the INTEC Thermolytic Cracking Process (INTEC-TCP®), all types of organic substances (as described before), substitute fuels and biomass are converted into a high-quality synthesis gas in several process steps.

  The gasification process is completely closed. Therefore, no emissions occur during the production of the synthesis gas.

  The main components of the Synthesis Gas plant

• **Main Reactor**:	Working temperature: 350°C to 500°C
• **Second Reactor**:	Working temperature: 500°C to 750°C
• **Third Reactor**:	Working temperature: 750°C to 850°C
• **Crack Reactor** for liquids (oil etc.)	Working temperature: up to 900°C
• **Gas Cleaning**:	The residues from gas cleaning are mainly particles of tar and oil. These residues are returned to the crack reactor where they are gasified.

The processes are the following:

1. Waste reception with water treatment
2. Pre-sorting
3. Waste processing
4. Gasification
5. Interim gas storage
6. Power generation
7. Post-combustion power generation
8. Medium-voltage plant and power feed-in

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

The benefits of the INTEC-SG Plant are the following:

General Benefits:

- Power generation of up to 1.8 MWh from one tonne of organic waste
- Carbon conversion to synthesis gas more than 99 %
- Thermal total efficiency degree approx. 88 %
- High availability due to modular and redundant design

Environmental Benefits:

- No flue-gases
- No dioxins and furans
- No residues such as oil, tar or the like
- No incineration

- Synthesis gas generation in closed system
- The INTEC Synthesis Gas System is not a pyrolysis system
- No external heat source required – autothermal process
- Compliance with valid emission control acts and guidelines

Further Advantages:

- Most modern technology Made in Germany
- Administrative approval in Germany for plant operation
- Very low electricity generation costs per kWh
- High profits for the operator

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

Because of logistik issues (the number of garbage-trucks, which have to access the bunker to leave the waste in the plant) we recommend to implement 2 INTEC-SG plants, each with a capacity of 2,100 tons of waste per day.

The investment amount per plant will be approx. 672 Million Euro per plant.

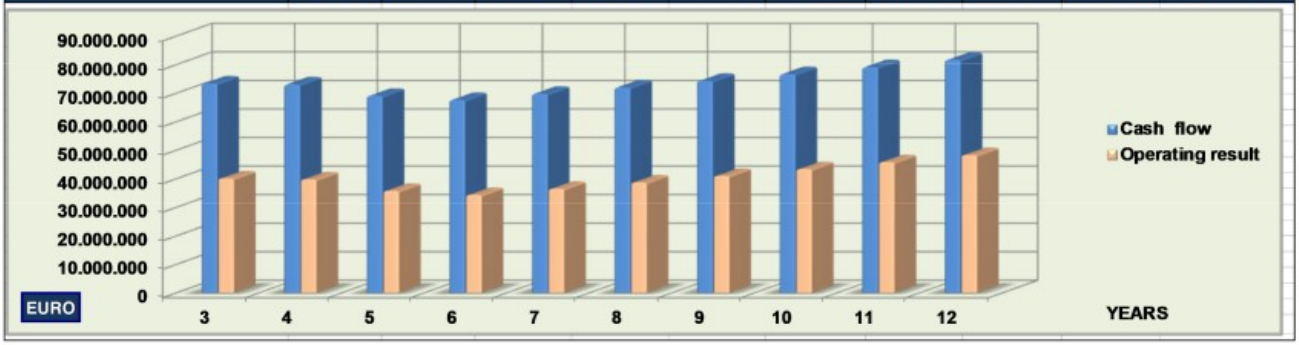
For the Financial Approach we are using the following parameter (one plant):

1.	Input on the Scale	Day / Year approx.	t	2112	756.800
2.	Moisture Waste and Inorganic		%	50,00 %	454.080
3.	Input on Reactor	Day / Year approx.	t	1267	
4.	Revenue per ton of waste		Euro	74	
5.	Revenue per kWh of electricity		Euro	0,028	
6.	Revenue per ton of coke		Euro	95	
7.	Revenue per Renewable Energy Credits		Euro	0	
8.	Total Turnover		Euro	85132967	
9.	Internale Rate of Return		%	10,87 %	
10.	Capital payback period		Years	9,13	
11.	Ratio Financing	Equity - Debt		100 %	0 %
12.	Production Costs per kW electrical current	without Loan Interest	Euro	0,0282	
13.	Production Costs per kW electrical current	including Loan Interest	Euro	0,0282	
14.	Production Costs per m Gas	without Loan Interest	Euro		
15.	Production Costs per m Gas	including Loan Interest	Euro		
16.	Total produced quantity of Gas	per Year	m3	197.297.760	
17.	Electricity generated in MW	hour / year	MWh	98,11	843.787
18.	Produced coke for sale	hour / year	t	6,34	54.490
19.	Revenue from electrical power	per Year	Euro	23.626.025	
20.	Revenue from solar energy	per Year	Euro	327.230	
21.	Revenue from electronics recycling	per Year	Euro		
22.	Revenue from coke	per Year	Euro	5.176.512	
23.	Revenue from CO2 certificates	per Year	Euro		
24.	Creation of new jobs	labors / 3-shifts	Employees	333	

PLANNING CALCULATION 10 YEARS - PROJEKT INTEC in USA - MIAMI

Miami INTEC SG 400	3rd year EUR	4th year EUR	5th year EUR	6th year EUR	7th year EUR	8th year EUR	9th year EUR	10th year EUR	11th year EUR	12th year EUR
Total turnover	85.132.967	87.686.956	90.317.564	93.027.091	95.817.904	98.692.441	101.653.214	104.702.811	107.843.895	111.079.212
Working material	2.353.132	2.423.726	2.496.438	2.571.331	2.648.471	2.727.925	2.809.763	2.894.056	2.980.877	3.070.304
Personnel expenditures	7.506.000	7.731.180	7.963.115	8.202.009	8.448.069	8.701.511	8.962.556	9.231.433	9.508.376	9.793.627
Insurance	201.491	207.536	213.762	220.175	226.780	233.583	240.591	247.809	255.243	262.900
Maintenance		2.545.120	8.833.820	12.607.427	12.859.894	13.117.420	13.380.106	13.648.055	13.921.375	14.200.171
Other costs	1.529.827	1.575.722	1.622.993	1.671.683	1.721.834	1.773.489	1.826.693	1.881.494	1.937.939	1.996.077
Total costs	**11.590.450**	**14.483.283**	**21.130.128**	**25.272.624**	**25.905.047**	**26.553.927**	**27.219.709**	**27.902.847**	**28.603.810**	**29.323.079**
Calculated interest										
Depreciation	33.331.845	33.331.845	33.331.845	33.331.845	33.331.845	33.331.845	33.331.845	33.331.845	33.331.845	33.331.845
Operating result	40.210.672	39.871.828	35.855.591	34.422.622	36.581.012	38.806.669	41.101.661	43.468.119	45.908.241	48.424.288
Cash flow	73.542.517	73.203.672	69.187.436	67.754.467	69.912.857	72.138.514	74.433.506	76.799.964	79.240.085	81.756.133
Cash-flow Gross Margin (in %)	**86,39%**	**83,48%**	**76,60%**	**72,83%**	**72,96%**	**73,09%**	**73,22%**	**73,35%**	**73,48%**	**73,60%**
Profitability (of borrowed capital)					**-24,64%**	**-20,40%**	**-17,48%**	**-15,35%**	**-13,73%**	**-12,46%**
Profitability (of equity capital)										
Return on Capital	**10,95%**	**12,24%**	**13,18%**	**14,87%**	**18,02%**	**22,68%**	**30,27%**	**44,79%**	**83,71%**	**530,06%**
Payback TOTAL investment (years)	9,13	8,17	7,59	6,73	5,55	4,41	3,30	2,23	1,19	0,19

Internal Rate of Return	IRR	10,87%				Net Present Value		NPV	EUR	1.040.742.729,93
EBITDA	73.542.517	73.203.672	69.187.436	67.754.467	69.912.857	72.138.514	74.433.506	76.799.964	79.240.085	81.756.133
EBIT	40.210.672	39.871.828	35.855.591	34.422.622	36.581.012	38.806.669	41.101.661	43.468.119	45.908.241	48.424.288



2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

The potential revenue streams of the INTEC-SG plant are:

- energy production
- tipping fee
- material recovery (glas, metal)
- sales of coke

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.). The site for the INTEC facility should ideally be located near the landfill. This ensures that existing traffic routes for garbage trucks are not altered.

During the pre-engineering phase, INTEC, in collaboration with the client, prepares all the necessary documentation so that a local construction company can carry out work such as earthworks and cement works, steel and hall construction, the erection of buildings, and general infrastructure. At the end of the pre-engineering phase, INTEC provides the client with all the necessary documentation. The client should provide an architect and three or four colleagues for supporting work.

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

The site size should be approx. 120,000 m² (approx. 12 hectares) for one plant. This area includes all INTEC plant components, as well as halls and buildings, roads and parking lots, and all infrastructure components.

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.
This is not a task for INTEC.

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.
This is not a task for INTEC.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

INTEC plans approximately 4 months for pre-engineering
The construction will take approx. 3 years. INTEC will construct the 2 plants parallel and will deliver them turnkey – with all employees trained in their job, ready to start operation.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

See C. Financial Approach
All the spare parts for the maintanance plan of the first operational year are included in the purchase price of the plant.

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

For Health/Safety see attached file "***INTEC SG Series Safety Concept.pdf***"
For Environmental see attached file "***INTEC SG-System_Emissions-Plant Units.pdf***"

E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

The following contracts will be signed with INTEC:

- Pre-Engineering Contract
- Delivery-Contract
- License-Contract

The Pre-Engineering-Contract includes the following objects/services:

1. Survey/data collection for property, infrastructure, regulations on-site
2. Task settings / initial considerations
3. Development plan for the installation site
4. Assessment of the conditions at grid connection point
5. Basic concept for security and environment related requirements
6. Documentation of environmental compatibility
7. Comprehensive Business Plan
8. Project Organigram
9. Rough schedule planning
10. Description of plant capacities
11. Complete process description
12. General procedural layout design after evaluation.
13. General layout design of the peripheral facilities
14. General building planning
15. Scheme of the internal supply lines
16. Draft layout plan for the complete project
17. Description of the plant components
18. Description of interfaces
19. Scope of delivery – preparation of machinery and equipment lists
20. Block diagrams for individual components and the complete project.
21. Description of the raw materials
22. Description of auxiliary media
23. Description of the input materials
24. Description of process residual materials
25. Quantity-, mass- and energy balances
26. Provision of documents necessary for approval procedures
27. Preparation of an internal logistics concepts
28. Personnel plan for assembly and plant operation

1. Fundamentals

Technological processing plants are to be built and to be operated in a way that no threats for the staff working with it, for the population in vicinity and for the environment arise.

The safety classification of a plant depends not only on itself but also depends on numerous other influencing factors such as products to be treated, chemical reactions, processes, technologies, technical equipment and last but not least the operator.

2. Substances

The threats possibly emanated by a plant are crucially determined by the substances utilised.

Substances can be flammable, explosive, toxic or hazardous to the environment. Therefore, an important aspect regarding plant safety is the prevention of incidents such as fires, explosions and the release of hazardous substances. The safety-related parameters of substances are hence documented by

- Thermal stability of substances or substance and reaction mixtures
- Burning and explosion behaviour of gases, vapours, fluids and solids
- Behaviour of dust turbulences
- Behaviour of dust deposits
- Safety of chemical reactions

3. Procedures

In technological processing plants, marketable products are manufactured by means of a mechanical, thermal and/or chemical treatment respectively conversion.

Therefore, all possible conditions and incidents during operation need to be evaluated.

4. Plant Technology

Safety of the technical design of a plant with the associated devices and machines is largely influenced by construction and choice respectively quality of components. This also comprises process control engineering, which manages complex safety tasks for technological plants.

For process and plant safety, numerous acts and regulations exist, which are to be pursued and adhered to:

- Compliance with regulations and guidelines (e.g., occupational safety, immission protection, other safety regulations, fire protection regulations)
- Safety-related calculations
- Safety concepts

5. Hazard Identification and Assessment of INTEC Synthesis Gas Systems SG Series

Hazard identification and assessment for the plant technology of the INTEC SG Series base on the experience to-date, performed tests and the continuous operation of the first installed plant of the INTEC SG Series. This plant operated between the years 1998 and 2011 and received the official approval for the industrial operation regarding plant safety, environmental compatibility (water pollution) and emissions.

For a target-orientated hazard identification and assessment, a consistent detail analysis on the preconditions for the occurrence of a hazard:

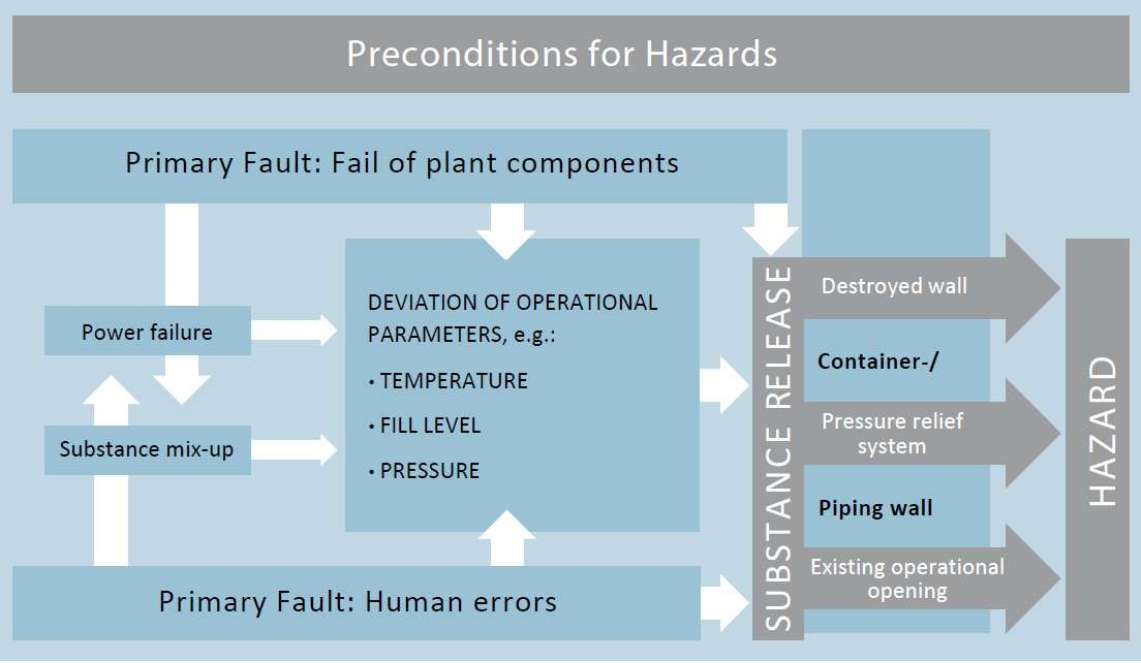


Illustration 1: Schematic depiction for causes and courses of an incident.
Translated after: International Social Security Association: (Ed.): „Praxisbewährte Methoden", page 29. Heidelberg/Germany, 2012.

Principally, two primary fault areas are distinguished:

- Failure of plant components (technical fault)
- Human errors (organisational deficiencies)

Several manifestations can be respectively attributed to these:

- Power failure
- Substance mix-up (unwanted substance pairing)
- Deviations of operational parameters

Herby accompanying, a fault assessment with an according questionnaire is carried out (see Illustration 1).

The Failure Mode and Effects Analysis (FMEA) is an inductive analysis method for the detection of failures and their valuation in the fields of construction and manufacture.

- Design-FMEA:
  For the design and construction optimisation already starting with design drawings in order to achieve functional reliability and safety
- Process-FMEA:
  Assessment of the construction, production and operational phases for CE Conformity according to the valid European Directive on Machinery 2006/42/EG (in Germany implemented by the ninth Product Safety Act ("9. ProdSV – Maschinen-verordnung" in the version from 8th of November 2011).)

Primary failure sources	Failure of plant components	**1.1 Failure of active components** (e.g., pumps, agitators, compressors, kneaders, centrifuges) **1.2 Failure of installation parts** (e.g., stirrers, static mixers, filter, propeller blades, drive shafts, column trays) **1.3 Blocked flows** (e.g., plugging, blocked valves, agglutinated valves, forgotten blanking spades, blocked pressure relief systems) **1.4 Failure of proces control equipment** (e.g., overfill prevention, pressure/ temperature limiter, flow-meters, controls, analysers, explosion suppression devices)	**1.5 Activation of potential ignition sources in Ex-Zone 0/1 resp. 20/21** (e.g., overheated parts, mechanical sparks, elektrical sparks, static electricity) **1.6 Breakdown of inner walls** (z. B. cooling coils, heating jacket, multi-channel tank separators) **1.7 Failure of flow-avoiding measures** (e.g., check valves, flame-traps, degradation locks **1.8 Failure of outer circumvallation** (z. B. Container wall, pipings, flange couplings, shaft seals, pressure relief systems, shut-off devices)
	Power failure	**2.1 Electrical energy for drives / heating** **2.2 Electrical energy for process control** **2.3 Control air** **2.4 Pressure air** **2.5 Cooling water**	**2.6 Brine circuit** **2.7 Cooling devices** **2.8 Steam** **2.9 Heating circle** **2.10 Inert gases (amongst others, nitrogen)**
	Human errors	**3.1 Omittance of relevant hand movements** (e.g., omittances of shut-down, dosing or switching) **3.2 Execution of prohibited actions** (e.g., locking, starting heaters, opening of plant components, bypassing, mechanical damaging)	**3.3 False execution of actions** (e.g., wrong location, point in time, hand movement, substance, course, connection or time span) **3.4 Maintenance/repair fault** (e.g., wrong assembly part, incomplete installation, forgotten tools, oversighted faults)
Corresponding questions	Unwanted substance pairings	**4.1 Mixing of substances which react together** (e.g., alkaline or acidic solutions) **4.2 Reaction-triggering impurities** (e.g., corrosion products, catalytically active impurities, crystal seeds, polymer seeds, product) **4.3 Wrong product/material pairings** (e.g., chlorine with non-ferrous metals)	**4.4 Hot and cold liquids** (e.g., water in meltings or in hot products **4.5 Dangerous explosive atmospheres in inerted plant complexes** (e.g., intruded air, released oxygen, sucked and not displaced air, exeeding oxygen limiting values) **4.6 Dangerous explosive atmosphere by high/ low substance concentration inside/ outside of plant components** (e.g., exceeding/deceeding explosion limits, whirled dust, gas release)
	Deviation of operational parameters	**5.1 Pressure (-difference)** **5.2 Temperature (-difference)** **5.3 Filling level (max./min.)** **5.4 Flow rate (max./min.)** **5.5 Flow direction**	**5.6 Reaction time** **5.7 Dwelling time** **5.8 Viscosity** **5.9 pH-value** **5.10 mix ratio, concentration** (e.g., too high, too low, demixing

Illustration 2: Questionnaire for reasons and course of an incident.
Translated after: International Social Security Association: (Ed.): "Praxisbewährte Methoden", page 29. Heidelberg/Germany, 2012.

Furthermore, the safety concept comprises:

6. Emergency Stop System

The activation of the emergency stop system respectively its triggering by measuring technology or malfunction induces measures according to the safety controls, which can lead to halt of actuators, processes or to an emergency mode respectively stand-by according to the dedicated emergency situation and its valuation.

Stand-by operation means to maintain of the procedural conditions with an interruption of the material stream in the thermal array.

Following concepts are implemented:

- Separation into emergency stop areas (area and function specific) and emergency stop categories, e.g., for transport and conveying systems or for functional units
- To avoid endangerments for persons and machines, regulated shut-down is always preferred by consideration of the emergency stop situation (integration of emergency programs)
- In case of unexpected emergency situations, e.g., outage of both process gas fans, the functional units are automatically evacuated so that a hazardous situation cannot occur.

Execution of emergency stop measures are assessed by a risk evaluation of the plant, machines, conveyors, engines etc. including electrical equipment according to DIN EN ISO 12100 "Safety of machinery - General principles for design - Risk assessment and risk reduction" as well as according to DIN EN ISO 13849-1 "Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design".

7. Emergency Power Supply

To avoid a power outage, process control and sensors as well as other smart devices are protected against short-term interruptions by an industrial UPS (Uninterruptible Power Supply). To ensure a regulated shut-down respectively to bridge the time of a power outage, an emergency power supply is integrated. It can be designed either for the shutting-down operation, for stand-by or as an option for the complete operation.

The emergency power supply is ensured by a Diesel emergency power generator.

8. Gas Monitoring System

The gas monitoring system bases on the ATEX guidelines („ATmosphère EXplosible“) issued by the European Union.

Currently, the directive comprises two guidelines in the fields of explosion safety, namely the ATEX product guideline 94/9/EG and the ATEX operational guideline 1999/92/EG.

Selection and installation of the corresponding gas monitoring system (stationary gas monitoring) comply with the requirements of the DIN EN 14181 and the DIN EN 13284-2 (Determination of emissions with automatic measuring devices and electronic computing systems) as well as with the VDI Guideline 3950:2006-12 (Emissions from stationary sources – quality assurance for automatic and electronic measuring devices; amongst others gas alarm systems, CO sensors, switch boards for ventilation and smoke units).

9. Emergency Gas Flare System

In exceptional cases it can occur that the produced synthesis gas cannot further processed in the electricity generators. The exceeding gas shall not be released into the atmosphere, it shall be disposed of in an environmentally appropriate manner. For this emergency disposal, gas flares are installed. The emergency gas flare system is an integral part of the INTEC Synthesis Gas System.

The gas flare system is designed according to the total thermal capacity (Megawatt) of the INTEC Synthesis Gas System. Operation of the emergency flare system takes place only during maintenance and repair or during operational disruptions. Ignition is carried out automatically with an also automated flame control in dependence of the pressure.

The operation of the emergency gas flare complies with the German emission protection acts and guidelines according to the *TA Luft* (Technical Instructions on Air Quality) and the *BImSchG* (Federal Immission Protection). The emergency gas flare system also complies with the requirements of the DIN EN 746 (safety requirements for industrial thermo-processing equipment).

10. Explosion Protection

Only during shut-down events as described before, the inner plant (synthesis gas generation and processing respectively synthesis gas conversion into energy) needs to be categorised in Zone 2 according to ATEX ("rare and short-term occurrence"). In all other cases, no explosive danger exists and a zonal categorisation is not necessary.

Due to the gas-proof design of the machinery and the under-pressure operation, gas leakage cannot occur so that no explosive gas/air mixtures can be built-up. Under-pressure in the plant is ensured by redundantly designed process gas fans.

In case of malfunction, all shutters (pneumatic, spring-returning) in the gas paths are opened to ensure under-pressure in and deaeration of the gas paths. Also in case of an incident, a shut-down with disposal of the exceed gas is ensured.

In the unlikely case that gas does exceed during an incident, this is detected by the installed gas warning system. To avoid build-up of explosive gas-air mixtures, a smoke and heat exhaust system is installed.

To allow a safe shut-down during gas incidents, the power supply for the plant units is divided into two circuits for explosion protected and non-explosion protected components.

11. Fire Prevention

An integrated fire detection system according to DIN 14675:2012-04 (Fire detection systems – installation and operation) within the existing fire detection and explosion prevention systems are installed within the complete processing and production area. An automated signal forwarding to the nearest fire department takes place according to DIN EN 50136 (Alarm systems – alarm forwarding devices and installations) where applicable. The fire detection system is also integrated in the explosion prevention installations. As extinguishing device serve sprinkler devices in processing and production halls.

12. Lightning Protection

The complete plant complex is equipped with a lightning protection system according to DIN EN 62305 lightning protection level II and I including remote monitoring.

All safety-related devices and hazard detection systems are equipped with overvoltage protection units.

13. Noise Protection

The plant complex is designed in the way that the limiting value of maximum 65 dB(A) in 1 m distance from the respective production building and within the production building the limiting value of maximum 85 dB(A) according to the TA-Lärm (German guidelines on noise emissions) are not exceeded.

14. Process Control

The complete INTEC Synthesis Gas System is controlled by a Siemens process control system. This control system also integrates maintenance and repair and diagnostic functionality.

As automation systems serve Siemens controls. The periphery is mainly connected in a decentralised way via redundant Profibus. Since the complete control system and its components including software is supplied by Siemens, a diversification is avoided which ensures an easy spare and ware parts logistic.

To minimise plant system failures, the highest possible redundancy of components is implemented:

Following components are affected:

- Bus systems (installation bus and terminal bus)
- Decentralised process relevant peripherals
- Controls
- Server
- Process relevant sensors
- Safety relevant actuators (e.g., process gas fans)

Failure of a sensor does not lead to a process termination – process relevant sensors are duplicated. The process continues and a message or warning is issued to identify the defect component. Exchange of the affected component is carried out during operation.

As far as technically possible, sensors and metrology are equipped with diagnosis functions in order to perform self-diagnosis or diagnosis by the control system. By taking advantage of components with diagnosis function, gradual failures can be detected and appropriate measures can be executed prior to a complete failure.

Process and safety relevant components are integrated in the maintenance system. In case of failures of process relevant plant components, a regulated stand-by or regulated shut-down is executed. An arbitrary complete shut-down of the plant is excluded.

15. Emission Performance of the Gas Engines

The synthesis gas treatment (filtration, gas scrubbing) in combination with the operation mode of the gas engine control ensure that the emission parameters of the engines comply with the strong German regulations. These are based on the on the limiting values as postulated in the *TA-Luft* (Technical Instructions Air) in the framework of the *BImSchG* (German Federal Law on Immissions).

16. Concluding Remarks

The advantages of the INTEC Thermolytic Cracking Process (INTEC-TCP®) for the generation of a clean and energised synthesis gas base on a complex application of procedural and technological solutions for the gasification of carbonic material. To achieve a high efficiency degree, the gasification technology needs to follow the dedicated properties of the carbon-containing solid fuels.

By consideration of the dedicated properties of the relatively high proportion of volatile substances in the fuel material in combination with the approach of a high carbon conversion, the constructive requirements for a new generation of gasification technologies are deducted.

The features are summarised as follows:

- The new technology for the energetic recovery of carbonic residues was developed in a 1:1 scale synthesis gas plant. Scaling effects with larger plant sizes do not occur since only the number of production lines will be increased.
- The technology bases on a new procedural solution for the gasification of high-calorific waste and residues (INTEC Thermolytic Cracking Process – INTEC-TCP®).
- The new procedural approach economically and ecologically complies with the requirements of modern standards:
  - Very advantageous mass-performance ratio
  - Considerably high efficiency degree
  - Carbon conversion > 99 %
  - No dioxins and furans, tar- and particulate-matter-free synthesis gas
  - Emission-free synthesis gas generation

Synthesis-Gas Systems INTEC SG 30 to SG 900

comprising:

1. **Plant Component 1: Waste Sorting Plant INTEC WS System**
2. **Plant Component 2: Synthesis Gas Plant INTEC SG System**
3. **Plant Component 3: Power Generation Plant INTEC PP System**

1. Plant Component 1: Waste Sorting Plant INTEC WS System

1.1 Basics

The waste and residuals utilised for the synthesis gas generation need to meet certain parameters. This applies for material composition, particle size and moisture.

In several subsequently following process steps, non-treatable materials such as metals and glass are sorted out and the remaining utilisable material will be shredded and pre-dried.

The energy required for drying is provided as waste heat, which is produced in different areas of the system.

All relevant system components are equipped with electric drives.

1.2 Emissions

No emissions of pollutants are released!

2. Plant Component 2: Synthesis Gas Plant INTEC SG System

2.1 Basics

The pre-treated solid waste is processed into a synthetic heat gas in a multi-staged process consisting of degassing and gasification in combination with different chemical reactions.

All relevant plant components are equipped with electrical drives.

2.2 Emissions

No emissions of pollutants are released!

2.3 Emissions of the Emergency Torch and Limiting Values According to *TA-Luft* *)

Temporarily occurring gases during initial start-ups of an INTEC SG Plant (2-3 times per year, 4-5 hours each time) – to reach process temperature from ambient temperature – are conveyed to the emergency torch and burned. These flue-gases accrue from the initial fuel materials such as wood pellets, char coal or similar.

For security reasons, this applies as well for occasionally occurring exceed gas.

During operation of the emergency torch, following limiting values are valid:

Substance	**TA-Luft***	**Emergency Torch**
NO_x Limiting Values	250 mg/m³	200 mg/m³
CO Limiting Values	80 mg/m³	73 mg/m³
SO- Limiting Value Sulphur Di-/Trioxide	400 mg/m³	350 mg/m³
Other Limiting Values		
Hydrogen Chloride	50 mg/m³	30 mg/m³
Hydrogen Fluoride	3 mg/m³	< 3 mg/m³

Due to the patented INTEC-TCP® technology, the limiting values according to *TA-Luft* are undercut respectively are adhered to.

*) The *TA-Luft* is Germans well-known "Technical Instructions on Air Quality Control" regulates the control of air pollution according to the "Federal Control of Pollution Act" *BImSchG* as issued 24th of July 2002.

3. Plant Component 3: Power Generation Plant INTEC PP System

3.1. Basics

During implementation of the provisions of the Kyoto Protocol and the procedural approach according to the EU-white paper "Energy for the Future" to reduce CO_2 emissions, the INTEC power plant driven by synthesis gas are equipped with specifically modified gas Otto-engines of the latest generation. These can be optionally supplemented with cogeneration and waste heat conversion units (ORC).

To observe NO_x limiting emission values of < 500 mg/Nm³ according to TA-Luft, the engines are driven with a regulated air exceed. To obtain the desired power density notwithstanding the surplus air, the engines are equipped with fuel mixture-generation system turbo-chargers and fuel mixture-cooling systems. Distinctions in the laminar flame velocity triggered by possible fluctuations of the gas composition and the heat value of the synthesis gas (depending on input material) are compensated by a corresponding engine control.

Following diagram illustrates typical emission courses (NO_x, CO and HC) by means of Lambda control (excess air regulation).

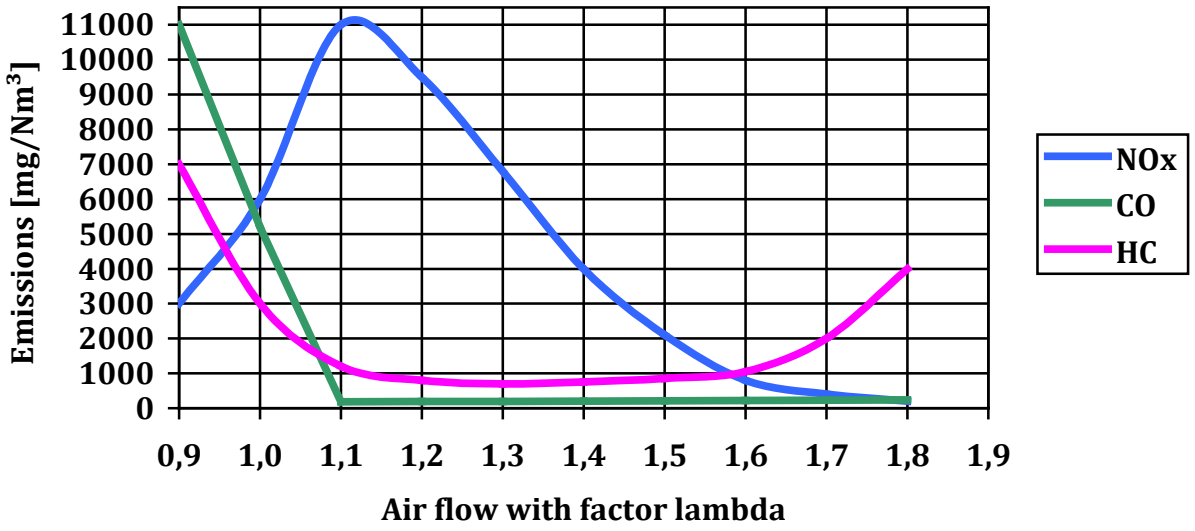


Diagram 1: Typical courses of emissions

3.2. Operation Mode of the Engines

The gas Otto-engines are driven in lean-operation mode. The resulting CO emissions are reduced with oxidation catalysers to CO values < 300 mg/Nm³.

Other pollutants like aldehydes occur only in marginal proportions due to the clean combustion in a gas Otto-engine.

3.3. Emissions of INTEC Gas Engines and Limiting Values according TA-Luft *)

	TA-Luft	**INTEC engine**
NO_x Limiting Values		
Lean Engines	500 mg/m³	< 438 mg/m³
CO Limiting Values		
Natural and Other Gases	300 mg/m³	211 mg/m³
SO Limiting Values		
Sulphur Di- and Trioxide	350 mg/m³	250 mg/m³
Other Limiting Values		
Formaldehyde	60 mg/m³	<10 mg/m³

Thus, the limiting values according to TA-Luft are undercut respectively adhered to.

*) The TA-Luft is Germans well-known "Technical Instructions on Air Quality Control" regulates the control of air pollution according to the "Federal Control of Pollution Act" BImSchG as issued 24th of July 2002.

Goldfinch

Market Research Response

MARKET RESEARCH

Prepared for:

Saba Musleh, Miami-Dade

Presented By:

Goldfinch X

Katherine Doerr, CEO & Founder

March 2025

Our Company

Founded in 2017 Goldfinch is a waste to value consultancy, trading house, and commercial ready developer. As a developer Goldfinch builds to own and operate municipal solid waste ("***MSW***") material recovery facilities ("***MRF***") throughout North America for the recovery of plastics, metals, OCC, electronics, and organics (our "***Final Products***"). Our waste to value developments are built in two stages when necessary.

Phase 1 focuses on the successful recovery and sale of all of our Final Products. Plastics are split into a minimum of three categories; sometimes more based on demand. Phase 1 commits to a minimum recovery of 70% of the inbound MSW.

Phase 2 focuses on the conversion of organics into energy through anaerobic digestion ("***AD***") if no other company has an interest in the stream that is economically viable. Organics from MSW ("***OFMSW***") are a great feedstock for RNG, electricity, and steam generation. This energy can be for sale to the County if desired.

Goldfinch specializes in landfill diversion for both the public and private marketplaces. Goldfinch is not a recycler, and specializes in producing client specific, high quality streams desired by our recycling partners while giving them market security through long term, fixed price contracts. These contracts simultaneously support the construction and operation of our recovery facilities. Recycling is prioritized over energy generation.

Goldfinch is majority owned by Katherine Doerr, and is a certified female owned business.

A. RESPONDENT

B. WASTE MANAGEMENT SOLUTIONS

The Solution.

Goldfinch proposes to develop, build, own, operate, and maintain a MRF and AD system to divert MSW away from landfill and incineration on behalf of Miami-Dade County (the "***County***"). All recovered products will be sold to recyclers prior to ground break via long term contracts. Goldfinch is certain that sortation will be cheaper, better for the environment, and quicker to action than a new incinerator or landfill as proposed in the Second Update on Directive No. 241676.

The Effectiveness.

MSW sortation and AD are tried and true solutions for landfill diversion when financially underwritten in a manner that aligns the interest of all involved parties. Multiple MSW sortation system are in operation today, and historical data is available proving their ability to successfully recover various materials for recycling and energy production. If desired, Goldfinch is able to share the performance parameters of our first plant with the County.

The Technologies.

MSW Sortation	Goldfinch is partnered with a U.S. based MRF vendor for the entire EPC of our sortation systems. Our desired vendor has 1,000s of hours of data showing successful recovery of all Final Products.
Anaerobic Digestion	Goldfinch is partnered with U.S. based vendors and contractors for the entire EPC of our organics upgrading systems. Our vendors have 1,000s of hours of data showing the successful conversion of organics into biogas and beyond.

B. WASTE MANAGEMENT SOLUTIONS

The Benefits.

Benefit Type	**Quantification & Qualification**
GHG Reductions	Direct recycling of post-consumer waste streams (including plastics, metals, and papers) into new materials is found to result in a GHG reduction ranging from 0.82 kg CO2-eq./kg to 1.37 kg CO2-eq./kg when compared to incineration with energy recovery. For landfilling, GHG savings range between 0.3 and 1.8 kg CO2-eq saved depending on the material type. The above savings is equal to removing an average of 76,000 gasoline cars from Miami roads per year if 1,000 tons per day of plastics, metals, and papers are deviated from incineration and into recycling systems.
Cost Reductions	MSW Sortation with Goldfinch is conducted free of charge. This results in a drastic reduction in costs associated with landfilling and and incineration. Online data suggests Miami currently pays $300 million annually with an operating incinerator, and up to $580 million without incineration. In Phase 1 alone Goldfinch is able to reduce these costs by 30% based off of national average recovery estimates. ***Organics processing is negotiated at a separate rate after the final product is chosen.*
Time Savings	Once a MSW supply contract and land lease are signed for the MSW sortation system Goldfinch is able to reach commercial operation within 2 years. This is almost 8 years faster than bringing online a new incinerator.

B. WASTE MANAGEMENT SOLUTIONS

The Quantities.

Goldfinch's plants are build in trains of 40 tons per hour. Each asset runs two shifts per day, five days per week. At this rate Goldfinch can sort the following tons per day and per year as desired by the County:

Used in this proposal

TPH	40	80	120	160	200
TPD	560	1,120	1,680	2,240	2,800
TPY	145,600	291,200	436,800	582,400	728,000

Phase 1: In Phase 1 Goldfinch commits to recovering all plastics, metals, papers, electronics, and organics. Based on EPA averages this accounts for an average minimum of 70% of residential and commercial MSW. A Goldfinch MRF is adaptable between residential, commercial, and industrial MSW. Our systems are also suitable for SSR.

Phase 2: In Phase 2 Goldfinch develops to build, own, and operate an anaerobic digester for the conversion of OFMSW into biogas. From biogas we are able to produce RNG, CNG, LNG, hydrogen, or electricity. A decision on the final product is made in conjunction with local demand. Goldfinch believes this energy product might be of interest to the County to reduce local carbon emissions associated with brown power consumption.

Please Note: depending on the financial structure determined between the County and Goldfinch Phase 1 and Phase 2 can be developed and brought online simultaneously. There is also a scenario in which Phase 2 does not occur. This could include relocating the organics to landfill for LFG generation, or incineration for cleaner electricity production

C. FINANCIAL APPROACH

The Costs.

Not Applicable for Phase 1. Goldfinch's MSW Sortation offering does not look to burden the County with any incremental cost of diversion from landfilling or incineration. All operating costs are borne by Goldfinch and supported through Final Product sales.

In order to financially support Phase 2, if desired by the County, a tip fee will be negotiated roughly in-line with current disposal rates.

The Funding Model.

Goldfinch is a privately owned infrastructure firm. Goldfinch develops to build own and operate MSW sortation and AD systems utilizing its own private funds. Goldfinch does not rely upon any public funding, or any federal or state grants.

The Revenue.

Goldfinch supports the construction and operation of Phase 1 entirely through Final Product sales. Goldfinch does not operate MSW sortation through the traditional tip fee model.

Goldfinch looks to support Phase 2 solely through energy sales, however current markets do not support AD construction and operation. With that Goldfinch is able to negotiate a balance between an organics tip fee and energy sales to support asset development and operation.

D. IMPLEMENTATION APPROACH

Our Role.

Goldfinch is a master developer to build, own, operate, and maintain. We source third party technologies for the overall design, but are involved in the full plant design and construction from start to finish. Goldfinch looks to retain ownership of all of our plants through their useful life.

Our Size.

Phase 1 MSW Sortation	For 2,240 tons per day of MSW sortation Goldfinch needs ten acres of land. Utilities required are electricity, potable water, sewage, and internet.
Phase 2 MSW Sortation	For 851 tons per day of organics Goldfinch needs five acres of land. Utilities required are electricity, potable water, sewage, natural gas, and internet. ***On average 38% of MSW is organic material.*

Operations & Maintenance.

For a 2,240 ton per day contract Goldfinch will employ 30 personnel for Phase 1, and an additional 10 full time employees for Phase 2. Our systems operate only two shifts a day, five days a week. The third shift and weekends are strategically reserved for maintenance and repairs so that there is limited impact to plant operating capacity.

D. IMPLEMENTATION APPROACH

Timing.

If selected to build Phase 1 Goldfinch expects roughly three (3) years from selection until operation. This accounts for one (1) year of contract negotiations, permitting, and design, and two (2) years for construction. Phase 2 can completed within this three year window as well if desired.

Permitting.

Phase 1 **MSW Sortation**	Solid Waste Permit Construction Permit
Phase 2 **Anaerobic Digestion**	Minor Source Air Permit Construction Permit

Site Ownership.

Goldfinch prefers to develop an asset on property owned by the County that is already permitted for solid waste, and can receive a minor source air permit. Siting is the only challenge Goldfinch foresees for this development.

A possible location for a MRF and AD system owned by Goldfinch is somewhere within the bounds of the closed landfill adjacent to the Doral Incinerator. Geo-technical work will need to be done to determine a financially viable location within the closed landfill that does not disrupt LFG collection but Goldfinch is optimistic of a positive outcome. Goldfinch is also open to other locations as suggested by the County.

Goldfinch looks to lease the land we will build and operate on through a 20 year or more real property lease at a fare market rate.

D. IMPLEMENTATION APPROACH

Health, Safety, & the Environment.

	Phase 1 **MSW Sortation**	**Phase 2** **Anaerobic Digestion**
Health	Each year 200,000 people in the United States die from air pollution. Recycling improves public health by reducing pollution, conserving resources, and minimizing the need for landfilling and incineration. These benefits lead to cleaner air and water, and thus reduced human exposure to hazardous substances.	AD is a more sustainable and environmentally friendly approach to waste to energy compared to incineration as it produces biogas (primarily methane) that is contained and burned cleanly while the digestate can be used as fertilizer. Conversely incineration is a known emitter of particulate matter, nitrogen oxides, and carbon dioxide which are devastating to human health in surrounding communities.
Safety	MSW Sortation & AD utilize heavy equipment, and require a diligent and organized approach to operations. Goldfinch employees seasoned MRF employees to safely implement our company standards.	
Environment	Please see page 4.	When compared AD produces half of the amount of CO_2 emissions of incineration. By reducing CO_2 emissions associated with food consumption the County will assist in stemming the devastating effects of global climate change.

E. OTHER INFORMATION

Procurement Model.

Goldfinch looks to work with suppliers of MSW in a manner that supports cost reduction and the timely implementation of our assets. Goldfinch has spent over five years building strong relationships with vendors and consultants who help us complete our projects, and therefore we do not hold RFPs for these jobs. If RFPs are required by the County Goldfinch is happy to oblige.

Partnerships.

In Goldfinch's professional opinion time is of the essence for the County to implement a waste reduction strategy. Attempting to partner with other government agencies will drastically slow down progress in waste diversion. The design and construction of a material recovery facility is relatively quick compared to landfills and incinerators.

Please note: Phase 1 and Phase 2 will not eliminate the need for waste disposal outright. However there will be a drastic reduction in the need for waste disposal. The County will still need access to dispose of non-recyclable material at the existing landfills as mentioned in the Second Update on Directive No. 241676. The County very well will need to consider partnerships with other agencies for waste disposal.

Additional Insights.

Traditional material recovery facility contracts employee high tip fee models that do not prioritize recycling and landfill diversion. Goldfinch does not stand for that. Your waste has a positive value when managed correctly. Please strongly consider MSW sortation with Goldfinch for your County. Together we can rewrite waste history.

MEET OUR TEAM

Katherine Doerr
CEO

Jeff Spinner
CFO

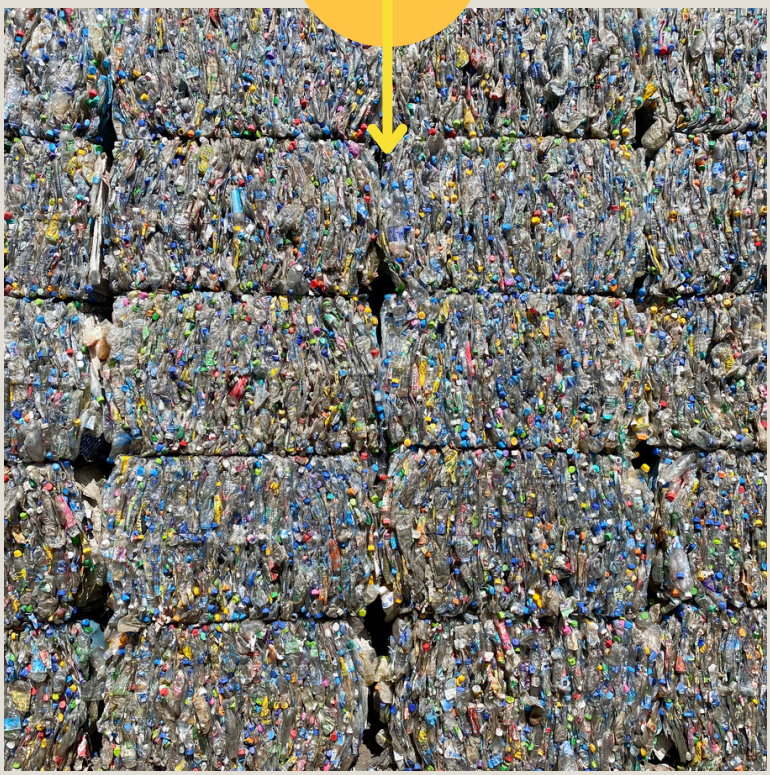
Patrick Wade
CSO

Jon Jackson
Strategic Advisor

Ashton Bolinger
Head of Organics

From waste to worth.

THANK YOU



Please Reach Out

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Gravitas Infinitum,
Carbotura
Market Research Response

OUR RESPONSE AND PROPOSAL TO MIAMI-DADE COUNTY'S REQUEST FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

1 INTRODUCTION AND EXECUTIVE SUMMARY

Greetings Mayor, Commissioners, DSWM, Economic Development team, and all other interested parties.

For the past two years, we have been following discussions regarding alternatives being considered to best manage the 5 million tons of municipal solid waste (MSW) generated in MDC every year – 13,700 tons per day (TPD). We agree that your approach to employing a variety of different modalities to process the many different waste streams is in the County's best interest, and we suspect that your request for MSW management solutions from industry experts will yield many available options for you to consider in creating a comprehensive solid waste management plan. We have sent all of you information about our **Carbotura Waste to Circular Manufacturing (WtCM)** production protocols over the past two years and have enjoyed meeting with many of you to discuss the benefits of including **Carbotura** in your plans. As a point of differentiation, **Carbotura** does not operate in the conventional waste management industry; rather, we **transform waste into valuable resources** through our proprietary WtCM protocols.

Carbotura's core capabilities include 100% landfill diversion, 100% materials recovery and recycling, with **zero emissions, and zero waste**. **Carbotura** is a manufacturing company that uses all types of **unsorted MSW** (see Appendix A) as its feedstock to produce a number of high-demand, high-value, renewable carbon-negative materials such as graphite and graphene, as well as ultra-pure water and other commodities that can be packaged and profitably sold to manufacturing clients who use these materials to produce items such as electric vehicle and cell phone batteries, as well as numerous other products in the electronics, energy storage, automotive, construction, medical and pharmaceutical industries. A list of many of these products can be found in Appendix B. MDC can choose to divert whatever amounts of MSW are necessary and/or desired, away from landfills, here in MDC or elsewhere, saving MDC taxpayers millions of dollars in MSW disposal costs every year in an environmentally sustainable way.

Carbotura plans to invest between $200M and $2B to build a production facility in MDC, with capacities ranging from 400 TPD (Tons Per Day) to over 4,000 TPD. This self-funded project will not require taxpayer money and will create hundreds of high-paying jobs, boosting the local economy and increasing the tax base.

The only thing **Carbotura** needs from MDC to develop and operate its facility in MDC, is a guaranteed Waste Supply Agreement (WSA). This eliminates any and all risks to MDC since **Carbotura** will be responsible for managing and paying for the development of its own facility, with MDC agreeing to send the contracted volume of MSW to the **Carbotura** facility once it is completed and ready to operate. Since MDC controls how the MSW produced in MDC is diverted, MDC can choose how much MSW you would like to divert to **Carbotura**, and **Carbotura** will invest accordingly. **Carbotura's** WtCM production process is deployed in modules that allow for construction of the manufacturing facility to be established with just a 400 TPD capacity and then quickly and easily be scaled up to 4,000 TPD or more as MDC needs/desires to divert more MSW to the **Carbotura** manufacturing facility.

The benefits to MDC of a WSA with **Carbotura**, aside from the aforementioned jobs creation, increase in tax base, and significant positive economic impact, would include the following:

- No upfront capital costs for MDC to build a facility, **Carbotura** will fully manage and pay for the development of the facility.
- Reducing or eliminating the reliance and cost (both financially and environmentally) of logistics for sending MSW out of MDC to be dumped in landfills to the north.
- Reducing or eliminating the need to continue dumping MSW in MDC landfills which are quickly reaching their capacities.
- Remediation of decommissioned landfills by mining the MSW and allowing MDC to use or sell that land for better purposes.
- Transitioning the Department of Solid Waste Management (DSWM) from a net negative cost center to a net positive profit generator through our revenue sharing rebate on Pregenesis fees, with Year 1 rebate of 123% of paid tipping fees, Year 2 rebate of 124%, and an additional 1% rebate each year thereafter.
- MDC can collect and retain all insurance proceeds from the fire at the RRF without having to reinvest them in the development of a new facility.
- Zero Waste, Zero Emissions, closed loop manufacturing process that does not incinerate MSW and recovers or produces sellable materials from 100% of the MSW processed, allowing MDC to be a leader in the Zero Waste Circular Economy movement.
- **Carbotura** manufacturing process breaks down and eliminates PFAS and PFOS in MSW getting rid of these forever chemicals in MDC.
- **Carbotura** can be up and operating a facility within 24 months of a WSA being signed
- MDC can run the main scales and direct waste flows, providing MDC with flow control.
- MDC will have full audit rights and oversight to verify volume of MSW processed and diversion rates.
- Other benefits can be discussed….

We welcome having additional meetings, including a formal presentation to the MDC BCC, and continuing discussions with all of you, to further the conversation and establish a mutually beneficial partnership. We look forward to hearing back from you soon. All the best from your **Carbotura** team.

1.1 RESPONDENT INFORMATION

Company Name: Carbotura, Inc. a Gravitas Infinitum LLC company

Address: 4850 Tamiami Trail N Ste. 301, Naples, FL 34103

Contact Person: Tyler Wood - VP Circularity - tyler@Carbotura.com - 617-899-6745.

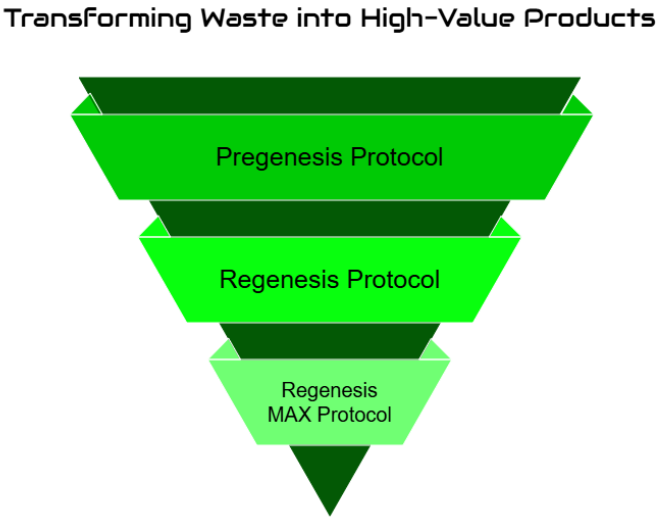
Company Background: Carbotura is a wholly owned subsidiary of Gravitas Infinitum LLC, a sustainable impact holding company, established in 2018. Unlike traditional waste management companies, **Carbotura** specializes in Circular Manufacturing, utilizing unsorted Municipal Solid Waste (MSW) as feedstock for its innovative Waste-to-Circular-Manufacturing (WtCM) production process.

1.2 ALTERNATIVE TO WASTE MANAGEMENT SOLUTIONS

SOLUTION: Waste-to-Circular-Manufacturing (WtCM) - 100% materials recovery and recycling, with zero emissions, and zero waste. **Carbotura** offers a proprietary comprehensive WtCM solution that directly addresses Miami-Dade County's waste management challenges through a series of proprietary protocols which transform waste into high-value products. Click on this link for ***WtCM Explained In Detail***

In Summary the **Carbotura** WtCM Protocols are as follows:

- **Pregenesis Protocol**: Prepares municipal solid waste feedstock by extracting ferrous metals and liquid components before conversion. It produces Stabilized Manufacturing Units (SMUs) by shredding, baling, wrapping, and stabilizing the waste. By extracting valuable materials upfront, Pregenesis™ enhances the quality of input materials and increases overall manufacturing efficiency.
  Pregenesis Explained in Detail
- **Regenesis Protocol**: Converts waste feedstock into valuable molecular material streams using Electromagnetic Energy, creating building blocks for new products.
  Regenesis Explained in Detail
- **Regenesis MAX Protocol**: Takes crude material streams from Regenesis and implements a multi-step refining process, transforming basic molecular outputs into high-value specialized products.
  Regenesis MAX Explained in Detail



For Miami-Dade County, **Carbotura** proposes implementing these three protocols as an integrated solution that completely eliminates the need for traditional landfills and recycling facilities. This directly addresses the County's need for sustainable waste disposal methods as identified in MDC Directive No. 241676.

EFFECTIVENESS: Carbotura achieves what traditional waste management approaches cannot:

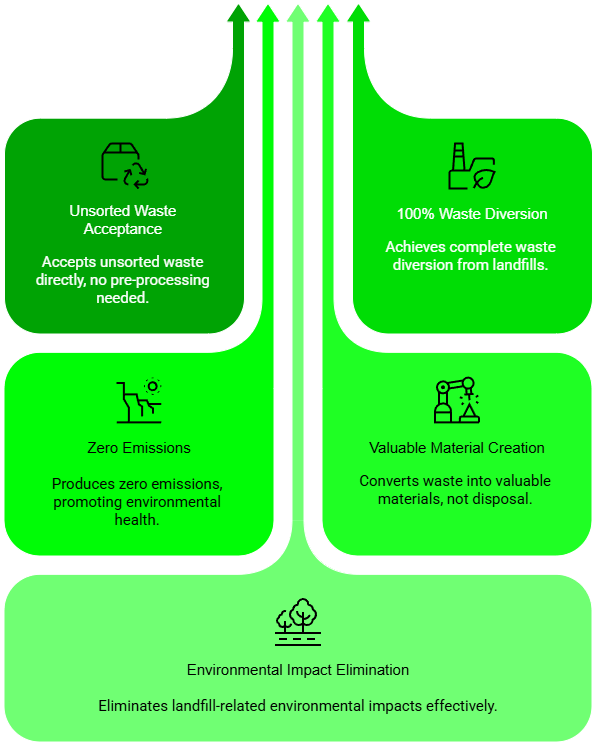
- Accepts unsorted municipal solid waste directly from collection vehicles with zero pre-processing requirements.
- Achieves 100% waste diversion from landfills.
- Produces zero emissions and zero waste.
- Creates valuable materials rather than simply disposing of or burning of waste.
- Eliminates the environmental impacts associated with landfills.

Complete Life Cycle Assessments (LCAs) validate the environmental attributes of our process, demonstrating superior environmental performance compared to traditional waste management methods. We consider the WtCM facility as a Beneficial Use Facility, where all products have LCAs and can have Beneficial Use Determinations.

Proven technology and processes used for over 25 years by leading global manufacturers like Toyota, BMW, Mohawk, Miele, Owens Corning, Michelin, and Continental in their own manufacturing operations.

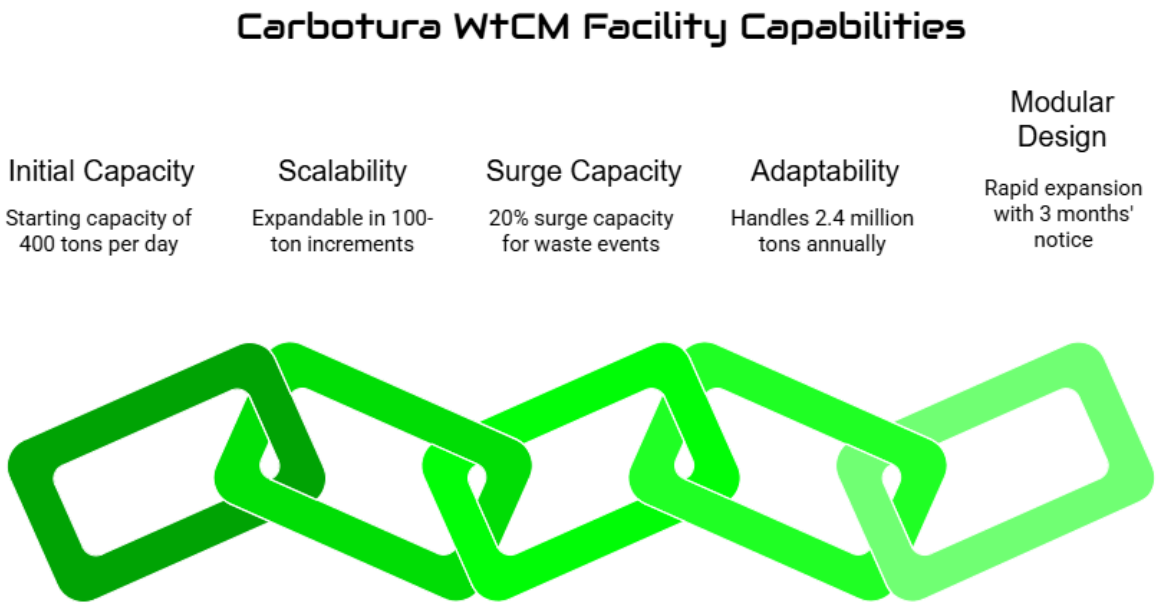
- over 1.7 million operating production process hours
- over 75 application use cases deployed by Fortune 1000 companies.
- over 25 commercial plants were installed, across food, military, aerospace, mining, and nuclear industries.
- in 1997 the first systems were deployed pioneering molecular recycling
- in 2006 the 1st 4-ton per hour multiphase reactor was commissioned
- in 2020 ZeroFill integration for waste management further enhances process capabilities.
- in 2023 **Carbotura** brings WtCM Regenesis Protocols to market.

Path to Zero Waste



QUANTITY AND ADAPTABILITY: Carbotura WtCM facilities can be scaled to meet Miami-Dade County's substantial waste volume requirements:

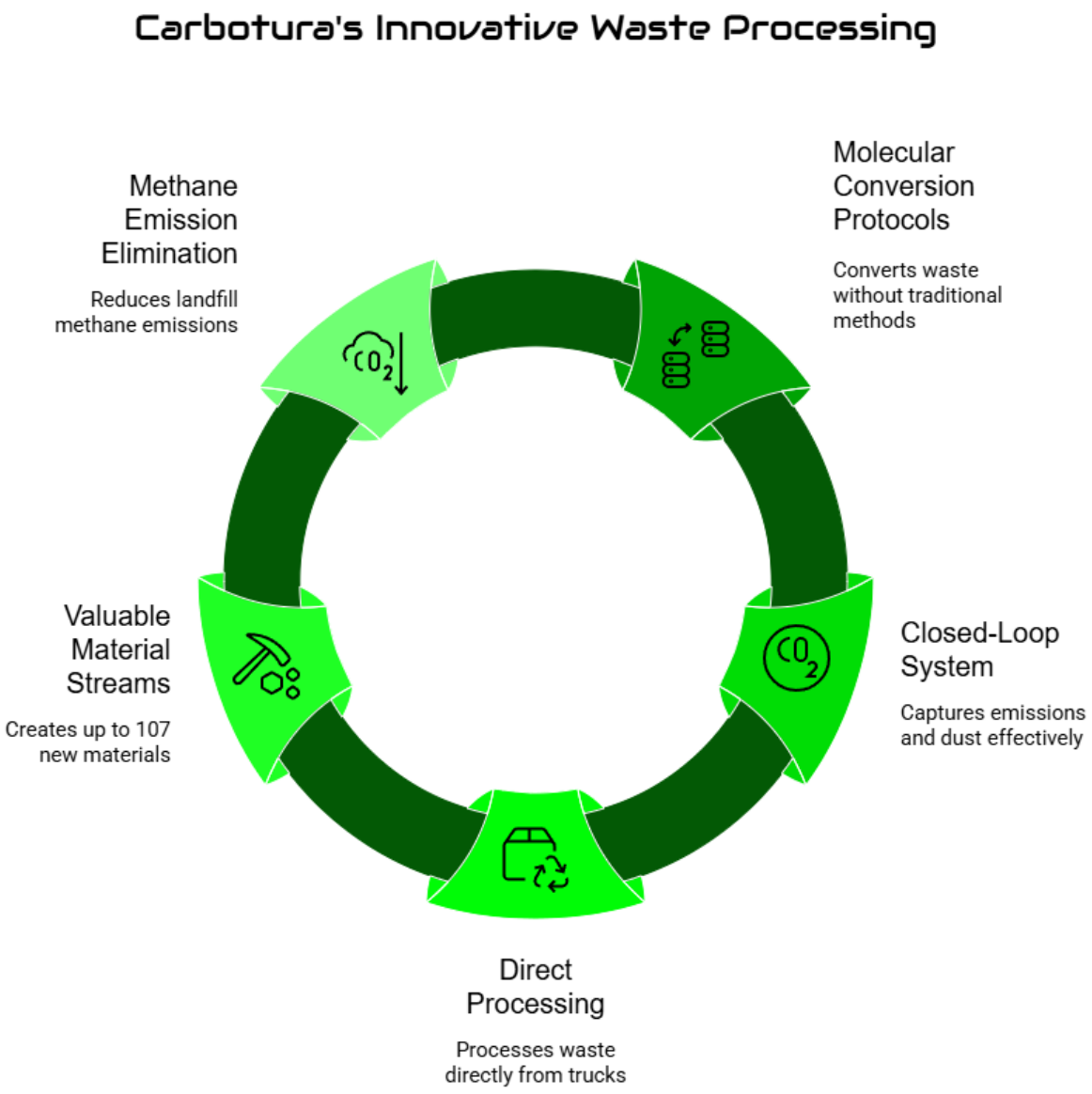
- Initial capacity of 400 TPD (146,000 tons per year) can be processed when the facility is first commissioned.
- Scalable in increments of 100 TPD up to 5,000 TPD (1,825,000 tons per year) at a single location.
- Estimated to take 180-days after expansion order is accepted for increased capacity to be operational.
- Includes 20% surge capacity built in for waste events (hurricanes, seasonal fluctuations, sargassum blooms, etc.)
- Adaptable to handling Miami-Dade County's 2.4 million tons of waste processed annually.
- Accommodates many varying waste compositions without pre-sorting or segregation.
- Protocols are available for Incinerator Ash, Wastewater Sludge, Tires, Mattresses, etc.



OPERATIONAL PROTOCOLS (EMBEDDED TECHNOLOGIES): Carbotura 's Waste-to-Circular Manufacturing (WtCM) approach differs fundamentally from traditional waste processing solutions:

- Utilizes proprietary molecular conversion protocols rather than incineration, gasification, or pyrolysis.
- Implements a closed-loop system with comprehensive emissions and dust capture.
- Processes waste directly from collection trucks without sorting or recycling operations.
- Converts waste into up to 107 different valuable molecular material streams and industrial products.
- Eliminates methane emissions associated with landfilling.

Unlike traditional waste-to-energy facilities that destroy materials to produce limited energy, our process manufacturing protocols preserve and transform molecular structures to create valuable new materials.



BENEFITS: Key advantages of **Carbotura 's** WtCM solution compared to traditional waste technologies can be summarized as follows:

CHALLENGES: As with any waste processing facility, **Carbotura 's** approach requires standard regulatory permitting for the Pregenesis phase of our manufacturing protocol. However, as a zero-emission, zero-waste manufacturing facility, our permitting process typically encounters fewer environmental objections compared to traditional waste disposal facilities.

Permitting challenges are mitigated through our comprehensive environmental documentation, including complete Life Cycle Assessments, emissions capture design, and process validation. We have extensive experience navigating the permitting process for our facilities but would welcome any assistance MDC can provide.

The Challenge of Changing the Status Quo - One of our greatest challenges at **Carbotura** isn't technical innovation, capital constraints, or operational scaling - it's overcoming the gravitational pull of the status quo. Human nature and organizational behavior share a common trait: resistance to change, even when that change represents clear improvement. The waste management industry has operated on the same fundamental principles for decades—collect, transport, sort, landfill or incinerate. This deeply entrenched model is backed by significant infrastructure investments, established regulatory frameworks, and operational comfort.

Introducing our zero-emissions, zero-waste circular manufacturing approach represents a paradigm shift that challenges every aspect of this established system. Municipal leaders must consider not just the environmental and economic benefits we offer, but also the political implications of moving away from familiar processes, the workforce transitions required, and the reimagining of long-term community planning that has typically centered around traditional waste management approaches. The inertia of existing contracts, bonds issued for landfills and incinerators, and the interconnected web of stakeholders all create friction against innovation.

Yet despite these headwinds, we're witnessing a remarkable shift. Our two deployments, now under 30-year contracts and entering the implementation phase, represent pioneering communities that recognized the transformative potential of **Carbotura's** solution. These forward-thinking partners saw beyond the comfort of the familiar to embrace a technology that fundamentally reimagines waste not as a burden but as a valuable manufacturing input. More encouraging still is our pipeline of a dozen communities in advanced negotiations and nearly 100 others that have expressed serious interest in our protocols.

What we're learning is that the status quo's strongest defense—fear of the unknown—is overcome through education, demonstration of results, and creating a clear, low-risk implementation path. When municipal leaders understand that our approach requires no capital investment on their part while eliminating emissions, waste, and long-term environmental liabilities, the perceived risk of change begins to be outweighed by the risk of inaction. As our early deployments demonstrate measurable environmental and economic benefits, we expect the pace of adoption to accelerate significantly, transforming what was once seen as revolutionary into the new standard for responsible resource management.

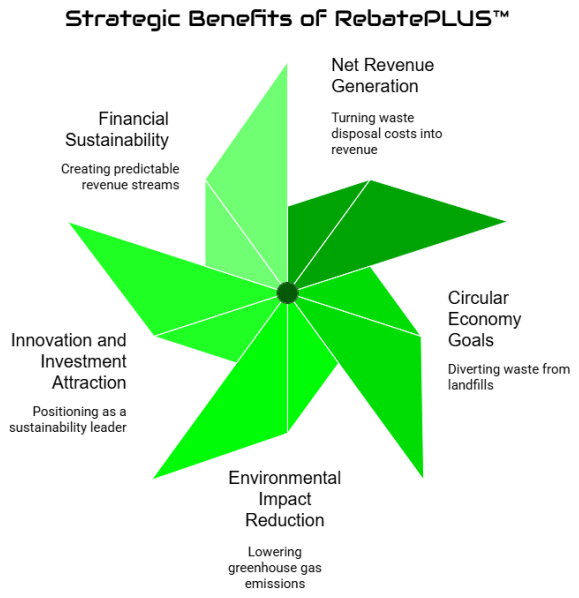
2 FINANCIAL APPROACH

CAPITAL INVESTMENT AND OPERATIONAL COSTS: There is NO upfront capital investment requirement for MDC, but a payment and waste guarantee, or waste guarantee and loan guarantee will be needed. **Carbotura** will be responsible for managing and paying for the development and operation of its own facility.

- **Carbotura** will invest approximately $50 million per 100 TPD of contracted capacity in MDC.
- An initial 400 TPD facility investment would therefore be ~ $200 million.
- This is then scalable to $2 billion + for up to a 5,000 TPD facility.
- **Carbotura's** 30-year operational costs are offset by material production revenues.
- MDC's costs for participating in a WSA with **Carbotura** will actually result in a **net positive revenue stream for MDC** over a 30-year operational term.
- **Carbotura** offers **RebatePLUS™** which can provide **net positive revenue streams for MDC**.

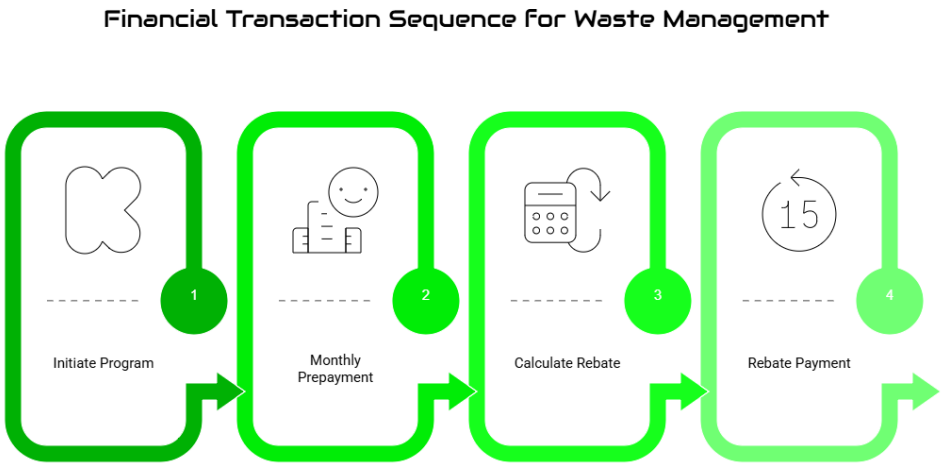
FUNDING MODEL: RebatePLUS™ provides MDC with an opportunity for a strategic transformation of its current waste management system into a leading-edge circular management model. **RebatePLUS™** can facilitate this transition, generating significant net revenue and environmental benefits for MDC.

PROGRAM: REBATEPLUS™ - TRANSFORMING WASTE MANAGEMENT INTO A REVENUE-GENERATING CIRCULAR SYSTEM - **RebatePLUS™** offers a paradigm shift from the traditional cost-centric model of waste management to a revenue-generating circular system. By partnering with **Carbotura**, MDC can:



- Generate Substantial Net Revenue: Receive significant rebates over the long term, turning a waste disposal expense into a new revenue stream.
- Advance Circular Economy Goals: Divert waste from landfills and contribute to a circular economy by providing feedstock for **Carbotura 's** advanced Waste to Circular Manufacturing (WtCM) facilities.
- Reduce Environmental Impact: Decrease landfill reliance, lower greenhouse gas emissions associated with waste disposal, and promote resource recovery.
- Attract Innovation and Investment: Position Miami-Dade County as a leader in sustainable waste management, attracting innovative technologies and potential economic development opportunities.
- Long-Term Financial Sustainability: Create a predictable and growing revenue stream from waste management, enhancing the County's long-term financial sustainability.

RebatePLUS™ - HOW IT WORKS:



Simplified Overview of the Carbotura-MDC Pregenesis Fee and Rebate Structure

Monthly Payments

- MDC agrees to deliver 400 tons per day (TPD) of waste to Carbotura.
- This equals 12,167 tons per month or 146,000 tons annually.
- MDC pays Carbotura a monthly "Pregenesis Fee" in advance, based on the agreed per-ton rate.
    - Example: At $100/ton in Year 1, MDC pays $1,216,700 per month.
- Actual tonnage is audited monthly, and the fee is adjusted ("trued-up") accordingly.

Initial Deposit

- MDC pays one month of the Pregenesis Fee upon signing the Waste Supply Agreement (WSA).

Year-End Rebate

- At the end of each year, Carbotura calculates a rebate for MDC.
- The rebate is a percentage of the total Pregenesis Fees paid that year.
    - Example for Year 1:
        - 146,000 tons delivered.
        - $100/ton fee = $14,600,000 paid by MDC
        - Rebate is 123% of that = $17,958,000
        - MDC profits $3,358,000 and avoids outside disposal/logistics costs.

Annual Escalation

- Each year, the Pregenesis Fee increases by 2.5%.
- The rebate percentage also increases by 1% annually.

Example for Year 2:

- Fee: $102.50/ton
- Total Paid: $14,965,000
- Rebate: 124% = $18,556,600
- MDC Profit: $3,591,600

Year 3 and Beyond:

- Year 3 Fee: $105.06/ton (rounded)
- Rebate: 125%
- The pattern continues annually, with increasing fees and rebate percentages.

30-Year Financial Impact:

- Total waste delivered: 4,380,000 tons (146,000 tons per year for 30 years).
- Total paid by MDC: $640,979,464
- Total rebates from Carbotura: $893,097,000
- Net profit to MDC: $252,117,536
- Disposal cost savings from not having to transport and dump the same volume of MSW in a landfill, assuming a cost averaging around $100 per ton over a 30-year period, would yield a savings of around $438M over that 30-year period.
- Outcome: An almost $700M ($252M+$438M) positive swing in MDC's waste management budget line over 30 years.

The Carbotura model not only eliminates disposal costs but also turns MDC's waste stream into a revenue-generating asset.

The following chart shows what those fees and rebates would be for a 30-year period based on just 400 TPD (146,000 tons per year) being delivered by MDC to Carbotura.

Year	Pregenesis Fee/Ton	Annual Fee	Rebate %	Rebate Total	Rebate/Ton	Net Revenue	Net Rev/Ton
1	$ 100.00	$ 14,600,000	123%	$ 17,958,000	$ 123.00	$ 3,358,000	$ 23.00
2	$ 102.50	$ 14,965,000	124%	$ 18,556,600	$ 127.10	$ 3,591,600	$ 24.60
3	$ 105.06	$ 15,339,125	125%	$ 19,173,906	$ 131.33	$ 3,834,781	$ 26.27
4	$ 107.69	$ 15,722,603	126%	$ 19,810,480	$ 135.69	$ 4,087,877	$ 28.00
5	$ 110.38	$ 16,115,668	127%	$ 20,466,898	$ 140.18	$ 4,351,230	$ 29.80
6	$ 113.14	$ 16,518,560	128%	$ 21,143,757	$ 144.82	$ 4,625,197	$ 31.68
7	$ 115.97	$ 16,931,524	129%	$ 21,841,666	$ 149.60	$ 4,910,142	$ 33.63
8	$ 118.87	$ 17,354,812	130%	$ 22,561,256	$ 154.53	$ 5,206,444	$ 35.66
9	$ 121.84	$ 17,788,682	131%	$ 23,303,174	$ 159.61	$ 5,514,492	$ 37.77
10	$ 124.89	$ 18,233,399	132%	$ 24,068,087	$ 164.85	$ 5,834,688	$ 39.96
11	$ 128.01	$ 18,689,234	133%	$ 24,856,681	$ 170.25	$ 6,167,447	$ 42.24
12	$ 131.21	$ 19,156,465	134%	$ 25,669,663	$ 175.82	$ 6,513,198	$ 44.61
13	$ 134.49	$ 19,635,377	135%	$ 26,507,759	$ 181.56	$ 6,872,382	$ 47.07
14	$ 137.85	$ 20,126,261	136%	$ 27,371,715	$ 187.48	$ 7,245,454	$ 49.63
15	$ 141.30	$ 20,629,418	137%	$ 28,262,303	$ 193.58	$ 7,632,885	$ 52.28
16	$ 144.83	$ 21,145,153	138%	$ 29,180,311	$ 199.87	$ 8,035,158	$ 55.04
17	$ 148.45	$ 21,673,782	139%	$ 30,126,557	$ 206.35	$ 8,452,775	$ 57.90
18	$ 152.16	$ 22,215,627	140%	$ 31,101,878	$ 213.03	$ 8,886,251	$ 60.86
19	$ 155.97	$ 22,771,017	141%	$ 32,107,134	$ 219.91	$ 9,336,117	$ 63.94
20	$ 159.87	$ 23,340,293	142%	$ 33,143,216	$ 227.01	$ 9,802,923	$ 67.14
21	$ 163.86	$ 23,923,800	143%	$ 34,211,034	$ 234.32	$ 10,287,234	$ 70.46
22	$ 167.96	$ 24,521,895	144%	$ 35,311,529	$ 241.86	$ 10,789,634	$ 73.90
23	$ 172.16	$ 25,134,942	145%	$ 36,445,666	$ 249.63	$ 11,310,724	$ 77.47
24	$ 176.46	$ 25,763,316	146%	$ 37,614,441	$ 257.63	$ 11,851,125	$ 81.17
25	$ 180.87	$ 26,407,399	147%	$ 38,818,876	$ 265.88	$ 12,411,477	$ 85.01
26	$ 185.39	$ 27,067,584	148%	$ 40,060,024	$ 274.38	$ 12,992,440	$ 88.99
27	$ 190.03	$ 27,744,273	149%	$ 41,338,967	$ 283.14	$ 13,594,694	$ 93.11
28	$ 194.78	$ 28,437,880	150%	$ 42,656,820	$ 292.17	$ 14,218,940	$ 97.39
29	$ 199.65	$ 29,148,827	151%	$ 44,014,729	$ 301.00	$ 14,865,902	$ 101.82
30	$ 204.64	$ 29,877,548	152%	$ 45,413,873	$ 311.00	$ 15,536,325	$ 106.41
Total	**$ 146.34**	**$ 640,979,464**	**139%**	**$ 893,097,000**	**$ 203.89**	**$ 252,117,536**	**$ 57.56**

Please note that rebates will be calculated and paid on a monthly basis, and will be paid 12 months after that month's Pregenesis Fee is paid by MDC.

Credit Requirements: Miami-Dade County's strong credit rating is a significant asset for the **RebatePLUS™** program. **Carbotura** requires a stable and reliable partner to ensure the consistent payment of the Pregenesis Fee, which forms the foundation of the program's economics. A strong credit rating demonstrates the County's financial stability and ability to meet its contractual obligations. We utilize the County's credit as security for our investment.

Guarantees: Guarantees from both parties for the mutual benefit of both parties will be as follows:

Payment Guarantee (**Carbotura**): **Carbotura** guarantees the rebate payment to MDC the month following the 12-month period after the Pregenesis Fee for that month has been paid by MDC and received by **Carbotura**. This structure provides a predictable return on MDC's commitment.

Waste Guarantee (Miami-Dade County): MDC guarantees the provision of the committed capacity of Recoverable Material Input to **Carbotura's** WtCM facility. This ensures the facility has the necessary feedstock to operate efficiently and generate the rebates for MDC.

The Future - Scalability of WtCM Technology

The revenue projections outlined above are based on a single 400 TPD Waste-to-Circular-Manufacturing (WtCM) facility. **Carbotura 's** WtCM protocols are highly scalable and can be deployed in facilities of varying sizes within a 5-year timeframe. The potential 30-year net revenues for MDC, assuming similar program economics but for larger facility sizes are shown on the following chart.[1]

TPD	Rebate Total	Net Revenue
400	$ 893,097,000	$ 252,117,536
1,000	$ 2,232,742,500	$ 630,293,840
2,000	$ 4,465,485,000	$ 1,260,587,680
4,000	$ 8,930,970,000	$ 2,521,175,360
5,000	$ 11,163,712,500	$ 3,151,469,200

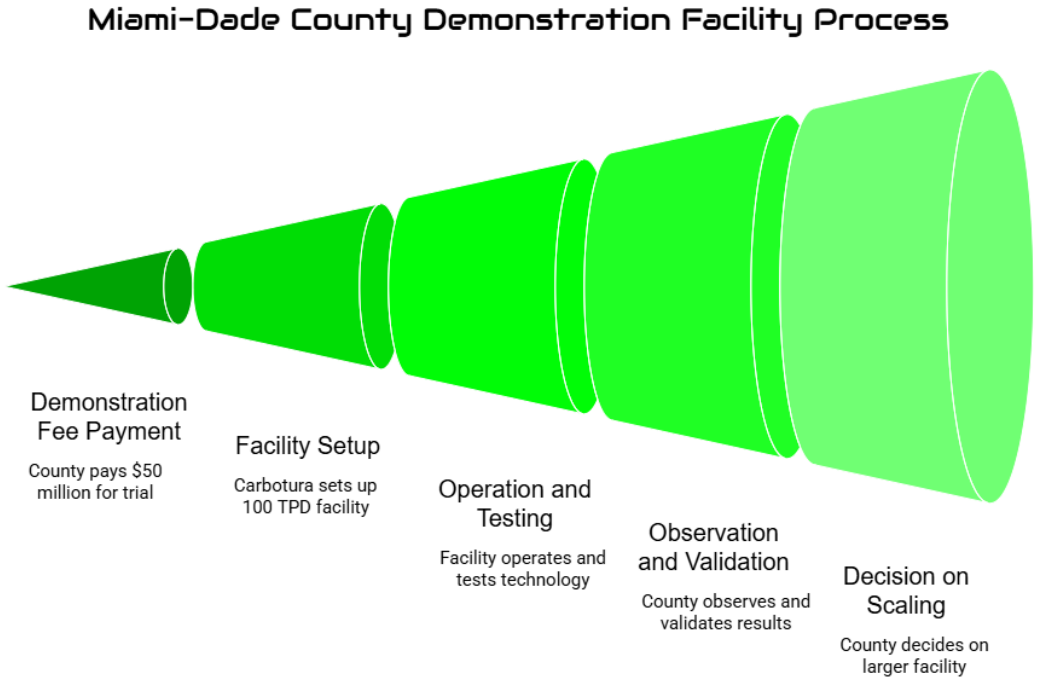
[1] Disclaimer: These revenue projections are estimates based on scaling the 30-year net revenue from the 400 TPD model. Actual revenues may vary depending on various factors, including but not limited to market conditions, operational efficiencies, waste stream composition, and regulatory changes. These figures are for illustrative purposes only and should be considered subject to change upon more detailed financial modeling and due diligence.

3 DEMONSTRATION FACILITY OPTION: 100 TPD FACILITY

If Miami-Dade County is interested in a more incremental approach, **Carbotura** offers a 100 TPD Demonstration Facility option. This allows the County to directly observe and validate the benefits of our Waste-to-Circular-Manufacturing (WtCM) protocols in a real-world setting before committing to a larger-scale deployment.

Key Details of the Demonstration Facility:

- Capacity: 100 TPD of Recoverable Material Input.
- Demonstration Fee: MDC will pay a demonstration fee of $50,000,000 to participate in this program. It is important to note that this fee is for the demonstration and operational verification of the **Carbotura** Protocols.
- Facility and Permitting: **Carbotura** will be responsible for providing the 100 TPD demonstration facility and securing all necessary permits and waste for its operation.
- Location: The demonstration facility will be located in Collier County, Florida.
- Timeline: The demonstration facility can be completed and fully tested within 24 months from the commencement of the program.
- Observation and Validation Period: 90-days from the Notice of Validation Period.
- This demonstration facility offers a unique opportunity for MDC to gain firsthand experience with **Carbotura's** WtCM technology with a capped financial commitment.
- Transfer Upon Scaling: Should MDC decide to move forward with **Carbotura** for a larger-scale WtCM facility (400 TPD or greater) after the successful completion of the validation program, **Carbotura** will transfer equipment to an MDC **Carbotura** location (TBD). This transfer is intended to serve as a jump-start for the County's larger capacity contract, providing an immediate operational asset.

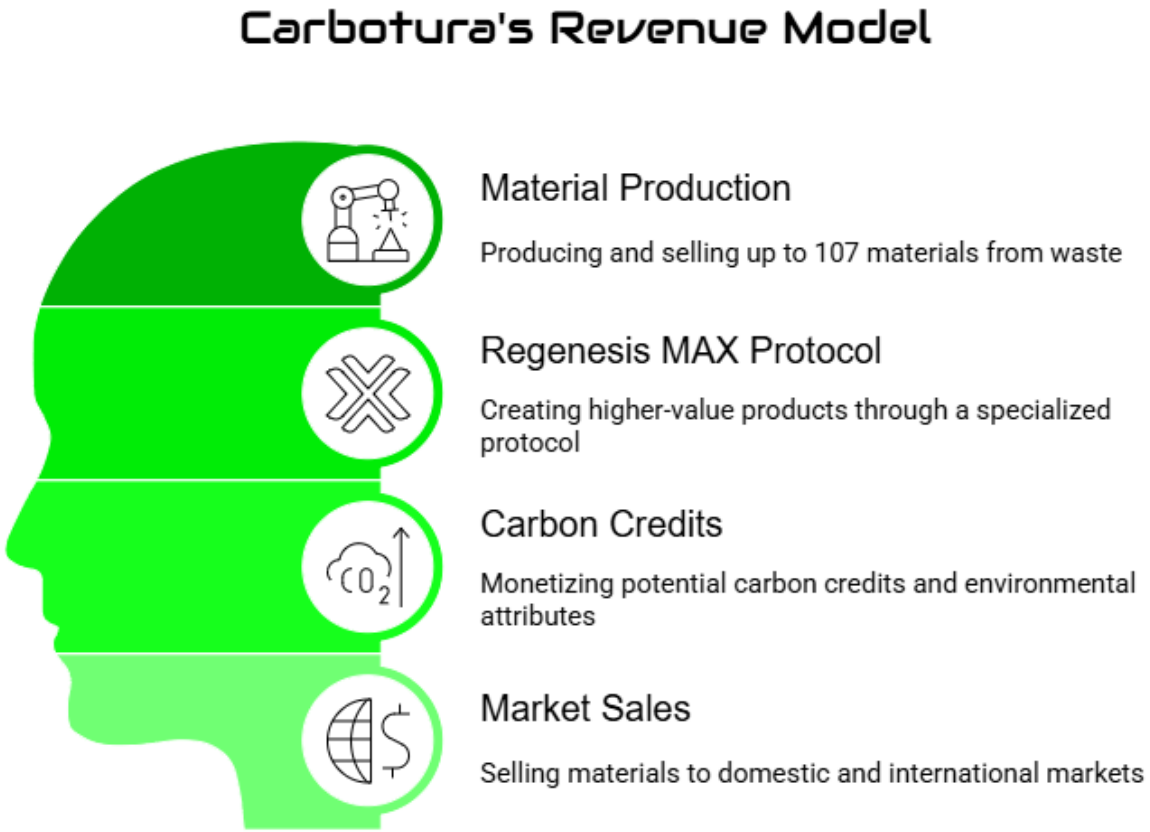


4 CARBOTURA'S REVENUE STREAMS:

Carbotura generates revenue through:

- Production and sale of up to 107 different materials derived from waste.
- Higher-value materials and products created through the Regenesis MAX Protocol
- Potential carbon credits and environmental attribute monetization
- Material product sales to domestic and international markets

These revenue streams cover operational costs and allow for revenue sharing with Miami-Dade County. All materials generated through the process have commercial value, creating multiple revenue sources beyond typical waste-to-energy operations.



5 IMPLEMENTATION APPROACH

INFRASTRUCTURE REQUIREMENTS: Carbotura would pay to build, own, and operate the complete facility with minimal requirements from Miami-Dade County:

• Standard utility connections (electricity, water, sewer)

• Road access for waste delivery vehicles

• No specialized infrastructure required from MDC

6 SITE SIZE:

• Approximately 3 acres per 100 TPD of capacity

• Initial 400 TPD facility would require approximately 12 acres

• Land requirement ratio decreases with larger deployments

• Site must accommodate truck traffic for waste delivery

• We can also accept rail delivered waste if available

SITE OWNERSHIP: Carbotura would secure (buy or lease) and develop the site privately, working with Miami-Dade County to identify suitable locations with appropriate industrial zoning. We have experience in site selection and development for our facilities but would welcome MDC's assistance in this effort. We have already identified a site in Medley that is properly zoned and can accommodate any size facility we plan to build and have discussed locating our facility on this site with the current owner who has expressed to us that they are amenable to **Carbotura** developing its facility on their site. If, however, after collaborating with MDC it is determined that this site is not the optimal location for a **Carbotura** facility, then we will work with MDC to identify and secure another site for this deployment.

PERMITTING: The facility would require standard environmental and industrial permits:

- Air emissions permits (though emissions are minimal)
- Solid waste processing facility permits.
- Facility designated a Beneficial Use Facility (BUF)
- Building and occupancy permits
- Other permits as required by local, state, and federal regulations.
- Typical permitting timeline is 12-18 months from contract signing.
- **Carbotura** will manage the entire permitting process but would welcome any assistance MDC can provide.

7 IMPLEMENTATION TIMELINE:

- 12-18 months for permitting.
- 6 months for structural deployment (400 TPD facility)
- Equipment installation upon building occupancy permit
- Total timeline: 24 months from contract signing to operational status.
- Once operational, additional capacity can be added within 3-6 months as needed.

OPERATIONAL AND MAINTENANCE REQUIREMENTS: Carbotura would handle all operational and maintenance needs as part of its build-own-operate model:

- 24/7 facility operations
- Comprehensive maintenance programs
- Staffing and training
- Environmental monitoring and compliance
- Product marketing and distribution
- No operational responsibilities required from Miami-Dade County beyond waste delivery.

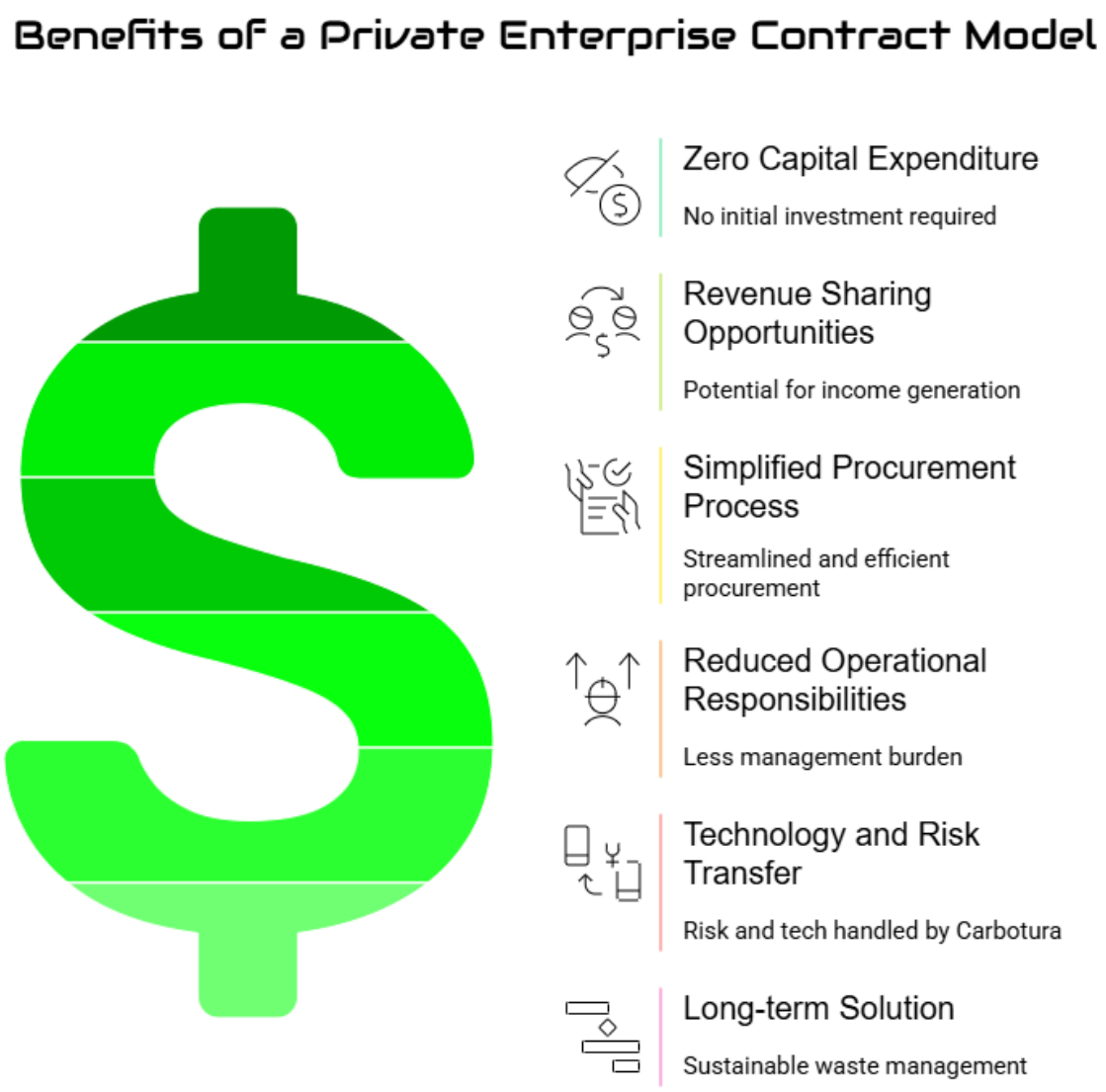
HEALTH/SAFETY/ENVIRONMENTAL PROTECTION: Carbotura's solution prioritizes health, safety, and environmental protection:

- Zero emissions with closed-loop systems for full emissions and dust capture
- Complete Life Cycle Assessments document environmental benefits
- No landfilling or incineration of waste
- Elimination of methane emissions associated with landfills.
- Dust control systems throughout the facility.
- Advanced safety protocols for all operations
- Continuous environmental monitoring

8 OTHER INFORMATION/ADVICE

RECOMMENDED PROCUREMENT MODEL: We recommend a Private Enterprise Contract model with a Waste Supply Agreement (WSA). This would allow Miami-Dade County to benefit from:

- Zero upfront capital expenditure
- Revenue sharing opportunities.
- Simplified procurement process
- Reduced operational responsibilities.
- Transfer of technology and performance risk to **Carbotura**
- Long-term waste management solution without ongoing procurement cycles

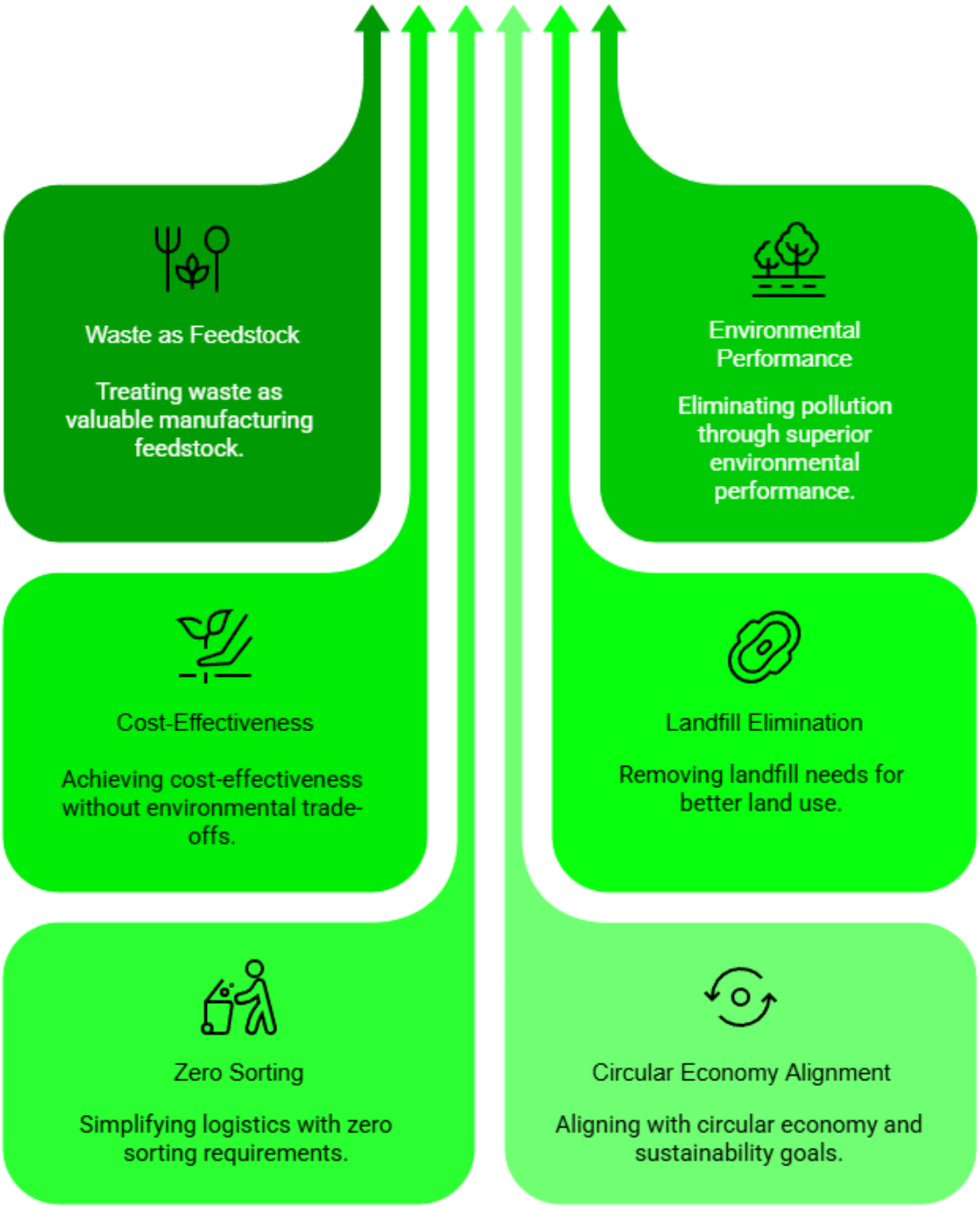


PARTNERSHIPS: Carbotura's solution eliminates the need for regional waste-to-energy facilities or landfills. We allow communities to go back to one bin and free their citizens from having to sort trash, which is often done incorrectly resulting in contamination and decreased conversion of recycled materials. The scalable nature of our protocols allows for expansion of our system to meet any and all MSW volumes that MDC may need to effectively manage their many waste streams. We do however recognize that MDC may wish to implement a number of different modalities to best divert and process its MSW, so we welcome being as big a part of that toolbox as needed or desired by MDC and can work with other modalities to best serve the needs of MDC. We can also locate our facility and scale it up to accommodate waste from multiple communities if desired. Should Miami-Dade County wish to explore regional partnerships, our modular approach could easily accommodate waste from neighboring municipalities/counties under various contractual arrangements. We have in fact been in discussions with the Broward County (BC) Solid Waste Authority (SWA) as they also study a variety of modalities for MSW management to deploy in their jurisdiction. So, if MDC wishes to form a regional partnership with BC and have **Carbotura** service the needs of both counties, that can also be accommodated. MDC however seems to be way ahead of BC in determining how to move forward, and we believe that MDC would likely prefer that **Carbotura** invest between $200M and $2B in MDC, create 100s of high-paying jobs in MDC, increase the County's tax base, and perhaps induce other affiliated **Carbotura** client companies to locate their manufacturing facilities in MDC near the **Carbotura** facility to multiply the significant positive economic impact **Carbotura** will make in MDC.

9 ADDITIONAL INSIGHTS:

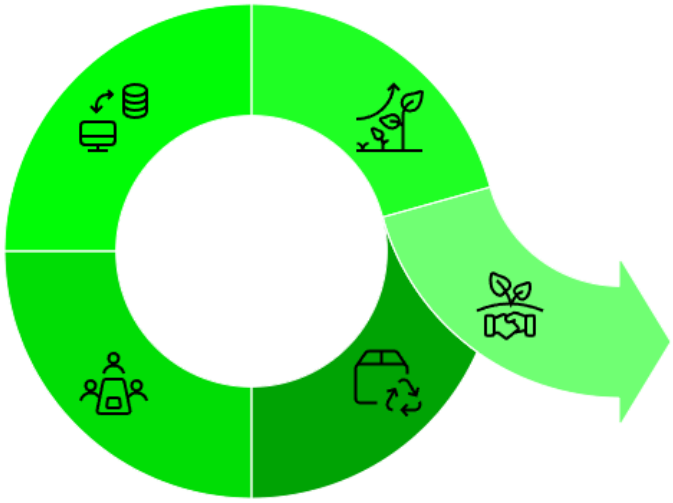
- **Carbotura's** approach fundamentally redefines waste management by treating waste as a manufacturing feedstock rather than a disposal problem.
- Our protocols eliminate the tradeoffs traditionally required between environmental performance and cost-effectiveness, we do not ask for permits or permission to pollute, we ask for permission to **NOT** pollute.
- The complete elimination of landfill requirements provides long-term land use benefits for the county.
- Zero sorting requirements simplify waste collection logistics and improve overall system efficiency.
- Our solution aligns perfectly with circular economy principles and sustainability goals.
- The ability to process unsorted waste provides significant operational advantages during emergency events like hurricanes.
- **Carbotura** will create hundreds of high paying STEM related jobs along with thousands of indirect and induced jobs as capacity scales up.
- We believe that **Carbotura's** Waste-to-Circular-Manufacturing (WtCM) solution represents a paradigm shift in municipal solid waste management that offers Miami-Dade County exceptional environmental, financial, and operational benefits compared to all traditional approaches.

Paradigm Shift in Waste Management



We welcome the opportunity to provide additional information, answer questions, or discuss our solution in greater detail. We are confident that our WtCM system can seamlessly resolve Miami-Dade County's waste management challenges and align perfectly with its long-term sustainability objectives.

Carbotura's Circular Engagementt Cycle



1	2	3	4	5
Propose Solution	**Engage Stakeholders**	**Implement Solution**	**Achieve Benefits**	**Align with Goals**
Present innovative waste management approach	Discuss benefits with Miami-Dade officials	Deploy waste-to-manufacturing system	Realize environmental, financial, and operational gains	Support sustainability objectives

Thank you for your time in reading our response to your request for information about MSW management solutions, and our proposal to participate in helping MDC with the challenges you currently face. We look forward to hearing back from you soon with any feedback and/or questions you may have, and trust that we will meet again with you in the near future to form a mutually beneficial partnership and launch this endeavor together to continue improving MDC's quality of life and economic prosperity.

Kindest Regards,

Tyler Wood
Vice President Circularity
Gravitas Infinitum - **Carbotura**
Naples, Florida

Allen Witters
Chairman
Gravitas Infinitum - **Carbotura**
Naples, Florida

10 APPENDIX A – ACCEPTABLE WASTE

ACCEPTABLE WASTE (AW) FOR Carbotura REGENESIS PROCESSING

OVERVIEW: Carbotura's Waste-to-Circular-Manufacturing (WtCM) protocols can process a wide variety of municipal solid waste streams through its proprietary molecular recycling process. The protocols are designed to handle mixed and contaminated waste streams that traditional recycling methods cannot process.

PRIMARY ACCEPTABLE WASTE CATEGORIES:

- GENERAL MUNICIPAL SOLID WASTE
  - Mixed household waste
  - Commercial waste
  - Institutional waste
  - Industrial non-hazardous waste
- PLASTICS (ALL TYPES)
  - Mixed plastic waste
  - Contaminated plastics
  - Multi-layer packaging
  - PET, HDPE, PVC, LDPE, PP, PS
  - Mixed or unknown plastic types
  - Plastic films and bags
- ORGANIC MATERIALS
  - Food waste
  - Yard waste
  - Wood waste
  - Agricultural waste
  - Paper and cardboard
  - Textiles and fabrics
  - Natural fibers
- GLASS AND CERAMICS
  - Mixed glass
  - Container glass
  - Window glass
  - Ceramics
  - Porcelain
- PROHIBITED MATERIALS
  - Radioactive materials
  - Live explosives or munitions
- CONSTRUCTION AND DEMOLITION (C&D) MATERIALS*
  - Mixed C&D waste
  - Composite materials
  - Insulation materials
  - Flooring materials
  - Roofing materials
  - Drywall/gypsum board
- ELECTRONIC WASTE
  - Consumer electronics
  - Computer equipment
  - Electronic components
  - Cables and wiring
  - Circuit boards
- SPECIAL WASTE STREAMS*
  - Tires and rubber products
  - Carpeting and padding
  - Furniture
  - Mattresses
  - Incinerator ash
  - Sargassum
  - Wastewater sludge
  - Other liquid waste
- MEDICAL WASTE (NON-INFECTIOUS)[2]
  - Medical packaging
  - Medical equipment (non-sharp)
  - Medical plastics
  - Medical textiles (non-infectious)

[2] Additional Protocol Considerations Required.

Waste Notes:

PREGENESIS PROCESSING: All accepted waste streams are processed through Carbotura's Pregenesis system, which:

- Stabilizes the waste (Stops GHG Emissions)
- Removes ferrous metals.
- Processes remainder into Stabilized Manufacturing Units (SMUs)
- Prepares material for Regenesis molecular transformation Packaged Units.
- Can be remotely located with Transfer Centers, or Standalone

BENEFITS:

- No pre-sorting required.
- Can handle contaminated materials.
- Processes mixed waste streams
- Zero-waste, zero-emissions process
- 100% materials recovery
- Complete PFAS destruction

ADDITIONAL CONSIDERATIONS:

- All waste must comply with local, state, and federal regulations.
- Waste acceptance may be subject to characterization and testing.
- Special handling procedures may apply for certain waste streams.
- Volume and composition restrictions may apply based on facility capacity.

11 APPENDIX B – MATERIALS PRODUCED

Carbotura Products - Zero Waste – Zero Emissions – 100% Resource Recovery

High-Purity Graphite

Applications: Battery anodes, nuclear moderators

Graphene

Applications: Energy storage, electronic components, medical devices

Conductive Carbon

Applications: Energy storage, electronic components

High-Grade Carbon Black

Applications: Tire manufacturing, polymer enhancement

Recycled Container Glass

Applications: Food packaging, beverage containers

Glass Beads

Applications: Road marking, blast cleaning

Foam Glass Aggregate

Applications: Building insulation, lightweight fill

Softened Water

Applications: Industrial processes, cooling systems

Distilled Water

Applications: Scientific research, battery manufacturing

Purified Water

Applications: Food production, beverage manufacturing

Argon

Applications: Welding operations, metallurgy

High-Purity Oxygen

Applications: Medical systems, industrial processes

High-Purity Nitrogen

Applications: Chemical processing, electronics manufacturing

High-Purity Hydrogen

Applications: Fuel cells, chemical synthesis

Benzene

Applications: Plastics manufacturing, chemical synthesis

Toluene

Applications: Industrial solvents, pharmaceutical production

Mixed Xylenes

Applications: Polymer production, industrial Chemistry

Chromium

Applications: Stainless steel, protective coatings

Barium

Applications: Medical diagnostics, specialized glass

Silver

Applications: Electronics, medical devices

Gold

Applications: Electronics, medical devices

Platinum

Applications: Catalytic converters, fuel cells

Palladium

Applications: Electronics, chemical processing

Cobalt

Applications: Batteries, superalloys

12 APPENDIX C – WASTE SUPPLY AGREEMENT (WSA)

Sample Waste Supply Agreement (WSA)

MASTER AGREEMENT

This MASTER AGREEMENT ("Agreement") is made and entered into as of the ____ day of _____, 2025 (the "Effective Date"), by and among [Client Name], a municipal entity of the [State], having its principal place of business at [Address] (hereinafter referred to as the "Client"), and **Carbotura, Inc.**, a Wyoming Corporation, with its principal place of business at 4850 Tamiami Trail North, Suite 301, Naples, FL 34103, which will assign this Agreement to a to-be-formed Special Purpose Vehicle company authorized to do business in the [State] to be created after contract signing (hereinafter,**Carbotura, Inc.** and its Special Purpose Vehicle company shall be collectively referred to as "**Carbotura**"). Together these three separate entities comprise the Parties to this Agreement.

12.1.1 RECITALS

WHEREAS, **Carbotura** intends to develop Waste to Circular Manufacturing (WtCM) facilities in [Client's municipality] which will receive Acceptable Waste (AW) from the Client to process using **Carbotura's** proprietary protocols and produce a number of high-demand, high-value, renewable carbon-negative materials with the benefits of 100% landfill diversion, 100% materials recovery and recycling, zero emissions, and zero waste, which will allow Client to be a leader in the Zero Waste Circular Economy movement;

WHEREAS, the Client desires to engage **Carbotura** for the purpose of deploying the Waste to Circular Manufacturing (WtCM) facilities in [Client's municipality] for the benefit of the community and to contribute to the circular economy through sustainable waste management;

WHEREAS, this Agreement shall be construed as a method of revenue sharing with the Client through **Carbotura's RebatePLUS** program, subject to performance and compliance with waste delivery and processing obligations;

WHEREAS, both Parties recognize the importance of maximizing waste utilization, reducing dependency on landfills, and ensuring compliance with all applicable regulations governing waste processing and conversion;

WHEREAS, this Agreement is part of an overall underwriting package for **Carbotura's** investment in and deployment of the WtCM facilities;

NOW, THEREFORE, in consideration of the mutual obligations and premises herein specified, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

12.1.2 ARTICLE I – AGREEMENT SCOPE

1. The Client shall be eligible for rebates ("Rebates") based on Client's performance under the waste supply terms outlined herein.

2. **Carbotura** shall invoice the Client on a monthly basis in advance for Pregenesis Fees, in accordance with the Pregenesis fees outlined in Article III.

3. Acceptable Waste shall be received at **Carbotura's** WtCM facility, with a defined Ramp Plan for Commercial Operations that ensures seamless integration of waste into the process.

4. The Rebate process shall proceed based on compliance with delivery obligations, Pregenesis Fee Payments, and non-breach conditions, ensuring a structured and consistent financial return to the Client.

5. The duration of the Rebate program aligns with the WSA term and remains in effect for the duration of the contractual commitment.

6. Audit rights are granted to the Client to verify compliance of Pregenesis Fees and Rebates, ensuring full transparency in waste supply transactions.

7. The Client agrees to participate in a structured reporting mechanism that provides regular updates regarding waste supply volumes, quality assessments, and operational metrics to ensure optimization of resource recovery.

8. **Carbotura** shall maintain detailed records of waste received, processed, and transformed into materials that can be reintroduced into the supply chain, creating a fully circular economy.

9. The Client shall commit to a minimum delivery requirement of Acceptable Waste per the Waste Supply Agreement, ensuring operational efficiency for **Carbotura**.

10. **Carbotura** reserves the right to refuse non-compliant waste as per regulatory standards and facility capability assessments.

12.1.3 ARTICLE II – TERM

This Agreement shall commence upon execution and remain in effect for thirty (30) years from the date of achieving Commercial Operations, subject to termination, renewal, and performance-based reviews every five (5) years to ensure alignment with evolving industry standards and regulations.

12.1.4 ARTICLE III – PRICING, PAYMENT, AND REBATES

1. **Pregenesis Fee**: Upon commencement of Commercial Operations, the Client shall pay **Carbotura** a per-ton Pregenesis fee, subject to annual increases based on an industry-standard index to ensure fair pricing adjustments.

2. **Pregenesis Payments**: Monthly payments in advance, calculated as the Committed Tonnage multiplied by the Pregenesis Fee, with adjustments for excess or shortfall, to maintain a predictable and balanced financial arrangement.

3. **Rebate Calculations**: The Rebate amount starts at 123% of the sum of total capacity payments made by the Client for each term year and increases per the percentage schedule set forth in Exhibit “A”. Rebate calculations shall be transparent and based on verified operational data.

4. **Carbotura** will provide financial statements reflecting the revenue generation from waste processing, ensuring that the Client has a clear understanding of the financial impact and benefits of the partnership.

5. Client acknowledges that Capacity Payments are unconditional and non-cancellable, except for those provided under force majeure provisions.

12.1.5 ARTICLE IV – DEFAULT, TERMINATION, AND REMEDIES

1. **Events of Default by Carbotura**:
   - Failure to accept/process minimum AW as per committed terms, impacting waste diversion goals.
   - Insolvency or bankruptcy events leading to financial instability.
   - Breach of material obligations under this Agreement, including compliance with regulatory standards.
2. **Events of Default by Client**:
   - Failure to make payments in accordance with the agreed-upon terms.
   - Breach of supply obligations or insolvency that materially affects **Carbotura's** operational capabilities.
3. **Termination for Convenience**: The Client may terminate early by paying a make-whole fee, defined as the present value of remaining payments, ensuring **Carbotura** is compensated for expected revenues.
4. **Remedies**: Specific performance, damages, or termination rights shall be available to the non-defaulting party, with structured resolution pathways in place.
5. Clients' failure to meet the minimum waste delivery threshold for two consecutive years shall constitute grounds for termination or renegotiation.

12.1.6 ARTICLE V – PERMITTING & REGULATORY COMPLIANCE

1. **Permitting Support**: The Client shall provide reasonable assistance in securing all necessary permits and regulatory approvals required for the establishment and operation of **Carbotura's** WtCM facility.
2. **Regulatory Compliance**: **Carbotura** shall ensure all waste processing, material recovery, and byproduct utilization comply with local, state, and federal laws governing waste management and beneficial use.
3. **Jurisdictional Alignment**: **Carbotura** shall work with relevant regulatory agencies to ensure the facility meets or exceeds environmental and operational standards, optimizing approval processes where possible.
4. **Permit Delays**: In the event of regulatory delays outside of **Carbotura's** control, such delays shall not be deemed as a breach or failure of **Carbotura** to meet operational milestones.

12.1.7 ARTICLE VI – MISCELLANEOUS

1. **Notice Requirements**: Written notice to designated contacts as set forth in Exhibit "B", ensuring efficient communication channels.
2. **Governing Law**: This Agreement will be governed by the laws of the [State], with any disputes resolved under applicable jurisdictional frameworks.
3. **Confidentiality**: Terms of this Agreement shall remain confidential, except as required by law, protecting proprietary and competitive information.

4. **Assignment**: No assignment without prior written consent, except for corporate finance structuring, ensuring strategic control over contractual obligations.
5. **Dispute Resolution**: The Parties shall engage in mediation before proceeding to formal legal remedies, ensuring efficient conflict resolution.
6. **Periodic Review**: The Agreement shall be reviewed every five years to ensure relevance, compliance, and alignment with emerging technologies and best practices.

EXHIBITS – as required in formal contracts.

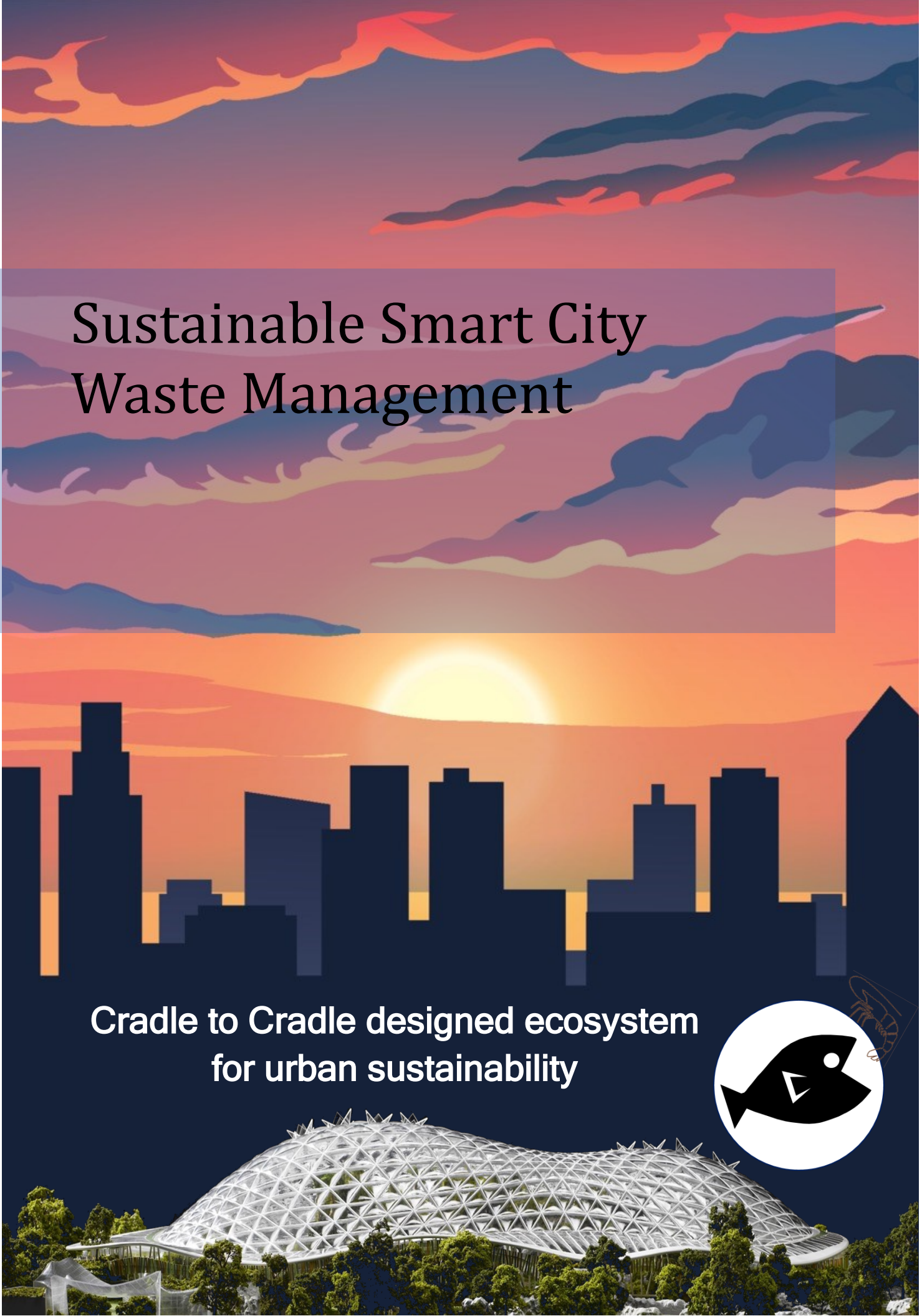
Carbotura

Redefining Sustainability

Green Energy Solutions LLC

Market Research Response

Sustainable Smart City Waste Management



Cradle to Cradle designed ecosystem
for urban sustainability

Situation Overview

Zero Waste Objective: Miami-Dade

On January 25, 2025 Mayor Levine Cava provided a Second Update on Directive No. 241676 to the Honorable Chairman Anthony Rodreguez and Members of the Board of County Commissioners of Miami-Dade who have mandated Mayor and Staff develop a broad strategy for Zero Waste management.

In her update, Mayor Levine Cava states there are no easy solutions when it comes to waste management. As Mayor, she notes: The underlying goal is to provide quality services to Miami-Dade residents in a financially and environmentally responsible and efficient way. Of utmost importance is the protection of the ratepayers.

Mayor Levine Cava also states that closure of North Dade Landfill and South Dade Landfill would represent on going annual revenue losses in the order of $50 million, plus a closure cost of $48 million. Reference was also made to the need to replace the RRF Facility at an estimated cost in excess of $1 billion involving a 10 year procurement cycle.

This proposal outlines a pathway that avoids these losses and could be operational within 18 months of starting construction. Existing landfill life may be extended by 95 times, and we are able to recover landfill space now used, including closed landfill space. This proposal generates significant net surplus (profit) and reduces environmental impacts. We employ the use of a well established modular technology referred to as being 'mature' by Stantec, a major international consultancy. This well proven technology is combined with other proven advanced farming and food preservation systems that utilize thermal energy left over after producing firm electrical power. The overall plant efficiency thereby goes from 23% (typical of standard Waste-to-Energy or WTE plants) to 75% efficiency. This efficiency gain combines to give the proposed plant an IRR of 15% prior to adjusting for avoided landfill costs and landfill space recovery this proposal represents.

This proposal reverses a major looming cost centre to a net positive revenue generator for the ratepayers, and significantly enhances net zero waste management objectives of Miami-Dade. We refer to this integrated technology package as the PEACE Bio-Dome. To learn more about this technology, click here to watch a short 8.5 minute video. Summary financial performance information is provided below, together with a cost comparison to standard WTE costs as stated by HDR in their reports to Miami-Dade.

PEACE Bio-Domes provide un-paralleled flexibility due to the modular design. Modularity means they may be expanded, contracted or moved to alternate locations providing maximum flexibility to the County in the years to come.

PEACE Bio-Domes do not generate a waste ash; a key element in achieving 'zero waste' status. In addition, PEACE Bio-Domes may be used to profitably recover valuable land covered with waste from prior generations, taking 'zero waste' to a new level.

Situation Overview - Miami-Dade County

Zero waste management goals ultimately should seek to enact policy and develop systems whereby MSW is significantly reduced or eliminated at source. As manufacturing technologies adapt to a reuse or zero waste mentality, significant reduction in MSW volumes is expected. Therefore, a commitment to extremely large centralized WTE or RFF plant is essentially an admission that zero waste is not achievable.

In the alternative vision proposed here; existing land, currently permitted for waste management (landfills), would be the home to a series of modularly expandable PEACE Bio-Domes. As Zero Waste initiatives are successfully implemented and less waste is generated at source, these facilities could switch focus to landfill mining and waste processing thereby recovering valuable land for development.

PEACE Bio-Domes represent an aesthetically pleasing waste management approach. Recovered landfill space and lands nearby would be more likely to attract development interest when buyers know that the benefits of the PEACE Bio-dome to them are lower household costs for cooling / hot water / heat and fresh food. Offsetting energy use with this lost resource (landfilled waste) is a positive step towards sustainability beyond that currently envisioned by the Zero-Waste plan.

Modular homes, built in Florida with recycled steel, are available through PEACE for deployment should a master planed self sustainable development be adopted. Such a development would be food and energy self-sufficient. Each home would be designed with permaculture elements. All waste, both sewage and solid wastes would be safely eliminated or repurposed , leading to true sustainability. PEACE provides Master Planning services through our NY office.

Food security for large urban areas like Miami-Dade should play a role in every decision. The great State of Florida will remain independent so long as the needs of the ratepayers are met in a sustainable fashion.

PEACE Bio-Domes represent a significant advantage to standard WTE systems. For instance, PEACE converts green organic waste to produce fish feed needed to raise antibiotic free shrimp and fish. The remainder makes excellent compost or RDF if there is no market for compost. All benefit from utilizing excess energy captured after making firm electrical power for sale 24/7.

This proposal is a pathway to zero-new-landfill space requirements no matter how large the County grows. Moreover, this proposal states that each closed or soon to close landfill, currently permitted for waste management could be transformed to one that never fills up, and becomes a self-sufficient community or development zone.

In summary this proposal outlines a new paradigm for municipal solid waste management.

Three Pillars to make Miami-Dade (Miami) the Smartest City

The current leadership of Florida, together with the extraordinary efforts of Mayor Levine Cava, will be seen through the lens of history as the fulcrum point administrations that made Miami-Dade County home to practical Smart City practices.

Miami-Dade is attracting record numbers of people who wish to live out their lives knowing there is smart leadership making wise critical decisions that will lead to fascial and environmental sustainability. Landfills were first utilized as a waste management strategy 5,000 years ago by the Egyptians and Persians. We are smarter now than they were.

Typical pillars of a smart city model *

I. City infrastructure and services

- **Built environment**
- Transport, mobility and **logistics**
- Water and wastewater management
- **Solid waste management**
- **Energy**
- Telecommunications
- **Health**
- Education and skills
- **Economic Development**

II. Institutional enablers

- Policy, legislation and regulation
- Leadership and governance
- City-wide planning (spatial, strategic / economic, smart city, etc.)
- Business model and financing
- **Innovation - seeing landfills as a resource**
- Citizen engagement / participation
- Sustainability and resilience

III. Digital transformation

- Data management and analytics
- Connectivity
- Interoperability and standards
- Security and privacy
- Urban platforms
- Disruptive technologies
- **Data center cooling with low grade energy from PEACE**

* PEACE Bio-Domes directly address those items in Bold type

PEACE Bio-Dome projects positively contribute across all three pillars. Of particular note is the way in which each complex assists the overall county in meeting waste management, energy, health, education and economic development goals while reducing traffic and improving power grid stability by providing a decentralized approach. Institutional enablers and staff regularly comment on the multiple ways our integrated complex (the PEACE Bio-Dome) holistically complements the goals and objectives they are seeking to facilitate.

PEACE Bio-Domes: a smart choice

Bio-Domes: a center for new community development.

Bio-Dome designs may be geared primarily towards high yield advance agriculture and aquaculture, or may be integrated with a more complex development model that includes a public market place and / or a hotel and convention development. In all cases the Bio-Dome is a source of both electrical power and district energy for cooling, heat and hot water. Moreover, the treatment of waste water may be integrated into the process design so that new developments do not add burden to existing sewage treatment plants.

Mobility:

Grow fish and prawns with feed from green waste. Fish waste grows pesticide free vegetables year round eliminates the need to transport food from far a-field to meet urban demands. Each Bio-Dome is a farmers market.

Safety and Security:

Uninterruptable food security from bio-secure non-GMO, pesticide free urban locations at scale meets critical planning needs.

Economy:

Bio-Dome attributes:

- Urban employment
- Eco-Tourism
- Entertainment
- Food products
- Fine dining
- Firm energy at discount

Living and Health:

Modern urban farms reduce long chain food supply lines. Traditional farming practices consume high volumes of water and, typically, non-renewable nutrients. Fresh harvested urban food delivered same day ensures highest nutritional value.

Energy:

Zero waste is the ultimate goal. Dumping waste, wasting it in a landfill is the last, worst, least enlightened solution; yet one used by the vast majority of urban civilizations (to use the word, in this context, loosely).

Bio-Dome complexes utilize chemical reactions to transform waste from a problem to reformed materials, recovered resources and continual (always available) biogenic energy.

Circular designs employed in PEACE Bio-Dome complexes use waste from one process as an input for the next. (e.g. fish waste is used as fertilizer for living lettuce and herbs.)

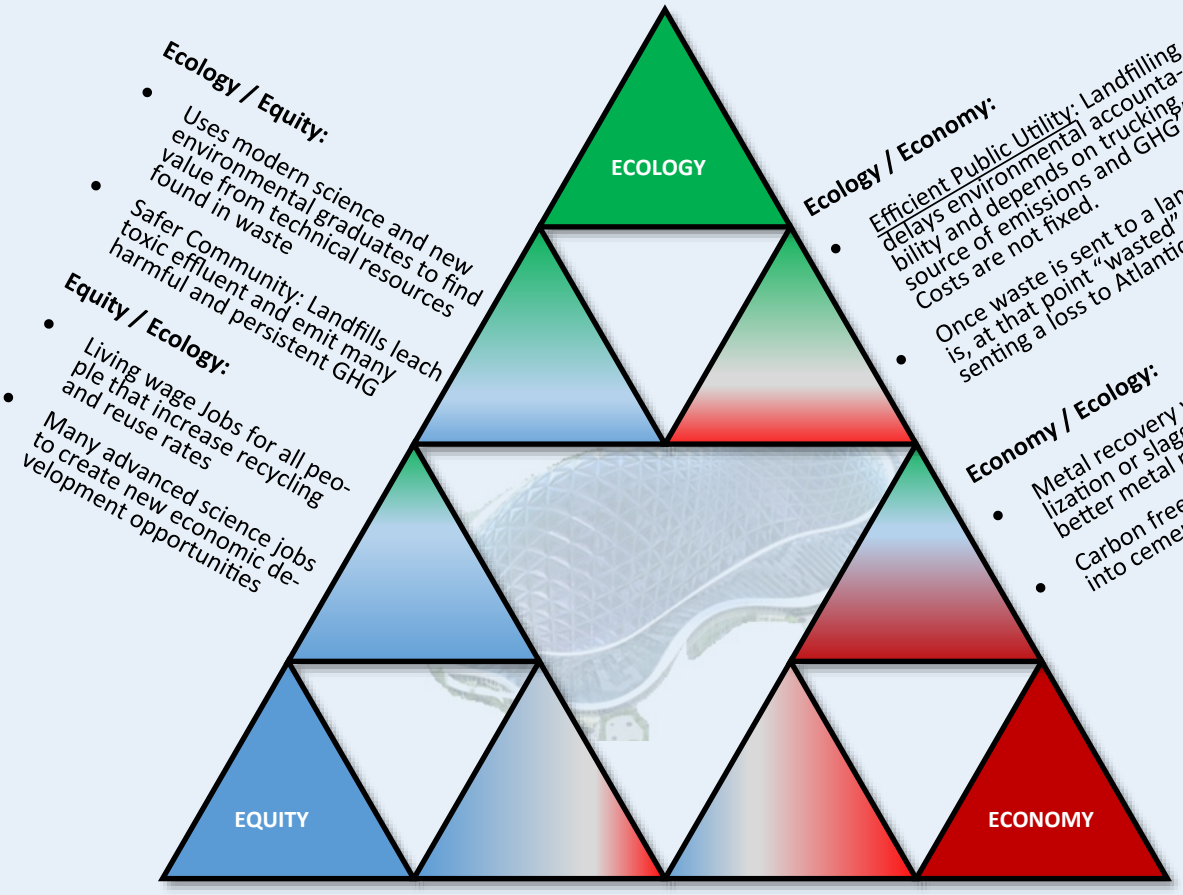
Education:

Intensive learning through advance information delivery systems that include entertainment and competitive elements are the vanguard for cross cultural impact. Bio-Dome focus is trained on environmental stewardship, using the understanding of circular design principals employed in the design of each PEACE complex to inspire vision for future projects locally and abroad.

Triple Bottom Line Analysis of the PEACE Bio-Dome Complex for Miami-Dade County based on one system processing 700 ton/day

Minimum calculated Total Equivalent Emissions Reduced utilizing US EPA Calculator for PEACE Bio-Dome Complex diverting 500 ton/day MSW from landfill

Total Equivalent Emissions Reduced [Total = Direct + Avoided]		
$MMTCO_2E/yr$ million metric tons of carbon dioxide equivalents per year	**tons CH_4/yr** tons of methane per year	**tons CO_2/yr** tons of carbon dioxide per year
0.5677	22,411	65,464
Equivalent to any one of the following annual benefits:		
Environmental Benefits		
• Carbon sequestered by __ acres of U.S. forests in one year:		737,226
• CO2 emissions from __ railcars' worth of coal burned:		3,122
• CO2 emissions from __ gallons of gasoline consumed:		63,875,745



Equity

- Tri-party advisory panel made up of community members, City representatives and Management Team
- Best annual art award using recycled metal
- Flag stones donated to charity for fundraising
- Food bank donations

Equity / Economy

- Organic fresh food production / green jobs
- Specialized nutraceutical products to reduce sickness at "no-name" prices

Economy / Equity

- New jobs in Green Sciences Sectors
- Advancement opportunities and training / advanced education based on merit

Economy

- Increased (decentralized) power supply to City on a continual basis to mitigate black-outs / economic losses
- Reduced waste management costs that stabilize far into the future
- Permeant employment at living wage or better rates in Green Energy, Food and Environmental job sectors

Miami-Dade County, Florida

SITUATION:

Miami-Dade County is seeking a comprehensive solution for Municipal Solid Waste (MSW). Currently the daily tonnage of MSW is 4,000 tons per day that had been processed in a Waste-to-Energy plant owned by Miami-Dade that is now permanently shut down.

PROPOSED SOLUTION:

This document presents an economically viable model for comprehensive MSW management that aligns with those envisioned for Smart City Developments as articulated above and as has been envisioned by the City planners of Miami -Dade County referred to herein as the PEACE Bio-Dome. In the alternative, and in order to allow comparison to more traditional Waste-to-Energy plants such as the one previously owned and operated by the County of Miami-Dade to process 4000 t/d, a basic low-efficiency comparative is provided.

In all cases, this proposal recommends a decentralized management approach for all MSW (Types 1, 2, 3, 4 and 5) "as received", based on 500 ton/day thermal treatment plant with '200 ton/day green waste' processing sub-system. Numerous plants, able to be set up turn-key within 12 to 18 months of order, would be located at existing landfill sites, currently permitted for waste management and owned by Miami-Dade County. Each plant could be expanded or contracted by adding or re-locating modules in the event of demand changes. Each system could allow for landfill mining by processing waste mined out should the decision to recover valuable land owned by the County for repurposing to support advanced food production, data centres, new affordable housing etc. , be made and thereby achieve higher overall energy efficiency and further emission reductions.

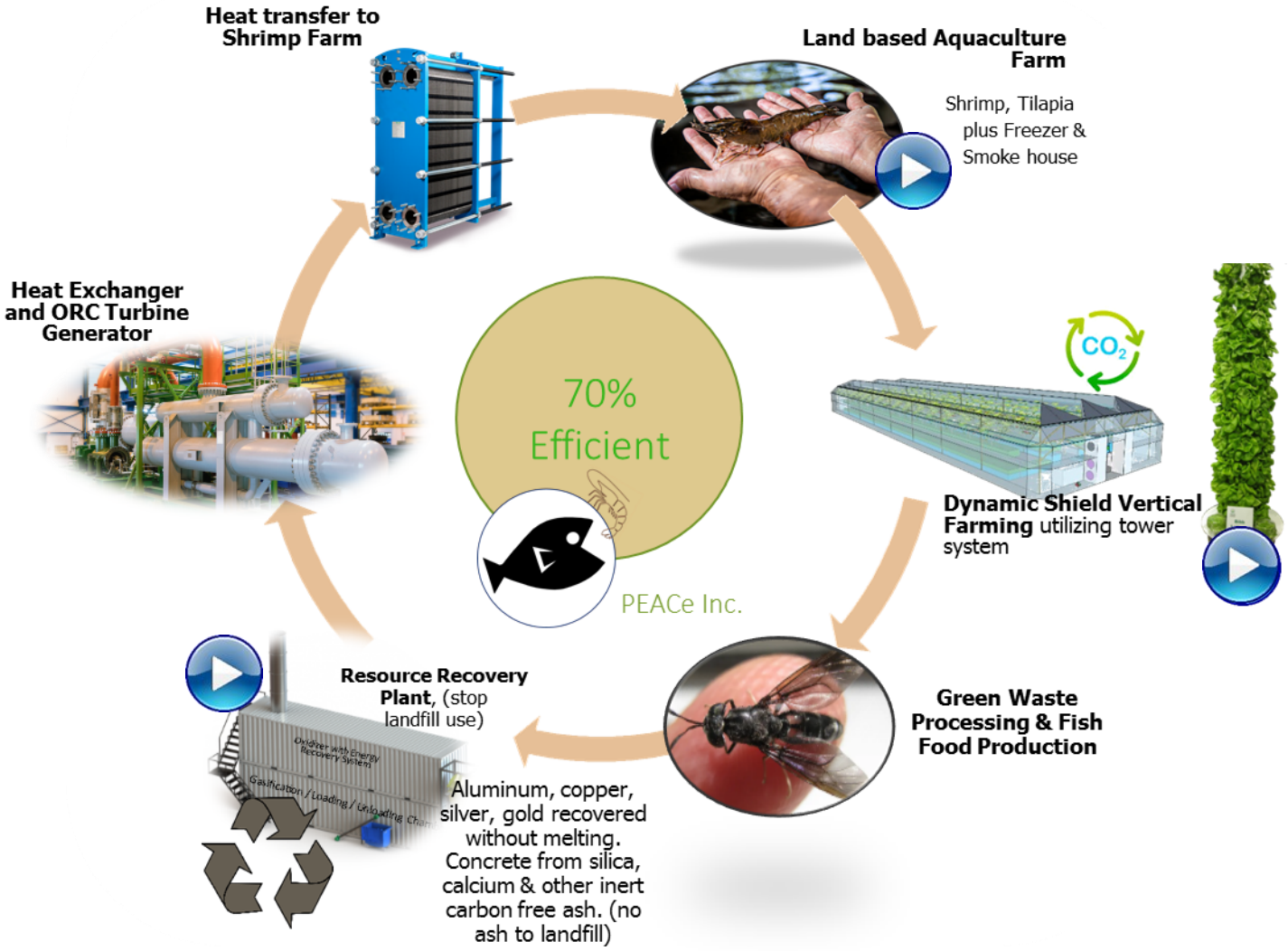
Basis

PEACE BIO-DOME SYSTEM:

Within the Bio-Dome enclosure we place all the integrated systems required to repurpose 500 tons per day of waste thermally, plus source separated 'green waste'. Our ash from the thermal units is carbon free, so we manufacture concrete blocks for use in landscaping by utilizing the ash as a Portland Cement ingredient. We do not need an ash landfill.

Continuous power is delivered to the grid and thermal energy is used on site to pump water and produce COLD for the production of Ice and Cold Storage Space. Fish and shrimp feed are produced on site making the farm sustainable as it does not depend on wild-caught fish from the ocean to be the feed source. Fresh vegetables and salad ingredients are grown using fish and shrimp excrement and provide further GHG offsets.

The entire system is covered. All odors from MSW are contained within the building and eliminated by our process.



Pro Forma comparative analysis and financial projections

Basis:

Comparative values for MASS BURN costs were derived from the document authored by HDR entitled: 'Master Plan Update / Miami-Dade County Solid Waste Management Master Plan, Miami-Dade County Department of Solid Waste Management, February 1, 2020, Page 13'. PEACE WTE plants have less down-time compared to the Mass Burn option described by HDR, meaning the annualized cost per ton is lower on both the PEACE Bio-Dome and PEACE Standard configurations. The PEACE Standard has lower operating costs and higher annualized net revenue than Mass Burn. The PEACE Bio-Dome has the highest annualized net revenue per ton of all systems, and provides far greater social benefit.

Most importantly however is the potential for either PEACE option to service debt and earn profit to offset other solid waste management operations that may be undertaken by the County.

Another major advantage to the PEACE system is the repurposing of ash to concrete retaining wall blocks, highway dividers, etc. This eliminates the need to landfill ash. In addition, PEACE Bio-Domes utilize a well proven, non-thermal green waste processor that is beneficial to our farming units and diverts wet waste from the thermal processors.

PRO FORMA ANALYSIS OF HYBRID AND STANDARD THERMAL SYSTEMS	PEACE BIO-DOME Hybrid with Advanced Farm	PEACE Standard Waste to Energy Plant	HDR Standard Waste to Energy Plant
Operating Life	40 Years	40 Years	30 Years
EBITDA (Yr.5 / Stabilized Op)	$ 38,480,579	$ 23,699,114	Not known
Total project cost:	$ 182,996,695	$ 126,958,867	$ 1,027,400,000
Straight-line - 500 t/d	4.76	5.36	
Kwh per ton	650	650	650
Capital Cost per Ton			
Ton per day (RATED)	700	500	4,000
Ton per year (ACTUAL)	249,660	173,375	1,328,600
Ton per hour	29	21	166.7
Cost per rated throughput ton	$ 261,424	$ 253,918	$ 256,850
Cost per annualized ton $ (WtE)	$ 733	$ 732	$ 773
Annualized Operating Cost / Ton	$ 72.01	$ 48.54	$ 65.76
Annualized Net Revenue / Ton	$ 154.13	$ 115.81	$ 16.91

FINANCIAL PERFORMANCE (US $000)	Risk Free Interest Rate (1)	Term	
IRR **Simple**		30	15%
NPV **Simple** (US $)	4.5%	10	$ 153,598,268
Total Maintenance to Project Cost Ratio over 20 years			100%

(1) Posted US Treasury Long Term Bond Rate

Revenues from tipping fees and farming together with power sales are projected to return an IIR of 16%.

Maintenance reserves in our model provide for perpetual operations based on major part replacements on pre-scheduled rotations to avoid any un-

PEACE Bio-Dome Resource Recovery Plant Overview

Basis:

Preliminary effort prior to engagement for pre-finance engineering and design has been completed in order to provide the reader the performance of the PEACE Bio-Dome system. No model is provided here for the standard system housed in a typical building focused mainly on electrical power production.

PEACE-in-Miami-Dade. Urban Farm : (Final Engineering Required) © Peoples Eco Agri Centre and Energy Inc. 2025								
Key Operating and Financial Assumptions for a 700 ton/day PEACE Bio-Dome with Shrimp RAS Aquaculture & Recycling Operation								
	Currency USD							
Construction Year (CY) One		1/1/2026	2026					
PLANT PRODUCTION at Start-up		**7/2/2027**			**2028**			
Shrimp (Jumbo)		160	tonne/year		960	tonne/year		
Seafood Processing / Freezing								
Metal and Glass recovered		8,669	tonne/year		9,986	tonne/year		
ICI Diversion from landfill		173,375	tonne/year		249,660	tonne/year		
								2028 Realised Annually
PLANT ENERGY VALUE for INTERNAL USE					**Efficiency**			
Generator rating = Kilowatts			13,550					
Electricty generation capacity - MWhr's			325		95%			112,763
Plant power consumption					15%			(16,914.47)
								95,849
Price per MWhr			$31				USD	31
Total Value used internally / not accounted for (USD - 000's)								$ 2,971
			GJh/Yr	**$'s/GJ**		Currency	USD	
Steam/(heat) generation - GJ available for use internally			574		$4.35	USD		$ 2,493
Construction Costs (US $)			**USD**					
Direct Construction Cost (PEACE Bio-Dome)			182,496,695					
Interconnection Cost			500,000					
Owners' Contingency	15%		27,410,532					
Interest During Construction			9,049,048					
Financing/Legal Costs			240,186					
					219,696,462			
Working Capital & Debt Service Res					11,000,000			
Total Development Costs & Construct, Financing					**230,696,462**			
PROJECT ASSUMPTIONS								
Owner's equity - percent of Initial Capital Costs + Contingency			0.53%		1,122,584			
Grants if available			0					
Income tax rate - percent			0					
Inflation - annual			3%					
PEACE Inc. franchise fees (percentage of gross income)			5.0%					
Construction/Term loan interest rate			3%					
Opening Cash recommended - (US $,000's)			0					
Term Loan - term			30	years				
Depreciation term			15	years				
Opening Day			7/2/2027					
Operational Contingency			5%					
Major Maintenance sinking fund			3% of original capital per year					

PRO FORMA Projections for PEACE Bio-Dome Resource Recovery

Basis:

Preliminary effort prior to engagement for pre-finance engineering and design has been completed in order to provide the reader pro forma performance summaries of the PEACE Bio-Dome system from an investment perspective.

PRELIMINARY: Pre-final engineering			Base Currency	USD			USD
Summary Financials	2026	2027	2028	2029	2030	2031	2032
(US $, 000)	**CY #1**	**CY #2**		**Year 2**	**Year 3**	**Year 4**	**Year 5**
Income Statement							
Revenues							
Current Revenue Stream		$ 11,263,758	$ 24,839,400	$ 32,518,837	$ 57,837,503	$ 59,430,382	$ 83,303,722
Operating Expenses	$ 350,000	$ 4,701,166	$ 9,366,289	$ 13,158,361	$ 20,390,282	$ 20,949,803	$ 28,114,496
EBITDA		$ 6,562,592	$ 15,473,112	$ 19,360,476	$ 37,447,221	$ 38,480,579	$ 55,189,226
EBITDA Margin %			62%	60%	65%	65%	66%
Interest Expenses		$ 5,390,392	$ 6,872,178	$ 8,145,252	$ 7,966,675	$ 8,979,420	$ 8,764,815
Cash Income		$ 11,263,758	$ 24,839,400	$ 32,518,837	$ 57,837,503	$ 59,430,382	$ 83,303,722
Net Margin %			68%	34%	51%	50%	56%
Statement of Financial Position							
Total Assets	$ 199,479,137	$ 44,967,962	$ 241,131,939	$ 275,223,784	$ 280,151,639	$ 321,307,756	$ 339,283,204
Current Assets	$ 18,101,151	$ 8,273,351	$ 12,059,349	$ 17,322,013	$ 35,189,317	$ 52,054,855	$ 85,629,040
Existing Cash	$ 7,101,151	$ 8,273,351	$ 16,874,285	$ 9,667,954	$ 20,726,946	$ 29,147,262	$ 54,490,830
Non-Current Assets		$ 36,694,611	$ 229,072,590	$ 257,901,771	$ 239,480,216	$ 258,288,688	$ 237,207,845
Total Liabilities	$ 192,377,986	$ 36,694,611	$ 224,257,660	$ 265,555,836	$ 259,424,693	$ 292,160,494	$ 284,792,374
Current Liabilities	$ 192,377,986	$ 36,694,611	$ 4,814,936	$ 51,216,944	$ 6,131,137	$ 45,365,942	$ 7,368,120
Non-Current Liabilities		$ -	$ 219,442,724	$ 214,338,892	$ 253,293,557	$ 246,794,552	$ 277,424,254
Equity	$ 7,101,151	$ 8,273,351	$ 16,874,285	$ 9,667,954	$ 20,726,946	$ 29,147,262	$ 54,490,830

Financial Summary

Funding Sources	2026	2027	2028	2029	2030	2031	2032	2033
	Const Yr. 1	**Const Yr. 2**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Equity	$ 7,101,151	$ 8,273,351	$ 16,874,285	$ 9,667,954	$ 20,726,946	$ 29,147,262	$ 54,490,830	$ 81,968,324
Debt	$ 192,377,986	$ 36,694,611		$ 47,250,735		$ 39,889,315		
Total Sources	$ 199,479,137	$ 36,694,611						
CAPEX (Cumulative)	$ 210,147,414			$ 257,398,149		$ 297,287,464		
Business Setup Costs	$ 20,549,048							
Revenue								
Recycling & Resource Recovery		$ 4,334,375	$ 8,668,750	$ 13,423,830	$ 15,664,606	$ 15,750,323	$ 15,838,611	$ 17,167,006
Fish Processing for outside catches		$ 2,040,590	$ 2,040,590	$ 2,101,808	$ 2,164,862	$ 2,229,808	$ 2,296,702	$ 2,365,603
RAS - Salmon		$ -	$ -	$ -	$ -	$ -	$ -	$ -
RAS - Black Cod (Sablefish)		$ -	$ -	$ -	$ -	$ -	$ -	$ -
RAS - Jumbo Shrimp		$ -	$ 7,755,613	$ 7,755,613	$ 24,197,513	$ 25,165,414	$ 48,395,027	$ 50,330,828
Dynamic Shield Vegetables	$ 1,238,045	$ 1,485,654	$ 2,971,308	$ 3,060,447	$ 3,152,260	$ 3,246,828	$ 3,344,233	$ 3,444,560
Off-site Energy (Power) Sales		$ 1,485,654	$ 2,971,308	$ 3,060,447	$ 3,152,260	$ 3,246,828	$ 3,344,233	$ 3,444,560
Metal Sales (4% by weight)		$ 3,403,139	$ 3,403,139	$ 3,403,139	$ 9,801,042	$ 10,095,073	$ 10,397,925	$ 10,709,863
Total	$ 1,238,045	$ 12,749,412	$ 27,810,708	$ 32,805,284	$ 58,132,543	$ 59,734,273	$ 83,616,730	$ 87,462,420

PRO FORMA Projections for PEACE Bio-Dome Resource Recovery

Basis:

Preliminary effort prior to engagement for pre-finance engineering and design has been completed in order to provide the reader pro forma performance summaries of the PEACE Bio-Dome system from an investment perspective.

Statement of Cash Flows (US$,000s)	Note	2027 CY 2	2028	2029	2030	2031	2032	2033
Cash Flow from Operations	1	11,263,758	24,839,400	32,518,837	57,837,503	59,430,382	83,303,722	87,140,022
Net Profit (EBITDA)	2	6,562,592	15,473,112	19,360,476	37,447,221	38,480,579	55,189,226	57,102,107
Adjustment of Non Cash Item	3			938,921	19,025,666	17,399,736	34,108,383	36,021,265
Cash Flow from Financing								
Term Loan		192,377,986	36,694,611	224,257,660	265,555,836	259,424,693	292,160,494	284,792,374
Term Loan - Repayment (Int & Pric.)		-	4,814,936	5,952,560	6,131,137	7,153,514	7,368,120	7,589,163
Equity		7,101,151	8,273,351	16,874,285	9,667,954	20,726,946	29,147,262	54,490,830
Cash at the end of the Year		8,273,351	16,874,285	11,215,224	29,480,547	29,501,159	46,424,411	48,558,336
NOTES	**NOTE REFERENCE**							

Summary Financials (US$,000s)	Note	2027	2028	2029	2030	2031	2032	2033
Current Ratio		9%	23%	250%	34%	574%	115%	1162%
Debt Service Coverage Ratio		2.00	3.21	3.25	6.11	5.38	7.49	7.52
Project IRR	1	4.30%	45.99%	4.31%	7.81%	11.24%	18.65%	28.78%
Project ROI based on NPV (3.5%) at given year	2		-183%	-174%	-166%	-152%	-138%	-119%
Cost of Funds	3	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Net Working Capital		8,273,351	16,874,285	9,667,954	20,726,946	29,147,262	54,490,830	81,968,324

NOTES	NOTE REFERENCE	
Project IRR	1	Divides Net Working Capital over Loan Balance (end of period)
Project ROI based on NPV (3.5%) at given year	2	Formula (NPV-CAPEX incld. Contingency) / (CAPEX incld. Contingency) based on Government Bond Rate of 3.5%
Cost of Funds	3	Cost of Debt Capital = Interest Rate * (1 – Tax Rate) where Tax Rate is assumed to be 20%

PRO FORMA Projections for PEACE Bio-Dome Resource Recovery

Pro Forma Balance Sheet Forecast:

PRELIMINARY: Pre-feaibility (NO DIVIDENDS SHOWN)									
			2027	2028	2029	2030	2031	2032	2033
BALANCE SHEET (US$,000's) Pro Forma		**Construction Year One**	**Construction Year Two**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Current Assets:									
Cash		7,101	8,273	12,059	17,322	35,189	52,055	85,629	121,116
Proceeds of Loan		11,000							
Prepaids & Deposits									
Total current		18,101	8,273	12,059	17,322	35,189	52,055	85,629	121,116
Property, Plant & Equipment									
Plant Costs		181,378	36,695	229,073	229,073	276,323	276,323	316,213	316,213
Capitalized Equipment Additions during year				-	47,251	-	39,889	-	-
Total Plant Costs				229,073	276,323	276,323	316,213	316,213	316,213
Depreciation for year	7%				18,422	18,422	21,081	21,081	21,081
Accumulated Depreciation				-	18,422	36,843	57,924	79,005	100,086
Net Property Plant and Equipment		181,378	36,695	229,073	257,902	239,480	258,289	237,208	216,127
Investments									
Maintenance sinking fund				-	-	5,482	10,964	16,446	21,928
Working Capital Reserve									
Total Investments		-	-	-	-	5,482	10,964	16,446	21,928
Total Assets		199,479	44,968	241,132	275,224	280,152	321,308	339,283	359,172
Liabilities & Equity									
Current Liabilities									
Due to Bank									
Accounts Payable									
Primary Equipment Loans		192,378	36,695		46,258		39,051		
Current portion of Taxes									
Current portion of long term debt: LOAN 1				4,815	4,959	5,108	5,261	5,419	5,582
Current portion of long term debt: LOAN 2						1,023	1,054	1,085	1,118
Current portion of long term debt: LOAN 3						-		864	890
Interest during construction									
Other									
Total Current Liabilities		192,378	36,695	4,815	51,217	6,131	45,366	7,368	7,589
Long Term Debt									
Long Term Debt - LOAN #1				219,443	214,339	209,082	203,667	198,090	192,346
Long Term Debt - LOAN #2						44,212	43,127	42,010	40,860
Long Term Debt - LOAN #3								37,324	36,408
Total Liabilities		192,378	36,695	224,258	265,556	259,425	292,160	284,792	277,203
Equity									
Share capital (1)			-	-	-	-	-	-	-
Retained earnings / (Deficit)		7,101	8,273	16,874	9,668	20,727	29,147	54,491	81,968
Total equity		7,101	8,273	16,874	9,668	20,727	29,147	54,491	81,968
Total liabilities & Equity		199,479	44,968	241,132	275,224	280,152	321,308	339,283	359,172

PRO FORMA Projections for PEACE Bio-Dome Resource Recovery

Pro Forma Income and Expense Forecast

PRELIMINARY: Pre-final engineering (NO DIVIDENDS SHOWN)			Base Currency	USD			USD	1.00000
Income and Expense (US $,000)	2026	2027	2028	2029	2030	2031	2032	2033
	CY 1	**CY 2**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Revenue (US $,000)								
Mined Waste			-					
Organic Green Waste			-	2,774	2,857	2,943	3,031	3,122
Clinical / Medical			-	-	-	-	-	-
Recycling		4,334	8,669	13,424	15,665	15,750	15,839	17,167
RAS Division								
Fish Processing		2,041	2,041	2,102	2,165	2,230	2,297	2,366
Salmon (Steelhead) Sales								
Black Cod Sales								
Shrimp Sales			7,756	7,756	24,198	25,165	48,395	50,331
Off-site energy sales		1,486	2,971	3,060	3,152	3,247	3,344	3,445
Certified Emission Reductions (?)				-				
Metal Sales (5% by weight)		3,403	3,403	3,403	9,801	10,095	10,398	10,710
Total Revenues	-	11,264	24,839	32,519	57,838	59,430	83,304	87,140
Expenses (US $,000)								
Recycling		2,546	2,546	2,546	3,682	3,792	3,906	4,023
RAS Division				-	-	-	-	-
Shrimp			2,138	2,202	6,671	6,938	13,343	13,876
Custom Order Processing		875	1,224	1,261	1,299	1,338	1,378	1,419
Maintenance Allowance			548	3,655	3,655	3,655	2,741	3,655
Technical Support		120	120	124	127	131	135	139
Office		286	286	295	303	313	322	332
Education		360	360	371	382	393	405	417
Grounds Keeping		34	34	35	36	37	38	40
Head Office Team, PR & Overheads	350	480	480	494	509	525	540	556
Operational Contingency			387	549	833	856	1,140	1,223
Total Expenses	350	4,701	8,124	11,532	17,498	17,978	23,949	25,681
Franchise Fee								
Training / Technology / Brand / Markets			1,242	1,626	2,892	2,972	4,165	4,357
Total operational expenses	350	4,701	9,366	13,158	20,390	20,950	28,114	30,038
EBITDA for 2025	(350)							
T Equip (Cel B43): Then EBITDA	(182,737)	6,563	15,473	19,360	37,447	38,481	55,189	57,102
Interest	3,549	5,390	6,872	8,145	7,967	8,979	8,765	8,544
Depreciation			-	18,422	18,422	21,081	21,081	21,081
Pretax operating profit	(3,899)	1,172	8,601	(7,206)	11,059	8,420	25,344	27,477
Taxes			-	-	-	-	-	-
Owner's investment	(3,899)	1,172	8,601	(7,206)	11,059	8,420	25,344	27,477
Net profit percent of total revenues			35%	-22%	19%	14%	30%	32%
IRR of Cash flow over 10 years			14.8%					
NPV, 10 year,	4.5%		$153,598					
Retained earnings open & Cash on Hand		7,101	8,273	16,874	9,668	20,727	29,147	54,491
Retained earnings close	**(3,899)**	**8,273**	**16,874**	**9,668**	**20,727**	**29,147**	**54,491**	**81,968**
Sources of Cash								
Net profit after tax	(3,899)	8,273	16,874	(7,206)	11,059	8,420	25,344	27,477
Yr 1=cash from Loan, then Depreciation Credit	11,000	-	-	18,422	18,422	21,081	21,081	21,081
	7,101	8,273	16,874	11,215	29,481	29,501	46,424	48,558
Uses of cash								
Repayment of term debt			4,815	5,953	6,131	7,154	7,368	7,589
Maintenance sinking fund				-	5,482	5,482	5,482	5,482
Other								
to Bank	7,101	8,273	12,059	5,263	17,867	16,866	33,574	35,487
	7,101	8,273	16,874	11,215	29,481	29,501	46,424	48,558
Annual Maintenance Expense Budget			548	3,655	3,655	3,655	2,741	3,655
Maintenace Sinking Fund Reserve			-	-	5,482	5,482	5,482	5,482
Total Operating Funds Allocated to Maintenance			548	3,655	9,137	9,137	8,223	9,137
Cummulative Operating Funds Allocated to Maintenance			548	4,203	13,340	22,477	30,700	39,837

Insoftel

Market Research Response

Synergy Conversion Solutions

Waste Conversion

Waste to RDF

Waste to Energy

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1. Project Overview

Comprehensive Waste-to-RDF and Waste-to-Energy Offering

Objective: This document aims to outline Synergy's cutting-edge Waste-to-Energy (W2E) solution and the potential partnerships and project structures that can be established in the development of a W2E facility.

The goal of any W2E project is to leverage Synergy Global Waste Systems' innovative Converter™ technology to effectively address waste management challenges, environmental concerns, and the impending scarcity of landfill space.

This document describes the entire Waste-to-Energy solution, the Waste-to-RDF solution follows the same process which the exception that the process ends after the Waste Conversion process and excludes the Smoldering and ORC Turbine processes.

Facility Features:

1. Capacity and Scale: The facility is designed as a modular system, divided into multiple processing blocks or modules. This modular approach allows for scalability and adaptability to varying waste volumes. Technology: Utilizing the patented Converter™
2. technology, the facility is capable of transforming diverse waste types, including MSW (municipal solid waste), ICI (industrial, commercial, and institutional), organics, medical and pharmaceutical waste, and construction and demolition debris, into a Normalized Refuse Derived Fuel (N-RDF) which is further processed into clean power. Energy Generation: The facility is projected to generate approximately 55 megawatts of net clean
3. power for every 100 metric tons of waste processed, significantly contributing to the local energy supply and sustainability goals.1
   Environmental Compliance: The design and operation of the facility adhere to the
4. stringent regulations and compliances set forth by the Ministry of The Environment (MOE). This ensures minimal environmental impact and promotes sustainable waste management practices. Synergy engages with local environmental experts for each project.

1 Final figures are determined during a project study and waste analysis.

Benefits to Project Sponsor2

1. Landfill Reduction: The facility will substantially decrease the reliance on landfills, thereby extending their operational lifespan and reducing associated environmental issues. Clean Energy Production: By converting waste to energy, the project not only deals with waste
2. management but also contributes to the generation of renewable energy, aligning with environmental sustainability goals. Economic Advantages: There are several economic benefits, the least of which is the life extension of the landfill, sale of power to the grid,
3. potential carbon credit revenue generation. Various funding models (purchase, lease, as-a-service) can also contribute to the economic benefits of the municipality or project owner/sponsor. Community Engagement and Employment: The project is committed to involving the
4. local community, promising job creation and opportunities for local businesses during the construction and operational phases of the facility.
5. Project Significance: This project represents a significant step forward in addressing the environmental and logistical challenges of waste management. By adopting an innovative waste-to-energy approach, the Sponsor can set a precedent for sustainable urban waste management, energy generation, and environmental stewardship, placing it at the forefront of ecological innovation in Canada and the United States.

[2] The project sponsor is the entity that benefits from the project, it could be a company, municipality, government, etc.

2. Comprehensive Waste-to-Energy Project Overview

This document serves as a summary of a proposed Waste-to-Energy (W2E) facility, developed by Synergy Global Waste Systems (hereinafter "Synergy") to address the critical challenges of waste management and landfill capacity that are currently confronting numerous municipalities across Canada and the United States.

Project Rationale and Objectives: The principal objective of this project is to provide a sustainable solution to the escalating issues associated with waste management and the diminishing availability of landfill space. Synergy, leveraging its patented waste-to-energy facility technologies, proposes a W2E facility capable of generating approximately 55 megawatts (MW) of clean power from every 100 metric tons (MT) of assorted waste processed.[3]

1. Partnership and Agreement Structure: Synergy is structured to engage in a variety of partnership agreements and operating models including,
    a. Synergy sells, builds and commissions a system for an owner (owner funds the project)
    b. Synergy sells, builds and commissions a system for an owner (Synergy funds the project)
    c. Synergy works with a funder to build and commissions a system for a project sponsor, where the system is owned by the funder and operated by Synergy or by the project sponsor or a third party – as a service project
    d. Synergy is open to other project structures.

2. Facility Design and Capacity: The proposed facility is meticulously designed in processing blocks to process the required waste input. Each module is equipped to handle a variety of waste types including municipal solid waste (MSW), organics, medical and pharmaceutical waste, industrial, commercial, and institutional (ICI) waste, and a majority of construction and demolition debris, utilizing Synergy's patented Converter™ technology.

3. Collaborative Development and Compliance: Synergy will undertake the responsibility of designing the facility, ensuring efficient spatial planning and the integration of advanced waste processing and energy conversion technologies. The design will be consistent with the existing models yet bespoke to the project's requirements. Compliance with all Ministry of The Environment (MOE) rules, regulations, and compliances is a fundamental aspect of this project. Synergy will partner with local firms in the development and construction of the project. Synergy is the General Contractor and Project Manager.

4. Technological Advantage: A key feature of the Synergy W2E facility is the Converter™ technology. This technology is capable of processing diverse waste types and converting

[3] Any figures need to be confirmed by project specific study.

them into a homogenous and consistent byproduct (N-RDF), serving as an ideal fuel source for low-temperature, low-pressure power generation. This method is environmentally advantageous, circumventing the negative impacts associated with traditional incineration-based power generation.

5. Operational and Financial Modeling: To ensure the facility's alignment with specific needs, an Operational Efficiency Study will be conducted, examining waste volume, mix, throughput, and capacity. This study is essential for determining the facility's scale and ensuring its operational efficiency. Concurrently, a comprehensive financial model will be developed. This is the first step in the process of developing a project plan.

6. Municipal Collaboration and Requirements: The successful implementation of any project requires active participation from the project owner/sponsor, including the provision of specific information to facilitate precise planning and operational efficiency. Elements such as project liaison, waste metrics per day, budget allocations, municipal waste standards, and details of various waste types are crucial for accurate financial modeling and operational planning.

7. Project Steps: The successful implementation of any project is based on a comprehensive program plan and schedule with milestones. The following outlines the general steps of the process, which will be further developed during the study phase of the project. Project steps,
    a. Presentation of general deck and concept
    b. High level review of waste volumes and current costs
    c. Review volumes, costs and high-level project outline
    d. Engage in a full project study
    i. Waste review
        ii. Costing review
        iii. Partnership structure
        iv. Funding
        v. Technology overview and equipment selection
        vi. Factory plan and layout
        vii. Local suppliers (construction companies, environmental consultants, etc)
        viii. Local customers (PPP, power purchase agreements)
        ix. Project schedule
        x. Terms & Conditions
        xi. Sample contract

3. Comparative Analysis of Waste Processing Technologies

This section delineates a comparative analysis of various Waste-to-Energy (W2E) technologies, highlighting their distinctive characteristics in juxtaposition with the Synergy W2E solution, particularly focusing on the Converter™ technology. W2E processes involve converting diverse waste materials into energy, typically manifested as electricity or heat. Each technology possesses unique advantages and disadvantages.

Key Differentiator: The Synergy W2E Solution, underpinned by the Converter™ technology, fundamentally distinguishes itself by operating at lower temperatures and pressures. This is primarily attributable to the utilization of Normalized Refuse-Derived Fuel (N-RDF) generated via the Converter™ technology. The homogeneous and consistent energy content of the N-RDF facilitates higher energy output and diminishes environmental impact.

Competing Technologies:

1. Incineration:

- Nature: A high-temperature (1,700 to 1,900 degrees Celsius) waste treatment process involving the combustion of waste materials.

Advantages:

- Energy Recovery: Generates electricity and heat from waste combustion.
- Volume Reduction: Decreases waste volume, reducing landfill requirements.
- Efficient Waste Disposal: Effectively disposes of municipal solid waste.

Disadvantages:

- Air Emissions: Significant levels of air pollutants and greenhouse gases.
- Residual Ash: Necessitates proper disposal of resultant ash.
- High Capital Expenditure: Incineration facilities are costly to construct and maintain.
- Operational Challenges: High temperatures required for complete waste consumption lead to complex optimization.

2. Anaerobic Digestion:

- Description: A biological process where microorganisms decompose organic materials in oxygen-deprived environments.

Advantages:

- Biogas Production: Generates biogas (methane and carbon dioxide) for energy.
- Organic Waste Treatment: Effectively treats organic residues.
- Nutrient-Rich Byproduct: Produces digestate suitable for fertilization.

Disadvantages:

- Limited to Organic Waste: Ineffective for non-organic materials. •
Prolonged Process: The digestion process can be time-consuming. •
High Initial Investment: Substantial costs for facility establishment.

3. Pyrolysis:
    • Operation: Thermal decomposition of materials at elevated temperatures in an inert atmosphere.

Advantages:
    • Biochar Production: Yields biochar, beneficial for soil amendment.
    • Versatility: Capable of processing various waste materials.

Disadvantages:
    • Energy Consumption: High energy requirements.
    • Technological Complexity: Requires skilled operation and maintenance.
    • Economic Feasibility: Challenges in achieving commercial viability.

4. Gasification and Plasma Gasification:
    • Functionality: Both technologies convert carbon-based materials into syngas. Plasma gasification operates at extremely high temperatures using a plasma torch.

Advantages:
    • Syngas Production: Both technologies produce syngas, a valuable energy source.
    • Efficiency: Generally more efficient than traditional incineration.

Disadvantages:
    • High Operational Demands: Require high temperatures and pressures.
    • Substantial Investment: High capital costs for facility establishment.
    • Limited Scale: Few large-scale commercial implementations.

Synergy W2E Solution's Superiority:

The Synergy W2E Solution, with its Converter™ technology, offers a more environmentally sustainable alternative by operating at lower temperatures, thereby avoiding the formation of NOx, dust, dioxins, furans, and other harmful compounds. Additionally, it produces an inert, white ash with minimal carbon content, further underscoring its environmental efficiency.

5. Plant Walkthrough Overview for Waste-to-Energy Facility

Detailed Walkthrough of the Waste-to-Energy (W2E) Plant Operations

This section provides an in-depth overview of the operational process of the Waste-to-Energy facility, emphasizing the technological sophistication and environmental compliance of each stage.

Initial Waste Reception Process

a) Vehicle Identification and Tracking: Upon entry, all vehicles are immediately identified, and their details are logged into the Plant's Operating System (OS). This procedure is crucial for maintaining a record of all incoming waste materials.
b) Weighing and pertinent Screening: Vehicles proceed over a calibrated scale station for accurate weight measurement. Concurrently, integrated radiation and chemical sensors perform a thorough analysis to ensure the exclusion of hazardous materials from the waste stream.
c) Visual Inspection and Waste Unloading: The waste is then subjected to a visual inspection for any anomalies before being directed to the designated 'tipping area.' Here, vehicles offload the waste into a reception pit. After unloading, vehicles are re-weighed at the scale station to calculate the net weight of the delivered waste.

Primary and Secondary Waste Processing

a)Transfer to Shredders: The waste is either automatically or manually transferred from the reception pit to primary and secondary shredders. These machines are designed to reduce the waste to a uniform size, facilitating efficient downstream processing.
b) Moisture Reduction and Mixing: A tumble dryer is employed post-shredding to remove excess moisture from the waste. This step is vital for optimizing the conversion process, ensuring that the waste reaches an ideal consistency for the subsequent conversion phase.

Conversion Technology: The Synergy Converter™

a)The Converter™ Process: The waste is fed into the Converter™, a technologically advanced system that processes waste at an average rate of 2000 kg/hour. The Converter™ is engineered to execute seven critical steps:
b) Automated Loading: Waste is loaded into the Converter™ automatically.
c) Shredding: Further reduction of waste size and homogenization takes place.
c) Evaporation: Additional moisture is evaporated from the waste.
d) Super-Heating and Sanitization: The waste is super-heated to eliminate pathogens.
e) Cooling: Post-processing cooling of the waste material.
f) Unloading: The processed waste is then unloaded onto a conveyor for the next operation.
g) Process Optimization: Each stage of the Converter™ is rigorously optimized, both manually and automatically, using feedback from various sensors. This optimization

ensures that the waste is neither under- nor over-processed, maintaining operational efficiency and environmental safety.

Smoldering and Oxidation

a) Smoldering Ovens: The converted waste, now termed Normalized Refuse Derived Fuel (N-RDF), enters the smoldering ovens. In these ovens, the N-RDF undergoes a controlled low-oxidation process without direct flame contact, a method deliberately chosen to avoid pollutant production and optimize energy recovery.
b) By-product Processing: Post-smoldering, the resulting char - an oxidized, inert, low-carbon content ash, is conveyed and processed to extract any residual metals. This char, characterized by its small particle size (less than 3 mm), is suitable for various applications in construction and road building.
c) Gas Oxidation: Gases emanating from the smoldering process are completely oxidized in the oxidation chamber, resulting in the generation of a hot exhaust gas, which is then utilized in the subsequent energy generation phase.

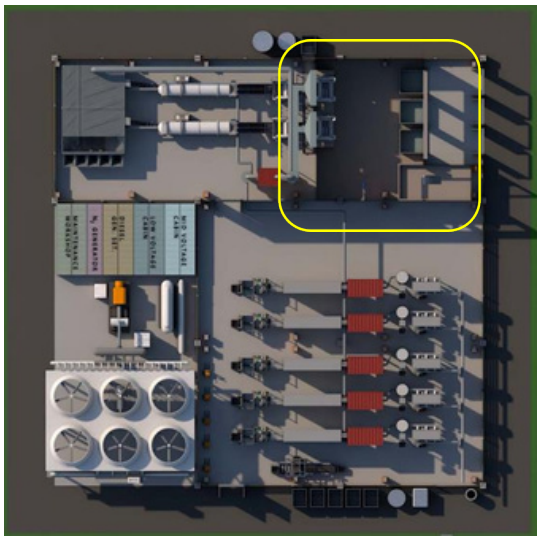
Power Generation: Organic Rankine Cycle Turbine

a) Heat Transfer to ORC Turbine: The heat derived from the smoldering and oxidation stages is transferred to a boiler. This boiler, in turn, heats the organic fluid used in the Organic Rankine Cycle (ORC) turbine.
b) Electricity Generation: The ORC turbine operates on a heat exchange principle. As the heated organic fluid expands and cools, it drives the turbine, which is connected to an electrical generator. This process efficiently converts thermal energy into electricity.
c) Environmental Considerations: Throughout this phase, meticulous attention is given to ensure minimal environmental impact, with the ORC turbine being a critical component in achieving sustainable energy generation from waste.

6. Incoming Waste Process for Waste-to-Energy Facility

Overview of Section 1A: Waste Receiving Protocol

1. Designation of Waste Reception Area:
The designated area for the receipt of waste, highlighted in yellow, is allocated solely for the reception of waste materials. This area is dimensioned at 24 meters in width, 18 meters in length, and 12 meters in height, with an ancillary dimension of 24 meters in width by 12 meters in length by 6 meters in height, culminating in a total volume of 1,728 cubic meters designated for waste storage. The area can support an average energy potential of 1,866 Megawatt-hours (MWh) for 518 metric tons, calculated at a density of 300 kilograms per cubic meter, hereby ensuring a feedstock provision for seven days to the facility's operational capacity of 100 metric tons per day.

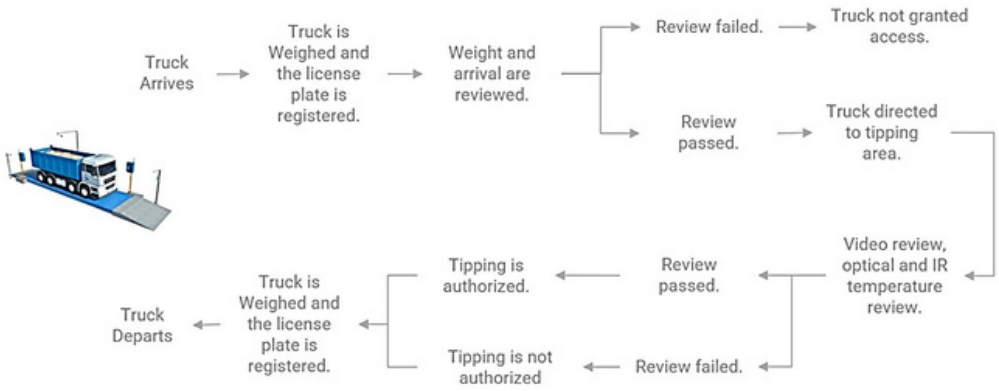


2. Procedure for Incoming Waste: The protocol for incoming waste is stringently governed by established procedures. The initial stage of waste acceptance initiates the data collection process for the Waste-to-Energy plant. The types of waste received include, but are not limited to, Municipal Solid Waste (MSW), medical waste, and Industrial, Commercial, and Institutional (ICI) waste. It is pertinent to note that hazardous waste materials, inclusive of but not limited to radioactive waste, paints, petroleum-based products, and pressure vessels, are expressly prohibited.
3. Vehicle Processing and Data Collection: Vehicles arriving at the facility are required to proceed to a weight station for data collection purposes. Here, the weight information is gathered, a video inspection of the incoming waste is conducted, and the vehicle and its contents pass through a comprehensive sensor suite to ensure the safety of the waste load. Vehicles must undergo a scan by a radiation monitor, such as that provided by Radiation Solutions Inc. or an equivalent entity, to screen for radioactivity.
4. Data Logging: The information pertaining to each vehicle is meticulously collected and logged, including, but not limited to, the transport company, the driver, the license plate number, the date and time of entry and exit, the inbound and outbound weight, images of the truck and its load, and video documentation of the tipping process. This rigorous data logging protocol serves to maintain inventory levels, facilitate operational scheduling, ensure the continuous operation of the system, manage risk, and support the implementation of Key Performance Indicator (KPI) tracking alongside continuous improvement initiatives.

5. Completion of Waste Receipt: Subsequent to the completion of the aforementioned protocols, the waste is transported to the tipping area. Post-unloading, vehicles are directed to exit the facility, passing through the outbound scale for final weight measurement, thus concluding the waste reception process.

6. Mandatory Equipment Requirements: The reception process mandates the utilization of the following equipment:
   - Scales: Inbound and outbound vehicle scales, of a caliber equivalent to Canadian Scales or similar, for precise weight measurement.
   - Monitoring Equipment: Video and Infrared (IR) cameras, recording equipment, and radiation sensors, preferably supplied by Radiation Solutions Inc. or a comparable provider.
   - Vehicle Recognition: A truck recognition system, forming part of the Synergy Operating System Platform, to ensure accurate vehicle tracking.
   - Illumination and Communication Systems: Adequate lighting, including traffic management indication lights, is requisite for the safe and efficient operation of the waste reception area.

Protocol for Incoming Waste Management and Verification Process



1. Upon arrival at the Waste-to-Energy facility, a waste collection truck enters the premises and approaches the weigh station. Here, the truck is subjected to an initial weight assessment, and the vehicle's license plate is meticulously registered into the facility's monitoring system. This initiates the formal documentation and tracking process of the waste reception protocol.

2. Following the weigh-in, the truck's load, along with the time of arrival, is carefully reviewed through a series of checks. If the review is successful and the truck passes the necessary criteria, it is then granted access to proceed. Conversely, if the review indicates a failure to meet the set standards, access is denied.

3. For trucks that have successfully passed the review, the next step involves directing them to the tipping area, where they are authorized to offload their waste. At this juncture, a secondary review takes place, which includes a thorough video inspection as well as optical and infrared temperature assessments to ensure the safety and compliance of the waste material with the facility's operational standards.

4. If the waste meets the approval criteria during this secondary review, tipping is authorized, and the truck proceeds to offload the waste in the designated dumping area. If the review results in a failure, the tipping is not authorized, and the truck is not allowed to offload its waste.

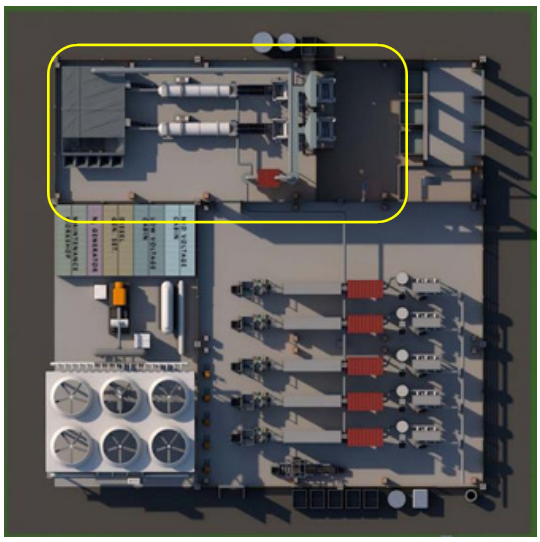
5. Once the waste has been successfully tipped, or if the truck is not authorized to tip, it proceeds back to the weigh station. The truck is weighed once more to determine the net weight of the waste deposited. The license plate is registered again, providing a meticulous record of the vehicle's entire transaction at the facility.

6. Finally, the truck departs from the Waste-to-Energy facility, completing the process of waste reception. The comprehensive data collected from the truck's entry to exit is stored and managed within the Plant’s Operating System, contributing to the efficient tracking, processing, and recording of waste inputs to the facility.

6. Section 1B: Description of Inbound Waste Reception and Processing Protocol

a) Allocation and Specification of the Inbound Waste Area

This section is delineated for the receipt and initial processing of waste at the Waste-to-Energy (W2E) facility. The designated area for these activities, referred to herein as the "Inbound Waste Area," outlined in yellow. The dimensions of this area are specified for a facility with a daily processing capacity of 100 metric tonnes (MT), measuring 24 meters in width by 18 meters in length by 12 meters in height, yielding a total storage volume of 1,728 cubic meters. This section is expressly for illustrative purposes and not indicative of the scale or design for Essex. The waste stored within this area contains an average energy content of 1,866 Megawatt-hours (MWh), assuming a density of 300 kilograms per cubic meter for 518 MT of waste, providing sufficient feedstock for a period of seven days.



b) Initial Waste Handling Operations

Upon satisfactory receipt, the waste undergoes a series of designated operations as follows: • Primary Shredding: The initial size reduction of waste to ensure uniform processing. • Metal Sorting: The separation of ferrous and non-ferrous materials from the waste stream.

- Tumble Drying: The removal of excess moisture and further homogenization of the waste.
- Secondary Shredding: Further reduction of waste granularity to facilitate subsequent processing.

The transfer of waste within this area is facilitated through either overhead cranes or grapple mechanisms, with operational flexibility for both automated and manual handling processes.

c) Oversight and Monitoring Systems

An operations control room, situated above the Inbound Waste Area, provides comprehensive oversight, ensuring adherence to the First In / First Out methodology and monitoring for consistency and quality in waste composition. The area is equipped with an array of automated monitoring systems including, but not limited to:

- Life Safety Systems: Provided by entities such as the Mircom Group of Companies or equivalent.
- Fire Suppression Systems: Both wet and dry suppression systems supplied by National Fire Equipment or equivalent to mitigate fire risks.

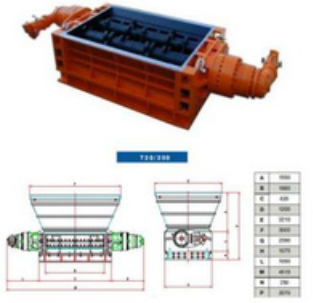
- Environmental Monitoring Equipment: Heat sensors, infrared cameras, and chemical sensors to monitor the environmental conditions within the waste reception area.
- Fire Protection Infrastructure: A dry system overhead fire sprinkler system is installed as a pre-emptive safety measure.
- Communication and Safety Systems: A robust communication system is in place to facilitate efficient and safe operations.

Air Quality Management

The facility includes an air circulation system capable of exchanging 30,000 cubic meters of air per hour with fresh external air, which serves multiple purposes:

- Dust and Odor Control: Minimizes the accumulation of dust and odors within the waste reception and holding areas.
- Fire Risk Mitigation: Acts as a preventive measure against potential fire hazards by facilitating regular air changes.

Process Transition to Material Recovery

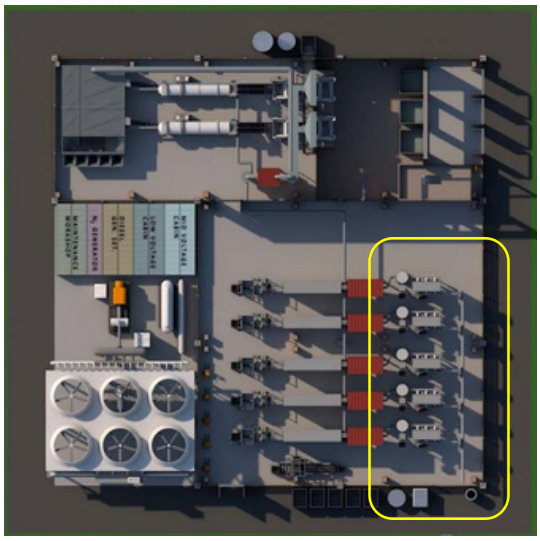


Post-reception, waste is conveyed to the primary processing stage where large, slow-speed shredding systems reduce waste to a granularity of 20 centimeters, with dual shredders in place to ensure process redundancy and maintenance flexibility. Secondary high-speed shredders refine the granularity to 5 centimeters or smaller. Upon completion of the shredding process, a metal separation system, such as those provided by ShieldsMagnetics, segregates metals which are then channeled to recycling facilities. The subsequent tumble drying phase employs a Pennati Type 701/210 unit, enhancing the homogenization of the waste and preparing it for further processing.

After exiting the secondary shredders, the uniformly processed materials are transported via conveyor systems through the subsequent stages of the facility, proceeding toward final conversion and energy recovery.

7. Overview of the N-RDF Conversion Process

Section 2: Transformation of Waste to Normalized Refuse Derived Fuel (N-RDF)



The subsequent phase in the Waste-to-Energy (W2E) facility's operation (outlined in yellow) encompasses the conversion of incoming waste material into Normalized Refuse Derived Fuel (N-RDF), an enhanced form of Refuse Derived Fuel (RDF). This section, equipped with state-of-the-art conversion apparatus, is designated for the advanced processing of waste and is encapsulated within an area that boasts a dedicated fire protection system, tailored to the specific needs of this segment of operations.

The primary objective of the N-RDF production zone is to refine the received feedstock into a superior quality fuel, characterized by its uniformity and precise composition. This zone is vital in the transformation process, where the proprietary Converter™ technology is employed to transmute waste into N-RDF. This innovative and patented process is not only effective in neutralizing all bacterial, pathogenic, and viral entities present in the waste but also plays a crucial role in obliterating odors associated with municipal solid waste and organic materials.

Through the N-RDF production process, the W2E facility successfully elevates the utility of the feedstock, rendering it into a consistent and high-caliber fuel source poised for the ensuing smoldering stage and ultimately contributing to the generation of clean energy.

8. Comprehensive Overview of N-RDF Production and its Impact on Clean Energy Generation

The Significance of Normalized Refuse Derived Fuel in Energy Recovery

Normalized Refuse Derived Fuel (N-RDF) stands as a pivotal innovation in resource recovery, transforming a wide spectrum of waste — from municipal solid waste to the byproducts of industrial, commercial, and healthcare activities — into a high-caloric energy source. This transformative process diverts waste from traditional disposal methods like landfills and incineration, instead converting it into a valuable commodity for the generation of electricity and heat. The strategic utilization of N-RDF within waste-to-energy (W2E) facilities marks a significant leap towards minimizing waste footprint, maximizing resource utilization, and fostering the principles of sustainable energy practices.

Detailed Waste Processing Procedures Prior to N-RDF Conversion

The journey of waste from its initial form to N-RDF encompasses a series of meticulously designed steps:

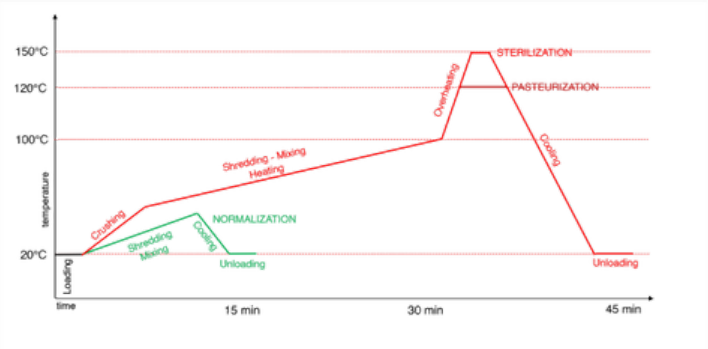
- Dimensional Reduction and Calibration: Employing industrial-grade shredders, specifically SatrindTech T20/200 and 3R20/320 models or their equivalent, the waste is shredded down to a strictly regulated size, ensuring that no single piece exceeds 2.5m x 2m x 1.5m, with a density threshold of 500 kg/m³. This size reduction aims to achieve a standardized low calorific value of at least 13 MJ/kg, laying the groundwork for consistent energy content on a dry matter basis.
- Meticulous Material Extraction: Through an automated system equipped with ShieldsMagnetics technology, all ferrous and non-ferrous materials are carefully segregated from the waste stream. This not only prepares the waste for conversion but also facilitates the recycling of metals, thus enhancing the facility's commitment to comprehensive waste recovery.
- Optimization of Moisture Content: A critical step in the preparation of waste for conversion is moisture optimization. Utilizing a Pennati type 701/210 tunnel dryer, the process harnesses residual thermal energy from downstream operations, precisely reducing the moisture content of the waste to the optimal level for N-RDF conversion.

The Conversion to N-RDF: A Precision-Driven Process

The standardized waste is then conveyed into the cutting-edge waste Converters™, which are engineered to process and refine diverse waste types into uniform N-RDF. These advanced systems, notably the 5000 MO Series converters, are capable of handling 1800 to 2500 kg of waste per hour, employing a seven-stage process to produce homogeneous N-RDF. The stages are meticulously delineated as follows:

1. Automated Loading: The initiation of the conversion process begins with the automated loading of waste into the treatment chamber.

2. Fine Shredding/Pulverization: Further size reduction is achieved through initial shredding, enhancing the waste's surface area and preparing it for effective conversion.
3. Consistent Heating: The waste is evenly heated to initiate the breakdown of complex waste compounds.
4. Efficient Dehydration: Excess moisture is removed, ensuring the waste is primed for energy conversion.
5. Sterilization and Pasteurization: The waste is subjected to controlled overheating between 151-160°C for sterilization or maintained at 121°C for pasteurization, eradicating all pathogens.
6. Controlled Cooling: Following sterilization, the material is methodically cooled down to stabilize the conversion process.
7. Systematic Unloading: The now-treated by-product is unloaded through centrifugal forces onto conveyors, ready for the next phase in the W2E process.



Integrated sensors continually monitor and regulate temperature, pressure, and friction throughout each phase. These measurements are vital for optimizing the process duration and minimizing energy consumption, which is finely tuned to approximately 0.5 kWh/kg of waste processed.

Ensuring Uniformity and Efficiency in N-RDF Production

The quality of the produced N-RDF is paramount, as it directly influences the energy extraction efficiency and environmental emissions. To achieve a consistently high-quality output, the waste undergoes multiple homogenization stages before and during the conversion process:

- Thorough Mixing Protocols: The waste is initially mixed upon arrival, then remixed during the shredding phase, and once more during tumble drying. Such repeated mixing ensures uniformity in the waste's consistency, size, and moisture content.

- Conversion Assurance: Post-mixing, the waste enters the Converters™, where it is transformed into N-RDF with a significantly higher energy value per kilogram than the original waste material. This consistent and homogeneous product is crucial for facilitating the precise control over the subsequent smoldering processes, ensuring optimal energy extraction and minimal emissions.

Systematic Operation of the W2E Conversion System

The W2E facility's conversion system is designed for robustness and redundancy:

- Converter Units: Each Converter™ unit operates autonomously, efficiently converting specified batches of waste into N-RDF. The system is adept at adjusting processing parameters in real-time to maximize N-RDF quality.

- Cooling and Electrical Infrastructure: Each Converter™ is accompanied by a dedicated cooling unit and an independent electrical system, which are crafted to support streamlined maintenance operations and facilitate the potential expansion of conversion capabilities.

For every 100MT/day increment of waste processing capacity, the W2E system incorporates at least five 5000 MO Series Converters™. This ensures operational continuity even when individual units are undergoing maintenance.

Maintenance Protocols and Command Center Integration

Maintenance protocols for the Converter™ systems are extensively documented, encompassing:

- Routine and Predictive Maintenance: A comprehensive maintenance schedule prescribes regular inspections and part replacements, bolstered by predictive analytics that pre-emptively identify areas requiring maintenance.
- Personnel Training and Certification: All operators are thoroughly trained and certified, ensuring a high level of expertise in managing the Converter™ units.
- Command and Control Oversight: The plant's nerve center, the Command and Control Center, orchestrates all operational aspects, from real-time monitoring to predictive maintenance, ensuring that every component functions at peak efficiency and in compliance with safety and environmental standards.

9. Command and Control Center: The Hub of W2E Operations

The Command-and-Control Center serves as the operational epicenter of the W2E facility, enabling real-time oversight and strategic management of the entire waste conversion process. The integration of advanced technological frameworks facilitates a comprehensive approach to plant management, ensuring efficiency, safety, and compliance with environmental standards.

Key Features of the Command-and-Control Center

- Real-Time Data Monitoring: Equipped with a network of sensors and monitoring devices, the center collects and analyzes data on waste processing stages, equipment functionality, and ambient environmental conditions.
- Comprehensive Data Integration: The center integrates data from a myriad of sources, including recycling machinery, conveyor systems, and safety apparatus, to form a cohesive operational picture.
- Environmental Vigilance: Continuous scrutiny of air quality, emissions, and noise levels is conducted to affirm adherence to stringent regulatory benchmarks.

Waste and Resource Management

- Accurate Weight and Volume Measurement: A suite of scales and sensors provide instantaneous data on the weight and volume of both incoming and processed materials, optimizing the operational flow.
- Visual Monitoring: Large video walls furnish live feeds from various plant locales, enabling visual surveillance and operational monitoring.
- Dashboard Analytics: Interactive dashboards present vital metrics such as waste throughput, recycling efficacy, and equipment performance, aiding in decision-making and operational refinement.

Key Performance Indicators and Reporting

- Performance Metrics: The center meticulously tracks KPIs, encompassing waste diversion rates, recycling efficacy, equipment reliability, energy utilization, and safety incident frequencies.
- Trend Analysis: Analytical tools examine historical data to identify trends and guide data-driven improvements and decisions.
- Automated Reporting Mechanisms: Regular and ad-hoc reports on KPIs are systematically generated to inform management decisions and fulfill regulatory reporting obligations.

System Controls and Automation

- SCADA and PLC Integration: The center utilizes SCADA and PLC systems for the real-time control and automation of industrial processes, ensuring precision and efficiency in waste management.

- ERP Systems: Enterprise Resource Planning systems orchestrate various business operations, from inventory tracking to proactive maintenance scheduling.

Safety and Emergency Protocols

- Emergency Response Systems: Automated shutdown protocols are in place for rapid response to safety incidents or operational anomalies.
- Personnel Safety Tracking: Advanced RFID or biometric systems monitor personnel locations within the facility to enhance safety and emergency response capabilities.
- Hazard Detection: A network of sensors continually assesses potential risks such as gas leaks or fire hazards, triggering automated alarms and mitigation responses when necessary.

Communication and Public Address Systems

- Effective Communication Channels: The center employs two-way communication systems for instantaneous coordination between control room staff and on-site personnel.
- Critical Event Alerts: Automated notification systems are in place to ensure prompt reaction to urgent operational or safety events.

Cybersecurity and System Resilience

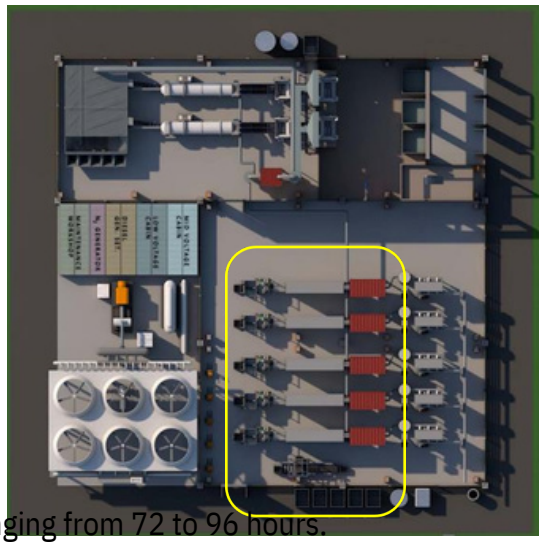
- Robust Cybersecurity Frameworks: The Command-and-Control Center is fortified with stringent cybersecurity measures to safeguard operational data, deter unauthorized access, and reinforce system resilience against potential cyber threats.

Operational Continuity and System Backup

- Redundancy and Backup: The Command-and-Control Center is designed with redundancy to ensure operational continuity, with backup systems in place to maintain functionality during unforeseen disruptions.

By centralizing operations through the Command-and-Control Center, the W2E facility not only streamlines the conversion of waste to N-RDF but also enhances its capacity for predictive maintenance, safety management, and environmental stewardship. The synergy between advanced technological systems and the expertise of the operational staff culminates in a W2E process that is not only efficient and effective but also aligned with the highest standards of sustainability and innovation.

10. Enhanced Smoldering and Oxidation Process for Energy Recovery



This comprehensive section delineates the intricate smoldering and oxidation operations crucial for energy recovery in the W2E facility, specifically in segment 3 of the process flow, indicated in yellow in the figure.

N-RDF Smoldering Area and Equipment

Within the designated area, the smoldering equipment is methodically arranged to handle the converted waste, known as Normalized Refuse Derived Fuel (N-RDF). This section, equipped with a specialized Fire Protection System, is dual-functional, serving both as a transformation zone for feedstock into solid fuel with consistent characteristics and as a temporary storage space for N-RDF. The storage capacity is calibrated to maintain a continuous smoldering operation for a period ranging from 72 to 96 hours.

The Smoldering Operation

The smoldering operation serves as the initial energy extraction stage from the N-RDF. Smoldering is a low-temperature combustion process without an open flame, distinguished by its slow, flameless thermal treatment of solid waste under controlled oxygen conditions. The homogeneous nature of N-RDF, resulting from the Converter™ process, significantly enhances the smoldering efficiency due to its ideal composition for low-temperature operations. This phase employs a multi-stage oxidation method to maximize the conversion of N-RDF components into inert gases and to produce a low-carbon ash by-product that is reusable in various industries.

Advantages of the Smoldering Process

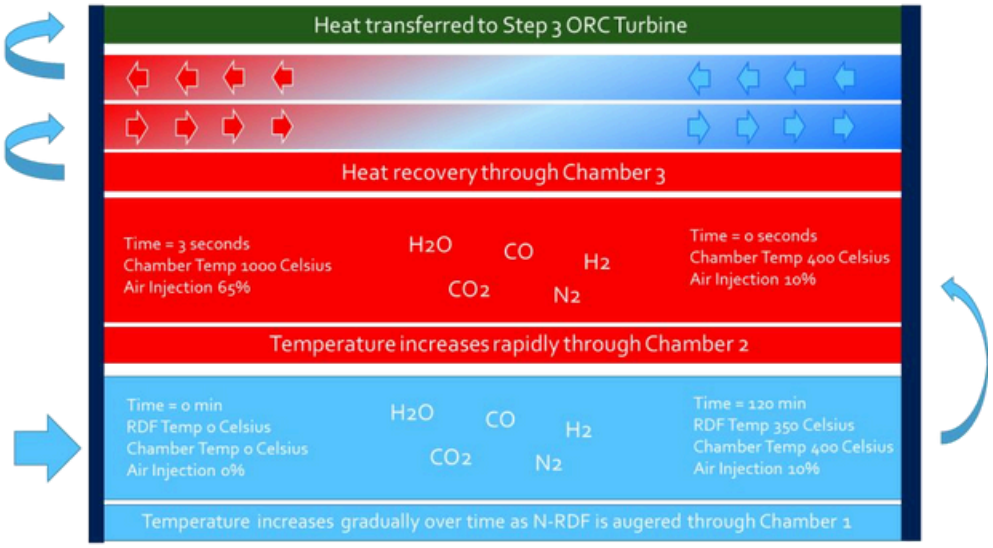
The smoldering process boasts numerous environmental and operational benefits:

- Effective removal of volatile elements such as carbon, hydrogen, nitrogen, oxygen, and sulfur.
- Recovery of energy content into high-quality heat, reaching temperatures of approximately 1000°C.
- Prevention of NOx, dust, dioxins, furans, carbon monoxide, and volatile compounds formation.
- Production of a highly inert, white ash with minimal carbon content.

Steps in the Smoldering Process

- Initiation: The process commences with external heaters that initiate the smoldering of the N-RDF and maintain the desired temperature range.

- Oxygen Limitation: Conducted under controlled oxygen supply, this step ensures partial oxidation of the waste, preventing full combustion and pollutant formation.
- Combustible Gases Formation: Heat causes the release of volatile compounds, contributing to the smoldering process as flammable gases.
- Surface Oxidation: The oxidation primarily occurs at the material surfaces, with oxygen reacting to produce heat and by-products at a controlled pace.
- Heat Generation: The generated heat sustains the smoldering process, facilitating ongoing oxidation as long as fuel and oxygen supply persist.
- Incomplete Combustion: Traditionally associated with incomplete combustion, the Converter™ process mitigates the production of residual char and ash.



Airflow Regulation

Control over airflow is paramount in the smoldering process. Air, drawn from the bunker area, is pre-heated via the drum dryer, serving a dual purpose: enhancing the N-RDF production and facilitating the water shift reaction for carbon extraction. This reaction benefits from the natural catalyst Fe2O3 found in the ash. Fans and injectors meticulously manage air distribution and flow rates, ensuring optimal conditions for the oxidation process.

Oxidation Chamber

The volatile compounds from the smoldering phase quickly transition to the syngas oxidation chamber, where they encounter an oxygen-rich environment for complete oxidation, producing a hot exhaust gas for further energy recovery. The oxidation chamber maintains temperatures between 850°C and 1000°C for a minimum of 2 seconds, equipped with an auxiliary burner to safeguard the operating temperature.

Bottom Ash By-Product Management

The bottom ash emerging from the process is fully oxidized, granulated, and ready for recycling or reuse without the need for further mechanical processing due to its already small granulometry (< 3mm). Metals are segregated via magnetic and eddy current separation, directly prepped for the recycling stream.

Temperature Profiles and Control

The Synergy process utilizes precise temperature profiles, controlled within the plant's Command and Control System, to ensure efficient operations. This low-temperature approach, distinct from other W2E methods, is pivotal for maximizing energy extraction and minimizing environmental impact.

The smoldering and oxidation process within the W2E facility is a testament to innovative waste management, transforming waste into a valuable resource while adhering to environmental sustainability and efficiency. The meticulous design and operation of this phase underscore the facility's commitment to advanced energy recovery techniques and pollution reduction.

11. Optimization of Energy Recovery through Advanced Smoldering Techniques

Following the detailed description of the smoldering and oxidation process, the discussion extends to the advanced methods employed in the W2E facility to enhance the efficiency and environmental sustainability of energy recovery.

Advanced Smoldering Techniques

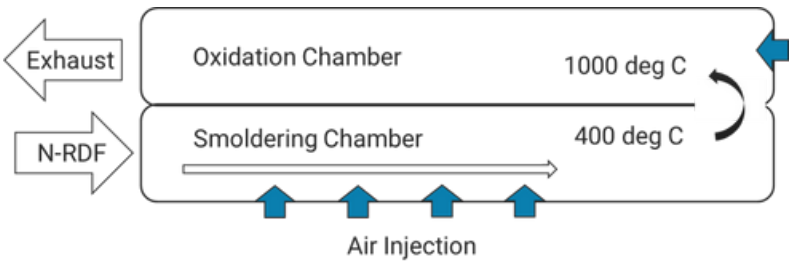
The process of smoldering in the W2E facility utilizes state-of-the-art techniques to optimize the energy recovery from N-RDF. These techniques are devised to leverage the controlled temperature combustion of N-RDF, thus ensuring the extraction of maximum energy:

- Controlled Air Injection: By precisely regulating the air supply into the smoldering chamber, the system can maintain the ideal oxidation levels, thus maximizing energy recovery while minimizing the production of pollutants.
- Temperature Management: The facility uses sophisticated temperature control systems to maintain the smoldering operation within the optimal thermal range, ensuring efficient conversion of waste to energy.
- Surface Area Maximization: Given the large surface area of N-RDF, the smoldering process is fine-tuned to facilitate surface oxidation, enhancing the slow and controlled release of energy.
- Material Homogeneity: The Converter™ process ensures that the N-RDF is homogeneous, which is critical for a uniform smoldering process and efficient energy recovery.

Integrated Oxidation Approach

The oxidation stage is a crucial component of the smoldering process, where volatile compounds are fully oxidized. The facility employs an integrated approach that includes:

- High-Speed Air Injection: The oxidation chamber features high-speed air injectors that increase the level of turbulence in the chamber, leading to a more thorough and efficient oxidation process.
- Combustion Gas Retention: Ensuring that the combustion gases remain at a high temperature for a defined period allows for the complete oxidation of harmful pollutants, reducing the potential for emissions.



Environmental Impact and By-Product Utilization

A key feature of the facility's smoldering process is its environmental performance, demonstrated by:

Reduced Emission of Pollutants: The slow and controlled smoldering process significantly lowers the risk of releasing pollutants such as NOx and dioxins into the atmosphere.

- Quality Ash Production: The ash produced is of high quality, with a very low carbon
- content, making it suitable for use in various industries without further processing.
  Resource Recovery: The facility's process not only generates energy but also recovers materials that can be recycled, thus contributing to the circular economy.

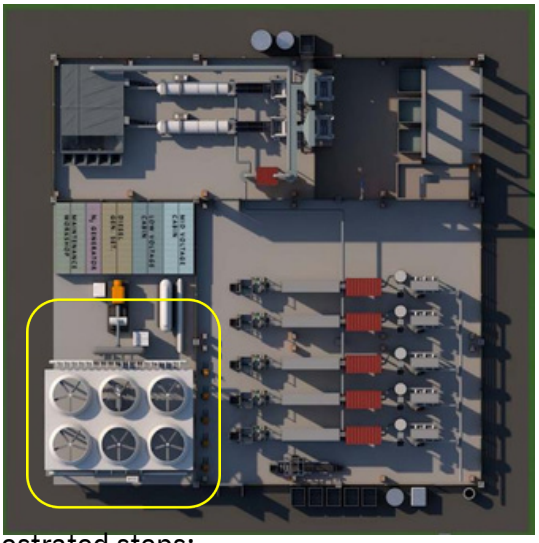
Command and Control System Integration

The facility's advanced smoldering process is overseen by a sophisticated Command and Control System that provides:

- Real-time Process Optimization: Continuous monitoring and adjustments to the smoldering process parameters ensure optimal performance.
- Predictive Maintenance: Utilizing data analytics, the system predicts when maintenance is required, thus preventing downtime and maintaining continuous operation.
- Safety and Compliance: The Command-and-Control System also plays a critical role in ensuring the safety of the facility and compliance with environmental regulations.

The smoldering and oxidation process at the W2E facility represents a harmonious blend of advanced technology and environmental stewardship. By focusing on controlled combustion and efficient energy recovery, the facility sets a new standard in waste-to-energy processes, ensuring that the conversion of waste into energy is both sustainable and environmentally responsible. The comprehensive process outlined here underscores the facility's commitment to innovation and its role in promoting a future where waste is a valuable resource, not a burden.

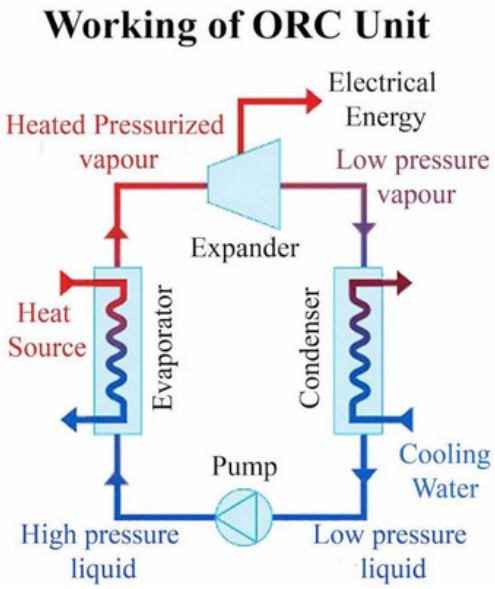
12. The Organic Rankine Cycle (ORC) Turbine Process for Power Generation



The Organic Rankine Cycle (ORC) Turbine Process for Power Generation within the Waste-to-Energy (W2E) facility represents the fourth crucial stage in the conversion of waste into electricity. Utilizing the innovative Organic Rankine Cycle, the Synergy W2E system converts thermal energy from the smoldering of Normalized Refuse Derived Fuel (N-RDF) into mechanical and subsequently electrical energy. This process is pivotal for transforming the low- to medium-grade heat emitted from the previous smoldering process into a valuable resource, thereby adhering to Synergy's commitment to energy efficiency and environmental stewardship.

The ORC Turbine operates in a series of meticulously orchestrated steps:

- Evaporation: The ORC turbine initiates its cycle with the evaporation of an organic working fluid. The fluid absorbs heat from the N-RDF smoldering process, transitioning from liquid to vapor within the evaporator unit.
- Expansion: This vapor then propels through the ORC turbine, driving the turbine blades to produce mechanical work. This mechanical work is harnessed via a connected generator to produce electrical power.
- Condensation: Post-expansion, the vapor transitions back into a liquid state in the condenser by releasing its heat to a cooling medium, which could either be ambient air or a water system.



- Pumping: A pump circulates the condensed fluid back to the evaporator, thereby completing the cycle and perpetuating the energy transformation process.

The incorporation of the ORC turbine is a testament to the W2E system's overarching low-temperature operational philosophy. The technology is particularly advantageous because it optimizes energy conversion from lower temperature heat sources, making it an ideal match for the thermal output of the N-RDF smoldering process.

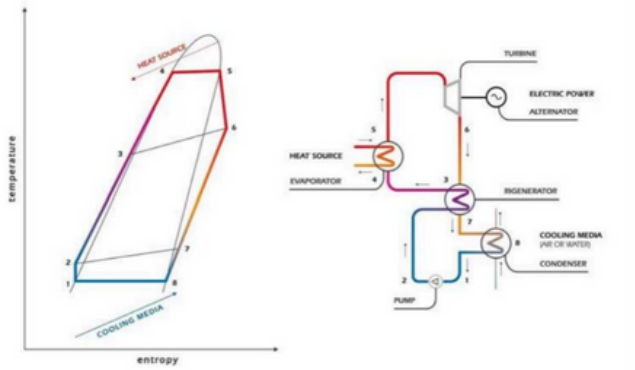
The ensuing steps further detail the operational intricacies of the ORC turbine:

- Heat Transfer: The boiler plays a critical role by transferring the energy from the hot exhaust gases generated in the oxidation chamber to the thermal oil, which then conveys this energy to the ORC turbine.
- Heat Recovery: An air heater is integrated into the system to reclaim any residual thermal energy from the thermal oil, post-turbine engagement. This heat contributes to various plant processes, such as drying operations and air exchange, enhancing the facility's overall energy efficiency.
- Air Preheating: To stabilize the Low Heating Value (LHV) of the incoming waste and facilitate the oxidation reactions, the combustion air is preheated. This process not only aids in the combustion process but also recovers energy, thereby positively impacting the plant's electricity generation efficacy.

The ORC turbine's efficiency is subject to the temperature differential between the heat source and the sink, the working fluid's properties, and the turbine's design. Moreover, the system's environmental benefits are underscored by its utilization of organic fluids with a low global warming potential and the recovery of waste heat, which collectively reduce the carbon footprint.

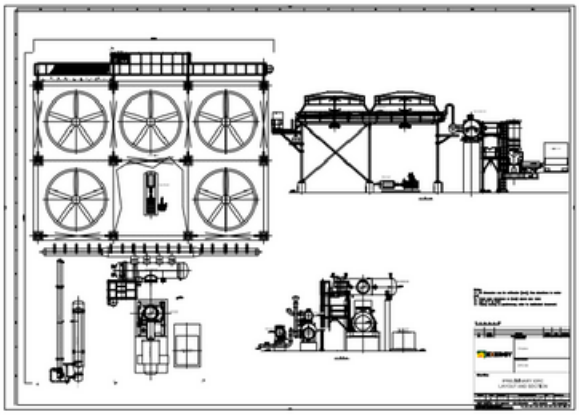
Thermal efficiency is calculated based on the ratio of the net work output to the heat input and is influenced by the temperature differential, the working fluid characteristics, cycle configuration, and the performance of the heat exchangers. This efficiency, when optimized, results in a superior, environmentally conscious electricity generation process.

Synergy's commitment to bespoke solutions during the Statement of Work phase ensures the ORC turbine is meticulously tailored to the specific W2E facility needs. The selection of the ORC turbine, from reputable global suppliers, is based on system specifications, supplier credentials, and support infrastructure.



ORC turbine working principle

The ORC turbine process exemplifies Synergy's holistic approach to sustainable energy generation. By harnessing the smoldering N-RDF's thermal energy, the ORC turbine reinforces the W2E facility's role as a harbinger of green energy solutions, aligning with global sustainability goals and demonstrating the tangible benefits of waste transformation technologies.



The Exergy EPS300 ORC Turbine • Turbine Electric Power: 3 MW (nominal), working range 600kW – 3300kW • Turbine gross efficiency at nominal in the range: 27.4%@20°C – 25.2%@30°C • Thermal oil: input @300°C / output @180°C

13. Detailed exposition of the ORC Turbine Process for Power Generation

Continuing with the detailed exposition of the ORC Turbine Process for Power Generation, the system's sophistication is evident in its multifaceted approach to maximizing energy conversion while minimizing environmental impact. The ORC turbine, specifically designed for Synergy's W2E facility, seamlessly integrates with the upstream smoldering and oxidation processes to ensure efficient power generation.

Detailed ORC Turbine Process Steps:

- Heat Source Integration: The ORC turbine is engineered to absorb the optimal amount of thermal energy from the smoldering of N-RDF. This is achieved by carefully selecting the working fluid that best matches the thermal characteristics of the smoldering process. The choice of fluid affects the evaporation temperature and pressure, directly impacting the turbine's efficiency.
- Mechanical to Electrical Energy Conversion: The mechanical energy produced by the expansion of the working fluid through the turbine is efficiently converted into electrical energy by the generator. The generator is chosen based on its ability to handle the output of the ORC turbine, ensuring minimal energy loss during conversion.
- Heat Rejection and Fluid Recirculation: The condenser is a crucial component where the vaporized working fluid is cooled and condensed back into a liquid. The design and efficiency of the condenser determine how quickly the system can return the working fluid to the evaporation stage, impacting the overall cycle time and efficiency.
- Working Fluid Pumping: The pump that recirculates the condensed fluid back to the evaporator is selected based on its capacity to handle the fluid volume and its ability to maintain consistent pressure throughout the cycle.

System Optimization and Control:

- Temperature and Pressure Monitoring: Sensors strategically placed throughout the system monitor temperatures and pressures to ensure the ORC turbine operates within its optimal range. The system uses this data to make automatic adjustments, optimizing the energy conversion process.
- Airflow Management: The airflow into the smoldering chamber is meticulously controlled. The system balances the oxygen levels to maintain the ideal smoldering conditions, which facilitates efficient thermal energy release for uptake by the ORC turbine.
- Heat Exchange Maximization: The thermal oil boiler and air heater are designed to transfer as much energy as possible from the smoldering process to the ORC turbine while ensuring that excess heat is used elsewhere in the plant, such as in drying processes or space heating.

Environmental Impact and Sustainability:

- Emission Reduction: The ORC turbine contributes to lower emissions by efficiently converting low-grade heat to electricity. This allows the W2E facility to harness energy that would otherwise be lost, reducing the overall carbon footprint.
- Waste Heat Utilization: All waste heat generated by the ORC turbine, which is not converted into electricity, is redirected to aid other processes within the facility, ensuring a closed-loop system that maximizes energy use.

Efficiency and Maintenance:

- Thermal Efficiency Evaluation: Regular assessments of the ORC turbine's thermal efficiency are conducted to ensure that the system is converting heat to electricity at the highest possible rate. This involves analyzing the net work output in relation to the heat input from the N-RDF smoldering process.
- Predictive Maintenance: The maintenance schedule for the ORC turbine is determined by predictive analytics, which assesses real-time data from the system to preemptively identify and rectify potential issues before they lead to downtime.
- Continuous Improvement: Data collected from the ORC turbine's operation is used to drive continuous improvement initiatives. These initiatives aim to further refine the system for better performance, higher efficiency, and reduced environmental impact.

The ORC Turbine Process is a testament to the W2E facility's innovative approach to energy generation. By meticulously designing each component and step of the process, and by employing real-time monitoring and predictive maintenance, the ORC turbine serves as a cornerstone for sustainable energy production, aligning with the facility’s overarching goal of waste reduction and resource recovery.

14. Technical Operation of the ORC

The detailed technical operation of the Organic Rankine Cycle (ORC) turbine system in the Waste-to-Energy (W2E) facility requires an advanced understanding of thermodynamics and mechanical engineering principles. This section will elaborate on the process, emphasizing the use of shared formulas for quantifying energy transformation and system efficiency.

Advanced ORC Turbine Process Mechanics:

- Thermal Oil Boiler Efficiency: The efficiency of the thermal oil boiler is critical to the ORC process. This efficiency is defined by the amount of heat energy from the smoldering process that can be transferred to the organic working fluid. The thermal oil boiler employs both radiant and convective heat transfer mechanisms to maximize energy uptake.
- Evaporator Design: The evaporator's design ensures that the maximum surface area is available for heat exchange between the hot thermal oil and the organic working fluid. This facilitates a complete phase change from liquid to vapor, which is essential for driving the turbine.
- Generator Efficiency: The generator attached to the ORC turbine converts mechanical energy into electrical energy. Its efficiency is often expressed as the ratio of electrical power output to mechanical power input. The generator is calibrated to the specific output of the ORC turbine to minimize losses and maximize electricity generation.

Formulae for Efficiency and Performance Analysis:

- Thermal Efficiency of ORC Turbine: The thermal efficiency (η) of the ORC turbine is a key metric that indicates the proportion of thermal energy converted to useful work. It is calculated using the formula:

$$efficiency = \frac{networkoutput}{heatinput} x100$$

- Net Work Output: The net work output is the difference between the work produced by the turbine and the work required to pump the working fluid through the cycle. This can be determined by the specific enthalpy changes of the working fluid and is affected by the properties of the fluid and the operational parameters of the turbine.
- Heat Input: The heat input is the amount of heat energy transferred from the smoldering process to the working fluid in the evaporator. This is typically measured in joules or kilowatt-hours and is a function of the thermal oil boiler's output and the heat capacity of the working fluid.

Sustainable Practices and Energy Recovery:

- Waste Heat Recovery: The ORC turbine's ability to recover waste heat from the smoldering process is quantified by its heat recovery efficiency. This efficiency

determines how effectively the turbine can use the available thermal energy to generate electricity.

- Heat Sink Efficiency: The condenser acts as a heat sink, and its efficiency is measured by how effectively it can condense the working fluid vapor back into a liquid. A high-performance condenser contributes to a shorter cycle time and higher overall system efficiency.
- Cooling Medium Optimization: The choice of cooling medium (air or water) for the condenser is optimized based on the ambient conditions and the operational requirements of the W2E facility. This optimization directly impacts the condenser's efficiency and, consequently, the efficiency of the entire ORC process.

Performance Monitoring and Optimization:

- Real-Time Efficiency Tracking: Continuous monitoring of the ORC turbine's efficiency is conducted using real-time data acquisition systems. This allows operators to make immediate adjustments to maintain optimal performance.
- Historical Data Analysis: Long-term performance data is analyzed to identify trends in efficiency and to implement strategies for improvement. This might involve adjustments to the working fluid, changes in operational parameters, or upgrades to system components.
- Predictive Analytics for Maintenance: Predictive analytics is used to forecast when maintenance should be performed on the ORC turbine to prevent inefficiency and downtime. This includes monitoring for wear and tear on turbine blades, seals, and bearings.

In the context of the W2E facility, the detailed ORC turbine process demonstrates a commitment to technical excellence and environmental stewardship. By adhering to rigorous efficiency formulas and performance metrics, the facility ensures the reliable transformation of waste into clean energy, embodying the principles of sustainable and responsible energy production.

Integration and Control:

- System Integration: The ORC turbine is fully integrated into the W2E facility's control system. This integration ensures seamless operation from waste heat recovery to electricity generation. The ORC system's parameters, such as flow rates and temperatures, are continuously adjusted based on the smoldering process outputs to optimize the cycle.
- Control System: The ORC turbine is governed by an advanced control system that uses feedback loops to maintain operational stability and efficiency. The system adjusts the fluid flow and heat exchange rates in real-time to respond to variations in heat supply and electricity demand.

Environmental Impact and Emission Control:

- Emission Reduction: The ORC turbine contributes to emission reduction by efficiently converting waste heat into electricity. This process reduces the need for additional fossil fuel consumption and the associated emissions.
- Environmental Compliance: The operation of the ORC turbine is closely monitored to ensure compliance with environmental regulations. Continuous emissions monitoring systems (CEMS) track the output of any potential pollutants to guarantee that the facility operates within the permitted levels.

Economic Analysis and Energy Pricing:

- Cost-Benefit Analysis: The economic viability of the ORC turbine is assessed through a detailed cost-benefit analysis. This analysis considers the capital costs, operational expenses, maintenance, and the revenue generated from the sale of electricity.
- Energy Pricing: The electricity produced by the ORC turbine is priced based on various factors, including production costs, market demand, and energy policies. Dynamic pricing strategies may be employed to reflect real-time production costs and market conditions.

Maintenance and Lifecycle Management:

- Lifecycle Management: The ORC turbine's lifecycle is managed to ensure long-term operational efficiency. This includes planned upgrades, refurbishments, and eventual decommissioning and replacement. Spare Parts Management: A detailed inventory of spare
- parts for the ORC turbine is maintained to minimize downtime. Inventory management systems track the usage and reorder parts as necessary, based on predictive maintenance schedules and historical data.

Safety Protocols and Training:

- Safety Protocols: Comprehensive safety protocols are established for the operation of the ORC turbine. These protocols include procedures for safe startup, shutdown, emergency response, and routine handling. Staff Training: Staff responsible for the ORC turbine's
- operation are provided with extensive training, including safety procedures, operational best practices, and emergency response. Regular drills and refresher courses are conducted to maintain high safety standards.

Efficiency Metrics and Performance Optimization:

- Performance Optimization: Continuous optimization efforts aim to enhance the ORC turbine's performance. This may involve tuning the system for improved heat exchange, optimizing the working fluid's properties, or implementing advanced control algorithms.
- Efficiency Metrics Tracking: Key efficiency metrics for the ORC turbine include the heat conversion rate, electrical output, operational uptime, and maintenance intervals. These metrics are tracked to identify opportunities for efficiency improvements.

Research and Development:

- Innovation: Ongoing research and development efforts focus on improving the ORC turbine technology. This includes investigating new organic fluids, advanced materials for heat exchangers, and innovative turbine designs.
- Collaboration with Academic Institutions: The W2E facility collaborates with academic institutions and research centers to stay at the forefront of ORC technology and to implement the latest advancements in the field.

In summary, the ORC Turbine Process in the W2E facility represents a sophisticated and environmentally responsible approach to energy generation. By meticulously managing every aspect of the process, from operational efficiency to environmental impact, the facility exemplifies a modern, sustainable approach to waste management and energy production.

15. Advanced Emissions Control and Monitoring in the Synergy Waste-to-Energy Solution

Comprehensive Emissions Control Strategy

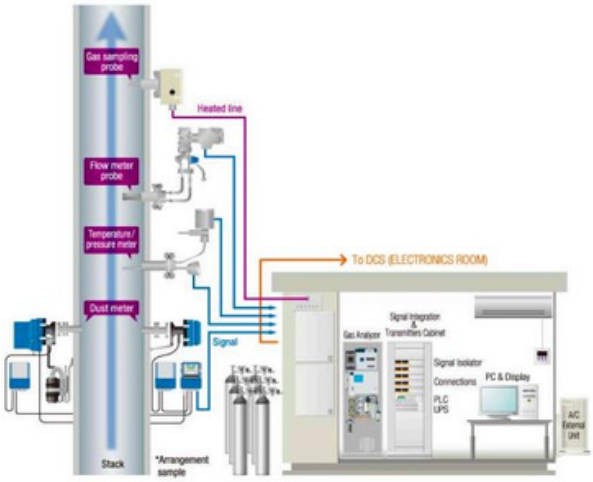
Innovative Low-Temperature Operation Synergy's Waste-to-Energy (W2E) Solution stands apart in its ability to operate effectively at lower temperatures, thanks to the use of Normalized Refuse Derived Fuel (N-RDF) produced via the advanced Converter™ technology. This unique approach yields significant benefits in both energy efficiency and environmental impact reduction. The key aspects include:

- Effective Removal of Volatile Elements: Efficient extraction of elements like Carbon, Hydrogen, Nitrogen, Oxygen, and Sulphur from waste.
- High-Quality Heat Recovery: Capable of converting waste into heat reaching temperatures up to 1000°C.
- Pollutant Formation Prevention: Successfully avoids the creation of harmful emissions such as NOx, dust, dioxins, furans, carbon monoxide, and volatile compounds.
- Production of Inert Ash: Results in an environmentally safe, white ash with very low carbon and silica content.

State-of-the-Art Emission Control Technologies

The W2E facility employs several cutting-edge technologies to minimize environmental impact, ensuring compliance with stringent standards:

- Envea SME Exhaust Gas Monitoring System: Continuously monitors a wide range of emissions, ensuring adherence to environmental standards through real-time detection and measurement of gases like CO, NOx, SO2, HCl, and particulate matter.
- Selective Non-Catalytic Reduction (SNCR): Utilized during the syngas oxidation phase, this technology reduces NOx emissions by injecting reagents like urea or ammonia into the combustion chamber.



- Baghouse Filters: Designed to capture particulate matter, keeping emissions well within the regulatory limits for dust and particulates.
- Activated Carbon Injection: Targets the adsorption of mercury, dioxins, furans, and other heavy metals, playing a crucial role in purifying emissions.

These technologies collectively ensure a remarkable 95% reduction in harmful emissions, aligning the operation with the strict environmental regulations of the Ministry of the Environment (MOE).

Rigorous Emissions Monitoring and Compliance

The facility adheres to precise monitoring protocols to ensure emissions remain within the following regulatory limits:

- DUST: Under 10 mg/Nm³
- Total Organic Carbon (TOC): Below 10 mg/Nm³
- Hydrogen Chloride (HCl): Less than 10 mg/Nm³
- Hydrogen Fluoride (HF): Under 1 mg/Nm³
- Sulfur Dioxide (SO2): Below 50 mg/Nm³
- Nitrogen Oxides (NOx): Less than 200 mg/Nm³
- Carbon Monoxide (CO): Below 50 mg/Nm³

Emissions monitoring is integral to the facility's operation, providing critical data for compliance with regulatory requirements and enabling timely corrective actions if necessary. The monitoring system includes performance indicators, various measurement techniques, frequent monitoring, and averaging times, all aligned with Ministry of the Environment standards.

Acid Gas Neutralization Techniques

- To mitigate acid gases like sulphur dioxide and gaseous halogenides, an alkaline reagent comprising lime and activated carbon is injected into the flue gases. This results in the formation of solid reaction products, which are then removed as dust in the bag filter. The system ensures over 95% removal of SOx, HCl, and HF, while also adsorbing PCDD/Fs and mercury.

Flue Gas Treatment

Alkaline Reagents Injection: For acid gases like SO2 and halogenides removal.

- Dry Sorption Process: Reagent addition to flue-gas flow for solid byproduct formation.
- Efficient Reagent Utilization: Controlled dosing based on flue gas analysis and a recirculation system.
- Bag Filters: PULCO AIR 24x08 3.500 CCF by TAMA Aernova with robust features for long-term operation.

Neutralization Reactions

The facility utilizes reactions such as:

$$Ca(OH)2 + SO2 \rightarrow CaSO3 + H2O$$
$$Ca(OH)2 + SO2 + 0.5\ O2 \rightarrow CaSO4 + H2O$$
$$Ca(OH)2 + 2\ HCl \rightarrow CaCl2 + 2\ H2O$$
$$Ca(OH)2 + 2\ HF \rightarrow CaF2 + 2\ H2O$$

Byproduct Management

- Disposal: Fly ash and other residues are treated as hazardous waste and disposed of accordingly.
- Reagent Cake on Filters: Acts as a secondary reactor stage, enhancing pollutant capture.

Environmental Benefits Assessment

Advantages Over Traditional Methods

- Reduced Landfill Dependency: Decreases methane emissions and conserves land.
- Resource Recovery: Efficiently reclaims materials and energy from waste.
- Renewable Energy Production: Contributes to reducing fossil fuel reliance.
- Carbon Footprint Reduction: Replaces fossil fuel energy, lowering overall carbon emissions.
- Local Environmental Quality Improvement: Enhanced air quality and healthier surroundings.

The Synergy W2E Facility's comprehensive approach to emission control and environmental management not only meets but exceeds current standards. This process ensures significant ecological benefits, aligning with sustainable waste management and energy production practices, while actively contributing to a cleaner, healthier environment.

Plant Optimization and Operational Efficiency

- The plant optimizes every subsystem and piece of equipment for maximum efficiency. This begins with the careful handling of incoming waste, ensuring it is appropriately mixed and processed for consistent conversion to N-RDF. The facility's design incorporates negative pressure areas, air recycling systems, and multiple mixing stages to ensure a homogeneous and consistent output. This careful preparation of waste prior to conversion is pivotal in achieving the desired efficiency and environmental standards.

Each sub-system, minor and major piece of equipment is optimized so as to ensure the entire W2E plant can operate in the most efficient manner.

Operational efficiency begins with the incoming waste. Based on waste studies, the vast majority of incoming wastes are random in nature. When incoming waste is entirely of the same type, the incoming / receiving protocols ensure that that particular load is handled manually to ensure it is introduced in a metered fashion into the system. Regardless of the incoming mix, the initial processing steps operate with the main goal of preparing the incoming waste such that it is random before entering the conversion phase.

The random nature of incoming waste is the first steps in optimizing the process. The operational efficiency of the plant is based on the ability to have a homogeneous and consistent Normalized Refuse Derived Fuel (N-RDF) and the initial processing and conversion phase of the process ensure this.

The waste is received in a contained area which is under a slight negative pressure, the air is recycled in the area every 10 minutes, and it used to feed the smoldering equipment. This ensures there is no build up of dust, emissions and odours from the waste.

Incoming waste is mixed a minimum of three times prior to entering the conversion phase; initial incoming mix, mixed during shredding and mixed again during the tumble-drying process. The tumble-drying process removed any excess moisture from the waste, this reduces the waste conversion cycle time, removes moisture from contacting conveyors and other equipment and prevents waste from clinging together. The heat for dryer is excess captured heat from the downstream operations of the smoldering, oxidation and boilers.

The shredding and drying of the waste ensures the inputs entering the Converters™ is of an ideal consistency. Once processed through the Converter™ the waste is converted into the Normalized Refuse Derived Fuel (N-RDF) which is extremely consistent and homogeneous in nature. This homogeneous and normalized state enables the remainder of the process is optimized.

After the conversion phase the optimization of the downstream phases (smoldering) is achieved through monitoring processes where temperature and time are micro-controlled; all achievable due to the generation of the N-RDF. Air, recirculated from the receiving bunker is fed, automatically, into the smoldering and oxidation chambers via specially designed nozzles which meter the speed, volume and turbulence of the input air so as to achieve the desired results of the smoldering or flash oxidation process.

The ORC turbine is the next step and is optimized via the thermodynamic behaviour of the organic fluid. A significant benefit of the ORC turbine is the operating range and the ability to generate power operating from as low as 10% to as high as 110%. Heat recovery and reuse is a main optimizing feature of this portion of the operations which excess heat being recycled within the system or diverted to other areas of the plant.

Maximizing overall operational efficiency involves a holistic approach to the management of W2E system;

- Process Optimization: Continuous improvement programs to enhance waste throughput rates, energy recovery, and operational uptime.
- Waste Stream Analysis: Ongoing evaluation of the waste input composition to optimize the conversion process for different waste types and caloric values.
- Automation and Control Systems: Leveraging the integrated control systems to adjust operational parameters in real-time for efficiency gains.
- Component Redundancy: Incorporating redundancy for critical system components to avoid downtime and maintain continuous operation.
- Corrosion Prevention: Application of protective coatings and use of corrosion-resistant materials in the construction of the equipment, an ORC turbine was selected, in part, due

to the fact that it operates with an organic fluid and not water, which eliminates the corrosion associated with water based steam turbines

- Technical Support and Parts Availability: Establishing a reliable supply chain for spare parts and technical support from the manufacturer to address any operational issues promptly.

The maintenance protocol, coupled with the collection of data from the systems and sensors, combined with the modular design of the system, and subsystems, ensures system longevity, reliability and optimization activities. The plant has a full stockroom of consumables and replacement parts, all monitored and maintained through the inventory management system. In addition, the selection criteria for any parts or system components is always conducted with the availability and local support of the system in mind. A min max level is maintained for all parts based on usage, inventory and part availability.

Documentation and Record Keeping contribute to the optimization philosophy of the plant.

- Maintenance Logs: Detailed records of all maintenance work performed, including date, nature of work, parts replaced, and observations.
- Operational Data Archiving: Storing operational data and maintenance records in a secure, digital format for easy retrieval and analysis.
- Compliance Documentation: Keeping up-to-date records of maintenance and operations to demonstrate compliance with regulatory requirements and standards.

Data is collected and displayed to scorecards and KPIs (Key Performance Indicators) with objectives and targets. Six Sigma practises are deployed so as to review the data for any improvement opportunities. All documents and record keeping are maintained and stored the plants Document Management System called Honeycomb. The system can store various data and document media, is fully searchable and provides password access to various levels of data.

The Plant’s Control and Automation Systems contribute greatly to the plant’s optimization strategy, the individual equipment, subsystem and system controls merged together in an overall Command and Control System that underpins the process's efficiency and reliability.

The heart of W2E’s efficiency lies in its sophisticated network of sensors and monitoring equipment, meticulously designed to maintain process integrity:

- Types of Sensors:
  - o Temperature Sensors: Deployed to monitor the heating elements' performance and the internal environment, ensuring optimal conditions for waste breakdown.
  - o Humidity Sensors: Critical in adjusting the process parameters for moisture control, particularly important in the drying and pyrolysis stages.
  - o Weight Sensors: Used for real-time tracking of waste input and output, aiding in the calculation of conversion efficiency and system throughput.

    - o Chemical Sensors: Detect specific gases and compounds during various stages to optimize syngas quality and ensure emissions compliance.
    - o Hazmat Sensors: All incoming waste passes through radiation sensors prior to being tipped.
- Sensor Locations: Strategically placed throughout the system, from waste input conveyors to emission stacks, providing comprehensive monitoring.
- Contribution to Process Efficiency: Sensor data is utilized for real-time adjustments, ensuring the system operates within predefined parameters, thus maximizing efficiency and reducing waste.

Automation is a cornerstone of W2E technology, facilitating precise control over the entire process:

- Shredding Phase Control: Automated adjustments to shredder speed and torque based on waste composition and size, enhancing the consistency of N-RDF output.
- Heating Phase Regulation: Dynamic temperature control in response to sensor feedback, ensuring optimal heating cycles for energy recovery and waste sterilization.
- Cooling Phase Management: Automated cooling cycles post-combustion, aimed at quickly reducing temperatures to secure the integrity of the processed N-RDF.
- Software for Process Control:
    - o SCADA Systems: Providing operators with a user-friendly interface for system oversight, data analysis, and manual overrides when necessary.
    - o PLC Integration: Programmable Logic Controllers (PLCs) form the backbone of process automation, executing control logic for each operation phase.
    - o Data Analytics: Advanced software tools analyze sensor data to predict maintenance needs and optimize operational schedules.

The ability to deliver on maximum energy extraction with minimal environmental impact is based on the low temperature, low pressure processes that can only be achieved through the patented N-RDF process of the Converter™. This process is achieved through the monitoring and control of subprocesses that make up the entire system.

Optimization Strategies

- Feedback Loops: Utilize sensor data to create feedback loops for continuous process improvement, reducing energy consumption and increasing RDF quality.
- Predictive Analytics: Implementing machine learning algorithms to anticipate system behavior and pre-emptively adjust operational parameters.
- Real-time Process Adjustments: Swift system responses to variations in waste input composition, ambient conditions, and energy output requirements.

The W2E Plant deploys a Quality and Six Sigma analysis approach to continuous improvement and process data is constantly being reviewed to better the process.

Advanced Process Monitoring and Automation

- The plant leverages a sophisticated network of sensors and automation systems for process integrity and efficiency. This includes temperature, humidity, weight, chemical, and hazmat sensors, all strategically placed to provide comprehensive monitoring. Automation controls the shredding, heating, and cooling phases, managed via SCADA systems and PLC integration.

Optimization Strategies for Enhanced Efficiency

The facility adopts several strategies for operational enhancement:

- Feedback Loops and Predictive Analytics: Utilizing sensor data for continuous process improvements, thereby reducing energy consumption and increasing N-RDF quality.
- Real-time Process Adjustments: Swiftly responding to variations in waste input composition, ambient conditions, and energy output requirements.
- Quality and Six Sigma Analysis: Employing continuous improvement practices to optimize process data.

Synergy's W2E Solution is a paradigm of technological advancement and environmental responsibility. Through innovative low-temperature operations, sophisticated emission control technologies, and rigorous monitoring and optimization strategies, the facility exemplifies sustainable waste management and energy production, setting new benchmarks in the industry.

16. Comprehensive Maintenance Protocols for the Synergy W2E Facility

Introduction to Maintenance Strategy

Maintaining the efficiency and continuous operation of the Synergy Waste-to-Energy (W2E) plant is paramount. To achieve this, a thorough maintenance protocol is in place, combining onsite expertise with advanced technological support.

Onsite Maintenance Personnel and External Support

- 24/7/365 Onsite Maintenance Team: Ensures immediate response and upkeep of the facility.
- Contracted Third-Party Support: Supplements in-house expertise, especially for specialized equipment and systems.

Core Maintenance Protocols

Preventive Maintenance

- Scheduled Inspections and Servicing: Regular checks, cleaning, lubrication, and replacement of components based on manufacturers' guidelines and industry norms.
- Predictive Maintenance Techniques: Incorporating advanced methods like vibration analysis, thermography, and oil analysis to foresee and prevent potential equipment failures. Specialized Maintenance Training: Continuous upskilling programs to maintain high
- levels of technical proficiency among the maintenance staff.

Predictive Maintenance and Six Sigma Implementation

- Command and Control Center Integration: The center schedules and logs all maintenance activities, utilizing system data for predictive maintenance.
- Six Sigma Methodologies: Regular adjustments of operating parameters to optimize maintenance schedules based on emerging trends and performance data.
- Optimization of Maintenance Intervals: Regular assessments to either extend or shorten maintenance intervals based on real-time performance data.

Component Selection for Reduced Maintenance

- ORC Turbine Example: Selected for its lower operating temperatures and non-reliance on water, significantly reducing corrosion and maintenance needs, thus enhancing uptime (over 98%). Low Temperature and Pressure Benefits: The plant’s design minimizes wear
- and tear, reducing overall maintenance requirements.

17. Detailed Maintenance Schedule

Daily Tasks

- ORC Turbine and Pipework Inspections: Checking for leaks, wear, and system anomalies.
- Monitoring System Performance: Via control systems to detect deviations from normal operations.
- Lubricant Level Checks: Ensuring optimal operation of moving components.

Monthly Tasks

- Safety Valve and Gauge Inspections: Confirming functionality and accuracy.
- Emergency Shutdown Tests: Ensuring readiness for unforeseen events.
- Sensor and Instrument Calibrations: Maintaining measurement accuracy.

Semi-Annual Tasks

- Overhauls and Inspections: Focused on pumps and turbine blades.
- Emission Control Filters: Cleaning or replacing to maintain optimal air quality.
- Thermal Imaging: Detecting potential electrical component failures.

Annual Tasks

- Comprehensive ORC Turbine Maintenance: Detailed inspection and servicing.
- Fire Protection System Servicing: Professional checks to ensure safety compliance.
- Control System Updates: Upgrading software and hardware as needed.

Advanced Remote Maintenance Support with Smart Glasses

- Enhanced Inspection Accuracy: Using visual comparisons for precise part inspections.
- Efficient Documentation: Voice-command-based logging for audits and tracking.
- Remote Diagnostic Support: Leveraging collective expertise for quick problem resolution and reduced downtime.
- Interactive Maintenance Guidance: Real-time display of maintenance steps and videos for additional support.

Maintenance Plan Structure

- Defined Objectives and Goals: Including regulatory compliance and environmental safety considerations.
- Maintenance Team Organization: Detailing key personnel, responsibilities, and equipment inventory.
- Preventive and Corrective Procedures: Outlining routine and emergency maintenance practices.
- Predictive Maintenance Framework: Utilizing condition monitoring and advanced technologies for pre-emptive maintenance.
- Training and Development: Ensuring continuous skill enhancement of the maintenance team.
- Spare Parts Management: Efficient inventory management and procurement procedures.

- Performance Metrics and KPIs: Monitoring and analyzing maintenance effectiveness for continuous improvement.
- Documentation and Record Keeping: Maintaining comprehensive logs, work orders, and compliance records.
- Budgeting and Resource Allocation: Ensuring optimal financial management of maintenance activities.
- Audit and Review Mechanisms: Implementing regular internal and external audits for quality assurance.
- Emergency Response Preparedness: Developing and maintaining contingency plans for emergency scenarios.

The Synergy W2E facility's maintenance protocol is a comprehensive framework designed to ensure uninterrupted, efficient plant operation. Through a combination of preventative, predictive, and corrective maintenance strategies, enhanced by advanced technological tools like smart glasses, the facility maintains optimal operational standards. This systematic approach not only preserves the longevity and performance of the plant but also aligns with stringent environmental and safety standards.

Maintenance Protocols

A robust maintenance protocol ensures entire facility operates at peak performance:

- Preventive Maintenance Schedule: A detailed timetable for routine inspections, cleaning, lubrication, and replacement of wear parts, following the manufacturer's recommendations and industry best practices.
- Predictive Maintenance Techniques: Use of vibration analysis, thermography, and oil analysis to predict and prevent equipment failures before they occur.
- Maintenance Training: Specialized training programs for maintenance staff to ensure a high level of expertise in handling the various systems and sub-systems.

The plant's Command and Control Center and the System's Operating Software encompasses a maintenance suite which schedules and records all maintenance tasks. In addition, collecting and reviewing operating parameters enables the predictive maintenance; six sigma philosophies are utilised to continually adjust both lower and upper operating parameters of key processes to ensure that the maintenance protocols are adjusted to any trends and do not remain static over the life of the plant. Areas where scheduled tasks can be optimized by 'stretching out' the time period, supported by performance data, or where, due to operating factors, scheduled tasks must be compressed to ensure optimal operations.

The selection of the W2E components was made with maintenance time and costs in mind.

The ORC turbine is a prime example, with lower operating temperatures and with the absence of water as a working fluid, the avoidance of corrosion decreases the maintenance compared to steam turbines and increases the uptime (>98%). Overall, the low temperatures and pressures

associated with the design of the Synergy W2E plant facilitate lower maintenance activities. The maintenance schedule is divided into daily, monthly, semi-annual, and annual tasks.

A. Daily Maintenance Tasks:
- Visual inspection of the ORC turbine and associated pipework for leaks or signs of wear.
- Monitoring system performance through the control system to check for any deviations from normal operating parameters.
- Checking lubricant levels and quality in moving parts and making top-ups if necessary.
- Key systems have automatic monitoring with levels and alarms programmed into the Plant's Command and Control System.

B. Monthly Maintenance Tasks:
- Detailed inspection of all safety valves and pressure gauges to ensure they are functioning correctly.
- Testing of emergency shutdown procedures to confirm they are operational.
- Verification of the calibration on all sensors and instruments.
- Key systems have automatic monitoring with levels and alarms programmed into the Plant's Command and Control System.

C. Semi-Annual Maintenance Tasks:
- Complete overhaul of pumps and inspection of the ORC turbine blades for any signs of corrosion or damage.
- Cleaning or replacement of filters in the emission control systems.
- Thermal imaging of electrical components to detect any hotspots that may indicate a potential failure.

D. Annual Maintenance Tasks:
- Dismantling and detailed inspection of the ORC turbine for comprehensive maintenance.
- Professional inspection and servicing of the fire protection system.
- Updating or upgrading control software and hardware as necessary.

For other key components such as conveyors, shredders, and the gasification unit, a similar maintenance schedule is followed, tailored to the specific requirements and manufacturer recommendations of each component.

All maintenance schedules and tasks are listed and triggered by the Plant's Command and Control System. The plant is also equipped with smart glasses enable advanced remote maintenance support.

Smart glasses can help make machine and part inspection processes more accurate and efficient. For example, smart glasses might display a particular component in proper working condition, enabling the technician to compare the part being inspected as if the two were side by side. From a documentation standpoint, smart glasses can provide excellent value as well.

During inspection processes, rather than writing down readings or entering them into a device, technicians can use voice commands to log inspection readings for audit and tracking purposes. Smart glasses can thus eliminate the need to locate and carry around paperwork or manuals while also enabling more accurate and reliable inspections to be completed more quickly.

When a maintenance issue occurs, the typical process is to take the machine out of service, diagnose the problem (or consult with someone who can) and remedy the problem (or, again, consult with someone who can). This can be a time-consuming cycle that results in increased costs — especially if emergency maintenance is required — and extended downtime. Smart glasses enable technicians and managers to overcome these inefficiencies through remote monitoring, drawing on the expertise of centralized personnel who do not need to be on-site in order to diagnose a maintenance problem and identify the right solution. With smart glasses, remote maintenance enables manufacturing organizations to better leverage the collective knowledge of all personnel across geographies, vastly increasing the speed and effectiveness of maintenance processes while also reducing downtime and additional costs for maintenance contractors or emergency maintenance services.

Whether for scheduled maintenance or unplanned repairs, smart glasses can assist in maintenance processes, helping to ensure fast, complete and accurate remedies to equipment issues. With smart glasses, the steps in a maintenance process — from diagnosis to implementation — can be displayed in real-time to the technicians, cycling through each step as it is completed. As with inspections, smart glasses can also use visual technology to help identify problems, speeding up the diagnostic stage of the process and identifying potential issues during routine maintenance that may go otherwise unnoticed.
Beyond a simple list of steps, smart glasses can show the wearer videos or interactive diagrams of a maintenance process in action, providing additional guidance for less-experienced technicians who may not otherwise be able to complete a task.

The overall maintenance plan includes:

- Objectives
- Document Control and Records
- Goals and Objectives
- Regulatory Compliance
- Environmental and Safety Considerations
- Maintenance Team Structure
- Key Personnel
- Responsibilities and Duties
- Equipment Inventory
- Asset Identification
- Equipment Classification
- Criticality Assessment
- Documentation and Records

- Preventive Maintenance Procedures
- Overview of Preventive Maintenance
- Frequency and Scheduling
- Inspection Checklists
- Lubrication Guidelines
- Calibration Procedures
- Corrective Maintenance Procedures
- Incident Reporting
- Work Order System
- Emergency Response
- Troubleshooting Guidelines
- Predictive Maintenance
- Condition Monitoring Techniques
- Predictive Maintenance Technologies
- Vibration Analysis
- Thermography
- Oil Analysis
- Maintenance Training
- Training Needs Assessment
- Training Programs
- Certification and Skill Development
- Continuous Learning
- Spare Parts Management
- Spare Parts Inventory
- Procurement Procedures
- Critical Spares
- Vendor Management
- Performance Metrics and Key Performance Indicators (KPIs)
- Metrics Selection
- Data Collection and Analysis
- Reporting
- Continuous Improvement
- Documentation and Record Keeping
- Maintenance Logs
- Work Orders
- Equipment History
- Regulatory Compliance Records
- Budget and Resource Planning
- Budget Allocation
- Resource Planning

- Cost-Benefit Analysis
- Audit and Review Procedures
- Internal Audits
- External Audits
- Management Reviews
- Emergency Response and Contingency Planning
- Emergency Contact Information
- Contingency Plans
- Business Continuity

18. Comprehensive Safety and Quality Management in Synergy W2E Facility

Quality Management Systems and Protocols

Site-Specific Quality Management

- ISO Compliance: Each facility adheres to Quality Management Systems and Operating Protocols in line with International Standards Organization (ISO) requirements, integrating federal, provincial, and local standards for equipment and processes in the W2E plant.

Emission Control Measures

Advanced Air Quality Management

- Air Exchange Systems: Implemented to reduce odors and dust, significantly lowering fire risk.
- High-Efficiency Filtration: Incorporates HEPA and activated carbon filters to trap fine particulates, dioxins, furans, and VOCs.
- Selective Catalytic Reduction (SCR): A urea-based solution is used in the exhaust stream to minimize NOx emissions.
- Flue Gas Desulfurization: Removes SO2 from exhaust gases, preventing acid rain.
- Continuous Emission Monitoring Systems (CEMS): Ensures real-time compliance with emission standards and facilitates environmental data reporting.

Wastewater Treatment and Management

Sustainable Water Use

- Effluent Treatment: Processes any liquid by-products within incoming waste to eliminate hazardous contaminants.
- Water Recycling: Repurposes treated water to minimize natural resource usage.
- Water Quality Compliance: Meets or surpasses all local and international water quality standards.

Environmental Management Systems (EMS)

ISO 14001 Standards Adherence

- Regular Environmental Audits: Evaluating control systems and identifying improvement opportunities.
- Sustainability Reporting: Providing comprehensive environmental performance data, including emission reduction and resource conservation metrics.

Impact Mitigation Strategies

Noise and Odor Control

- Acoustic Dampening Measures: To minimize noise pollution.
- Odor Management: Utilizing biofilters and neutralizers, alongside air exchange systems to control odors, particularly in waste receiving areas.

Facility-Specific Quality Manual

Quality Assurance Documentation

- Introduction and Quality Policy: Outlining the facility's commitment to quality.
- Quality Objectives and Management System Scope: Tailored to specific facility requirements.
- Organizational Context and Interested Parties: Assessing internal and external influences on quality management.
- Leadership Commitment: Establishing governance and customer focus policies.
- Operational Planning and Control: Ensuring efficient waste handling and emergency preparedness.
- Support and Resource Management: Addressing personnel competence, training, and awareness.
- Performance Evaluation: Implementing monitoring, internal audits, and management reviews for continuous improvement.
- Improvement Procedures: Managing nonconformities, corrective actions, and fostering innovation.

Safety and Quality Integration

Comprehensive Safety and Quality Integration

- Combining Safety with Quality Management: Ensuring that safety protocols are an integral part of quality assurance.
- Emergency Response Planning: Incorporating emergency preparedness into daily operations and risk assessments.
- Continuous Learning and Improvement: Encouraging innovation and learning as part of the quality and safety culture.

The Synergy W2E facility's approach to safety and quality management represents a holistic, integrated strategy that prioritizes environmental stewardship, operational efficiency, and continuous improvement. By adhering to international standards and implementing advanced control systems, the facility not only ensures compliance but also sets a benchmark in sustainable waste-to-energy conversion practices.

The Quality Manual, tailored to the facility and developed during the Statement of Work Phase that defines and designs the W2E Plant specific to the application will include,

- Introduction
- Quality Policy
- Quality Policy Statement
- Quality Objectives
- Scope of the Quality Management System (QMS)
- Scope Statement
- Applicability
- References

- Applicable ISO Standards Legal and Regulatory
- Requirements Normative References Terms and
- Definitions Context of the Organization
- Organizational Context Internal and External Issues
- Interested Parties Scope of the Quality
- Management System Establishing the QMS Scope
- Determining the QMS Processes QMS Processes
- Interaction of Processes Process Map Leadership
- Leadership and Commitment Leadership and
- Governance Customer Focus Policy Establishment
- of the Quality Policy Communication of the Quality
- Policy Roles, Responsibilities, and Authorities Roles
- and Responsibilities Management Representative
- Planning Actions to Address Risks and
- Opportunities Risk and Opportunity Management
- Continual Improvement Quality Objectives and
- Planning to Achieve Them Establishing Quality
- Objectives Planning to Achieve Objectives Support
- Resources General Resources Personnel
- Competence Determining Competence Providing
- Training Awareness General Awareness
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- Communication
- Communication
- Internal Communication
- External Communication
- Operation
- Operational Planning and Control
- Operational Planning
- Operational Control
- Waste Handling and Transfer Processes
- Receiving and Sorting
- Loading and Transportation
- Emergency Preparedness and Response
- Emergency Preparedness
- Emergency Response
- Performance Evaluation
- Monitoring, Measurement, Analysis, and Evaluation
- General Requirements
- Customer Satisfaction
- Internal Audit
- Audit Program
- Audit Process
- Management Review
- Management Review Meetings
- Management Review Inputs and Outputs
- Improvement
- Nonconformity and Corrective Action
- Nonconformity Management
- Corrective Action
- Continual Improvement
- Continual Improvement Processes
- Innovation and Learning

19. Comprehensive Overview of Synergy W2E Plant

Waste Quantity and Feedstock Composition

The facility is engineered to process 4,000 metric tons of municipal solid waste (MSW) per day, equating to approximately 1.46 million metric tons annually. Consistent with Synergy's practices, the waste input is non-hazardous and derived from household and commercial sources, exhibiting an average calorific value of 3.78 kWh/kg. Prior to conversion, waste undergoes dimensional reduction, ferrous and non-ferrous separation, moisture optimization, and homogenization, forming the basis for efficient N-RDF production.

Thermal and Electrical Capacity

The plant encompasses 37 independent processing modules, each rated at 18 MW thermal power capacity, culminating in a total thermal power output of 657 MW. In parallel, eight ORC turbines, each producing 20 MW of electrical power, collectively generate 160 MW of electricity. These systems mirror Synergy's modular ORC architecture, which supports energy recovery from low-temperature smoldering operations. Each ORC unit is supported by thermal oil systems for efficient heat transfer and real-time power optimization.

Site Requirements

Total land requirements for the W2E installation are 4,300,000 square feet, of which 2,000,000 square feet are dedicated to covered facility infrastructure. As with Synergy's typical layouts, this includes designated areas for waste reception, N-RDF processing, smoldering, oxidation, ORC generation, emissions control systems, and the command and control center. Site design emphasizes spatial efficiency, modular integration, and environmental containment measures.

Power Generation Output

The facility will yield approximately 1,200,000 MWh of net electricity annually to the grid. This figure accounts for internal parasitic loads and reflects Synergy's philosophy of maximizing net energy output through efficient waste preprocessing, controlled smoldering, and advanced ORC integration. All power metrics are validated via detailed operational and thermodynamic modeling during the engineering phase.

Resource Recovery

In addition to power generation, the system is designed to recover approximately 87,600 metric tons of recyclable metals per year. Metal recovery is facilitated through staged magnetic and eddy current separators during the preprocessing phase. These materials are diverted from the residual waste stream and reintroduced into the recycling market, further supporting the facility's circular economy approach. Furthermore, with modular additions, Hydrogen and Medical Grade Oxygen can also be produced as an additional resource and revenue stream.

Employment and Staffing

The operation of the W2E plant will support 90+ direct jobs, including 20+ highly trained technicians responsible for system monitoring, maintenance, and optimization. Staff will be stationed across key zones such as the inbound waste reception area, Converter™ and smoldering zones, the ORC turbine plant, and the Command-and-Control Center. Personnel training, safety certification, and ongoing technical education will be managed according to Synergy's Quality Management Protocols.

Operating and Maintenance Costs

Annual maintenance expenditures are projected at approximately $35 million USD, covering spare parts and predictive maintenance services. This budget is consistent with Synergy's Six Sigma-based maintenance strategy, which includes condition-based monitoring, vibration analysis, and thermographic inspections. Additionally, consumables (e.g., filter reagents) are expected to cost around $20 million USD annually, covering critical emissions control inputs such as activated carbon, lime, and urea.

Construction Timeline

The construction and commissioning of the full-scale plant is anticipated over a six-year period. The phased deployment strategy aligns with Synergy's standard approach to modular expansion:

- 25% operational capacity: Year 2
- 50% operational capacity: Year 3
- 75% operational capacity: Year 4
- Full commissioning: Year 6

Each phase is structured to begin revenue generation early and provide operational feedback for successive expansions. All project scheduling is overseen via Synergy's integrated project management system.

We are prepared and open to working with local organizations to bid on and build this project.

Investment Budget and Capital Allocation

The total projected investment for the Waste-to-Energy facility is between $1.625 to $2.1 billion USD, encompassing all engineering, procurement, and construction activities associated with the deployment of 37 processing modules and 8 Organic Rankine Cycle (ORC) turbines.

- Facility Construction: Approximately $300 million of the total investment is allocated to the development of permanent structures across the site, including:
  - Covered operational buildings
  - Waste reception and storage zones
  - Converter™ housing and N-RDF processing infrastructure
  - Emissions control systems and flue gas treatment lines
  - Command-and-Control Center and administrative offices
  - Worker accommodations, access roads, and perimeter fencing
- Technology and Systems Integration: The remaining supports the procurement and commissioning of:
  - Modular Converter™ units
  - Smoldering and oxidation systems
  - ORC turbine packages and heat recovery systems
  - Sensor networks, automation software, SCADA, and ERP integrations
  - Emissions control hardware and reagent delivery systems
  - Fire suppression, air handling, and safety systems
  - Maintenance and logistics infrastructure

This capital outlay reflects Synergy's commitment to turnkey delivery and operational excellence, ensuring all systems are optimized for efficiency, scalability, and long-term sustainability. All expenditures are subjected to continuous financial oversight and milestone-based disbursement, in alignment with the project's phased rollout schedule.

Disclaimer

This document (the "Document") has been prepared and issued by Synergy Global Waste Systems Inc. ("Synergy") exclusively for informational and market research purposes. It is intended solely to provide a general overview of Synergy's waste-to-energy (W2E) and waste-to-refuse-derived-fuel (W2RDF) technologies, project development approach, and potential applications for stakeholders interested in exploring advanced solutions to modern waste management challenges.
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CEO: Joseph Alexander
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Petrofski, John

From: Cristian Burbano <cristian.burbano@insoftel.us>
Sent: Monday, April 14, 2025 12:59 PM
To: Musleh, Saba (SPD)
Cc: Byers, Ross; Joseph Alexander
Subject: Submission of Draft Proposal for Synergy Conversion Solutions
Attachments: Synergy W2E Miami Market Research Document 04142025.pdf

Dear Saba and Ross,

I hope this email finds you well.

Attached, please find our draft proposal in response to the market research document provided for the Waste-to-Energy facility project. Our team has carefully crafted this proposal to address all the questions and requirements outlined, while emphasizing our commitment to collaboration and environmental sustainability.

Additionally, I am including a short video for your review: [OMPECO Technology Overview](https://drive.google.com/file/d/1hr_CAt3V3-Arrr4KxRfqxZ0pjtYyZZrm/view?usp=drivesdk). This video provides a sample explanation of the OMPECO technology that Synergy represents in Canada and North America, further illustrating the innovative capabilities at the core of our solution.

We welcome any feedback or additional inquiries to ensure the proposal aligns with Miami-Dade County's objectives. Please let us know if further adjustments are needed or if additional documentation is required.

Thank you for the opportunity to present our solution. We look forward to discussing how Synergy/Ompeco can support the County in achieving its waste management and energy goals.

Warm regards,

Cristian Burbano | Business Director

8400 NW 36th Street. Suite 450

Miami, FL, 33166

C. 1+ 310.334.9480

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From: "Musleh, Saba (SPD)" <Saba.Musleh@miamidade.gov>
Date: Tuesday, March 25, 2025 at 3:34 PM
To: "Musleh, Saba (SPD)" <Saba.Musleh@miamidade.gov>

Cc: "Byers, Ross" <Ross.Byers@atkinsrealis.com>
Subject: Market Research for Municipal Solid Waste Management Solutions

Good Afternoon,

The County is conducting market research to garner industry comments and solutions regarding potential future projects for a comprehensive solid waste management approach. Refer to the hyperlink below for additional information and for response instructions.

Market Research for Municipal Solid Waste Management Solutions

The Market Research document, attached, is also located within the Learn More section of the above website, at the link below.

2025-03-market-research-municipal-swm-solutions.pdf

Please feel free to forward this request to any party that may be interested in providing feedback to the County. Your feedback is greatly appreciated.

Best Regards,

Saba Musleh, CPPB
Negotiator
Strategic Procurement Department
Miami-Dade County
Cell: 786.631.8095
Office: 305.375.5375
www.miamidade.gov/procurement

Miami-Dade County is a public entity subject to Chapter 119 of the Florida Statutes concerning public records. Email messages are covered under such laws and thus subject to disclosure.

All Lobbyists must register prior to meeting with County Personnel. Register online or in person at Clerk of the Board (COB), 111 NW First Street, 17th Floor. The COB may be contacted at (305) 375-5137.

Juno Technologies

Market Research Response

MIAMI-DADE COUNTY
MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

JUNO LLC RESPONSE

*Our mission is to **stop wasting waste**, so that products that were once destined to be buried or burned are given a second chance on life.*

A. Respondent

Provide a brief summary of the respondent to include the following.

- Respondent's name and address
  Juno LLC – a Georgia-Pacific company
  133 Peachtree St NW
  Atlanta, GA 30303

- Contact person, title, email address, and telephone number
  David McConnell
  Commercial Development Director
  Robert.mcconnell@gapac.com
  404 652 3380

- Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides

  Juno's commercially proven technology processes unsorted residential and commercial municipal solid waste (MSW) sent to landfills/incinerators today. The technology can recycle and divert up to 95% of MSW that is processed through a Juno facility. Recyclables include fiber, metals, plastics, glass and organic materials that can be converted into biogas via anaerobic digestion. Of the up to 95% of waste that Juno processes that is diverted from landfills or incineration, approximately 60-70% of that can be recycled or recovered. Finally, Juno is a proven technology that recycles and diverts up to 90% of the paper fiber that is in the MSW streams that it processes, allowing that paper fiber to be reused in paper products in the economy. Miami-Dade County's recycling rate in 2023 was 37% with 40% contamination, an area that a Juno project can improve the overall recycling rate to the top tier of the counties in the State of Florida.

  Juno has a total of 15 years' experience in the technology development and commercial operation of the Juno Oregon facility.

  In 2011, the Georgia-Pacific Juno Team began research and development efforts around difficult-to-recycle paper products and was able to successfully process used paper cups. The Team evolved the design to subsequently process most fast-food waste and increase the recovery of additional valuable resources.

  In 2013, the Juno pilot waste processing system was built and proven to process waste from fast food restaurants, office buildings, airports, and amusement parks. This pilot was able to process hundreds of batches of waste, generating clean paper fiber that was able to be made into new paper products.

  In 2015, Juno designed and engineered a 70,000-ton capacity and 380,000-ton capacity waste processing system viable for U.S. and EU operations. This Juno operating model was developed to integrate seamlessly within existing solid waste industry infrastructures.

  In 2019, Juno invested in the commercialization of its technologies and processes by beginning the development of a 70,000-ton capacity waste recycling system in Toledo, Oregon.

In 2021, the Toledo, Oregon Juno site finished construction and prepared to receive feedstock from surrounding areas. Juno also began accepting residential waste in addition to commercial.

In May 2021, Juno Oregon commenced operations. The facility sends recovered sanitized paper fiber to the Georgia-Pacific Toledo containerboard mill which then processes the material into new paper products.

From May 2021 to present, Juno Oregon has been processing multiple feedstock streams from local Oregon Counties as well as King County Washington, demonstrating the ability to successfully recover commodities from residential and commercial municipal solid waste.

The Juno team has multiple years of experience in planning and executing Mixed Waste projects, below are the key members of the team:

Christer Henriksson, President, Juno LLC
25-plus years of experience in pulp and paper, recycling and innovative technologies.
His roles have included R&D, engineering, technical, manufacturing, and management.

Erik Wist, Vice President Commercial Development, Juno LLC
20 years of experience for the commercialization of innovative technologies.

Trent Moberg, Vice President Technology, Juno LLC
23 years with Georgia-Pacific designing, installing, and starting up capital projects related to waste paper recycling, sludge/waste reduction & wastewater treatment plant (WWTP) modernization.
7 years with Juno leading technology development and project development.

David McConnell, Director, Commercial Development North America, Juno LLC
25-plus years of experience in solid waste disposal and recycling services and 10 years of commercial development of solid waste diversion technologies.

Shannon Cochran, Sr. Director - Financial Planning & Analysis, Georgia-Pacific
20 years of experience in corporate finance and business analysis across paper, recycling, and consumer good companies. 8 years of experience specific to the Recycling industry.

William Haskins, Senior R&D Engineer Consultant, Juno LLC
13 years of experience in paper recycle plant process development and operations,
8 years of those in process design and plant operations for Juno.
4 years of experience in effluent treatment plant process.
4 years of experience in papermill sludge alternatives development.

James Rule, Senior Chemical Process Engineer, Juno LLC
8 years of experience in civil construction surveying in the Pinellas and Hillsborough County region.
5 years of experience on Juno technology as a process engineer, including startup and commissioning of the first commercial scale pilot plant.

B. Waste Management Solutions

1) Solution

Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link.

Juno® Technology was created to capture valuable commodities that traditional waste management and recycling industry standards currently allow to be landfilled or incinerated. Juno allows these commodities to be given a second chance at life. A Juno unit has the potential to recycle and divert up to 95% of municipal and commercial waste from landfills.

Juno Technology uses a patented wet-separation process developed by Georgia-Pacific to sanitize municipal solid waste (MSW) and recover commodities for reuse, diverting up to 95% from landfill or incineration. Recyclables include fiber, metals, glass, and plastics. In addition, food can be turned into renewable biogas. Of the up to 95% of waste that Juno processes that is diverted from landfills or incineration, typically about 60-70% of that can be recycled or recovered, which allows Juno to move higher up the integrated hierarchy of waste management results compared to other globally accepted technologies, such as waste to energy. Finally, Juno is the only currently known technology to recycle up to 90% of the paper fiber that is in the MSW streams that it processes, allowing that paper fiber to be reused in paper products in the economy.

MSW will be received and managed within a closed tipping floor with fast-acting doors and under negative pressure via building sweep air. Once unloaded, material will be handled with a front-end loader which will feed the floor conveying or grapple system used to load the Juno Claves.

In the Juno Clave processing unit, the material is steam sanitized and treated at an elevated temperature and pressure, then classified by size using a multi-stage washing device.

The large material (>10 mm) is further sorted into recyclable categories such as ferrous and non-ferrous materials, recyclable plastics, aggregate, and Solid Recovered Fuel (SRF), with a small unrecoverable fraction being sent to landfill.

The smaller solids fraction (<10 mm) including fiber and most of the free liquid, rich in dissolved organic material, is sent to a fiber screening system. This is where the organic rich filtrate from the process is extracted and sent to anaerobic digestion where the dissolved organic material is converted to biogas. This biogas can then be consumed on-site to generate the required steam for the process or cleaned and injected into the natural gas distribution pipeline.

After screening and cleaning the fiber, it is sent to a pulp dryer, where the fiber is dried and converted into bales that can be shipped off-site for reuse in new paper products, including food contact applications.

The SRF produced, after high value metals and plastics are recovered (as described above), and undesirables such as PVC are removed, can be sent to an offsite cement kiln as a replacement for a fossil fuel, an Energy from Waste operation, or an onsite Combined Heat & Power system that could

generate enough steam and electricity to sustain the entire Juno facility, as well as produce a slight excess of electricity that could be sold back to the grid.

2) Effectiveness
Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

Due to the modular Juno Clave system, Juno has the ability to scale and process an increased amount of waste depending on the client's requirements and waste stream availability. Furthermore, we have the experience and ability to recycle and recover up to 70% of the waste processed for beneficial reuse and divert up to 95% of the incoming material from the landfill and incineration, thus capturing almost all valuable recyclables including fiber, rigid plastics, metals, food, glass and other residues which can be processed into Solid Recovered Fuel (SRF) or generate non-fossil fuel electricity via a Combined Heat & Power operation.

In May 2021, Juno Oregon commenced operations. The facility sends recovered sanitized paper fiber to the Georgia-Pacific Toledo containerboard mill which then processes the material into new paper products. Juno Oregon is a one Juno Clave operation with a capacity of 70,000 tons annually.

From May 2021 to present, Juno Oregon has been processing multiple feedstock streams from local Oregon Counties as well as King County Washington, demonstrating the ability to successfully recover commodities from residential and commercial municipal solid waste.

3) Quantity
Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

Juno Technology is a modular system consisting of four Juno Claves designed to process 1,100 tons per day or 380,000 tons per year. Depending on the County's volumes requirements, additional Juno modular systems can be added to process the volume requirements. To process 3,300 tons per day, we would propose three Juno modular systems. The benefit of multiple Juno modular systems will allow for continuous non-interruptible service during planned maintenance turnarounds.

Juno Technology can be adapted to manage changes in waste composition as well as inbound feedstock tonnage based on the configuration of the final recovery processing equipment.

4) Technologies
Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

Juno Technology uses a patented wet separation process developed by Georgia-Pacific, along with several other main processes:

- MSW will be received and managed within a closed tipping floor with fast-acting doors and under negative pressure via building sweep air. Once unloaded, material will be handled with a

front-end loader which will feed the floor conveying or grapple system used to load the Juno Claves.

- The Juno Clave processing unit is a rotating autoclave that uses direct injection steam to elevate the temperature and pressure within the vessel, which sanitizes the waste, breaks down the paper products into individual fibers, and hydrolyzes most of the organic material into a liquid state. Once the cooking step is completed, the material stream is then classified by size using a multi-stage washing device.
- The smaller solids fraction and most of the free liquid, rich in dissolved organic material, is sent to a fiber screening system, with a portion of the filtrate from the process being sent to anaerobic digestion where the dissolved organic material is converted to biogas. The type of anaerobic digestor used is an externally circulated sludge bed reactor (ECSB), which is ideal for very low solids wastewater streams and has a short hydraulic retention time required to convert the dissolved organic material into biogas. This biogas can then be consumed on-site to generate the required steam for the process or further cleaned to produce Renewable Natural Gas and injected into a natural gas distribution pipeline. Small, high-density particles consisting of glass, small rocks, and other grit like material are also collected during the fiber screening process and recovered for use as an aggregate material.
- After screening and cleaning the fiber, it is sent to a pulp dryer, where the fiber is dried and converted into bales that can be shipped off-site for reuse in new paper products, including food contact applications.
- The large material (>10 mm) is further sorted into recyclable categories:
    - Ferrous materials are sorted using an overband magnet
    - Non-Ferrous materials are sorted using an Eddy Current Separator
    - Recyclable plastics such as polypropylene (PP) and polyethylene terephthalate (PET) are sorted using optical (IR) systems and air jets
    - Glass and grit are sorted using density separation
    - The remaining material is then shredded to produce a Solid Recovered Fuel (SRF) of a uniform size that is optimal for the Combined Heat and Power (CHP) boiler
- The SRF produced, after high value metals and plastics are recovered (as described above), can be sent to an offsite cement kiln, or an onsite combined heat and power system that could generate enough steam and electricity to sustain the entire Juno facility, as well as produce an excess of electricity that could be sold back to the grid.

See Process Flow Chart Attachment A

5) Benefits

Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

Juno® Technology can process unsorted residential and commercial municipal solid waste (MSW) sent to landfills/incinerators today. The technology can process, recycle, and divert up to 95% of MSW that is processed through a Juno facility. Recyclables include fiber, metals, plastics, and organic materials that can be converted into biogas via anaerobic digestion. Of the up to 95% of waste that Juno processes that is diverted from landfills or incineration, approximately 60-70% of that can be recycled or recovered. This allows Juno to move higher up the integrated hierarchy of waste management compared to other globally accepted technologies, such as incineration. Finally, Juno is a proven

technology that diverts up to 90% of the paper fiber that is in the MSW streams that it processes, allowing that paper fiber to be reused in paper products in the economy.

Based on the AtkinRealis 2024 Miami-Dade County waste characterization (subcontracted to SCS Engineers), the Juno process can recover an estimated 60 to 70% of the recyclable commodities (fiber, metals, plastics, aggregate and biogas) and divert an additional 20 to 30% to produce heat and electricity or as a Solid Recovered Fuel (SRF) to replace fossil fuels.

See Miami-Dade County Mass Balance Data Attachment B

This commodity recovery and renewable energy generation leads to Juno reducing Carbon Dioxide Equivalent (CO_2e) for every ton of waste it processes, compared to if the waste would have otherwise been sent to a landfill or an energy from waste facility in the US. This was validated by a Life Cycle Assessment (LCA) that was conducted by Sphera Solutions, a leader in consulting services focusing on Environmental, Health, Safety & Sustainability (EHS&S). This assessment had external panel review and the LCA confirms to ISO 14044:2006 Standards. It showed that in the US, a Juno facility processing 380,000 tons / year waste that would have otherwise gone to a landfill will reduce CO_2e emissions ~600,000 tons annually (GWP 20 inclusive of biogenic carbon). Compared to a waste to energy plant, Juno reduces carbon emissions by ~380,000 tons annually for every 380,000 tons it processes.

See LCA Graph Attachment C

6) Challenges
Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

Georgia-Pacific has a long history of permitting and constructing large CAPEX projects with extensive experience in Palatka, Florida at GP's Pulp and Paper Mill.

Juno will conduct local community meetings to explain the benefits of the mixed waste process to address the local zoning and permitting issues.

A detailed property search by a local real-estate agency will be conducted to address the utilities and zoning requirements for the process. The permitting process for the Juno plant in Oregon took less than 12 months.

C. Financial Approach

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1) Costs
Provide capital investment and 30-year operational costs associated with the respondent's solution.

The preliminary CAPEX estimate for a 380,000 ton/year system is $325 to $400 million. Scaling larger will bring capital efficiencies to lower the overall CAPEX / ton of processing capacity.

The preliminary estimate for operating costs for a 380,00 ton/year facility are $20 to $25 million / year.

2) Funding Model
Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

Juno currently plans to finance the technology build-out through third party investors. Juno has already engaged large investment funds and companies that finance projects of this size and larger. There appears to be a great deal of interest in the investment community to fund projects similar to the Juno projects discussed and contemplated in this proposal. Juno is open to a county-funded project, but that is not required.

Juno will pursue federal and state tax credits and applicable grant programs that already exist for technologies like Juno Technology. Initial research suggests Juno would be eligible for several existing programs.

3) Revenue
Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Juno's primary revenue source is MSW gate fees. Secondarily, Juno will generate revenue off its commodity streams including recycled paper pulp, recovered metals, and recovered plastics. Juno can also generate revenue from its renewable biogas which can be put back to the grid or turned into electricity, and it can generate revenue from electricity created from its combined heat and power unit. Finally, Juno will explore the ability to generate revenue from carbon credits and renewable energy credits.

D) Implementation Approach

1) Infrastructure
Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).
Juno will function as the Technology and EPC provider as well as operate the facility.

The infrastructure requirements to manage 1,100 tons per day of MSW feedstock are the following:

- Water: 0.4 million gallons per day, with peak flows of up to 350 GPM
  - Grey water supply may account for 280,000 gallons per day
  - Potable water supply for the remaining 120,000 gallons per day
- Electricity: Average draw of 10 MW, peak draw of 12.5 MW
- Water Treatment Facilities: 0.4 million gallons per day with peak flows of up to 350 GPM. (This can be significantly reduced with the implementation of additional internal water treatment equipment; this would also lower the grey water supply required.)
- Natural gas: Access to a pipeline that can supply 1,250 MMBtu/day for start-up purposes. If the biogas generated onsite is exported, the needed pipeline capacity is 900 MMBtu/day.
- Transportation: Adequate access for up to 100 inbound route collection vehicles and transfer trailers and 50 outbound trailers per day.

2) Size
Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

The site acreage requirement for a 1,100-ton site is 20 to 25 acres with the appropriate industrial zoning requirements. A three-module operation would require a 50 to 60-acre site that would have a 3,300-ton capability.

3) Site Ownership
Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

Georgia-Pacific will contract with one of their land brokers to secure the recommended site to implement the required project.

Consultant to be contracted to address the local zoning requirement for the appropriate industrial zoning and height requirement.

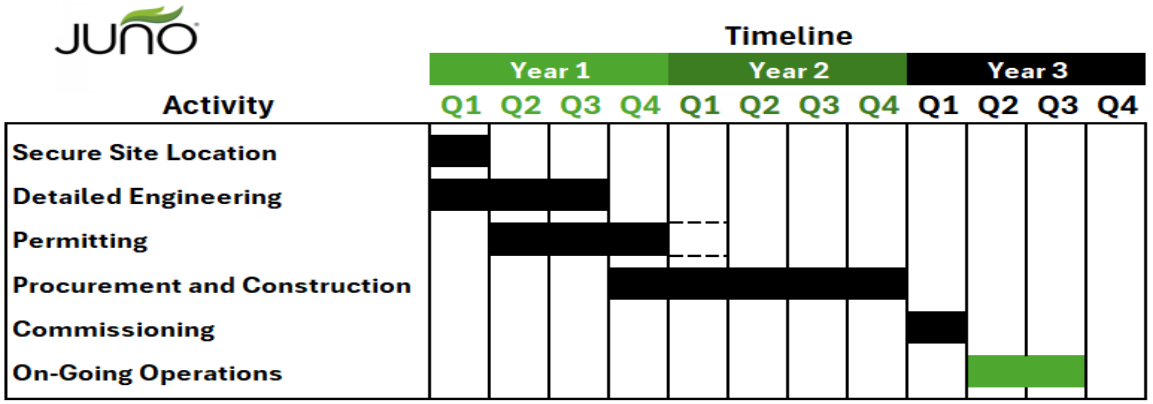
4) Permitting
Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

Local County construction and land use permit
Florida DEP

- Waste Processing Facility Permit – Chapter 62 –701
- Air Permit – Potential Title V requirement
- Industrial Wastewater Permit
- Anaerobic Digestion Permit – Chapter 62-709
- Recovered Material Dealer Permit – Chapter 403-7046

5) Timing
Identify the estimated timeframe for the implementation of the respondent's solution.

Upon execution of feedstock agreement with County the facility can be ready for commissioning in 3 years.



6) O&M
Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

A total of 75 FTEs will be required to operate 1,100 ton per day facility. Scaling to a 3,300 tons operation would require a total ~150 FTEs based on synergies of the operations.

The planned downtime for the full operation is targeted at ~20 days per year in total.

7) Health/Safety/Environmental
Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

Juno protects the environment by recycling waste that would normally end up in a landfill or incinerator, thus reducing the carbon footprint of those materials, which can make a measurable impact in helping municipalities reach their climate goals. Based on a Life Cycle Assessment performed by Sphera Solutions that conformed to ISO 14044:2006 standards, a Juno plant reduces emissions by ~600,000 tons of CO2 for every 380,000 tons of waste processed when compared to landfills or 380,000 tons of CO2 when compared to waste to energy. To address potential odor concerns, the Juno plant is designed to have a fully enclosed tipping floor with fast acting doors and a sweep air system that will treat the building air before discharging back to the environment. The Anaerobic Digestion system is such that the entire system is in sealed tanks that operate under a slight vacuum, ensuring no vapors are emitted from the system during treatment. Best Available Control Technology (BACT) will be utilized to ensure all site air emission requirements are met, including any particulate emissions from the pulp dryer. After site selection is confirmed, detailed engineering will be completed and a focus on noise pollution minimization will be incorporated with respect to building design and equipment location.

Georgia-Pacific places great emphasis on continuous improvement through robust Training Programs, comprehensive Safety Manuals, detailed Standard Operating Procedures (SOPs), and proactive Preventative Maintenance Plans. These resources are instrumental in guaranteeing the attainment of the highest performance standards.

Georgia-Pacific remains dedicated to fostering a culture of excellence and accountability in all our endeavors.

E) Other Information / Advice

1) Procurement Model
Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

Juno will be the EPC provider for the project to manage the purchase of all major equipment and construction packages (design-bid-build).

2) Partnerships
Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

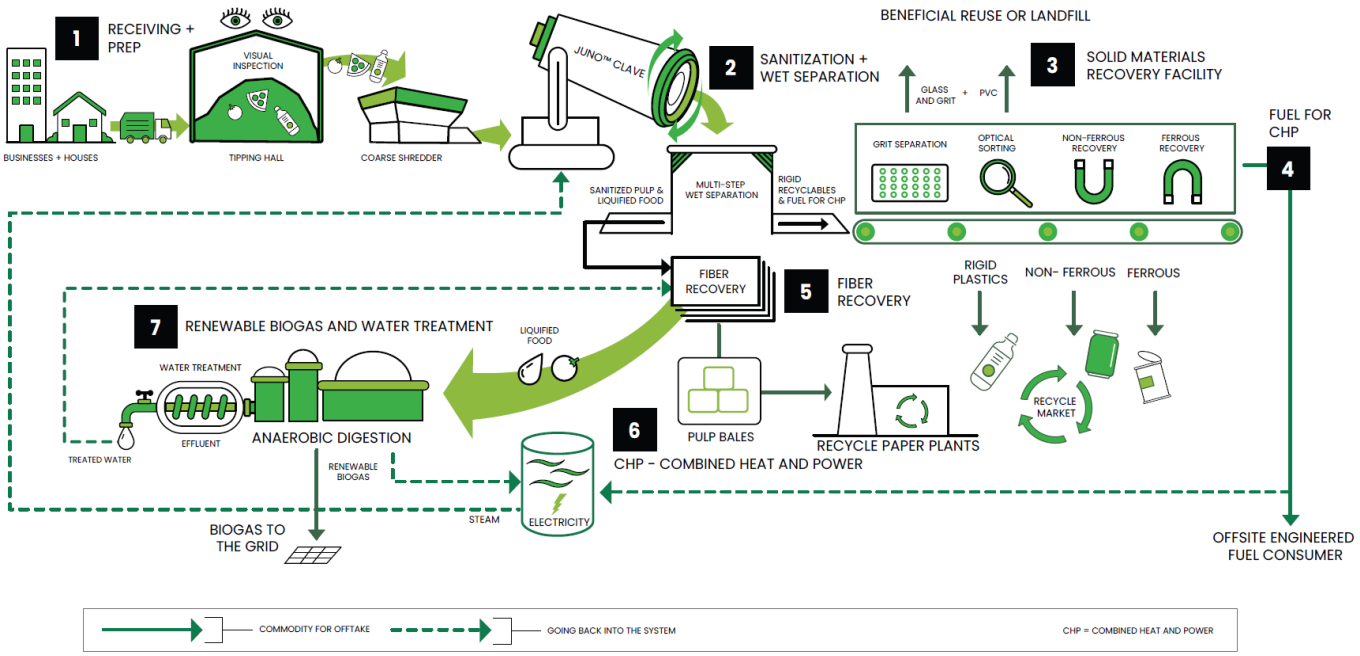
Juno has partnered with Wood PLC, a global engineering firm, to engineer the project and manage construction. Juno will engage local consultants to lead the County/Municipality and environmental permitting requirements.

3) Additional Insights
Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

The internal capability to manage the sale of commodities via the
Leverage Georgia-Pacific's CORE Capabilities:

- Recycling Expertise
- Engineering
- Procurement
- Construction
- Project Management
- Commissioning
- Operations & Maintenance Excellence Team
- Environmental Compliance
- GP Recycling Off Take Commodity Sales
- Energy Trading Team
-

Attachment A – Juno Process Flow Chart


1
RECEIVING + PREP
VISUAL INSPECTION
BUSINESSES + HOUSES
TIPPING HALL
COARSE SHREDDER
JUNO™ CLAVE
2
SANITIZATION + WET SEPARATION
BENEFICIAL REUSE OR LANDFILL
GLASS AND GRIT
+
PVC
3
SOLID MATERIALS RECOVERY FACILITY
GRIT SEPARATION
OPTICAL SORTING
NON-FERROUS RECOVERY
FERROUS RECOVERY
FUEL FOR CHP
4
SANITIZED PULP & LIQUIFIED FOOD
MULTI-STEP WET SEPARATION
RIGID RECYCLABLES & FUEL FOR CHP
FIBER RECOVERY
5
FIBER RECOVERY
RIGID PLASTICS
NON- FERROUS
FERROUS
7
RENEWABLE BIOGAS AND WATER TREATMENT
LIQUIFIED FOOD
WATER TREATMENT
EFFLUENT
TREATED WATER
ANAEROBIC DIGESTION
RENEWABLE BIOGAS
PULP BALES
RECYCLE PAPER PLANTS
RECYCLE MARKET
6
CHP - COMBINED HEAT AND POWER
STEAM
ELECTRICITY
BIOGAS TO THE GRID
OFFSITE ENGINEERED FUEL CONSUMER
COMMODITY FOR OFFTAKE
GOING BACK INTO THE SYSTEM
CHP = COMBINED HEAT AND POWER

Attachment B – Miami-Dade County Mass Balance

Mass Balance based on the Miami-Dade County 2024 Waste Characterization** for a

1,100-tonne per day Juno Commercial Facility

Recycling Capture Rate – 65 to 71%
Total Diversion – 90 to 95%

Inputs - Waste Characterization (tons/day)	
Category	**As Received**
Paper*	215
Plastics (PET)	21
Plastics (PP)	19
Plastics (PVC)	1
Plastics (other)	121
Metals (Ferrous)	26
Metals (Non-Ferrous)	26
Organics (food, green, etc.)	341
Inerts (glass, grit, etc.)	75
Other (textiles, wood, etc.)	156
Total	**1,000**

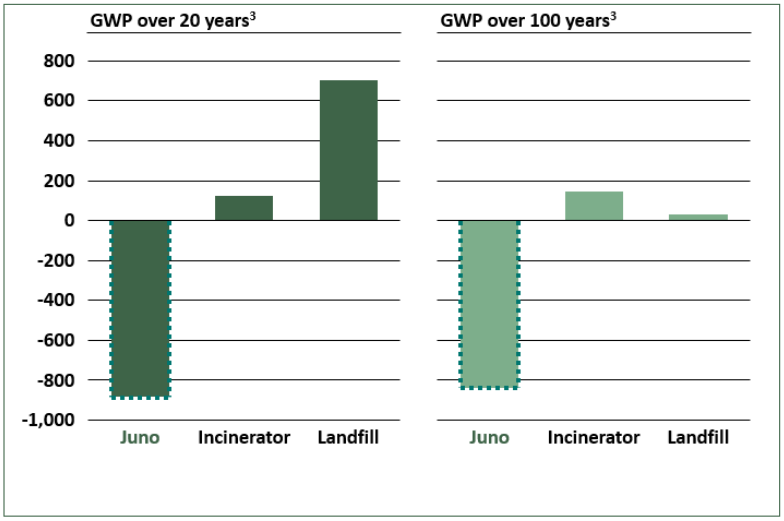
Outputs (tons/day)	
Category	**Products**
Sold / Recovered	
Pulp Bales	90
PET	20
PP	18
Ferrous	26
Non-Ferrous	23
Aggregate (glass, grit, etc.)	98
Biogas Generation	439
Energy Recovery	
Engineered Fuel	247
Landfilled	
Ash	37
PVC	2
Total	**1000**

* Typcially includes over 50% moisture and fillers
**AtkinsRéalis contracted with SCS Engineers December 2024 report

Attachment C – Life Cycle Assessment Graph

Juno reduces carbon emissions versus landfills and incinerators in the US

Global Warming Potential (GWP)[1] measured in kg CO2e per metric ton of waste processed[2]



If 380,000 tons of waste is processed by Juno rather than sent to an average US landfill, **C02e will be reduced by ~600,000 tons** using GWP20.

Processing 330k tons with Juno rather than a landfill represents the….

…the carbon sequestered by a U.S. forest half the size of **Miami-Dade County, FL**[4]

1) The U.S. EPA defines **Global Warming Potential (GWP)** as a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO2).
2) Based on **2023 Life Cycle Assessment (LCA) performed by Sphera Solutions with external panel review**; LCA Conforms to ISO 14044:2006 Standards
3) Includes biogenic CO_2; Excluding Biogenic available upon request
4) Based on US EPA's Greenhouse Gas Equivalencies Calculator

Novastus

Market Research Response

April 2025

To: Miami-Dade County Department of Solid Waste Management Attn: Saba Musleh, CPPB and Ross Byers

Dear Ms. Musleh and Mr. Byers,

On behalf of Novastus, I am pleased to submit our response to Miami-Dade County's market research request for innovative municipal solid waste management solutions. We believe Novastus can provide Miami-Dade with a transformative, scalable path to landfill diversion that is both economically viable and environmentally sustainable.

Our TotalMRF + NovaDry platform offers the ability to incrementally divert up to 90% of MSW from landfills—starting at today's disposal costs – by converting it to a carbon-negative fuel that can be used in existing industrial processes. By deploying just one 100,000 TPY system on existing County infrastructure, we can immediately reduce the financial and environmental burden of rail-haul waste exports.

Our system is designed for rapid deployment, with each train operational in 9–12 months and scalable across multiple County sites. We have a signed LOI with a major, local industrial facility capable of offtaking fuel derived from up to 600,000 tons per year of MSW—the equivalent of six TotalMRF trains. From there, we can expand to process the County's full 2.4 million TPY waste stream, ensuring long-term landfill diversion, energy recovery and cost control.

With our commercial validation, in-County fuel offtake partner and flexible funding model, Novastus is uniquely positioned to help Miami-Dade chip away at the waste challenge, reduce costs, and create clean energy opportunities that will define the next generation of infrastructure.

We view this not only as an infrastructure project, but as a critical opportunity for Miami-Dade to demonstrate global leadership in climate-resilient, circular waste systems. We look forward to working with your team to begin implementation and scale over time.

We look forward to working with your team and welcome the opportunity to explore a phased implementation strategy.

Sincerely,

Jake Suski
Chief Executive Officer
Novastus, Inc.
jsuski@novastus.com

Subject: Market Research Response – Novastus Waste Management Solution

To:
Saba Musleh, CPPB, Negotiator
Strategic Procurement Department
saba.musleh@miamidade.gov

CC:
Ross Byers, Project Manager
AtkinsRéalis
ross.byers@atkinsrealis.com

A. Respondent

Company Name: Novastus
Address: 1368 W. Broad St, Cookeville, TN 38501
Primary Contact:
Jake Suski, CEO
Email: jsuski@novastus.com
Phone: 931.324.2500

Company Overview:
Novastus is a clean infrastructure and waste solutions technology company redefining how municipalities manage their solid waste through sustainable, cost-effective innovation. We help municipalities achieve up to **90% landfill avoidance** at today's landfill disposal costs. We convert mixed municipal solid waste (MSW) into two high-value outputs: recyclable materials and NovaFuel—a carbon-negative fuel—using our patented, non-thermal NovaDry system integrated within our scalable Total Material Recovery Facility (TotalMRF) platform. Our model addresses both landfill diversion and climate mitigation in one deployable, modular infrastructure package. Our system has been validated at commercial scale in Tennessee and is ready for deployment in Miami-Dade County to reduce waste volumes, emissions and costs while building resilient local waste-to-fuel infrastructure.

B. Waste Management Solutions

B. 1. Solution Overview

Miami-Dade County faces a critical inflection point in its approach to municipal solid waste (MSW). With over 2.4 million tons generated annually, rising landfill pressures, and increasing rail-haul disposal costs, the County needs a solution that is immediately impactful, economically feasible, and future-ready. Novastus offers a proven, modular solution—TotalMRF powered by NovaDry—that can begin diverting waste within 12 months and scale to meet Miami-Dade's full MSW volume over time.

The TotalMRF platform integrates proven recycling technology with NovaDry, our patented, non-thermal drying system. This enables ~90% landfill diversion and production of NovaFuel—a storable, carbon-negative solid fuel—while maximizing material recovery. The system is designed for seamless integration at existing County facilities, with no need for source separation, public education or combustion.

Key Solution Attributes:

- **TRL-9 Validated:** NovaDry has been verified by Sargent & Lundy and operated since 2021 at commercial scale in Tennessee
- **Demonstrated 3 Years Of Runs:** Includes food waste, plastics, paper, biosolids, and MSW directly from municipal transfer stations
- **Energy Efficient:** <100 kWh/ton energy use—85% lower than conventional drying
- **High Diversion:** Up to 90% of inbound MSW diversion from landfill
- **Modular Deployment:** One 100,000 TPY train = ~35,000 ft²; deployable at landfills, transfer station sites or other county property
- **Low Impact:** No combustion, no leachate, no odor, no digestate
- **Resilient:** Even without fuel offtake, reduces MSW export tonnage by ~40%

The TotalMRF system functions in three integrated stages:

1. **Front-End Sorting**: Incoming waste is mechanically sorted using shredders, screens, magnets, optical sorters, and eddy current separators. This stage recovers high-value recyclable materials such as:
    a. PET and HDPE (#1 and #2 plastics)
    b. Ferrous and non-ferrous metals
    c. Cardboard and mixed paper

    d. Bulky waste for separate handling
2. **Drying and Fuel Conversion**: Non-recyclable waste—typically wet and organic-rich—is sent to **NovaDry**, our ambient, non-thermal drying system. NovaDry efficiently dries mixed, unsorted waste streams—including food scraps, film plastics, yard waste, and contaminated fiber—using only ambient air and mechanical energy. The system applies nucleation physics (similar to cloud formation) to remove moisture without heat, pressure or combustion. The result: a clean, stable fuel input with ~35% mass reduction and no emissions.
3. **NovaFuel Production**: The dried output is densified and baled into **NovaFuel**, a carbon-negative alternative fuel with ~15 MMBtu/ton of heating value. It is ideal for use in kilns, boilers, or gasifiers and can be stored for 10+ years without degradation. We have secured an LOI with a major industrial facility in Miami-Dade capable of using fuel derived from up to 600,000 TPY of MSW—supporting the full buildout of six TotalMRF trains.

In combination, these three stages provide Miami-Dade with a turnkey solution for landfill diversion that improves recycling rates, reduces transport and disposal costs, and generates a new stream of locally usable clean energy.

The modular design allows Miami-Dade to start small—chipping away at its waste volumes with one train—and scale to six or more trains as infrastructure and fuel demand grow. Future trains can be added to support additional volumes or geographic coverage as demand for clean fuels and recyclables continues to increase.

Even without immediate fuel offtake, the system delivers economic and environmental value by reducing export mass, recovering revenue-generating recyclables, and preserving landfill capacity. Baled NovaFuel can be stored securely for over 10 years without degradation, odor, or environmental risk—giving the County flexibility without compromise.

This system is particularly well-suited to Miami-Dade's waste stream, which contains a high percentage of organic material, film plastics, and paper—all of which are difficult to recover using traditional MRFs or composting programs. Our technology has been validated on

thousands of tons of similar material in Tennessee and can be implemented without requiring changes to public behavior or source separation.

Material Recovery and Fuel Composition Breakdown

All recovery assumptions are based on Miami-Dade's 2024 Waste Characterization Study, with rates modeled from standard optical and mechanical recovery systems (e.g., belt magnet, eddy current, NIR sorters). Recovery rates for PET, HDPE, metals, and cardboard are consistent with industry norms for mixed-waste material recovery systems and validated by our operational runs.

Material Type	% of Waste Stream	Estimated Recovery Rate	Description
Recyclables			
OCC Cardboard	10.2%	50-60%	Clean cardboard & boxboard
PET (Plastic #1)	2.1%	80-90%	High-value clear plastic recovered for reprocessing
HDPE (Plastic #2)	1.3%	80-90%	Pigmented/natural containers (e.g., milk jugs, detergent)
Ferrous Metals	2.6%	95+%	Steel cans, scrap metal, and magnetic items
Aluminum Cans	0.7%	80-90%	Aluminum cans
Non-Ferrous Metals	.08%	50-85%	Copper wires, non-magnetic materials
Total Recovered:			~11.5%
Landfilled / Alternative Daily Cover			
Bulky Waste	0.5%	100%	Furniture and oversized waste, redirected separately
Hazardous Household Waste	2.8%	95+%	Segregated for safe disposal (paints, batteries, sharps)
Inerts (e.g., dirt, fines)	8.7%	100%	Screened fines and inerts that won't go into NovaFuel; will be landfilled or used as ADC
Total Landfill & ADC:			~12%
NovaFuel			
Fuel Feedstock (mixed wet waste)	77%	100%	Remaining dry combustible material used to produce NovaFuel
Moisture Removal	35%	100%	Moisture removed from NovaFuel Feedstock
Fuel Produced (dry tons by weight):			~50%

In short, TotalMRF + NovaDry allows Miami-Dade to:

- Deploy a pilot facility now—without waiting for a major incinerator or hauling contract

- Achieve ~90% landfill diversion using proven, affordable infrastructure
- Support a growing clean fuel economy while cutting costs and emissions
- Scale up or down as needs evolve—resilient, adaptive, and community-ready

B.2. Effectiveness – Results and Validation of the Solution

The NovaDry system is already operating at commercial scale in Tennessee and has undergone rigorous validation to support full-scale deployment in Miami-Dade.:

- **Commercial-Scale Facility Since 2021:** Our Cookeville, TN operation features a full-scale NovaDry system and integrated front-end sorting line. The site has processed thousands of tons of mixed MSW, including loads trucked in directly from a municipal transfer station.
- **3 Years Of Operating Runs:** Across all seasons, waste types, and configurations. This includes contaminated MSW, food waste, paper, organics, and plastics—producing consistent recovery rates and fuel output.
- **Third-Party Engineering Validation**: Our system has been independently reviewed and certified at Technology Readiness Level 9 (TRL-9) by Sargent & Lundy, a leading global energy and infrastructure engineering firm.
- **Offtake Agreement Secured:** A Miami-Dade-based industrial user has signed a letter of intent to purchase up to 300,000 TPY of NovaFuel—equivalent to the fuel yield from ~600,000 TPY of MSW.
- **Proven Adaptability to Mixed Waste:** Unlike anaerobic digesters or WTE incinerators, NovaDry handles heterogeneous, high-moisture, and non-source-separated MSW, including film plastics, organics, and textiles—waste streams common in Miami-Dade's profile.
- **No Source Separation or Behavior Change Required:** Designed to work with existing collection practices and infrastructure, TotalMRF delivers diversion without new burdens on residents or haulers.

While no new infrastructure is ever "risk-free," Novastus offers one of the most validated and replicable waste processing solutions available to municipalities today. We have operated the system for over two years, under real-world MSW conditions. Our partners, engineering team, and offtakers are ready to deliver this same performance in Miami-Dade—at scale, on budget, and without delay.

B.3. Quantity – Processing Capacity and Flexibility

Each TotalMRF train processes approximately 100,000 tons of mixed MSW annually, and can be deployed in compact, ~35,000 ft² buildings at County-owned sites. This modular format allows the County to scale its processing capacity incrementally—either by siting smaller trains near waste generation (transfer stations) or building larger, centralized facilities at locations like South Dade Landfill.

- South Dade Landfill
- North Dade Landfill (Cell 5)
- West Transfer Station

With fuel offtake secured from a local industrial facility for up to six trains, Novastus can initially handle 600,000 TPY—about one quarter of the County's MSW and deploy these facilities within 36 months.

The program could expand further to accommodate **all of the County's waste over time**. As demand grows from cement kilns, biomass power, steam users, or renewable fuel producers, additional TotalMRFs can be deployed—either co-located or distributed across the County. NovaFuel is also suitable for export to regional biomass or industrial energy markets.

In scenarios where NovaFuel must be stored or exported, TotalMRF trains still deliver significant cost avoidance by reducing the **total weight of unrecoverable waste requiring long-haul transport**—and by preserving valuable landfill airspace.

***Key Advantages For Transport Cost Avoidance And Landfill Preservation*:**

- **~13,800 TPY of recyclables** recovered (metals, OCC, PET, HDPE)
- **~30% moisture removed** from remaining MSW, eliminating water weight before transport

- **Final export tonnage reduced by ~40%**, from 100,000 to ~61,700 tons per train
- **Significant savings**, even before accounting for fuel value
- **NovaFuel can be stored safely for 10+ years**, with no leachate, odor, or emissions

More importantly, the system allows the County to **postpone or avoid high-cost landfill expansions** by reducing inbound tonnage and using baled NovaFuel or screened inerts for daily cover or deferred disposal. This **preserves landfill airspace**, defers capital projects, and strengthens resiliency.

Even in a deferred offtake scenario, TotalMRF is not just cost-competitive with traditional hauling—it's a **strategic hedge** against rising export costs, landfill saturation, and infrastructure bottlenecks.

B.4. Technologies – Waste Processing Technologies Utilized

The Novastus TotalMRF platform integrates standard, commercially available material recovery equipment with our patented non-thermal NovaDry system. This enables full-system landfill diversion without combustion, anaerobic digestion, or source separation.

Material Recovery & Pre-Processing:
Off-the-shelf equipment is customized for Miami-Dade's waste stream and includes:

- Shredders and fines screens
- Magnetic separators (ferrous)
- Eddy current separators (non-ferrous)
- Near-infrared optical sorters (plastics and paper)
- Air classifiers for lightweight fraction separation

NovaDry System – Patented Non-Thermal Drying
NovaDry uses nucleation physics to remove moisture from MSW at ambient temperatures, combining:

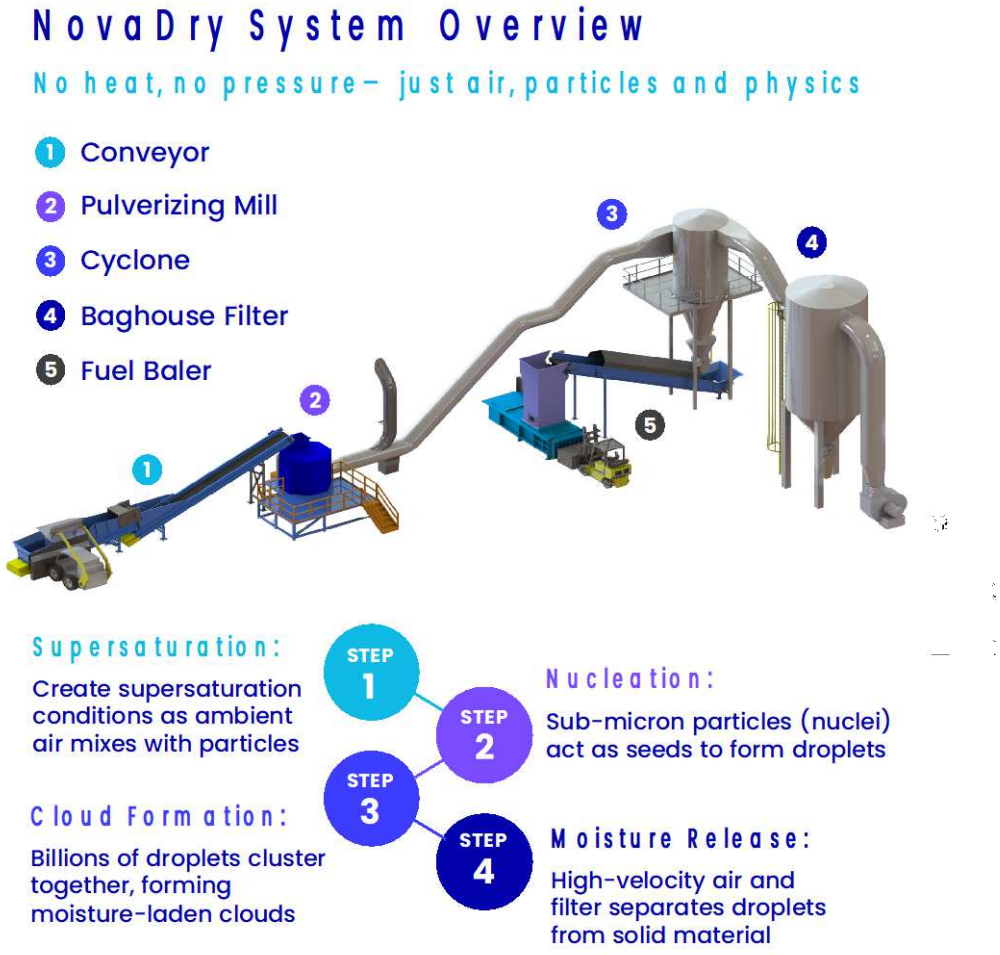
- A high-speed pulverizing mill
- Ambient air injection with moisture supersaturation
- Cyclone and baghouse separation
  No combustion, no pressure, no emissions. The system halts biological activity and produces a dry, storable fuel feedstock with <15% moisture.

Fuel Densification & Wrapping
NovaFuel is densified, baled (1.5 tons per bale), and wrapped for:

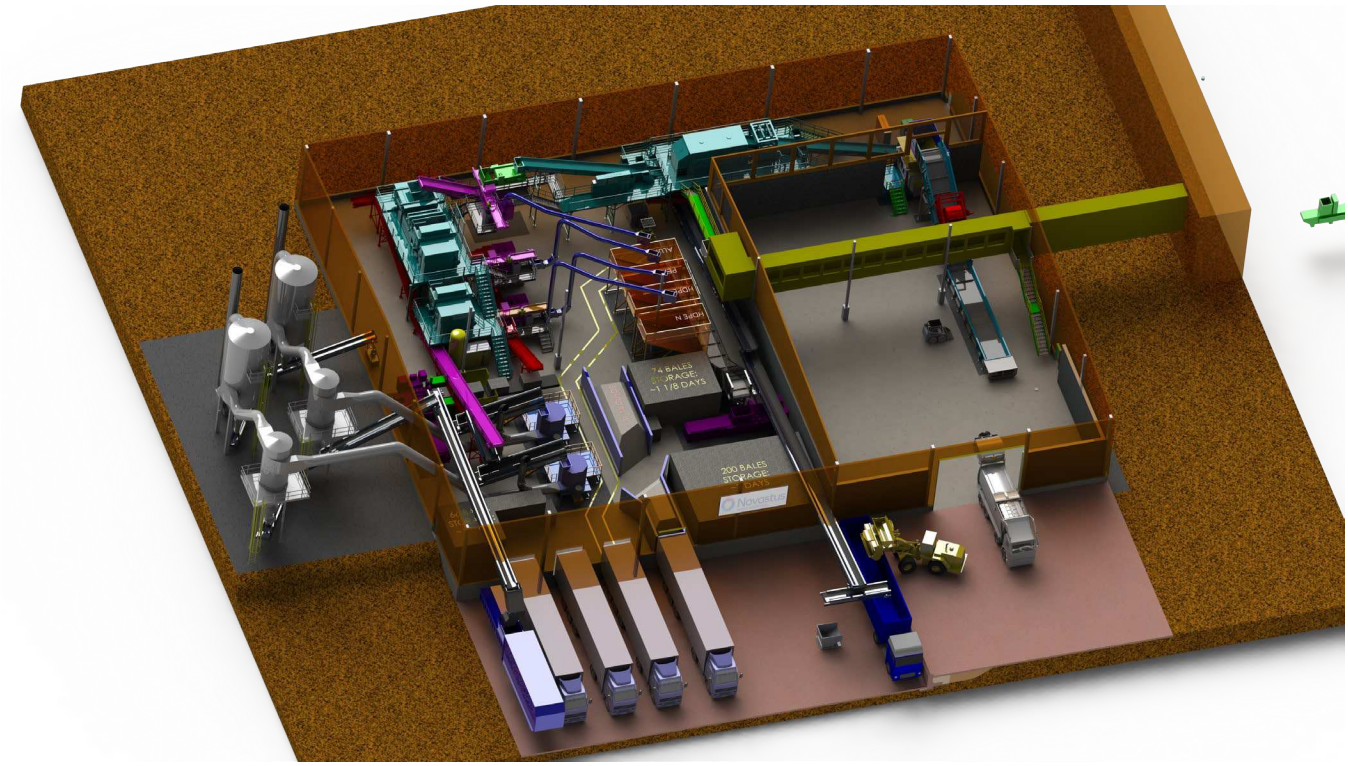
- Safe long-term storage (10+ years)
- Clean transport to local or regional fuel offtakers
- Use as a clean-burning replacement for coal, biomass, or refuse-derived fuel

Emission-Free Operation
TotalMRF is a non-combustion system, meaning:

- No emissions stack or Title V air permit required
- No need for flue gas treatment, ash handling, or secondary containment
- No digestate or liquid discharge—just dry fuel and recovered recyclables



TotalMRF Train Reference Design



B.5. Benefits – Advantages Over Other Solutions

The Novastus TotalMRF + NovaDry platform offers a fundamentally different, more flexible, and cost-effective approach to managing municipal solid waste—designed to maximize landfill diversion, reduce emissions, and generate clean energy at a lower operational cost than traditional methods.

General Benefits

- **Up to 90% landfill diversion**: Recovers recyclables and converts remaining material into clean, carbon-negative fuel.
- **All-in processing cost of ~$70/ton**: vs. $120–135/ton for long-haul disposal. That's over **$5 million in annual savings per 100,000 tons processed**.
- **Modular deployment**: Scales in 100,000 TPY increments to meet community needs without massive upfront capital.
- **No combustion or incineration**: Simplifies permitting and eliminates stack emissions, ash disposal, and public health objections.

- **No leachate or odor**: Moisture is removed and biological activity halted—no need for lined pits, aeration systems, or odor management.
- **Storage-friendly fuel**: NovaFuel can be baled and stored safely for 10+ years with no emissions, leachate, or degradation.
- **Resilient to fuel market delays**: Even without immediate offtake, the platform reduces total waste mass by ~50%, slashing transport and landfill demand.

Comparison to Rail-Haul and Landfill Disposal

- **Lower lifecycle cost:** Compared to rail-haul and landfill export, TotalMRF reduces outbound mass by ~40%, significantly lowering long-haul transport costs. These savings are further offset by recovered revenue from metals, plastics, and cardboard—delivering net system savings even before fuel is combusted or sold.
- **Mass reduction = fewer railcars**: Drying and recycling reduce transport mass by ~40%, meaning fewer railcars, fewer emissions, and lower per-ton cost even without fuel sale.
- **Local value retention**: Recovered materials and NovaFuel benefits stay within the County, providing the region with jobs, energy value and circular economy development.
- **Landfill preservation**: Reduces inbound volume and enables the use of inerts and NovaFuel residue as alternative daily cover –freeing up landfill space and deferring future capital investments.

Comparison to Waste*-To-Energy Plant*

- **Permitting simplicity**: TotalMRF and NovaDry require no combustion stack, no Title V air permit, and no thermal emissions controls. There are no NOx, SOx, dioxins, fly ash, or bottom ash—bypassing the regulatory complexity associated with mass burn plants entirely.
- **Public approval**: Waste incineration proposals frequently face intense community opposition. Our system avoids the “burn plant” stigma by drying and processing waste into an odorless, inert fuel. There's no visible stack, no smoke, and no need for a new industrial-scale incinerator—making TotalMRF much easier to permit, site, and expand over time.
- **Fuel compatibility & siting flexibility**: NovaFuel is engineered to replace fossil fuels as a biomass substitute in existing industrial or energy facilities, offering a drop-in, odorless, storable alternative. It enables decentralized energy planning: power generation can be sited away from dense population centers, using existing industrial corridors, utility rights-of-way, or co-location with cement kilns and

industrial boilers. In effect, this turns a centralized "waste burning" project into a clean biomass fuel solution with fewer community objections.

- **Enhances future WTE feasibility**: If the County later pursues a new WTE facility, NovaFuel provides a better feedstock. With a consistent, high-BTU (~15 MMBtu/ton) fuel, fewer and smaller boilers are required, improving heat rates and reducing facility footprint, capital costs, and emissions. This de-risks a future WTE plant by front-loading processing and reducing combustion uncertainty.
- **Capital efficiency:** Mass burn systems require $1.5-1.8 billion and 7–10 years to deliver. By contrast, TotalMRF trains cost $12–15 million for each 100,000 TPY, can be installed at transfer stations or landfill-adjacent sites, and go live in under 12 months—giving the County results within a single fiscal cycle.
- **Scalable and phased:** Unlike all-or-nothing incinerators, TotalMRF scales modularly. Miami-Dade can start with a single 100,000 TPY facility and add trains as fuel demand or political support grows—without committing to megaproject timelines or costs.

Comparison to Anaerobic Digestion & Composting Programs

- **Waste compatibility**: NovaDry processes mixed waste streams, including plastics, textiles, contaminated paper, and food waste. No need for source separation or education campaigns.
- **Diversion performance**: AD systems often achieve 30–40% diversion at best. TotalMRF achieves ~90% with no need for separate organics bins.
- **Operational complexity**: No digestate to dispose of, no biogas handling infrastructure, and no risk of PFAS or contamination.
- **Leachate & odor**: Anaerobic systems can produce leachate and odor if mismanaged; NovaDry produces none.
- **Footprint & scale**: Compost and AD facilities require large, clean, open space and are hard to site near urban areas. Each TotalMRF train fits into ~35,000 ft² and co-locates with existing solid waste facilities.

B.6. Challenges – Implementation and Mitigation Strategy

The Novastus TotalMRF + NovaDry platform provides a proven, near-term solution that meets the County's urgent need for cost-effective diversion while keeping long-term infrastructure options open. Unlike incinerators, digesters, or landfill expansion, it delivers measurable financial and environmental results in under 12 months—and scales to match demand.

1. Permitting Unfamiliarity
Challenge: NovaDry is a non-thermal, low-emission process that falls outside traditional combustion, composting, or anaerobic digestion categories. Regulatory agencies may not have pre-existing frameworks for evaluating this class of drying and processing infrastructure.

***Mitigation*:**

- We provide detailed engineering documentation, third-party validation (Sargent & Lundy), and TRL-9 certification to support agency review.
- We engage early with state and local permitting agencies, offering pre-submittal briefings and emissions modeling to streamline review.
- Because there is no combustion, no stack, no digestate, and no leachate, **Title V air permits and water discharge permits are not required**, dramatically simplifying permitting timelines and reducing compliance burdens.

2. Siting Logistics at County Facilities
Challenge: Landfills and transfer stations are often space-constrained and require minimal disruption to ongoing operations.

***Mitigation*:**

- Each TotalMRF train occupies ~35,000 ft² and is designed for phased integration alongside existing solid waste infrastructure.
- Facilities are engineered with standardized building layouts and utilities requirements for **fast-track site planning and construction**.
- Site studies and utility assessments are part of our predevelopment support. We've designed layouts that allow construction to proceed while transfer station or landfill functions remain uninterrupted.

3. Fuel Offtake Timing and Market Development
Challenge: Demand from local cement plants, biomass power, or industrial steam users may not immediately match the full volume of waste produced in Miami-Dade.

***Mitigation*:**

- We have secured an LOI with a Miami-Dade-based industrial user that can absorb 300,000 TPY of NovaFuel (derived from ~600,000 TPY of MSW), supporting up to six trains at launch.

- NovaFuel is engineered to be storable for 10+ years with no emissions, leachate, or odor—**creating no environmental liability if stored on-site**.
- We provide marketing and logistics support to expand regional offtake, and the product can be exported to biomass markets statewide or beyond.
- Even if temporarily stockpiled, the **~50% mass reduction in waste** from TotalMRF dramatically reduces hauling and landfill costs.

C.1. Costs – Capital and Operational

Novastus delivers one of the most affordable and scalable landfill diversion strategies available—without the complexity, delay, or financial risk of megaproject infrastructure. Our modular TotalMRF trains allow Miami-Dade to incrementally build capacity in 100,000 TPY units and maintain predictable long-term costs.

Capital Expenditures (CapEx)

Each TotalMRF train is estimated to cost **$12–15 million**, depending on site logistics, utility access, permitting scope, and sitework needs. This range is based on sitework from comparable layouts in Tennessee and the southeastern U.S.

This capital budget covers:

- Material recovery and sorting systems
- NovaDry drying and fuel conversion system
- Fuel baling and wrapping equipment
- Control and SCADA systems
- Clear-span pre-engineered building
- Site prep, utilities and installation
- Engineering, commissioning and contingency

A detailed equipment list and cost model can be shared during predevelopment.

Operating Expenditures (OpEx)

- Under a **Novastus-financed Build-Own-Operate (BOO)** model, all-in service fee—including capital recovery—is **$65–85 per ton**, depending on contract structure, site conditions and revenue available from recyclables.
- Under a **County-owned (DBOM)** model, with Novastus operating the facility, the operating costs are projected in the range of **$50–70 per ton**, depending on labor, power rates and site-specific variables.

Operating costs include:

- O&M labor and training
- Power and utilities
- Spare parts and scheduled maintenance
- Insurance, licensing, and system upgrades
- Fuel wrapping and handling
- Performance monitoring and uptime analytics

Our pricing model is based on long-term, inflation-aligned service contracts that offer cost certainty and transparency—unlike volatile tipping fees or legacy disposal structures.

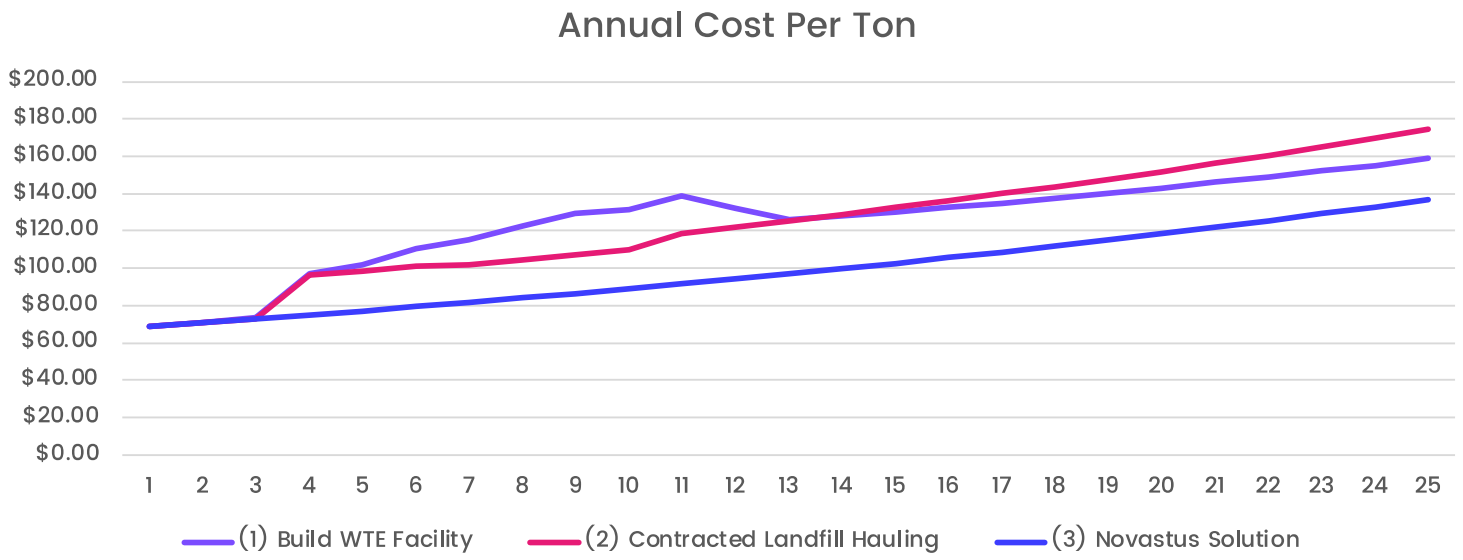
Over a 30-year horizon, Novastus offers a cost-stable alternative to rail export and landfill expansion. Our model is designed around long-term service pricing—avoiding the volatility of fuel, tipping fees, and transport escalation.

Annual Cost Per Ton

(Comparative Data From Miami-Dade Mayor's 2/8/25 Memo)

Year	(1) Build WTE Facility	(2) Contracted Landfill Hauling	(3) Novastus Solution
1	$68.84	$68.84	$68.84
2	$70.84	$70.84	$70.84
3	$73.30	$72.89	$72.89
4	$96.96	$96.16	$75.00
5	$101.93	$98.74	$77.18
6	$110.66	$101.39	$79.42
7	$115.00	$101.50	$81.72

8	$122.34	$104.23	$84.09
9	$129.52	$107.05	$86.53
10	$131.37	$109.94	$89.04
11	$138.78	$118.84	$91.62
12	$132.24	$122.10	$94.28
13	$126.05	$125.45	$97.01
14	$128.17	$128.91	$99.83
15	$130.38	$132.46	$102.72
16	$132.69	$136.12	$105.70
17	$135.11	$139.88	$108.76
18	$137.64	$143.75	$111.92
19	$140.28	$147.74	$115.16
20	$143.03	$151.84	$118.50
21	$145.91	$156.06	$121.94
22	$148.90	$160.40	$125.48
23	$152.03	$164.87	$129.12
24	$155.29	$169.48	$132.86
25	$158.68	$174.21	$136.71
TOTAL	$3,125.94	$3,103.69	$2,477.16



If Novastus were deployed at full scale to process all 2.4 million tons of Miami-Dade's MSW annually, the County would save over $1.5 billion in direct costs over the

next 25 years compared to either building a new WTE facility or continuing to export waste via rail.

Even a phased deployment—starting with a single train—would deliver:

- Immediate per-ton cost savings
- Recyclables recovery and landfill airspace preservation
- Reduced long-haul transport demand
- A faster path to emissions reductions and resiliency

C.2. Funding Model

Novastus offers multiple financing structures to align with the County's fiscal, legal, and procurement preferences—whether through full private capital deployment or public ownership with operational support.

Option 2 – Build-Own-Operate (BOO):

Under a BOO model, Novastus finances 100% of project costs and operates the facility under a multi-year processing agreement with the County. This model:

- Requires no upfront capital from the County
- Locks in a predictable per-ton processing fee (e.g., $65–85/ton)
- Shifts all construction, performance and operating risk to Novastus
- Accelerates implementation by avoiding the County's debt authorization cycle

We are actively engaged with infrastructure investors, clean energy funds and equipment leasing firms prepared to back these projects through preferred equity, tax equity and senior debt—including investors already backing municipal-scale energy and climate infrastructure.

Option 2 – Design-Build-Operate-Maintain (DBOM):
Under this structure, the County funds the facility through its preferred capital channels (e.g., bonds, grants) and Novastus acts as a turnkey builder and performance-based operator. This model:

- Preserves County ownership of the asset
- Allows the County to capture depreciation, grants, or bond eligibility
- Establishes fixed, long-term O&M rates with uptime guarantees
- Keeps operations with a private partner while maintaining public accountability

Eligible Funding Sources:

- **Private Activity Bonds (PABs)** – Facilities qualify due to public use and infrastructure status
- **DOE and EPA grant programs** – Particularly for waste diversion, renewable fuels, and clean manufacturing
- **Clean infrastructure and resiliency financing** – For landfill life extension and emissions reduction

C.3. Revenue Streams

The TotalMRF + NovaDry platform enables multiple **diversified, long-term revenue streams** that can be structured to reduce net system cost, generate local economic value, or return savings to the County.

1. **Tipping / Processing Fees**
    - Paid by the County or contracted haulers as a per-ton service fee
    - Structured as an inflation-indexed, performance-based processing agreement
    - May be offset in part by fuel or recyclable value depending on contract structure
2. **Sale of Recovered Recyclables**
    - PET, HDPE, metals, and paper recovered through front-end sorting
    - Revenues can be shared with the County or used to offset costs
3. **Sale of NovaFuel (under LOI)**
    - Letter of Intent secured with a Miami-Dade-based industrial user capable of consuming up to 300,000 TPY (derived from 600,000 TPY MSW)
    - Fuel can also be exported to biomass users, cement plants, or industrial facilities elsewhere in Florida
4. **Potential Carbon Credits**
    - According to EPA's WARM analysis, each ton of NovaFuel avoids ~3.4 MTCO2e of methane emissions versus landfilling

- Even post-combustion, Novastus process remains ~1.7MTCO2e better than baseline waste disposal
- Opportunity to monetize avoided methane and long-term storage via voluntary carbon markets

D. Implementation Approach

D.1. Infrastructure Role

Novastus is structured to serve as a full-service development, delivery, and operations partner, with the flexibility to match the County's preferred ownership, control, and procurement structure. Whether through a public-private agreement or full County ownership, our turnkey role ensures delivery, performance, and accountability across every phase of the project.

- Master Developer: We oversee project delivery from pre-development and permitting through commissioning, coordinating with County agencies, regulatory bodies, and offtake partners.
- Technology Provider: Novastus is the exclusive provider and integrator of the patented NovaDry system, which has been validated at commercial scale and TRL-9 by Sargent & Lundy.
- Design-Build Partner: We provide full EPC (Engineering, Procurement, Construction) services for each train, backed by experience deploying commercial material recovery systems across the U.S.
- Operations & Maintenance Provider:
  - Under a Build-Own-Operate (BOO) model, Novastus provides long-term operations with performance guarantees.
  - Under a Design-Build-Operate-Maintain (DBOM) structure, Novastus trains County staff or third-party contractors and ensures continuity through scheduled maintenance, SCADA support, and uptime guarantees.

Across all delivery models, Novastus reduces capital and operational risk for the County by centralizing technical responsibility and providing a single point of performance accountability—ensuring consistent delivery from concept through full-scale operations.

D.2. Site Size and Suitability

- **Footprint per Train**: Approximately 35,000 square feet under roof per 100,000 TPY train, plus space for material handling, fuel storage, and access roads.
- **Infrastructure Compatibility**:
  - Can be co-located at existing landfills or transfer stations
  - Requires standard utility connections (electricity, water, stormwater management)
- **Priority Sites Identified**:
  - **South Dade Landfill** – space and access to southern flow
  - **North Dade Landfill (Cell 5)** – open area for full build-out
  - **West Transfer Station** – ideal for decentralized processing close to urban centers
- **Zoning**: Most sites already have solid waste or public works zoning; minor modifications may be needed depending on build area.

D.3. Site Ownership

- All preferred sites are **County-owned**, reducing real estate costs and permitting complexity.
- Sites can be:
  - **Leased to Novastus** under a concession-style BOO model
  - **Retained by the County** under a DBOM agreement with Novastus as operator
- Flexibility in ownership structure allows the County to maintain control, transfer risk, or blend both depending on political and fiscal priorities.

D.4. Permitting

One of the major advantages of the TotalMRF + NovaDry system is that it does not fall under traditional "thermal waste processing" permitting.

- **Air Permitting**:
  - No combustion, no stack, no incineration
  - Therefore, no Title V or major source air permit required
- **Water & Waste Permitting**:
  - No leachate or liquid waste discharge
  - Standard solid waste facility registration, stormwater permit, and utility hookup

- **Timeline**:
    - With early engagement, permitting can be completed in **4–6 months**
    - We support this process with pre-engineered designs and emissions data

D.5. Timing

Speed to deployment is a major differentiator of our approach.

- **Pilot Train**:
    - Can be operational within **9–12 months** of notice to proceed
- **Full 6-Train Rollout**:
    - Trains can be constructed in a staggered rollout (every 2-3 months)
    - All 6 trains (~600,000 TPY capacity) can be delivered within **36 months**

This timeline allows the County to begin achieving savings, landfill life extension, and climate goals well before any traditional waste-to-energy project could break ground.

D.6. Operations & Maintenance (O&M)

- **Jobs Created**:
    - Each train supports **14–22 full-time positions** across operations, maintenance, and logistics
    - Focus on **local hiring and workforce development**
- **Training**:
    - Novastus will train County operators or third-party staff under O&M contract
- **Monitoring & Controls**:
    - Facilities are managed via centralized SCADA systems with remote diagnostics and uptime analytics
- **Maintenance**:
    - Modular system design enables predictable lifecycle maintenance with minimal downtime

D.7. Health, Safety, and Environmental Protections

- **Emissions**: No combustion = no stack emissions, no ash, no air pollutants
- **Water**: No leachate, no wastewater treatment requirements
- **Noise & Odor**: No open tipping pits or compost piles; system is clean and mechanically enclosed

- **Workplace Safety**:
  - All systems comply with OSHA standards
  - Enclosed material handling minimizes dust, injury risk, and contact with hazardous materials
- **Hazardous Waste Management**:
  - Segregated at front-end for appropriate disposal or treatment
  - No hazardous residues generated from drying process

E. Other Information / Advice

Don't Wait for a Megaproject – Act Now with a Scalable First Step

Miami-Dade County cannot afford to delay action on waste infrastructure while long-term options like mass-burn waste-to-energy or landfill expansion are debated, funded, and permitted. Rail-haul disposal costs are already exceeding $120/ton and rising. Landfill airspace is finite. And large-scale infrastructure projects—while potentially complementary—take 7–10 years and hundreds of millions in public funding before they deliver relief.

The Novastus model gives the County a way to act now:

- A first **100,000 TPY TotalMRF** train can be permitted and operational in **9–12 months**
- Additional trains can be deployed every 2–3 months, scaling to 600,000 TPY in 36 months
- Each train diverts ~90% of waste, recovers high-value materials and frees valuable landfill space
- Additional fuel can be stored temporarily or systems can be deployed to reduce transport costs and ease landfill pressure

This approach creates immediate financial and operational relief, without precluding future investment in centralized WTE, SAF, or landfill capacity. In fact, it enhances them—by reducing incoming waste, improving feedstock consistency, and preserving public trust through clean, visible progress.

Procurement Model

We recommend a **progressive design-build** or **public-private partnership (P3)** procurement structure. This allows Miami-Dade to:

- Launch a **low-risk pilot** with minimal capital exposure
- Retain **flexibility to scale** based on performance, demand, or budget
- Share capital risk if desired, while locking in a predictable processing cost (~$70/ton)
- Ensure performance accountability through **structured operating agreements**

We are also open to County-ownership models via design-build-operate-maintain (DBOM) contracts and will support any preferred procurement pathway.

Regional Coordination

Miami-Dade can lead Florida in developing **a decentralized, regional waste-to-fuel network**. Our modular platform is well-suited for:

- **Hub-and-spoke planning**: Multiple sites within the County funneling fuel to in-County or regional users
- **Interlocal partnerships**: Neighboring counties and cities could leverage Miami-Dade's infrastructure for processing or fuel sourcing
- **Industrial cluster strategy**: NovaFuel can support cement, glass, steel, and biomass energy facilities across South Florida

NovaDry systems also support distributed deployment along **industrial corridors**, helping reduce pressure on centralized facilities and regional landfills.

Additional Insights

- **Pilot-ready**: We can begin permitting a 100,000 TPY facility within 60–90 days of award, with COD in 9–12 months from permits
- **Carbon integration**: NovaFuel and our drying process create carbon-negative outputs, enabling County participation in:
    - Low Carbon Fuel Standard (LCFS) credits
    - Voluntary carbon markets
    - Federal SAF (sustainable aviation fuel) blending pathways

Strategic Supply Chain Partnerships

Novastus works with an integrated network of global and domestic suppliers to ensure high system performance, durability, and timely delivery. Our partners include:

- **Material recovery systems**: Industry leaders in shredding, sorting, and baling

- **Industrial drying and filtration**: Proven providers of the hardware behind our NovaDry systems
- **EPC and civil contractors**: Regional construction firms with landfill and public facility experience

This ensures Miami-Dade receives proven, commercial-grade components—not prototypes, and benefits from a scalable supply chain that can support near- and long-term deployment goals.

Our Team

- **Jake Suski, CEO**: Led corporate affairs and clean tech investments for a global energy company; 20+ years of experience in energy, finance, government, and infrastructure.
- **Michael Idelchik, CTO**: Former VP of GE Global Research with over 40 years of experience in advanced industrial technologies.
- **Kelly Warbis, COO**: 30+ years founding and scaling companies in technology development, equipment deployment, and construction.
- **Ian Subel, CFO**: 25+ years in corporate finance, chartered accountancy, and investment banking.
- **Case Atchison, Director of Technical Sales & Project Design**: 25+ years leading design, installation, and commissioning of material recovery systems across the U.S. and Europe.
- **Jatila Ranasinghe, Director of Power**: Over two decades leading engineering and power equipment sales for global energy OEMs.
- **Eric Trusiewicz, Advisory Board**: Global cement industry expert with deep knowledge in industrial fuel transitions and decarbonization.
- **Kripa Varanasi, PhD, Advisory Board**: MIT Mechanical Engineering professor and leading researcher in nucleation physics and thermal-fluid systems.

Novastus
WASTE REDEFINED

Novastus Proposal To Miami-Dade

A scalable solution to reduce costs, preserve landfill space and deliver clean energy within 12 months

THE CHALLENGE

Rising Disposal Costs
Rail-haul costs already exceed $120/ton and escalating, while new WtE plant is too slow & capital-intensive

Limited Landfill Life
County landfill airspace is shrinking; major capital projects will take years to build

Urgency To Act
Large-scale WtE or landfill expansion take years. Miami-Dade needs results now.

OUR SOLUTION

Patented NovaDry Technology
Converts waste into carbon-negative fuel with no heat or pressure – 85% less energy use

TotalMRF: Zero-Landfill Facilities
End-to-end material recovery & fuel production, diverting up to 90% MSW from landfills

Scalable Deployments
First 100,000 tpy facility ready to deploy in 9-12 months; 600,000 tons w/in 36 months and can scale beyond

MIAMI-DADE BENEFITS

Immediate Cost Avoidance
Reduces up to 90% of material going to landfill at rates significantly lower than hauling

Modular & Permittable
Can be deployed across county sites, with no odors, emissions or leachate issues

Future-Ready Infrastructure
Fuel compatible with power, cement & SAF markets; positioning Miami-Dade as a global leader in sustainable

Let's start with one train. Fuel offtaker LOI secured. Permitting can begin within 60-90 days of award.

Novastus

Miami-Dade County

Over **2.4 million** tons of MSW per year

- Already using rail export at **$120/ton**
- Landfill space is shrinking, with no alternatives
- Rising costs and pressure to reduce emissions

A Global Waste Crisis

Across the globe, **70% of municipal solid waste (MSW)** ends up in **landfills or dumps.**

Moisture in waste causes organic materials to decompose, polluting our soil and emitting **methane**, which is **80 times more potent than CO2.**

Recycling facilities help, but don't recover materials mixed with **wet, organic waste.**

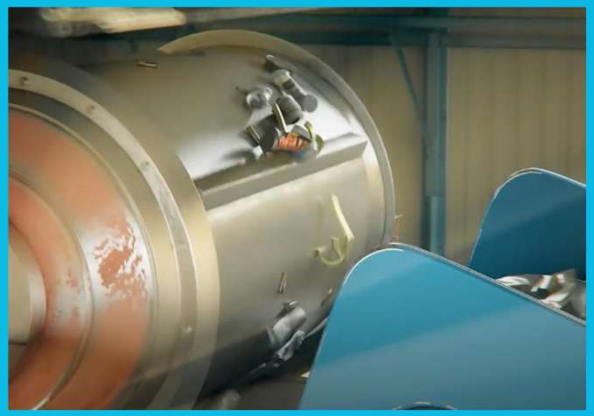
Incinerators destroy recoverable resources and face **public opposition**.

Other waste-to-energy processes are costly, energy intensive and limited by **outdated waste-drying technologies.**

A Zero Landfill Solution

Our patented waste-to-fuel system enables complete material recovery

HOW WE DO IT: A Total Material Recovery Facility (TotalMRF)



STEP 1: Material Recovery

We sort out recyclables and inert materials with off-the-shelf sorting equipment tailored to the waste stream and customer fuel specs.

STEP 2: NovaDry

Our breakthrough system turns wet, mixed waste feedstocks into fuel by pulverizing and drying in one energy-efficient step with no heat or pressure.

STEP 3: NovaFuel

A new standard for waste-derived-fuel is a ready-to-use alternative to fossil fuels for cleaner cement, power, steam or sustainable fuel production.

THE RESULT: Up to 90% landfill diversion without cost increases or subsidies

OUR INNOVATION

NovaDry

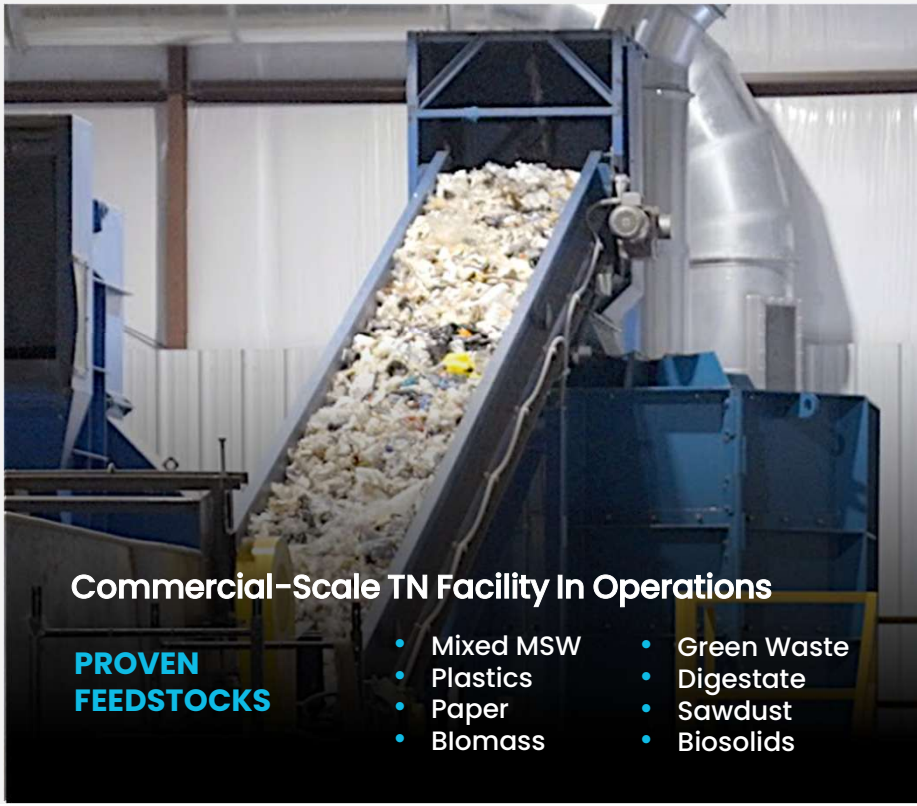
Revolutionizing waste management with non-thermal drying technology – no heat, no pressure, just results

Efficient Waste Processing

- **Reduce Costs:** Achieve landfill diversion for less than today's waste disposal costs
- **Energy Savings:** Consumes **85% less energy** (<100kWh/ton) than conventional drying methods
- **Effective Moisture Reduction:** Pulverizes **and** removes moisture to below 15% in one step; halting **odors, leachate and methane emissions**

Proven And Scalable System

- **Universal Compatibility:** Handles heterogeneous feedstocks like mixed MSW
- **Scalable Design:** System scales to your size (~40,000 TPY systems) with off-the-shelf equipment
- **Trusted Performance:** Commercial-scale system operating in TN since 2021, delivering reliable performance across diverse feedstocks



Novastus

NovaDry

A first-of-its-kind drying system inspired by cloud formation

How It Works

- Leverages nucleation physics, mimicking natural cloud formation
- Moisture and nuclei combine to form billions of droplets, just like clouds in nature
- Developed with nucleation experts at MIT and Oak Ridge National Labs

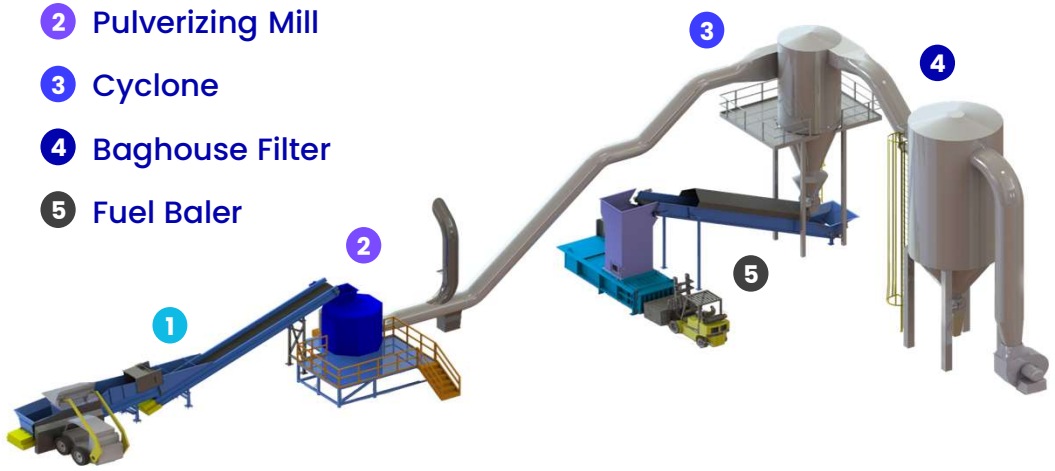
Novel System Patented And Proven

- Secured IP: 4 US patents and 12+ PTCs
- Validated at TRL 9 by Sargent & Lundy
- Proven at Scale: Commercial-scale system operating since 2021 in TN

NovaDry System Overview

No heat, no pressure— just air, particles and physics

1. Conveyor
2. Pulverizing Mill
3. Cyclone
4. Baghouse Filter
5. Fuel Baler



Supersaturation:
Create supersaturation conditions as ambient air mixes with particles

Nucleation:
Sub-micron particles (nuclei) act as seeds to form droplets

Cloud Formation:
Billions of droplets cluster together, forming moisture-laden clouds

Moisture Release:
High-velocity air and filter separates droplets from solid material

NovaFuel

A Carbon-Negative Fuel

Power your operations with cleaner, cost-saving fuel – ideal for cement, steam, power and renewable fuels

Cut Costs & Reduce Methane Emissions

✓ Every ton of NovaFuel from MSW avoids ~3.4 MTCO2e

✓ Even after combustion, still avoids 1.7MTCO2e

Reliable Energy Value For Your Industry

✓ Concentrates biogenic material in MSW from 55-75%

✓ 2 tons MSW produces ~1 ton of NovaFuel (~15MMBtu / ~4400 kWh)

Exceeds Industry Specs; Trusted By Leaders

✓ Tests exceeded specs for kilns, boilers and gasifiers

✓ Secured LOI from US cement facility (~300k tpy capacity)

Low-Cost Transport, Safe Storage

✓ Easy to compact, bale and wrap (43" x 43" x 72" = 1.5 tons)

✓ Can store 10+ years with no methane, odor or leachate

Turning Waste Into Value

Our patented system turns MSW into clean fuel for cement, power, and SAF—recovering value while cutting landfill costs

Waste Feedstocks

- Pulp & Paper ~40M tpy
- Landfilled MSW ~1.4B tpy
- Agriculture/Green Waste ~2B tpy
- Forestry Residuals ~300M tpy

Novastus

NovaFuel End Uses

- Cement (FL customer secured) ~1.25B TPY (~18.7B MMBtu)
- Power (coal substitute in boilers) ~9.5B TPY (~143B MMBTU)
- Industrial Steam ~3.3B TPY (~50B MMBTU)
- Sustainable Aviation Fuel ~590M TPY (~9B MMBTU)

WASTE INPUT	LOW-COST SORTING	NOVADRY	NOVAFUEL	SUSTAINABLE PRODUCTS
We accept contaminated mixed MSW, no pre-sorting required	Industry standard sorting equipment, tailored to waste	Patented system removes moisture and odor efficiently	Carbon-negative fuel with 10+ year storage potential	Decarbonize local industry and reduce landfill disposal

Novastus Solution For Miami-Dade

Avoid higher landfill disposal costs and capital-intensive WtE project by deploying Novastus TotalMRF for production of carbon-negative fuel

TotalMRF	• Novastus will build, own and operate TotalMRF facilities in exchange for MSW processing contract • Divert ~90% of MSW from landfills by recycling and producing a carbon-negative fuel
NovaFuel	• A large industrial facility in Miami-Dade has agreed through an LOI to offtake up to ~300k tpy of NovaFuel (derived from ~600k tpy of MSW) • Additional cement & biomass offtakers are engaged across Florida and the Southeast

Miami-Dade Benefits

OPERATIONAL
- ✓ Avoid $120/ton export costs
- ✓ Offset $1.5B WtE facility
- ✓ Leverage local labor & logistics

ENVIRONMENTAL
- ✓ Reduce methane emissions
- ✓ Increase recycling rates
- ✓ Enable clean fuel economy

STRATEGIC
- ✓ Preserve landfill space
- ✓ Scale flexibly as demand evolves
- ✓ No combustion, no odor

TotalMRF Overview

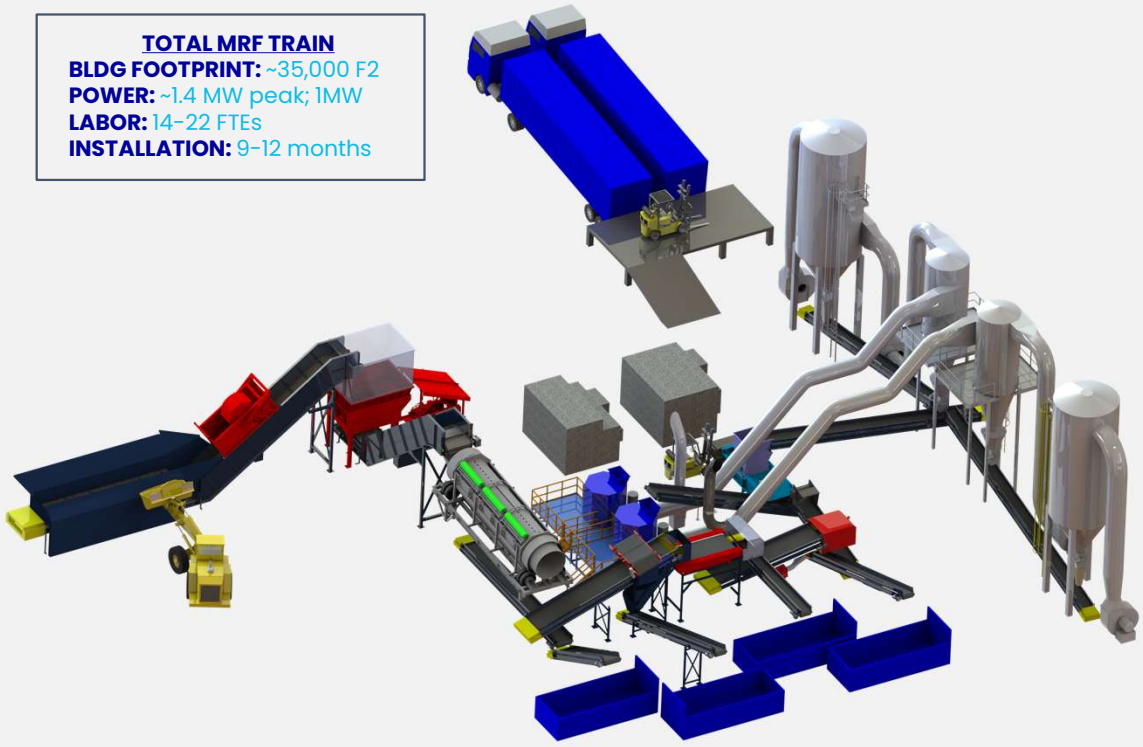
To meet our local partners demand for fuel, we will install 6+ TotalMRF trains that process ~100,000 tpy MSW each

MSW CAPACITY: 100,000 tpy (320 tons/day)
RECOVERED MATERIAL:
based on Miami-Dade provided waste study

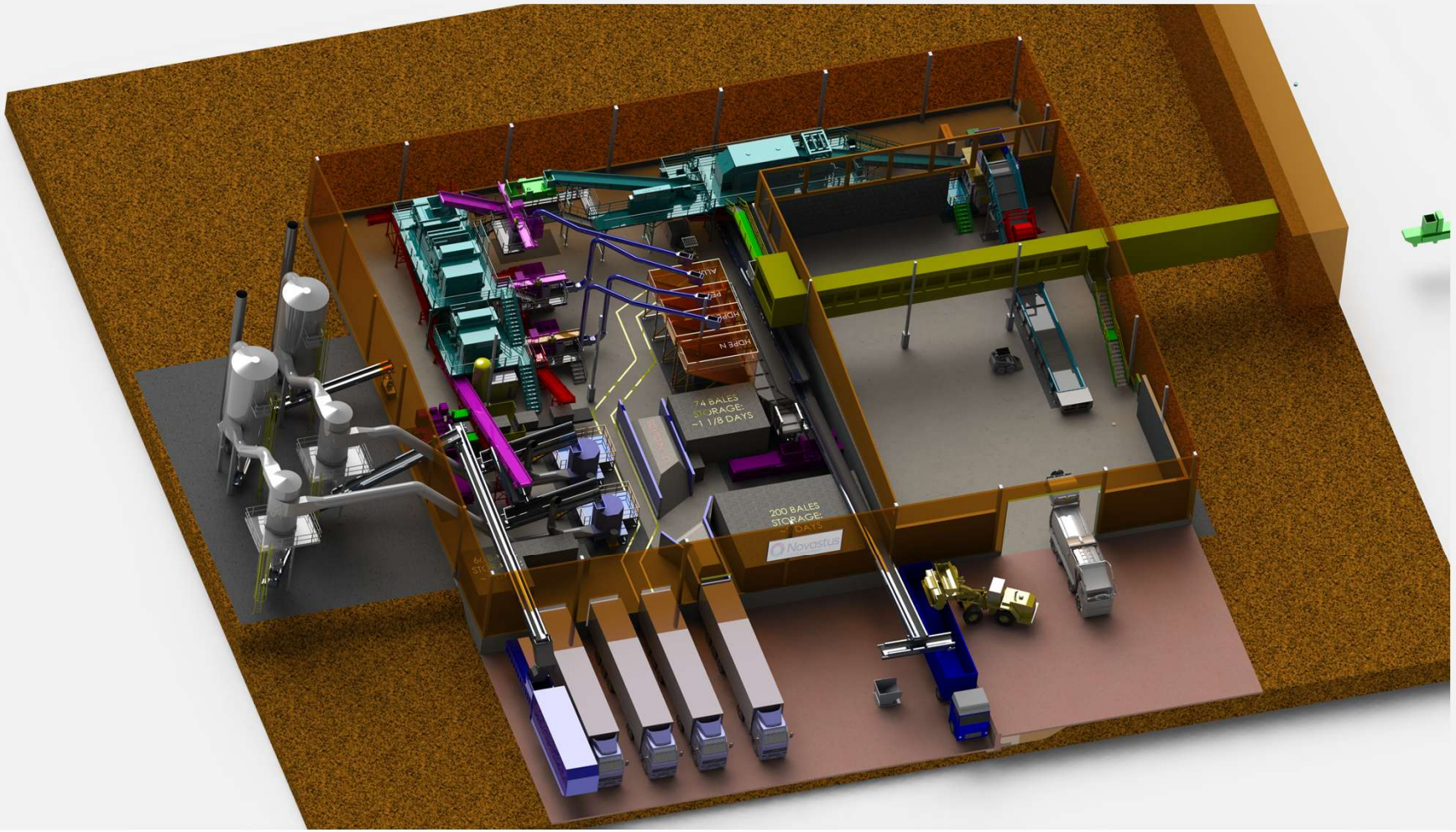
Material	Tons Recovered	What It Does
NovaFuel*	~50,500 (dry tons)	Clean-burning fuel for industry
Metals	~3,500	Recycled into new products
Paper/OCC	~5,100	Recycled into new products
Plastics (HDPE/PET)	~2,100	Revenue generating recyclables
Daily Cover (Inerts)	~8,800	Used at landfill
Bulky Waste / HHW	~2,800	Separated for alternative handling

*Note: Reflects a 35% mass balance reduction from the removal of moisture in NovaDry process

TOTAL MRF TRAIN
BLDG FOOTPRINT: ~35,000 F2
POWER: ~1.4 MW peak; 1MW
LABOR: 14-22 FTEs
INSTALLATION: 9-12 months



TotalMRF Reference Design



Start with One Train. Scale to Six. Results Within 12 Months.

PHASE 1:

Build First TotalMRF (~100k tpy MSW)

- Novastus will finance, build, own, and operate the first 100,000 TPY facility under a performance-based processing agreement
- The facility will divert up to 90% of waste from landfills through recycling and fuel production
- LOI in place with local industrial facility for NovaFuel offtake

PHASE 2:

Add 5+ TotalMRFs Trains (~600k tpy MSW)

- Additional trains can be co-located or distributed across County-owned transfer stations or landfill sites
- Fuel will be baled and wrapped for transport to existing offtaker, with additional capacity available for regional customers

Timeline

Each train reduces hauling costs, recovers high-value recyclables, and extends landfill life—starting in Year 1.

Three Steps To Launch

Novastus can begin permitting and site prep in the next 90 days—with the first train operational within 12 months

1. SITE SELECTION

- Evaluating 3 potential sites; open to all County-owned transfer stations and landfills
- Building requirements: 85’ x 380’ enclosed structure; 130’ x 55’ outdoor air system pad
- Power: ~1.4 MW peak, <1 MW typical
- Must allow for: MSW receiving + NovaFuel loading without disrupting County operations
- Preferred: Site with existing permit or SWF authority to accelerate timeline

2. WASTE PROCESSING AGREEMENT

- Ready to engage in any RFI, RFP, or direct negotiation process the County prefers
- Goal: Long-term processing agreement with no increase to current tipping fee structure
- Contract model will include: Performance guarantees, fuel offtake coordination, and inflation indexing

3. PERMITTING PATH

- Permitting is simplified due to non-combustion system (no Title V or stack permit required)
- Leveraging a site with existing solid waste or industrial use authorization would expedite process
- Novastus is preparing a permitting matrix and would value early engagement with County staff

Cost Comparison

Novastus Solution: Most Affordable Long-Term Strategy for Miami-Dade

Annual Cost Per Ton

(Comparative Data From Miami-Dade Mayor's 2/8/25 Memo)

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13	$126.05	$125.45	$97.01
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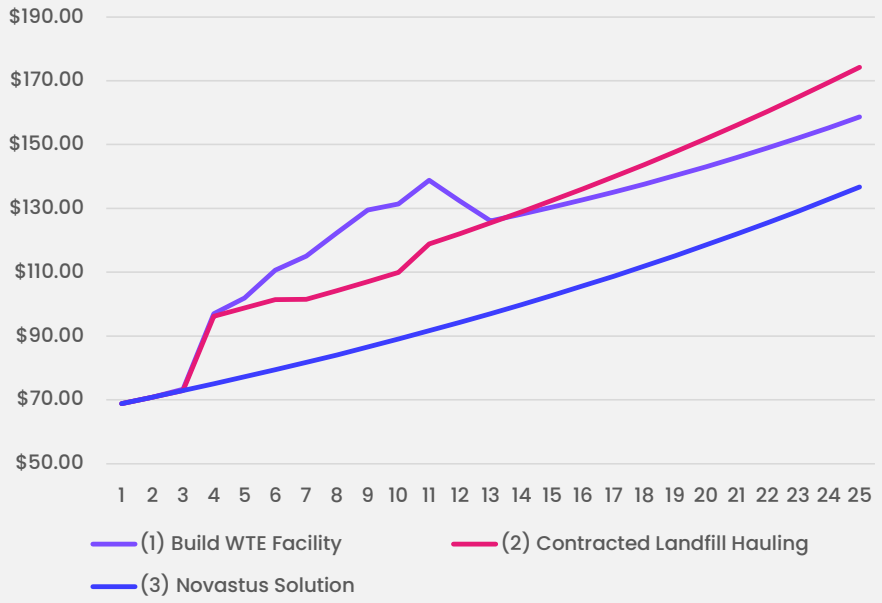
18	$137.64	$143.75	$111.92
19	$140.28	$147.74	$115.16
20	$143.03	$151.84	$118.50
21	$145.91	$156.06	$121.94
22	$148.90	$160.40	$125.48
23	$152.03	$164.87	$129.12
24	$155.29	$169.48	$132.86
25	$158.68	$174.21	$136.71
TOTAL	**$3,125.94**	**$3,103.69**	**$2,477.16**

Annual Cost Per Ton



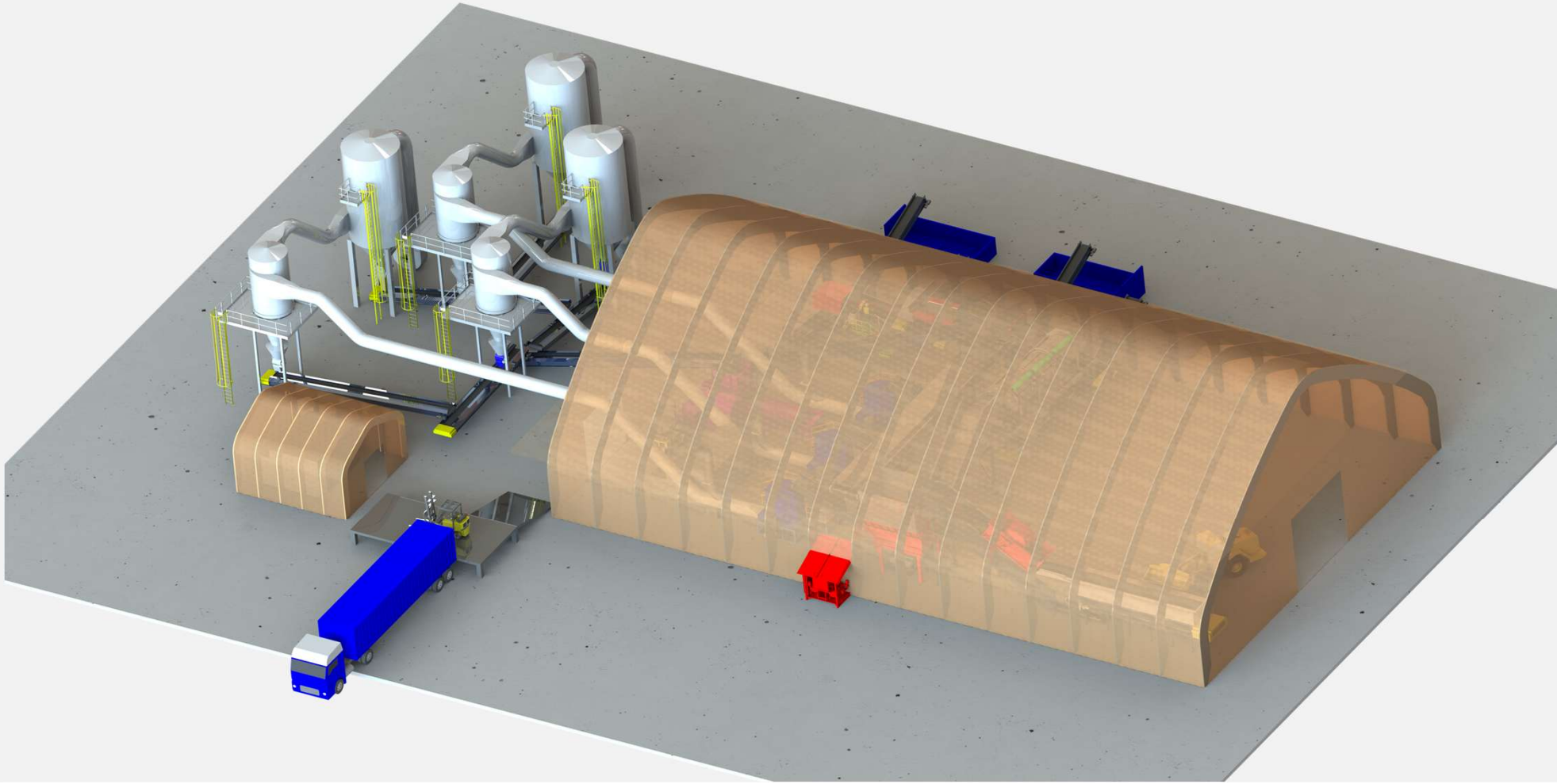
Novastus solution offers savings of **OVER $1.5B** if deployed at scale.

- ✓ Savings vs. WTE: $649/ton
- ✓ Savings vs. Rail Export: $627/ton
- ✓ 25-year savings at full scale: ~$1.5B

Novastus

Appendix

Clear Span Building Deploys Rapidly



NovaDry Competitive Advantage

The novel non-thermal drying process is far more effective and energy efficient for both biomass and mixed waste feedstocks

Conventional Waste Drying Limitations

- Rely on heating material surface area, moisture removal and controls difficult with mixed or inconsistent feedstock
- Involve shredding and heating in two different steps, requiring more equipment
- Thermal processes more energy intensive, corrosive and produce emissions
- Biodrying processes require large footprints, are time consuming and challenging to scale

Water Content

- MSW: 40%+ moisture
- Biogenic matter: up to 65% moisture
- Ag waste: 30-60% moisture
- Biosolids: 70-90% moisture

Waste Drying Technology

Technology	Drying Source	Temperature	Energy
Rotary Drum	Flue gas/hot air/steam	175-230°F	1100-2400 kWh/ton
Fluidized Bed	Flue gas/hot air/steam	140-212°F	1000-1500 kWh/ton
Flash/Pneumatic	Hot Air	140-248°F	1100-2300 kWh/ton
NovaDry	**Nucleation**	**Ambient**	**<100 kWh/ton**

- Data based on biomass, because existing drying technologies do not guarantee specifications for MSW
- Doesn't include pre-sizing equipment of material (shredders)

Novastus

NovaFuel Can Decarbonize Emissions-Heavy Industries

Cement: Industry In Europe Already Using Waste-Derived Fuels

- Alternative waste-derived fuels produce 50% of thermal energy in European cement plants today (~13mm tons), displacing 20mm MTCO2e of fossil fuel emissions
- Novastus already has LOI in place with one of Florida's largest cement producers

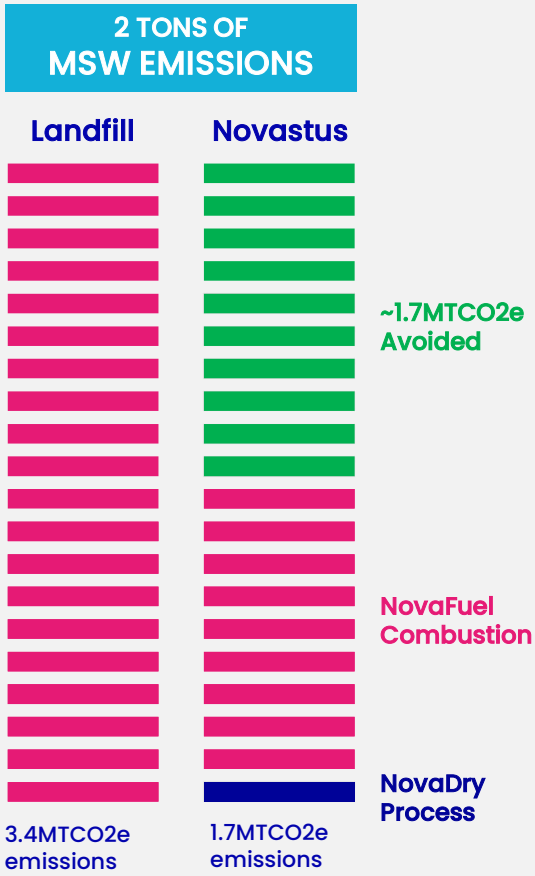
Power: Carbon-Negative, Dispatchable 24/7

- Can be co-fired in boilers at existing coal plants or newbuild efficient waste-to-energy plants
- NovaFuel's high heating value reduces boiler size and capex for newbuild waste-to-energy plants

Renewable Fuels: Demand Growing

- Derived from municipal, agricultural or forestry waste, there's a growing market to produce renewable fuels like sustainable aviation fuel (SAF)

Avoiding Carbon Emissions

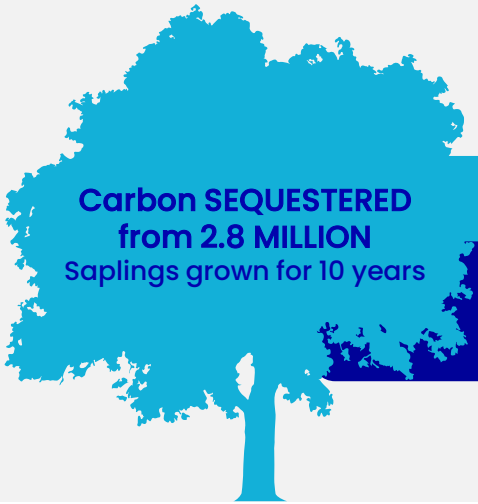


Novastus Energy-Efficient Solution

- NovaDry requires minimal electricity (100kWh/ton) to convert MSW to fuel (4400kWh/ton)
- Additional energy required to sort recycled materials avoids material extraction or mining emissions

Produces Carbon-Negative Fuel

- 2 tons of US MSW produces ~1 ton of NovaFuel (~3.4MTCO2e landfill emissions avoided)
- When combusted as alternative to coal or fossil fuel, every ton of NovaFuel has ~4400kWh of energy and produces less than 1.7MTCO2e



Every 100,000 tons of NovaFuel....

- Can power over 12,000 homes for a year
- Access carbon credits

Novastus

Operational History

Advanced NovaDry System And TotalMRF Solution To Commercialization

OPENED COOKEVILLE FACILITY IN 2021

- Features commercial-scale NovaDry system and total material recovery sorting equipment
- Thousands of hours of operations processing MSW, pulp & paper rejects, biomass and other feedstocks

PATENTED, PROVEN TECHNOLOGY

- Secured 4 patents for NovaDry system
- Technology Readiness Level 9, making it ready for commercial operations validated by Sargent & Lundy
- NovaFuel samples exceeded specs in testing by boiler manufacturers and cement companies

DOE GRANTS AND COLLABORATIONS

- Successfully completed DOE advanced gasifier program with MSW & corn stover
- Collaborated with MIT and Oak Ridge National Laboratory to define dewatering phenomenon and computational modeling

Novastus Leadership Team

Jake Suski | CEO

Led global affairs & clean tech investments at global energy company with over 20 years executive experience in infrastructure, finance & government.

Kelly Warbis | Co-Founder & COO

Over 30 years executive experience founding companies in technology development, sales & construction.

Michael Idelchik | Co-Founder & CTO

Oversaw GE's global research endeavors in emerging technologies the last 15 years of his 40-yr GE career.

Ian Subel | CFO

Over 25 years of international experience in corporate finance, investment banking and chartered accountancy.

Case Atchison | Sales & Project Design

Over 25 years leading design, installation, commissioning and sales of material recovery systems across US and Europe.

Jatila Ranasinghe | Director of Power

Led power team for global energy company after over 20 years leading engineering teams and product sales.

Eric Trusiewicz | Advisory Board

Global cement industry and decarbonization expert with more than a decade of executive experience at top multinational cement firm.

Kripa Varanasi, PhD | Advisory Board

MIT Mechanical Engineering Professor with a specialization in nucleation physics.

World-Class Partners:

CROSS WRAP®

Sargent & Lundy

SEBRIGHT PRODUCTS INC.

TITUS MRF SERVICES

B&W BABCOCK & WILCOX

Vinson&Elkins

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Orlando Bioenergy

Market Research Response

Dear Saba,

My name is Jenny Jaegal, and I am a Business Development Manager at Bigadan. We are a Danish biogas company that have become a global leader in the technology of transitioning organic waste to renewable natural gas with over four decades of experience. During the last couple of years, our team has been developing biogas projects in the U.S. including Florida. We have certainly explored Miami-Dade as a potential location for our biogas project and have started valuable dialogues with stakeholders in the County and City levels.

We are pleased to present the below response to the County's municipal solid waste management solutions in hopes of being considered to play a critical role in diverting the organic waste in your community, in addition to aiding in local renewable energy and bio-fertilizer production as described further in my responses below.

A. Respondent

Provide a brief summary of the respondent to include the following.

- Respondent's name and address
    - Bigadan Americas
    - Local Florida address: 20 N Orange Ave., Suite 1100, Orlando, FL 32801
- Contact person, title, email address, and telephone number
    - Jenny Jaegal, Business Development Manager
    - jja@orlandobioenergy.com
    - 941-380-4841
- Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides
    - Since 1982, Bigadan, which is the parent company of Bigadan Americas, has developed over 40 biogas facilities around the world, while owning, building,

and operating 12 facilities in Denmark and Germany. In the recent years, Bigadan has established Bigadan Americas in order to develop biogas facilities in the U.S. that we will own, build, and operate. The current projects being developed are located in Orlando (FL), Franklinton (NC), and Clayton (NC). Our core area of expertise is in the diversion of organic waste, including pre and post-consumer food waste, agriculture residues, and industrial organic by-products. We extract methane and carbon dioxide from those waste materials through anaerobic digestion, and the methane is used as energy, and CO2 is used in the food and beverage industry as it is beverage grade. The leftover material from extracting the biogas is a nutrient-rich liquid organic fertilizer that can be used as an effective alternative to commercial fertilizer in large farming practices. We build and operate biogas large-scale biogas facilities that can handle up to 1 million tons of organic waste on an annual basis, and can provide a one-stop solution to Miami-Dade's entire organic waste stream.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link. https://documents.miamidade.gov/mayor/memos/01-25-25-second-update-on-directive-no-241676.pdf

    a. Some of the notable challenges according to the above report are the current waste management facilities (landfills and WTE) that are reaching capacity and the heightened need to develop additional facilities, or to replace them. Bigadan can provide a solution that can address all those issues. We are a privately owned company that will fund our own biogas facility, and the County will not be responsible for the funding, maintenance, and operation of Bigadan's facility. Furthermore, the potential 1 million tons of organic waste that can be diverted to our facility each year will significantly reduce the amount of waste ending up in current County facilities that are reaching capacity, thereby extending the lifespan of those said facilities, and reducing the need to develop additional landfill or WTE facilities.

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

    a. Bigadan has developed over 40 successful biogas plants in 17 countries during the span of over 40 years. The utilization of each biogas plant is uniquely adapted to their local availability of organic waste and energy need, and notable examples can be found here in our website. We have long-term collaborations with local partners at each of our biogas facility that remain strong due to the effectiveness of our technology and expertise that benefit all parties involved.

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

    a. Generally, our facilities process about 500,000 tons – 1 million tons of organic waste at full capacity. There may be a ramp-up period where we build smaller and expand throughout the years. This will depend on the availability of organic waste materials in the local area. We can accept a wide range of organic materials with the exception of biosolids and yard waste. We can accept all types of pre and post-consumer food waste (solid or liquid, packaged or non-packaged), agricultural residue (manure, offal, bagasse, etc.), as well as industrial organic by-products from large factory operations (pharmaceutical waste, potato peels, etc.).

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution

    a. Bigadan uses anaerobic digestion technology to process organic waste. Biogas plants receive various types of organic waste that are first mixed in a reception tank, then this biomass is heated to 38-52°C (100.4–125.6°F) and transferred to the reactor where biogas production takes place. The biomass stays in the reactor for two to three weeks, after which the digested slurry is used as an enhanced fertilizer for agricultural crops. This upgraded fertilizer has the advantage of emitting less odor and significantly reduces greenhouse gas emissions when spread on fields. Biogas can be injected into the natural gas grid, used as fuel for land and maritime transportation, or utilized to

generate electricity and district heating. A more detailed description of our process is available upon request.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

    a. There are currently several methods of organic waste management. The one most commonly used is landfilling, which is the least ideal option as the gas potential and nutritional value of the organic waste are lost while they take up significant space in the limited landfill space, not to mention the greenhouse gas emissions in an uncovered landfill. The second most common organic waste management is composting, which allows for the recovery of the nutritional value of the organic waste, however not the gas potential in the organic waste. Biogas solution that Bigadan offers, is the only solution that will recover both the biogas and the nutritional value of the organic waste. While not a common technology found in Florida at the moment, Bigadan can offer a 40+ year expertise in biogas technology from around the world in order to ensure a smooth transition towards organic waste management.

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

    a. Bigadan's biogas facilities require source separated organic waste. This is typically not a problem when the organic waste is coming from agricultural or industrial organizations. However, when the organic waste contains pre and post-consumer food waste from commercial and private sources, we may find a variety of contamination such as utensils, service ware, gloves, and other random objects. While our facilities are capable of handling a certain level of contamination through the de-packing system at the reception area of our facilities, it is important to educate our stakeholders to ensure the lowest level of contamination as possible. We have this experience in Denmark, where we have facilities that are getting those types of food waste, and can use those experiences to educate the public.

    b. Another challenge we anticipate is the public and regulatory/permitting officials' concerns for odor at our facility. Our reception hall where organic waste is dropped off from haul vehicles is an enclosed building with effective air cleaning systems in place, and the odor is controlled in the best way

possible. This is a significant improvement to an uncovered landfill or compost facility, and we are prepared to address their concerns using our experiences with odor control in Denmark.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.
    a. Bigadan will provide a capital investment of about 80 million – 100 million dollars for each biogas plant.
2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).
    a. Private-funded, federal tax credits, federal and state grants.
3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).
    a. Tipping fee: we will keep under the landfill tipping fee to encourage customers to utilize our services
    b. Renewable natural gas sale
    c. Biogenic CO2 sale
    d. Renewable Identification Numbers (RINs)
    e. Bio-fertilizer sale

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such

implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

   a. Bigadan has in-house engineers that will design the biogas plant, and will contract with local developers and consultants to build and permit the facility, and will employ operators for the facility.

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

   a. Approximately 20 acres of land is ideal, but we can be flexible with working on smaller properties. We have started looking at potential sites with Foundry Commercial and are open to exploring any additional resources the County may have available. Site needs access to roads that can handle frequent traffic of heavy-duty vehicles on a daily basis, and preferably away from residential areas.

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

   a. We have not identified a single piece of property as of current, however we have identified several options through Foundry Commercial.

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

   a. Based on our experiences with permitting for the Orlando biogas facility, we will need a Source Separated Organic Processing Facility (SSOPF) permit, air permit, and a fertilizer permit with the FDEP, as well as any local permits as required.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

   a. A biogas plant takes about a year to build, then about 6 months to commission until it is running on full capacity. Prior to this, Bigadan will

identify feedstock sources, gas sale, and fertilizer off takers, acquire land and all required permits, and this can all take about a couple of years due to the complexity of the collaboration between numerous stakeholders.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.
    a. Bigadan has internal O&M plans that ensures the longevity of the biogas facility that are used across all of our facilities that are each anticipated to last 30+ years.

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).
    a. By capturing the methane and CO2 from the organic waste that would have otherwise been emitted into the atmosphere and caused environmental and health issues, Bigadan is significantly improving the quality of life and health for the people of Miami-Dade County, not to mention the environmental health of the community. We also reduce odor due to our excellent odor control procedure in place.

E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).
    a. We typically design and build our own biogas plants, however we are open to a public private partnership opportunity. We have biogas plants that are run in a variety of models and believe we can find success in any methods we use.

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.
    a. Not applicable

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.
    a. Not applicable

We believe it is worth starting a dialogue to see how Bigadan may help the County with their waste management challenges based on the high-level overview of our services and expertise listed above. Please reach out with any questions, and if you'd like to dive deeper into any specific topics with industry experts from our company. We look forward to your response and perhaps a potential meeting to discuss in person/virtually.

Best regards

Jenny Jaegal
Business Development Manager

Direct | Mobile +1 941-380-4841
jja@orlandobioenergy.com | www.bigadan.dk
20 North Orange Ave. Suite 1100 | FL 32801 Orlando | CVR DK25191153

Orlando Bioenergy

Recycling Equipment Systems Corporation

Market Research Response

RECYCLING EQUIPMENT SYSTEMS CORP.

130-37 90th AVENUE, RICHMOND HILL, NY 11418
TEL: (718) 441-3100 FAX: (718) 441-3032

EQUIPMENT SALES DIVISION
Distributors and Engineers of Baling and Compacting Systems

April 7, 2025

Saba Musleh, CPPB, Negotiator
Strategic Procurement Department
Miami-Dade County

Attn: Saba Musleh

We are pleased to provide the following information for market research in Solid Waste Management for the County of Miami-Dade.

Respondent:

RECYCLING EQUIPMENT SYSTEMS CORP.
130-37 90 AVE
RICHMOND HILL, NY 11418
ATTN: JAMES ORIOLI
PRESIDENT

718-441-3100(O)
917-642-1435(C)
JIMMY@RECYCLINGEQUIPMENTSYSTEMSCORP.COM

I am the owner of Recycling Equipment Systems Corp. located in NYC. I have been in business for over 38 years working in the solid waste and recycling industry. When it comes to a solution to handling the transportation and disposal of solid waste, I have years of experience with the largest private and public waste haulers and transfer stations in the North East.

Solution:

When it comes to handling the disposal of solid waste, most facilities are locked into one way only. I have created a means to dispose solid waste through baling the solid

waste first. By baling solid waste, this gives you the ability to utilize various disposal sites. In addition to different sites, you now have the ability to utilize different means of transportation as well. Baling solid waste in the North East has been popular for over 35 years and in some cases the only way to dispose solid waste. Landfills close to large cities are not generally available and are harder and harder to find. Long haul disposal to landfills that are in areas that are accepted by those states and communities are reached the most efficient way by baling the solid waste first.
The effectiveness of baling solid waste has been proven to be the least costly and most environmentally friendly solution. With thousands of tons per day being baled in NY, Ct and other states in the North East, long-haul cost-effective disposal has been perfected. General freight and goods are transported by flat bed and van trailer trucks into our community every day. One of the biggest issues with truck transportation is the truck usually returns to pick up the next load empty. Not making the trucking industry to be as cost efficient as possible. Because baled waste can be placed on flatbed trucks and van trailers, we can utilize the inbound trucks to our cities and efficiently transport the waste to landfills as backhauls at an extremely efficient and cost-effective way.

Each baling system is designed to handle approximately 1000 tons per day of waste. Whether you are baling 1000 tons per day or 5000 tons per day, you would simply add more equipment as needed. The system is made up of three components. The Solid Waste Baler (Attachments 1, 2, & 3) the conveyor and the bagger. The baler is similar to a baler in any waste paper, scrap metal or commingle facility but it is purpose built for baling solid waste. The baled waste is placed in a bag (Attachments 4 & 5) rather than tied like you may see in recycling facilities. What goes in the baler, goes in the bag. The bag is sealed and made specifically for the transportation of solid waste whether you are using, flatbed trucks, (Attachments 6 & 7) van trailers or open top gondolas for long haul rail disposal. The conveyor will accept the solid waste via loader or excavator and transport the waste into the baler. The baler is designed with highly efficient, environmentally friendly electric motors to compress the waste into tight bales. Each uniform bale has a dimension of 5' x 5' x4' and each bale weights up to 5000 Lbs. The waste is ejected into a bag and the bag is staged for either truck or rail disposal. The system is extremely compact and takes up about 2000 square feet per system.

The benefits of baling solid waste will allow you to market your waste to various outlets and with various means of transportation. This is the true benefit over every other means of disposing solid waste. If you were to ship the waste loose, you are limited to 100 yd walking floor trailers. These trailers are good for local disposal only and again they lose their efficiency and effectiveness as the truck comes back empty each time. This is environmentally unfriendly as you add unwanted truck traffic. When baling solid waste, you can maximize every load whether you are using a flatbed truck, van trailer or open top rail gondola. Even lose trash placed in rail cars has its disadvantage over bales as maximum weights are hard to achieve and

specialized lids or coverings are needed. When placing bales in a gondola, (Attachments 7 & 8) no lids or covers are needed and maximum weight is achieved every time. Whether your disposal area is in Florida, Alabama, Georgia or Ohio, with baling you can reach each area efficiently and environmentally friendly. In addition to the above, another major benefit to baling solid waste is the loose trash at the transfer station is always being baled and the bales can be stored. (Attachments 9-12) This is beneficial when trucks and rail transportation is shut down do to storms or unforeseen circumstances.

In addition to the above, reviewing the local landfill reports shows landfill capacity and time frames left will benefit from baling. In your reports several landfills have limited capacity based on cubic yards of space left. For short haul disposal, most facilities utilize 100yd walking floor trailers. A typical 100yd trailer will deliver about 25 tons of material. However, if bales are delivered to the land fill, the same 25 tons baled will take up 35 cubic yards of space. Because the trash is in a bag, the daily cover used at a conventional landfill is limited. Baling can increase the useful life of local landfills (Attachment 13). A major benefit to bales in a landfill, just like the balefill in North Dakota, bird population is reduced. Many landfills are near airports and the balefill eliminates the deadly bird strike issue to planes.

The challenges to installing and operating a solid waste baling system is, there are none. There is no environmental impact to the community or pollutants in the air. The transfer stations that is already excepting the loose trash is the same buildings that will house the baling system. The permitting is minimal except for a modification to the floor plan of the transfer station to show the baling system.

Financial Approach:

The financial costs of adding the baling system into the daily operation are minimal compared to a complete overhaul to build a waste to energy plant or other major infrastructure projects. From what I understand, the waste right now is being handled several different ways in the interim until a new design is implemented. Therefore, we can make the assumption that scales, transfer station buildings and yellow iron are in place. This allows adding a baling system to the operation cost effective. The scales that are already weighing in trucks can remain. The transfer station building that is accepting the waste can remain the same. The same excavators loading out rail cars will load out bales. The financial burden of the system is minimal as the infrastructure does not have to be modified. The cost for each system per 1000 tons per day is approximately 3 million dollars. Simply put to handle 5000 tons per day, the financial burden would be about 15 million dollars to install the systems. Funding of said project and revenue generation is TBD.

Implementation approach:

As mentioned above, the baling system in most cases fits into the preexisting operation. Most people will think that the building cannot fit the equipment because of the space that the loose trash is taking up. But the baler can take the loose and turn it into bales for efficient handling of the inbound waste stream. Without knowing exactly what buildings are being used at the present moment, if the transfer stations are handling the waste, then the buildings as is would be sufficient for the baling systems.

In regards to the ownership this is to be determined. But the concept of baling is to be implemented by the county to the operator so the County could generate the best possible means of disposal. Permitting is minimal as modifications are limited. Because of limited modifications to buildings and site plan work, the baling system could be up online for cost savings to the county in 6 months.
There is a cost to run the system, however, most of the workers that are currently loading trailers and rail cars are going to operate the baling system. The baling system is operated with a four-person crew. The crew is broken down the following way. One excavator operator to feed the conveyor, one operator to take the bales away and two persons to place the bags on the bales. The cost to operate the system is based on the following: Labor, electricity, bags and maintenance. The cost to operate the system is $5.00 per ton.

There is no health/safety/environmental impact on the workers, the facility or the surrounding community. The infrastructure of the existing transfer stations remains the same.

Other information / Advice:

As mentioned in the beginning of this report, being in the industry for over 38 years I can provide all the services needed to design, construct, install and place into operation and the training for the baling system. Just about any operator that the county may hire has already run my equipment. From Waste management, Waste Connections, Sun Waste, USA Waste in Ct, WIN Waste, they have all taken advantages of baling solid waste.

The future for Miami-Dade may be a new waste to energy plant built in a location that is acceptable to all, however this project may take 7-10 years before on line. What I provide to many is the quick and efficient means of waste disposal at a capitol cost that is manageable and savings that are instant. We want to look into the future, but the problem exists today and the cost savings and increased environmental issues lead to baling solid waste as an alternative today, and not tomorrow.

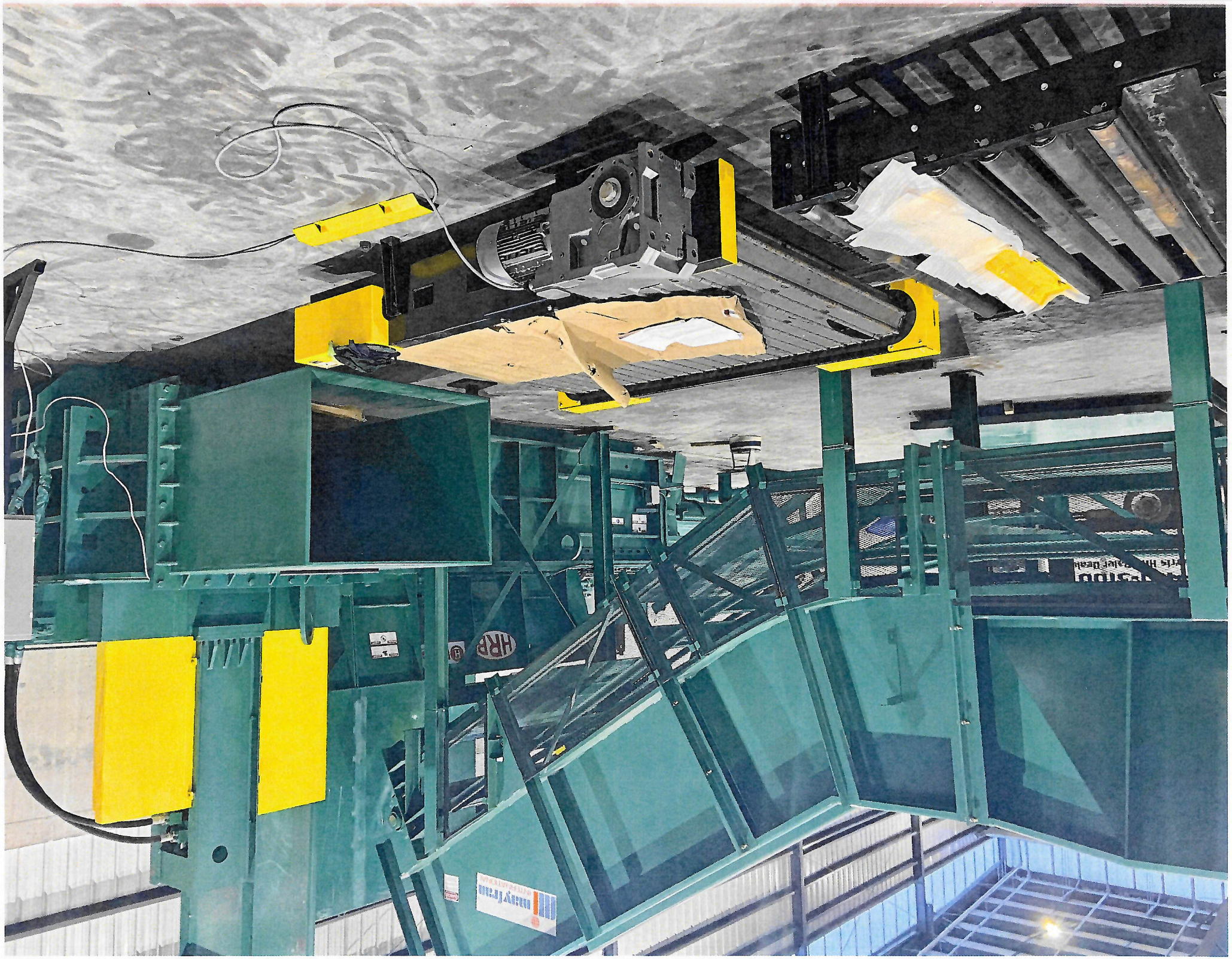
The residents of Miami-Dade are the creators of this solid waste issue. Residents, put their waste at the curb and assume the trash just disappears. They don't want landfills, the perception of the waste to energy plant is not accepted and they don't want the smell of the trash in their backyard. But they need to remember, the trash belongs to them, we are here to just make it better for all. I am available to consult further, design and build the next level for waste disposal for the County of Miami-Dade.

Should you have any questions, please feel free to contact me.

Thank You,

James Orioli

HRB
Harris
RAB



MUNICIPAL WASTE

M S W

PENNEBOGEN

LEWX
2087

GAETA

RECYCLING EQUIPMENT SYSTEMS CORP.

130 – 37 90th AVENUE, RICHMOND HILL, NY 11418
TEL: (718) 441-3100 FAX: (718) 441-3032

EQUIPMENT SALES DIVISION
Distributors and Engineers of Baling and Compacting Systems

Office of the Mayor

Mayor Daniella Levine cava

Maimi, FL

James Orioli
jimmy@recyclingequipmentsystemscorp.com

MUNICIPAL WASTE

GAETA

MSW

HRB
Harris

mayfran

mayfran
HRB

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RePower

Market Research Response

Response to Miami-Dade County Market Research for Municipal Solid Waste Management Solutions

Prepared By RePower South, LLC
April 11, 2025

A. Respondent Provide a brief summary of the respondent to include the following. • Respondent's name and address • Contact person, title, email address, and telephone number • Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides

RePower South, LLC ("RePower")
1859 Summerville Ave, Suite 800
Charleston, SC 29405

Brian Gilhuly, Cofounder and CEO
w 800-917-4256
briangilhuly@repowersouth.com
www.repowersouth.com

RePower is a recycling and clean energy company working with communities to recycle more, landfill less, produce circular products, produce low carbon, renewable fuel, reduce community greenhouse gas emissions, and advance a sustainable, circular economy. RePower solutions deliver efficient and cost effective innovations in solid waste management to meet and exceed community's recycling, solid waste diversion, and sustainability goals.

As the country's leading and longest running mixed waste processor, RePower has developed, constructed, owned, operated, and advanced sustainability technology with two state of the art operating facilities, in South Carolina and Alabama, each commissioned in 2019, with additional projects in development. These facilities process landfill bound MSW (residential, commercial, and industrial) to recover materials for conversion to circular products and energy.

Our mission is to **eliminate landfill reliance** by providing a **comprehensive, proven waste management alternative** transitioning communities from a **linear economy (take-make-dispose) to a circular economy**.

B. Waste Management Solutions
1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc.

RePower South proposes the development (build, finance, own, and operate) of (one or more) **Miami-Dade County Sustainability Center(s)**, state-of-the-art facilities designed to serve as a model for sustainable waste processing, material recovery, and circular economy innovation. Each facility would process a to be determined tonnage of County controlled, landfill bound residential and/or commercial waste streams.

A Sustainability Center will:

- **Process and recover valuable resources** from residential (and select commercial) waste, optimizing material diversion through cutting-edge sorting and separation technologies.
- **Leverage AI-powered automation and real-time data analytics** to enhance waste sorting precision, improve efficiency, and minimize contamination.
- **Incorporate advanced recycling, upcycling, and repurposing technologies**, ensuring non-recyclable materials are converted into sustainable, high-value products.
- **Support environmental and economic objectives**, including creating sustainable employment opportunities, reducing carbon footprints, and fostering green industry growth.

Each Sustainability Center will be a processing, manufacturing, and education campus that recycles, creates clean energy, and manufactures sustainable products. Miami-Dade County waste would be processed into separate, specific materials for downstream processing into products that are sold into different commercial markets. This recovery diverts waste from landfill, reduces greenhouse gas emissions, and builds a circular economy.

The Sustainability Center will maximize recycling and recovery to **divert 70+% of the typical waste stream from landfill** enabling Miami-Dade County to exceed recycling and organics diversion goals, move away from landfill and its harmful greenhouse gas methane emissions, and build a circular economy.

In summary, each Sustainability Center will deploy intelligent sorting technologies, utilizing robotics, optical sorters, and machine learning algorithms to classify materials into dedicated streams, significantly increasing processing efficiency and purity.

Targeted materials are:

1) **Traditional "mechanical" recyclable materials**, including cardboard, mixed paper, plastic bottles, aluminum, glass, and steel, which will be sold into commodity markets like a traditional recycling program. Miami-Dade communities can continue current recycling programs or take advantage of this method of recycling recovery as it does not require a separate "blue bin collection", representing a significant reduction in local traffic and savings to the local communities/ residents. Either way, the facility will greatly enhance overall recycling in Miami-Dade County community.

2) **Organic material (food waste)** from the landfill bound waste is anaerobically digested to produce renewable natural gas (RNG). The RNG will be sold into the local gas utility pipeline. The post anaerobic processing organics could be further processed for PFAS destruction and/or used as a soil amendment adding to regional agriculture and soil regeneration efforts. Glass and inert materials recovered during initial processing will be offered as an alternative daily cover or aggregate.

3) **Non-recyclable papers with limited organics and other plastics** are converted by innovative UBQ technology converting this material to a bio-based thermoplastic. UBQ's advanced waste conversion technology breaks down organic matter into its basic particulate constructs—lignin, cellulose, fibers, and sugars—and, along with other plastics present, reassembles them all into a homogeneous and consistent composite thermoplastic material. The thermoplastic material replaces fossil plastic in new sustainable products for current customers such as Mercedes Benz, PepsiCo, and McDonalds.

4) **Hard-to-recycle polyolefin plastics**, predominantly film/single use plastics, are converted to a pyrolysis oil for sale to petrochemical companies, replacing fossil oils in the manufacturing of new plastic products, for a true circular recycling of plastics. This will greatly decrease the region's plastic pollution, removing plastic litter from the oceans and waterways, and landfill.

Advanced environmental monitoring systems will track emissions, material diversion rates, and operational performance, ensuring compliance with city, state and federal sustainability benchmarks. The facility will continuously review and evaluate materials not recovered for further processing and diversion.

The Sustainability Center education campus will be a welcoming place to foster a more conscious society where insight into the efficiency of RePower's proven processing technologies, knowledge of true greenhouse gas and carbon impacts of waste, and the value of a circular economy are gained. Through the education campus, the community will come to understand Miami-Dade County's roll in a more sustainable future.

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

As the country's leading and longest running mixed waste processor, RePower has developed, constructed, owned, operated, and advanced sustainability technology with two state of the art operating facilities, in South Carolina and Alabama, each commissioned in 2019, with additional projects in development. These facilities process landfill bound MSW (residential, commercial, and industrial) to recover materials for conversion to circular products and energy.

In addition to the 5+ years of experience operating its own facilities at scale, RePower South collaborates with world-class technology partners to integrate state-of-the-art innovations into its sustainability initiatives, ensuring best-in-class material recovery and circular economy execution. With RePower, each partner provides in-depth specialized knowledge bringing decades of expertise and proven solutions in waste processing, renewable energy, and advanced recycling technologies:

Bioenergy Devco, LLC (BDC) A global leader in anaerobic digestion technology, BDC specializes in converting organic waste into renewable natural gas (RNG) while significantly reducing landfill methane emissions. With over 250 operational digesters

worldwide and its most recent facility built in Jessup Maryland, BDC has a proven track record of providing scalable, sustainable solutions that transform waste into clean energy.

UBQ Materials Ltd. (UBQ) Pioneering a revolutionary approach to waste transformation, UBQ Materials converts select municipal waste materials—primarily papers, plastics, and organics—into bio-based thermoplastics. This plastic replacement material seamlessly integrates into supply chains across various industries, including automotive (car parts for Mercedes Benz), retail (trays for McDonalds), and consumer goods(pallets for Pepsico), replacing conventional fossil plastics and reducing overall carbon emissions. With a climate-positive impact and cost-competitive price, UBQ™ empowers manufacturers with a simple transition to greater sustainability.

Clean Planet Energy (CPE) A leader in advanced plastic recycling, CPE upcycles non-recyclable polyolefin (film and single use) plastics into sustainable plastic alternatives. Their proprietary EcoPlant technology is designed to circularly recycle thousands of tons of plastic waste annually, reducing plastic pollution and fossil-fuel-based plastic products.

RePower and its partners bring the financial capability and experience necessary to design, permit, build, commission, and operate the proposed Miami-Dade County Sustainability Center. RPS has assembled a comprehensive team exceptionally skilled in EPC design, construction and commissioning and have matched this expert team with a professional long term financing partner capable of sourcing, structuring and closing of required capital to rapidly support a project for Miami-Dade County.

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

Each facility is designed to process 400,000-500,000 tons of waste per year. We are prepared to develop multipole facilities in the region to properly serve Miami-Dade County needs. Each facility processing capacity limitations are generally driven by site, traffic, and transportation constraints. A multi-facility, hub and spoke plan would be explored to process the desired and available tonnage. Each facility would be customized to process the variable composition of the waste available.

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

As fully described above in paragraph B.2., RePower is the country's leading and longest running mixed waste processor advancing sustainable technologies in two state of the art facilities. In addition, RePower's world-class technology partners, BioEnergy Devco, UBQ Materials, and Clean Planet Energy, add in-depth specialized knowledge in renewable energy

and advanced recycling technologies, ensuring best-in-class material recovery and circular economy execution.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

At RePower South, we recognize that waste is not an endpoint—it is a **renewable resource**. Our commitment to a **circular economy** is deeply embedded in every aspect of our operations, ensuring that materials remain in continuous circulation reducing environmental impact.

By leveraging **advanced recovery technologies, upcycling innovations, and data-driven waste management solutions**, we are redefining traditional waste processing and pioneering new sustainable pathways. The transition to a circular economy offers a wealth of benefits, including:

- **Drastically reducing landfill reliance** through enhanced recycling, material recovery, and waste diversion strategies, potentially diverting 70+% from landfill.
- **Lowering greenhouse gas emissions**, preventing methane release, and reducing the carbon footprint of transportation and manufacturing industries by over 650,000 MTCO2e per year, conserving 1.2 million barrels of oil or removing over 150,000 cars from the road (per facility). [1]
- **Stimulating economic growth and job creation** within the green technology sector, supporting the development of local and national circular economies.
- **Enhancing energy efficiency**, providing Miami-Dade County with sustainable energy alternatives such as RNG while optimizing resource utilization, with over 250,000 mmBTU's of energy, enough to power more than 2,500 homes (per facility).[1]
- **Driving sustainable product innovation**, replacing fossil-fuel-based materials with upcycled alternatives to support climate goals.

Through a **combination of technological advancements, strategic partners, and data-driven sustainability initiatives**, RePower South is committed to transforming waste management and advancing Miami-Dade County's leadership in environmental innovation.

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

Challenges include availability of suitable site location(s) and the permit-ability of each site. However, RePower would work with the County to explore existing County-owned site options as well as explore commercially available sites. RePower would engage in extensive community outreach to educate and enable a true understanding of the benefits to a RePower program. RePower will work with the County and Florida DEP to secure and remain in compliance of all

[1] Estimates based on a typical waste stream at each 400,000 ton per year facility

required zoning and operating permits, as we have proven with a violation free track record at all existing facilities. See more on permitting in paragraph D.4 below.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

The capital investment and operating costs will vary dependent upon the final design configuration necessary to service the volume and types of waste committed to a facility. County participation in capital investment can be $0 or a to be negotiated amount if the County seeks to investment. Operating costs will vary based on the agreed parameters of the public private partnership and local economy dynamics.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

Each facility would be developed in a public private partnership anchored by a long-term County waste supply commitment. Leveraging County participation to reduce overall cost of capital and operations is encouraged and will be explored, however, it is not required as a fully private funded facility option is available.

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Each facility will generate revenue from tip fees and sale of the various manufactured products and energy. Select products, such as renewable natural gas, include revenue generated from RIN credits in addition to energy based revenue. There is no requirement for government subsidies for facility success.

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

RePower will fully develop, finance, own and operate each facility.

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

A typical facility site footprint approximates 40+ acres. If multiple sites were deployed in a region, there is an opportunity to utilize a combination of smaller satellite/ larger locations in a hub-and-spoke model design.

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

A specific site or sites have not yet been identified. RePower would explore County controlled as well as commercially available sites. Any site needs to be zoned Industrial District, Conditional (IU-C) and be compatible with the surrounding area. The overall volume commitment, where the waste is generated, and transportation costs will guide the site size, search, and selection.

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

In addition to industrial zoning/use compliance, each facility will require County and State permitting including a resource recovery and management facility solid waste permit, stormwater permit, environment resource permit, and air emission permit, to name a few. While permitting for every new development is a complex process, final site selection is critical to ensure permitting does not become an impediment to successfully developing a facility. RePower and its technology partners have a proven track record of successfully navigated permit processes.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

Approximately 30-36 months from executed waste supply commitment to operations, subject to permitting.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

Each facility will be fully staffed with a plant team responsible for day-to-day operations. All ~100+ positions, including plant management, maintenance, equipment operators, and recycling technicians, are full time, living wage jobs with benefits sourced from the local community. Complimenting our spare parts inventory, system spare parts are readily available in the US to maximize plant efficiency. Corporate management and multi-plant collaboration assists with training, community outreach, product sales, and ongoing plant optimization. Building a dedicated and loyal team is paramount to achieving peak plant performance.

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

At RePower South, we recognize that waste is not an endpoint—it is a **renewable resource**. Our commitment to a **circular economy** is deeply embedded in every aspect of our operations, ensuring that materials remain in continuous circulation reducing environmental impact.

By leveraging **advanced recovery technologies, upcycling innovations, and data-driven waste management solutions**, we are redefining traditional waste processing and pioneering

new sustainable pathways. The transition to a circular economy offers a wealth of benefits, including:

- **Drastically reducing landfill reliance** through enhanced recycling, material recovery, and waste diversion strategies, potentially diverting 70+% from landfill.
- **Lowering greenhouse gas emissions**, preventing methane release, and reducing the carbon footprint of transportation and manufacturing industries by over 650,000 MTCO2e per year, conserving 1.2 million barrels of oil or removing over 150,000 cars from the road (per facility). [2]
- **Stimulating economic growth and job creation** within the green technology sector, supporting the development of local and national circular economies.
- **Enhancing energy efficiency**, providing Miami-Dade County with sustainable energy alternatives such as RNG while optimizing resource utilization, with over 250,000 mmBTU's of energy, enough to power more than 2,500 homes (per facility).[1]
- **Driving sustainable product innovation**, replacing fossil-fuel-based materials with upcycled alternatives to support climate goals.

Through a **combination of technological advancements, strategic partners, and data-driven sustainability initiatives**, RePower South is committed to transforming waste management and advancing Miami-Dade County's leadership in environmental innovation.

Operational safety and minimal local impact are also a critical element of our operating approach. Odors are actively controlled, noise levels are below OSHA recommended ear plug levels, and facilities operate under "minor source" air emission profiles. Our long term operating track record reflects our determination and success to minimally impact our environment and keep our employees and neighbors safe and undisturbed.

E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

RePower recommends the County partner with private enterprise and leverage, via a true collaborative approach, County resources (such as waste control, site access(if applicable), permitting assistance, community education and advocacy, residue disposal contracts(if applicable), and low cost capital (if desired)) and private enterprise expertise (development, financing, technology, and operations) to deliver the most effective, least cost solid waste solution for County constituents.

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the

[2] Estimates based on a typical waste stream at each 400,000 ton per year facility

State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

RePower believes partnership with other local or regional solutions is critical to managing the extraordinary volume and variability of Miami-Dade's waste. There is no one-size fits all solution. As example, RePower's focus in on residential and select commercial/industrial waste streams. RePower would not process C&D, bulk and brush, electronic, hazardous, medical, sludges, and other various waste streams generated in the County. Optimizing the management of select materials via a RePower solution in collaboration with other providers who process other waste streams will enable the County to have a greater impact on the total recovery and diversion from landfill. A wholistic and collaborative approach will maximize both the short and long term benefit to the County as waste management approaches and technologies continue to evolve.

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

RePower applauds Miami-Dade County for actively investigating alternative, sustainable waste management solutions. We believe there is a future circular economy where both the County constituents (consumer, commercial and industrial) and the environment win.

RePower SC Facility

Scrapp

Market Research Response

MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

Background

Miami-Dade County ("County") provides an integrated waste management system that provides collection, transfer, and disposal services to include landfills and historically included a waste-to energy facility. The County's Department of Solid Waste Management (DSWM) provides waste collection services twice a week to more than 350,000 households in a 320-square-mile waste collection service area. DSWM operates 13 Neighborhood Trash and Recycling Centers and administers the contracted collection of household recyclables. Historically, the County produces over five million tons of waste annually, of which DSWM disposal system processes more than 2.4 million tons.

Objective

The County is conducting market research to garner industry comments and solutions regarding potential future projects for a comprehensive solid waste management approach. This effort is being undertaken by the County as part of a review and analysis to further explore all available delivery methods for the disposal of waste. Various items related to solid waste management were discussed by the Board of County Commissioners on February 19, 2025 and the agenda to such meeting can be accessed using the following link.

https://www.miamidade.gov/govaction/commminute.asp?cmbmeetdate=5227&file=false

The County is particularly interested in responses to this market research from industry experts from all available sectors of waste management. The requested information will assist the County to better understand the marketplace, gather information regarding the current state of the industry, and gauge interest in the projects and may also be used by the County for any other purpose.

Public Record

Respondents are hereby notified that all information submitted as part of, or in support of, this analysis will be available for public inspection in compliance with Chapter 119, Florida Statutes, popularly known as the "Public Record Law." Accordingly, do not submit any information in response to this analysis which the respondent considers to be a trade secret, proprietary or confidential, is competitively sensitive, or which violates any intellectual rights of a third party.

Responses

Responses should address the requested information below and indicate "not applicable" when a particular item cannot or will not be addressed by respondent. Responses should be submitted to the County's contact person indicated below via email no later than **April 14, 2025**.

Email to: With a copy to (CC line of email): Saba Musleh, CPPB, Negotiator
Ross Byers, Project Manager Strategic Procurement Department
AtkinsRéalis
saba.musleh@miamidade.gov, ross.byers@atkinsrealis.com

Respondents are encouraged to not limit their responses to any already-identified potential sites, locations, or assumptions as to the size or capacity of the respondent's solution. Respondents are encouraged to consider any combination of waste disposal methods such as, but not limited to, waste-to-energy, landfills, or hauling waste.

Requested Information

A. Respondent

Provide a brief summary of the respondent to include the following.

Name: Evan Gwynne Davies

Address: 0 Ivy Lane, Burlington, MA, 01803

Evan Gwynne Davies, Co-founder & CEO, evan@scrappzero.com, +44 7596104767

I have spent the last 10 years of my professional career working for data-driven organizations, where my main job responsibilities specialized in managing both public and private datasets. I started Scrapp to help organizations track waste and communicate their claims to ensure regulatory compliance, such as EPR.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link.

   Conflicting rules, diverse packaging types, and limited infrastructure have led to a global crisis where two-thirds of recyclable waste ends in landfill. Scrapp develops software that educates & engages citizens on correct waste practices through better communication. Our solutions use data to help customers reduce landfill waste and save money on waste program management.

   https://documents.miamidade.gov/mayor/memos/01-25-25-second-update-on-directive no-241676.pdf

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

   Scrapp addresses resident confusion about proper recycling, municipal inefficiencies, and low engagement rates. This leads to high contamination rates and costs.

   Our platform offers three tools:

   1) Mobile app: Users scan/search items for local disposal instructions, earn rewards for correct recycling, find drop-off programs & learn best practices

   2) Web Portal: Municipalities manage programs, update rules, implement gamification, send reminders, and verify recycling data

   4API: Integrates waste performance visualization & app functionality into existing websites

Key differentiators: Reward-based behavioral approach, data verification system, and unified platform connecting residents with municipality waste programs.

Validated through 5 years of operation, R&D with 1,000+ users, pilots in 3 municipalities (500,000 residents), and partnership with several major brands.

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

   N/A

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

   Subscription software solution

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

   N/A - digital technology provider, not a waste processing technology.

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

- *Scrapp currently follows GDPR principles and respects user privacy and personal identifiable information.We do not collect any PII that is not necessary to the function of the software.*
- *Accounts are not required to use the app which further anonymizes users and does not allow for unnecessary information to be collected.*
- *Given the USA privacy laws are significantly less stringent than UK and EU regulations, there is minimal risk to Scrapp's practices and operations.*
- *We have not encountered any legal barriers throughout our operations given the scope and field we operate in. All information utilized from an industry perspective is public record and brands, municipalities, and individuals are happy to share.*

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

   $0.15c per household per year. For Miami-Dade county it is estimated to be $150,000 per year. Over 30 years, it would be $7.1M when accounting for an average CPI of 3%.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

Subscription software

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Higher throughput of secondary materials

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

Technology provider

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

N/A

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

N/A

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

N/A

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

3-6 months

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

Some technical support to ensure smooth integration into existing technology infrastructure

7. Health/Safety/Environmental - Describe how the respondent's solution protects both

human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

N/A

E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

   N/A

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

   Need to engage stakeholders upstream (eg. pre-waste management services). Mandate packaging and material flows before they become an issue the county has to deal with and optimize production for end-life. This can be done with better data transparency, something my company Scrapp is working towards.

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

   The team has consulted with other US states ont their circular economy policies (eg. EPR).

Skyscraper Farm

Market Research Response

Petrofski, John

From: Nick Starling <nstarling@skyscraper.farm>
Sent: Monday, April 7, 2025 1:46 PM
To: Musleh, Saba (SPD)
Cc: Byers, Ross
Subject: Proposal – Bundled Ferry, Waste & NOAA Solutions via RLPC + SDVOB Partnership

Dear Saba,

Thank you again for your ongoing communication and the opportunity to support Miami-Dade County's strategic objectives. I'm reaching out to formally offer a bundled solution that brings together the decentralized ferry system, municipal solid waste strategy, and the NOAA-backed Brickell Key sea-scaping initiative—delivered through a flexible, federally compliant legal structure.

As someone with your expertise in procurement and negotiation, I know you understand the *Getting to Yes* principle of creating **third options**—the kinds that balance risk, cost, and strategic upside. This proposal is just that: a high-leverage, cross-agency solution that checks multiple boxes for the County with minimal friction.

Dual Legal Entity for Maximum Flexibility

1. The Ranger Leadership & Policy Center (RLPC) – *501(c)(3) Think Tank*

- Eligible conduit for **grants requiring nonprofit status** (per 2 CFR § 200.331).
- Ideal for sea-scaping and transit infrastructure projects that unlock **NOAA, DOT, or DOE funding**.

2. Skyscraper Farm – *Service-Disabled Veteran-Owned Business (SDVOB)*

- Compliant with:
  - **FAR 19.1406** – SDVOB sole-source contracting
  - **2 CFR § 200.321** – Federal small business utilization
  - **Miami-Dade's equity and local business goals**
- Perfect for ferry system management, waste consulting, and implementation of scalable public-private partnerships.

  With both entities at your disposal, we can route each component through the most strategically advantageous path—compliant, fast, and fundable.

Additional Value to the County

- **Reduced Rates for Bundled Engagement**
  If awarded both contracts (waste and ferry), I will apply a discount to each—lowering overall costs while accelerating delivery.
- **Expanded Federal and Military Alignment**
  I have strong working relationships across the **U.S. Southern Command (SouthCom)**, headquartered in Miami-Dade. Through RLPC, I can help the County **expand coordination and partnership opportunities** with SouthCom—supporting resilience, infrastructure protection, high-tech innovation, and community readiness.

- **Civic Impact and Credibility**
  I was responsible for the **inception of Miami Fleet Week**, which has since become a cornerstone of the County's cultural and economic calendar. This level of initiative and execution is exactly what I'm offering again—this time with a triple-impact bundle across transit, environment, and innovation.

Timing & Next Steps

I am prepared to execute immediately, but I will be departing at the **end of this month**. If we finalize a bundled contract before then, it ensures not only **discounted delivery**, but a **cohesive rollout** of all three solutions with federal, military, and private-sector alignment from day one.

Please let me know if you or a member of your team would like to meet this week. I'm available to walk through the bundled structure and answer any outstanding questions.

786-741-8778 is my cell.

Gracefully,
Nick Starling
Founder
Skyscraper Farm LLC

On Monday, April 7th, 2025 at 2:18 PM, Musleh, Saba (SPD) <Saba.Musleh@miamidade.gov> wrote:

> Good Afternoon,
>
> Please find attached a waste characterization study provided as supplemental information to the market research document previously shared by the County. Friendly reminder that responses to the market research should be submitted by April 14, 2025 as further detailed in the market research document which can be accessed using the following link.
>
> https://www.miamidade.gov/newsletter/pdf/2025-03-market-research-municipal-swm-solutions.pdf
>
> Best Regards,
>
> Saba Musleh, CPPB
>
> Negotiator
>
> **Strategic Procurement Department**

Miami-Dade County

Cell: 786.631.8095

Office: 305.375.5375

www.miamidade.gov/procurement

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Spartan Holdings

Market Research Response

Spartan Holdings LLC

Certified SDVOB
www.spartanholdings.net

RESPONSE TO MIAMI DADE COUNTY MARKET RESEARCH ON MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

Imagine the options available for Miami Dade County, where this land could be used for whatever, you want, instead of a landfill. The future is only as good as the decisions we make now……

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RESPONESE TO: MIAMI-DADE COUNTY

MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

Background

Miami-Dade County ("County") provides an integrated waste management system that provides collection, transfer, and disposal services to include landfills and historically included a waste-to energy facility. The County's Department of Solid Waste Management (DSWM) provides waste collection services twice a week to more than 350,000 households in a 320-square-mile waste collection service area. DSWM operates 13 Neighborhood Trash and Recycling Centers and administers the contracted collection of household recyclables. Historically, the County produces over five million tons of waste annually, of which DSWM disposal system processes more than 2.4 million tons.

Objective

The County is conducting market research to garner industry comments and solutions regarding potential future projects for a comprehensive solid waste management approach. This effort is being undertaken by the County as part of a review and analysis to further explore all available delivery methods for the disposal of waste.

A. Respondent

Provide a brief summary of the respondent to include the following.

• Respondent's name and address

Spartan Holdings LLC
4721
South Saint Lawrence
Chicago, IL 60615
USA

• Contact person, title, email address, and telephone number

Barry Burford
International Marketing Manager
burf9905@aol.con
(708) 612-4227

Bernard V. Conley Sr.
International Marketing Manager
cabeinc@aol.com
(301) 643-4254

• Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides.

Please note that the Respondent has bolded all responses.

TECHNNOLOGY SUMMARY

ProMaxxx Advance Fuel is a company specializing in the production of energy commodities from alternative hydrocarbon feedstock, specifically, converting LDPE (Low Density Polyethylene i.e., plastics) into distillation diesel, Jet -A-fuel or Electricity (MW/hr. Ton= 1.977). ProMaxx Advanced Fuel requires three key components, feedstock, technology, and commodity. Through careful control of the risks associated with these components, ProMaxx Advanced Fuel has created a tremendous opportunity in the fuel market.

THE FEEDSTOCK

- ***LDPE (Low Density Polyethylene), or plastic trash, which can produce either diesel fuel, Jet-A- fuel or Electricity.***

THE PROMAXX TECHNOLOGY

- ***Large units convert 150 tons of LDPE per day into 17.837 gallons per day of distillation diesel and 18,000 lbs. of activated carbon worth approximately .45 cents per pound.***
- ***Small units convert 25 tons of LDPE per day into 2973 gallons per day of distillation diesel and 3000 pounds of activated carbon, worth approximately .45 cents per pound.***
- ***These units can produce electricity instead of diesel: MWhr/Ton = 1.977***
- ***The equipment can be set up to make Jet-A fuel instead of diesel.***
- ***A SOLUTION TO THE PROBLEM OF PLASTIC TRASH.***
- ***Licensed and protected by patents & trade secrets.***
- ***Multiple samples of similar feedstock have been run to confirm product output.***
- ***Earlier versions of Fischer-Tropsch (FT) Technology processing a variety of feed stocks have been in operation in several countries for over 13 years.***
- ***12-month equipment warranty, with an optional 5-year extended warranty.***
- ***Equipment is manufactured to Client needs and our specifications under our supervision in the Southern California facility (made in the USA)***
- ***Flexibility to produce a ration of high cetane F-T diesel and high value synthetic paraffin wax.***

THE COMMODITY

- ***Our Diesel is approved for use by the U.S. Department of Energy and the U.S. Navy, among the world's most stringent diesel fuel certifications.***
- ***Production can be adjusted to local commodity prices, tax incentives and regulations.***
- ***Returns can be hedged and maximized through futures and advanced market commitments***.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc.

Waste to Electricity

Pyrolysis is also referred to as a "conversion technology" Pyrolysis involves the super-heating of a feedstock—be it MSW, coal, agricultural residues, or wood paper, etc.—in an oxygen-controlled environment to avoid combustion. The distinguishing features for pyrolysis is that the primary heat source is self-sustaining from gas already produced, the oxygen level is extremely low, and operating temperature ranges from as low as about 600°F (300°C) to as high as 1,300°F (700°C) depending on the feedstock.

In these low-oxygen environments the production of dioxins and furans from waste can be significantly reduced compared with incineration, with emissions potentially falling even below detection limits.

Conversion technologies are further distinguished from conventional MSW incineration by the production of synthesis gas (or syngas) composed mainly of hydrogen and carbon monoxide, a product of the thermal reactions that take place during the processes. The syngas can then be burned in an efficient, low-emissions natural gas generator or refined into other valuable products.

These differences make conversion technologies cleaner, more efficient, and more valuable than mass-burn incineration.

The cleaning of contaminants and impurities from syngas produced via conversion technologies is often cost-prohibitive. ProMaxx's manufacturing partner has developed and deployed an affordable solution for syngas cleaning that is included with every system that we deploy.

Conversion technologies do have a clear benefit in that they leave behind safer solid residues—and less of it—than burning MSW. Incinerators produce significant amounts of a waste called bottom ash, of which about 40% must be landfilled. The remaining 60% can be further treated to separate metals, which are sold, from inert materials, which are often used as road base. Our pyrolysis technologies, by contrast, offer immediate recovery of metals and inert slags. As the ash typically requires no further treatment and with smaller volumes, typically in the 10% range, it can be readily

disposed of at landfill or sold to cement companies as fillers. If the feedstock contains a high enough percentage of plastic (15% to 20%), then enough carbon black is produced to warrant separating out the carbon black from the ash as an additional revenue source. This explains why conversion technologies have caught on in regions where landfill space is extremely tight or available at a premium.

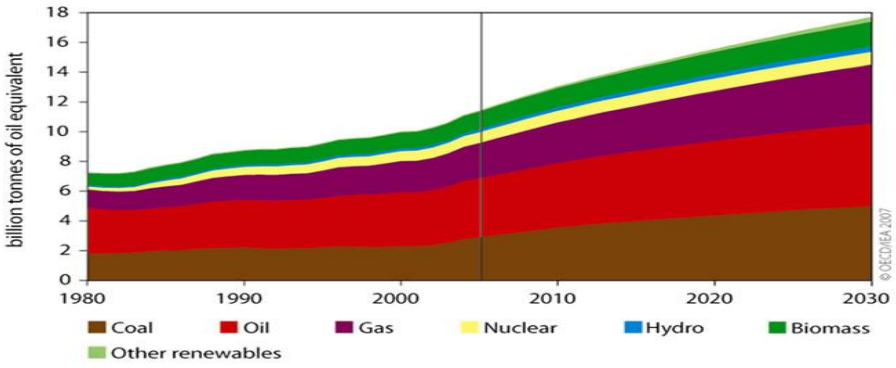
Marketing Analysis

While public opinion is trending against the dependency on oil and other fossil fuels, the world is still heavily dependent on such sources of energy. The need for innovative alternative ways to satisfy the growing demand on scarce energy resources is becoming a top political and social issue.

Our licensed and patented system takes in all types of feed stocks and produces higher value distillation diesel, Fischer-Tropsch (FT) Diesel or Jet-A-fuel.

The chart below from the Energy Watch Group shows the heart of the problem. The red line is the World Energy Outlook (WEO), from the International Energy Agency (IEA), which predicts the demand for oil will rise from the 85 million Barrels per Day (Mb/d) to nearly 120 Mb/d in 2030. Consumer demand will be 120 Mb/d and the projected supply will only be 1/3 of that amount.

World Primary Energy Demand in the Reference Scenario



This means that in 2030, 2/3 of the fossil fuel demand will need to be replaced by new fuels that we do not have today.

The annual need for over 31 billion barrels of crude oil will not disappear in the near future. Incremental and intermediate steps will be necessary to meet the challenge of fulfilling our energy needs, ProMaxx Advanced Fuels offers a solution. The innovative technology reduces the amount of crude oil needed to convert into diesel fuel while creating cleaner and more empowered communities.

While clean energy production has been a small source of energy In developed parts of the world., the trend toward clean energy is growing and is beginning to expand into developing markets.

2**. Effectiveness -** Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

Imagine a solution …. Instead of burying used car tires they are profitably converted into high octane gasoline and conventional diesel fuel, in a zero-emission process. How it works… First, used tires and plastic are shredded into pieces a maximum of 1.5 inches. This becomes the "feedstock" (80% Tires / 20% Plastic).

Next, the feedstock goes into a pyrolysis unit, which is an oxygen-free, closed system. Once inside, the feedstock is super-heated and gasified. There are no emissions during this process. The Promaxx Advanced Fuel system converts the feedstock into a producer gas. If the desired commodity is gasoline, the producer gas is cleaned up and converted into a liquid form (GTL: Gas to Liquid).

The liquids are separated and finished into high octane gasoline and conventional distillation diesel fuel: Approximately 75% Gasoline (102-105 Octane) and 25% Diesel. Another valuable by-product from the conversion process is carbon black. Carbon Black can also be upgraded into Activated Carbon and sold to the filtration industry. Scrap steel from the tires also has value.

However, If the desired commodity is electricity the gas then powers the Generators, the generators inject power into the electrical grid, Promaxx Advanced Fuels offers a system that turns a liability, used tire feedstock, into either high-octane gasoline or electrical power. And, it is done profitably, while leaving no carbon emissions

Moreover, protection of public health is paramount. Landfills, produce methane. Methane contributes to the formation of ground-level ozone, a human health hazard and greenhouse gas in its own right. Breathing ozone can aggravate or even cause asthma and other lung diseases. Further, the landfill gas produced during decomposition of organic materials also contains small amounts of other compounds, including a variety of toxic air pollutants, including benzene, toluene, and xylenes, which can cause cancer, respiratory issues, and other health problems.

Unless a landfill has controls in place, most of the gas seeps out of the landfill and escapes into the atmosphere. With our system, the landfill is cleaned up, and there is no trash to cause methane gas. More on this point later in our response! As for deployment of our technology please see below list:

SYSTEMS IN USE: DEPLOYMENT

China -	**Feedstock**	**Tires**	**1993**
Taiwan-	**Feedstock**	**Tires**	**1998**
California, USA -	**Feedstock**	**Cow manure**	**2004**
Maine, USA -	**Feedstock**	**Laundry waste**	**2005**
Milan, Italy-	**Feedstock**	**Plastic**	**2006**
Knoxville, TN, USA-	**Feedstock**	**Feedstock**	**2007**
Tacoma, WA USA-	**Feedstock**	**Tires**	**2007**
China-	**Feedstock**	**Medical Waste**	**2008**
California, USA-	**Feedstock**	**Sewage Sludge**	**2008**
Seoul S. Korea-	**Feedstock**	**Tires**	**2009**
Brisbane, Australia-	**Feedstock**	**Coal**	**2011**
Pennsylvania, USA-	**Feedstock**	**Plastic**	**2012**
Romania-	**Feedstock**	**Tires**	**2013**
Colorado, USA-	**Feedstock**	**Tires**	**2013**
Turkey-	**Feedstock**	**Chicken manure**	**2014**
Caribbean-	**Feedstock**	**Feedstock**	**2014-2016**
Romania-	**Feedstock**	**Feedstock**	**2016**
Midwest, USA-	**Feedstock**	**Tires**	**2017-2018**
Oklahoma, USA-	**Feedstock**	**Natural Gas**	**2019-2020**

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

The quantity computed as of current approximations can change since our systems are custom-made according to the client's needs and our engineers' recommendations. However, in this scenario, we will compute tons into pounds. The North Dade Landfill is reported as 13,627,578 tons of waste, which equates to 43,367,928,000 lbs. Our 150-ton ProMaxx moves 300,000 pounds per day or (300,000 x365) 109,500,000 lbs, annually, per machine.

South Dade Landfill is reported as 21,683,964 tons of waste, which equates to 27,255,156,000 lbs. Our 150-ton ProMaxx moves 300,000 pounds per day or (300,000 x365) 109,500,000 lbs, annually, per machine.

Resources Recovery Facility Ashflll is reported as 6,662,794 tons of waste, which equates to 13,325,408,000 lbs. Our 150-ton ProMaxx moves 300,000 pounds per day or (300,000 x365) 109,500,000 lbs, annually, per machine.

Note: Consider the difference between moving waste around, whether by rail, truck, boat or burying. The problem still compounds everyday with a new load of trash filling space. But by utilizing the ProMaxx System, that same trash is making renewable energy, whether to be added to your electric grid, defraying the costs of your county vehicles with fuel, the sale of the by-products from tires and carbon credits, all with zero emissions.

Please review slides 1-6 attached for adaptability for different waste compositions:

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

According to EPA, the current landfill capacity is sufficient at a national level, but there are some regions that are becoming more limited in their disposal options. Seven states are looking at running out of disposal space in the next five years, one state will reach capacity in five to 10 years and three states have 11 to 20 years to go. These states will be at the mercy of other U.S. states, willing to accommodate the

produced waste. Even the Miami-Dade County report speaks of possible creation of another landfill, though this can take up to 10 years to approve, locate, and start the process. We spoke of our waste to electricity process in our solution process.

Below are some common types of waste reduction/management technologies in use and their apparent limitations in meeting stringent air and environment quality standards.

Traditional Gasification: Traditional techniques use an oxidizing agent such as oxygen to create the desired reaction. With the introduction of oxygen, oxidation occurs resulting in creation of undesired emissions such as acid gases, dioxins and furans, nitrogen oxides, sculpture dioxide, particulates, cadmium, mercury, lead, and hydrogen supplied.

Incineration: The most widely used waste reduction method internationally is still the burning or incineration of trash. Air emissions include in extreme amounts acid gases, dioxins and furans, nitrogen oxides, sulphur dioxide, particulates, cadmium, mercury, lead, hydrogen sulphide, carbon monoxide, and carbon dioxide.

Landfills: Contradictory to common belief, landfills are not a viable solution to sustain our environment. People are misled to believe land filling provides a suitable environment for natural decomposition, believing eventually that waste in landfills will decompose over long periods of time. The truth is decomposition needs oxygen to occur and with time landfills become oxygen-depleted environments. Over time, decomposition actually slows and waste materials in landfills are preserved for future generations to deal with.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

Landfills are cleaned up with the ProMaxx System by removing legacy waste. The land can be used for green affordable housing; or the now vacant land can be used for solar farms. In short, eradicating the trash in the landfills gives Miami Dade County options. Using the same current methods will eventually cause a larger problem in the future.

Other benefits include:

- **The gases created are extremely combustible with immense thermal potential, allowing superior marketability.**
- **Extreme reduction of volume and mass. The remaining solids are the inert proportion of the waste material.**
- **Our licensed technology can efficiently process ANY carbon-based material without harmful emissions into the atmosphere or environment.**
- **The extreme reaction temperatures decompose organic toxins such as PCB's & dioxins.**
- **The re-utilization of the accumulated synthetic fuels back into the operations of our thermal distillation system solutions allows the solution to be completely independent of exterior/third party energy sources.**
- **Our system solutions can be customized to maintain or vary reaction temperature facilitating optimal reduction and conversion conditions for various waste stream materials. Reaction can be meticulously controlled to gasify virtually any and all waste materials.**
- **Organic materials are thermally decomposed while inorganics are condensed into an inert slag.**
- **Our thermal decomposition system solutions are completely customized for your waste management and energy consumption needs.**
- **Solid waste is reduced in volume and weight in significant amounts without harmful emissions into our environment and atmosphere.**
- **An abundant NET surplus of fuel is created after all energy has been deducted for fueling our thermal distillation operations. This fuel energy is accumulated, refined, and sold as a commodity for revenue. No harmful emissions are floating in the environment in Miami Dade County.**
- **We work with municipalities, States and Federal governments all over the world. If you incur the high costs of waste management or hazardous solid materials, incur a high cost for energy consumption, we can customize a solution for you to eliminate your liability management expenses energy**

consumption expenses and many times create a revenue stream in substitution.

- **The ProMaxx System, will allow Miami Dade County to receive cash for trash, because other counties would pay them to process their trash.**
- **Finally, unlike other Waste Removal Companies, that may take plastics and paper to recycle, and transport MSW to landfills, ProMaxx can be customized to create renewable energy on your existing footprint or smaller.**

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

The only challenges we foresee are decisions made by client and recommendations from our engineers as to how many machines will be necessary, their size and location of installation. The permitting is applied for during the 9-10 months when the equipment is being built. All permits are pulled before the system ships.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

The Promaxx machines are custom made to accommodate different kinds of feedstock, depending on which machine is ordered, the capital investment would normally be between 25 and 60 million dollars. Each machine pays for itself in 18-36 months depending on the type of feedstock used.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such a solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

Financing is available. The client is also encouraged to seek public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Revenue can be derived from the sale or use of (Diesel fuel, Jet A fuel. Electricity, Paraffin Wax, Carbon, and Carbon Credits. In addition, charging your county neighbors for their waste disposal, without jeopardizing your own areas of responsibility. In addition, to fueling county vehicles that would defray costs from county budget expenditures, installing the produced electricity into the electrical grid for cost savings.

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

Technology provider, machine builder, design. Life Expectancy of equipment: 20 years (up to 30 years in an enclosed building), by keeping up with your regular maintenance. You can not only turn your trash into energy, Jet A fuel, Diesel Fuel, Paraffin Wax, and Carbon, you can also receive carbon credits, Electricity, that can supply the electrical grid.

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

System Dimensions in Meters & Feet / Layouts

Width x Length x Height in meters

Model Sizes	**Diesel and Wax**
2000/7,703=	**15.5 x 23 x 7.5**
10000/38,289=	**15.5 x 38.1 x 7.5**
19000/73,395=	**15.5 x 46 x 7.5**

Width x Length x Height in feet

150 tpd = 50 x 125 x 24

25 tpd = 50 x 75 x 24

Each skid mount is up to 18T in weight (20 short tons)

WAX SKID: If you are going to buy the unit that makes all diesel and no wax, you need to envision another skid at one end which is added to the length of the above measurements (in meters 3 X 10.5 x 7.5) this add-on feature means more cost, however allows the wax that is produced to re-enter the unit and convert to all diesel. (in feet 35 x 10 x 20)

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

It is the responsibility of the client to secure the site.

Building & Commissioning: It is the client's responsibility to have the site ready for the equipment's arrival. When the equipment arrives at the site a team of specialists will arrive to supervise installation by the client and commission the equipment and simultaneously train the local crew for operations and maintenance. This process takes 2-4 weeks.

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

We have two units in Southern California permitted and licensed by the most stringent permitting agency in the world, the South Coast Quality Air District, therefore, it is reasonable to expect they can be permitted anywhere in the world. Permitting on your end is a local task, for example, typical permitting in the USA 4-6 weeks.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

Build Time: 12**-14 months when FT is part of the system. 6-8 months if it is a machine that's making electricity or distillation diesel (i.e., Tires, Coal, or Plastic).**

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

Maintenance: One 8-hour shift per month plus 7-10 days a year for major maintenance. Manpower: two technicians per shift (three 8-hour shifts): Workers can manage other tasks while on duty, or, up to four units at the same location. Skills of manpower: People who have worked at refineries would be good choices. If the labor force doesn't offer those kinds of choices, then you need people capable of learning how a system works and being physically able to handle the maintenance and monitoring. There will occasionally be metal pipes and forklift activity as part of the maintenance.

Footprint of equipment: Small unit: 50x75x24 Large unit 50x150x24 Units should be on 8-inch concrete slab in a building, with a 10-foot working area around each unit.

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.)

SAFETY: T**his equipment is no less safe or more dangerous than any usual machine operations.**

There has never been a case of an explosion or catastrophe in the USA or abroad, involving FT technology or this type of equipment. We do not know of any accidents, anywhere, ever, involving this equipment. The equipment is safe and has a built-in computer control system with safety features. It is designed to run 24/7 for 365 days per year. At about 3-4 years the catalyst needs to be replaced.

Does the equipment generate heat?

Yes, the equipment is exothermic, so in warmer climates the building should have large open doors like an aircraft hangar.

E. Other Information/Advice

1. Procurement Model - Provide respondents' advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

Sales Process: Your Spartan Holdings LLC Representative and Promaxx Engineers will work with you to make sure you are ordering the machines you need to reach your desired outcomes.

Step one: **We work out a specific quote and spreadsheet for prospective clients. (RFQ document). RFQ is returned with a purchase contract that spells out the details.**

Step two: **Prospective clients may visit the factory for a tour and meeting, preferably with the client's top technical expert in attendance.**

Step three: **If needed, and at the sole discretion of our manufacturer, a visit to an on-site unit.**

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal. methods such as landfills or hauling waste.

As an industry expert, we recommend addressing the issue at hand with the eventual capacity of landfills space being too full. The best possible advice is to allow our experts to sit down with your experts to come up with a list of countermeasures to delay, control or get rid of the current trash problems.

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

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The report submitted was thorough and full of vital information. However, it would not befit us to speculate until we can assess the problems firsthand. But we do know that we can assist Miami Dade County with its trash problem with real results. By using the ProMaxx System, cleaning out legacy trash and simultaneously turning day-to-day trash into renewable energy and or fuel. The county would no longer be operating in a deficit on where to haul trash but turning trash into cash. That cash can go to county programs by adding it back into your budget. It may take a little time, so there must be patience, but it can be done!

Our Spartan Holdings LLC and ProMaxx Team thank you for the opportunity to respond to this Market Research.

Sincerely,

Barry Burford, IMM
Spartan Holdings, LLC
(708) 612-4227

Bernard V. Conley, Sr., IMM
Spartan Holdings, LLC
(301) 643-4254

NATURAL GAS

- 2 machines / 4 variations: (The following information is based on ***typical pipeline natural gas with 92% methane*** - the equipment output varies slightly depending on gas composition)

- **LARGE UNIT:** 10,930 gallons per day of premium FT Diesel plus 38,647 lbs. of paraffin wax unit; (requires 5 million cubic feet per day of NG)

- Variation: For an extra cost, an extra component adds to the unit allowing the wax to be run through a second time producing **19,389 gallons of FT diesel per day** (no wax):

- **SMALL UNIT:** 2,186 gallons per day unit producing premium FT diesel plus 7,729 lbs. of paraffin wax: (requires 1 million cf per day of NG)

- Variation: For an extra cost an extra component allows the wax to be run through a second time, producing approx. **3878 gallons per of FT diesel per day,** no wax.

COAL

- PerforMAXX equipment can handle up to 1.5% sulphur, after that an additional 200k of equipment is required to clean it first.

- Coal Test: For a fee (inquire for current rate) PerforMAXX can run a 400 lb. sample of a buyers specific coal in order to get precise production estimates and other data. Coal should be 1.5 inches or less. Here is a video of another customer getting their coal tested: https://www.youtube.com/watch?v=qGbdkmdaPU4&feature=youtu.be

- **BTU's to gallons (gallon output increases with btu values)**

- 13,000 BTU's = 390 gallons per hour = 9360 gallons per day plus 9,750 lbs. activated carbon
- 12,000 BTU's = 360 gallons per hour = 8653 gallons per day plus 9,750 lbs. activated carbon
- 11,000 BTU's = 330 gallons per hour = 7933 gallons per day plus 9,750 lbs. activated carbon
- 10,000 BTU's = 300 gallons per hour = 7211 gallons per day plus 9,750 lbs. activated carbon
- 9,000 BTU's = 270 gallons per hour = 6480 gallons per day and 9,750 lbs. activated carbon
- 8,000 BTU's = 240 gallons per hour = 5769 gallons per day and 9,750 lbs. activated carbon

- **Production: gallons per ton & lbs. of activated carbon**
- 13,000 BTU with 1% sulphur = 125 gallons of FT diesel plus 130 lbs. of activated carbon
- 12,000 BTU with 1% sulphur = 115 gallons of FT diesel plus 130 lbs. of activated carbon
- 11,000 BTU with 1% sulphur = 105 gallons of FT diesel plus 130 lbs. of activated carbon
- 10,000 BTU with 1.5% sulphur = 96 gallons of FT diesel plus 130 lbs. of activated carbon
- 9,000 BTU with 1% sulphur = 90 gallons of FT diesel plus 130 lbs. of activated carbon
- 8,000 BTU's: of coal fines (ground up less than 1.5 inches and smaller) 75 to 80 gallons of FT diesel plus 130 lbs. of activated carbon.

- *activated carbon per day valued at $0.45 per pound.

TIRES

- 150 ton unit produces approximately:
- -16,662 gallons per day of distillation diesel
- -96,000 lbs. of carbon black worth approx. 20-25 cents per pound
- -45,000 lbs. of scrap steel

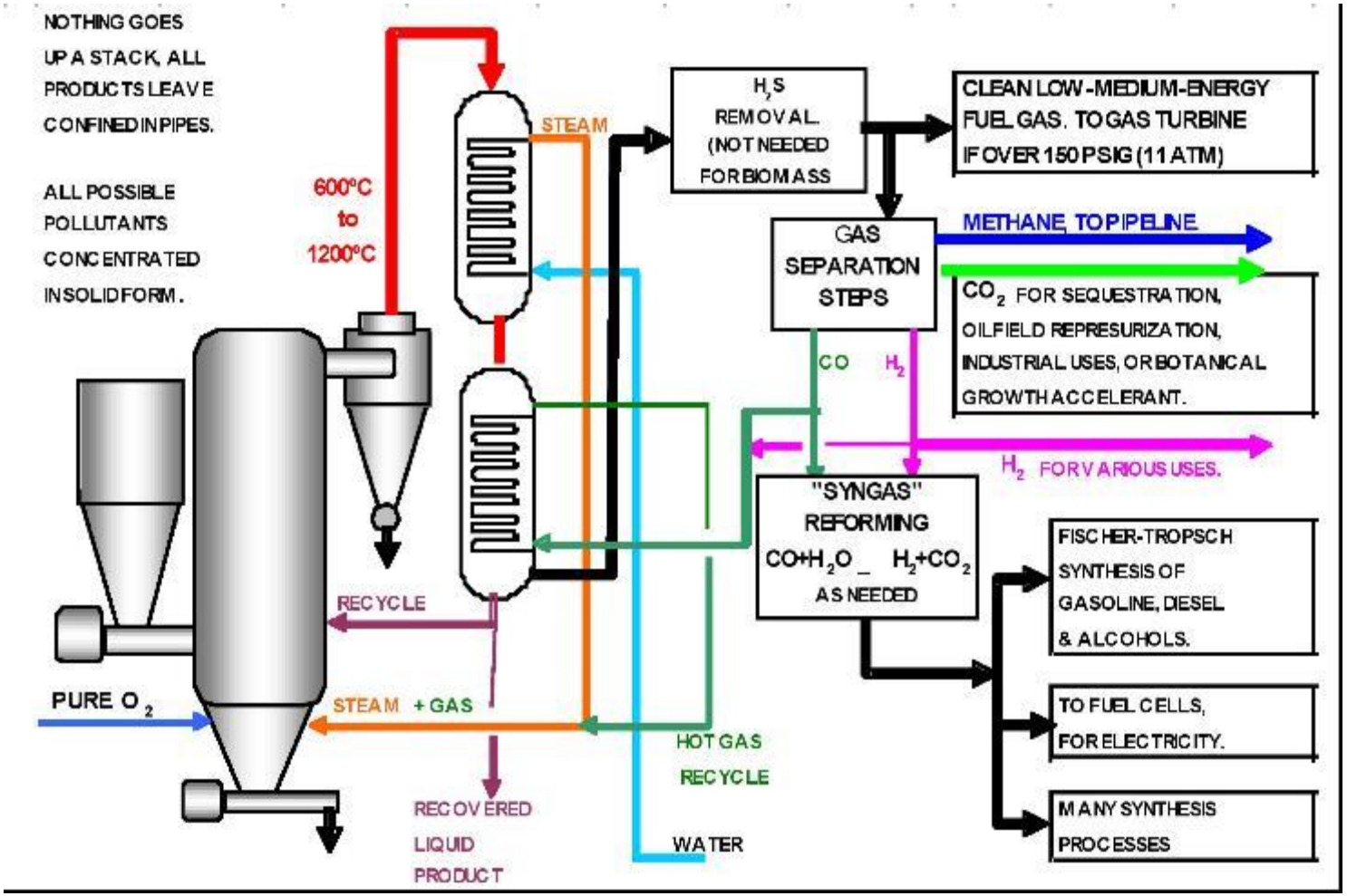
- 25 ton unit produces approximately:
- -2777 gallons per day of distillation diesel
- -16,000 lbs. of carbon black worth approx. 20-25 cents per pound
- -7500 lbs. of scrap steel

- These systems work really well financially at 150 tons per day of tires per system. The diesel produced is a distillation diesel and not FT diesel. This is for car tires. Truck tires have more inert fillers and don't produce as much diesel per ton so car tires are better.

- If someone fills out an RFQ for tires, the percentages of car vs. truck tires should be identified.

MSW – MUNICIPAL SOLID WASTE

- Typical U.S. MSW is approximately **6,000 BTU per pound.** A 25 ton per day system is expected to produce 500 gallons of FT diesel, 1,450 pounds of synthetic paraffin wax and 2,500 pounds of carbon black daily.

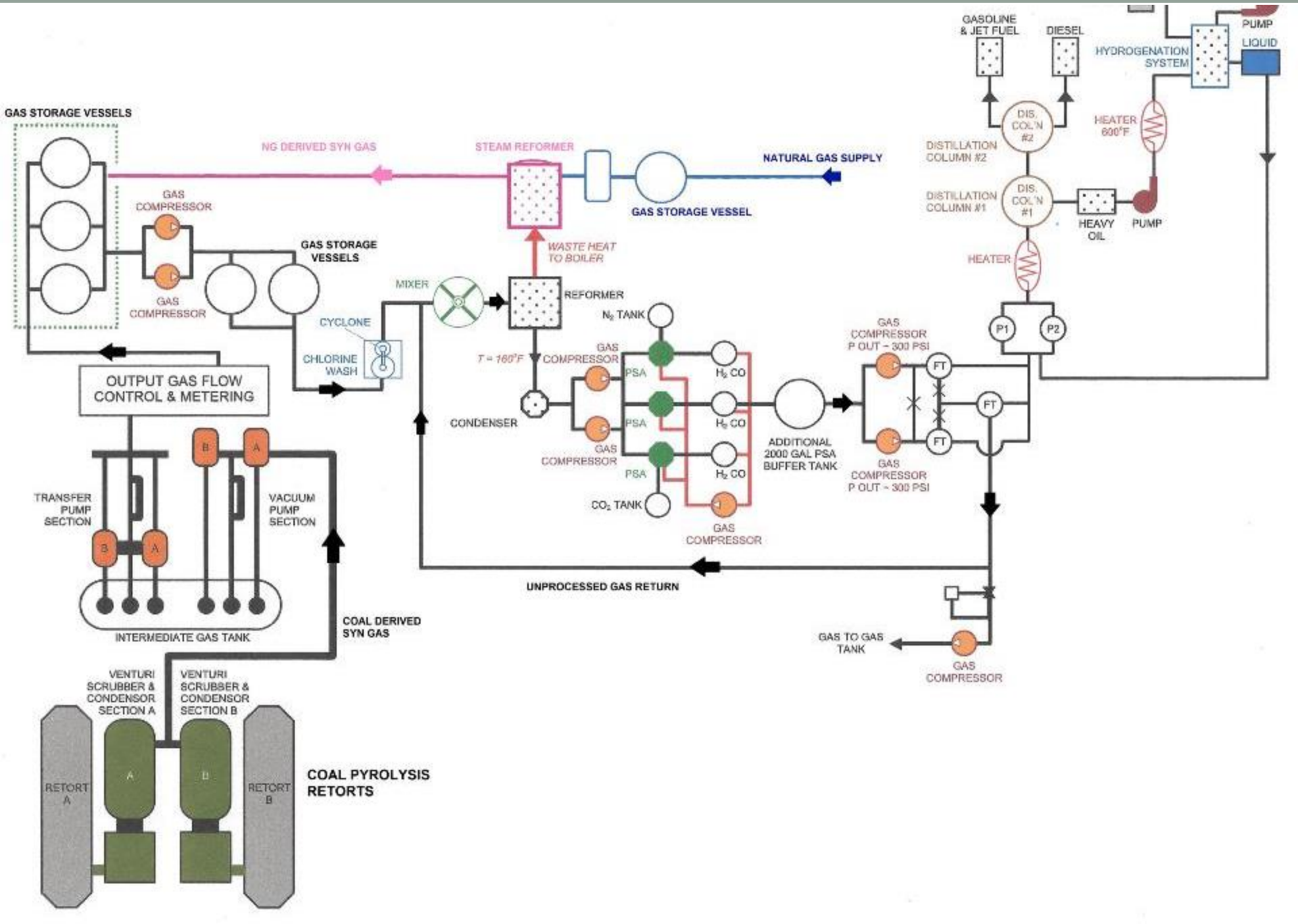


PLASTIC (LDPE: Low Density Polyethylene) to Diesel:

- **LARGE UNIT:** Feedstock: 150 tons per day of low density plastic
- Produces: 17,837 gallons per day of distillation diesel & 18,000 lbs. of activated carbon OR Electricity MWhr/Ton = 1.977

- **SMALL UNIT:** Feedstock: 25 tons per day of low density plastic
-
- Produces: 2973 gallons per day of distillation diesel & 3000 lbs. of activated carbon OR Electricity MWhr/Ton = 1.977

- Additives are blended in to reduce the pour points to the different required temperatures. The pour point of our distillation diesel is -22C.
- The oil is pyro oil. This is the 1st phase of the oil as it exits the condensation and cleanup skid and enters into the distillation skid. It exits the distillation skid as diesel.
- **The activated carbon is a benign commodity valued at approx. $0.45 per pound.** The carbon and ash drop out at the end of the 1st stage pyrolysis reactor. Left un-separated the carbon/ash mix is considered a low grade fertilizer.


GAS STORAGE VESSELS
NG DERIVED SYN GAS
STEAM REFORMER
NATURAL GAS SUPPLY
GAS COMPRESSOR
GAS STORAGE VESSEL
GAS STORAGE VESSELS
WASTE HEAT TO BOILER
GAS COMPRESSOR
MIXER
REFORMER
CYCLONE
CHLORINE WASH
N2 TANK
T = 160°F
GAS COMPRESSOR
OUTPUT GAS FLOW CONTROL & METERING
PSA
H2 CO
CONDENSER
PSA
H2 CO
GAS COMPRESSOR
ADDITIONAL 2000 GAL PSA BUFFER TANK
GAS COMPRESSOR P OUT ~ 300 PSI
FT
FT
FT
GAS COMPRESSOR P OUT ~ 300 PSI
PSA
H2 CO
CO2 TANK
GAS COMPRESSOR
TRANSFER PUMP SECTION
VACUUM PUMP SECTION
UNPROCESSED GAS RETURN
INTERMEDIATE GAS TANK
COAL DERIVED SYN GAS
GAS TO GAS TANK
GAS COMPRESSOR
VENTURI SCRUBBER & CONDENSOR SECTION A
VENTURI SCRUBBER & CONDENSOR SECTION B
RETORT A
RETORT B
COAL PYROLYSIS RETORTS
GASOLINE & JET FUEL
DIESEL
HYDROGENATION SYSTEM
PUMP
LIQUID
DISTILLATION COLUMN #2
DIS. COL'N #2
HEATER 600°F
DISTILLATION COLUMN #1
DIS. COL'N #1
HEAVY OIL
PUMP
HEATER
P1
P2

BERNARD CONLEY SR. (301) 643-4254
BARRY BURFORD (708) 612-4227
SPARTAN HOLDINGS LLC

LINKS FOR VIDEOS ON PROMAXX ADVANCE FUELS SYSTEM

https://youtu.be/XbG8w3t_Jn4

https://youtu.be/0H2Pzl9h5R4 (No Sound)

THIS IS THE LINK TO PROMAXX https://promaxxaf.com/

Sustainable Generation

Market Research Response

Sustainable Generation®

SG Advanced Composting™ Technology

SG MOBILE® SYSTEM

FULL SUPPORT & FAST SETUP

SG MOBILE® System with GORE® Cover is the most flexible and cost-efficient way to bring covered aerated static pile composting to your facility or community project. Using as little as 500 square feet of space, this SG Advanced Composting™ System works in all weather conditions and can be operational the same day the equipment arrives on-site.

The Sustainable Generation® (SG) team fully supports your team through the entire process of setup, configuration, operational support, and technical training resulting in a quality compost product that meets all regulations, with a report to prove it. There is no need to invest in costly infrastructure or find end markets without assistance. With SG's expertise and guidance, the whole process is simple, fast, economical, and efficient – and we can help you scale up if that is what is intended to come next for you.

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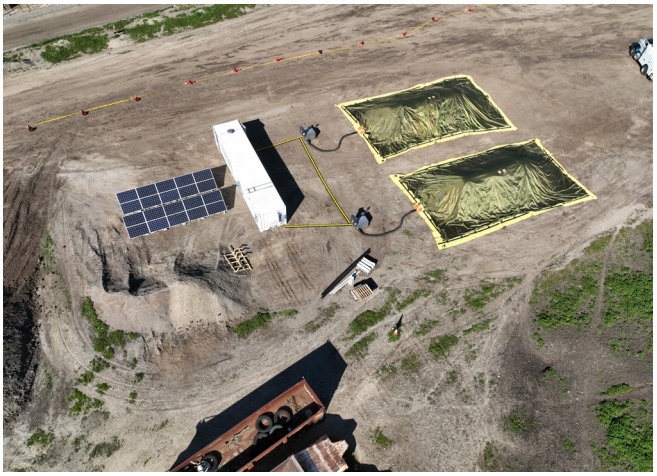
SG MOBILE® SYSTEM



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KEY FEATURES

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- SG's covered, aerated static pile design has lower energy consumption compared to negative, reverse, and timed positive ventilation systems
- A proprietary remote oxygen and temperature control system technology provides the highest level of process control and the most cost-efficient processing
- SG Advanced Composting™ Technology eliminates the need for costly, high-energy bio-filters

SIMPLE TO OPERATE

- Remotely monitor each pile with the SG Compost Control™ System via a browser based web interface.
- Few moving parts and maintenance required, typically only one operator required for every 10,000 tons processed annually

EFFECTIVE IN ALL CLIMATES

- SG and GORE® Cover technology are not influenced by weather or climate and do not need an enclosed building
- From the arid heat of the Mohave Desert to Finland's subzero snowy climate, SG's solution is a proven winner in any climate, be it hot, wet, dry, or freezing

VARIED INPUTS

- Treated wastewater sludge / biosolids, pulp and paper, manures and bedding, animal and chicken waste, fish waste, anaerobic digestates

MOISTURE MANAGEMENT

- Once the proper 55% - 65% moisture content is achieved on the initial mix recipe, our solution manages the moisture throughout the entire process with little or no need to add additional water

CONSISTENT HIGH COMPOST QUALITY

- Achieves the highest quality product in an 8 week process, matching your ROI goals
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Sustainable Generation®

SG Advanced Composting™ Technology

SCALABLE FOOD WASTE COMPOSTING SOLUTIONS

Sustainable Generation® supports composters, waste haulers, municipalities, project investors, and policymakers by providing the necessary expertise and experience to compost food waste and Source Separated Organics (SSO). We offer guidance through every phase, including design, construction, operation, and compliance, ensuring long-term success. Our mission is to align environmental sustainability with economic viability.

Our proven scalable commercial food waste composting solutions, utilizing the GORE® Cover, are backed by first-hand owner-operator knowledge and the reliability of more than twenty years of successful application.

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SG COMMUNITY™ SYSTEM

SG COMMUNITY™ Composting System is the best solution for your community composting needs. Utilizing the GORE® Cover, our solutions are proven to work in all weather climates and can accept any organic feedstock. Our systems are backed by first-hand owner-operator knowledge and the reliability of twenty years of successful GORE® Cover applications.

The Sustainable Generation® (SG) team fully supports your team through the entire process of setup, configuration, operational support, and technical training resulting in a quality compost product that meets all regulations, with a report to prove it. There is no need to invest in costly infrastructure or find end markets without assistance. With SG's expertise and guidance, the whole process is simple, fast, economical, and efficient – and we can help you scale up if that is what is intended to come next for you.

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SCALABLE BIOSOLIDS COMPOSTING SOLUTIONS

Leverage the power of SG Advanced Composting™ technology with our covered aerobic composting systems to streamline your composting operations. Our innovative solutions transform the complexities of composting with biosolids into a straightforward process, consistently producing Class A compost. Achieve repeatable, reproducible results and comply with stringent air and water quality regulations, all while enjoying the benefit of the lowest total cost of ownership in the industry.

Explore how the SG team can expertly facilitate your transition from Class B to Class A composting quickly and precisely. Utilizing our deep expertise and cutting-edge GORE® Cover technology, our commercial biosolid waste composting solutions are proven and scalable and backed by years of successful implementations and hands-on operational experience. Trust SG to elevate your operations with solutions that deliver reliability and efficiency.

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Synagro

Market Research Response

Environmental Protection & Improvement Company, LLC (EPIC) Municipal Solid Waste Management Solutions for Miami-Dade County

A. Respondent

Provide a brief summary of the respondent to include the following:

- Respondent's name and address

  Environmental Protection & Improvement Company, LLC (EPIC)
  319 Avenue P
  Newark, NY 07105

- Contact person, title, email address, and telephone number

  Elliot Pomeranz, Vice President of Rail Operations
  epomeranz@synagro.com
  973-856-4418

- Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides

  The Environmental Protection & Improvement Company, LLC (EPIC) is the rail transportation and disposal division of Synagro Technologies, Inc. With over 35 years of experience transporting biosolids, municipal solid waste, hazardous waste and other commodities, for beneficial use/disposal by rail. EPIC provides safe, reliable, cost effective, and eco-friendly transportation using our unique intermodal rail system, reducing carbon footprints for transportation by over 85%. EPIC is the largest private waste-by-rail fleet of equipment in North America that is not directly connected to any particular disposal vendor, and this offers a more diverse and lower risk solution to our clients. EPIC maintains guaranteed disposal agreements, securing capacity for disposal in markets that are farther away than trucking transportation is effective to get to, but has excess capacity for disposal. EPIC services some of the largest municipalities in the Northeast, such as New York City, The City of Baltimore and many more large counties from the greater Boston area to the

EPIC has the largest independent waste-by-rail fleet of equipment in the country.

Maryland. EPIC has also recently been awarded a contract (PM-EVN0017499**)** to transport and dispose of biosolids generated by Miami-Dade WASD by rail.

EPIC maintains its largest Rail Operations Hub at Brills Yard in Newark, New Jersey, which is highlighted below:

- Brills Yard – Intermodal Transload Container Facility
  - Operates 24-7, 365 days/year
  - Capacity to receive and ship up to 3,400 tons per day
- Current fleet includes 403 railcars and over 2,650+ intermodal containers
- Own/operate tractors and intermodal container trailers
  - A-901 Certified transporter in New Jersey
  - NYC BIC Contractor: #BIC-4640 (Environmental Protection & Improvement Company, LLC)
- 30 on-site employees
- Union shop – (Local 125 and Local 825)

In addition to the Brills yard, EPIC has utilized yards in Boston, Massachusetts; Baltimore, Maryland; Detroit, Michigan; Lamar, Colorado; and even in Canada. EPIC is skilled at establishing various yards and launch points for transportation of various forms of solid waste.

EPIC's Brills Yard in Newark, New Jersey

EPIC's involvement in the waste-by-rail industry has, its 36-year history, grown into the most effective transportation mode for hauling waste material. EPIC is the largest independent waste by rail provider in North America. As successfully proven by our many high-volume waste-by-rail projects, operationally, rail hauling of waste material is straightforward. For safety, reliability, and cost effectiveness, rail transportation of material by EPIC is the best option bar none.

Since 1991, EPIC has safely transported over 17 million tons of material via rail and truck without a material incident or accident. EPIC was awarded the Passaic Valley Sewerage Commission's (one of the nation's largest WWTP facilities) Solid Waste Transportation and Disposal Contract in 1991 and have been performing that work ever since. The scope of that contract required the transportation of up to 1,200 tons per day of biosolids from Newark, New Jersey to facilities in Texas, Ohio, Pennsylvania, Alabama, Georgia and Virgina for

beneficial use. EPIC's successful performance of the PVSC contract paved the way for us to provide similar services for other customers. Our current and former client list includes the New York City DEP; Joint Meeting of Union and Essex Counties, New Jersey; Middlesex County Utilities Authority, New Jersey; Bergen County Utilities Authority, New Jersey; and Camden County Municipal Utilities Authority, New Jersey; City of Baltimore, Back River and Patapsco WWTPs; Greater Boston area generators; as well as Waste Management, Veolia, Casella Waste Systems, Republic Waste, Allied Waste Services, Clean Harbors, US Ecology, Stablex, EQ Environmental, Sevenson Environmental, and numerous other companies within the environmental industry in both biosolids and MSW.

Working with all Class I Carriers such as CSXT, NS, BNSF, and the UP railroads, and many regional short line railroads, EPIC's rail transportation program has consistently shown a high degree of efficiency, reliability, and flexibility in dealing with varying quantities of material requiring transportation.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc.

The challenge that Miami-Dade County (County) faces is not unlike what EPIC has seen and assisted other large municipalities within other areas. Said simply, capacity is decreasing in most large metropolitan areas, new facilities are expensive, present significant siting risk, and take a long time to permit and construct. As in the directive, we agree with the potential three options the County identified for consideration moving forward. In particular, we believe that utilization of existing landfills outside the County has strong merit. This option could result in an even better outcome for the entire state of Florida by adding access to landfill(s) outside the State. EPIC's solution would eliminate the need to construct a new landfill altogether and still provide guaranteed capacity at multiple landfills for decades to come.

EPIC specializes in managing transportation and disposal by rail. Our suggestion to the County is to concentrate on landfill disposal outside of Miami-Dade County, not through new construction, but rather through guarantees of disposal capacity for up to the 30-year window that the County is exploring with this study. There are facilities that can support the needs of the County for the entirety of this timeframe, and these are facilities that EPIC can offer exclusively to Miami-Dade County.

The approach would be to load and transport waste, either from transfer stations or existing landfills to a rail hub in the immediate area, load material onto trains, and transport it out of state to one or more fully permitted and existing facilities. This approach is one that EPIC has implemented and is performing successfully. Evidence of this can be found in EPIC's two longest relationships with New York City and Passaic Valley Sewerage Commission, both of which have been in continuous operation of waste by rail for over 30 years.

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

Waste by rail has been an effective solution for many large municipalities in the US where disposal capacity has become constrained. Rail transportation is the most cost-effective, sustainable, safe, and community friendly way to move waste from an area which has disposal capacity constraints to areas where there is ample capacity for the foreseeable future.

As stated previously, New York City is a perfect case study to show reliability and sustainability of this solution. Again, they have been utilizing this solution for over 30 years, for both solid waste and biosolids, and plans are for this to continue. As the region becomes more capacity constrained, even more waste has started to move by rail in the Northeast from areas stretching from Maine to Maryland.

> Rail transportation provides the most cost-effect, sustainable, safe, and community friendly way to move waste from large metropolitan areas.

To expand further, rail is a "green" and community friendly solution. It is proven that rail transportation reduces carbon footprint versus trucking by up to 85%, it reduces truck traffic and congestion on highways and local roadways, mitigates the impact of more truck traffic on local communities and helps address historic environmental justice issues.

Rail is cost effective and sustainable as it has been proven to be more cost effective for long-distance transport than trucking. The high capacity of EPIC railcars allows for transport of more material per unit keeping overall unit cost consistent and efficient. Furthermore, costs are more predictable long term and less volatile because s fuel is a lower portion of cost and equipment use.

Rail transportation is the safest mode of major transportation in North America. Statistically, railroads are far safer than trucking transportation at over sixteen times less incidents per unit transported.

Next, implementing the waste by rail solution would be surprisingly simple. While the County has explored many ambitious and environmentally responsible solutions, all of these are time consuming to design, build and put into practice, and comparatively higher cost. Most of the proposed solutions in the directive are also challenging to site and permit in the face of community concerns. Waste by rail will require no new permits, as the sites EPIC has secured to launch waste by rail in the County will operate under rail preemption for transferring waste from truck to rail. Transfer of containers from truck to rail is not a permitted activity. There would be no new transfer stations needed, and all the identified disposal sites are already permitted and have ample daily capacity to offer the County. The sites identified also have current lifespan (without expansion) that would exceed 30-years of capacity for the County. The multiple sites EPIC can offer for disposal of Miami-Dade waste offers both redundancy and flexibility. Rail transportation allows for material to be brought to a single launch point and have reliable access to multiple disposal sites, all with the same equipment.

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

EPIC can offer the County the ability to transport as much waste as is required. It's understood that the amount of waste that is generated in Miami-Dade County is up to five million tons annually, with 2.4 million of those tons managed by MDC DSWM. It's also understood that the County has other contracts for the service of transportation and disposal. Where EPIC would be capable of taking the entirety of the county's waste, that is not the expectation. We understand, and agree, that diversification is also an important part of the total solution. This said, the capacity of the landfills that EPIC plans to utilize have the ability to receive the full amount of the County's waste with adequate equipment to get the waste to the facility. As part of a diversified County program, EPIC would propose taking a minimum of 350,000 tons per year but could take much more than that if the county so desired. To transport more waste, EPIC would simply need to understand the minimums and maximums expected and would design the fleet of equipment to the desired quantity.

While EPIC would propose a minimum tonnage per year to support a diversified program, our equipment and disposal sites have the capacity for all of the County's waste.

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

The technology for disposal in EPIC's solution is waste by rail to landfill. It is of note that the facilities that EPIC is contracted with to accept the County's waste are subtitle-D permitted sites.

These are lined landfills with leachate management systems in full compliance with all state and federal guidelines.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

Key benefits to the County for EPIC's waste by rail solution are cost-effective, sustainable, reliable and proven. More specifically, and critically, waste by rail offers the following key benefits that are not part of other solutions:

- Rail offers diversification not available with local solutions. Specifically,
- Rail can reach multiple landfills from one launch point for the similar cost, which truck hauling cannot provide.
- Rail allows for access to already existing disposal capacity outside of the state of Florida both reducing the overall capacity burden to Florida and eliminating permitting and siting risk. The entire state of Florida has depleted capacity and transporting waste by rail to other states where there is ample capacity helps relieve capacity constraints not only for Miami-Dade County, but for the entire State.
- Rail is easily scalable. In the event of a hurricane, lack of capacity from an alternative vendor, or other unplanned event, EPIC, with rail transport, can scale up quickly to assist at a higher rate.
- Rail provides protection from permit, operational, or other issues, that may affect a single facility solution or landfill as rail allows access to multiple facilities
- EPICs proposal provides a predictable cost structure which translates to price stability long term for the County.
- Rail transportation is available 24/7, mitigating operating day constraints present with local landfill and truck operations.
- EPIC acquiring and performing waste by rail for Miami-Dade DSWM could facilitate a lower cost to the Miami-Dade WASD for biosolids disposal through cost savings benefits passed onto the County.
- Rail dramatically reduces the truck traffic to manage MSW.

Rail transportation dramatically reduces truck traffic which provides an 85% reduction in greenhouse gas emissions.

- Rails provides an 85% reduction in greenhouse gas generated from truck transport.
- Rail to existing facilities eliminates siting time and risk of building a new facility.

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

One of the primary advantages of this solution is that there are virtually no regulatory or permitting challenges because the launch points and receiving landfills are already permitted to perform this operation. The implementation of EPIC's proposed solution is straightforward. Put most simply, the following would be the basic series of events to begin work under this option:

- Identification of the origin of waste by MDC DSWM.
- Understanding of the quantity that EPIC will be managing.
- Contractual/procurement activity – Guarantee of capacity to the County at multiple landfills.
- EPIC procures dedicated fleet of equipment to service the County.
- EPIC concurrently completes development and improvements of rail launch point.
- Equipment is built and mobilized to the County.
- Waste by rail to out of state landfills begins.

Where this process is simple, it is not without some challenges. These are all easily surmountable with proper planning and clear mutual understanding.

EPIC will need to ensure manufacturing timeframes for equipment are in line with time to implement solution, to build a fleet of this size, the approximate timeframe is six (6) to twelve (12) months based on current raw materials availability. The rail launch site will need to have some track expanded (no new permits needed to do so). Additional handling equipment will need to be purchased. This additional equipment is readily available domestically and includes trucks, top-pick machines. EPIC would also provide the finding for the purchase and maintenance of this equipment to support the operation.

Again, the largest advantage of EPIC's solution to Miami Dade County is its simplicity in approach and ease of implementation.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

EPIC would require no capital investment from Miami-Dade County to implement our solution. Rather, EPIC is willing to invest its capital to provide a dedicated rail fleet for the County provided a long-term contract agreement is effectuated. However, if the County would like to contribute to capital investment, the cost to the County would improve.

30-year operational costs associated with the solution are fairly limited to labor, equipment maintenance, railroad transportation, and land leases. These are all very straightforward and predictable.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

EPIC would provide the funding for the implementation of this solution. However, a public private partnership (PPP) is a possibility that may pose potential advantages, particularly where procurement is concerned. PPP may allow for negotiated terms rather than going through a formal public procurement process.

There is also the possibility of federal funding to improve the rail infrastructure in the area to assist in the facilitation of the rail launch site. Once the full depth of the opportunity is understood, EPIC could investigate this further to determine the potential cost benefits.

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

It is possible that Miami-Dade County could monetize energy credits from carbon footprint reduction realized from changing to rail transportation from trucking, however these would need to be investigated further to determine the true potential value.

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

EPIC would facilitate and supervise all activity in readying the rail launch point(s), build and delivery of the equipment, as well as implementation of the logistics.

Infrastructure requirements on the rail launch point are generally small and can be completed within nine (9) months.

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

The recommended site that EPIC would launch rail from in Miami-Dade County is confidential based on agreements with landowners and developers, however it is in the county, west of Miami proper. The footprint of the site is approximately ten (10) acres.

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

EPIC plans to sign a long-term lease on the property in Miami-Dade County, concurrent with the term of the agreement with the DSWM. The site owners are agreeable to this. There are no zoning or re-zoning requirements. The location and owner of the site is currently considered confidential.

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

No new permits are required.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

EPIC can implement this solution within twelve (12) months of contract implementation. This timeframe may vary slightly based on number of annual tons that the County requires EPIC to remove.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

In order to perform this service for the County, EPIC would require the following for operations:

- Day-Cab trucks (EPIC or County provided)
- Chassis for the transport of containers from rail yard to County loading sites (Landfills or transfer stations)
- Railcars: 89' "flatcars"
- Containers: 62 cubic yard "12-highs"

Maintenance of the equipment will be performed by either EPIC or the railroad. As a rule, railcars are regularly inspected by the railroads at each junction and any needed maintenance or repairs are done on a constant basis as needed.

Maintenance on all other equipment would be done on a preventive basis as required, either at eth EPIC rail yard or at the landfill.

Generally, the equipment used for this type of operation is very low maintenance and reliable. However, EPIC plans to include redundant equipment as contingency plan at both origin and destination.

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

As previously outlined, rail transportation is both 85% lower impact to the environment through greenhouse gas emissions reduction, as well as sixteen times safer than trucking. Rail has been, and remains, the safest and most reliable mode of transportation for large volume freight. The volume of waste in Miami-Dade County is a large volume of material.

Further advantages for health and environmental impacts are through a potential overall reduction in truck traffic in the area through less material being transported by truck. The containers that EPIC proposes to use are to be loaded at County locations, sealed there, and they are not opened again until delivery to the landfill by rail. Loading and sealing the containers at the origin will reduce additional handling of waste, reducing the potential for material release and odors. Lastly, there is less potential for contamination of materials.

The site(s) where EPIC would load the containers onto railcars is not near any population centers, would not impact the public, and would propose no new nuisance.

E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

Given the simplicity that EPIC's proposed solution offers to Miami-Dade County, the procurement should be as simple. We recommend one of three avenues:

1) EPIC's contract for biosolids management with MDC WASD has a "related services" clause. EPIC is hauling biosolids by rail and believes that solid waste by rail could easily be a related service (another waste by rail from the County) and added to the existing contract.
2) The County could issue a bid waiver and negotiate a contract directly from this submission.
3) The County should issue a "Waste by Rail only" solid waste procurement, requiring material to be loaded in Miami-Dade County onto the rail with disposal that is required to be out of the state of Florida.

EPIC recommends a minimum contract length of ten years, with successive, and evergreen, ten-year extensions, up to thirty years.

There is precedence for these avenues at large municipalities and within the County. Related services is a common addition in Miami-Dade County.

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

Not applicable.

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

Where the market today is littered with many new technologies, benefits are often uncertain, and the true outcomes are unknown. We believe that it is in the County's best interest to proceed on two key principals, no matter what vendors or technology you choose. These key principals are diversity and proven results.

For diversity, this is not just of disposal sites, or waste handling technologies, but also of vendors. Where it may be thought that vendors are all competition, we do prefer to share both the burden and benefits. In the case that one provider has temporary issues (which are bound to happen at some juncture) the other(s) can pick up the slack. This can be in times of planned down time or unplanned emergencies. We encourage the County to diversify your solution rather than make a decision based on only one solution's advantages.

Lastly, we encourage the County to choose a disposal solution that has been proven to work, and on the large scale that Miami-Dade County is seeking. Where there are potential advantages of some new technologies, or handling methods, there are few that have decades of real-world experience and evidence of success. The County requires reliability, and where diversity offers one way to increase reliability, proven results on a large scale is another piece that is critical. Certainly, we believe that transportation and disposal by rail, in the fashion outlined above, will provide the keys to success.

TECAM

Market Research Response

Miami-Dade County Florida

MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

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New Spectrum Technologies LLC

TECAM USA

Introduction:

New Spectrum Technologies LLC, opportunity to outline the uniqueness and significant advantages of the TECAM Advanced Waste to Energy Pyrolysis municipal solid waste applications, and along with

TECAM Technologies has developed the processes and equipment to solve one of the primary environmental challenges of our time in the United States: the treatment and disposal of polluting municipal solid waste.

Waste Valorization:

TECAMs Waste Treatment Technologies generate energy in the form of steam, hot water, or electricity from the initial design, which can be recovered for the power production requirements of the plant, and also for Clean Electric Power market opportunities.

The Technologies of Advanced Waste Valorization have become the advanced alternative technology for energy recovery that has minimal impact on the environment and can generate heat and electricity. Pyrolysis plants and waste incineration plants include flue gas treatment systems that collect and eliminate the gases generated, following an efficient and safe procedure, to guarantee maximum respect for people and the environment.

TECAMs tailor-made design:

You can always count on tailor-made solutions with TECAM Engineering and, where necessary, the development of specific components, *software*, and/or materials. Our technicians engage with every project, using their *expertise* and knowledge to design customized equipment for each case and customer.

No matter how big or complex the problem is, TECAM is the technology partner that will provide you with the support and solutions you may require at various times.

Waste Management Solutions:

Please review the Attached Document;

TECAM's Rotary Kiln Controlled Pyrolysis. WASTE TO ENERGY SOLUTIONS

Waste Management Solutions: continued

TECAM Engineering would base our recommendations concerning Miami-Dade County's MSW requirements on our standardized, Waste-2-Energy, 3-line, High-Temperature Controlled Pyrolysis System, scaled to meet the specific MSW requirements of each Landfill, North Dade, South Dade, and the Resource Recovery facility and the possibility of utilizing the Transfer Stations.

1- Three Line System Informational Data set;

1, 3-line MSW processing System processes approx. 700 Tons Daily; and 200,000 Tons Annually of MSW.

The TECAM W-2-E operating system produces approximately 20 to 25 MGW of continuous Clean Electric Power production per 1, 3-line processing system. For example, 2 units, 3-line system, 400k tons annually; 40 MGW continuous clean electric power production, etc.

TECAM'S 3-line processing system is specifically designed for full "scalability" to meet large-scale processing applications and specific MSW requirements with adaptability. Tires, Plastics.

TECAM capabilities include the specific engineering and design of your processing facilities to meet all locational and MSW volume requirements.

For example:

North Dade Landfill:

Utilizing 2020 HDR MSW Projections through 2029:

Incoming Waste: 766,000 tons/yr would require 4, 3-line processing systems. When fully operational.

Provides for the Reduction and elimination of additional MSW Deposits into landfill;

Creating approx. 80 MGW of continuous Clean Electric Power production.

Massive reductions and elimination of additional CO2 and Methane emissions.

90 to 95% waste destruction, (5 to 10% in ashes)

No Dioxins and Furans are emitted into the atmosphere emissions or solid residue.

South Dade Landfill:

Utilizing 2020 HDR MSW Projections through 2029:

Incoming Wasted: 1,513,000 tons/yr would require 6, 3-line processing systems. When fully operational.

Reduction and elimination of additional Deposits into landfill;

Creating approx. 120 MGW of continuous Clean Electric Power.

Massive reduction and elimination of additional CO2 and Methane emissions.

90 to 95% waste destruction (5 to 10% in ashes)

No Dioxins and Furans are emitted into the atmosphere emissions, or the solid residue.

All the same benefits as North Dade Landfill and much more due to the volumes involved.

TECAM Engineering's advanced W-2-Energy technologies allows for the options to Mine and Clean up closed Waste landfill sites for the long-term goal of complete MSW site remediation of existing landfills. Controls and Eliminates Carbon Dioxide and Methane emissions from Closed Waste Landfills.

By creating a full utilization plan for the management of MSW for the benefit of Miami-Dade County, Municipal Solid Waste provides a Significant positive Economic, Financial, and Environmental opportunity to capture and utilize Significant Tax incentives, Carbon Credits Market opportunities, Clean electric power generation utilization for the communities and/or open market sales.

Resource Recovery Facility:

Consider strategic reclamation and re-utilization of the property to meet future MSW requirements evaluation. **Note,** explore the possibility of utilizing the location of the transfer stations in Miami-Dade County into Waste-2-Energy processing locations to minimize hauling expenses and the implication of large-scale trucking requirements.

Effectiveness:

What are the main competitive advantages of TECAM's Controlled Pyrolysis plants compared to other WTE technologies?

MAXIMUM WASTE DIVERSION: • 90 to 95% waste destruction (5 to 10% in ashes). TECAM W-2-E Systems are capable of processing organic waste (no need for separation) to minimize and eliminate organics deposited in the MSW Landfills.

• the ashes act as a strengthening agent to be sold as additives in concrete/Asphalt applications.

ENVIRONMENTAL SAFETY: The facilities are designed with very quiet operations while in full operation.

• no dioxins and furans in the atmosphere emissions or in the solid residue.

• less gas volume as an output than other thermal treatment solutions

• less production of NOx in the combustion chamber (totally removed with the Flue Gas Treatment unit)

• less particles in the flue gas due to the slow combustion in the primary chamber

LOWER INVESTMENT: less air volume-> smaller combustion chamber-> less manufacturing costs

LOW OPERATING COSTS:

• Little energy consumption (heat value residue can be auto-thermal),

• Few operating personnel Required for full operation.

ENERGY EFFICIENCY: maximum extraction of the potential energy contained in the waste (up to 85%)

ABILITY TO TREAT MIXED WASTE STREAMS:

• The System does not require the separate collection of waste (types/ sizes). System owners/operators no longer are required to sort out Organics. Organic materials are fully processable with our technology and W2E systems. Provides Significant cost reductions in the management of MSW.

• The System does not require a homogeneous waste mix into the incinerator. Only actual identified recyclable products, metals, cardboard, specific plastics, etc. are separated for recycling.

Quantity: Referenced above;

With TECAMS Engineering, Design, and Scalability capabilities, our clients will always be able to adapt and improve on the ever-changing requirements/updates of the Client's MSW Management requirements and goals for the future.

Technologies: Pls See the Attached Technology outline.

Benefits:

Scalability; 99% Clean Emissions; Customed Designed for specific volume requirements; Eliminates further requirements for expansion or additional Development of MSW landfill facilities; Massive Reductions/elimination of Carbon Dioxide and Methane emissions; adaptable to specific locations and Applications; Significant Clean Electric Power production opportunities; the System Does Not require sorting and the specific requirements to dispose of Organics; Provides for the ability to adapt to advancements in Technology applications in the future; Provides the opportunity to remediate and clean up Past and Present landfill operations for the future; today's MSW Technology advancements and

applications will provide a significant, long term Significant Positive Economic Opportunity for our clients.

Challenges:

TECAM Technologies presently operates in Europe, the Middle East, and Asia. In those markets, TECAM meets and exceeds all regulatory requirements in which it operates. Historically the applicable regulations are significantly more restrictive in these locations than US regulations.

Financial Approach: Please review the attached Financial Proposal from our Financial Partner, MPAKT

Implementation Approach:

Infrastructure:

TECAM Environmental Technologies is a Technology Provider and we partner with a leading Design, Engineering and Construction Management firm to provide the highest quality of Project Design, Engineering, and Project Management for the development of the Environmental treatment of various waste streams for the benefit of Miami-Dade County Florida. Concerning the development of MSW solutions for Miami-Dade County, we would work intimately with the clients and their Master Project developer as an MSW Technology applications expert and team member to provide superior operational and technical support for the project's immediate success and the client's future.

Presently, we are at the very early stages of introduction. We have not had the opportunity to discuss, outline, and understand the present status of Miami-Dade County's MSW system, its priorities, possible innovations available, and collaboration opportunities with local and regional communities that may create and provide a comprehensive MSW management program for Miami-Dade

County and their adjacent communities. As a Technical Advisor for Miami-Dade County, we would outline all opportunities/options available based upon the outline of the scope of engagement Miami-Dade County requests of TECAM for MSW management W-2-E solutions, to provide the most comprehensive MSW program to meet Miami-Dade County's present challenges and to develop a long-term plan to meet future projected challenges and goals.

Size Requirements of TECAM MSW Operating Systems:

Referencing previous Information, based upon TECAM Technologies 1, 3-Lane MSW processing system, as a baseline usually requires approx. 4 to 6 acres of space and that includes all logistical requirements exterior building, roads, trucking requirements, access and parking etc. As an example, the requirement of 3, 3-lane MSW processing systems would be approx. 10 to 13 acres. Scalability is the key to long-term MSW site utilization and management. Scalability is critical and is customized to specific designated landfill processing requirements concerning Miami-Dade County's goals.

Site Ownership:

Miami Dade County property.

Permitting:

TECAM Technologies presently operates in Europe, the Middle East, and Asia. In those markets, TECAM meets and exceeds all regulatory requirements in which it operates. Historically the applicable regulations are significantly more restrictive in these locations than US regulations.

Timing of Implementation:

Based upon the activation of a signed contract for the planning, design, and development of Waste to Energy Facilities, and a financial deposit secured for

committed services, Planning, Design, and Buildout of facilities, the first, (Possibly 2 units) of 3-line systems will be operational in approx. 18 to 24 months. As additional systems are required, additional systems and locations can occur simultaneously. (10 Processing Systems could be deployed and operational within a 4-to-six-year period of time).

O&M Carlos & Jose Pls Respond

Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

Health/Safety/Environmental: Jose

Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

TECAM Advance Municipal Solid Waste systems have been designed and are presently operating throughout the EU, Middle east and Asia. These systems are designed to operate within the intimacy of their communities. TECAM's Systems operate at 99% Clean Emissions, No noise emissions outside the operating facility, and without any Odors.

Procurement Model: Jose Input Please

Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, **operation and/or maintenance** of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

2. **Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.**

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

* Consider Utilizing all presently available Miami-Dade County MSW sites.

* Utilizing **Advanced Pyrolysis Waste-to-Energy (WTE)** technologies for the management of **Municipal Solid Waste (MSW)** in **Miami-Dade County, FL** offers several strategic, environmental, and economic benefits. Comparing the **deployment of multiple smaller-scale plants across the county** versus a **single large central facility** highlights key trade-offs, with decentralized approaches offering unique advantages in this specific urban context.

Benefits of Advanced Pyrolysis WTE for MSW Management

1. **Efficient Waste Reduction**
    - Converts up to 90% of organic and plastic-rich waste into usable products.
    - Reduces landfill dependency and extends landfill lifespan.

2. **Energy Recovery**
    - Produces syngas, bio-oil, and char — all of which can be converted to electricity, heat, or biofuels.
    - Offers a renewable alternative energy source, decreasing reliance on fossil fuels.

3. **Lower Emissions**
    - Operates in low-oxygen environments, reducing toxic emissions (e.g., dioxins and furans) compared to incineration.
    - Helps meet climate action goals by reducing methane emissions from landfills.
4. **Material Recovery**
    - Recovers valuable metals and produces carbon-rich char, which can be used in agriculture (biochar), activated carbon, or construction.
5. **Flexibility in Feedstock**
    - Can process mixed MSW, including plastics, biomass, and even tires or sewage sludge.

Multiple Decentralized Plants in Miami-Dade County:

Benefits

Compared to one massive central facility, placing **multiple smaller pyrolysis WTE plants** at strategic locations in the county can provide several benefits:

1. Reduced Transportation Costs & Emissions

- Localized waste processing minimizes the need to truck MSW long distances.
- Cuts down on fuel usage, traffic congestion, and associated emissions.

2. Scalable & Resilient Infrastructure

- Smaller plants can be built faster and adapted more easily to local waste volumes.
- Reduces single-point failure risk (i.e., if one plant goes offline, others can compensate).

3. Improved Community Engagement & Job Creation

- Each plant becomes a community asset, offering local jobs in operations, maintenance, and logistics.
- Easier to incorporate community feedback and adjust operations based on neighborhood needs.

4. Zoning & Site Flexibility

- Smaller facilities may be easier to permit and integrate into industrial or urban zones.
- Can be co-located with existing waste transfer stations to simplify logistics.

5. Environmental Justice

- Avoids concentrating environmental burdens in one location, especially in disadvantaged communities.
- Promotes equitable distribution of infrastructure and services across the county.

Drawbacks of a Single Large-Scale Central Plant

- High Initial Capital Costs & Long Construction Timelines
- Requires Extensive MSW Transport Logistics
- Higher Risk of Community Pushback
- Vulnerable to Operational Disruptions

Strategic Fit for Miami-Dade County

Given **Miami-Dade's large geographic area, growing population, diverse communities, and environmental sensitivity (e.g., sea level rise, landfill constraints)**:

- A **network of pyrolysis micro or mid-scale plants** (e.g., 250 tons 1500/day per site) strategically located in **North, Central, South Dade** could:
    - Optimize waste flow.
    - Promote energy independence.
    - Protect the environment.
    - Enhance climate resilience.

Final Thought

Advanced Pyrolysis WTE offers a next-generation solution for sustainable urban waste management. **Decentralized deployment across Miami-Dade County** is more aligned with modern infrastructure planning — smart, modular, community-integrated, and environmentally conscious.

2TECAM Environmental Engineering

Advanced Waste-to-Energy Solutions for Miami-Dade County, Florida

EXECUTIVE SUMMARY

TECAM Environmental Engineering and New Spectrum Technologies LLC have developed innovative processes and equipment to address one of the primary environmental challenges in the United States: the treatment and disposal of municipal solid waste. This document outlines our proposal for implementing TECAM's Advanced Waste to Energy Pyrolysis technology in Miami-Dade County, Florida to transform waste management operations while generating clean energy and significant environmental benefits.

CONTACT INFORMATION

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INTRODUCTION

New Spectrum Technologies LLC, in partnership with TECAM Technologies, has developed the processes and equipment to solve one of the primary environmental challenges of our time in the United States: the treatment and disposal of polluting municipal solid waste.

TECAM's approach to waste management focuses on transforming waste into valuable energy resources through advanced Waste-to-Energy Pyrolysis technology. Our solutions generate energy in the form of steam, hot water, or electricity, which can be recovered for plant operations and clean electric power market opportunities.

Waste Valorization: TECAM's Waste Treatment Technologies convert municipal solid waste into valuable energy resources with minimal environmental impact. Our advanced waste valorization technologies represent the cutting edge in energy recovery with extremely low environmental impact, generating heat and electricity while ensuring maximum safety for communities and the environment.

Tailor-Made Design Approach: TECAM Engineering provides customized solutions for every client, developing specific components, software, and materials as needed. Our technical experts engage deeply with each project, applying their specialized knowledge to design equipment tailored to each client's unique circumstances and requirements.

CORE TECHNOLOGY: ROTARY KILN CONTROLLED PYROLYSIS

TECAM's standardized Waste-to-Energy solution utilizes High-Temperature Controlled Pyrolysis Systems that can be scaled to meet specific MSW requirements for each location. Our modular approach allows for flexible implementation across various facilities including landfills and transfer stations.

Key System Specifications:

- **Processing Capacity:** A standard 3-line system processes approximately 700 tons daily and 200,000 tons annually
- **Energy Production:** Each 3-line system produces approximately 20-25 MGW of continuous clean electric power
- **Scalability:** Systems can be combined and scaled to meet specific volume requirements
- **Adaptability:** Technology can process diverse waste streams including tires and plastics

- **Space Requirements:** A standard 3-line system requires approximately 4-6 acres including all logistical requirements

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PROPOSED SOLUTION FOR MIAMI-DADE COUNTY

Based on TECAM's analysis of Miami-Dade County's waste management needs, we propose implementing multiple Waste-to-Energy processing systems across key locations:

North Dade Landfill:

- Annual Waste Volume: 766,000 tons/year (based on 2020 HDR MSW Projections through 2029)
- Recommended Implementation: 4 systems (3-line each)
- Benefits:
    - Reduction and elimination of additional MSW deposits into landfill
    - Approximately 80 MGW of continuous clean electric power production
    - Massive reductions in CO_2 and methane emissions
    - 90-95% waste destruction (only 5-10% in ashes)
    - No dioxins or furans emitted

South Dade Landfill:

- Annual Waste Volume: 1,513,000 tons/year (based on 2020 HDR MSW Projections through 2029)
- Recommended Implementation: 6 systems (3-line each)
- Benefits:
    - Reduction and elimination of additional deposits into landfill
    - Approximately 120 MGW of continuous clean electric power
    - Massive reduction in CO_2 and methane emissions
    - 90-95% waste destruction (only 5-10% in ashes)
    - No dioxins or furans emitted

Resource Recovery Facility: We recommend evaluating the strategic reclamation and re-utilization of this property to meet future MSW requirements. Additionally, we suggest exploring the possibility of transforming existing transfer stations into Waste-to-Energy processing locations to minimize hauling expenses and reduce trucking requirements.

COMPETITIVE ADVANTAGES

TECAM's Controlled Pyrolysis plants offer significant advantages over other waste-to-energy technologies:

Maximum Waste Diversion

- 90-95% waste destruction (only 5-10% remains as ash)
- Ability to process organic waste without separation
- Remaining ash can be sold as additives in concrete/asphalt applications

Environmental Safety

- No dioxins or furans in atmospheric emissions or solid residue
- Lower gas volume output compared to other thermal treatment solutions
- Reduced NOx production in the combustion chamber
- Fewer particles in flue gas due to slow combustion in primary chamber
- Extremely quiet operations while in full operation

Lower Investment & Operating Costs

- Smaller combustion chamber due to lower air volume requirements
- Reduced manufacturing costs
- Minimal energy consumption (heat value residue can be auto-thermal)
- Fewer personnel required for full operation

Energy Efficiency

- Maximum extraction of potential energy contained in waste (up to 85%)

Flexible Waste Processing

- No requirement for separate collection of waste by type or size
- No need for homogeneous waste mix in the incinerator
- Only recyclable products (metals, cardboard, specific plastics) need separation
- Full processing capability for organic materials

IMPLEMENTATION APPROACH

Infrastructure Requirements: Each 3-line MSW processing system requires approximately 4-6 acres, including all logistical needs (exterior building, roads, trucking requirements, access, and parking). Multiple systems can be deployed based on capacity needs, with scalability being critical for long-term MSW site utilization and management.

Site Ownership: Operations would be conducted on Miami-Dade County property.

Regulatory Compliance: TECAM Technologies currently operates in Europe, the Middle East, and Asia, meeting and exceeding all regulatory requirements in these

markets. The applicable regulations in these locations are typically more restrictive than US regulations, positioning TECAM well for compliance with local requirements.

Implementation Timeline: Following contract signing and financial commitment:

- First systems (possibly 2 units of 3-line systems) would be operational in approximately 18-24 months
- Additional systems can be deployed simultaneously
- Up to 10 processing systems could be operational within a 4-6 year period

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BENEFITS FOR MIAMI-DADE COUNTY

Implementing TECAM's Waste-to-Energy technology across Miami-Dade County would provide numerous significant benefits:

Environmental Benefits

- 99% clean emissions standards
- Elimination of further requirements for landfill expansion
- Massive reduction/elimination of carbon dioxide and methane emissions
- No noise or odor emissions outside operating facilities

Economic Opportunities

- Significant clean electric power production
- Tax incentive opportunities
- Carbon credits market opportunities
- Revenue from energy production

Operational Advantages

- No requirement for sorting and separate disposal of organics
- Adaptability to future technology advancements
- Opportunity to remediate and clean up existing landfill operations

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STRATEGIC RECOMMENDATION: DECENTRALIZED APPROACH

We recommend implementing multiple smaller pyrolysis WTE plants strategically located across Miami-Dade County rather than a single large central facility. This decentralized approach offers several key advantages:

Benefits of Multiple Decentralized Plants:

1. **Reduced Transportation Costs & Emissions**
    - Localized waste processing minimizes the need to truck MSW long distances
    - Reduces fuel usage, traffic congestion, and associated emissions
2. **Scalable & Resilient Infrastructure**
    - Smaller plants can be built faster and adapted more easily to local waste volumes
    - Reduces single-point failure risk (if one plant goes offline, others can compensate)
3. **Improved Community Engagement & Job Creation**
    - Each plant becomes a community asset, offering local jobs in operations, maintenance, and logistics
    - Easier to incorporate community feedback and adjust operations based on neighborhood needs
4. **Zoning & Site Flexibility**
    - Smaller facilities may be easier to permit and integrate into industrial or urban zones
    - Can be co-located with existing waste transfer stations to simplify logistics
5. **Environmental Justice**
    - Avoids concentrating environmental burdens in one location
    - Promotes equitable distribution of infrastructure and services across the county

Strategic Fit for Miami-Dade County: Given Miami-Dade's large geographic area, growing population, diverse communities, and environmental sensitivity (e.g., sea level rise, landfill constraints), a network of pyrolysis plants (250-1500 tons/day per site) strategically located across North, Central, and South Dade would:

- Optimize waste flow
- Promote energy independence
- Protect the environment
- Enhance climate resilience

CONCLUSION

TECAM's Advanced Pyrolysis Waste-to-Energy technology offers Miami-Dade County a next-generation solution for sustainable urban waste management. Our proposed decentralized deployment approach aligns with modern infrastructure planning principles—smart, modular, community-integrated, and environmentally conscious.

By partnering with TECAM Environmental Engineering, Miami-Dade County has the opportunity to transform its waste management challenges into environmental and economic advantages, setting a new standard for sustainable municipal solid waste management in the United States.

For further information or to discuss implementation details, please contact:

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TECHNICAL DESCRIPTION AND COSTS ESTIMATION

MUNICIPAL WASTE TO ENERGY PLANT

Miami Dade

NE-24164/01

DOCUMENT EDITIONS				
Revision	**Description of changes**	**Edited**	**Revised**	**Approved**
01	Second Edition	David Martin Process Engineer	José Miguel González Engineering Director	Bernat Sala CEO
		07/04/2025	07/04/2025	07/04/2025
00	First Edition	David Martin Process Engineer	José Miguel González Engineering Director	Bernat Sala CEO
		28/03/2025	28/03/2025	28/03/2025

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1. PROJECT BACKGROUND

The present document is being issued in response to the Market Research for Municipal Solid Waste Management Solutions that has been raised by Miami-Dade County.

TECAM firmly believes in the very significant advantages that Thermal Treatment of Solid Waste can provide to the community while, at the same time, significant profits can be obtained from financial perspective by means of Waste Valorization or Waste-to-Energy strategies.

As an example, the present document is referred to the potential Construction and Operation of a Waste-to-Energy Plant, with capacity to treat up to 200,000 Tons of Municipal Solid Waste per year (at a rate of, approximately, 27,000 Kgs/h). This would mean significant reduction of waste having to be sent to and disposed at a landfill while, at the same time, production of electrical energy of up to 22 MWe could be achieved and injected to the electrical grid (based on average LHV of Waste of 3,000 Kcal/Kg), thanks to the installation of Heat Recovery Steam Generators and Steam Turbine, whose purpose would be the obtention of advantage from the high temperatures that Thermal Treatment of Waste are required to work according to.

The technical solution that is described in this document is based on relevant and official norms, standards and regulations, as well as on the knowledge and background from TECAM gained thanks to the experience on several installations referred to Thermal Treatment of Waste (see document “Waste Thermal Treatment and Flue Gas Treatment References February 2025“ for reference).

Main equipment designed and considered for the thermal treatment of Municipal Solid Waste, contributing to a significant reduction of waste to be sent to and disposed at landfill, are:

- Solid handling (three lines of conveyor belt of capacity up to 9,000 kg/h)
- Rotary kiln incinerator (three lines of capacity up to 9,000 kg/h waste inlet with burner)
- Oxidation chamber (three units, 77,000 kg/h flue gas inlet)
- Heat recovery steam generator (three units, 35,000 kg/h of steam outlet at 44 bar(a) and 400ºC)
- Steam turbine (22 MW of electric power generation)
- Gas treatment (three units, chemicals dosing, filtration, fan and stack)

This installation is designed to treat municipal waste. There will be 3 different waste inlets in parallel.

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The rotary kiln is a cylindric rotatory reactor and is designed to treat waste and it starts the oxidation of organic compounds giving a minimum residence time between 45 to 90 minutes at 650ºC. Then, the flue gas is generated and sent to oxidation chamber.

The oxidation chamber eliminates the hazardous compounds giving a minimum residence time over 2 seconds in the oxidation chamber assuring and operating temperature of 850 ºC.

In this two equipment (rotary kiln and oxidation chamber) are prepared to extract flying ashes and will be sent to the ash silo.

In addition, the whole installation will be autosufficient in terms of electric consumption due to its steam turbine generation up to 20.5 MW of electric power.

2. SCOPE OF MAIN PROCESS EQUIPMENT

The facility will consist of three lines composed of three main processing units (incineration, heat recovery, and gas treatment), feeding to a common unit composed of steam turbine and auxiliaries.

The aforementioned main processing units are responsible for the following:

- Rotary kiln incinerator and secondary combustion chamber: This unit is responsible for oxidizing the inlet product and generating the flue gas which will be sent to the secondary chamber to give enough residence time to be completely oxidized.
- Heat recovery steam generator: This unit is responsible for taking profiter the energy of the flue gas and producing superheated steam which will be sent to the turbine.
- Gas treatment: This unit is responsible for treating all the flue gas coming from the HRSG in order to be emitted to atmosphere without any pollutant.
- Steam turbine: This unit is responsible for producing electricity from superheated steam.

More specifically, the equipment composing each unit will be:

- For each one of the 3 units 200 – Rotary kiln package
    - 1 Conveyor Belt.
    - 1 Reception Hopper, including isolating valves on its discharge.
    - 1 Feeding Screw Conveyor driven by moto-reducer with frequency converter.
    - 1 Ash Cooler Screw Conveyor.

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- 1 Rotatory with all associated equipment and instruments for the proper working of the unit, including associated Burner and Burner Fan.
- 1 Oxidation Chamber, including associated Burners and Burners Fans.
- 1 Combustion Air Fan.
- 1 Ash Cooler and associated Rotary Discharge Valve.

- For each one of the 3 units 300 – Heat recovery package
  - 1 Heat Recovery Steam Generator with all equipment involved.
- For each one of the 3 units 400 – Flue gas treatment package
  - 1 Bag Filter.
  - 1 Reactor Mixer.
  - 1 Stack.
  - 1 Main Fan.
  - 2 Transport Fans.
  - 1 Ashes Hopper.
  - 3 Screw Conveyors for proper handling, respectively, of NaHCO3, Active Carbon and Bag Filter Discharge.
  - Rotary Valves for the discharge of silos and hoppers.
- For unit 500 – Steam turbine package
  - 1 Steam Turbine.
  - 1 Steam Turbine Condenser.
  - 1 Preheater.
  - 1 Cooling Water Pump.
  - 2 Boiler Feedwater Pumps.
  - 1 Cooling Tower.
  - 1 Deaerator.
- Instrumentation, field control cabinets, instrumentation cables and trays for the above mentioned items.

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3. DESIGN BASIS

This section summarizes the main parameters taken into consideration in the design of the waste to energy valorization facility described in this Proposal.

AMBIENT CONDITIONS

Regarding the ambient conditions of the chosen location, the facility has been designed according to the following assumptions.

PARAMETER	UNITS	MINIMUM	AVERAGE	MAXIMUM
Location	United States			
Air relative humidity	%	90 (estimated)		
Absolute pressure	mbar	1.013,25		
Average wind velocity	m/s	To be defined in next phase		
Maximum wind velocity for gusts	m/s	To be defined in next phase		
Seismic risk factor	m/s^2	To be defined in next phase		
Snow load	mm	To be defined in next phase		

Note- All these data shall be confirmed by Client

MAIN DESIGN PARAMETERS

The incinerator plant has been designed with the following data. There are some information that TECAM has estimated (due to lack of information) and this data shall be confirmed by Client in the next phase of the project in order to design with more precision and accuracy.

DESIGN PARAMETERS	VALUE	UNITS
Rotary kiln and combustion chamber		
Design flowrate (municipal waste)	3 x 9,000	Kg/h
Design Low Heating Value (LHV) (estimated by TECAM)	3,000	Kcal/kg
Rotary kiln operating temperature (1st combustion chamber)	650	ºC
Solid waste residence time	45 to 90	Min
Number of Rotary Kilns	3	Unit
Fuel for burners	Natural gas	-
Oxidation chamber		
Oxidation chamber operating temperature (2nd combustion chamber	850	ºC
Minimum residence time in combustion chamber	> 2	s

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DESIGN PARAMETERS	VALUE	UNITS
Number of Oxidation Chambers	3	Unit
Fuel for burners	Natural gas	-
Heat Recovery Steam Generator		
Expected working hours per day	24	h
Number of HRSG	3	Unit
Design flue gas flowrate per unit	77,000	Kg/h
Superheated steam produced per unit	35,000	Kg/h
Superheated steam operating pressure	44	Bar (a)
Superheated steam operating temperature	400	ºC
Steam turbine power generation		
Turbine type	Condensation	
Expected working hours per day	24	H
Number of turbines	1	Unit
Inlet steam pressure	44	bar (a)
Inlet steam temperature	408	ºC
Outlet steam pressure	0.1	bar (a)
Maximum electrical power produced	22	MW-e

EMISSION LIMITS

Atmospheric emissions arising from the production process will comply with the Emission Limit Values (ELV) as shown below:

POLLUTANTS	UNITS	EMISSION LIMIT VALUES (daily average)(*)
Dust	mg/Nm^3	10
HCl	mg/Nm^3	10
TOC	mg/Nm^3	10
CO	mg/Nm^3	50
HF	mg/Nm^3	1
SO_2 / SO_3	mg/Nm^3	50
NO_x	mg/Nm^3	200
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	mg/Nm^3	0,5
Hg	mg/Nm^3	0,05
Cd+Tl	mg/Nm^3	0,05
Dioxins/furans	$TEGng/Nm^3$	0,1

(*) Values referred to standar conditions at 101.325 kPa, 0ºC (273K), 11% de O2, dry basis.

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LOCATION

Plant will be installed in Miami State, United States.

A preliminary layout could be provided as reference, if specifically requested.

4. MAIN GOALS ACHIEVED

Thanks to the installation and operation of the proposed MSW Thermal Treatment Plant, the following goals will be achieved

MAIN GOALS ACHIEVED	UNITS	COMMENTS
MSW handled and treated at the proposed plant	200,000 Tons/year	
MSW not landfilled thanks to the proposed plant	180,000 Tons/year	Estimation: up to 10% of bottom and flying ashes to be extracted from Thermal Treatment Process, including unburnable materials such as glass and metals
Yearly electricity production	165,000 Kwh	Based on average production of 22 MW, during 7,500 hours/year
Carbon footprint reduction	65,000 Tons/year of CO2	Methane production for 180,000 Tonnes of waste landfilled equal to 5,400 Tonnes (0.03 tonnes of methane per ton of MSW. Equivalent CO2 would be 135,000 Tons (warming potential of methane is 25 times greater than CO2). Estimated CO2 production of the Plant is 70,000 Tons of CO2. Difference is the total carbon footprint reduction associated to the technology proposed.

5. PROCESS DESCRIPTION

As stated before, the process will consist of three main processes:

- ✓ Three (3) Incinerator Package Units
- ✓ Three (3) Heat Recovery Steam Generator Package Units
- ✓ Three (3) Gas Treatment Package Units
- ✓ One (1) Steam Turbine Package Unit

Both the main processes and and the auxiliary will be described in depth in the following sections.

In addition, Process Flow Diagrams (PFD) could be provided as reference, if specifically requested.

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ROTARY KILN INCINERATOR (1st COMBUSTION CHAMBER)

The feedstock to the oxidation process is supplied by gravity from a feeding hopper, that discharge product into the rotary kiln through an automatic slide gate sluice. This feeding hopper will be filled with product by screw conveyors (feeding screw) that collect the inlet waste from the discharge of the conveyor belt.

The rotary kilns will consist in a steel drum rotating inside a refractory lined.

Inside the rotary kiln, there will be temperatures around 600 – 650ºC. This will allow volatile compounds to be gasified and sent to the secondary oxidation chamber. The solids will have a residence time around 45 to 90 minutes in order to facilitate the oxidation. There will be solids which will not be able to be oxidized, then, the ash conveyor at outlet will be extracting this inert ashes.

OXIDATION CHAMBER (2nd COMBUSTION CHAMBER)

The flue gas coming from the rotary kiln is sent to the vertical combustion chamber. This chamber has a minimum volume that allows the flue gas to be completely oxidated. This equipment is designed with a minimum residence time of 2 seconds and an operating temperature of 850ºC. It has been decided this temperature due to europeen normative that obliges this residence time and its temperature in order to assure the completely elimination of hazardous compunds. The flue gas will raise from bottom to top.

In the bottom part, there will be 2 natural gas burners which will keep the temperature at 850ºC. This burners will have an associated burner fan to keep the minimum oxygen content on the flue gas.

The will be foreseen an ashes conveyor at bottom of the oxidation chamber. There will be the same working principle of the ash conveyor in the rotary kiln.

HEAT RECOVERY STEAM GENERATOR (HRSG)

The flue gas coming from the oxidation chamber will be sent to the heat recovery steam generators. The HRSG will produce approximately 33.6 t/h of steam at 44 bar (a) and 400ºC. The superheated steam will be sent to a steam turbine that will harness the energy of the steam to produce electricity.

The heat recovery unit consists of two main units:

- ✓ Steam boiler: consisting of a watertube boiler with evaporators, superheaters, and economizers.

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- ✓ Water-steam cycle. Consisting of a deaerator vessel and its pumps, condensates tank and its associated pumps.
- ✓ Urea injection to reduce NOx: There will be injected a urea solution in the boiler.

STEAM TURBINE

The superheated steam produced at the steam boiler will be sent to a steam turbine which is expected to generate up to 22 MW of electricity. The superheated steam conditions used in the turbine are 44 bar (a) and 400 °C.

FLUE GAS TREATMENT

The flue gas coming from the steam boilers will be sent to a gas treatment unit consisting in several consecutive treatment stages. First, various chemicals will be injected into the flue gas in order to neutralize the acid gases contained in the gas stream, as well as remove the heavy metals. After the chemicals injection, the flue gas passes through a baghouse filter that will retain the particles resulting from the neutralization and adsorption of metals, and unreacted chemicals. After being neutralized and filtered, the flue gas is released to the atmosphere through the stack.

Each of the flue gas treatment stages are described in detail in the following sections.

- ✓ Dry chemical dosing: In order to neutralize the acidic compounds (HCl, HFand SOx) and adsorb the heavy metals that the flue gas might carry, sodium bicarbonate and active carbon will be injected into the flue gas stream leaving the boiler.
- ✓ Reactor mixer: In order to maximize the efficiency of the flue gas treatment process, the system will include a Reactor-Mixer unit. The Reactor-Mixer will foster the contact between chemicals and flue gas by increasing the turbulence of the gas flow. In addition, the reactor will increase the residence time of the gases, promoting a longer contact time between flue gas and chemicals, thus resulting in a higher efficiency of the process.
- ✓ Bagfilter: The exhaust gases from the mixing reactor are redirected to the baghouse filter, where dust particles, acidic compounds, heavy metals, dioxins and furans are removed from the process gas.
- ✓ Ash silo: In different equipment of the installation, there is foreseen an ash pneumatic transport to an ash silo. In this ash silo, there will be stored all ashes from the plant. Then, a truck will collect this ash and take it to a landfill.

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- ✓ Main fan: An induced draft fan will force the flue gas to circulate through the different elements of the installation from rotary kiln to the bagfilter. This main fan will create a negative pressure throughout the installation, forcing the flue gas to circulate through the entire treatment process, and preventing any risk of leakage into the atmosphere and thus, possible diffusion of emissions.
- ✓ Stack with CEMS: Cleaned gas will be sent through a stack (25m height and 1m diameter). The gas will be monitored by a CEMS which will control the concentrations of some pollutants such as NOx, O2, CO, SO2, HCl, Total Organic Compounds and solid particles.

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6. PROJECT EXECUTION

As reference, a Project Execution Programme is provided, see document “NE-24164.G.R.001 Rev00 Project Programme”.

7. CAPITAL INVESTMENT

In principle, a plant of this type and size may require an Initial Investment which, as order of magnitude, is shown below:

CAPITAL INVESTMENT REQUIRED	
Process Equipment (Waste to Energy Plant)	**170,000,000 USD€**
Balance of Plant (Fire Fighting, Utilities, etc)	**15,000,000 USD**
Civil Works (Office Building, Roadways, Gardening)	**45,000,000 USD**

8. LIST OF ANNEXES

The following documents are annexed to the present proposal, forming the complete documentation package the description of content and characteristics of the quoted scope of goods and services:

- NE-24164.G.R.001 Rev00 Project Programme
- NE-24164.N.D.001 Rev00 Preliminary Layout
- Waste Thermal Treatment and Flue Gas Treatment References February 2025

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Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

MPAKT has partnered globally to create the highest level of flexibility, assurance, verification, & value for renewable infrastructure finance & bonding related to global renewables, energy, mining, & commodities infrastructure projects. Any project, or underlying asset, line of revenue, or valued commodity can be securitized and financially de-risked with a 5-30-year horizon & backed by globally regulated exchange capital partners. This is a novel offering not available anywhere else in this structure. The offering is a groundbreaking comprehensive financing and data solution for smart bonds, designed for global renewables, energy, mining, and commodities infrastructure projects.

The MPAKT offering, in conjunction with our global partners, revolutionizes project-driven renewable infrastructure bonding & data with the following highlights:

- **Unprecedented 80-100% repayment guarantees and political risk assurance through global insurance leaders**
- **Highest credit rating possible thanks to financial and political repayment guarantee's & assurances**
- **Streamlined "Infrastructure as an "Asset Class" project bonds, simplifying complex contracts**
- **Pioneering green infrastructure AI, tailored to specific project locations**
- **Cutting-edge project data valuation, intelligence, and outcome projections**
- **Verifiable, "from source", data collection that tracks and helps monetize all credits (carbon, REC's, RIN's, Water, Grid, & Tax) that can be utilized as securitizable or tokenized assets**
- **Industry-first, 360° view of sustainability-driven outcomes, based on source data**
- **Enhanced liquidity via secondary market access**
- **Flexible, up to 30-year amortization with lower cost of capital & amortization**
- **Optionality of debt or equity financing**
- **Capital "Grey Market" with large global**

With this unparalleled level of flexibility, assurance, verification, and value, any project, asset, revenue stream, or commodity can be securitized and financially de-risked, backed by global leaders and a 30-year horizon.

For example:

On the Miami-Dade project the following benefits would apply:

- **Access to private capital markets would be available if needed. Large scale PE, banking, & pension funds are a part of our partners grey market capital access**
- **Funding can come from any source; public, private, or hybrid so multiple sources can be utilized to fulfill project needs**
- **The available "repayment guarantee" can mitigate risk as seen with the Coventa plant**
- **Political guarantees can mitigate against changing political climates & regulatory environments**
- **The environmental & tax benefits can be fully realized, verified, & monetized through our platform**
- **The cost of capital structure is built specifically for projects such as these and lowers the risk of potential project failure**
- **The financial guarantees along with the environmental outcomes makes Miami Dade a leader in the US, and globally, in deploying W2E infrastructure to both reclaim land from waste & create a circular energy economy for its citizens**

- **The intelligence from the connected W2E plants can be used to create the most efficient, and impactful, renewable deployments anywhere and optimize financial environmental outcomes**

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Brian: You / Tecam will have to describe this portion from an energy production, and waste Savings, perspective:

Following is a conservative outcome for environmental credits available in Florida only based on the deployment methodology outlined in this proposal. It can be further optimized with additional carbon capture, microgrid, and energy solutions. A deeper dive is needed but this is a generalized framework for the available credit avenues in regards to annual value.

Based on standing project details: 10-12 plants, 2.2 million tons of waste processed annually, 200 MW of continuous clean power (1.93 million MWh/year), and emissions claimed as 99% clean (no CO2, no methane, only steam—though this is critiqued below). Assumption is that carbon capture is added to align with credit eligibility, refining the estimates accordingly.

Step 1: Updated Assumptions with Carbon Capture

- **Carbon Capture Addition**: Assume carbon capture and storage (CCS) is retrofitted to capture CO2 from W2E combustion. Typical W2E emissions are 0.8–1.2 tons CO2/ton of waste. Using 1 ton CO2/ton (midpoint), 2.2 million tons of waste could emit 2.2 million tCO2/year without CCS. With

90% capture efficiency (industry standard), 1.98 million tCO2/year is captured.

- **Power Output**: Remains 1.93 million MWh/year (200 MW continuous).
- **Fuel Production**: For 45Z eligibility, assume a portion of waste is converted to renewable natural gas (RNG) or syngas as a transportation fuel, alongside electricity. Estimating conservatively, 10% of waste (220,000 tons/year) could yield ~50 million gallons of RNG (based on ~225 gallons/ton conversion rates from biogas processes).
- **Emissions**: Original "no CO2" claim is unrealistic without CCS. With CCS, 90% of CO2 is captured, leaving 0.22 million tCO2/year emitted.

Step 2: Renewable Energy Credits (RECs)

- **Volume**: 1.93 million RECs/year (1 REC = 1 MWh).
- **Value**: $5–$10/REC (voluntary market in Florida).
    - $9.6M–$19.3M/year (unchanged from prior estimate).

Step 3: Carbon Capture Credits (Section 45Q)

The federal 45Q tax credit incentivizes carbon capture and sequestration. Eligibility requires capturing at least 100,000 tCO2/year from industrial sources like W2E, which this project exceeds.

- **Volume Captured**: 1.98 million tCO2/year.
- **Credit Rate**: $50/tCO2 (2025 rate, inflation-adjusted from 2022 base of $36/tCO2, per IRS guidelines, assuming ~3% annual increase).
- **Value**: 1.98M tCO2 × $50 = $99M/year.
- **Duration**: 12 years after CCS equipment is placed in service, totaling ~$1.19B over the period, assuming consistent capture.

Step 4: 45Z Clean Fuel Production Tax Credit

The 45Z credit, effective January 1, 2025, supports clean transportation fuel production (e.g., RNG) with emissions below 50 kg CO2e/mmBtu. Available until 2027, it requires IRS registration by 2024.

- **Fuel Volume**: 50 million gallons/year of RNG.
- **Emissions Factor**: RNG from W2E typically has a carbon intensity of 10–20 kg CO2e/mmBtu with CCS (vs. 50 kg threshold). Assume 15 kg CO2e/mmBtu.
- **Credit Calculation**: $1/gallon base rate (assuming prevailing wage/apprenticeship met), adjusted by emissions factor: (50 – 15) ÷ 50 = 0.7 multiplier. Credit = $1 × 0.7 = $0.70/gallon.
- **Value**: 50M gallons × $0.70 = $35M/year.
- **Total (2025–2027)**: $35M × 3 = $105M (assuming steady production).

Step 5: Other Credits Available in Florida

1. **Section 48 Investment Tax Credit (ITC)**:
    - Applies to CCS equipment costs. Assume $200M/plant for CCS retrofits across 11 plants = $2.2B total cost. ITC offers 30% credit if wage/apprenticeship requirements are met (6% otherwise).
    - Value: 30% × $2.2B = $660M (one-time credit, claimed in year equipment is placed in service).

- Note: Cannot double-claim ITC and 45Q on the same equipment; ITC applies to initial investment, 45Q to captured CO2.

2. **Florida Renewable Energy Production Credit (F.S. 220.193)**:
    - Offers $0.01/kWh for renewable electricity sold to utilities, capped at $5M/year statewide (prorated if oversubscribed). For 1.93M MWh (1.93B kWh):
        - Potential: 1.93B kWh × $0.01 = $19.3M/year.
        - Adjusted: Likely prorated to ~$0.5M–$1M/year per project due to cap and competition.
3. **Local Incentives**:
    - Miami-Dade may offer property tax abatements or expedited permitting for sustainable projects (e.g., under its Green Building Program), but these are site-specific and not quantified here.

Step 6: Total Credit Volume and Value

- **Annual Credits**:
    - RECs: $9.6M–$19.3M.
    - 45Q: $99M.
    - 45Z: $35M (2025–2027).
    - Florida Credit: $0.5M–$1M.

    - Total Annual: $144.1M–$154.3M (2025–2027, with 45Z); $109.1M–$119.3M post-2027.
- **One-Time Credits**:
    - ITC: $660M.
- **Lifetime Value (12-Year 45Q Period)**:
    - RECs: $115.2M–$231.6M.
    - 45Q: $1.19B.
    - 45Z: $105M (3 years).
    - Florida Credit: $6M–$12M.
    - ITC: $660M.
    - Total: $2.08B–$2.2B.

Critical Analysis

- **Emissions**: Adding CCS aligns with 45Q and 45Z but contradicts the "no CO2" claim. Realistically, uncaptured CO2 (0.22M tCO2/year) remains, requiring verification for credit integrity.
- **45Z Feasibility**: RNG production needs separate processing infrastructure, increasing costs (~$50M–$100M/plant). Eligibility hinges on lifecycle emissions analysis (e.g., GREET model).
- **Market Risks**: REC and carbon credit prices fluctuate; 45Q requires geologic storage sites, potentially limited in Florida (saline aquifers exist but need permitting).

Final Estimate

- **Volume**: 1.93M RECs, 1.98M tCO2 (45Q), 50M gallons RNG (45Z), plus minor Florida kWh credits.

- **Value**: $144.1M–$154.3M/year (2025–2027), $109.1M–$119.3M/year thereafter, plus $660M one-time ITC. Lifetime: $2.08B–$2.2B.
- **Recommendation**: Pursue CCS for 45Q, pilot RNG for 45Z, and secure ITC for equipment. Validate emissions and register with IRS by 2024 for 45Z.

This maximizes credits, leveraging federal and Florida incentives, though technical and regulatory hurdles require detailed planning.

The following outlines a conservative financial projection for environmental credits attainable within Florida, derived solely from the deployment methodology specified in this proposal. Optimization is feasible with the integration of additional carbon capture, microgrid, and energy solutions. Further analysis is recommended, however, this serves as a generalized framework for potential annual credit streams.

Building upon the previous evaluation concerning the waste-to-energy (W2E) project located in Miami-Dade County, Florida, this revision incorporates carbon capture for credit eligibility, the 45Z Clean Fuel Production Tax Credit, and other pertinent credits available within Florida. The fundamental project parameters remain consistent: 10-12 plants, an annual processing capacity of 2.2 million tons of waste, a consistent output of 200 MW of clean power (1.93 million MWh/year), and an initial claim of 99% clean emissions (absent of CO2 and methane, emitting solely steam—subject to subsequent critique). The implementation of carbon capture, to meet credit requirements, is assumed, with corresponding adjustments to the estimates.

Step 1: Refined Assumptions Incorporating Carbon Capture

- **Carbon Capture Integration**: It is postulated that carbon capture and storage (CCS) is retrofitted to sequester CO2 from W2E combustion. Typical W2E emissions range from 0.8 to 1.2 tons CO2 per ton of waste. Employing a midpoint of 1 ton CO2 per ton, 2.2 million tons of waste would yield 2.2

million tCO2 annually without CCS. With a 90% capture efficiency, a recognized industry standard, 1.98 million tCO2 is captured annually.

- **Power Generation**: Maintained at 1.93 million MWh per year (200 MW continuous).
- **Fuel Generation**: For eligibility under 45Z, it is assumed that a portion of waste is converted into renewable natural gas (RNG) or syngas for utilization as a transportation fuel, in conjunction with electricity generation. Conservatively estimating, 10% of waste (220,000 tons annually) could produce approximately 50 million gallons of RNG (based on a conversion rate of approximately 225 gallons per ton derived from biogas processes).
- **Emissions**: The original assertion of "no CO2" is deemed unrealistic without CCS. With the incorporation of CCS, achieving 90% CO2 capture, the residual emission is 0.22 million tCO2 per year.

Step 2: Renewable Energy Certificates (RECs)

- **Volume**: 1.93 million RECs per year (1 REC equates to 1 MWh).
- **Valuation**: $5 to $10 per REC (voluntary market in Florida).
- Valuation: $9.6M to $19.3M per year (consistent with previous estimate).

Step 3: Carbon Capture Credits (Section 45Q)

The federal 45Q tax credit provides incentives for carbon capture and sequestration. Eligibility requires the capture of a minimum of 100,000 tCO2 per year from industrial sources, such as W2E, a threshold exceeded by this project.

- **Captured Volume**: 1.98 million tCO2 per year.

- **Credit Rate**: $50 per tCO2 (2025 rate, adjusted for inflation from a 2022 base of $36 per tCO2, in accordance with IRS guidelines, assuming an annual increase of approximately 3%).
- **Valuation**: 1.98 million tCO2 multiplied by $50 equals $99 million per year.
- **Duration**: 12 years post-commissioning of CCS equipment, totaling approximately $1.19 billion over the designated period, assuming consistent capture.

Step 4: 45Z Clean Fuel Production Tax Credit

The 45Z credit, effective from January 1, 2025, supports the production of clean transportation fuels (e.g., RNG) characterized by emissions below 50 kg CO2e/mmBtu. Available until 2027, it necessitates IRS registration by 2025.

- **Fuel Volume**: 50 million gallons of RNG per year.
- **Emissions Factor**: RNG derived from W2E typically presents a carbon intensity of 10 to 20 kg CO2e/mmBtu with CCS (compared to a 50 kg threshold). Assume 15 kg CO2e/mmBtu.
- **Credit Calculation**: $1 per gallon base rate (assuming fulfillment of prevailing wage and apprenticeship requirements), adjusted by the emissions factor: (50 – 15) divided by 50 equals 0.7 multiplier. Credit equals $1 multiplied by 0.7, totaling $0.70 per gallon.
- **Valuation**: 50 million gallons multiplied by $0.70 equals $35 million per year.
- **Total (2025–2027)**: $35 million multiplied by 3 equals $105 million (assuming sustained production).

Step 5: Additional Credits Available in Florida

1. **Section 48 Investment Tax Credit (ITC)**: Applies to CCS equipment costs. Assume $200 million per plant for CCS retrofits across 11 plants, totaling $2.2 billion in costs. The ITC provides a 30% credit contingent upon meeting wage and apprenticeship requirements (6% otherwise). Valuation: 30% multiplied by $2.2 billion equals $660 million (a one-time credit, claimed in the year equipment is placed in service). Note: Concurrent claiming of ITC and 45Q on the same equipment is prohibited; ITC pertains to initial investment, 45Q to captured CO2.
2. **Florida Renewable Energy Production Credit (F.S. 220.193)**: Offers $0.01 per kWh for renewable electricity sold to utilities, capped at $5 million per year statewide (prorated in the event of oversubscription). For 1.93 million MWh (1.93 billion kWh): Potential: 1.93 billion kWh multiplied by $0.01 equals $19.3 million per year. Adjusted: Likely prorated to approximately $0.5 million to $1 million per year per project, due to the cap and competitive landscape.
3. **Local Incentives**: Miami-Dade County may offer property tax abatements or expedited permitting for sustainable initiatives (e.g., under its Green Building Program), but these are site-specific and not quantified herein.

Step 6: Aggregate Credit Volume and Valuation

- **Annual Credits**: RECs: $9.6 million to $19.3 million. 45Q: $99 million. 45Z: $35 million (2025–2027). Florida Credit: $0.5 million to $1 million. Total Annual: $144.1 million to $154.3 million (2025–2027, with 45Z); $109.1 million to $119.3 million post-2027.

- **One-Time Credits**: ITC: $660 million.
- **Lifetime Value (12-Year 45Q Period)**: RECs: $115.2 million to $231.6 million. 45Q: $1.19 billion. 45Z: $105 million (3 years). Florida Credit: $6 million to $12 million. ITC: $660 million. Total: $2.08 billion to $2.2 billion.

Critical Analysis

- **Emissions**: The incorporation of CCS aligns with 45Q and 45Z, yet contradicts the assertion of "no CO2." Realistically, residual uncaptured CO2 (0.22 million tCO2 per year) remains, necessitating verification for credit integrity.
- **45Z Feasibility**: RNG production requires separate processing infrastructure, incurring additional costs (approximately $50 million to $100 million per plant). Eligibility hinges upon lifecycle emissions analysis (e.g., GREET model).
- **Market Risks**: REC and carbon credit pricing exhibits volatility; 45Q mandates geologic storage sites, which may be limited in Florida (saline aquifers are present but necessitate permitting).

Final Estimate

- **Volume**: 1.93 million RECs, 1.98 million tCO2 (45Q), 50 million gallons of RNG (45Z), alongside nominal Florida kWh credits.
- **Valuation**: $144.1 million to $154.3 million per year (2025–2027), $109.1 million to $119.3 million per year thereafter, with a one-time ITC of $660 million. Lifetime Valuation: $2.08 billion to $2.2 billion.

Recommendation: Pursue CCS for 45Q eligibility, pilot RNG production for 45Z compliance, and secure the ITC for equipment. Conduct emission validations and finalize IRS registration by 2025 for 45Z.

TECAM's Rotary Kiln Controlled Pyrolysis.

WASTE TO ENERGY SOLUTIONS

TECHNOLOGY PRESENTATION

TECAM's High Temperature Controlled Pyrolysis

A CLEAN AND EFFICIENT TECHNOLOGY TO ELIMINATE INDUSTRIAL AND HAZARDOUS WASTE.

THE ONLY TECHNOLOGY WITH REAL REFERENCES IN N.O.R.M. RESIDUES (Natural Occurred Radioactive Materials) THERMAL TREATMENT.

TECAM
Environment. Technology. Efficiency.

Any type of residue can be treated by controled pyrolysis.

Solids

- Industrial waste
- Hospital waste
- General waste
- Fuel derived residues
- Urban waste

Liquids and pastes

- Contaminated oils
- Contaminated water
- Organic liquids and solvents
- Oil sludge
- Water treatment plants sludge

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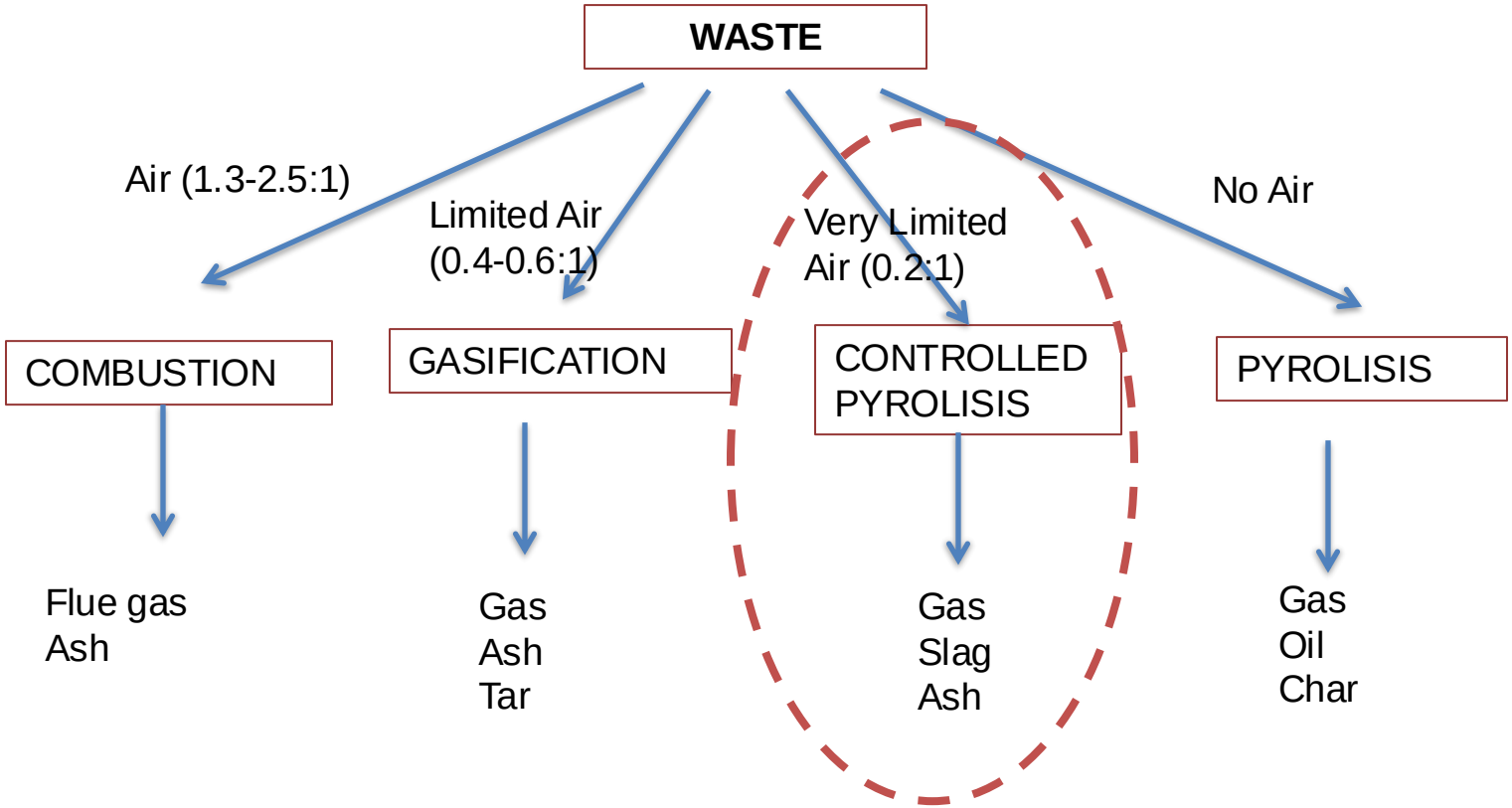
What is Controlled Pyrolysis?

Controlled Pyrolysis is a thermal-destruction method that combines the best of Pyrolysis with the best of Direct Incineration.



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Which are the main competitive advantages of TECAM's Controlled Pyrolysis plants in front of other WTE technologies?

MAXIMUM WASTE DIVERSION:

- 90 to 95% waste destruction (5 to 10% in ashes)
- the ashes can be reused as additives in concrete.

ENVIRONMENT SAFETY: the facilities can be located beside residential areas..

- no dioxins and furans in the atmosphere emissions nor in the solid residue.
- less gas volume as an output that other thermal treatment solutions
- less production of NOx in the combustion chamber (totally removed with the Flue Gas Treatment unit)
- less particles in the flue gas due to the slow combustion in the primary chamber

LOWER INVESTMENT: less air volume -> smaller combustion chamber -> less manufacturing costs

LOW OPERATING COSTS:

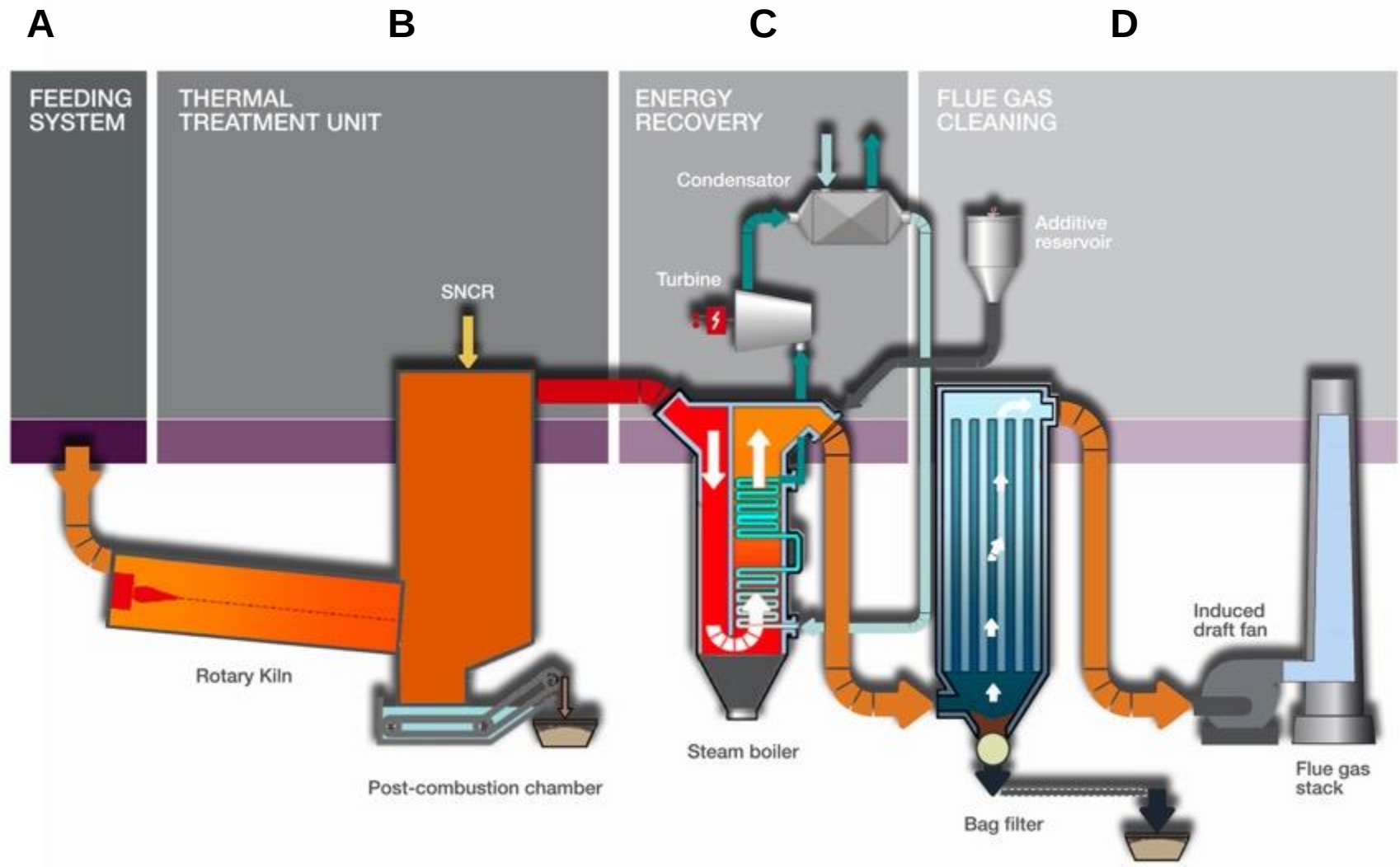
- Little energy consumption (heat value residue can be autothermal),
- few operation personnel (just 2 people needed)

ENERGY EFFICIENCY: maximum extraction of potential energy contained in the waste (up to 85%)

ABILITY TO TREAT MIXED WASTE STREAMS:

- does not require separate collection of waste (types/ sizes),
- does not need homogeneous mix into the incinerator

Which are the parts of a Controlled Pyrolisys plant for waste treatment?



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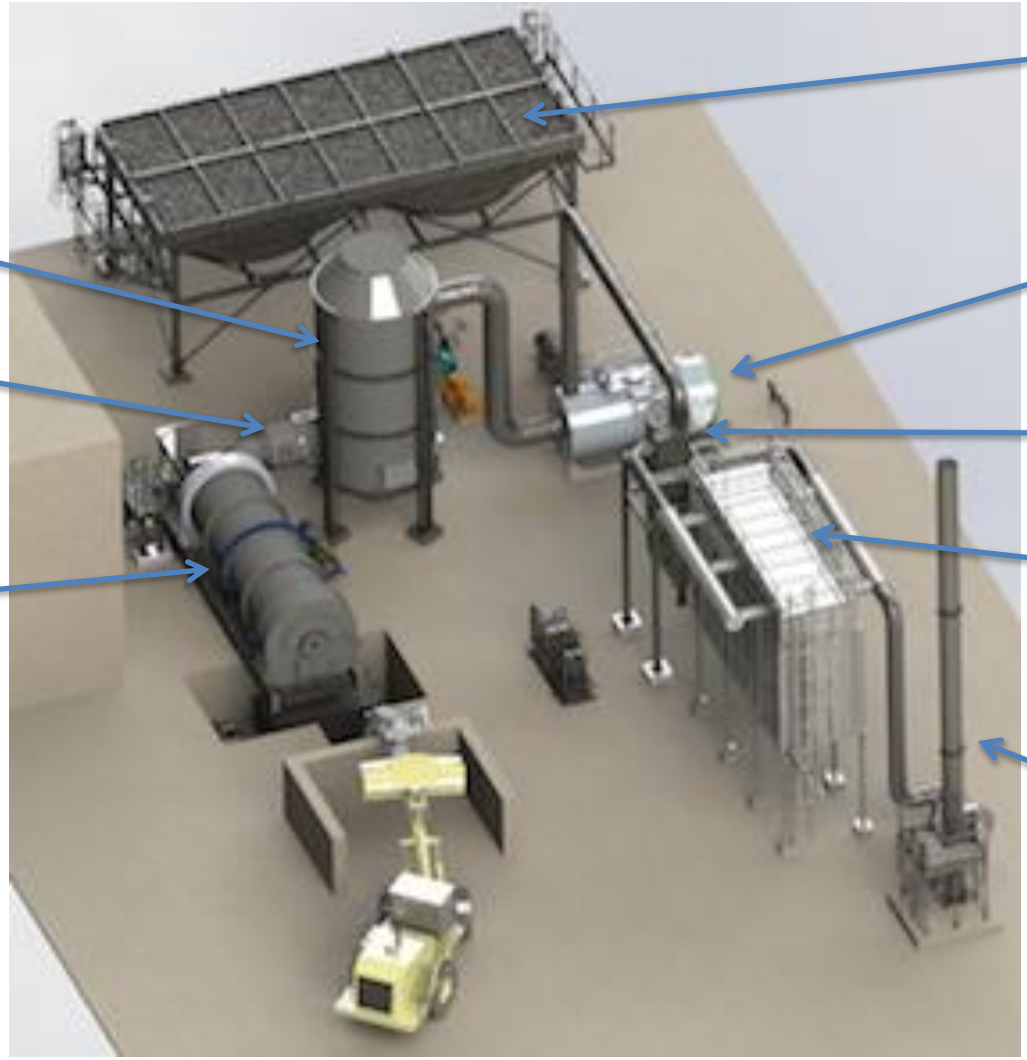
Which are the main parts of a Controlled Pyrolisys plant for waste treatment?



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A. Feeding system

1. SOLIDS: **ram feeder**
2. LIQUIDS: **direct injection** inside the combustion chamber
3. SLUDGES: **screw conveyor**

ram feeder

Drum turner

Special case: Drums

- Crusher + conveyor solution for **sludges/ paints**.
- **Drum turners**
- Cabinets for **inert atmosphere** for **explosive residues**.

screw conveyor

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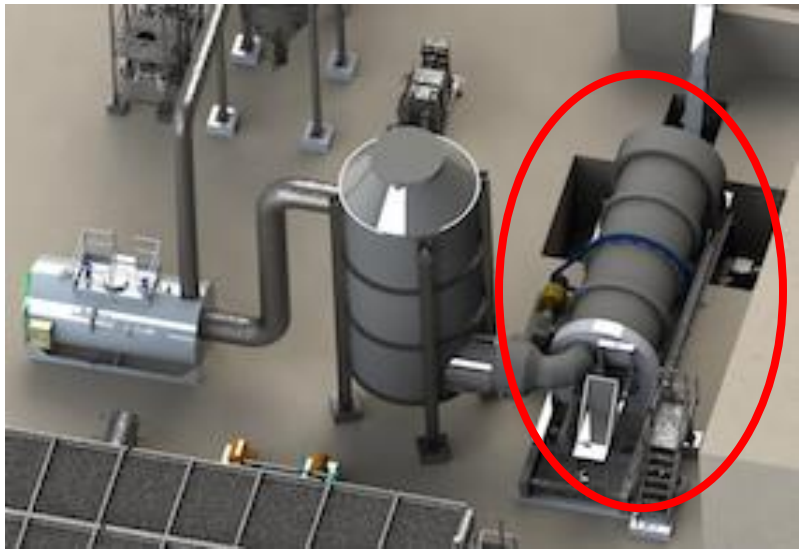
B. Thermal treatment

B1. High temperature primary pyrolitic chamber

Main characteristics

- 10% of combustion
- T = 850 ºC
- 20% oxygen (of the Stoichiometry requirements)
- output: 90-98% syngas + 2-10% slag
- kiln: rotary or static



Highlights

- no liquid tar fractions formed
- no dioxines or furans in the slag (just in the syngas), so it can be further reused
- sludges do not stick to the wall thanks to special technologies
- low energy consumption
- less than 3% of carbon in the slag

B. Thermal treatment

B2. Afterburner

Main characteristics

- 60% of combustion
- Syngas mixed with air
- Combustion from 850 ºC to 1100 ºC (for hazardous waste)

Highlights

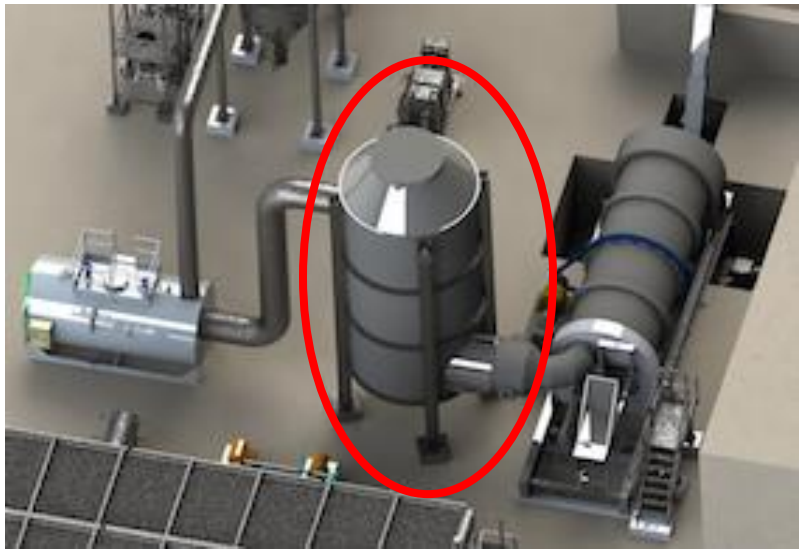
- it is not necessary for distillation of the different gases (expensive and troublesome)
- maximum burning efficiency by creating gas turbulences
- can be autothermal

B. Thermal treatment

B3. Secondary combustion chamber

Main characteristics

- 30% of combustion
- Temperature: 850 to 1100 ºC
- Residence time: > 2 seconds



Highlights

- complete dioxins and furans destruction (99.99%)
- high thermal capacity of the off-gases, that can be used
- > 6% of O_2 at the outlet (guarantees 100% C combustion)

C. Energy recovery

Steam generator

Main characteristics

- Flue gases in Temperature: 1100 ºC to 850 ºC
- Cooling systems: no quench towers (no efficiency, wastewater)
- Energy recovery: steam, hot air, hot oil, electricity

Highlights:

- cooling/ heat exchange system cools down gas from 850 ºC to 200 ºC in less than 1 second, to **avoid dioxines reformation**
- **energy recovery efficiency**: 80-85% (energy = residue HV + fuel)
- **Na** and **Mg oxides** ash fouling, slagging and deposition on the tubes surface of boiler/ heat exchanger, can be avoided by use of compressed air, chemical additives, special surface treatment and/or specific cooling systems before the boiler

Heat exchanger

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D. Flue gas cleaning (dry system)

Main characteristics

- **Urea** injection for the abatement of **NOx**
- **Sodium bicarbonate** dosing system for **SO_2/acid** abatement
- **Activated Carbon** dosing system for **dioxins/furans** and **heavy metals** abatement
- **Baghouse filter** (**particulate** matter and Air Porllution Control reagents retention)
- **Stack**

Highligjts

- Reactor mixer for better performance of reactives
- CEMS
- Emissions limits meet with EU-Waste Incineration Directive

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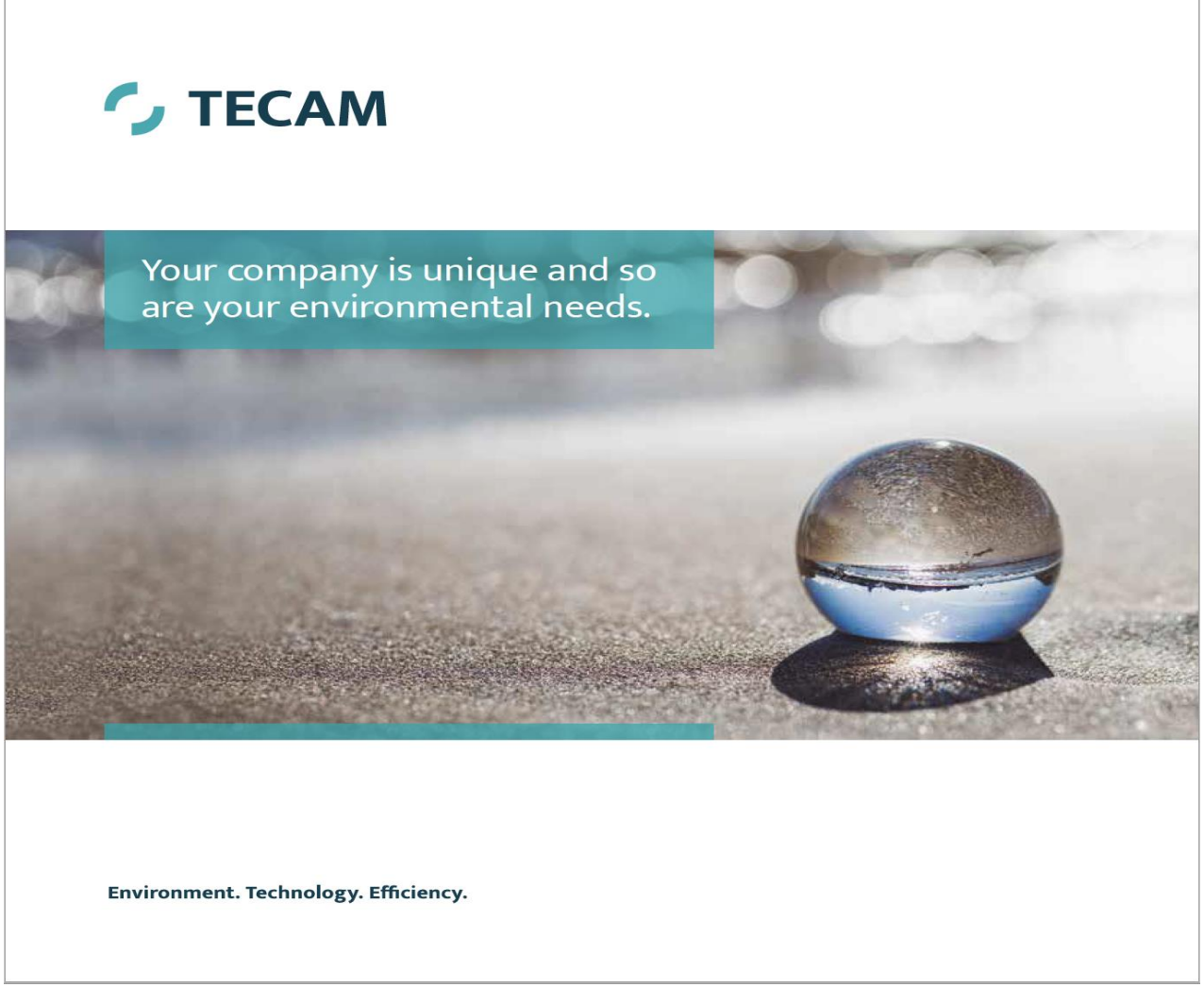

NEW SPECTRUM TECHNOLOGIES INC.

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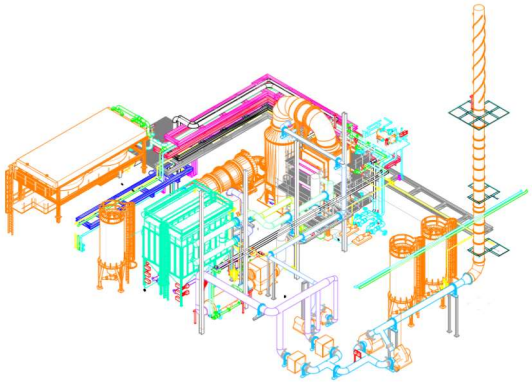
Waste Thermal Treatment and Flue Gas Treatment Project References

Company and Technology Presentation – February 2025

WASTE THERMAL TREATMENT AND FLUE GASES TREATMENT DESIGN, MANUFACTURING, SUPPLY AND COMMISSIONING

Ruwais, Abu Dhabi. 2015-2018



Waste Treatment Capacity: 500 kg/hour

NORM Waste Thermal Treatment system + Gas treatment, composed of:

- Naturally Occurring Radioactive Material (NORM) Thermal Treatment, with rotating kiln
- Different compounds combination: Oil, scale and sludge waste Thermal Treatment from oil refinery process
- Gases dry treatment with DeNOx SCR (Selective Catalytic Reduction), approximate Flue Gas Flowrate of 15000 Nm3/h
- Heat exchanger
- Chemical dosification (Sodium Bicarbonate and Active Carbon)
- Double bag filter and HEPA filter, approximate Flue Gas Flowrate of 15000 Nm3/h
- System of recovery and storage of slag and ashes
- The Average Heat Value is 8.500 kcal/kg and the unit operates at negative pressure
- The system was designed to operate in a flexible way, which operates in different working ranges depending on the variable combination of the three types of waste present (Oil, scale and sludge)

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WASTE THERMAL TREATMENT AND FLUE GASES TREATMENT DESIGN, MANUFACTURING, SUPPLY AND COMMISSIONING

OPROLER

Panama Airport – 2016

Waste Treatment Capacity: 700 kg/hour

Hazardous Waste Thermal Treatment system, composed of:

- Hazardous waste Thermal Treatment system, with static kiln
- Flue Gas treatment, approximate Flue Gas Flowrate of 3000 Nm3/h
- Complete gases system treatment (Sodium Bicarbonate and Active Carbon)
- Waste to energy recovery system
- Designed to destroy 700 kg/h of hazardous waste
- The Low Heat Value (LHV) is 1500kcal/kg

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WASTE THERMAL TREATMENT
DESIGN, MANUFACTURING, SUPPLY AND COMMISSIONING

Ambimed® Stericycle® **Torres Vedras, Portugal 2012**

Waste Treatment Capacity: 1.000 kg/hour

Waste Thermal Treatment System for Hazardous/Hospital/Medical Waste (class 3 & 4), Pharmaceutical residues, Liquids from hemodialysis clinics, etc.

Composed of:

- Rotating kiln
- Screw conveyor to inject sludge-like substances: creams, pomades, medicated shampoos, medical active principles, etc.
- Boiler producing 2.2 Ton/hour of steam
- Steam producing 400 kW/hour of electricity
- Chemical dosing (urea solution, bicarbonate, active carbon)
- Bag filter, approximate Flue Gas Flowrate of 25000 Nm3/h
- The Average Heat Value is 3,000 kcal/kg

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WASTE THERMAL TREATMENT AND FLUE GASES TREATMENT DESIGN, MANUFACTURING AND SUPPLY

PROMINCOM SK Stakonstruksiya Rusia, 2020

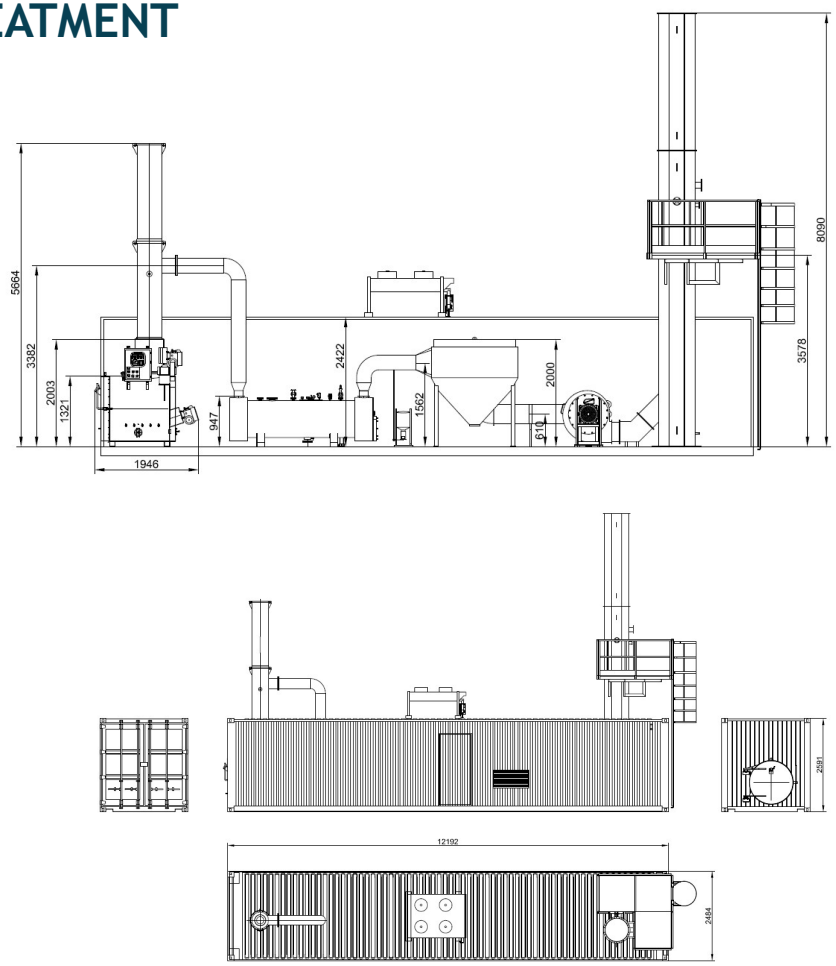
Thermal Treatment Capacity: 95 kg/hour

Mobile Thermal Treatment System for Pharmaceutical residues, Liquids and Solid waste.

End User: GAZPROM

Composed of:

- G-6 Static Thermal Treatment Unit
- Slag Screw conveyor extractor.
- Boiler producing Hot Water for District Heating in the plant
- Chemical dosing (bicarbonate, active carbon)
- Bag filter, approximate Flue Gas Flowrate of 5000 Nm3/h
- The Average Heat Value is 3.000 kcal/kg



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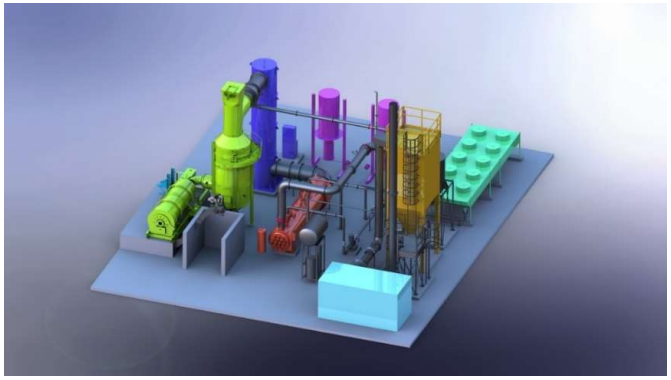
WASTE THERMAL TREATMENT AND FLUE GASES TREATMENT DESIGN, MANUFACTURING AND SUPPLY

SAFA Environment

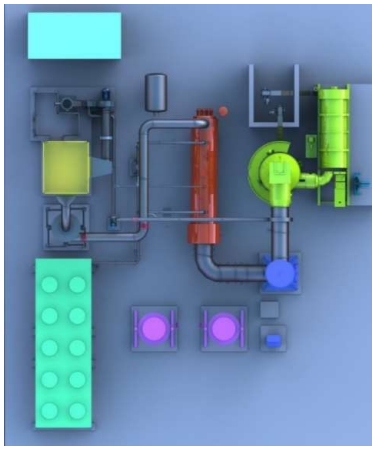
Riyadh - Saudi Arabia 2021



Waste Treatment Capacity: 1.000 kg/hour

Rotary Kiln system + Flue Gas treatment and Heat Recovery with Electricity Generation

- Designed to destroy 1.000 kg/h of Hospital waste.
- Gases dry treatment with DeNOx SCR (Selective Catalytic Reduction)
- The Average Heat Value is 6.500kcal/kg and the unit operates at negative pressure.
- Boiler is working 2,2 Bar(g) and 217ºC
- Steam producing 500 kW/hour of electricity by Condensing Steam Turbine
- System of recovery and storage of slag and ashes
- Complete gases system treatment (Sodium Bicarbonate and Active Carbon), approximate Flue Gas Flowrate of 25000 Nm3/h



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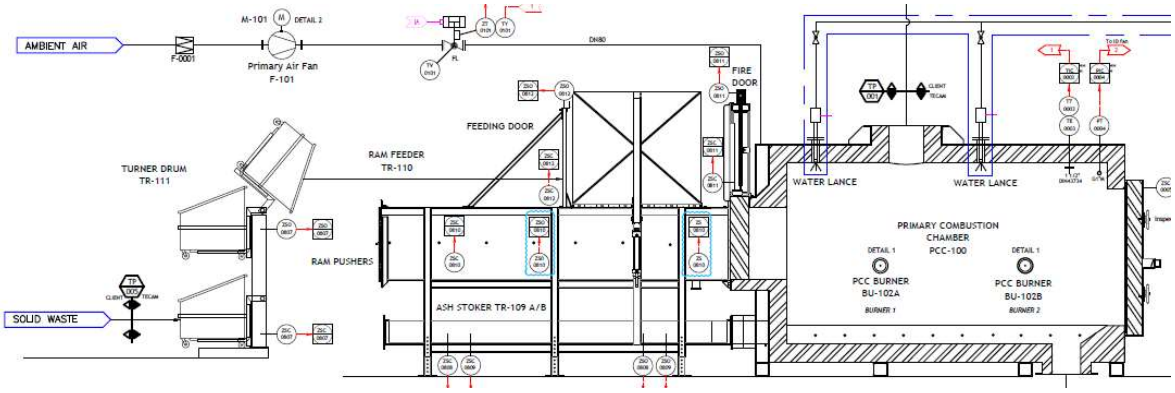
WASTE THERMAL TREATMENT
DESIGN, MANUFACTURING, SUPPLY AND COMMISSIONING

DAMARIS TECHNOLOGY

Pardubice Hospital - Czech Republic 2023

Waste Treatment Capacity: 270 kg/hour



Primary Combustion Chamber

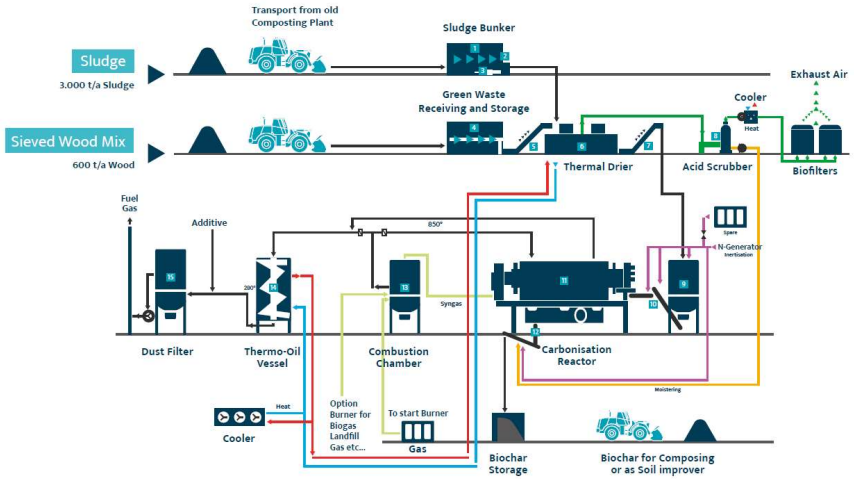
- Designed to destroy 270 kg/h of Hospital waste.
- The Average Heat Value is 3.500kcal/kg.
- Auxiliary Equipment for Primary and Secondary Combustion Chamber also designed, manufactured and supplied by TECAM.
- Scope also includes Bins Lift/Tipper

TECAM

WASTE THERMAL TREATMENT AND FLUE GASES TREATMENT DESIGN, MANUFACTURING, SUPPLY AND COMMISSIONING

HSY
Helsingin Seudun Ympäristöpalvelut / Helsinki region Environmental Services Authority 2020

Capacity: 3,000 t/year of sewage sludge
Rotary kiln pyrolysis system



- Rotary kiln pyrolysis system with peripheral equipment: pyrolysis reactor, combustion chamber, heat exchangers, flue gas treatment system (approximate Flue Gas Flowrate of 1500 Nm3/h), process automation.
- The specified capacity is 3,000 t/a or 60 t/week of sewage sludge and 600 t/a or 12 t/week of a pre-screened wood mixture.
- The kiln temperature is adjustable in 3 heating zones between 550 °C - 850 °C.
- The target value for the sum of 16 EPA-PAH shall be < 6 mg/kg (limit value IBI –international biochar initiative) and the max. allowed sum of 16 EPA-PAH is < 12 mg/kg.
- The carbonisation process will be able to eliminate organic pollutants and microplastics contained in the sludge.

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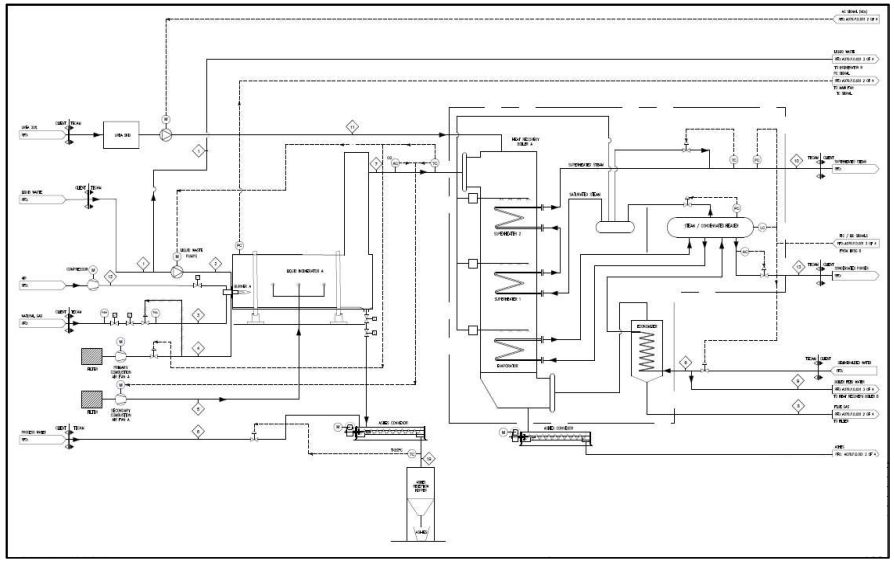
WASTE THERMAL TREATMENT - ENGINEERING SERVICES

STALKONSTRUKTSIYA Amursky
Gas Processing Plant Project
Svobodny, Amur region, Russia
Waste Treatment Capacity: 4.000 kg/hour 2018

Liquid Waste Thermal Treatment System - Basic Engineering

- The Thermal Treatment Unit is designed to work at +1100 ºC and with a retention time > 2s in order to assure a removal efficiency of 99.99%.
- In order to remove NOx compounds, it is foreseen a urea injection in the heat recovery boiler.
- The flue gas generated in the Thermal Treatment Unit will be sent to a heat recovery boiler (HRB) and it is designed at full capacity of the Thermal Treatment Unit (4.0 t/h).
- The Thermal Treatment Unit is designed with a burner of double combustible (natural gas and liquid waste). This solution is optimal when liquid wastes with a high LHV (about 9500 kcal/kg).



COMPOUNDS (C_i)	LHV_i (kcal/kg)	Calculated mass fraction (Note 1) (%)
C4 (as 1-butane)	10938	3
C5 (as i-pentane)	10823	10
C6 (as 1-hexene)	10629	75
C7 (as heptane)	10663	4
C8 (as octane)	10628	<1
C9 (as nonane) and C10+	10601	4
Dimethyldichlorsilane	2150	<1
MIXTURE	**~9490**	**100%**

TECAM

WASTE TO ENERGY PLANT (Portugal) - ENGINEERING SERVICES

termogreen

Suggestions to optimize operation and performance of the Plant 2024

- From a Site Visit to the existing Plant (in operation), and share of experiences and opinions from operators, specific Workshop was conducted.
- Theoretical Heat and Mass Balances were produced by TECAM, in order to compare reality with office calculations.
- On those Units of the Plant where operators were more interested in optimizing the performance and operational activities, TECAM provided recommendation and advice based on their experience and interpretations of the reality.

WASTE TREATMENT PLANT (Spain) - ENGINEERING SERVICES

Solution Analysis for the upgrade of Flue Gases Cleaning System 2024 - ongoing

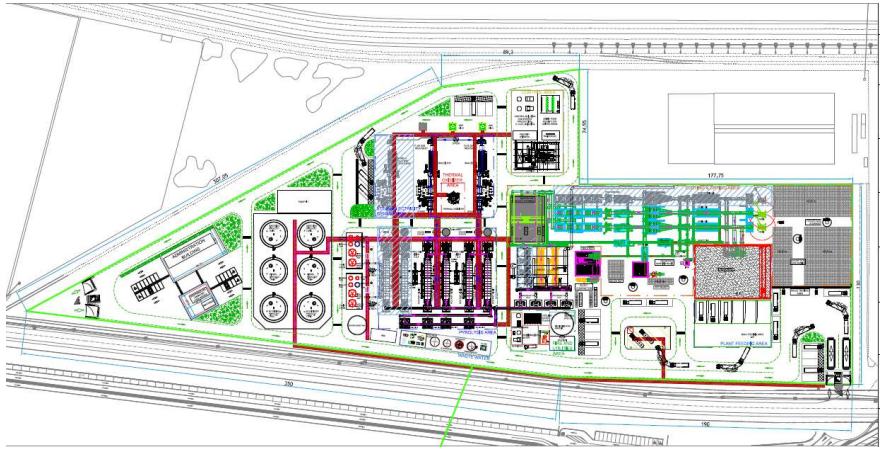
- Different solutions providing technically feasible solution for the upcoming demands of the Plant in terms of Flue Gases flowrates and associated emissions presented to Client.
- Basic Engineering of two different solutions being developed, at FEL3 level.
- Active cooperation with Client in order to help them decide on which specific option is more adequate, considering the specific demands and requirements of their Plant, in full accordance with the corresponding legislation and environmental permits and licenses.

WASTE TO PRODUCT – SOLUTION ANALYSIS, FEL3 ENGINEERING PACKAGE, SUPPORT TO LICENSING AND PERMITTING

SONAE CAPITAL

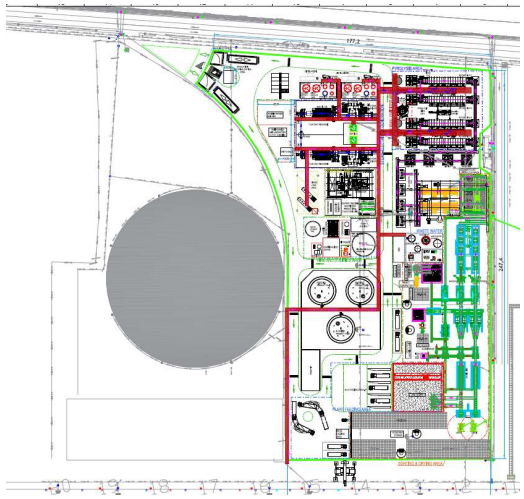
wasteplastic IBERIA

Huelva & Bilbao, Spain - 2019 ongoing (different phases)

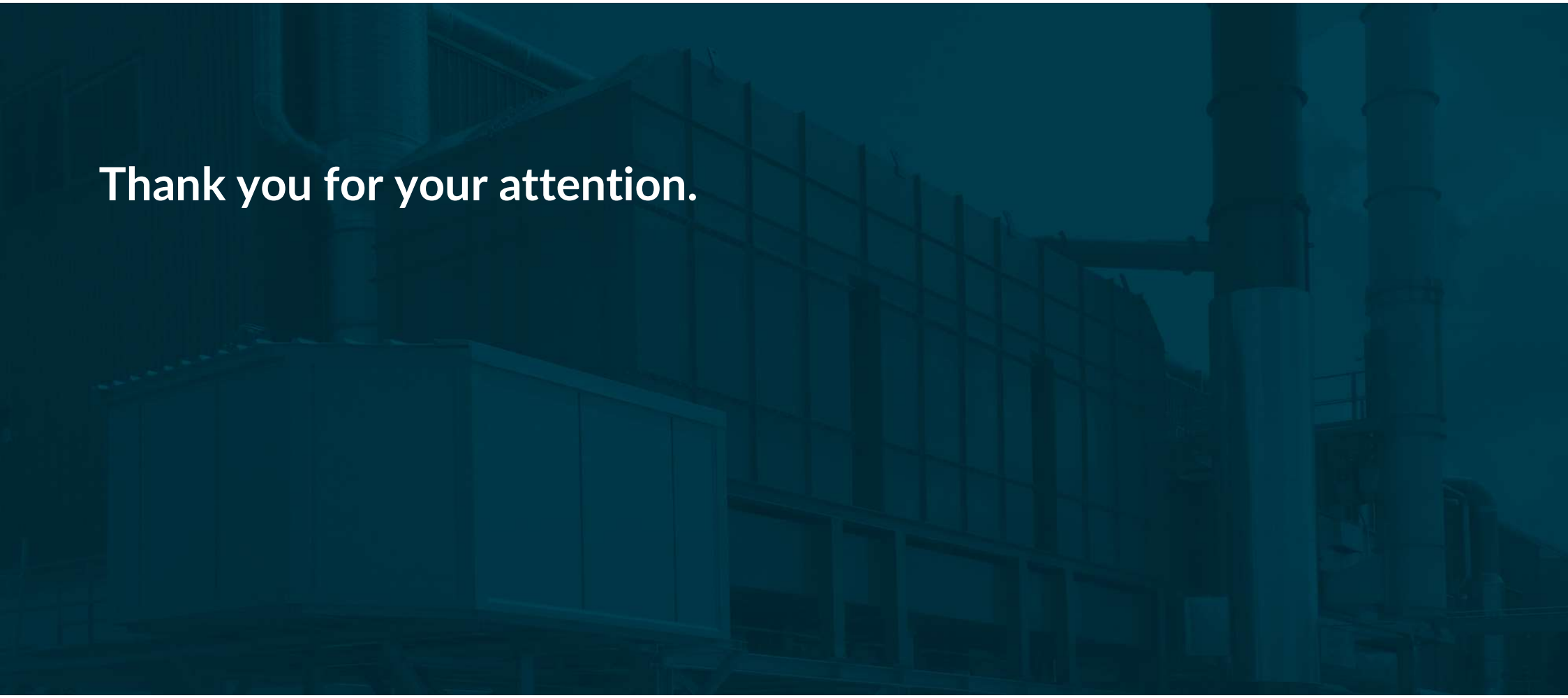


Engineering services for 2 waste-to-fuel plants to valorize plastic waste via pyrolysis composed of:

- First Conceptual and then Basic Engineering (FEL3) of two Biofuel Generation Plants from the Pyrolysis of Plastic Waste, in the seaports of Huelva and Bilbao, with a waste management capacity of, respectively, up to 320,000 and 200,000 tons/year.
- Support to Licensing and Permitting for both plants.
- Support in Port Authorities administrative works for Bilbao and Huelva.
- Technical management of specialized and High Added Value engineering companies in different phases of the production process.
- Update of FEL3 Engineering Package corresponding to Huelva Project, in order to integrate Technology Concept from NESTE.



TECAM



Thank you for your attention.

TECAM
Environment. Technology. Efficiency.

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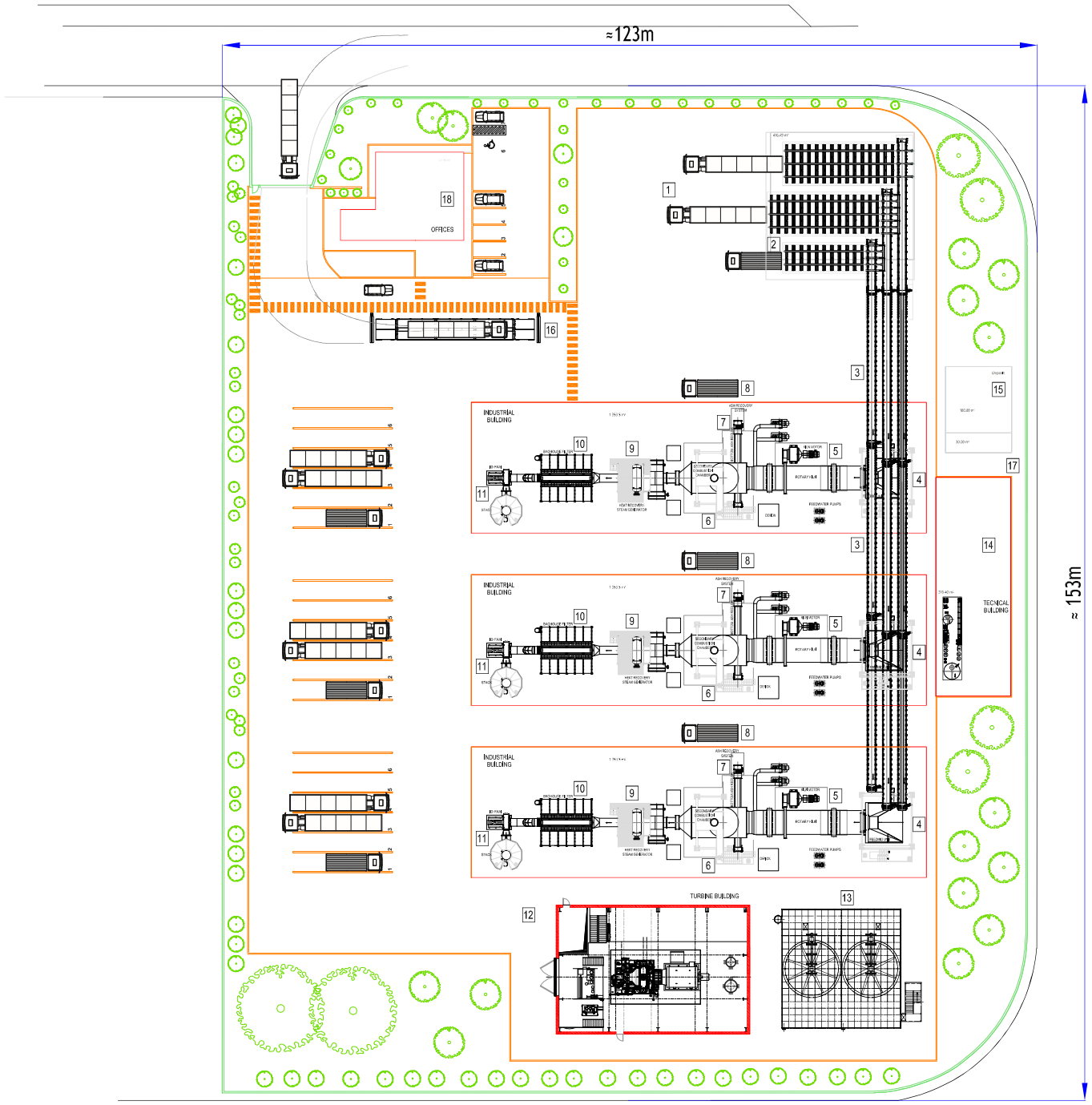

LIST OF EQUIPMENT	
1	Waste reception
2	Waste storage buffer
3	Feeding system
4	Feeding hooper
5	Rotary Kiln
6	Secondary combustion chamber
7	Bottom ash redler
8	Ash recovery system
9	Heat recovery steam generator
10	Flue gas treatment
11	Flue gas stack
12	Turbine
13	Condenser
14	Auxiliary system
15	Fire system
16	Weighing bridge
17	Transformation
18	Offices

Main Equipment supplied by TECAM

PRELIMINARY EQUIPMENT AND DIMENSIONS TO BE CONFIRMED DURING DETAIL ENGINEERING

REV	DATE	REVISION DESCRIPTION	EDITED	CHECKED	APPROVED
00	7/04/2025	PI: Issue for Information	P.T.	J.M.G.	J.M.G.

PROJECT TITLE: Municipal Solid Waste - Thermal Treatment Plant
Capacity: 200,000 Tons/Year

CLIENT: MIAMI DADE

DRAWING TITLE: Preliminary Layout

TECAM

DRAWING Nº NE-24164.N.D.001

REV 00

SCALE: s/n

SHEET Nº 1 of 1

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Tritor

Market Research Response

TRITOR®

RESPONSE TO MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

Company Overview

Tritor srl (www.tritor.it) is an Italian-based environmental technology company specialized in modular and mobile systems for solid waste treatment and materials recovery. Tritor Srl is part of Belenergia group (www.belenergia.com), a Leading European Player in Renewable Energy and Circular Economy.

We design, manufacture, and deploy rapid-response waste management solutions, both for municipal and private-sector clients, in complex contexts where agility, sustainability, and immediate impact are key. Our operations focus on enabling circular economy strategies and high- efficiency waste pre-treatment.

We operate across Southern Europe and the Mediterranean, providing integrated systems for waste shredding, sorting, RDF production, and mobile ecological hubs. Tritor solutions have been implemented in islands, rural zones, transport terminals, and regional hubs—always prioritizing low environmental footprint and rapid activation.

Tritor srl is in the process of constitution of a new company Tritor Americas that will have its headquarters in Miami, Florida. Our interest is to develop Waste solid management market through partnerships with Municipal and privates' entities and to establish long term relationships through joint venture with US companies and direct investment in United States market.

Respondents history and experience

Antonino Ferrera, a manager with more than 20 years experience in the development and management of contract in the energy and infrastructure field of business, is Tritor contact reference for this project in Miami. Tritor Srl is a company that has worked in the field of integrated solid waste management for over 10 years, with the aim to find scalable technological solutions to solve the environmental challenges of waste solid management. Tritor Srl has developed and deployed mobile treatment platforms in diverse settings—from small municipalities in Sicily to logistical applications in airports and coastal ports.

Tritor Srl, has a consolidated experience that ranges from operational planning to institutional advisory. Tritor collaborated with public authorities on the optimization of ecological islands and provided strategic guidance on RDF readiness and landfill diversion programs. Our approach combines field pragmatism with long-term circular economy vision, shaped by years of hands-on involvement in the waste sector across different regulatory and geographical contexts.

Tritor Srl, has already in plan a project to create a local unit in the USA, with the local address in Miami, Florida.

Tritor Technologies – Equipment Portfolio

Tritor Hurricane® – Mobile Shredding & Sorting Unit

A fully autonomous mobile waste treatment platform engineered for high- efficiency pre-treatment of MSW, bulky waste, and industrial residuals. It integrates shredding, magnetic separation, air separation and optical sorting in a compact containerized structure. Ideal for rapid deployment in municipalities, ports, and emergency zones.

Tritor Energy Station® – RDF & Biomass Processing System

A semi-mobile unit designed to prepare solid waste streams for energy recovery applications. It handles drying, homogenization, and conditioning of RDF-grade material while ensuring compliance with emission-reduction targets. Perfectly suited for integration with WtE facilities or co-processing in cement plants.

Tritor Hospital® – Hazardous & Healthcare Waste Line

Engineered for the safe handling of hazardous, hospital and red bag waste streams, this line combines high-temperature shredding, sterilization modules, and volume reduction processes. Compliant with European and international health and safety standards, it serves temporary or permanent medical facilities.

Tritor Urban Station® – Smart Ecological Island

A modular waste management micro-hub combining compactors, smart containers, solar panels and user interfaces for urban environments. It allows decentralized separation and storage of recyclable fractions, integrated with sensors and access control. Tailored for city districts, islands, or transitional communities.

Tritor Truck® – Mobile Waste Treatment on Wheels

An all-in-one waste treatment truck equipped with a complete onboard shredding and sorting system. Designed for field interventions and municipal services in remote or disaster-struck zones. It supports immediate volume reduction, on-site sorting, and safe containment of processed materials.

B.1 - Waste Management Solution:
Tritor's Response to Miami-Dade's Systemic Challenges

Miami-Dade County currently faces a multifaceted waste management crisis, exacerbated by the catastrophic loss of the Resource Recovery Facility (RRF), impending landfill capacity limits, escalating capital requirements for infrastructure replacement, and the growing fiscal pressure on taxpayers. As outlined in the County's second update to Directive No. 241676, no single approach can adequately resolve these interconnected issues without creating long-term financial and environmental burdens.

In response, **Tritor srl** offers a **decentralized, modular, and mobile waste management platform** capable of mitigating the County's immediate risks while supporting a longer-term transition toward zero-waste strategies.

Our solution directly addresses the County's critical challenges:

- **Post-RRF Disposal Capacity Deficit**: Tritor's mobile platforms (e.g., Hurricane® and Energy Station®) can be deployed across existing County-owned lots or interim-use sites to reintroduce localized processing capacity for MSW and RDF production—without the delays of constructing a new WTE facility. This can bridge the multi-year capacity gap identified in the report.

- **Landfill Saturation & Revenue Loss:** With North Dade and South Dade landfills approaching capacity in 4–5 years, our systems reduce incoming volumes by up to 70%, extending landfill lifespan and safeguarding the County's projected $50M in annual landfill revenue.

- **High Capital and Legal Risk of New WTE Facilities**: Unlike centralized WTE options estimated at $1.5–$1.9 billion with 7–10 year lead times and high legal exposure, Tritor stations offer rapid deployment (within 6–9 months) with capital costs under $12M per unit. Their modular nature avoids the siting battles and litigation delays anticipated in the County's report.
- **Budget Constraints & Ratepayer Protection**: The County's memo highlights the pressure to maintain low taxes and service fees. Tritor's operational model is designed to be cost-efficient, scalable, and eligible for public-private partnerships or grant-backed funding structures, easing the strain on public capital budgets..
- **Contingency for Insurance Recovery**: Given the February 2026 deadline to secure a facility contract for full insurance proceeds, Tritor's short lead time offers a practical path to demonstrate contractual commitment—preserving access to potential recovery funds.

In summary, Tritor offers an **agile, scalable, and fiscally prudent approach** to meet the County's near-term disposal needs while positioning for a more resilient, decentralized waste infrastructure. We do not aim to replace long- term solutions like WTE or new landfill development—but rather, to serve as the **critical operational bridge** the County urgently needs.

B.2 - Effectiveness of Tritor’s Solution

Tritor’s modular and mobile waste management solutions have proven highly effective in addressing a range of municipal waste challenges, particularly where infrastructure constraints, time sensitivity, or environmental concerns limit the viability of traditional fixed plants.

Our technology has been successfully deployed in:

- **Island municipalities** such as **Sicily** (Italy), where the lack of landfill capacity and logistical difficulties made traditional models unsustainable. There, our **Tritor Hurricane®** and **Urban Station®** platforms allowed a 65% reduction in waste volumes, optimized recycling separation, and created conditioned RDF for export or energy recovery.

- **Transport and logistics nodes**, where mobility, hygiene standards, and energy efficiency are essential. Our **Hospital**® line for medical and hazardous waste ensures regulatory compliance and on-site sterilization in sensitive environments.
- **Temporary and transitional zones**, where rapid response was needed—such as post-emergency or redevelopment areas. Our equipment was deployed in less than 120 days, immediately restoring basic solid waste treatment capabilities while avoiding long-haul transport and costly landfill use.

In all these contexts, **key indicators of effectiveness** included:

- Up to **70% reduction in volume of residual waste**
- Diversion of **60–75%** of incoming waste away from landfills
- RDF production up to **18 tons/day per mobile line**
- Deployment lead times of **6–9 months from contract to operation**
- Operability with mixed MSW, bulky waste, organic waste, and select hazardous streams

Tritor's performance is not theoretical—it is rooted in real-world results where constraints are most critical. Our approach transforms waste from a liability into a managed and partially valorized resource, with strong public acceptance due to reduced nuisances and visible environmental gains.

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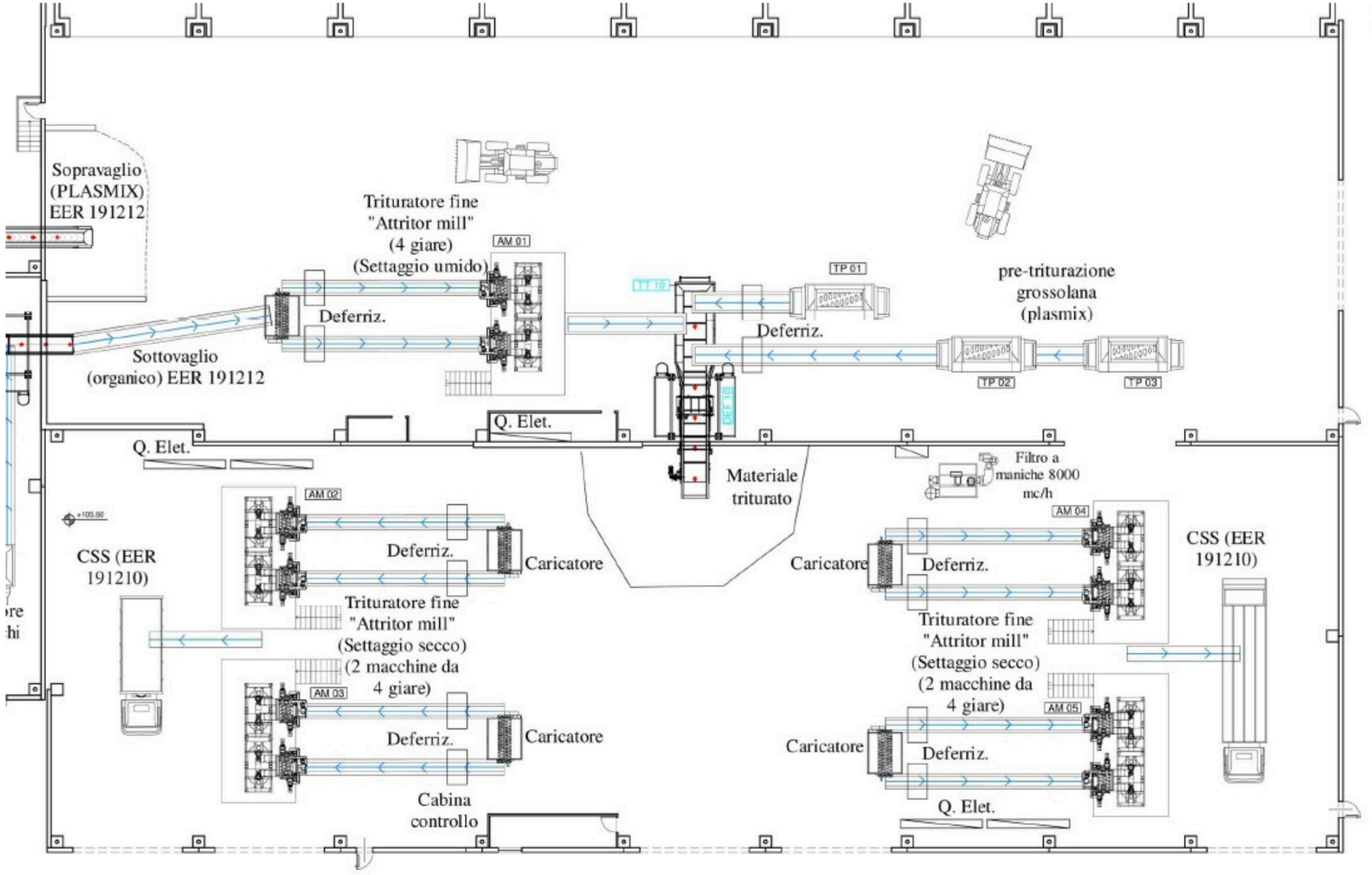
Tritor’s proposed plant configuration is designed to process up to 600 metric tons per day of unsorted municipal solid waste, generating approximately 400 metric tons of high-quality Refuse-Derived Fuel (RDF). The system requires a footprint of approximately 6,000 square meters, optimizing logistics and significantly reducing transportation-related CO_2 emissions. Processed RDF and stabilized residuals can be transported and managed at two to three decentralized satellite facilities located outside the urban core of Miami, supporting regional flexibility and environmental impact mitigation.



PLANIMETRIA T.M.B. Scala 1:200

TRITOR®

Technologies and Processes

GREAT COMPANIES ARE BORN FROM GREAT GROUPS

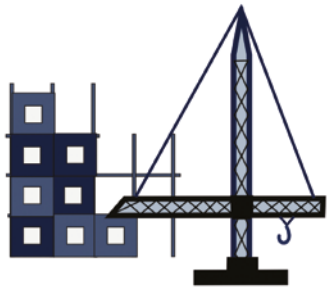
Tritor® belongs to the **Belenergia S.p.A.** Group, a major European player in the renewable energy and circular economy sector operating in the sector for over 10 years. The company was born with the sole ambition to succeed in having zero landfilled waste policy adopted in the shortest time possible, thanks to the invention of an innovative waste treatment technology to obtain exclusive benefits for the people and the environment.

In a short period, **Tritor**® emerged and became the voice of Italian Green Energy in the field, relying on the experience gained by the large industrial group behind it and strengthened by working with businesses and professionals with expertise in the sector, like Green Advisory companies, boasting a technical department headed by a specialized Technical Manager, a sales network throughout Europe and a dedicated Marketing Office.

INNOVATIVE TECHNOLOGY TO CONVERT WASTE FROM PROBLEM TO RESOURCE FOR THE ENVIRONMENT

Following the principles of the Circular Economy, **Tritor**® has designed a complete process to transform and valorise waste, achieving a top and exclusive place in the field of waste valorisation for development of gas, electrical and thermal energy.

After separate collection, the waste can indeed have purpose in a circular economy. **Tritor**® offers its patented technology, a revolutionary system that can treat various types of waste – like general waste, dry and organic fractions and sludge – to produce and store high quality Refuse Derived Fuel (RDF) to be used instead of polluting fuels in facilities such as:



CEMENT FACTORIES

ENERGY INTENSIVE INDUSTRIES

ELECTRICAL POWER STATIONS

FARMS

ADVANTAGES

Compared to traditional systems, treatment with **Tritor**® technology offers remarkable benefits also in terms of operating costs and treatment time, as well as reduction of weight and volume, thus optimising the plant's profitability.

- **Times are drastically shortened** and costs for landfill disposal are reduced.
- **Reduction of production waste** destined to landfill.
- **Substantial reduction of percolate production** at landfill, with drop of 35% of weight and 70% of volume of waste.

3 TECHNOLOGIES
FOR 1 INDIVIDUAL IMPORTANT OBJECTIVE

Tritor® has demonstrated all its potential in the radical transformation of the waste management sector. Also, in addition to offering immediate solutions for waste treatment, by boosting the importance of recycling and reducing waste disposal, it can contribute to the creation of a more aware community engaged in protecting the environment.

Our industrial project is in the first place an environmental mission: transform waste into resources for an ever more sustainable future.

To meet the objectives set, the company has adopted 3 different technologies.

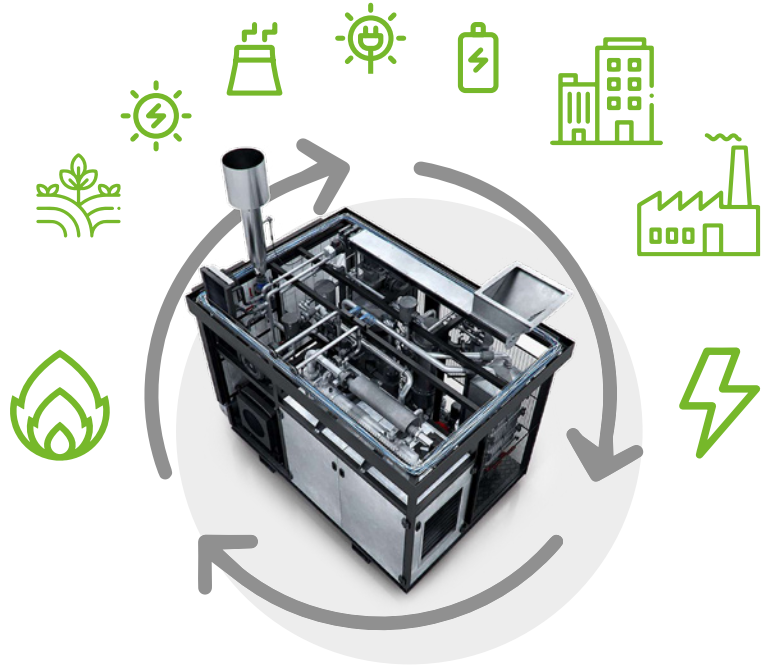
Tritor® revolutionises waste treatment, optimising its management and transformation.

Tritor Energy® is a micro cogeneration system producing electrical and thermal energy through high quality RDF. This state-of-the-art technology makes the most of the energy potential of the waste, while minimising harmful emissions in the atmosphere.

Tritor Hospital Waste Station® offers a safe and specialised solution for the disposal of hospital waste, it complies with legal standards and the proper management of critical waste from health care facilities, transforming them in a precious resource for the environment.

TRITOR®

TRITOR®
Hospital Waste Station



TRITOR® ENERGY

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THE PROCESS TRANSFORMING WASTE INTO A RESOURCE FOR THE ENVIRONMENT

Tritor® technology is a step forward in solid waste treatment, offering innovative solutions that turn waste into precious resource for the environment.

PHASE 1

PERFORMING WASTE TREATMENT

Tritor® is a system to prepare and refine waste, secondary materials and biomass with initial low energy content, built to produce fuel for use in energy systems: Refuse Derived Fuel (RDF) with high heating power.

After pick-up, the waste undergoes pre-treatment with the Primary Crusher. Then it goes through friction and impact in the **Tritor**® system, which uses steel balls operated by hammers set inside the treatment vat. They exercise such powerful pressure that the materials are instantly crushed, the microbial flora destroyed, and bacteria and odours eliminated, thus contributing to dehydration.

Tritor Hospital Waste Station® is a rather small size machinery, installed in hospitals and healthcare facilities for the transformation of hospital waste into urban sterilised waste. The process is completed in 30 minutes only, through mechanical crushing under continuous negative pressure. The treated waste turns into Refuse Derived Fuel (RDF) with high heating power, totally sterile and dry.

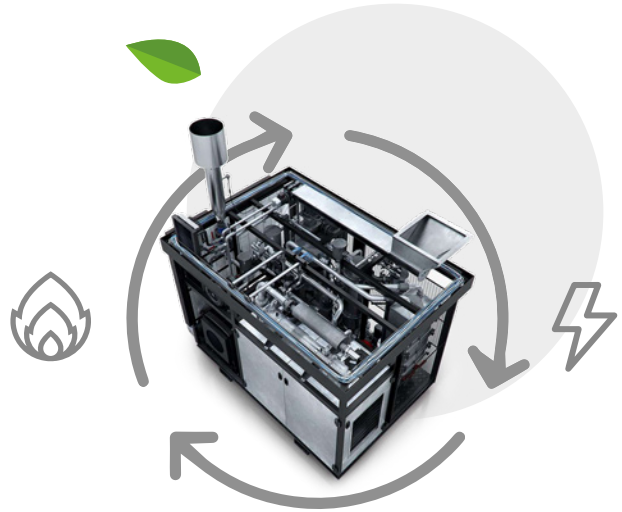
PHASE 2

PRODUCTION OF CLEAN AND SUSTAINABLE ENERGY

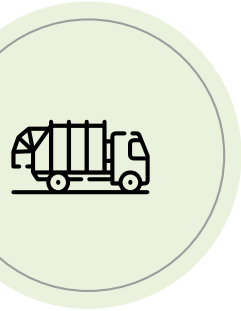
Tritor Energy® is the electrical and thermal energy generator that completes its offer, the answer to the need for clean and sustainable energy. This is a micro cogeneration system, enclosed in a small box, it is easy to position and install, and it produces electrical and thermal energy using high quality RDF obtained from waste treated with **Tritor**® and **Tritor Hospital Waste Station**®.

Energy is generated via gasification at high temperatures, in total absence or with minimum quantity of oxygen.

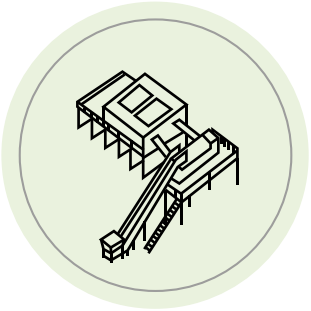
By integrating waste treatment with energy production, **Tritor Energy**® offers a concrete opportunity for energy self-sufficiency and cost reduction, which actively contributes to sustainability and to the research of a true circular economy.



TRITOR®

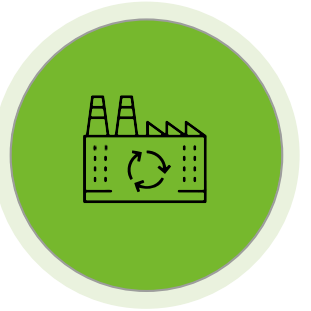


WASTE COLLECTION

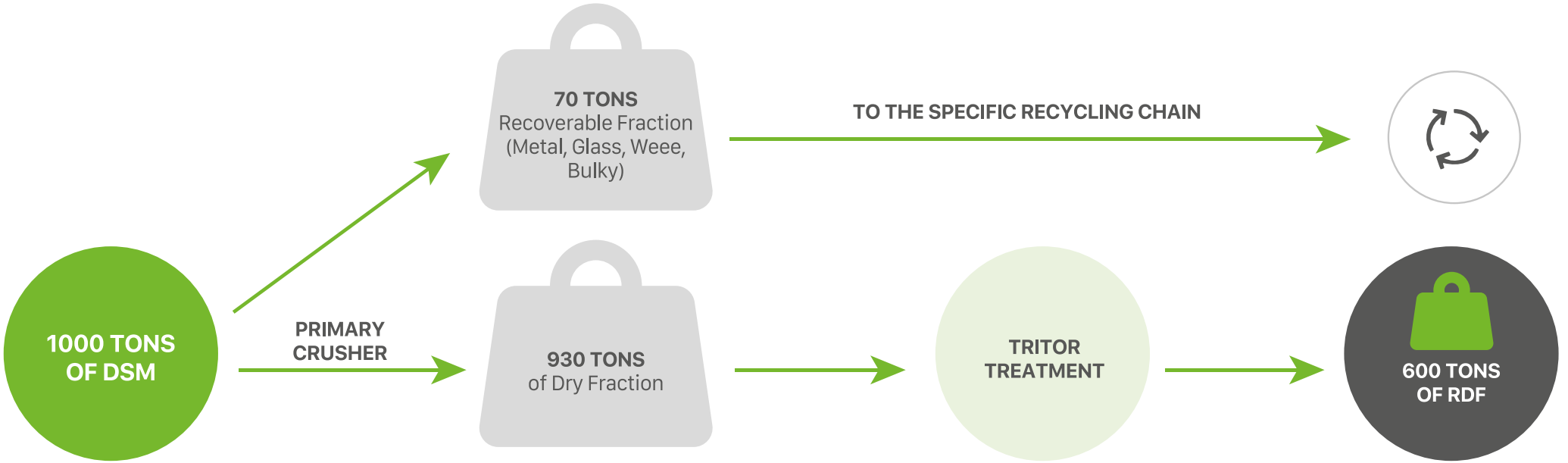


PRIMARY CRUSHER PRE-TREATMENT

TRITOR WASTE TREATMENT



RDF



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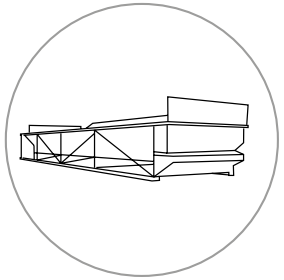
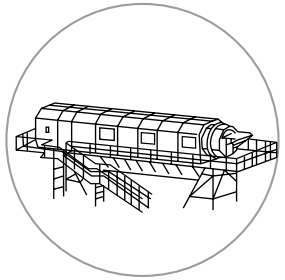
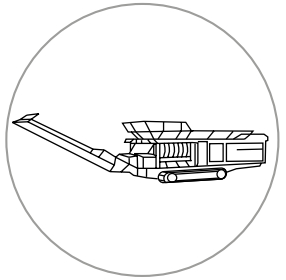
PICK-UP AND SORTING



DSM
Opening the bag



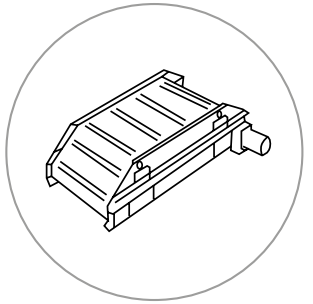
PRIMARY CRUSHING
Screen (rotating)



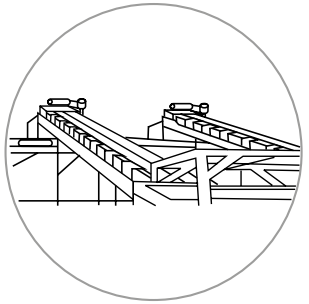
DRY FRACTION
40mm mesh crusher Grill

UNSUITABLE FRACTION
(Bulky, ferrous, non-ferrous material, glass etc...)

HUMID BIODEGRADABLE FRACTION



MAGNETIC SEPARATOR



TRITOR PLANT

COMPOSTING CHAIN

HIGH QUALITY RDF

FLOW DIAGRAM OF THE INSTALLATION OF URBAN SOLID WASTE TREATMENT

TRITOR®

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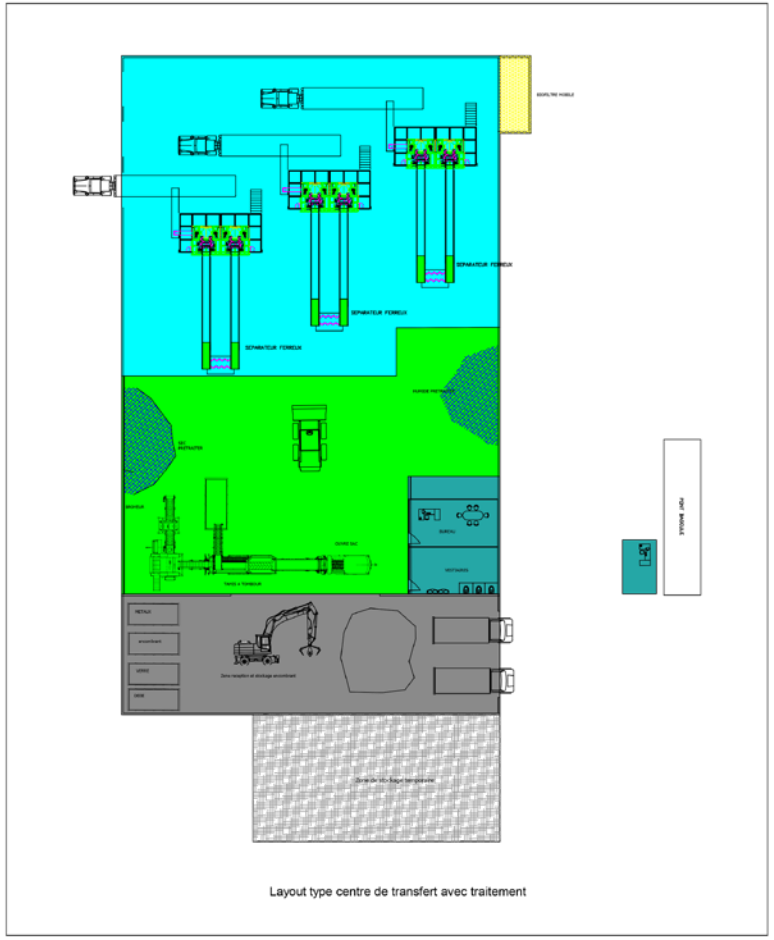
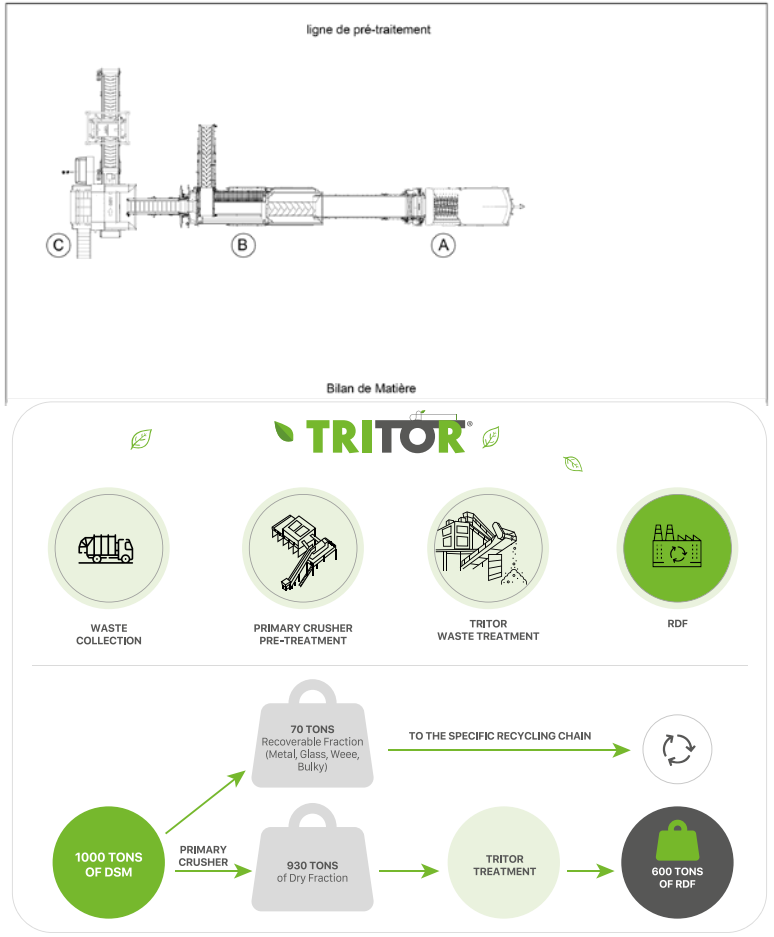
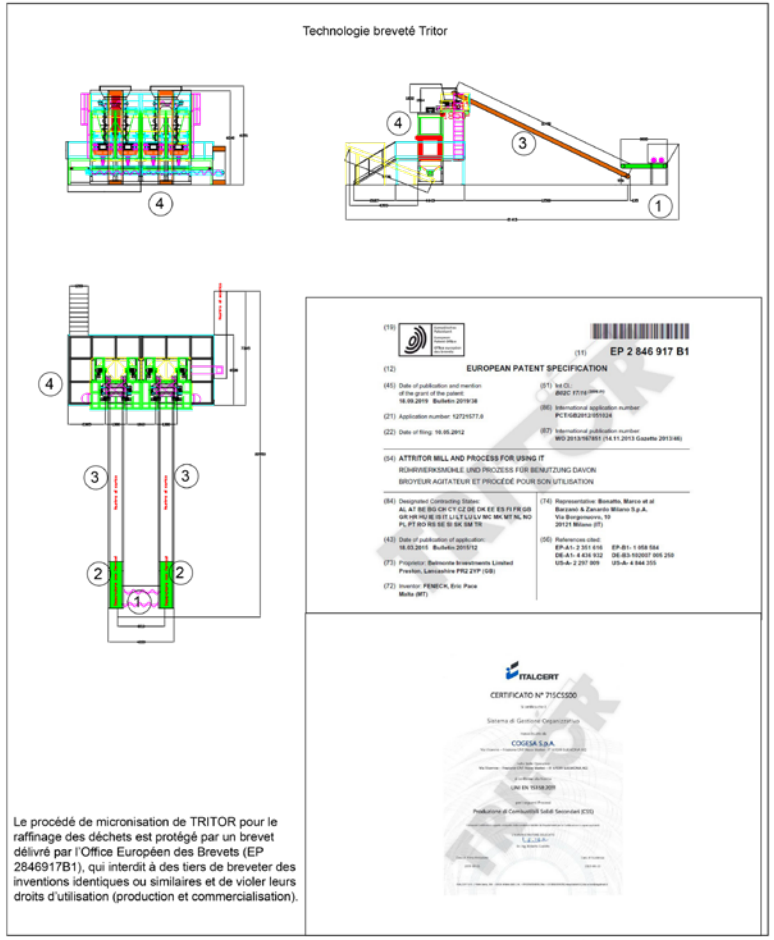
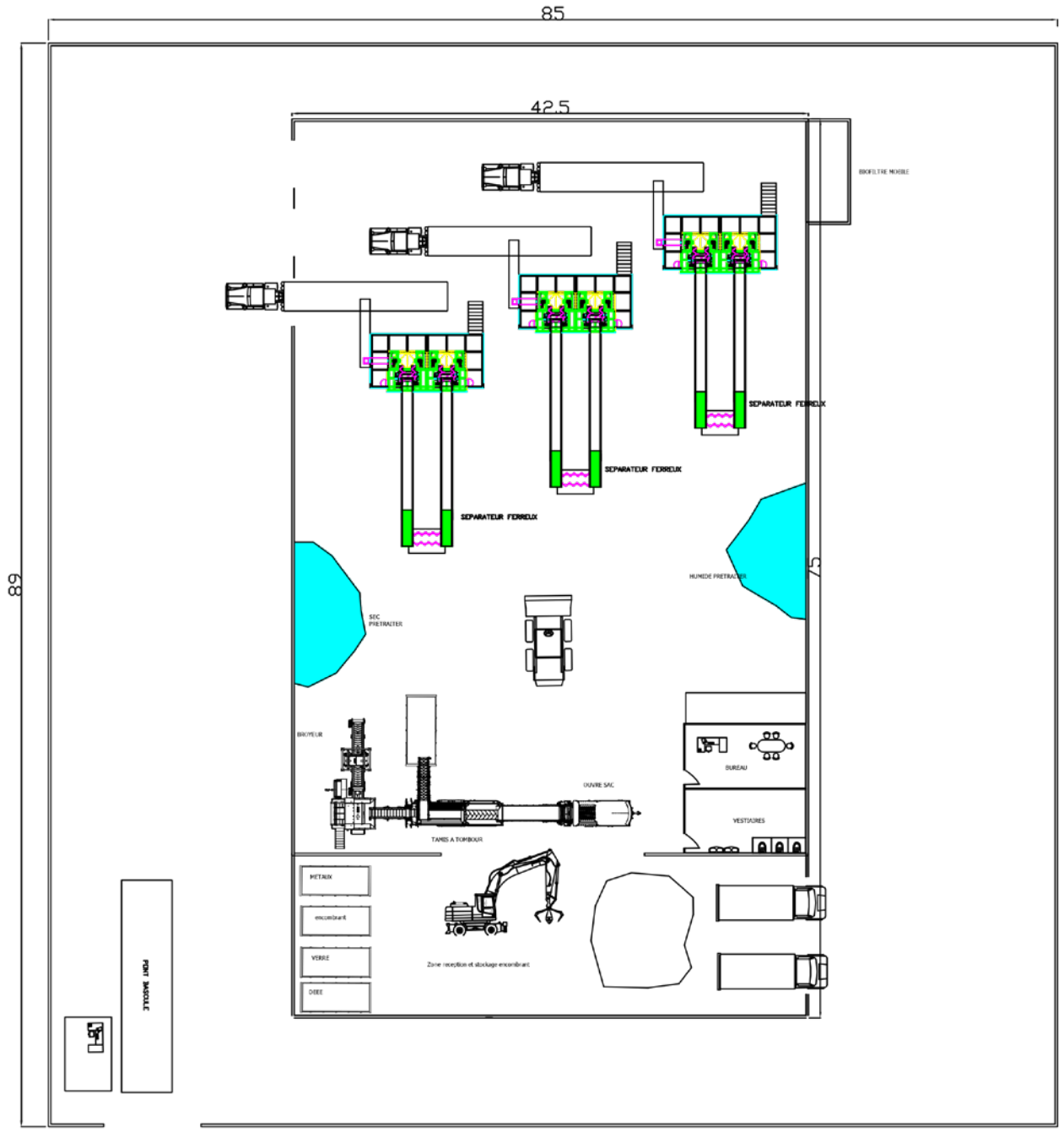
LAYOUT OF THE TRANSFER CENTRE WITH PROCESSING

Tritor's waste treatment micronization process is protected by a patent issued by the European Patent Office (EP 2846917B1), which prohibits third parties from patenting identical or similar inventions and from infringing use rights (production and marketing and sales).









SCHEMATIC LAYOUT OF THE TREATMENT SYSTEM WITH TRITOR'S EQUIPMENT

TRITOR®

Tritor® is committed to transforming waste into resources by promoting reliable and sustainable solutions for a responsible waste management, by actively contributing to building a greener and cleaner future for all.

Join the green revolution by choosing the system best suited for your needs.

TRITOR®

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tritor.it

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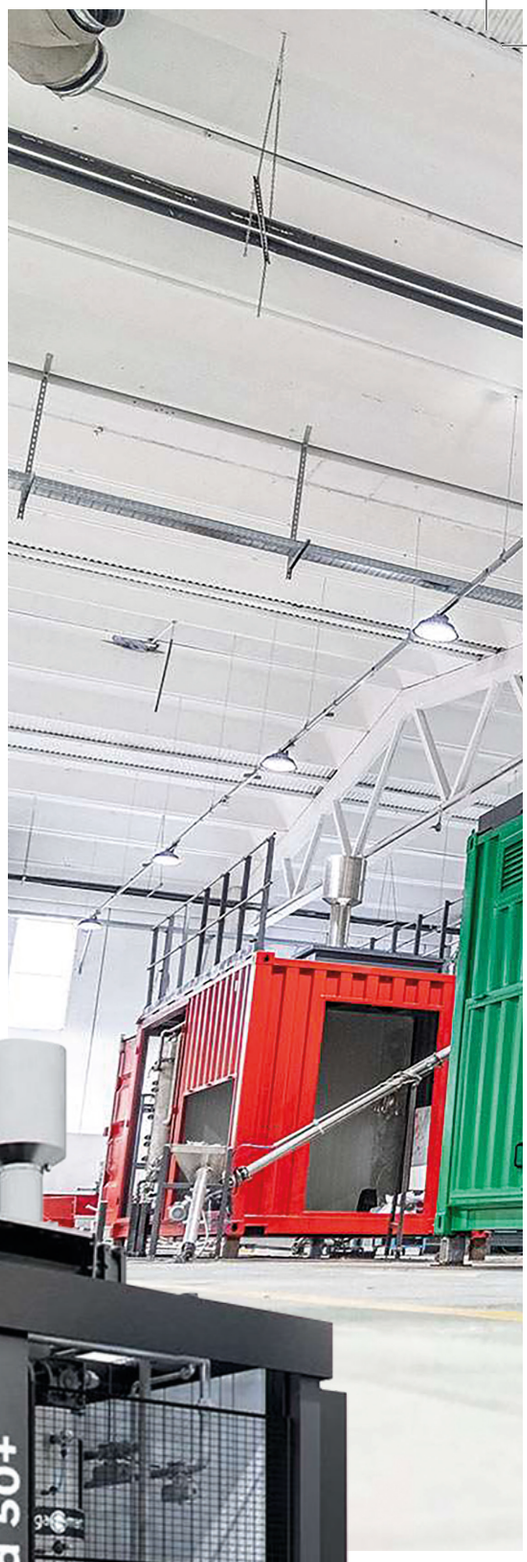
ENERGY FROM BIOMASS AND WASTE

TRITOR® ENERGY

WASTE
AS NEW ENERGY SOURCE



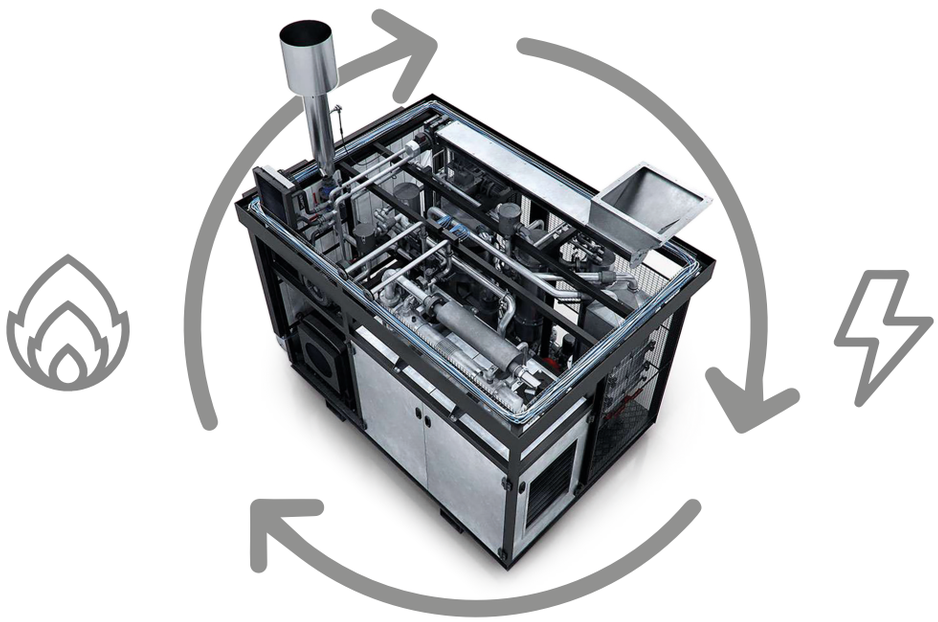
Waste, once viewed as an environmental problem only, is increasingly proving to be a new and promising source of energy. As the world strives to respond to the climate crisis and reduce its dependence on fossil fuels, converting waste into energy becomes an innovative and sustainable solution.

SSF (Secondary Solid Fuel) produced with the latest technology machinery for various types of waste treatment – i.e. unsorted general waste, dry fraction, organic fraction and sludge – is currently the most "sustainable" solution from the standpoints of the environment and affordability. It is used to produce thermal and electric energy in cogeneration plants, and it revolutionises our way of thinking regarding energy and the environment.

TRITOR® ENERGY

THE GREEN REVOLUTION
COMES TO YOUR PLANT

Tritor Energy is a micro cogeneration system producing electric and thermal energy through high quality SSF. Energy is generated via gasification at high temperatures, in total absence or with minimum quantity of oxygen.
This state-of-the-art technology makes the most out of the energy potential of the waste, while minimising harmful emissions in the atmosphere.



Operational Rental - your rental system: you only pay for the energy you consume.

BECOME
ENERGY SELF-SUFFICIENT

Tritor Energy is the ideal choice for urban and industrial heating, as energy production from solid waste increases energy efficiency and generates revenue from the sale of the electricity and heat produced.
This energy solution aims to greatly reduce dependence on traditional fossil fuel sources and mitigate problems linked to the depletion of non-renewable natural resources and to green gas emissions.
Using **Tritor Energy** to produce electric energy can contribute to energy security of the entire country. Diversifying the energy base with SSF can reduce dependence on fuel imports and improve energy independence.

YOU GAIN
AND THE ENVIRONMENT TOO!

Tritor Energy is the ideal solution to meet the high-energy demand from businesses, institutions and public entities, while giving back to the grid part of the electric energy produced, combining profits and care of the environment.

DISCOVER OUR FULL SERVICE SOLUTIONS

From 20 to 200 kWh (electric)
From 40 to 300 kWh (thermal)

BENEFITS
OF TRITOR ENERGY

ZERO IMPACT ON THE ECOSYSTEM

Tritor Energy fits in the natural cycle and respects the environment by generating only clean energy, with no negative impact on global overheating.

LOWER UTILITY BILLS

Self-produced electric and thermal energy lowers significantly your company's utility expenses.

ENERGY SELF-SUFFICIENT AND EFFICIENT

Your business can be energy self-sufficient, and enjoy the additional benefit of energy efficiency.

NATURAL FUEL

The high variety of fuels that can be used in this type of plant makes its use valuable in a number of sectors.

AUTOMATED AND SAFE PROCESS

Every phase of the process is automated and can be controlled remotely or on site with a simple and intuitive interface.

MINIMAL AND FUNCTIONAL DESIGN

The Tritor Energy box holds the entire process and it is easy to move, install and start up (indoor or outdoor).

MODULAR AND SCALABLE

Tritor Energy compact system is simple and quick to manage, extremely adaptable and flexible. The container configuration allows multiple installations and connections to achieve the desired output power.

TRITOR® ENERGY

IT IS THE IDEAL SOLUTION FOR:

- Municipal administrations
- Hospitals
- Hotels
- Sport facilities

Carbon Free Energy from 20 to 200 kWh

CERTIFICATIONS

Tritor Energy micro-cogenerator complies with the **European Conformity (EC)** in all the safety and quality requirements laid down by the regulation.
The production process is certified according to an integrated system of Quality - Environment - Safety UNI EN ISO 9001/2017 - ISO 14001 - ISO 9100:2009 - ISO/TS 16949:2002.

Member of CISQ Federation
CERTIFIED MANAGEMENT SYSTEM
ISO 9001

Member of CISQ Federation
CERTIFIED MANAGEMENT SYSTEM
ISO 14001

Member of CISQ Federation
CERTIFIED MANAGEMENT SYSTEM
EN 9100

Member of CISQ Automotive
CERTIFIED MANAGEMENT SYSTEM
IATF 16949

CE

OUR SUPPORT
TO INSTITUTIONS AND BUSINESSES

Tritor Energy provides support during every phase of the installation process of the micro-cogenerator, ensuring comprehensive consulting and assistance services.

Installation assistance
We provide free of charge context analysis of the facility and of all the engineering services needed for Tritor Energy installation.

Activation assistance
We support you during the application process for the administrative authorizations required to activate Tritor Energy.

Global Service
We support you all the way from preparation of the Business Plan to commissioning the plant. The system is flexible and customizable according to your needs and can be deployed immediately, in turnkey fashion.

TECHNICAL SPECIFICATIONS CE

General Information	TE 20	TE 50	TE 102	TE 109	TE 200
Configuration	20' Container (6,1 x 2,4 x 2,6 m)	20' Container (6,1 x 2,4 x 2,6 m)	2 20' Containers (6,1 x 2,4 x 2,6 m)	30' Container (9,1 x 2,4 x 2,9 m)	2 30' Containers (9,1 x 2,4 x 2,9 m)
Weight	5.500 kg	7.550 kg	15.100 kg	12.000 kg	24.800 kg
Electric power	20 kWp [±20%]	50 kWe	100 kWe	100 kWe	200 kWe
Net thermal power	40 kWth	73 kWth	146 kWth	146 kWth	292 kWth
Biomass Consumption (1)	22-26 kg/h	60 kg/h	120 kg/h	120 kg/h	240 kg/h
BioChar (avg)	1,6 kg/h	4,2 kg/h	8,4 kg/h	8,4 kg/h	16,8 kg/h
Gasification units	1 RESET Evo-5 downdraft fixed bed	1 RESET Evo-5 downdraft fixed bed	2 RESET Evo-5 downdraft fixed bed	2 RESET Evo-5 downdraft fixed bed	4 RESET Evo-5 downdraft fixed bed
Motor (1500 rpm@50Hz)	GM Vortec 4.3 L - V6	n. 1 Origin 10.3 L - V8	n. 2 Origin 10.3 L - V8	n. 1 MAN E3262 E302 - V12	n. 2 MAN E3262 E302 - V12
Generator (50 Hz / 400 V)	Meccalte - ECP 28 VL4	SINCRO SK225	(2x) SINCRO SK225	(2x) SINCRO SK225	(2x) Meccalte - ECP 34 2M4 C
Ability to produce and environmental footprint @ 7200 hrs/year	**TE 20**	**TE 50**	**TE 102**	**TE 109**	**TE 200**
Electricity output	137 MWh	360 MWh	720 MWh	720 MWh	1,440 MWh
Thermal output	200 MWh	526 MWh	1,051 MWh	1,051 MWh	2,102 MWh
BioChar production (avg)	11,5 ton/year	30,2 ton/year	60,5 ton/year	60,5 ton/year	121 ton/year
Primary energy savings (2)	42,7 TEP/year	112,5 TEP/year	225 TEP/year	225 TEP/year	450,1 TEP/year
CO_2 Savings (3)	-125,2 ton/year	-329,5 ton/year	-659,1 ton/year	-659,1 ton/year	-1,318,1 ton/year

(1) Ref. wood chips with 10/12% moisture content pursuant UNI EN ISO 17225-4 standard; variable according to quality of biomass and residual humidity.

(2) Conversion factor of electric energy in Italy: $0{,}187 \times 10^{-3}$ tep/kWhe - SOURCE: ARERA Resolution EEN 3/08.

(3) Sum of CO_2 avoided by equivalent production from fossil sources and CO_2 equivalent to Carbon sequestered in BioChar (68%). Ref. natural gas generation (367,3 grCO_2/kWe; 231,1 grCO_2/kWth) - SOURCE: ISPRA "Atmospheric emission factors of greenhouse gas in the domestic electricity sector..." ed. 2020.

TRITOR® ENERGY

A Tritor S.r.l.
registered trademark

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tritor.it

In collaboration with

RESET
INNOVATION IN BIOMASS TECHNOLOGY

Please note that continuous power performance might be subject to variations in relation to the degree of moisture and the heating value.

TRITOR HURRICANE®

Greater efficiency, lower consumption: waste valorisation at its best

TRITOR HURRICANE®

About Tritor® S.r.l

As a leader in waste management and treatment services, **Tritor® S.r.l.** is dedicated to developing cutting-edge solutions that integrate sustainability, energy efficiency, and innovation.

Tritor's mission is to provide systems that minimise environmental impact by optimising industrial processes, reducing both the footprint and mass of waste for treatment, and improving the quality of materials designated for recycling or energy recovery.

TRITOR HURRICANE®

Reducing waste volumes: a core step towards sustainability

Volume reduction of waste is a crucial step in advancing towards a sustainable circular economy. Compressing waste and minimising its mass and volume are essential pre-treatment processes before materials can undergo recycling or repurposing.

The **Tritor Hurricane**® is engineered as a breakthrough in “pulverization” technology, aiming to significantly reduce energy costs compared to existing solutions while enhancing the effectiveness of volumetric and mass reduction.

TRITOR HURRICANE®: Advanced Technical Specifications

The **Tritor Hurricane**® is an innovative plant designed for pulverising and dehydrating waste via a system that harnesses centrifugal force and an integrated hot air vortex. This design enhances efficiency while reducing energy consumption.

Its compact structure and advanced features make it one of the most efficient and sustainable plants available on the market.

Additionally, the introduction of hot air allows uniform heating of the entire grinding chamber.

TRITOR HURRICANE®

Electric motor and milling system

The **Tritor Hurricane**® is powered by an electric motor rated between 45 kW and 55 kW, generating substantial centrifugal force that activates the fragmentation system within the grinding chamber.
This motor drives a system of spherical bodies (balls or hammers) that rotate, crushing incoming material into fragments suitable for subsequent treatments.

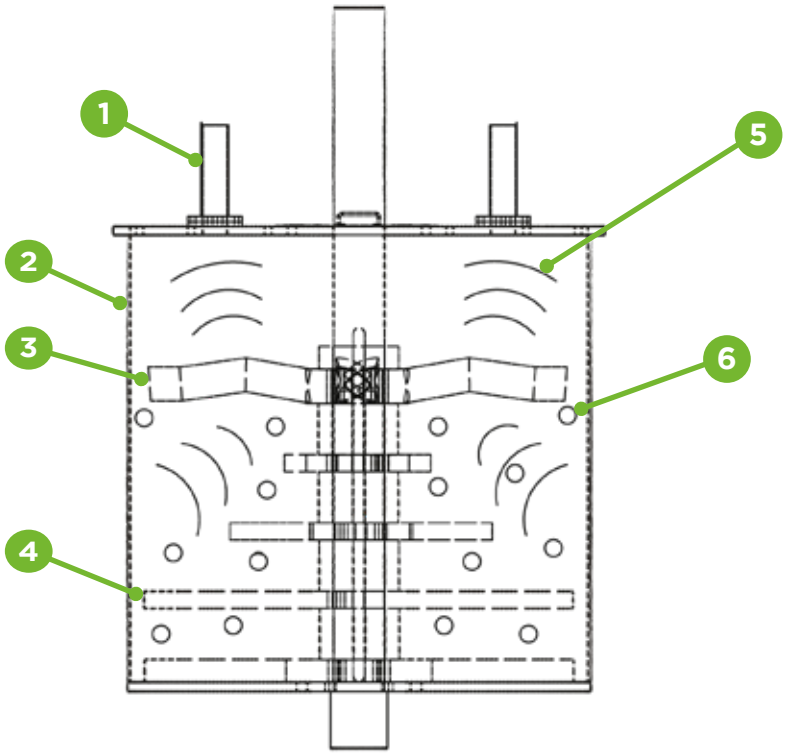
TRITOR HURRICANE®

Grinding chamber

The core of the system is the grinding chamber, internally lined with removable **Hardox 450-500** strips, a steel highly resistant to impact and gentle on friction. These strips are designed to reduce chamber wear and enhance process efficiency. Their unique geometry projects waste fragments towards the centre of the grinding chamber, preventing radial dispersion (ineffective for pulverisation) and optimising fragmentation.
The new and expanded chamber measures 2.4 meters in diameter.

TRITOR HURRICANE®

Rotating block and stability



1 Waveguide Magnetron
2 T-Chamber
3 Upper Helix
4 Blades
5 Electromagnetic Waves
6 Grinding Balls

The rotating grinding block, composed of a central shaft, is mounted on two rotation points (top and bottom), stabilising the system during operation and preventing wear due to shaft displacement. This design extends the machine's overall lifespan and lowers maintenance costs.

TRITOR HURRICANE®

Vanes and balls: pulverisation optimisation

The **vanes**, rotating components on the shaft, are also constructed from **Hardox 400** and, together with the balls, maximise pulverisation efficiency. The geometric configuration of the vanes is designed to optimise the movement of crushing bodies, reducing component wear and increasing the machine's volumetric reduction capability.

TRITOR HURRICANE®

Blades on the rotating plate

Blades on the rotating plate further reduce the transverse particle size of the processed material. With an adjustable orifice height between 2 and 5 mm, the output material can be processed to reach very small sizes, ensuring readiness for subsequent processing or recycling stages.

TRITOR HURRICANE®

Heating system and energy savings

A standout innovation in the **Tritor Hurricane**® is its ability to dehydrate by heating with a hot air vortex, eliminating additional electric consumption. This novel system achieves **higher temperatures** within the grinding chamber with **lower energy consumption**.

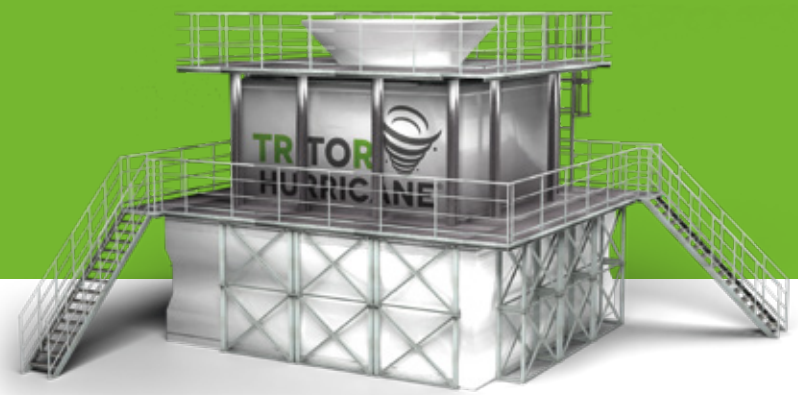
The combination of hot air and the milling system's movement **creates a vortex** that increases material dehumidification capacity, optimising the process and further reducing energy consumption.

TRITOR HURRICANE®

Monitoring and automation via PLC

The **Tritor Hurricane**® is equipped with an advanced monitoring system based on a **Programmable Logic Controller** (PLC), enabling real-time control of machine operating parameters. The system monitors the moisture content and specific weight of incoming and outgoing material, ensuring optimal pulverisation management.
Additionally, three preset treatment modules are available for dry waste, moisture levels up to 35%, and up to 50%, reducing personnel needs from three operators to one per shift.

TRITOR HURRICANE®



Compact design and easy installation

The **Tritor Hurricane**'s compact design, achieved through lateral placement of the electric motor, significantly reduces space requirements.

Compared to traditional solutions, the overall height of the machine's loading system is approximately 4.2 meters.
The **Hurricane** is modular, and based on client needs, 1/2/4 modules can be installed in-line to meet production (waste volume) and space requirements at the production site.

Specifications

Material Types	Partially stabilised organic waste from mechanical treatment, mixed waste from mechanical treatment
Material Types	Mixed Waste from Mechanical Treatment
Non-Suitable Materials	Metals, inerts, glass
Input Granulometry	< 80 mm
Input Humidity	< 60%
Single Chamber Production	t/h 1,2-1,7
Production with 4 Chambers	t/h 5-7

General specifications

Operating Temperature	- 10 to + 40 °C
Electrical Voltage	380 V 50 Hz
Installed Electrical Power	220 kW
Operating Electrical Power	136 kW
Operating Time	Automatic, 16 h/day
Refiner Dimensions	L: 4 m x W: 4 m x H: 4.4 m (excluding waste feeding)
Control Cabinet Dimensions	L: 5 m x W: 1 m x H: 2 m

TRITOR HURRICANE®

Superior energy efficiency and performance

Despite its relatively low motor power (45 kW), the **Tritor Hurricane**® delivers performance equivalent to that of machines with far more powerful motors, thanks to optimised design and transmission systems.

The machine's **high Coefficient of Performance** (COP) between electric energy input and pulverised mass output is a key factor distinguishing it from competitors, ensuring a substantial reduction in operational costs.

TRITOR HURRICANE®

Conclusion

The **Tritor Hurricane**® stands as a reference solution for waste treatment and pulverisation, with a focus on energy efficiency, sustainability, and cost reduction. Thanks to its technological innovations and compact configuration, this machine represents a secure investment for companies aiming to optimise industrial processes and minimise environmental impact.

TRITOR®

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Tritor S.r.l. is part of the BelENERGIA Group

COMPANY PRESENTATION

2025

A Leading European Player in Renewable Energy and Circular Economy

Executive Summary

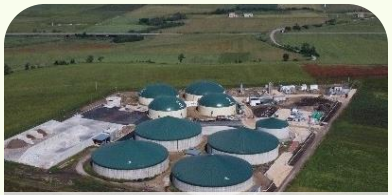
- Founded in 2011 by French entrepreneur Vincent Bartin, **BelEnergia** is an Italian-based group active in **renewable energy** and **circular economy**
- The Group's headquarters are located in Milan (Lombardy) since 2022 and Lecce (Puglia) with a current headcount of c.>**235 FTEs**
- BelEnergia **develops, builds, owns and operates solar PV** and **wind** assets (150 MW operating & under construction) as well as **biogas** and **biomethane units** (19 MW and 1,900 Sm3/h operating & under construction) generating power and gas from **organic waste**
- By **2023,** we will have processed **450,000 tons** of **bio-waste, residues** and **co-products** in line with the **sustainable** requirements of the **RED2.**
- The Group has a unique **entrepreneurial, hands-on approach** to the business with EPC and O&M activities mainly performed in-house, which ensures timely delivery of projects and cost efficiency
- While Italy will remain BelEnergia's core market, **development in other Southern European countries is well underway** with a first biomethane unit in operation in France and numerous projects with several years of development in France, Spain and Greece

€100m	**305 GWh**	**450,000 tons**	**78,750 tons**
2023A Revenues(1)	2023 *Equivalent power generation*	**of bio-waste, residues and co-products** in 2023	Carbon emissions avoided in 2023

Source: *Company Information*
Notes: All pipeline figures are gross unprobabilized capacity
(1) Aggregated under management

2023 - 2024 New achievements

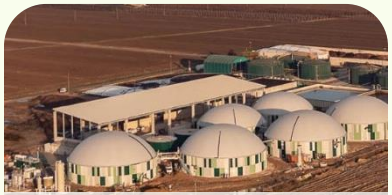
Biomasse premium & biowaste new sites review



BELAGRI

CTIP BLU

DISTILLERIA BARTIN



SB BIOMETANO

GAIA, 29%

SOLOGNE BIOGAZ

Solar Review

E8 (Revamping)

Mefli 1 & 2

BelEnergia's Fully Integrated Business Model

DEVELOPMENT & SOURCING

- **Permitting and authorization**
  - Land negotiation
  - Project & plant design
  - Permit development (environmental study,…)
- **Offtake** Securing offtake through public auctions, corporate PPA and BPA

ENGINEERING, PROCUREMENT AND CONSTRUCTION

- **Global project management**
- **Engineering** (process design)
- **Procurement of equipment**
- **Construction phase**
- **Commissioning**

REVENUE MANAGEMENT

- **Targeting over 70% contracting** across assets in the medium term
- Each asset to have **optimized and secured revenue offtake** depending on the technology and market
- Financial reporting with **dedicated KPIs**

OPERATIONS & MAINTENANCE

- Managing **maintenance**, **operational purchase** & **feedstocks**
- **Operation of plants**
- **Asset management** (administrative, financial and contractual services)
- Performance improvements exploiting **synergies between sites**, to increase the **operativity of the initial perimeter**

FINANCING & BUSINESS PLAN

- Project **financing**
- Financing **support fully integrate with the EPC** process to provide constant monitoring and control of projects' costs & funding needs
- **#3 people at top management level** in charge of relationships with banks and other financial providers

BelEnergia Today

151 MW and 1,900 Sm3/h Operating & Under Construction

90 MW

Energia Otto PV Plant

61 MW

Bel Lavello Wind Farm

19 MW(1)

Enterra Biomass Boiler

1,900 Sm³/h

Bel Agri Biomethane Plant

Key numbers

€100m
2023A Revenues(1)

250 FTE
End 2024

305 GWh
2023

450,000 tons
of bio-waste, residues and co-products in 2023

78,750 tons
Carbon emissions avoided in 2023

Compliance & Quality Culture

BelEnergia implements a systematic approach of doing business which ensures that the highest standards are met

BelEnergia's Certification Roadmap

	ISO 9001 *Quality*	ISO 14001 *Environmental compliance*	ISO 45001 *Safety on work*	ISO 37001 *Anti-bribery*	GRI *ESG*	MOG 231/2001 Italian Anti bribery compliance system
BelEnergia industrial holding	Q2 2025	-	-	Q1 2024	Q1 2025	2018
Enterra 2022	2022	2022	2022			
Distilleria Bartin 2021	2021	2018	2021			
SWM 2023	2023	2024	2023			
TRITOR	Q3 2023	Q3 2023	Q3 2023			
Belagri, CTIP BLU, BBO, BGN, SB, BEAR, Perbel	2025	2025	2025			

BelEnergia's Systematic Approach

Corporate Level

- **Management system** identified and controlled (**operational mapping**)
  - The **operational mapping** (broken-down into processes by business line) describes the actions to be carried out and integrates the requirements of **international standards such as ISO 37001, ISO 9001, etc.**
- **Resources** (management rituals, team organization, etc.)
- Approach focused on **strategic objectives**

Operating Level

- **Operating procedures, instructions and guidelines**
- **Standard documents** (form, checklist, BP template, standard CGA, project review template, dashboard, etc.)
- **Recordings and follow-ups**

Source: Company Information

Top-notch Management Team with Strong Industrial Background

Currently 216 people from c.80 mid 2021

Total: >235 People

Top Management

- **Vincent Bartin** *President*
- **Vincenzo Rena** Compliance Officer
- **Jacques-Edouard Lévy** *CEO*

Holding Company

- **Antonio Di Guglielmo** *Program Director and Development*
- **Sergio Starace** *Legal senior*
- **Pierpaolo Indino** *CFO*
- **Nicolas Baron** *CIO*
- **Francesco Pietrantuono** *Developper senior*
- **Josepha Boussageon** ***Legal***
- **Antonella Ruberto** *Accounting Tax and Treasury Manager (Italy)<*
- **Annapaola Bianco** *Group Controller and Italy CFO*
- **Cinzia Troilo** *HR Manager*
- **Andrea Emmanuele** *Quality, ESG Manager*
- **Michele Amoia** consolidation manager
- **Jean-Marie Suret** *France Financial Director*
- **Marika Spoto** *Communication & PR*

55 People

Biowaste Business Unit

- **Alexander Ladurner** *General Manager Biowaste Nord*
- **Giuseppe Caudo** *General Manager Tritor*
- **Michele Lagioia** *General Manager Biowaste Sud*
- **Francesco Leone** *Head of EPC*
- **Alberto Mansueti** *CTIP Blu*
- **Paolo Spagone** *BelAgri*
- **Tommaso Pertosa** *Perbel*

Country heads (S&W and Biowaste)

- **Damien Chesne** *BU Director France*
- **Emilio Ezquerro** *BU Director Spain*

>180 People

Solar & Wind Business Unit

Solar & Wind Operation

- **Giuseppe Buccella** *Director Solar & Wind*

Source: Company Information

BelEnergia today

11 Biowaste plants[(1)] (19 MW + 1,900 Sm³/h) and 37 Solar & Wind sites in operation (151 MW)

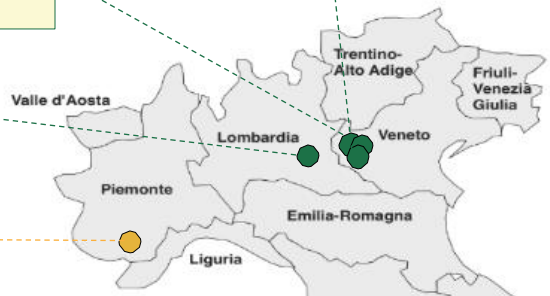
Belagreen Nord + **Societa Agricola BBO**
2 biogas plants
(2 x 1 MW)

Biometano SB
Biomethane
(500 Sm³/h)

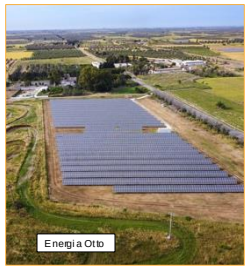
CTIP Blu
Urban Waste Biomethane
(400 Sm³/h)

Enterra
Biomass Boiler
(13 MW)

BEAR
(Biogas 1 MW)



Next Sol PV 2
PV Plant
(1 MW)



PV plants in operation in South Italy
- **Energia Otto** *(12.4 MW - 12 sites)*
- **Intersun** *(3.5 MW - 1 site)*
- **Belex Basilicata 24** *(1 MW)*
- **Compagnia Solare 1** *(2 MW – 2 sites)*
- **Belaria** *(3 MW - 3 sites)*
- **Mithra** *(11 MW – 11 sites)*

30 sites in total

Belagri
Biomethane Plant
(500 Sm³/h)

Perbel
Refinery

GFV
Biomass Boiler
(1 MW)

Sigma Bel Energy *("Melfi")*
PV Plant
(56 MW - 4 sites)

Bel Lavello
Wind Farm
(40 MW)

Gallo Due
Wind Farm
(21 MW)

Sologne Biogaz
Biogas
(0.8 MW)

Distilleria Bartin
Distillery + Biogas (1 MW) + Compost
+ Wastewater treatment
+ 500 Sm³/h biomethane

Source: *Company Information*
Notes: Solar locations in the South represent the range of BelEnergia's sites, not actual sites. (1) Excluding GAIA which is owned at 29%

Outstanding Positioning of BelEnergia

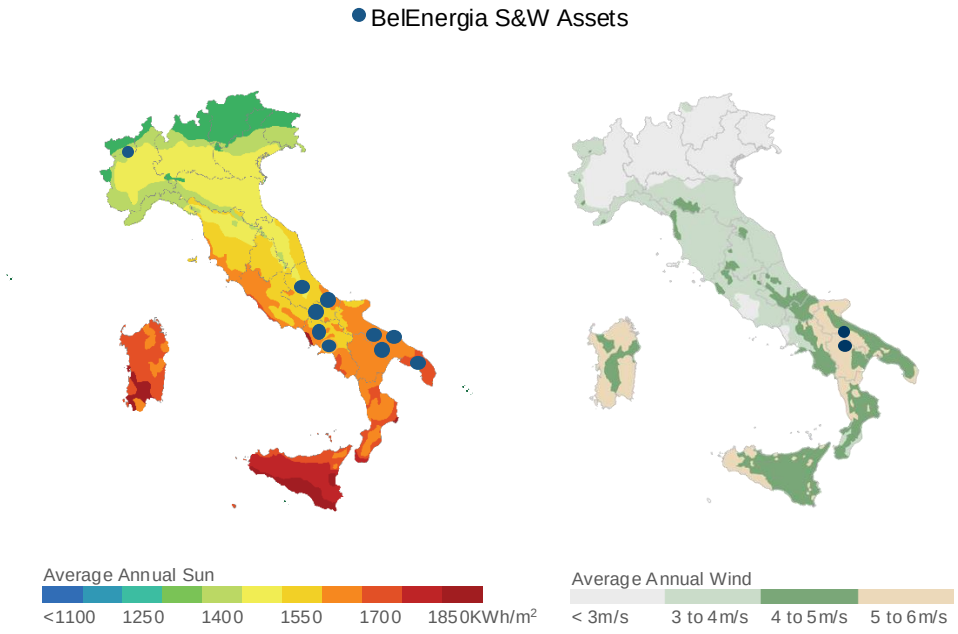
Focus on Solar and Wind

- BelEnergia was born in **Southern Italy which offers from 1,500 up to 2,100 hours of solar PV production every year, strong winds**
- Subsequent developments in Northern Italy – among the highest solar irradiation / wind intensity in Europe – Greece, Spain and France all aimed at **combining favorable climate with the best business and regulation**

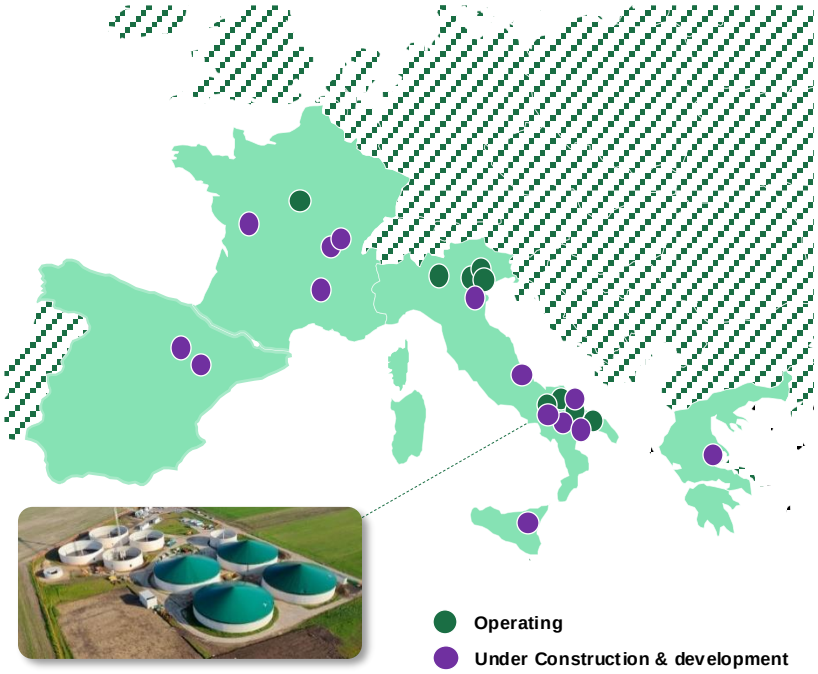
Strong Regulatory Tailwinds in Europe

- **Abundant waste streams** from **agriculture and agro-industrial by-products** to produced energy
- EU and local regulators increasingly favor **circular economy and renewable energy** and in particular **biomethane**

Focus on Solar & Wind in Italy

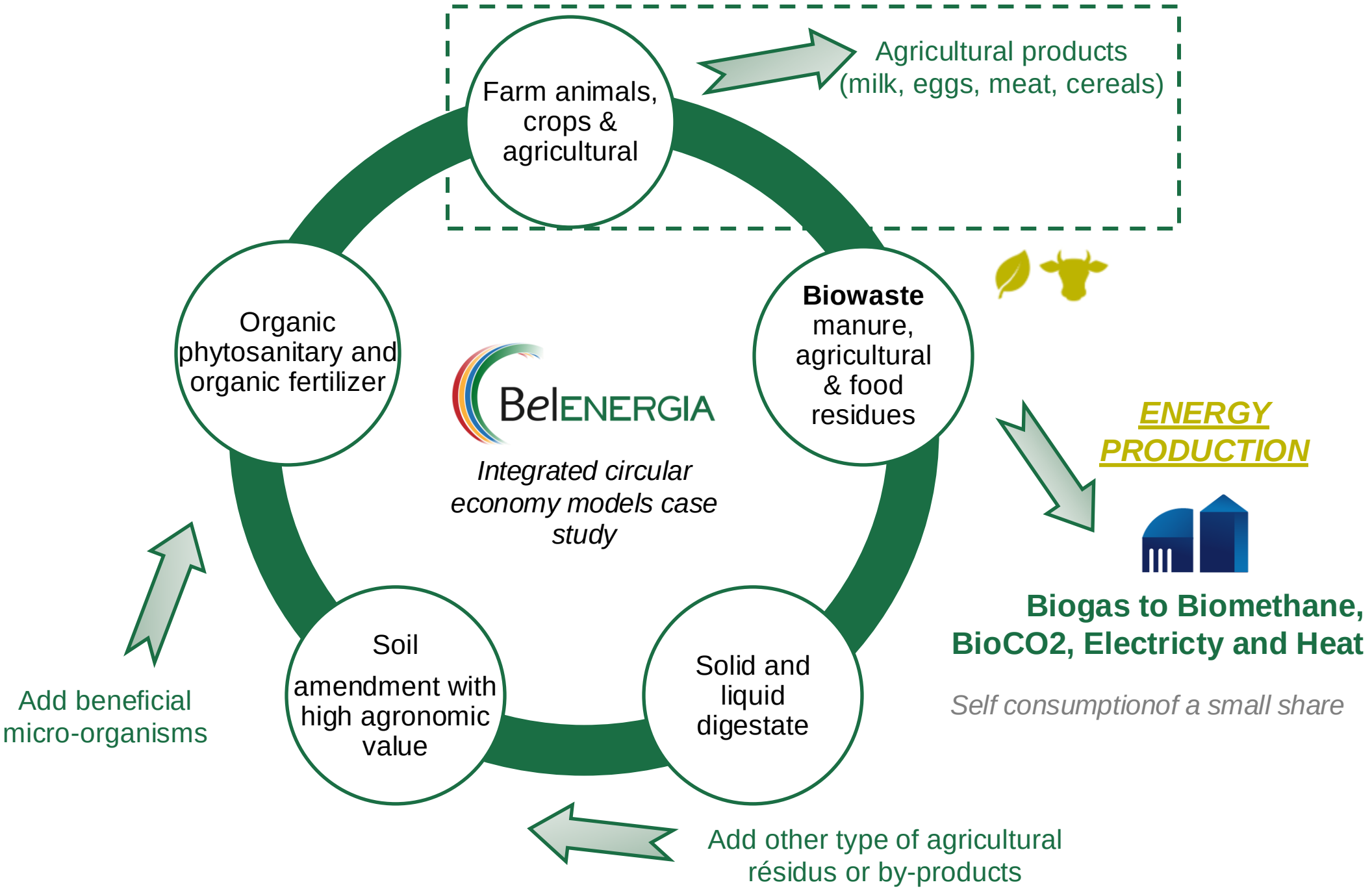


Focus on biogas, biomass and biomethane



Source: *Company Information, 2022 Wind Energy in Europe, A Gas for Climate report July 2022,*
Notes: (1) In Europe, for anaerobic digestion

BelEnergia Circular economy model



Hands-on Mindset Combined with Entrepreneur & Compliance Culture

Hands-on Approach

- **In-house ability to fully deliver and operate most projects :**
  - Development
  - Financing
  - Engineering & Procurement
  - Construction Management
  - Operations & Maintenance

  → **In-house**
- **Strong track record to successfully develop assets after land has been secured**
- **Best-in-class productivity on assets**
  - ✓ In-house teams enable to deliver and monitor projects in an industrially-efficient manner
  - ✓ Sites downtime reduced to minimum thanks to intimate knowledge of the assets
  - ✓ Feedback loop with engineering teams

Entrepreneur & Partnership Spirit

- **High industrial DNA management team incentivized in equity to reinforce entrepreneurial spirit**
- **Partnerships with local players in Italy, Greece, Spain, etc.**
- **Long-term privileged scouting partnerships to attract projects with high-return potential**

Compliance & Quality Culture

ISO 9001	ISO 14001	ISO 45001	ISO 37001	MOG 231 / 2001
Quality	*Environment*	*Safety on the Work*	*Anti-bribary management*	*Italian Compliance Regulation*

- **Highest standards of ethics ensured by adherence to the most stringent regulations and norms**

Source: Company Information

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Upland Road

Market Research Response

To: **Saba Musleh, CPPB, Negotiator**
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saba.musleh@miamidade.gov

CC: Ross Byers, Project Manager
Atkins Réalis
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April 14, 2025

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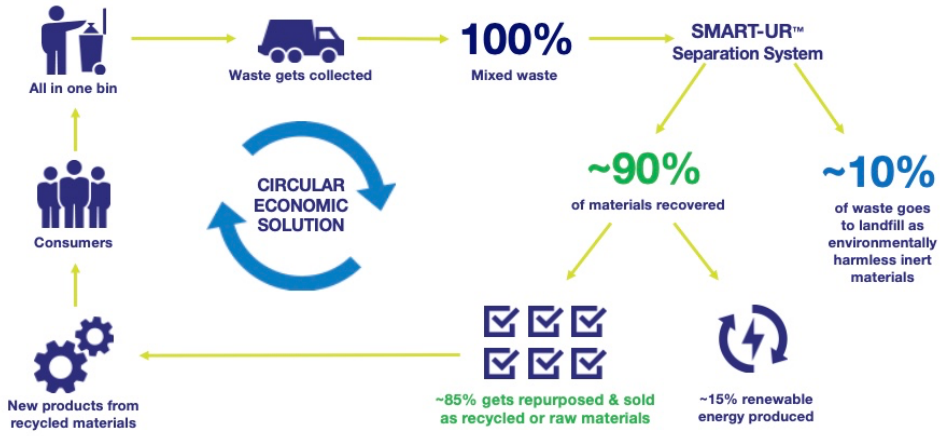
Upland Road was formed in 2020 by a team of seasoned experts who have extensive experience in solid waste management, manufacturing operations, conversion technologies, advanced technology development and deployment, corporate sustainability, and environmental market transformation. Team members have broad and deep contacts across multiple industries, as well as within municipal and national governments.

Upland Road's innovative, patented technology, the SMART-UR™ Separation System, rigorously separates co-mingled waste and turns the *entire* material stream, including food waste, manually sorted traditional recycling, and hard-to-recycle items such as electronic waste, into consumer goods, pure feedstock for further manufacturing, soil amendments, clean energy, and green fuels. We extract the value from all elements of the waste stream on a "highest and best" use basis.

Virtually all solid waste is recyclable. Co-mingled waste materials are garbage; properly separated waste materials become valuable feedstocks. By converting ~90% of municipal solid waste to productive use, SMART Centers™ significantly extend the life of existing landfills and minimize the need for waste incineration. Additionally, and importantly, the SMART Center™ model does not require separate waste and recycling bins, allowing pickup routes to be consolidated, reducing truck traffic, improving roadway safety, and lowering costs, GHGs, and air pollution.

SMART Centers™ transform waste into its highest value



B. Waste Management Solutions

1. **Solution** - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include technologies, approaches, etc.

The SMART Center™ and SMART-UR™ Separation System

Upland Road's SMART (Sustainable Materials and Advanced Recovery Technology) Center™ is an eco-industrial campus designed to fully convert each element of the municipal waste stream into its highest and best use, drive economic growth, and advance environmental sustainability.

Each SMART Center™ consists of a tip floor with up to ten days of holding capacity and waste sorting lines under roof and negative pressure. The 50-60 ton-per-hour waste sorting lines operate 20 hours a day, staffed by three shifts, with down time for maintenance; they can process up to 2,400 tons a day. When the processing lines work side-by-side, their capacity can be expanded modularly to accommodate the County's entire regularly-controlled 2.4 million ton waste flow, as well as increased volumes and extraordinary solid waste generation events, such as major sporting events, concerts or storm cleanup. They can also operate as dedicated lines, so that traditional single stream materials can be processed separately for several shifts, if required by variations in flow or content. A SMART Center™ directly employs approximately 300 people, creates up to three additional indirect jobs for every direct job and attracts significant private investment.

SMART Centers™ enhance their economic value by on-site production and co-location with offtake partners.

The type of contamination that results from traditional sorting facilities – wet fiber, paper/plastic mixes, glass shards – is virtually eliminated with the SMART-UR™. This rigorous sorting, combined with our back-end processing capabilities, unlocks the full value of all materials, optimizing sale prices of materials generated by the SMART-UR™. This is important to both resellers and direct purchasers such as consumer packaged goods (CPG) companies who are demanding an ever-increasing volume of recycled materials, particularly plastics.

In addition to the SMART-UR™ separation technology, a typical SMART Center™ can have co-located on the same campus:

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- Plastic cleaning, sanitizing, pelletizing facilities
- Processes to clean and convert glass into furnace-ready recycled glass (cullet) or lightweight construction aggregate
- Mixed metal commodity separation and baling
- Yard waste aerated static pile composting and fermentation or anaerobic digestion of food waste
- E-waste processing into metal, glass, and plastic components
- Mixed dry organics (rubber, textiles, wood, etc.) processing and conversion, and
- Paper manufacturing.

One of the significant challenges that all solid waste processing and disposal facilities currently face is the increasing frequency of fires that can disrupt operations and cause significant injuries and property destruction. Miami-Dade County is all too familiar with this unfortunate reality. According to recent data, the number of fires at post-collection waste and recycling facilities continues to increase, as Americans discard dangerous items such as lithium-ion batteries, vapes, and propane tanks into their trash can or recycling carts.

Upland Road will install world-class fire prevention and mitigation systems in its facility. These systems will include the leading vision technologies that utilize both x-rays and traditional cameras to identify potentially dangerous items and segregate them before they are processed further into the facility, where a fire could cause catastrophic damage. In addition, Upland Road will use the leading providers of fire mitigation systems for waste facilities to eliminate any fires or other thermal events before they evolve into major incidents that harm facility personnel or operations.

The SMART Center™ represents a significant step forward in building and advancing the recycling sector and supporting emerging, regenerative technologies. A SMART-UR™ Separation System™ feeding a SMART Center™ would improve Miami-Dade's recycling performance dramatically, while reducing the waste-to-landfill at a rate not seen anywhere else in the U.S.

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

Upland Road brings a breakthrough technology and business model – that will realize the full economic and environmental potential of the discarded material stream. This model is fundamentally different from the traditional models of waste collection, processing, and disposal, which typically emphasize shipping waste via truck or rail to landfills.

Upland Road shifts the economics of the waste system from one based largely on tip fees, collection fees, related municipal taxes, and often-volatile commodity sales, to one driven by consistent revenue derived from the discarded waste itself. By extracting significantly more materials from the waste stream and then by cleaning and processing them on-site, Upland Road can then sell these materials as feedstocks or products at consistently higher prices than are typically available in the commodities markets.

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In the EU, where landfill space is constrained and regulations already impose costs and restrictions on packaging producers and other major municipal waste generators, several early prototypes of a SMART Center™ have been functioning for the past decade. In Granada and Barcelona, Spain, and Oslo, Norway, our systems integrator, Stadler, has designed and installed waste sorting systems that accomplish, at scale, some of what we will achieve in Miami-Dade with a purpose-built SMART Center™. The Oslo facility is a dry sorting line that separates paper, plastics, metals and other dry organic materials for resale into commodity markets.

In Spain, the facilities are larger and have evolved over the past decade into integrated municipal waste sorting facilities as technologies have been added piecemeal. Wet organics that had previously been landfilled, for example, are now processed further after sorting to make soil amendments and other value-added products. Plastics sorting has become increasingly efficient, raising volumes and yields of recovered material.

Through Upland Road's relationship with Stadler, and the learning gleaned from these prototypes, a facility designed and built for Miami-Dade would optimize outcomes from the time of its commissioning and would be flexible enough to incorporate any significant improvements in technology throughout its operating life, driven, for example, by advancements in AI that inform the operation of front-end robotics.

3. **Quantity** - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

Upland Road's SMART-UR™ system, when configured for Miami-Dade County and built out in phases, would be capable of processing the County's full volume of waste, 2.4 million tons per year.

Each SMART-UR™ sorting system can process 2,000-2,400 tons per day (600,000-700,000 tons per year). **Four co-located separation facilities and the associated manufacturing and logistics, along with campus energy and water infrastructure, would be sufficient to handle the 2.4 million tons controlled by Miami-Dade each year.**

Upland Road's system is designed to separate and process the full mixed-waste stream. It is also designed to handle seasonal changes in composition and volume throughout the year, including extraordinary waste generation events, such as major sporting events. We also can work with the county to include the ability to process elements of storm cleanup waste, if desired. While the system's ability to process Construction and Demolition waste is constrained, the SMART Center™ campus can serve as a collection hub and preliminary screening center for this type of waste as well as for bulky waste such as white goods and furniture destroyed by water or wind.

4. **Technologies** - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

Machines separate materials much more effectively than do businesses and consumers. Shifting the burden of waste segregation from people to machines at meaningful volumes helps create a truly circular system that extracts the highest and best value from all elements of the waste stream while

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building a platform for further materials-focused innovation. And, by moving the burden of waste separation from people to machines, we free up resources to expand efforts focused on reduction and reuse of materials. While some fiber for paper recycling may be lost through wet-dry contamination, it will be recovered through other processes on the SMART Campus™. In addition, because all of the fiber in the discarded material stream is captured, significantly more total fiber will be re-purposed than in any variation of the current recycling system.

At the heart of the SMART Center™ is the SMART-UR™ Separation System, the first truly automated mixed waste separation system. The SMART-UR™ is designed to separate everything in the waste stream into clean and consistent feedstock streams. It includes up to 70 pieces of proven sorting equipment – several times the number of sorting steps in a traditional single-stream sorting facility – and it will be customized to meet both the composition and variance of Miami-Dade County's recycling and waste, and the desired outputs for the manufacturing processes on the campus.

The SMART-UR™ is engineered and built by Stadler, the world's largest and most experienced waste processing system integrator, using a custom design that is covered by 24 U.S. and international patents. The SMART-UR™ system is guaranteed and bonded to separate and recover ~90% of the waste stream into feedstocks of 95% material purity, with 97% system operational reliability.

Downstream manufacturing and conversion processes co-located with the SMART-UR™ Separation System™ at the SMART Center™ use proven, established technologies from industry-leading companies, such as Voith, Krones, ETIA, Kanadevia (formerly Hitachi) and Jenbacher that will fall under a full Engineering, Procurement, and Construction (EPC) performance guarantee.

Each SMART-UR™ Separation System can operate 20 hours per day to process up to 2,400 tons of waste, six days per week. Total sorted throughput is 600,000-700,000 tons per year. The equipment will be maintained to the highest standards, meeting or exceeding manufacturer recommendations. We will strive to shut down only one of the two processing lines at a time, to ensure consistent, continued processing of materials, and we have sufficient indoor waste storage for maintenance periods.

The SMART-UR™ is designed for reliability with dual material processing lines for redundancy, while a robust on-site maintenance and repair operation ensures reliability. A system of bunkers and temporary storage allows for weekly and seasonal fluctuations in waste generation and a precise sizing of back-end processing technology to ensure the highest efficiency, maximum uptime, and the elimination of unnecessary investment in processing capacity.

Because the SMART-UR™ is designed to separate everything in the waste stream, fluctuations, or changes in waste composition over time will not impact the ability of the facility to process Miami-Dade County's waste in the future.

The SMART-UR™ Separation System: modular additions to address required volume:

- **Plastic**: the SMART-UR™ system will deliver plastic sorted by resin at 90-95% purity. Additional sorting, washing, flaking, pelletizing occurs at an on-site pelletizing plant.
- **Paper**: to supplement the sale of bales sorted by colors and density into the commodity

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markets, if an adequate quantity of acceptable fiber can be secured, other fiber-related manufacturing processes can be built on campus.

- **Metals**: bales of ferrous and non-ferrous metals can be sold in the commodity market, with maximum economic value being gained due to proximity to Port of Miami and Asian/South American markets which offer higher prices for metals.
- **Glass**: cleaning and processing recovered glass into construction products or color-sorted feedstock that can be put back into the glass bottle manufacturing stream.
- **Yard waste**: composting, digestion/fermentation, and pyrolysis technologies for biochar will convert green waste into clean energy (liquid & gaseous), fertilizer and soil amendments.
- **Food waste**: digestion/fermentation and pyrolysis technologies for biochar will convert food waste into clean energy (liquid & gaseous), fertilizer and soil amendments.
- **Mixed dry organics** (textiles, rubber, plastic residue, etc.): are converted into syngas for energy production and a variety of chars for filtration and other uses.
- **E-waste**: are separated into metal, glass, plastic elements; precious metals and rare earths are also extracted.
- **Combined heat and power** (CHP) units provide electricity and process heat for the SMART Campus from waste-derived fuels. This will be the major source of emissions.
- **Wastewater** from paper production (if installed), plastic washing, and glass washing will be processed on-site and the majority of water will be recirculated for process use.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

Upland Road's SMART Center™ proposal can manage all County-controlled waste, extend the life of County landfills, bring significant employment and private investment to the County, reduce waste management expenditures for the County, its residents and businesses.

The envisioned SMART Center™ can recover 90% of everything in the mixed waste stream, leading to a reduction in the County's carbon footprint of over 2 million tons per year.

The SMART Center™ addresses the environmental challenges stemming from today's fragmented approach to waste management and reliance on landfills, incineration, and exporting (domestically and internationally) to address discarded materials.

Upland Road's proven, innovative technology, embodied in a robust portfolio of patents, effectively separates co-mingled waste – eliminating reliance on consumers to separate waste at scale – and turns the entire material stream, including hard-to-recycle items such as electronic waste, into pure feedstocks for consumer goods, soil amendments, clean energy, and green fuels.

By using a "one-bin" model, collection routes can be consolidated, reducing traffic, GHG emissions, and wear on roadways, while lowering costs and expanding recycling participation to 100% for *all* consumers and businesses. Through a competitive tipping fee, potential route consolidation, and revenue sharing, a **SMART Center™ approach can substantially reduce the County's waste management costs.**

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The SMART Center would reduce or eliminate Miami-Dade County's reliance on landfill capacity in other portions of Florida and the southeastern United States, mitigating the risk that other states, including Alabama, could seek to block disposal or increase the costs of out-of-state waste disposed of in their landfills on top of the transportation costs incurred in moving high volumes of waste long distances.

Today's material recovery infrastructure cannot deliver the accuracy and material purity needed to return valuable resources to the consumer product stream, as opposed to creating industrial inputs. Only the SMART Center™ does exactly that.

The SMART Center™ approach could bring up to 1,500 skilled manufacturing jobs plus construction and other induced employment to the County.

Looking longer term, Artificial Intelligence, data capture, and data analysis, which are essential elements of the SMART-UR™ Separation System, provide crucial insight into the contents of the waste stream. Upland Road can create a detailed waste characterization for every day of the year. This data enables more effective program development and delivery for the County, as well as better targeted off-take business activities, and third-party verification of carbon and methane savings, which in turn can provide another revenue stream for the SMART Center™ through environmental credits.

6. **Challenges** - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

The entitlement process to obtain government approvals and permits needed to develop a SMART Center™ on a specific real estate parcel is complex and can slow down or derail a project if not performed well. As discussed in Section D.4, Upland Road's protocols employ accurate planning and scheduling, partnerships with globally-recognized design, engineering and contracting companies, and continuous effective communication and technical excellence.

We research, vet and engage premier regional experts in real estate development, infrastructure design and construction, and environmental permitting. Our strategy of working closely and communicating continuously with planning and approval agencies and FDEP permit engineers ensures that approvals are obtained within agency-published minimum review and approval times.

We discuss issues that may be problematic, or subject to various interpretations, ahead of application submission with project partners such as FDEP permit engineers, county planners or various city departments. Such issues may include EPA air emission factors, pollutant control efficiencies, property setbacks or wetlands buffer requirements. Clarification of agency positions prior to application submission streamlines the review process and eliminates the need for multiple revisions, additional information requests and rounds of application review.

Our use of local consultants that are recognized experts in regional regulatory requirements, and recognized as such by the applicable regulatory agencies, further expedites the approval process and "bullet-proofs" our applications from objections and obstructions.

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The core technical profile of a SMART Center™ campus – the tip floor and waste sorting arrays under roof and under negative pressure, with air filters and bag houses to minimize fugitive odor and dust - make it resemble an e-commerce fulfillment center or logistics distribution facility. This has provided critical assurances to neighbors in every other area in which we have pending proposals. In addition, our approach to siting is rooted in disclosure and transparency in all facets of our operation, enhancing community trust in the outcome.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution

The anticipated capital expenditure for the facility is approximately $2,250-$2,750 million. This includes systems for municipal solid waste (MSW) sorting and separation, plastics, glass, metals/e-waste, and mixed dry organics processing and manufacturing, organics processing through digestion, fermentation and biochar production, and onsite combined heat and power and wastewater treatment, as well as necessary upgrades to the chosen site. It does not include the potential addition of a recycled paper mill.

Estimated initial annual operating expenses (opex) are projected at $425-475 million. Opex is expected to increase aligned with inflation over the 30-year operating period. Opex includes necessary capital replacement and upgrades.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

Several major firms, including Morgan Stanley, have expressed interest in acting as lead arranger for, or participating in, debt and equity project financing.

Upland Road anticipates that it will take 6-12 months to achieve full financing of the SMART Center™ following the execution of a contract between Miami-Dade County and Upland Road. During the fundraising and planning phase of the project, we would work closely with Miami-Dade County to identify potential public and private sources of traditional project financing, participation from impact investors, and economic incentives, to ensure that the SMART Center™ has the strongest financial foundation – along with community support – possible.

We are open to alternative financing structures, including public-private partnerships or strategic corporate investments – particularly from companies aligned with country-preferred partners.

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

The project will generate revenue from four primary sources: product sales, tip fees, energy production, and regulatory/market credits (e.g., carbon credits and Renewable Identification Numbers, or RINs).

Upland Road also anticipates that it will share a portion of the net revenue generated through this

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project on an annual basis with Miami-Dade County. These funds would ideally be utilized to educate residents, visitors, and others about sustainability and recycling, and to support local Zero Waste efforts.

Tip Fee

Our current financial model anticipates a tip fee between $65-$75/ton. The majority of revenue will be derived from sources other than the tip fee, principally the items described above – product sales, energy production, soil amendments, and regulatory and market credits.

Once the overall financial framework for the project has been established, there is potential for a revenue share back to the County.

Revenue sources include:

Product Sales

- Plastics: Plastics will be flaked, pelletized, and can be manufactured on-site into end-use products, depending on comparative economics for competing uses. Recycled PET, for example, is highly desirable as a feedstock in several manufacturing sectors, including fiber makers and container manufacturers. Additional manufacturing for these uses would take place at off-site facilities after the feedstock was shipped in bulk to those locations, or potentially on-site if local off-takers of the products can be found.
- Paper: Recovered Miami-Dade wastepaper is modeled to be baled and sold into the commodity market. We can further process the recovered fiber into recycled kraft paper at an on-site paper mill, most likely for the production of new corrugated boxes, if sufficient acceptable fiber can be found.
- Metals and e-waste: After separation, these materials will be sold in the commodity market.

Energy Production and Organic Soil Amendments

- Organics (yard and food waste): These streams will be converted into renewable energy, and liquid and pelletized fertilizers.
- Mixed dry organics (textiles, rubber, #7 Plastic, other residues): This feedstock will support energy production and will be processed into various technical chars for filtration or other uses.

Regulatory and Market Credits

- Carbon Credits: Generated through significant landfill diversion.
- RINs: Earned through the conversion of organic waste to renewable energy for transportation uses under applicable regulatory frameworks.

Data

Artificial Intelligence, data capture, and data analysis are essential elements of the SMART-UR™ Separation System, providing crucial insight into the contents of the waste stream. Upland Road can create daily detailed waste characterizations, as well as calculate the potential carbon and methane savings created by the system. Use of this data facilitates more targeted off-take business activities, as

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well as third-party verification of carbon and methane reductions, which can provide an additional revenue stream for the SMART Center™ through offset sales.

D. Implementation Approach

1. **Infrastructure** - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

Upland Road will act as master developer and operator of the SMART Center™ campus. We have established relationships with several leading national and international architectural and general contracting firms to execute and implement the plans and provide all necessary financial assurances and an EPC wrap on the project as a whole.

The SMART Center™ is designed to be as closed-loop as possible. Access to water, electricity and gas will be needed; an onsite wastewater treatment facility is included in the design to recirculate 75-90% of the water flow and supply 60-100% of the electricity and process heat needs through conversion of received materials.

2. **Size** - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

Of the sites evaluated by the County, the Airport West site can best accommodate the proposed SMART Center™ complex. Without a recycled paper mill, up to 150 acres would be needed for sorting, manufacturing and logistics. An additional 10-15 acres would be needed for a paper mill, should one be installed. Capital assumptions include the wetland mitigation and roadway improvements identified by the County. If this site does not prove feasible for any reason, or works best in conjunction with another related site, Upland Road will work to secure the appropriate additional locations.

3. **Site Ownership** - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

The Airport West site is owned by the County. Upland Road is willing to negotiate a mutually favorable arrangement on a public-private partnership basis, or an arms-length commercial basis.

4. **Permitting** - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

SMART Center™ activities will include solid waste management, processing, recycling and composting operations, as well as alternative waste-to energy technologies and manufacturing of products from and reuse of recovered materials.

In addition to the SMART-UR™ separation technology, a typical SMART Center™ can have co-located on the same campus:

- Plastic cleaning, sanitizing, pelletizing facilities,

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- Processes to clean and convert glass into furnace-ready cullet (broken or refuse glass that is ready to be re-melted) or lightweight construction aggregate,
- Mixed metal commodity separation and baling,
- Yard waste aerated static pile composting, anaerobic digestion and fermentation of food waste,
- e-waste processing into metal, glass, and plastic components,
- Mixed dry organics (rubber, textiles, wood, etc.) processing and conversion, and
- Paper manufacturing. Permits can be secured if a recycled paper mill is installed.

These diverse activities present a complex, multi-media permit application process that requires accurate planning and scheduling, continuous effective communication and technical excellence. Upland Road's team has the experience and management systems to complete the permit approval process on time and accurately.

In addition, Florida Department of Environmental Protection (FDEP) has a robust permit application support infrastructure that includes regional districts, a Pre-Application Meeting process and an Office of the Ombudsman and Public Services to facilitate communication between FDEP, businesses, governmental agencies, advocacy groups and the public.

Upland Road will initiate the project development process through detailed planning before the Pre-Application meeting, to ensure that all applicable FDEP Departments and state and local agencies are represented at the meeting and have been provided sufficient background regarding their potential involvement in the project.

Local permitting consultants, leading experts in each applicable environmental program, will accompany and support Upland Road at the Pre-Application Meeting.

The Pre-Application meeting will review the complete proposed project, including the SMART-UR™ separation facility and all anticipated back-end technologies.

Environmental permits that may be required include, but are not be limited to:

- Air Quality State Permit to Construct
- Air Quality State Permit to Operate
- Part 70 (Title V) Operating Permit (Air)
- Solid Waste Permit (Processing Facility)
- Natural Wood Waste Recycling Permit
- Stormwater Discharge Permits (Permits are needed for both the Construction Phase and Operations Phase, along with written plans for compliance)
- Water and Sewerage Construction Permit
- County/City Wastewater Discharge Permits
- Erosion/Sediment Control Planning
- Solid Waste/Hazardous Waste/Industrial Waste Registrations and Approvals, as appropriate

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Multiple permits may be required from any of the permitting departments (air, water, solid waste, etc.) due to the number of different processing and manufacturing activities that will be present at the SMART Center™.

Based on review and discussion of concept-level designs, potentially problematic permitting issues will be identified and addressed, as appropriate. Upland Road's campus design is flexible enough to eliminate or mitigate any potential conditions of concern through substitution or modification of process equipment and operations. Re-location of back-end manufacturing facilities to other jurisdictions may also be possible.

At the conclusion of the Pre-Application process, the components and configuration of the SMART Center™ will be largely set. Applications will be prepared by the leading local environmental consultants, under the direction of Upland Road's environmental permitting and compliance group. Protocols for information transfer and communication with permit reviewers will be established and will result in expedited review, modification and finalization of permit applications and issuance of permits.

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

Upland Road offers the following proposed schedule for Smart Center™ construction and start-up of services:

1. Secure project financing – 6-12 months after signing of County/Upland Road contract.
2. Acquire site/Obtain Regulatory Approvals – 12-18 months after contract.
3. Commence site construction – 15-20 months after contract.
4. Phase 1 Substantial Completion – 33-36 months after contract.
5. Phase 2 Substantial Completion – 45-48 months after contract.
6. Pilot Phase 1 Operation – County delivers limited quantities of MSW and single stream recyclables – 33 months after contract.
7. Phase 1 Operation – County delivers all single stream recyclables and increasing quantities of MSW – 36 months after contract.
8. Pilot Phase 2 Operation – County delivers increased quantities of MSW for recycling 42 months after contract.
9. Phase 2 Operation – County delivers all MSW for recycling – 45 months after contract.
10. Hauling Efficiency Upgrade – County eliminates two-cart system and delivers mixed recycling and MSW – timing at County discretion, after Upland Road demonstrates 80+% MSW diversion for three consecutive months.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

Upland Road's sorting system will operate six days a week, 20 hours a day with four hours of hot maintenance. Each Sunday, a 28-hour warm maintenance will be performed. One week per year will be dedicated to full-swap maintenance requirements. The tip floors will have ten days of indoor baled and wrapped waste storage capacity.

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We have up to eight manufacturing operations, including CHP and our WWTP. Each process has its own O&M requirements and annual budget which, on average, includes 5% of total capex for replacement parts and 3% for other maintenance requirements.

We will have onsite maintenance and repair facilities and will maintain a comprehensive replacement part inventory. Our upkeep schedule will meet or exceed manufacturer recommendations.

7. **Health/Safety/Environmental** - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

Upland Road's technology-driven processes ensure that much of the traditionally-manual work of separating and processing waste is now done by machines – including robots, optical and density sorters, filters and conveyors.

All machines and conveyors in the SMART-UR™ system are designed with worker safety in mind and are equipped with advanced machine guarding, hazardous energy release prevention (lockout/tagout), fall protection, ergonomic and other worker protection features.

As a company focused broadly on sustainability – of people and planet, as well as profit – Upland Road is implementing the policies, processes and measurement practices needed to ensure that we hold ourselves to the highest standards in hiring and sub-contracting throughout our supply chain.

The Upland Road team has decades of construction and industrial manufacturing safety experience and has incorporated industry best practices as a priority into all designs and operations. The company's corporate culture builds protection of human health and the environment into all activities, from site preparation to ground-breaking, through construction and during operations.

With a view to the broader community, Upland Road performs materials management and manufacturing operations indoors and uses advanced negative pressure air handling systems and technologies to capture and eliminate potential air emissions and odors. To the extent possible, all process water and storm water are collected, treated and reused. Air emissions, odors, wastewater discharges and solid waste generation are minimized to mitigate potential risk to human health and the environment, as well as to expedite permitting of the SMART-UR™ systems and back-end manufacturing facilities.

Finally, Upland Road is committed to adhering to, or exceeding Miami-Dade County's hiring and subcontractor objectives.

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E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

Upland Road would be pleased to submit responses to a traditional RFI/RFP process, with all of the customary restraints on communication with County officials. In light of the innovative nature of the solutions that we would propose, however, we would require assurances that RFP itself would not contain preclusive preconditions, such as a requirement that comparable systems had been operating in the United States for a minimum number of years.

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

Upland Road proposes to build the U.S.'s most advanced waste handling, sorting, processing and manufacturing hub in a central location in Miami-Dade County. Upland Road's patented SMART-UR™ sorting processes will be at the center of that hub. Building out from that center will be a variety of elements ranging from onsite manufacturing, logistics and operational support infrastructure in energy and water, to collaborations in reducing the environmental impact of the waste collection supply chain.

For example, for the County's waste collection and recycling truck fleet, Upland Road offers both the possibility of route consolidation, because separate pickups of consumer waste and recyclables will no longer be necessary. The one-bin approach also facilitates the pathway to a fleet fueling conversion, as the SMART Center's™ organics processing will create large volumes of RNG, suitable for vehicle fuel.

Similarly, while approximately 90% of solid waste will be diverted from landfill, the facility will generate grit, fines and other non-processable materials suitable for use as alternative daily cover (ADC) by the North and South Dade landfills or other non-County facilities.

More broadly, the steady volume of sorted, pure materials that will come off the process lines will be available as feedstock for on-campus manufacturing operated by Upland Road, as well as for co-located partners with their own proprietary technologies whose science is proven but who need supply guarantees to be economically viable. This is a step change from traditional recycling collection centers, which even at their best are only staging areas for certain materials bound for out-of-state commodity markets.

Upland Road is open to working with all possible partners – as well as with the County itself – on an open book and transparent basis, to maximize the outcomes for all participants in the economy created by Upland Road's SMART Center™ hub.

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3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.

With the SMART Center™, Upland Road will partner with local and regional universities and local corporations to support development of the most advanced waste management practices, technologies and emerging waste conversion businesses. This Center of Excellence will allow us to train our workforce, including aiding in expanding opportunities for professional development for underserved populations that are seeking employment; these populations include returning veterans, first-time offenders, qualified and willing members of the "structurally unemployed," and individuals who may be transitioning from older industries. It will also facilitate engagement with and contributions to the local education systems and the community more broadly.

The SMART Center™ configuration can drive a new approach to education, where 80% of the instruction is around the first 2 ‘‘Rs”, Reduce and Reuse, which is the opposite of the current structure. Machines sort better than humans, but they cannot make purchase decisions. Thus, placing emphasis on the things that people do well, or better than machines, will lead to a greater reduction in waste sent to landfill.

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Who we are

Upland Road is an environmental technology development company that owns a robust suite of municipal solid waste (MSW) sorting process patents. This technology – and our related business model – diverts most MSW from landfills, significantly reduces solid waste collection and disposal costs, and creates a truly circular economy.

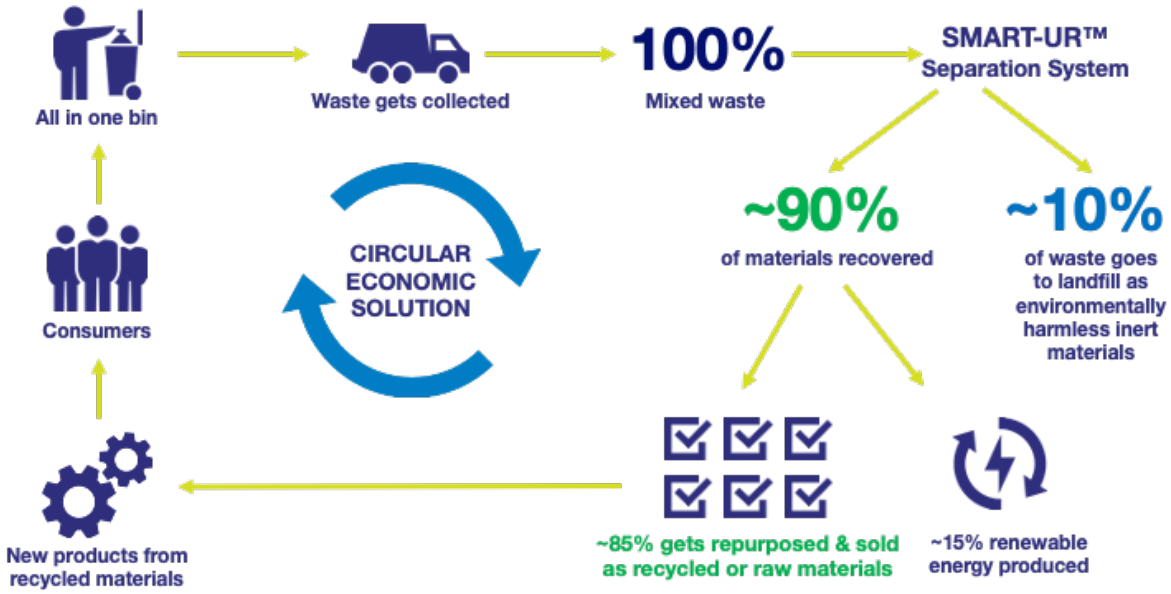
What we do

- Process 600,000 to 720,000 of MSW tons per year in a six-acre building under negative pressure
- Separate MSW into pure, re-usable constituent streams, with further processing to minimize commodity price volatility
    - ~90 recovery rate; ~10% inert residual material to landfill as ADC

Benefits

- Extend landfill life up to 10 times the remaining permitted cell life
- Eliminate incineration
- Consolidate multiple MSW and recycling pickup routes
- Reduce odors and greenhouse gas emissions dramatically
    - Waste materials collected in one bin eases traffic, lowers fuel costs, and reduces air pollution

Our circular economic system



System guaranteed and bonded by Stadler

- Operational uptime of 97%
- Separated waste streams (plastic, paper, metal, food waste, yard waste, wood, leather, furniture, textiles, e-waste) reach 95% purity levels
- Overall material recovery and landfill diversion rate of ~90%

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Upland Road | ADVISORS DEVELOPERS INVESTORS DATA

CLOSING THE LOOP ON MSW: HOW SMART-UR™ SORTING AND ADVANCED MATERIALS CAMPUSES CAN UNLOCK THE FULL POTENTIAL OF THE CIRCULAR ECONOMY

Anne-Marie McGonnigal - Principal and Director, External Affairs, Upland Road
Austen Smith - Project Coordinator, Upland Road

Abstract

The processes involved in today's linear chain of material "ownership" rely heavily on manual intervention, and the infrastructure supporting those processes amplifies the shortcomings of the choices forced by the current industry structures. The burden is placed on consumers to separate their waste effectively, despite often-confusing labeling, inadequate resources, and differing local requirements. Separate infrastructure exists for those materials that are collected, be it additional trucking routes or material-specific recycling technologies. Even the most effective sorting and processing facilities can only work with the materials that are brought to them in the first place.

This fragmented approach does not address the municipal solid waste (MSW) challenge in a holistic, system-wide manner. It impedes the advancement of promising circular technologies from pilot stage to fully scaled, flourishing enterprises. And importantly, it does not do enough to achieve our myriad environmental and economic goals.

The U.S. has a stagnant or declining recycling rate of ~25-30%, and we continue to send valuable materials to landfills and incinerators.

Upland Road has the technology to reframe the MSW narrative from one of incremental improvements to one of complete and integrated circularity.

By fundamentally changing the sorting infrastructure through sequencing proven technologies in a new way, we can facilitate the consolidation of ALL waste to a single stream for collection and processing. This removes human error and reduces cost, emissions and hazards associated with waste-hauling trucks.

Our patented advanced sorting technology—the SMART-UR Separation System™—separates paper, plastics, wet and dry organics, glass, and other materials in the MSW stream into discrete materials at the level of purity and volume needed by end users.

When expanded into a larger setting, the SMART-UR™ system becomes the centerpiece of a more comprehensive SMART™ advanced materials campus. Here, existing technologies at scale can manufacture valuable products with minimal transport costs and emissions. Applied materials researchers can obtain the needed volumes of separated waste materials to develop new technologies and products with that waste. Potential and current employees also benefit from university and applied materials research activities to train and expand their skills with these emerging technologies.

We can move beyond our current material- and waste-related paradigms to expand dramatically material re-use and achieve energy efficiency, emissions reduction, and yield savings that unlock the full potential of the circular economy.

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Upland Road

Transforming Tomorrow, Today

SMART™ Waste Industry Transformation

April 2025

Upland Road's mission

We resolve solid waste challenges at scale.

Upland Road's patented, proven waste sorting processes power an eco-industrial campus, turning trash into valuable materials and building a circular waste management system.

Overview

- Upland Road's patented, technology-driven waste management system, the SMART-UR™, combined with selected off-take manufacturing located at a SMART (Sustainable Materials and Advanced Recovery Technology) Center™ campus, will recover and reuse ~90% of solid waste, reduce costs throughout the system and generate solid economic returns.

- The $200 billion U.S. waste management industry is ripe for disruption. Incumbents and new entrants alike are modernizing infrastructure. There are significant financial and environmental incentives to capture value from the ~75% of waste that today is landfilled or incinerated. The market demands this change.

- Building with a future-focused approach, Upland Road partners with corporations, communities and universities on advanced-materials science research, workforce training and skills development.

- Globally, Upland Road's approach will be transformative in countries where waste is a significant challenge and waste management infrastructure has never been developed.

Photo:STADLER

The waste challenge

We must address the entire waste stream, not segments of it, to achieve full materials re-use.

Today's recycling and waste management systems emphasize consumer-based waste separation. They are not structured to achieve needed environmental and economic performance.

The waste management industry is focused on self preservation and incremental change. The problem demands a bold solution.

>450

million tons of waste generated annually in the US[1]

~25%

current recovery of discarded materials, including yard waste[1]

100%

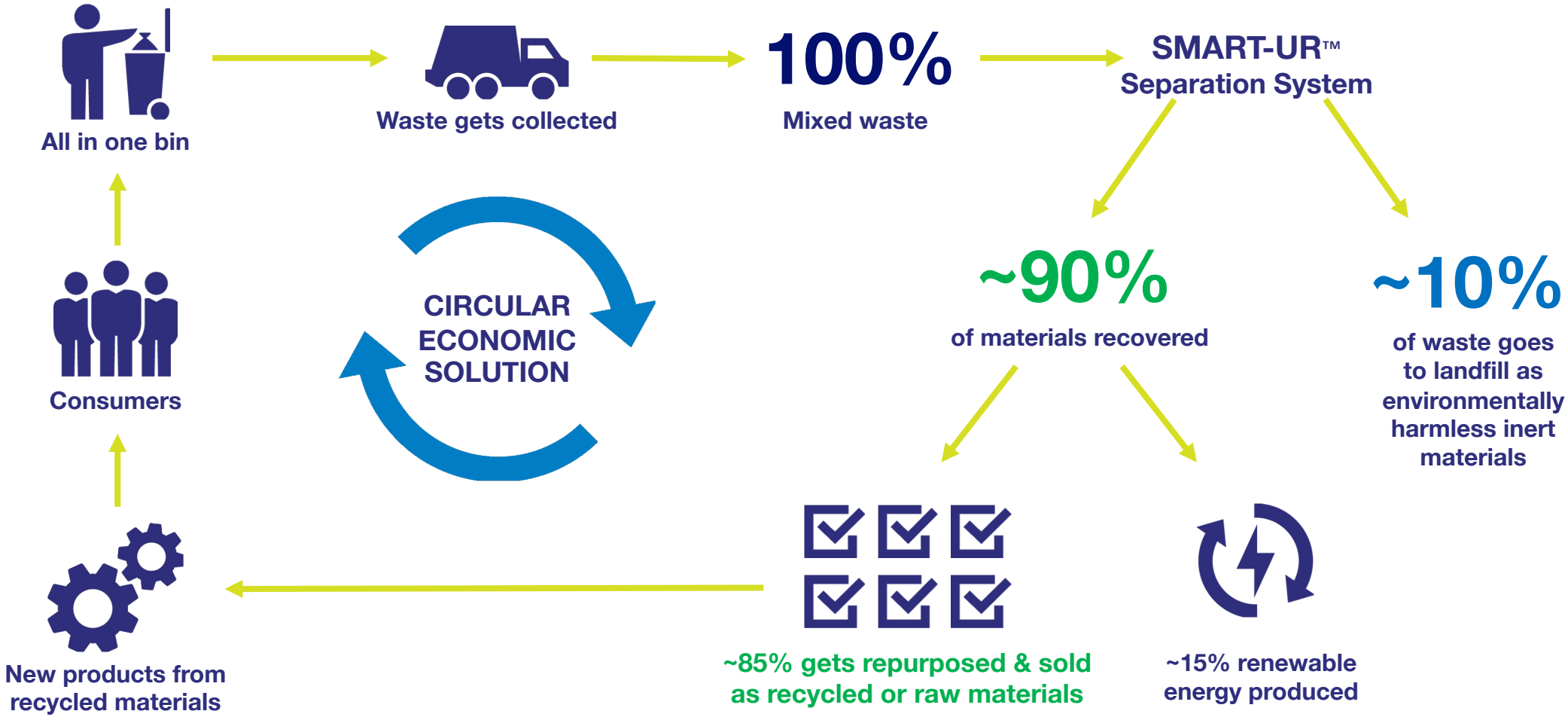
recycled PET demand to exceed supply in the US by 2030[2]

>$140

billion in potential product value buried or burned each year[3]

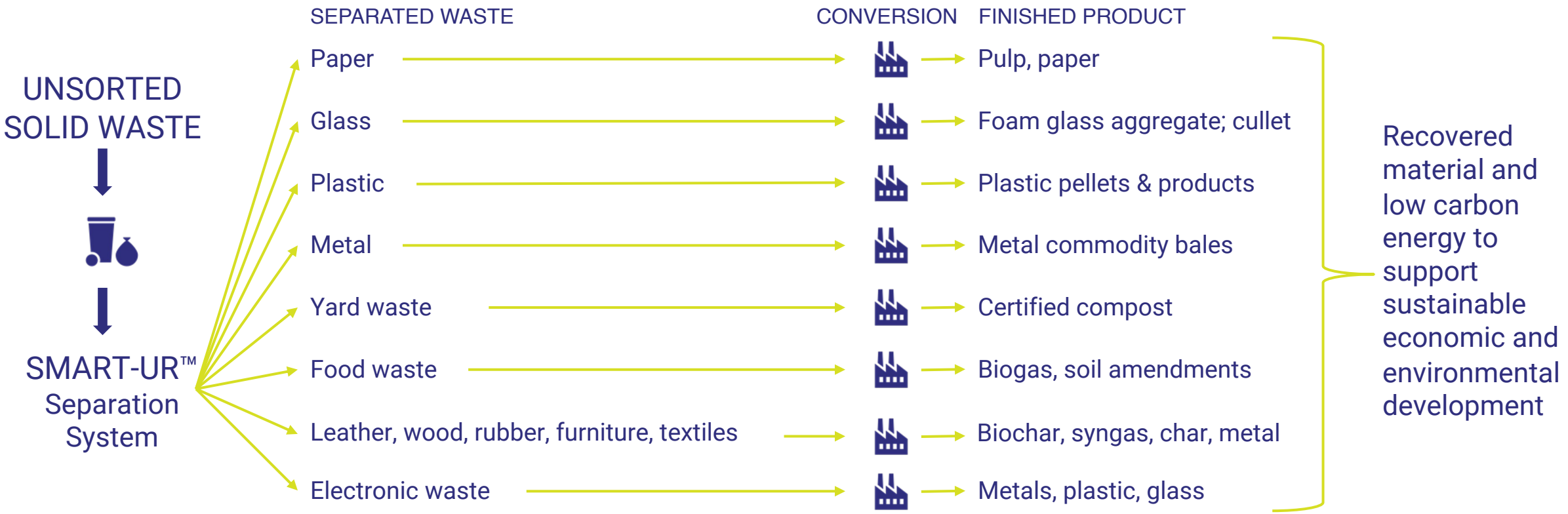
Sources:
[1] Waste Business Journal 2022 Data Pack
[2] Recycling Today, 2023
[3] Upland Road calculations

Upland Road uses machines, not consumers, to achieve circularity



Combining technology and infrastructure on an advanced materials campus unlocks greater value from discarded materials and reduces costs for municipalities and consumers

SMART Centers™ create economic value from on-site production and co-location with off-take partners



Proven technologies: The foundation of the SMART-UR™ Separation System

Process up to 2,400 tons/day of MSW vs. 200-300 tons/day for a typical recycling facility (MRF)

Capture and extract value from the entire waste stream, not only traditional recyclables

Guarantee ~90% purity for conversion to recycled products, soil amendments and clean energy

Reduce contamination dramatically by separating wet/dry waste streams with multiple separation steps

Sort materials with **specificity** and **scale** to allow innovative conversion technologies that need reliable large volumes to be economical

Facilities currently using comparable sorting array –operating in Spain and Norway for a decade demonstrate the successful operation of Upland Road's technologies and processes

Global patents and processing scale set Upland Road apart from competitors

Comprehensive patents

- A robust portfolio of U.S. and international patents cover all SMART Center™ processes and technologies
- All system components are proven at scale

Outstanding performance

- Diverts ~90% of waste, compared with current US rate of ~25%
- Facilitates onsite manufacturing and product innovation with high processing capacity
- Attracts off-take customers with high-quality sorted materials and products
- Extracts value from the entire waste stream

Extensive experience and relationships

- Executive-level team has shaped critical environmental decisions in multiple industry sectors around the world
- Deep relationships with recognized industry experts who will lead key elements of construction and operations of SMART Centers™

Data

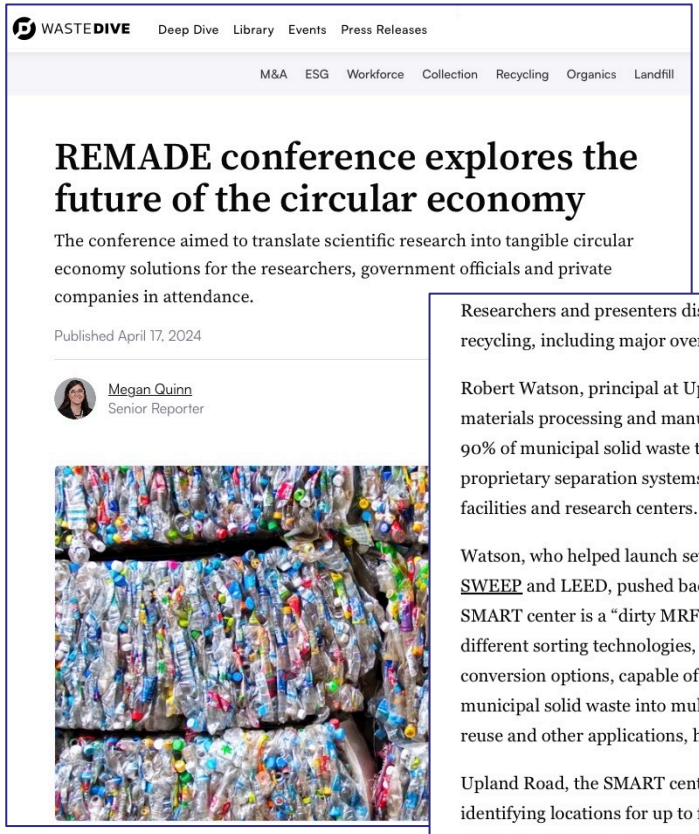
- The SMART Data Solution™ provides crucial, in-demand information about waste composition and volumes to industry and policy makers

Recognition

2025 Earthshot Prize Nominee

2023 Cincinnati Cintrifuse Rethink Recycling Hack-a-thon

2024 REMADE Institute Conference – *Waste Dive*



WASTEDIVE Deep Dive Library Events Press Releases

M&A ESG Workforce Collection Recycling Organics Landfill

REMADE conference explores the future of the circular economy

The conference aimed to translate scientific research into tangible circular economy solutions for the researchers, government officials and private companies in attendance.

Published April 17, 2024

Megan Quinn
Senior Reporter

Researchers and presenters discussed new ideas for managing waste and recycling, including major overhauls of local recycling systems.

Robert Watson, principal at Upland Road, pitched the SMART center, a materials processing and manufacturing campus he said could convert 90% of municipal solid waste to "productive use" by co-locating proprietary separation systems with other features, like manufacturing facilities and research centers.

Watson, who helped launch several sustainability standards, such as SWEEP and LEED, pushed back against the idea that the proposed SMART center is a "dirty MRF 2.0." The system could have 60 to 70 different sorting technologies, and multiple manufacturing and conversion options, capable of sorting up to 2,400 tons a day of municipal solid waste into multiple streams for recycling, composting, reuse and other applications, he said.

Upland Road, the SMART center developer, is in the process of identifying locations for up to five centers, which could come online in a few years, once site selection and funding come together, Watson said.

The idea is to extend the life of existing landfills and minimize waste incineration, but "we need a fundamental systems change" to make that happen, he said.

Key management biographies

Jeffrey A. Smith, Managing Principal

Jeff is a retired partner of Cravath, Swaine and Moore LLP, where he founded the environmental law practice. For the past 40 years, he has advised companies, financial institutions, and their boards in every industry around the world on all facets of environmental transaction management and the role of capital markets. Jeff is a graduate of Harvard College and received his law degree from the University of Pennsylvania.

Bob Ehlers, Principal

For decades, Bob has worked with leading multinational companies to develop, evaluate and improve corporate Environmental Management Systems (EMS). He is an innovator in EMS thinking and has successfully completed hundreds of site investigation and remediation projects. Bob has a BS in Biology from Fairfield University and a Masters in Environmental Engineering from SUNY Stony Brook.

Sameer Jagetia, Chief Financial Officer

Sameer is a globally-ranked financial modeling expert. He co-founded machine learning and NLP company Robuzz LLC and acquired and served as Chairman and President of leading sales intelligence platform Redbooks; he sold both successfully. He served as VP of Investments with TCS Capital Management and was with the Global Communications investment banking group at Salomon Smith Barney. Sameer has a BS (Finance) from the Wharton School and a BA from the University of Pennsylvania.

Anne-Marie McGonnigal, Principal

Anne-Marie is Upland Road's Director of External Affairs. She is an expert in building strong programs at the intersection of the private and social sectors. Anne-Marie has held senior roles in the U.S. and Europe in corporate sustainability/ESG, fundraising and communications in industries ranging from telecommunications to financial services. She has a BA from Mount Holyoke College and an MBA from the University of Washington.

Rick Pooler, Principal

Rick is Upland Road's Director of Project Development and was an accomplished Senior Counsel/Engineer at Bristol-Myers Squibb. Rick has extensive national and international experience with multifaceted projects in the U.S. and over a dozen other countries. Rick has a BS in Environmental Engineering from Rensselaer Polytechnic Institute and a JD from Syracuse University College of Law.

Rob Watson, Principal

Known as the "Founding Father of LEED," Rob has worked for over 35 years as an international leader in market transformation and has achieved LEED Certification for over 40 million ft^2 projects. Rob also has launched the Solid Waste Environmental Excellence Performance (SWEEP) Standard, building on his LEED experience. Rob is a graduate of Dartmouth College, has an MSc from UC Berkeley, and an MBA from Columbia.

Senior Advisors

David Biderman

David has been a leader in the solid waste and recycling industry for more than 28 years. He was the Executive Director of the Solid Waste Association of North America (SWANA) from 2015-2023, and helped substantially increase its membership, visibility, and leadership position in the U.S. concerning waste and recycling issues. He also served on the U.S. Department of Commerce's Environmental Technologies Trade Advisory Committee (ETTAC) and represented the U.S. at International Solid Waste Association events. David joined SWANA in April 2015 after 18 years with the National Waste & Recycling Association, where he was General Counsel, Vice President of Government Affairs and Safety Director. He is a frequent expert witness, has testified before numerous federal, state, and local agencies and councils, is quoted frequently in national publications, and has spoken about environmental issues, policies, and trends at numerous domestic and international environmental conferences in the United States, Canada, Asia, Latin America, and Europe. Today, David is the President of Biderman Consulting, LLC, focusing on sustainability, safety, and advocacy.

Myles Cohen

Myles is a leading expert in MRF design, construction and operation in the U.S. He was president of two of the largest recyclers and MRF operators globally, each a multi-billion-dollar integrated manufacturer of sustainable packaging; Sonoco, a $6 billion packaging manufacturer, and Pratt Industries, the world's largest manufacturer of 100% recycled paper packaging. As CEO of the recycling divisions at both companies, he led teams that designed, constructed, and managed over 40 material recovery facilities (MRFs). Myles and his team also negotiated or managed single-stream and dual-stream recycling contracts with jurisdictions throughout the U.S., including New York City's curbside recycling contract for residential paper; the largest municipal contract for recycled paper in the U.S. He served on Pratt Industries' executive committee during the construction of three 100% recycled greenfield paper mills in the U.S. During his tenures, he led teams that bought, sold, or brokered over 40 million tons of recycled paper, plastic, glass and metal, including hundreds of thousands of tons out of the state of Florida.

In 2021, Myles formed Circular Ventures, LLC, a sustainable packaging recycling advisory firm. He is a sought-after speaker and is a recipient of a lifetime achievement award in the recycling industry. He serves on the board of the U.S.'s division of the largest independent trader of recyclables in the world. He is a past board and executive committee member, division chairman and chapter president of the Institute of Scrap Recycling Industries (ISRI, now ReMA), and co-founded ISRI's MRF committee.

Advisory board

Judith Albert, Former Executive Director, E2; Former Board Chair, Cornerstone Capital

David Hackett, Senior Counsel, Baker & McKenzie

Cornelius (Neil) B. Murphy, Senior Fellow for Environmental and Sustainable Systems, State University of New York, College of Environmental Science & Forestry

Dr. E. Sarah Slaughter, CEO/President, Built Environment Coalition; Former Professor, MIT (Civil and Environmental Engineering, Sloane School of Management Science, Urban Studies and Planning; Founder/Former CEO, MOCA Systems, Inc.)

Adam Zurofsky, Director, Northeast Regional Hydrogen Hub

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ADVISORS | INVESTORS | DEVELOPERS | DATA

Introduction and Motivation

Almost all waste has value. Yet, today's waste-related technologies and the structural landscape they support address only the items considered "recyclable," sending vast quantities of materials—and the value inherent in them—to landfill or incineration.

Today's fragmented industry structure, legacy technologies and processes, complex product and packaging design, and consumer habits contribute to stubbornly low recycling rates for both residential and business waste.

By shifting the view of how we handle waste and separate it into its constituent commercial elements—reconceiving the infrastructure to build a system that processes ALL discarded materials with minimal manual separation—we can unlock the significant value in that waste. By changing the system fundamentally, many obstacles inherent in our current system are removed, and a greater percentage of waste will then have the potential to be returned to productive use. Businesses, consumers, and municipalities benefit, and landfill and incineration of waste can be cut dramatically.

At the same time, by adopting a new model for waste handling infrastructure and processes, we open the door to expanding our ability to develop new technologies, capture currently untapped sources of waste, and make significant progress toward achieving our ambitious waste- and emissions-related goals.

Waste-Related Infrastructure

When discarded materials are mixed, they are garbage; when they are separated, they become feedstocks. We believe that, eventually, all material—including mixed municipal solid waste (MSW)—will be recyclable at varying levels of profitability.

Current waste management and recycling systems are not structured to capture waste effectively or efficiently. Of the fraction of the total waste stream that is recovered, not all of it is separated to a degree that a conventional Material Recycling Facility (MRF) can accept. Also, separate infrastructure exists for different waste streams, such as materials collected for compost or recycling versus general waste, be it additional trucks and trucking routes or material-specific facilities and technologies.

These recycling practices and technologies cannot:

- **Process mixed materials.** Much packaging today is not designed with recycling in mind. Rather, whether soda bottles with caps, paper cups with coatings, or metal jar lids with silicone seals, it is made of mixed materials that are unable to be separated with conventional recycling technologies.
- **Achieve the aggressive zero waste to landfill goals** established at a federal level or by individual municipalities. Examples of these goals include:
    - The U.S. Environmental Protection Agency (EPA) established a national recycling goal, to increase the recycling rate to 50% by 2030 (National Recycling Strategy: Part One of a Series on Building a Circular Economy for All, p. 2).
    - Cincinnati aims to achieve 50% diversion city-wide by 2030, and city-wide zero waste (90% diversion) by 2040 (Green Cincinnati Plan, 2023).
    - New York City, which currently generates 11,000 tons/day of residential waste, set the goal of diverting 100% of recyclable waste from landfill or incineration by 2030 (Recycling Today, 2023).
- **Measure the effectiveness of recycling accurately.** For example, figures provided by the EPA and the U.S. Department of Energy (DOE) are not aligned, with the DOE recently providing evidence that current recycling figures are lower than previously thought.
- **Meet the current and future needs of backend markets** at sufficient levels of purity, volume, and price. As product manufacturers increasingly pledge to include more recycled materials in their products and packaging, demand is rising rapidly for certain materials. Republic Services, for example, estimates that by 2030, demand for recycled PET in the U.S. will exceed supply by 100% (Recycling Today, 2023).
- **Withstand the fluctuations of commodity prices to make recycled materials consistently economically viable,** leading to an increase in landfilling and incineration when volatile commodity prices are low.

This disintegrated approach to managing our vast—and rising—quantities of waste is costly and inefficient, and it does not address the MSW challenge in a holistic, system-wide manner. Together with the volatile nature of commodity pricing, this fragmentation impedes the advancement of, and investment in, promising circular technologies from pilot stage to fully scaled, flourishing enterprises. And importantly, it does not do enough to achieve our myriad environmental and economic goals. In a word, it is wasteful.

Who is Responsible for Recycling?

Current linear processes involved in the movement of materials through the supply chain from sourcing and production to final disposal rely heavily on material labeling and manual sorting in both residential and commercial waste management. In fact, in the U.S. we continue—after nearly 50 years of consumer-focused efforts—to develop new programs and finance campaigns intended to compel and train individuals to separate their waste more often and correctly. As an example, the EPA awarded $23 million for 25 Recycling Education and Outreach grants in November 2023. There have been many similar programs in past decades, paid for with philanthropic grants, commercial programs, and municipal budgets.

At the same time, the lack of consistency across jurisdictions regarding what can be recycled and how it should be separated makes it difficult to know what to put in each bin. Add to that the complexity of many products and packages, along with a proliferation of new food waste related programs, and it is little wonder that consumers either do not participate or do not achieve consistent good results when they do.

Despite these recycling and composting programs, only a fraction of households that have access to recycling participate regularly (and communities' measurements of "regular participation" are inconsistent). In addition, many households, particularly in multi-family and low-income or rural areas have limited or no access to recycling; fewer than 40% of households in multi-family buildings have access to recycling, for example, according to The Recycling Partnership's 2024 State of Recycling report. This is due to factors that include the cost of creating space for multiple waste bins in multi-family buildings and the cost and impracticality of adding duplicative recycling truck routes in regions with great distances between homes, landfills, and recycling facilities.

For commercial waste, there is less data about recycling, though business generates at least two thirds of MSW.

Transform the System—a Circular Model with Advanced Technologies

By removing the burden of separation and recycling from residential and business consumers, Upland Road has the ability to accelerate the evolution of the current solid waste disposal and recycling landscape *at scale*. Using proven technologies sequenced in new ways, the patented SMART-UR Separation System™ can separate mixed MSW into its many discrete materials at a volume far exceeding a typical MRF.

By co-locating this advanced materials recovery system with manufacturing on a campus setting, we gain further efficiencies and create an ecosystem in which to develop new technologies, create skilled jobs, and build a source of sustainable economic growth. Partnerships with universities and communities foster continued advanced-materials science research, together with workforce training and skills development, which are crucial in an increasingly technology-driven industry.

We believe that the U.S. would be well served by shifting the waste management paradigm from one of incremental improvements to one that embraces a new generation of technologies, including those nascent ones still in development. And by moving the burden of waste separation from people to machines, we free up resources to expand efforts focused on reduction and reuse of materials.

Current State of the Recycling Industry

Recovery Snapshot

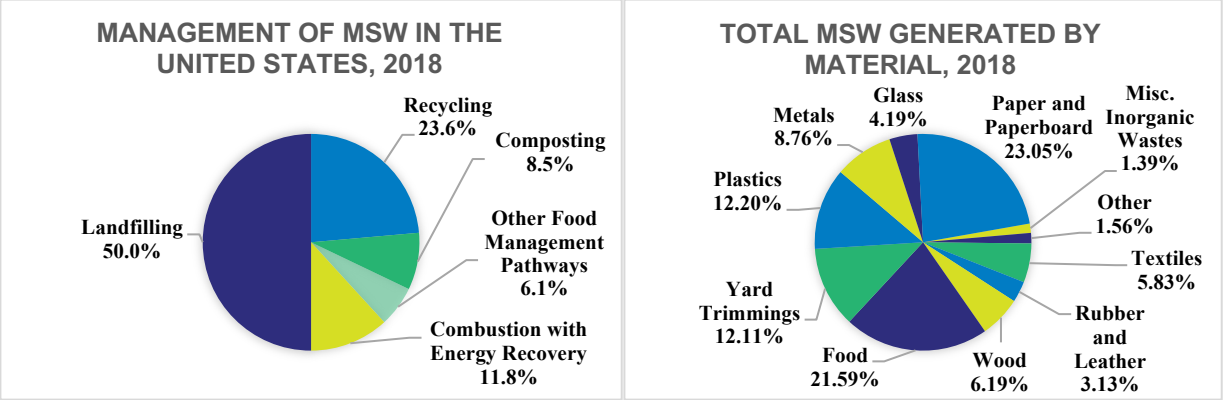

Figure 1: U.S. EPA: Advancing Sustainable Materials Management Factsheet
Figure 2: U.S. EPA: National Overview, Facts and Figures on Materials, Wastes and Recycling

The EPA estimates that in 2018, approximately half of the 292.36 million tons of MSW generated in the U.S. was sent to a landfill. An additional ~12% was lost to combustion, in exchange for a contextually small, but dirty, source of energy, leaving a combined 32.1% recycling and composting rate. Of the more than 146.1 million tons of MSW landfilled in 2018, more than 84% of that was plastics, paper and paperboard, metals, textiles, glass, and organic materials such as food, yard trimmings, and wood (EPA, 2018).

While these EPA figures provide an idea of the proportions of materials being recovered and lost, numerous studies have concluded that the amount of total MSW generated and landfilled in the U.S. is far higher than—*and as much as double*—EPA estimates. DOE and National Renewable Energy Laboratory (NREL) studies also have found higher landfilling rates and lower recycling rates for both plastics and fiber (Resource Recycling). These disparities illustrate lack in standardization in the ways solid waste is measured in the U.S., as different entities use different methods of data collection, and individual states have differing reporting requirements for facilities that handle solid waste.

The EPA estimated that the overall recycling rate for plastics was just 8.7% in 2018. Even the most used and readily recyclable plastics, PET, and HDPE, have recycling rates of only 30%. Other kinds of plastic have far lower rates. Polypropylene (PP), for instance, had an estimated recycling rate of only 2.7% in 2018 (U.S. EPA: Advancing Sustainable Materials Management: 2018 Tables and Figures), even though it is technically recyclable. Some plastics, such as films, are often not accepted in curbside collections, because most MRFs are unable to process them (Franklin-Wallis, 2023).

Each of the material streams noted above has well-established pathways to higher and better uses and has considerable economic value. The DOE and NREL estimate that the value of recycled paper and cardboard material alone that was landfilled in 2019 was worth $4 billion (2023). These losses reflect the limitations of our current recovery and collection methodologies, but also reflect the potential of untapped sources of recyclable material in the waste stream.

Challenges of MRFs and Current Recycling Infrastructure

Packaging design choices that may be made for practical or aesthetic reasons may impact an item's recyclability. Greenblue's How2Recycle Recyclability Insights Report found that 56% of packaging was either only partially recyclable or not yet recyclable (2020). While it is understandable for a consumer to mistakenly place an item like this into a recycling bin, a typical MRF will not be able to separate the part that it can process from the part that it cannot.

Contamination also presents a major challenge for MRFs. In particular, most MRFs cannot process paper or plastic materials with even small amounts of contamination from food waste, causing the rejection of entire loads of otherwise

valuable material. If a group of recyclable items arrive at a MRF in a plastic bag, they will often be rejected and sent to a landfill, because most MRFs cannot process the bags.

Materials free of contamination and technically recyclable still may not end up being recycled into new products due to market conditions. Once raw materials are recovered, they are sold into a volatile commodity market, where prices for specific material streams can fluctuate dramatically over a short period of time. For instance, the price of baled Old Corrugated Containers (OCC), or cardboard, declined from $180/ton in 2017 to lower than $25/ton in 2019, then climbed back to over $160/ton by 2021 (Solid Waste Environmental Excellence Performance (SWEEP) Standard, 2023). If the price for a particular commodity is too low at a given time, it might end up being sent to a landfill, even after it has been successfully recovered at a MRF.

Recycling and Landfill Diversion Program Structures

Municipalities have largely looked to *source separation* to divert MSW from landfills and support recycling programs.

An example of this is curbside composting programs for food and other organic waste. These programs have been difficult to implement due to their expense, lack of infrastructure, or lack of participation. Austin, TX, for instance, has expanded a substantial curbside recycling program that has provided over 200,000 households with access to source-separated organics diversion (Waste Dive, 2021). However, an audit determined that the program had only a 30% participation rate, and that participation had declined from years past (Waste Dive, 2021). Municipal curbside composting programs also often rely on the political will of elected officials and can become casualties of budget cuts.

According to The Recycling Partnership, 73% of all U.S. households have "access" to recycling programs. (State of Recycling 2024, p. 10). A significant disparity exists, though, between single-family households, which have 85% access, and multifamily households, which have only 37% access. Furthermore, the overall participation rate among households that have access is estimated to be 59%, which means that only 43% of households actively recycle (State of Recycling 2024, p. 17). These numbers also do not account for non-residential sources like businesses, which often generate a significant portion of total MSW in a given municipality.

Separate Infrastructure

Advanced recovery technologies may be able to provide better outcomes for specific material streams, but they often lack a holistic approach, and they continue to depend on the same outdated means of collection for their source material. For example, anaerobic digestion (AD) can divert organic waste from landfills and recover usable end products, in the form of clean energy and soil amendments. While it reduces landfill emissions and presents a positive end-of-life alternative for organic material, the high capital costs of AD and comparatively low economic value of its back-end products pose challenges for scalability. AD also often requires highly specific streams of food and organic waste for optimal performance, placing greater importance on source separation. The fact that most AD facilities are stand-alone hinders achievement of maximum circularity, as added trucking routes and distance traveled raise logistical, economic, and emission costs.

Georgia-Pacific's Juno project, which uses an autoclaving method to boost the recovery rate of hard-to-recycle fibers, provides another example. The project aims to divert up to 90% of the waste it processes from a landfill (Recycling Today, 2021). While Juno's technology is promising, a fundamental barrier remains: the facility can process only the materials it is fed. The MRF with which the technology is co-located receives its waste via the conventional, consumer-sorted collection system; thus, it receives only the pre-separated, higher-value materials, leaving what consumers put in their waste bins to go elsewhere. Though the technology can recover 90% of what the MRF processes, it still will not recover what it could if it had access to the entire waste stream.

Mixed-Waste Processing in the U.S.

Mixed-waste processing (MWP)—sending unsorted MSW directly to a sorting facility without extensive consumer source separation—has been attempted previously to capture a greater percentage of the MSW stream than is typically captured by traditional recycling infrastructure. However, this practice has come to be associated with so called, "dirty MRFs," which is a term used to describe facilities that have lacked the sorting ability to process mixed waste effectively. One notable example is the Infinitus Renewable Energy Park (IREP) in Montgomery, AL, which was intended to achieve up to

a 90% landfill diversion rate by recovering recyclables from single-stream waste and separating organic material for use in on-site energy recovery and composting. Limitations in the facility's machinery and sorting ability meant that it had difficulty separating the mixed waste it received at high levels of purity and specificity. As a result, a large portion of technically recyclable material was only suitable for less valuable uses such as refuse derived fuel (RDF). Organics were particularly challenging to separate, resulting in a greater level of contamination and lower quality outputs of recovered recyclable material. A commodity market downturn shortly after the facility opened made selling the recycled materials that were recovered even more difficult.

Other mixed-waste processing faculties with more sophisticated sorting systems and greater input capacity have been implemented in locations such as Sun Valley, CA, Placer County, CA, and Santa Barbara, CA, with varying degrees of success. When operating as intended, these facilities are capable of separating organics and recyclable material from a mixed-waste stream, and of achieving higher landfill diversion rates. Some even take the extra step of processing organics on-site through AD or composting. However, since most of the recovered recyclable material is baled and sold into the commodity market, this kind of facility is subject to the same price-related instability as traditional MRFs. An extended period of low commodity prices makes it more difficult to achieve the economic returns necessary to cover high capital, maintenance, and operating costs. Even if the sorting system is technically more sophisticated than that of other MRFs, the volatility of commodity market they rely on for revenue can prove to be the salient obstacle for mixed-waste processing facilities such as these.

Technology Approach

Overview—Advanced Processes and Business Model

By reconceiving the waste-related processes and business model to collect, measure, and process *all* MSW at scale and on one campus, we can realize fully the economic and environmental potential of the discarded material stream. With emerging technology advancements, we believe that all material—including mixed MSW—will be recyclable at varying levels of profitability.

Upland Road's patented sorting process, called the SMART-UR Separation System™, uses optical sensing technologies, artificial intelligence, and robotics, to separate mixed waste into its constituent feedstock materials. It can then process them into value-added products on the same campus, gaining manufacturing and transport efficiencies while reducing cost and emissions.

While the SMART-UR™ can work with existing collection infrastructures, it can also use a one-bin collection approach to reduce the need for extra trucks and bins and cut the expense of education and promotion needed to induce consumers to separate and store their recyclables (by conventional definition), food scraps and other waste in separate containers. In addition, this single bin approach can facilitate the full participation of multifamily and institutional customers, and eventually all nonresidential waste generators.

Figure 3: Combining technology and infrastructure on an advanced materials campus unlocks greater value from discarded materials and reduces cost for municipalities and consumers.

The SMART Center™ Eco-Industrial Campus

Upland Road's combined sorting and manufacturing campus is called a SMART (Sustainable Materials and Advanced Recovery Technology) Center™. At the core of a SMART Center™ campus (40-90 acres) is the SMART-UR Separation System™, which consists of a patented sequence of proven, field-tested equipment that is purpose-built to separate mixed waste into 40+ clean, consistent feedstock streams.

The SMART Center™ is designed to separate and recover up to 90% of the material received, including food waste, which does not need to be segregated and delivered separately from mixed MSW in order to be captured and processed. The remaining ~10% of the post-sorted materials—~200 tons/day based on processing capacity of up to 2,400 tons/day—will be mostly inert, such as rocks, grit, and glass shards. This ~10% residual material will be disposed of at a landfill until a viable value-add process is found that can be co-located on the SMART™ campus.

Each facility is designed to accept mixed MSW, single/dual-stream recyclable, and yard-waste-only loads, as well as loads commingled with other materials. In addition, facilities will have the capacity to recover bulky waste, such as furniture and appliances.

Collected materials delivered to the facility are separated mechanically into feedstock streams that are guaranteed by our systems integrator to be ~90% clean. On the campus, separated materials will be processed into recycled products, clean energy, and soil amendments, resulting in disposal diversion of up to 90% of the materials.

The following diagram shows the basic material flow through the system and the resulting feedstock categories.

Figure 4: SMART Center™ material flow

SMART-UR Separation System™ Capabilities

All waste separation systems, including the patented SMART-UR Separation System™, use physics—density, dimension, and optical properties—to separate materials with a level of precision that humans cannot.

Current, dirty MRF systems are designed merely to skim "recyclables" from mixed waste, with the hope of finding some added value as fuel in the remaining material. Typically, 25-30% by mass of low value recyclables are extracted, with the remainder going to RDF (refuse derived fuel) or landfill.

The SMART-UR™ process flow has approximately five times the number of sorting technologies as a comparable dirty MRF, as shown in Figure 5, which compares the original failed Montgomery, AL, dirty MRF, with 12 separation technologies (Bulk Handling Systems, 2014), with the SMART-UR Separation System™ which has 60–70, depending on the needs of a particular jurisdiction. The Montgomery plant was subsequently upgraded with additional steps, but still only has one third the sorting steps of what is needed to process mixed waste effectively.

With this greater number and frequency of sorting steps, SMART-UR™ separates *all* materials in the waste stream to ~90% purity for easy conversion to recycled products, soil amendments and clean energy. [Note: it is possible to clean the feedstocks to a greater level of purity, but at significantly higher cost.]

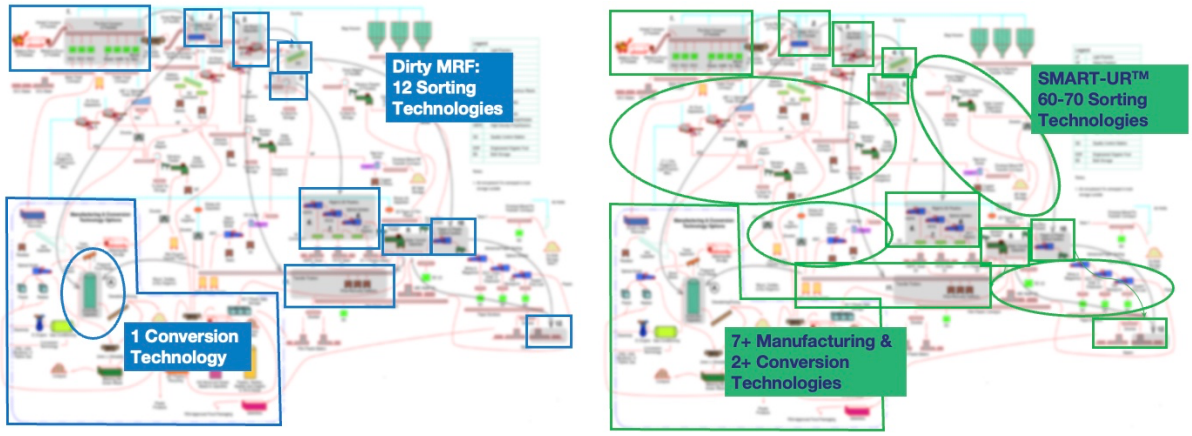

Figure 5: Illustration of number and types of processes at a "dirty MRF" vs. SMART-UR Separation System™

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Because waste composition differs markedly between jurisdictions—whether between Europe and the U.S. or between Seattle, Chicago, and Shreveport—the sizing and sequencing of machines will factor in these differences. Average waste characterization, with variances for quantity and composition, for multiple U.S. locations have been calculated through review of available local and regional studies. With this information, sizing and sequencing of the machinery can be engineered to meet the range of desired specifications: ~90% of the total material stream separated into feedstock flows of guaranteed 95% purity, with 97% uptime reliability.

A typical 2,000 ton/day SMART-UR™ facility is housed in a two-section, 300,000 ft^2 facility. A 90,000 ft^2 tipping floor can store up to six days of waste, or ten days if baled, wrapped, and stacked. On a normal day, waste trucks drop their loads on the tip floor, where oversized, bulky, heavy, and potentially hazardous items such as propane tanks, are segregated for separate processing. The remaining waste is pushed onto walking floors that bring the material to a dosing bin that measures waste onto a conveyor and screens out larger items.

A relatively small, manually staffed pre-sort pick line extracts large corrugated and other materials, winders (rope, electric cords) as well as household hazardous waste (HHW), eWaste, and monolithic items (e.g., chunks of concrete) found in the mixed waste prior to dimensional separation. After pre-sort, a multi-stage trommel sorts the initial flow with increasingly small flows.

A shredder reduces the elements further to a relatively uniform size, making density and optical sorting easier later. Metal items are extracted magnetically, and smaller dimension materials are removed to a sink-float line. A series of trommel screens, air knives, and rotary air separators provide screening by size and dimension. Materials are separated further into several density categories via dosing bins and drum feeders, vibratory feeders, ballistic separators, and heavy-duty disc screens. Additional screening and centrifuging remove food and green wastes. Another round of metals removal (ferrous and nonferrous) occurs through additional magnets, eddy-current, and induction-current machines at each stage of the process.

Finally, optical sorters, and human robotic quality control (QC) sorters segregate glass by color, sort plastics by #1-7, and, if warranted, paper by color and type.

All materials are conveyed to balers or bunkers for further processing.

Contamination

In Upland Road's mixed-waste processing approach, "contamination" has a different meaning from that of a conventional MRF. For example, once separated, most types of plastic (#1-6) can be processed mechanically, so plastic film would not be considered a contaminant. Wet-contaminated fiber would fall into the composting line of the SMART-UR Separation System™, with quality control to ensure that the liquid in question is compostable (e.g., vegetable oil is compostable; motor oil is not). As a result, this fiber would still be diverted from the landfill, but through a different process. Given the number of times that materials are "touched" in the SMART-UR™ system with the addition of AI robotic quality control of the final product, dry contaminants such as glass or paper/plastic in the wrong material stream are minimized. As noted above, certain types of materials cannot be recovered economically and/or converted into new products, soil amendments, or energy, such as street sweeping grit or glass shards.

SMART-UR™—Existing Related Facilities

According to Stadler, Upland Road's system integrator, mixed waste processing in general is growing strongly, especially in Europe and North Africa. A decade of successful operation and evolution of existing facilities in Europe validate the leapfrog approach of the SMART-UR Separation System™ and the SMART Center™.

For example, the EcoCentral in Granada, Spain, in operation since 2013, processes 1,800 short tons/day of post-single stream mixed waste and packaging. Spanish single-stream separation rates are significantly above typical American single stream diversion, so the remaining material is much wetter and less "rich" in recyclables than what would be found in the U.S. Nonetheless, recyclables equaling an additional 25-30% of what comes from the initial single-stream separation are recovered and sold into the market. Multiple new polishing and refining modules for organics have been added to the original design; the plant operator, FCC, has recently built a pelletizing plant adjacent to the separation facility to capture #1, #2, #4 & #5 plastics for pelletizing. The core wet and dry fraction separation was a permitted field test application of

the same wet-dry separation technique used in the SMART-UR™ system. Many of the same downstream sorting principles are applied to the post wet and dry fractions in the bolted-on upgrades to the Granada facility as are found in the integrated SMART-UR™ design.

End Products of Sorted MSW

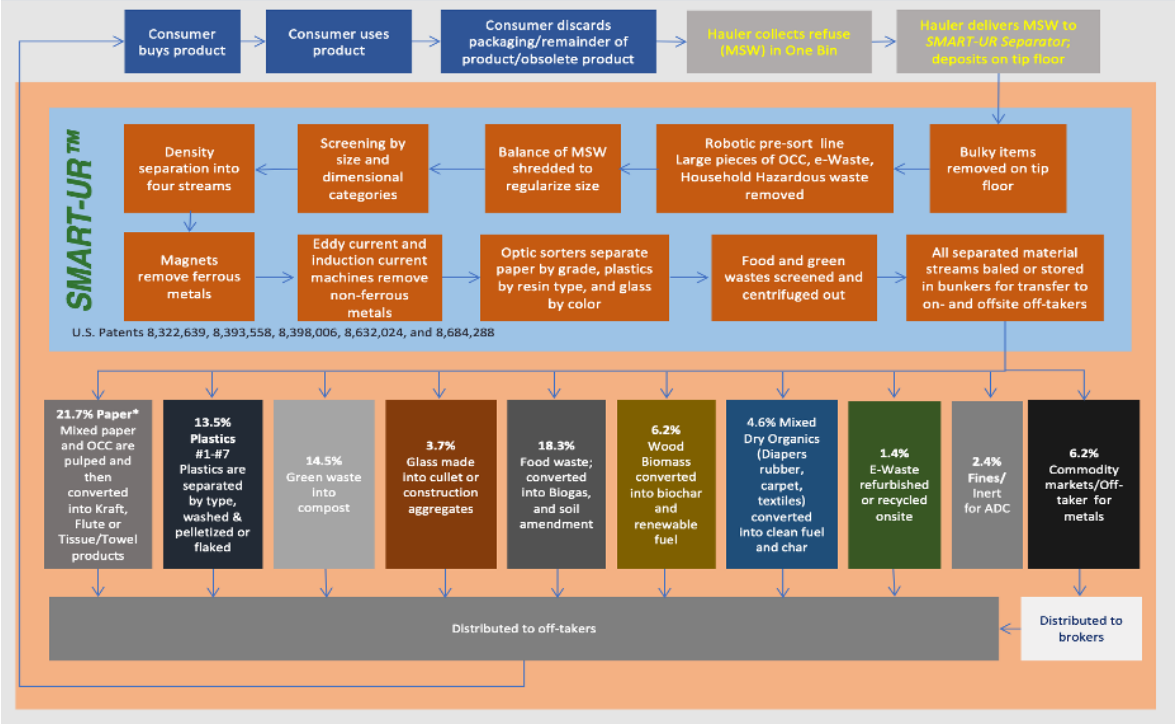

Figure 6: Process flow overview of the SMART Center™. Note: This is a preliminary illustration and may change as the exact configuration is finalized.

The SMART-UR Separation System™ will separate materials to the level of recovery as indicated above. Materials that have established pathways to being recycled, like paper, plastics 1-6, and metals, can be sold into the commodities market at different grades (such as food grade) that meet the specifications of individual processes or customers.

In a full campus setting, paper can be pulped and converted into paper products on site and can be sold directly to customers. Wood and heavy yard debris, such as trunks or stumps, can be converted into biochar, which creates clean energy and soil amendments. Materials that currently do not have established scalable recycling pathways, like Number 7 plastics, rubber, and textiles, can be converted into advanced carbon materials such as carbon black, graphite, graphene, nanotubes, and energy for on-site use.

Wet organic materials can be delivered directly to a SMART Center™, or they can be extracted from other comingled materials in a one-bin collection system. Once separated, each stream can be utilized by four basic processes: composting, anaerobic digestion, fermentation, or conversion to biochar, depending on which process it is best suited for. Yard waste, for example, can be processed by a licensed facility that uses aerated static pile composting technology. However, due to issues with odor and vermin, as well as potential added methane emissions, we have determined that food waste would be better suited for AD and fermentation, which produces clean energy and high-quality soil amendments. Both processes can occur on site.

Campus Infrastructure

Each SMART Center™ will be engineered to optimize aesthetic, environmental and community benefits, including:

- Negative pressure building, filtered exhaust to minimize odor
- Closed loop water treatment for conservation and pollution prevention
- Renewable natural gas to power and heat our facility and minimize emissions, and
- Advanced logistics to minimize transportation impacts.

Upland Road's design and engineering team aims to minimize net energy and water consumption of the facility. Biogas and syngas from biochar and other products are anticipated to power approximately 30MW of cogeneration capacity that can provide electricity and process heat for glass and plastic washing and paper making. For papermaking, we intend to use "zero water" processes to clean and recirculate pulping water for reuse.

Centers of Excellence—Partnering with Educational Institutions and Communities to Advance Materials Science and Training

Building with a future-focused approach, Upland Road will partner with universities and local corporations in each SMART Center™ region to support continued development of the most advanced waste management practices and technologies. These Centers of Excellence will allow us to train our workforce, contribute to local education systems, engage with communities, and develop the next generation of waste technologies.

The accessibility of a SMART Center™ presents an opportunity to turn a place where solid waste is processed into an ideal environment in which to foster material science innovation. With full waste stream access and a steady supply of materials, promising future technologies can be tested at scale. The campus setting may also allow us to unlock the full potential of materials that have been dismissed as "hard to recycle," but may in fact have value. If a SMART Center™ can generate consistent feedstocks of materials that were previously unable to be processed at a MRF, it may be possible for these materials to be used in ways they haven't before.

Discussion

Despite significant efforts to expand recycling and reduce waste going to landfill and incineration, the volumes of waste being generated continue to rise, landfills are reaching capacity, and demand for solutions is rising.

Yet, neither today's infrastructure nor the consumer can separate and process these vast quantities of waste at the scale and with the accuracy needed to return valuable resources to the product stream.

Capturing the Entire Waste Stream—Increased Recycling Accessibility

Approximately 20 million families in the U.S. lack access to recycling. According to The Recycling Partnership, only 85% of single-family and 37% of multi-family households have recycling access. (State of Recycling Report 2024, p. 13). Likewise, the business sector, which generates more than two thirds of waste by some measures, often lacks consistent access to recycling. Key reasons for this lack of access, particularly for households, include space (and the related cost of space) and funding. Economically underserved communities are at a particular disadvantage, as they frequently do not have access to the recycling and composting programs that tend to proliferate in better-resourced communities.

Effectively capturing and sorting the *entire* waste stream creates an opportunity to shift significantly more waste back into productive use, while also transferring the responsibility of sorting away from individuals and businesses who may not participate in or have access to municipal recycling programs.

Benefits of Single Campus—Greater Efficiency and Shared Economics

While municipalities may choose to keep their waste hauling infrastructure as it is, the SMART Center™—as the single receptacle for all waste—facilitates the consolidation of trucking routes which are currently discrete for each consumer-separated material stream. This consolidation reduces traffic, fuel costs and emissions, benefiting businesses, municipalities, and communities alike.

Combining the sorting, processing, and backend technologies (that would generally be built as standalone pieces of infrastructure) on the single campus further streamlines logistics and reduces the economic and environmental costs generated by processing-related transportation.

After the materials are processed on site, businesses that choose to locate on the campus also benefit and contribute to the fully circular system inherent in the SMART Center™; their feedstocks are produced on site, at the scale they need, while their costs related to obtaining those materials are minimized.

The Value of Data and Measurement Methodologies

The SMART Center™'s ability to sort through the *entire* MSW stream allows us to improve dramatically how waste generation and recycling are measured. AI, data capture, and data analysis are essential elements of the SMART-UR Separation System™, providing crucial insight into the contents of the waste stream and the potential carbon and methane savings created by this system, as well as third-party verification of carbon and methane savings. Promising tracking technologies such as the Alliance to End Plastic Waste's HolyGrail 2.0 project, which aims to use digital watermarks and high-resolution cameras to track plastic packaging in the waste stream, could be integrated into the system, and would benefit from full waste stream access. The implications of this technology are significant, not least for businesses, which could then track their waste more accurately.

More broadly, because waste-related reporting requirements and methodologies differ between jurisdictions across the U.S., it is currently difficult to get accurate, consistent measures of waste volumes, recycling participation and recycling rates. Yet, to address the current challenges and capture the opportunities related to waste more effectively, we must establish reliable, agreed-upon ways to measure that waste and what is happening to it at scale.

As a central repository for *all* MSW in a region, the SMART Center™ allows us to do just that. And because that waste is then sorted to the level of individual materials, we can capture *daily waste characterizations* for each operating jurisdiction with a degree of accuracy that would be difficult to achieve through current methods of measurement. In addition, because we can segregate commercial and residential waste on the tipping floor, we can provide accurate, daily waste characterizations of *each* stream, something that is not possible with current waste infrastructure.

Reducing Off-Take Market Volatility

As noted earlier, the commodity markets for recycled materials can be a significant obstacle for many recyclers, as their ability to sell recovered raw materials depends on the prices for particular material streams at any given moment. By processing sorted material on-site before they are sold, value is added to those materials, and volatility is reduced, though not eliminated.

Intermediate products, such as parent rolls of testliner that eventually may be manufactured into cardboard boxes by another entity, are also likely to benefit from smaller price fluctuations than what is seen in raw-material markets. This will help to ensure the circularity of nearly all materials fed into the facility, as they will be separated into clean, discrete materials streams AND turned into new products.

Challenges

The SMART Center™'s ability to process approximately 2,000 tons/day of waste has many advantages, which we have discussed. At the same time, this scale means that it is not right for all locations. Rural areas with significant distances to cover for waste collection may not produce enough waste within a reasonable geographic area to make the economics of a large-scale facility feasible. A *hub and spoke model* may work in some areas, but not all, and we continue to explore ways to cover less-populated regions. These hard-to-reach areas may be served more cost effectively and efficiently by other waste handling models.

Because the Upland Road handles all elements of the waste stream at scale, we also cut across established boundaries in the financing world. We are both bigger and more all-encompassing than facilities with single-material processing capabilities. The individual elements of our campus are known entities. While we separate plastics into a pure form ready for up-manufacturing, a plastics-to-energy plant for which sorted plastics are less essential is a known thing to the financing world. Similarly, an AD tank array and a recycled paper mill are familiar. The SMART Center™ campus has

elements of all of those things and so pushes the financiers, who are used to diligencing the individual elements and technologies, to create a different approach with which to analyze Upland Road's model.

Conclusion & Recommendations

According to Circle Economy's Circularity Gap Report (2023), the global economy is only 7.2% circular, and this figure is declining. We continue to extract and use materials from virgin sources, discarding them into landfills and incineration at an alarming rate.

The U.S.'s current system of managing these discarded materials in their many forms has changed only incrementally over time, despite tremendous effort, expanding waste management budgets, and the genuine desire by many to transform the system into one that is more circular. Likewise, with the current fragmented approach, many consumers and businesses have little choice in how their waste is disposed of and treated.

Addressing this problem requires a holistic approach at every level—from packaging design, changes in consumption habits, improvements to existing infrastructure, and legislative action—there is no single solution that will solve all the problems with how we handle solid waste.

We believe that a SMART Center™ can serve this larger goal in a way that can be potentially transformative. With advanced technologies and new processes, and an innovative model, we can facilitate the achievement of bold, ambitious zero-waste goals. And, by moving beyond our current material- and waste-related paradigms, we can unlock the full potential of the circular economy, turning waste into a source of sustainable economic growth.

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About the Authors

Anne-Marie McGonnigal, Principal, Upland Road

Anne-Marie is Upland Road's Director of External Affairs. She is an expert in building strong programs at the intersection of the private and social sectors. Anne-Marie has held senior roles in the U.S. and Europe in corporate sustainability/ESG, fundraising and communications in industries ranging from telecommunications to financial services. She has a BA from Mount Holyoke College and an MBA from the University of Washington.

Austen Smith, Project Coordinator

Austen supports the senior management team by providing industry analysis and building out internal research to help inform corporate strategy. He oversees the recruitment and administration of Upland Road's undergraduate student internship program. Austen holds a BA in English Literature from Colgate University.

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Upland Road

REMADE conference explores the future of the circular economy

The conference aimed to translate scientific research into tangible circular economy solutions for the researchers, government officials and private companies in attendance.

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Megan Quinn
Senior Reporter

OperationShooting via Getty Images

Recycling innovators at the REMADE conference in Washington, D.C., last week envisioned a future where recycling is easier, cheaper and more efficient — and proposed ideas for how to get there.

The conference, April 10-11, aimed to present the latest research and technology for accelerating the U.S.'s circular economy transition. REMADE is a national institute, established by the U.S. Department of Energy, that partners with academia, trade groups and national laboratories with the goal of creating circular economy jobs and increasing supplies of recycled materials.

Keynote speaker Ellen MacArthur, whose foundation has led initiatives such as the U.S. Plastics Pact, said business innovation is critical to alleviating global challenges such as accumulative and persistent pollution, climate change and biodiversity loss.

"Through numerous studies, we've shown the transition to a circular economy not only stimulates innovation, creates new forms of economic value and reduces dependencies on raw materials, but also shows that circular economic models can also contribute to competitiveness and resilience," she said.

Researchers and presenters discussed new ideas for managing waste and recycling, including major overhauls of local recycling systems.

Robert Watson, principal at **Upland Road**, pitched the SMART center, a materials processing and manufacturing campus he said could convert 90% of municipal solid waste to "productive use" by

co-locating proprietary separation systems with other features, like manufacturing facilities and research centers.

Watson, who helped launch several sustainability standards, such as SWEEP and LEED, pushed back against the idea that the proposed SMART center is a "dirty MRF 2.0." The system could have 60 to 70 different sorting technologies, and multiple manufacturing and conversion options, capable of sorting up to 2,400 tons a day of municipal solid waste into multiple streams for recycling, composting, reuse and other applications, he said.

Upland Road, the SMART center developer, is in the process of identifying locations for up to five centers, which could come online in a few years, once site selection and funding come together, Watson said.

The idea is to extend the life of existing landfills and minimize waste incineration, but "we need a fundamental systems change" to make that happen, he said.

Other innovators are looking at the much smaller scale to improve recycling access. Mario Urdaneta, CEO of MicroRecycling Systems, said he and other researchers are working on an integrated "load and forget" recycling system meant to sort and process durable goods that are hard to recycle, like personal electronics or the humble office stapler.

The recycling system, which Urdaneta envisions could be as small as a Dumpster, would sort and identify plastics, metals and other materials and would be easier and more straightforward to operate than traditional MRF setups. The final product could be ready in five to 10 years, he said.

Though technologies like Urdaneta's are in the early stages, other researchers are working on projects they hope can have more near-term applications.

Improving optical sorters' plastics recognition can improve recycling throughputs, said Vaishali Maheshkar, a Ph.D. student at the University of Buffalo. She worked with a research team focused on how to improve recognition when items are mangled, dirty or made with darker dyes — characteristics that are harder to detect with near-infrared or visible light wavelengths, she said.

Other researchers discussed bench-scale and pilot-scale projects meant to improve myriad chemical recycling processes. Such research aims to make those processes more efficient and more environmentally friendly, they said.

Ezra Bar-Ziv, an engineering professor at Michigan Technological University, presented research on a pilot-scale chemical recycling method that uses solvents to extract polypropylene. The project, a partnership with Braskem and the University of Wisconsin-Madison, is partly funded by a grant from REMADE. The goal, Bar-Ziv said, is to improve on other solvent-based chemical recycling technologies on the market, making the field more competitive and efficient.

DOE officials at the event touted other government-funded projects meant to advance circular economy goals. The agency

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sees recycling and reuse innovations as key to securing domestic supply chains for critical materials and positioning the U.S. as a competitive manufacturing country, officials said.

"We need tech solutions that are cost-competitive and make good business sense for manufacturers across the country," said Carolyn Snyder, deputy assistant secretary for buildings and industry at the DOE.

Snyder highlighted projects like the Re-X Before Recycling prize, which will award up to $5.6 million in federal funding and technical assistance for projects that can reintegrate end-of-life materials back into the economy before recycling. It's among the sustainability efforts DOE has funded recently, along with a separate $4 million e-scrap recycling competition with a similar innovation goal.

Academics, innovators, private industry and government agencies must work together to transform ideas into workable circular economy solutions, Snyder said.

"It's vital that we design for circularity from the beginning. We need to develop strategies that maximize the useful life of the technologies and materials that are already in our economy. And each of you here today is invaluable as part of that collective effort to increase the circularity," she said.

This story first appeared in the Waste Dive: Recycling newsletter. Sign up for the weekly emails here.

Upland Road resolves solid waste challenges at scale.

Our patented, proven waste sorting processes are at the core of an eco-industrial campus, turning trash into valuable materials and building a truly circular waste management system.

Upland Road | Transforming Tomorrow, Today

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Wastaway

Market Research Response

MARKET RESEARCH FOR MUNICIPAL SOLID WASTE MANAGEMENT SOLUTIONS

Background

Miami-Dade County ("County") provides an integrated waste management system that provides collection, transfer, and disposal services to include landfills and historically included a waste-to-energy facility. The County's Department of Solid Waste Management (DSWM) provides waste collection services twice a week to more than 350,000 households in a 320-square-mile waste collection service area. DSWM operates 13 Neighborhood Trash and Recycling Centers and administers the contracted collection of household recyclables. Historically, the County produces over five million tons of waste annually, of which DSWM disposal system processes more than 2.4 million tons.

Objective

The County is conducting market research to garner industry comments and solutions regarding potential future projects for a comprehensive solid waste management approach. This effort is being undertaken by the County as part of a review and analysis to further explore all available delivery methods for the disposal of waste. Various items related to solid waste management were discussed by the Board of County Commissioners on February 19, 2025 and the agenda to such meeting can be accessed using the following link.

https://www.miamidade.gov/govaction/commminute.asp?cmbmeetdate=5227&file=false

The County is particularly interested in responses to this market research from industry experts from all available sectors of waste management. The requested information will assist the County to better understand the marketplace, gather information regarding the current state of the industry, and gauge interest in the projects and may also be used by the County for any other purpose.

Public Record

Respondents are hereby notified that all information submitted as part of, or in support of, this analysis will be available for public inspection in compliance with Chapter 119, Florida Statutes, popularly known as the "Public Record Law." Accordingly, do not submit any information in response to this analysis which the respondent considers to be a trade secret, proprietary or confidential, is competitively sensitive, or which violates any intellectual rights of a third party.

Responses

Responses should address the requested information below and indicate "not applicable" when a particular item cannot or will not be addressed by respondent. Responses should be submitted to the County's contact person indicated below via email no later than **April 14, 2025**.

Email to:
Saba Musleh, CPPB, Negotiator
Strategic Procurement Department
saba.musleh@miamidade.gov

With a copy to (CC line of email):
Ross Byers, Project Manager
AtkinsRéalis
ross.byers@atkinsrealis.com

Respondents are encouraged to not limit their responses to any already-identified potential sites, locations, or assumptions as to the size or capacity of the respondent's solution. Respondents are encouraged to consider any combination of waste disposal methods such as, but not limited to, waste-to-energy, landfills, or hauling waste.

Requested Information

A. Respondent

Provide a brief summary of the respondent to include the following.

- **Charles Moseley, WastAway, 195 Mt. View Industrial Drive, Morrison, TN 37357**
- **Charles Moseley, Business Development & Sales, cmoseley@wastaway.com, and 334.327.2248**
- WastAway, based in Morrison, Tenn., is a leading green technology company boasting a multi-patented equipment design and automated processing system that converts municipal solid waste (MSW) to a sustainable, green energy fuel while achieving 85% landfill diversion. WastAway's technology discreetly removes metals (ferrous and non-ferrous), plastics, glass and inerts for recycling and converts the remaining waste into sterile carbon rich sustainable engineered fuel for a variety of uses. Its renewable – negative carbon footprint – products include; a proven, high-BTU fossil fuel replacement for cement kilns, power plants, steel mills, pulp mills and other solid fuel users; biofuels through gasification and pyrolysis; renewable natural gas (RNG) through anaerobic digestion; and a soil enrichment additive. WastAway was founded in 2002 as a subsidiary of Bouldin Corporation, which began in 1959 as Bouldin & Lawson, a manufacturer of automated agricultural and horticultural machinery for the greenhouse and nursery industries. For more information, visit www.wastaway.com or use this link to an informational **brochure:** https://online.flippingbook.com/view/673267/

B. Waste Management Solutions

1. **Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link.**

   WastAway is a leading green tech company that converts municipal solid waste (MSW) to fuel. Our commercially proven, proprietary technology-based garbage processing plants convert 85% of all inflowing solid waste into recycled raw materials and biofuels, presenting a cost effective, long-term solution to landfilling.

   Based on previous conversations with the Florida Department of Environmental Protection (FDEP), they expressed that a WastAway facility should have minimal permitting timelines or challenges.

   Because the facility design can be adapted to multiple configurations based on the nature and volume of waste, WastAway facilities can be strategically sized and located nearer the waste source to minimize waste transportation costs, thereby, reducing the carbon footprint caused by trucking.

   Through the experience of multiple projects, WastAway has identified main considerations and economic impacts of constructing new municipal solid waste conversion plants nationwide.

Our proprietary solid waste plants are comprised of a large system of green tech machinery that sorts, shreds, and transforms municipal solid waste through an automated process. As the material flows through the system, recyclables such as ferrous and non-ferrous metals and various types of plastics are removed discreetly and sold into existing markets. The process removes inert material as well, and only about 15% of the incoming material is sent to a landfill. The remaining material is further processed through WastAway's proprietary cellulator, yielding a pathogen free material called cellulate. The cellulate can be used in its raw form as a soil enhancement or be further processed to yield our SE3 renewable fuel to offset the use of fossil fuel in existing solid fuel boilers to produce green electricity. Alternatively, the cellulate can be used as is for feedstock for an anaerobic digestor. The anaerobic digestor converts a portion of the material into renewable natural gas and the remaining solid portion (digestate) can be dried to yield SE3 which can be used as a substitute for fossil fuel and combusted to produce green electricity. Both SE3 fuel and RNG are green, renewable biofuels that can be sold as is or burned onsite to generate and sell green electricity.

The process, equipment, and machinery are standardized and have been verified by third parties and past WastAway commercial experience, as well as research and development. The processing building is approximately 50,000 square feet to accommodate the machinery, daily trash inflow, recyclables, inorganics and biofuels. Additional buildings may be required for cellulate utilization. The components are designed for long-term continual use, and they are standardized for quick repair and routine maintenance replacement. Ultimately, the goal of this technology is to provide a low cost and effective permanent diversion alternative to landfilling while supporting the local community with green energy, recycled materials, and stable jobs.

https://documents.miamidade.gov/mayor/memos/01-25-25-second-update-on-directive-no-241676.pdf

2. **Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.**

We use technology from suppliers that have decades of experience. Our primary sorting system is supplied to our design by a company that has more than 300 facilities in operation and will provide process guarantees for the material flow. Our anaerobic digestion company has installed systems throughout the world and has numerous projects in operation and construction across the United States. They can provide biogas conversion guarantees that assure the biogas quantity and quality.

We have produced thousands of tons of the cellulate at our commercial plant in Morrison, TN, – in operation since 2003 – that can be used as fossil fuel replacements or converted to biogas. The Morrison plant, originally operated for several years at commercial scale ~~24/7~~ to produce ~~compost~~a soil additive. However, it is currently used as a platform for introducing innovations to the process, producing cellulate for testing and demonstration purposes for visitors. Initially, the biomass ~~product~~ soil additive was used ~~as a beneficial soil additive~~ in the local nursery industry through 2007. At that time, the program to develop today's sterile, pathogen-free renewable fuel was launched.

Testing of the material as fossil fuel replacement has been conducted by multiple power generators and industrial customers, as well as extensive laboratory testing and the fuel has been shown to be extremely stable and consistent.

The material has undergone more than a year of laboratory testing at an anaerobic digester producer in Europe. This data has been utilized to provide the quantity and quality of the produced biogas and the design parameters for the RNG production plant.

We have completed engineering and design packages to build processing facilities in Murfreesboro, TN near Nashville and Kern County, CA, that each will divert 85% of the waste processed into renewable fuel and other beneficial products.

3. **<u>Quantity</u> - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.**

   WastAway has produced the design and drawings for shovel ready projects nationwide including the Bena Landfill in Kern County, CA, and a green field site in Murfreesboro, TN. Each high diversion facility will have a nominal annual capacity of 140,000 tons of incoming waste. However, facility design can be customized for Miami-Dade County needs to provide multiple plants of varying capacities and locations.

   Through these Request for Proposals procedures, WastAway was selected as the preferred vendor for a facility that would allow Kern County to meet ever increasing diversion goals for its solid waste program with multiple facilities across the county, while minimizing the economic impact on its citizens. WastAway has refined the innovative, original concept to produce a leading-edge option for solid waste diversion and disposal. WastAway facilities are designed to divert significant fractions of solid waste, including organics, from the landfill. They will also process waste streams that do not easily lend themselves either to composting or to other processing technologies.

   Economic and operational analysis led to the determination that a facility designed to process 140,000 tons per annum of incoming waste materials provides highly positive cashflows while maximizing the operational benefits. The WastAway facility will generate significant revenues, above and beyond the cost of owning and operating the facility. No other solid waste processing facility will do this.

4. **<u>Technologies</u> - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.**

   The WastAway suite offers:
   - Proprietary sorting and recycling
   - Proprietary technology designed to produce an engineered feedstock for anaerobic digestors
   - Unique anaerobic digestor system
   - Gas upgrading equipment. to produce Renewable Natural Gas (RNG).

   These integrated technology packages provide municipalities with multiple revenue streams, thus delivering both added financial and environmental benefits. In addition to RNG, output from our facilities include solid digestate material that can be used either as a soil amendment or as a compost substrate as required to maximize diversion credits. The digestate can also be sold as an engineered low carbon renewable fuel as a fossil fuel substitute for gasification processes or combustion processes that utilize coal.

5. **<u>Benefits</u> - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.**

   Key Benefits of the Project

   - WastAway facilities can handle mixed wastes as collected without source separation.
   - The WastAway process achieves 85% landfill diversion.

- Positive cashflows will be generated by the facilities.
- Markets for the fuel produced have already been established.
- More than 75% of the incoming solid waste will be used to produce renewable natural gas (RNG).
- The remaining solid digestate can either be used as compost or sold as a renewable solid fuel. No other technology can do this.
- Municipalities will experience significant reductions in harmful greenhouse gas emissions from landfills and facilities that utilize the solid fuel produced.
- The WastAway facilities will allow municipalities to significantly reduce the cost of disposal. This is accomplished by the revenues from the sale of RNG, and its related environmental credits, as well as the sale of the solid fuel.
- Our facilities are designed for flexibility that will allow these benefits to remain as the volume and composition of solid waste varies over the life of the plants.

6. **Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.**

Development and implementation challenges are local permitting, lead times for key equipment, raw material cost increases (primarily steel) and infrastructure improvements (natural gas, water, electricity, roads). All these development and implementation challenges will be addressed during the feasibility and project development phases. Other challenges:

- WastAway is aware that educating the public that our proprietary process is not incineration is important. Once processed, the resultant fuel has been determined by the EPA to no longer be considered solid waste. It is also incumbent on the parties to extol the advantages this process brings to the city and county versus other processes.
- Another challenge will be site selection. This involves determining demographics and logistics.
- Based on previous conversations with the Florida Department of Environmental Protection (FDEP), they expressed that a WastAway facility should have minimal permitting timelines or challenges.

C. Financial Approach

1. **Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.**

Capital investment for a solid fuel only WastAway facility is currently estimated to be $37 million. This does not include building, project site and site improvements. These costs are site specific, and dependent on location.

~~These costs are site specific, and dependent on location.~~ Capital investment for a solid fuel plus RNG facility is currently estimated to be $89 million. This does not include building, project site and site improvements . These costs are site specific, and dependent on location.

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2. **<u>Funding Model</u> - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).**

   If the facility is owned by Miami-Dade County, all financial benefits will accrue to them. This can result in a significant, positive financial impact to the citizens of the county.

   The WastAway business model is to sell our proprietary system and license the technology. We conduct comprehensive employee training at our Morrison, TN facility prior to plant commissioning; and during the early months of operation, WastAway will be on-site for follow-up training. WastAway can also provide a long-term operating agreement for this project if desired.

   We can enter a public-private partnership or partner with an investor to own and operate the facility, whereby Miami-Dade County will only pay a tipping fee.

   During the project development and feasibility phases, WastAway will identify customers for the high-value recyclables, RNG and biofuels.

3. **<u>Revenue</u> - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).**

   WastAway facilities present a unique opportunity to generate income from the sale of renewable energy in the form of RNG and solid fuels, in additional to the sale of recovered products through recycling. The generation and sale of RNG has significant tax benefits that add value in the marketplace. WastAway facilities produce all of the noted revenue streams:

   - Energy Production
   - Material Recovery
   - Tax Credits
   - Sale of Products

D. <u>Implementation Approach</u>

1. **<u>Infrastructure</u> - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).**

   As the technology provider, WastAway will provide a detailed, comprehensive analysis of the facility's infrastructure requirements, sufficient for development of supply agreements and capacity design.

Depending on configuration, electrical connected load will be between 3 MW and 5 MW. A steam boiler is part of the plant equipment and will require natural gas and water supply. There will also be a water requirement for plant sanitation.

The plant equipment general arrangement drawing will depict the sorting lines and a tipping floor for receipt of waste.

2. **Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.**

   A typical plant land requirement is generally no less than 3.5 acres and up to 10 acres. This is determined by ingress and egress for truck traffic, and sufficient space for a 50,000-to-60,000-square-foot processing building. The land condition should be flat and able to accommodate required infrastructure including building and utilities.

3. **Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.**

   The WastAway plant in Morrison, TN, is located in Warren County's Mountain View Industrial Park. The park's tenants include Tier 1 and Tier 2 automotive parts suppliers, Bridgestone tire manufacturing and additional U.S. and international manufacturers.

   Typically, a WastAway plant is well-suited for industrial parks or light manufacturing zoned areas. Since we don't use combustion in our process, our facilities are clean, green and odor free.

   We will work with Miami-Dade County to identify and rank site candidates based on the parameters described herein, i.e. logistics for MSW transport, infrastructure requirements and zoning.

4. **Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.**

   Based on previous conversations with the Florida Department of Environmental Protection (FDEP), they expressed that a WastAway facility should have minimal permitting timelines or challenges. FDEP indicated that facility permitting will be similar to a transfer station.

   WastAway will work with FDEP and all appropriate government agencies to comply with necessary permits.

5. **Timing - Identify the estimated timeframe for the implementation of the respondent's solution.**

   Based on conversations with FDEP, we estimate permitting to be six months or less. The manufacturing and construction timeline is 18-24 months. The facility, or facilities, startup will be accomplished prior to the estimated landfill closure.

6. **O&M - Describe the anticipated operational and maintenance requirements and**

needs for the operational phase of the respondent's solution.

The plant operates 16 hours a day processing waste and performs routine and necessary maintenance, as well as cleaning for 8 hours a day. There are 26 employees at each plant, comprised of skilled and semi-skilled workers, including management. There is robust maintenance schedule followed daily.

Electricity

The plant will require up to a five-megawatt (5 MW) connection to feed:

- Plant Operations.
  - Plant operations consist of the overall motor load for all processing equipment. This is estimated at 5,571 horsepower or 4.2 MW.
- Balance of Plant.
  - Balance of plant includes lighting, HVAC, elevator, etc. estimated at 0.403 MW.

Water

The input of water into the system is required in three places:

- Boiler
  - The boiler is needed to make steam for the hydrolyzer. It is calculated that the water needs per input ton of MSW is 50 gallons. The water to make steam must be boiler quality which will require treatment in a BWT (boiler water treatment) system prior to entering the boiler.
- Anaerobic Digestor
  - The anaerobic digestor may need initial water addition to begin the digestor process. After the digestor has reached steady state operations the make-up water needed will be water recovered downstream in the digestate dewatering process which uses screw presses. A water balance for the anaerobic digestor will be calculated initially based on waste composition and extrapolated from pilot work. It will later be adjusted based on empirical data after steady state operations are achieved.
- Organics recovery
  - A small amount of make-up water will be needed in this subsystem of the Feedstock Preparation Line. The organics recovery unit takes a slipstream from the MSW feed sorting line and recovers light fractions for introduction to the Anaerobic Digestor Preparation Line.
- Domestic Water
  - Sanitary
  - Wash down areas

Natural Gas

Natural gas is used in the plant in two separate places:

- To fire the boiler to make steam.
- As a fuel supplement for the flare system for burning the tail gas from the gas preparation system.
- The flare will also serve as an emergency method of removing biogas from the Anaerobic Digestor in the event of inability of the gas preparation to take all or a portion of the biogas.

Compressed Air

Compressed air is needed in the plant for several functions:

- Operation of the hydrolyzer system.
- Plastics and metals removal system.

- Pulse jet baghouses.
- Various other uses throughout the plant, generally not ongoing or essential for plant operations.

7. **<u>Health/Safety/Environmental</u> - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).**

   Environmental & Human Health Benefits of the Project

   The WastAway process is perhaps the most environmentally beneficial technology ever developed to manage MSW. Not only by the shear percentage of the incoming MSW that is converted to renewable or recovered products but there are also numerous other environmental benefits associated with a WastAway facility:
   - The facility offsets 100% of the methane gases that would be released from a landfill by the diverted MSW.
   - The material produced will become either a renewable, low carbon solid fuel or RNG, or both. This will offset GHG emissions from the fossil fuel that it replaces.
   - The RNG that is produced can be utilized by the host community to offset CNG or diesel in its fleet, providing a significant reduction in GHG emissions by the host.
   - Significant diversion of waste from the landfill to beneficial use
   - Reduced greenhouse gases as a fossil fuel replacement
   - Reduced pollution from leachate
   - Reduced truck traffic by converting to single stream waste collection system if desired

   Our 400 TPD propriety green technology can deliver the carbon equivalent of removing 96,000 automobiles from the highway, eliminating 866 billion pounds of carbon from the air and adding 517,000 acres of clean oxygen producing forest land each year.

E. <u>Other Information/Advice</u>

1. **<u>Procurement Model</u> - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).**

   If the county chooses to be the owner, WastAway will provide the design criteria for building, foundation, civil work and land. Additionally, WastAway will design, supply and install a complete system. This also includes necessary control systems, operation instruction and training. The county can use traditional procurement practices for the land acquisition, the civil works, the foundations and the building.

   This is the least cost option.

   As stated above, WastAway could work with a public/private partnership or engage with a private owner. Under a public/private partnership, the county will provide the land. The

entity will provide the complete and operating facility, including civil works, building and foundation. Additionally, WastAway will design, supply and install a complete system. This also includes necessary control systems, operation instruction and training. The partnership will design/build. This includes startup, staffing, training, testing and operations.

Under this scenario, the county will receive a percentage of revenues based on the ownership structure and responsibility of each party under the defined structure.

In the case of WastAway partnering with a developer, the developer is responsible for the entire project, including site acquisition. Under this scenario, the county will be responsible for providing ~~to~~ solid waste to the facility under a long-term contract for MSW, at an established tip fee, under negotiated terms of the agreement.

2. **Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.**

   WastAway proposes multiple facilities strategically located throughout the county. This approach allows for reduced transportation costs, thereby reducing truck traffic and carbon emissions.

   WastAway facilities are compatible with other disposal methods as part of an integrated solid waste management plan. Under county ownership, a WastAway facility can produce a significant net revenue source, which helps lower the cost of solid waste disposal across Miami-Dade County. WastAway can co-locate at current waste transfer stations or other existing waste disposal sites, if land is available. Utilizing current infrastructure – such as existing transfer stations or other disposal sites – will result in no change to the hauling pattern, the lowest cost option for the county.

3. **Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know.**

   WastAway has identified several biofuel customers for this project, including local cement kilns. Using biofuel for electric production is also an option.

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Jonathan P. Steverson
Interim Secretary

Memorandum

TO: Charles A. Moseley, WastAway

FROM: Karen S. Moore, Waste Reduction Program Administrator KSM

SUBJECT: Potential Recycling Credits for Products of the WastAway Process

DATE: July 31, 2015

WastAway has requested that the Department evaluate the WastAway process for applicable "Recycling Credits" as at it relates to Section 403.7032, Florida Statutes, and the goal for establishing a 75% recycling rate for municipal solid waste (MSW). We appreciate your taking the time to share your process with us, and for time in requesting information about how these processes fit into the calculation of recycling rates under our rules.

Based on the information reviewed by our department, the WastAway process is expected to qualify for recycling credits that would be applied for the county of origin for the MSW. Recycling credits would be awarded in the form of Renewable Energy Credits, Fuel of Fuel Substitute Recycling Credits or Processed Fuel Recycling Credits. Recovered materials, such as metals separated from the incoming municipal solid waste would also receive recycling credits based upon the amount of material recovered.

Per Rule 62-716.480(3)(c), Florida Administrative Code (F.A.C.), fuel or fuel substitutes used at cement kilns (or other facilities that would use this as a heat source), would be eligible to receive fuel or fuel substitute recycling credits (which yields a ton for ton credit).

In accordance with Section 403.706(4)(a), F.S., and Rule 62-716.480(2)(b), F.A.C., fuel or fuel substitutes used at Waste-to-Energy plants or other renewable energy facilities generating electricity, would result in renewable energy recycling credits which yields 1 ton of recycled material per megawatt-hour produced. If a county creating renewable energy from solid waste implements and maintains a program to recycle at least 50 percent of municipal solid waste by means other than creating renewable energy, that county shall count 1.25 tons of recycled materials for each megawatt hour produced. If waste originates from a county other than the county in which the renewable energy facility resides, the originating county shall receive such recycling credit.

Additional circumstances and the methods that would be used for calculating county recycling rates are discussed in other subsections of Rule 62-716.480, F.S. In general, to estimate potential credits one can estimate the various products produced and then calculate possible credits using the above information.

Once you have reviewed this information and the associated rule language, we would be happy to work with you to generate an example calculation for a particular example scenario. If there are any questions, or is you would like to a specific example for the calculation of county recycling rates, please contact me at (850) 245-8864.

Waste Connections

Market Research Response

WASTE CONNECTIONS, INC.
Connect with the Future

Waste Connections of Florida, Inc.
3840 NW 37th Court
Miami, FL 33142

kurt.salac@wasteconnections.com
Phone: 727.254.8527

February 28, 2025

Via Email
Honorable Mayor, Chairman, and Members
of the Board of County Commissioners
Miami-Dade County
111 NW 1st Street
Miami, Florida 33128

Re: Miami-Dade County ("County") Request for Industry Input Relating to Waste Disposal Solutions

Honorable Mayor, Chairman, and Members of the County Commission:

I write on behalf of Waste Connections of Florida, Inc. ("Waste Connections") to express our continued commitment to serving Miami-Dade with innovative and cost-effective waste disposal solutions. On February 19, 2025, the County Commission Chairman directed those interested companies to contact the Mayor to begin discussions of what private sector companies can do to further the waste disposal needs of the County. Waste Connections is here to help.

Waste Connections Offers the County Immediate Solid Waste Disposal Relief.

For over 30 years, Waste Connections has proudly partnered with the County to provide solid waste and recycling services to residents and businesses. Additionally, Waste Connections currently partners with the County to provide recycling collection to over 150,000 residential units. As a proud partner, we are committed to assisting the County resolve its short-term and long-term solid waste disposal and recycling challenges. Indeed, on January 22, 2025, the County Commission adopted Resolution No. R-6125, extending the Agreement between Waste Connections and the County through October 1, 2035, and expanding solid waste disposal service solutions to include transportation of solid waste by rail to the Heart of Florida Landfill in a low-emission and cost-effective manner.

To further assist the County with its needs following the unfortunate circumstances at the County's burner, Waste Connection has not only taken additional direct deliveries of waste from the County, but significantly increased the County reserved capacity at our JED landfill to help satisfy the County's solid waste concurrency needs.

Waste Connections is Ready to Provide Technical Expertise to the County.

Waste Connections can complement its local team and its 30+ years of experience in Miami-Dade and South Florida by calling on its national network. Locally, Waste Connections has 5 transfer stations and 2 hauling operations. Additionally, Waste Connections owns and operates a network of landfills in the state. As an enterprise, Waste Connections has close to $10 billion dollars in annual revenue and employs 25,000 employees which help deliver solid waste transportation and disposal needs across forty-five U.S. states and Canada

WASTE CONNECTIONS, INC.
Connect with the Future

Waste Connections of Florida, Inc.
3840 NW 37th Court
Miami, FL 33142

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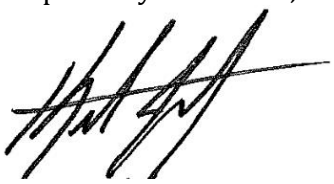
through truck and rail infrastructure. This national footprint means the County can count on Waste Connections' national industry leading experts in devising first-class, innovative, and practical solutions to the County's solid waste disposal objectives.

We would like to propose a meeting between County Administration and subject matter experts from Waste Connections national senior leadership and local management to further explore the needs of the County and how Waste Connections can lead the effort to solve this critical governmental service issue.

Waste Connections is here to help. We look forward to working with the County and discussing potential partnerships and procurement assistance needed to meet the County's solid waste disposal needs.

I will be in touch soon to set a meeting to discuss in greater detail, but in the meantime, if you have any questions or concerns, please feel free to reach out to me.

Respectfully submitted,



Kurt Salac
Director of Business Development and Municipal Affairs

Requested Information

A. Respondent

Provide a brief summary of the respondent to include the following.

• Respondent's name and address

Waste Connections of Florida, Inc.

• Contact person, title, email address, and telephone number

Kurt Salac, Director of Municipal Business Development and Governmental Affairs

727-254-8527

• Brief description of respondent's history, years of experience in the respondent's solution, core areas of expertise in the waste management industry, and any products and/or services the respondent provides

Waste Connections is the 3rd largest waste company in North America. The Company is a fully integrated waste company with a national footprint and over 25,000 employees.

For over 30 years, Waste Connections has proudly partnered with the County to provide solid waste and recycling services to residents and businesses. Additionally, Waste Connections currently partners with the County to provide recycling collection to over 150,000 residential units. As a proud partner, we are committed to assisting the County resolve its short-term and long-term solid waste disposal and recycling challenges. Indeed, on January 22, 2025, the County Commission adopted Resolution No. R-6125, extending the Agreement between Waste Connections and the County through October 1, 2035, and expanding solid waste disposal service solutions to include transportation of solid waste by rail to the Heart of Florida Landfill in a low-emission and cost-effective manner.

To further assist the County with its needs following the unfortunate circumstances at the County's burner, Waste Connection has not only taken additional direct deliveries of waste from the County, but significantly increased the County reserved capacity at our JED landfill to help satisfy the County's solid waste concurrency needs.

B. Waste Management Solutions

1. Solution - Describe the waste management solution(s) that the respondent specializes in that could address the challenges identified by the County in its report which was provided in response to Board of County Commissioners Directive No. 241676, to include any technologies, approaches, etc. The report can be found at the following link.

As noted above, we own and operate two Class one landfills within the state of Florida, JED Landfill located in St. Cloud Florida and HOF Landfill in Lake Panosofkee.

https://documents.miamidade.gov/mayor/memos/01-25-25-second-update-on-directive-no-241676.pdf

2. Effectiveness - Describe the effectiveness of the respondent's solution, where the solution has been implemented, and any other information that would explain the benefit of the solution.

With the amendments to our long-held contract executed in January of this year, we have agreed to accept 312,000 tons of material (249,600 by rail and 62,400 tons by truck) at our Miami Transfer Station in Hialeah and deliverable to our HOF Landfill.

3. Quantity - Describe the quantity of waste that the respondent's solution can process annually and indicate the adaptability of the respondent's solution to different waste compositions and quantities.

In addition to those contracted tons referenced above, both of our landfills have more than fifty years of remaining life. With some local site modifications, we can accept as much additional volume as necessary to address the County's needs.

4. Technologies - Describe the waste processing technologies (e.g., waste-to-energy, anerobic digestion, gasification, advanced recycling, etc.) that are part of the respondent's solution.

Both of our landfills capture gases for alternative use and convert the same to electricity.

5. Benefits - Describe the key benefits of the respondent's solution as compared to the other waste processing technologies that are available.

We feel that we are uniquely positioned with our landfill capacities and have two modes of transportation directly from Miami into the HOF Landfill.

6. Challenges - Describe any challenges associated with the respondent's solution, including any regulatory or permitting challenges, and how the respondent plans to overcome such challenges.

We are in the process of obtaining all necessary permitting through the City of Hialeah and Miami-Dade County. At this point, we see no significant barriers, and all appears to be on track as expected.

C. Financial Approach

1. Costs - Provide capital investment and 30-year operational costs associated with the respondent's solution.

We consider the specificity of such costs to be proprietary information. That being said, the Company is traded on the public exchanges at the NYSE & the TSX. The company had over $9 billion dollars in revenue last year.

We have purchased or leased all the equipment necessary and have the assets in place, to successfully meet the terms of our contract.

2. Funding Model - Identify the funding model for the respondent's solution and whether respondent would provide financing for such solution. Indicate the arrangements for the funding and financing (e.g., public private partnership, private-funded, County-funded, financing, federal tax credits, and federal and state grants, etc.).

All of our current operations are funded entirely by the Company.

3. Revenue - Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

Not Applicable

D. Implementation Approach

1. Infrastructure - Describe the infrastructure requirements necessary to implement the respondent's solution and the role the respondent would fulfill in such implementation. (i.e., master developer, design/builder, operator, technology provider, etc.).

We have been working with engineers, designers and construction professionals to construct a rail spur at our Hialeah Transfer Station along with a rail spur at our HOF Landfill. The transportation will go from one property and directly to the second, both of which we own and operate.

2. Size - Identify the recommended site, including any identifiable site information, and footprint of the site that will be necessary to implement the respondent's solution.

Answered above

3. Site Ownership - Describe the respondent's plan to secure the recommended site to implement the respondent's solution, including any zoning or re-zoning requirements. Identify the current owner of the site.

Answered above

4. Permitting - Describe any necessary permitting or regulatory processes necessary to implement the respondent's solution.

Answered above

5. Timing - Identify the estimated timeframe for the implementation of the respondent's solution.

We anticipate being fully operational by 8/1/25.

6. O&M - Describe the anticipated operational and maintenance requirements and needs for the operational phase of the respondent's solution.

Answered above

7. Health/Safety/Environmental - Describe how the respondent's solution protects both human health and the environment and any anticipated environmental impacts of the respondent's solution (e.g., emissions, noise, odor, etc.).

The utilization of rail significantly reduces the number of trucks on the road along with improved emissions. As mentioned, capturing landfill gases for alternative use decreases the carbon footprint.

E. Other Information/Advice

1. Procurement Model - Provide respondent's advice as an industry expert regarding the recommended procurement approach for the design, construction, operation and/or maintenance of a new facility such as a waste-to-energy facility, or any alternative solution, for the County such as traditional methods (e.g., design-build or design-bid-build) and alternative delivery methods (e.g., public private partnership).

2. Partnerships – Identify if respondent as an industry expert has any other advice such as constructing a larger regional waste-to-energy facility with other local governments or the State of Florida or building a smaller facility combined with utilizing other waste disposal methods such as landfills or hauling waste.

3. Additional Insights - Provide any additional insights or advice as an industry expert that the respondent believes would be helpful for the County to know

In response to these final three questions, we have sent a letter to the mayor and all elected officials, dated February 28, 2025, offering to meet and provide insights and provide technical advice and insights to the County.

The management team that has worked on the latest contract extension and amendments have over 100 years of industry experience and we stand ready to augment our long-term solid relationship.

Waste Management

Market Research Response

1800 N. Military Trail, Suite 201
Boca Raton, FL 33431

The following sections were prepared in support of Waste Management, Inc. of Florida's (WM) response to Miami-Dade County's (County) Market Research for Municipal Solid Waste Management Solutions (Market Research) regarding the Board of County Commissioners Directive No. 241676

A. Respondent

Waste Management Inc. of Florida
1800 N. Military Trail, Suite 201
Boca Raton, FL 33431

Contacts:
Alex Gonzalez – Senior Manager, Government Affairs
agonzalez@wm.com 305-525-5953
Christopher Carey – Director, Landfill Planning and Development
ccarey1@wm.com 954-214-3161

As North America's leading provider of comprehensive environmental services, WM serves millions of residential, commercial, industrial, and municipal customers throughout the U.S. and Canada by collecting, transporting, and finding new uses for the waste they generate. We also collaborate with our customers to help them achieve their sustainability goals through managing and reducing waste and operating more sustainably.
To serve our diverse customer base, we have developed the industry's largest network of collection operations, transfer stations, and recycling and disposal facilities, led by a team of ~61,700 employees motivated to go above and beyond. Unmatched in geographical reach and ability, our resources enable us to manage every aspect of our customers' waste streams.

B. Waste Management Solutions

Solutions

- To address the challenges identified by the County in its report provided in response to the Board of County Commissioners Directive No. 241676, WM has the capability to provide a wide range of additional services and process additional volume. A brief summary of some of the potential additional services is provided herein.

A. Current and Future disposal capacity

- WM has in and out of county landfill capacity disposal commitments to the County for 2,700,000 tons per year. In addition, WM has the capability to increase its rail transfer capability to the Okeechobee Landfill should the County require additional disposal capacity.
- The solution developed by WM to rail haul County waste limits environmental impacts by utilizing LNG powered locomotives and minimizing truck traffic to transport the waste. Further, WM is constructing Renewable Natural Gas Facilities at both the Medley and Okeechobee landfills to capture and recycle the methane generated from the breakdown of waste.

B. Rail Extension to Landfill
   - As the County increases its utilization of WM's rail transfer network, WM will relocate the intermodal rail facility in Ft. Pierce Florida from the one adjacent to Route 1 in Ft. Pierce to a more convenient location adjacent to Rt. 70 and closer to the Okeechobee Landfill to reduce truck miles and improve efficiency. This new unloading facility is expected to be in operation in early 2026. In addition, as rail shipping of waste from south Florida increases over the next few years, WM is planning to extend the rail spur to the Okeechobee Landfill property to further remove truck traffic from local roads, decrease traffic and carbon emissions and improve efficiencies.

C. Operate a Transfer Site at the South Dade Landfill
   - Should the County decide to begin transferring waste from the site, WM has the capability to transfer waste to the Okeechobee Landfill via rail through the Dade Intermodal Facility.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
   - If the County decides to divert waste from the South Dade Landfill and prefers not to build its own transfer station, WM has the capability to construct a transfer station in the vicinity of the South Dade Landfill (with site choice in consultation with the County). WM can provide per ton pricing for managing the waste volumes from the South Dade Landfill vicinity through its rail intermodal facility to the Okeechobee Landfill with no capital cost to the County.

E. Organics Processing
   - If the County desires to source separate food waste organics, WM has the capability to compost food waste for the County thus removing it from the disposal waste stream. WM has the capability to re-start our permitted composting operation at the Okeechobee Landfill site and can provide this service to the County as needed. WM is prepared to meet with County staff to develop a logistics and pricing solution regarding the handling of food waste organics if desired.

F. Composting
   - WM has the capability to compost clean segregated yard waste if the County decides to enact a program to separate and collect yard waste. WM is prepared to work with the County to identify a suitable site and make an investment in permitting and siting an appropriate site to compost yard waste into a suitable material that can be reused as a soil amendment or fertilizer product.

G. Single Stream Recycling Capability
   - WM currently processes single stream recycling for the County. A new WM state of the art single stream recycling facility is under construction in South Florida that will increase throughput capacity to 275,000 tons per year. This increased capacity will provide an opportunity for increased throughput if the County requires it due to increased diversion efforts, along with recycling additional materials, potentially including plastic film/bags.

Effectiveness

A. Current and Future Capacity
   - WM and the County have already demonstrated the ability to move waste efficiently and economically from the County to the Okeechobee Landfill via rail. WM's ability to continue to scale this operation to meet the needs of the County require only lead time of a few months to acquire additional intermodal waste containers. The County has annual guaranteed capacity of 700,000 tons at the Medley Landfill and 2,000,000 tons at the Okeechobee Landfill.

B. Rail Extension to Landfill
- The WM rail transfer operation has proven its effectiveness in moving County waste to the Okeechobee Landfill. The current and future projects to relocate the intermodal facility first closer to and ultimately at the Okeechobee Landfill will only serve to increase the efficiency and reliability of the operation while providing for reduced truck traffic and reduced greenhouse gas emissions.

C. Operate a Transfer Site at the South Dade Landfill
- The County and WM have demonstrated the effectiveness of transferring waste from the West County Transfer Station to the Okeechobee Landfill via the intermodal rail facility. Including a new transfer station at the South Dade Landfill would simply be a matter of adding equipment and expanding the current operation. This could be accomplished utilizing WM owned intermodal containers.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill.
- WM currently operates 3 transfer stations in the County and can effectively site an additional transfer station in the vicinity of the South Dade Landfill agreed to by the County if needed. WM would transfer the material to its Dade Intermodal Facility for rail transport to the Okeechobee Landfill as is currently being done with County waste volume.

E. Organics Processing
- WM has extensive experience with processing food waste via composting and has previously operated a composting facility at the Okeechobee Landfill site. Composting at the site was suspended several years ago when food waste customers decided to cease their composting efforts. This facility can be restarted should the County implement food waste collection.

F. Composting
- WM has extensive experience with composting clean green waste (yard and landscaping waste) into a suitable product that can be reused as a soil amendment or fertilizer. WM is prepared to work with the County to identify a suitable site and make an investment in siting and permitting that site to compost clean green waste generated and delivered on behalf of the County.

G. Single Stream Recycling Capability
- WM's state of the art South Florida Recycling Facility will be fully operational in early 2026 and will have increased capacity from the existing plant capable of processing additional material than is being handled with the County's current recycling program.

Quantity

A. Current and Future Capacity
- Current Agreement – Up to 2,000,000 tons per year at Okeechobee and 700,000 tons per year at Medley Landfill.
- Additional Capability – 1,000,000+ tons per year as needed.

B. Rail Extension to Landfill
- N/A

C. Operate a Transfer Site at the South Dade Landfill
- 1,000,000 tons per year.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill

- 1,000,000 tons per year.

E. Organics Processing
- 50-100,000 tons per year.

F. Composting
- 100-200,000 tons per year depending on needs and commitment from County.
- Single Stream Recycling Capability.
- 275,000 tons per year.

Technologies

A. Current and Future Capacity
- Continue to utilize the WM/FEC Intermodal Facility to move waste to the Okeechobee Landfill.
- LNG locomotives will be utilized to deliver waste to Okeechobee Landfill.
- Both Okeechobee and Medley landfills will have Renewable Natural Gas facilities to recover and reuse methane.

B. Rail Extension to Landfill
- This extension will further reduce truck traffic on Florida roads and minimize environmental impacts from diesel fueled trucks.

C. Operate a Transfer Site at the South Dade Landfill
- Utilize a County owned and operated transfer station at the South Dade Landfill to extend the life of the South Dade Landfill and move waste to the WM/FEC Intermodal Facility and ultimately the Okeechobee Landfill.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- Utilize a WM owned and operated transfer station to be sited in the vicinity of the South Dade Landfill to extend the life of the South Dade Landfill and move waste to the WM/FEC Intermodal Facility and ultimately the Okeechobee Landfill.

E. Organics Processing
- Compost clean segregated food waste into a soil amendment / fertilizer product utilizing a Covered Aerated Static Pile (CASP) system already permitted at the Okeechobee Landfill site. Material will be ground and placed into the CASP system where temperature and oxygen levels will be monitored and controlled to promote breakdown and compost generation after which material is screened and processed for sale. This process is widely used and proven effective for managing segregated food waste.

F. Composting
- Compost clean segregated yard and landscaping waste into a soil amendment / fertilizer utilizing a windrow technology. Material will be ground and placed into windrows for the composting process where temperature, moisture content, and oxygen content will be monitored and controlled throughout the process to promote breakdown and compost generation via windrow turning after which the material will be screened and processed for sale. WM anticipates this processing would occur at a site to be located within the County to minimize transportation costs. This process is widely used and proven effective for managing segregated clean green waste.

A. Single Stream Recycling Capability
- WM's new South Florida Recycling Facility will process the County's single stream recycling material utilizing state of the art technology including magnetic and eddy current separation for ferrous and non-ferrous metals, optical scanners, air pulse separation equipment and AI

technology to separate recyclables from contaminants. This technology has proven safer and more effective in recovering material from the waste stream.

Benefits

A. Current and Future Capacity

- The agreement in place provides the County with 2,700,000 tons per year of disposal capacity.
- The agreement provides the County with the means to meet concurrency requirements.
- Minimal capital expenditures required by the County.
- The average cost per ton to the County is less than the rate being charged to contracted customers in the County system.
- Energy production from the County waste disposed of at the Okeechobee and Medley landfills through the Renewable Natural Gas RNG facilities currently under construction.

B. Rail Extension to Landfill

- Increased efficiency and reliability, decreased truck traffic within the state of Florida, decreased greenhouse gas emissions.

C. Operate a Transfer Site at the South Dade Landfill

- A proven solution to extend the life of the South Dade Landfill and provide for a permanent disposal solution for South Dade volume when it ultimately closes.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill

- A proven solution to extend the life of the South Dade Landfill and provide for a permanent disposal solution for South Dade volume when it ultimately closes with no large capital outlay from the County for the construction of a transfer station.

E. Organics Processing

- Increased recycling rates by adding food waste to the material eligible for recycling and increased diversion from the disposal needs of the County.

F. Composting

- Increased recycling rates from adding green waste to the material eligible for recycling and increased diversion from the disposal needs of the County.

G. Single Stream Recycling Capability

- Increased recycling processing capability should the County require it along with increased ability to handle film plastic recycling.

Challenges

A. Current and Future Capacity

- The implementation of the rail haul solution has provided WM and the County with the opportunity to work through and address many of the challenges associated with the intermodal movement of waste outside of the County.
- 3-4 months lead time to acquire needed additional intermodal equipment as the needs of the County increase.

B. Rail Extension to Landfill

- Lead time for permitting and construction.

C. Operate a Transfer Site at the South Dade Landfill

- Lead time for permitting and construction.
- County capital required for construction.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill

- Lead time for site acquisition, permitting and construction.

E. Organics Processing
- County establishes a clean, segregated food waste program within the County.

F. Composting
- County establishes a clean, segregated green waste program within the County.
- Acquisition and permitting of an appropriate site within the County.

G. Single Stream Recycling Capability
- None. The County's recyclables are currently processed at WM Reuter Recycling. The replacement facility is currently under construction with an opening date in early 2026.

C. Financial Approach

Costs

A. Current and Future Capacity
- Per existing contract with minimal County capital expense.
- The current cost to dispose at Medley Landfill is $45.41 per ton and the rate for transportation and disposal to Okeechobee Landfill is $71.47 per ton.
- Pricing is adjusted annual per the agreement. Total 30-year costs are dependent upon the amount of capacity the County ultimately utilizes.

B. Rail Extension to Landfill
- N/A - No impact to County.

C. Operate a Transfer Site at the South Dade Landfill
- County capital expense to construct a transfer station,
- County to cover operational costs.
- 30-year costs contingent upon disposal volume.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- No County capital expense.
- WM and County to determine a transfer and transportation expense on a per ton basis and use the pre-existing disposal contact with transportation component from the WM/FEC Intermodal Facility.
- 30-year costs contingent upon disposal volume.

E. Organics Processing
- No County capital expense for construction and processing of the proposed organics processing facility.
- Should the County choose to pursue this service, WM and County to negotiate a per ton processing and transportation fee.

F. Composting
- WM to assume capital cost for site acquisition, permitting, and construction.
- Should the County choose to pursue this service, WM and County to negotiate a per ton processing and transportation fee.

G. Single Stream Recycling Capability
- WM has already assumed all capital cost for site preparation, permitting and construction of a new single stream processing facility.
- Processing fees are established in the current agreement.

Funding Model

A. Current and Future Capacity

- N/A – ongoing fees at established contract rates.

B. Rail Extension to Landfill
- N/A – WM responsibility, no financial cost to County.

C. Operate a Transfer Site at the South Dade Landfill
- Capital cost for a county transfer station to be borne by County.
- Should WM participate in any operations activities, the County and WM will negotiate an appropriate operating fee as a portion of the annual solid waste budget.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- WM will fund the capital cost for the transfer facility.
- Operating, transportation, and disposal costs will be charged to the County on a per ton basis.

E. Organics Processing
- WM will fund the capital cost for the facility.
- Operating, transportation, and processing costs will be charged to the County on a per ton basis.

F. Composting
- WM will fund the capital cost for the facility.
- Operating, transportation, and processing costs will be charged to the County on a per ton basis.

G. Single Stream Recycling Capability
- WM funding for capital cost.
- County is charged a processing fee on a per ton basis as per the current agreement.

Revenue
- Describe the potential revenue streams from the respondent's solution (e.g., energy production, material recovery, tax credits, sale of products, etc.).

A. Current and Future Capacity
- N/A

B. Rail Extension to Landfill
- N/A

C. Operate a Transfer Site at the South Dade Landfill
- N/A

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- N/A

E. Organics Processing
- N/A

F. Composting
- N/A

G. Single Stream Recycling Capability
- Revenue share per current agreement.

D. Implementation Approach
Infrastructure

A. Current and Future Capacity

- All infrastructure is in place for the volume addressed by the WM/County Disposal Agreement.

B. Rail Extension to Landfill
- WM/FEC are working on the intermediate and long-term rail expansions.
- No cost to County for these infrastructure improvements.

C. Operate a Transfer Site at the South Dade Landfill
- County to provide infrastructure.
- WM has the capability to act as the operator of the transfer station if needed.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- WM actively searching for suitable property to develop a transfer station.
- WM will design, build, and operate the transfer station should this option be chosen.

E. Organics Processing
- WM to provide infrastructure and will operate the facility.

F. Composting
- WM to provide infrastructure and will operate the facility.

G. Single Stream Recycling Capability
- WM in process of constructing the new facility and will operate once the facility is completed.

Size

A. Current and Future Capacity
- N/A

B. Rail Extension to Landfill
- N/A

C. Operate a Transfer Site at the South Dade Landfill
- N/A

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- WM is searching for an appropriate property with a minimum of 5 acres.

E. Organics Processing
- N/A

F. Composting
- ~ 50 acres based on County needs.

G. Single Stream Recycling Capability
- N/A

Site Ownership

A. Current and Future Capacity
- WM owns all the transfer stations and landfills in our disposal agreement with the County and has contracted with FEC for intermodal and transportation services.

B. Rail Extension to Landfill
- Any expanded track to be owned by FEC or WM.

C. Operate a Transfer Site at the South Dade Landfill
- N/A

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- 5-acre site to be identified and acquired by WM in the vicinity of the South Dade Landfill or other site mutually determined to be suitable by WM and County.

E. Organics Processing
- Pre-existing site at the Okeechobee Landfill

F. Composting
- Depending on the requirements and commitments of County a ~50-acre site to be identified and acquired by WM in a mutually determined suitable location.

G. Single Stream Recycling Capability
- WM of South Florida Recycling is owned by WM and sited in Pembroke Pines.

Permitting

A. Current and Future Capacity
- All permits are in place.
- Pursuing necessary solid waste and DERM permits to increase capacity at the Medley Landfill.

B. Rail Extension to Landfill
- FEC is currently permitting the new intermodal facility.

C. Operate a Transfer Site at the South Dade Landfill
- County responsibility.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- WM to permit a new facility after property is secured and an agreement with County is in place.

E. Organics Processing
- WM operating permit in place.

F. Composting
- WM to permit a new facility after property is secured and an agreement with County is in place.

G. Single Stream Recycling Capability
- WM operating permit in place.

Timing

A. Current and Future Capacity
- 3-4 months lead time required to order additional intermodal containers as volume needs increase.

B. Rail Extension to Landfill
- Completion scheduled for early 2026 for phase 1.
- Phase 2 to follow.

C. Operate a Transfer Site at the South Dade Landfill
- County timeline.

D. Construct and operate a WM owned Transfer Site in the vicinity of the South Dade Landfill
- 24 to 36 months to acquire, permit, and construct.

E. Organics Processing
- 12 months after an agreement is in place.

F. Composting
- 24 to 36 months to acquire, permit and construct.

G. Single Stream Recycling Capability
- New facility projected to open early Q1 2026.

6. **O&M**

- As the leader in providing environmental services, WM is well versed in the operational and maintenance requirements of all the proposed solutions included in our response. Each solution will have specific requirements and permit conditions that will be adhered to. WM has in house resources to track and manage the O&M requirements for each of these proposed solutions. Final details will be determined once the solutions are chosen, and ultimate permits are received.

7. **Health/Safety/Environmental**

- Each of the proposed solutions are designed to provide a long term environmentally sustainable and safe solution for the County. Our landfills are designed to control dust, odors and minimize any emissions while capturing any methane generated for recycling in our RNG facilities.
- The rail component of our transportation solution is powered by LNG locomotives thus minimizing greenhouse gas emissions while reducing truck miles traveled on Florida roadways.
- Our organics composting and recycling solutions divert waste from landfills and provide a sustainable solution for these discreet solid waste categories.
- WM is fully staffed with in house environmental health and safety professionals to ensure our operations are in full compliance with all permits and regulations and provide a safe work environment for our employees.

E. Other Information/Advice

Procurement Model

- The solutions proposed by WM do not present any significant procurement challenges for the County. Except for the potential for a county transfer station at the South Dade landfill, WM's proposed solutions all assume WM will finance design and build the required infrastructure for the proposed solutions.

Partnerships

- WM's transfer and disposal solutions are in place and providing cost effective disposal for the County. Our agreement with the County provides the flexibility for the County to explore alternative solid waste management solutions while meeting its concurrency requirements.
- WM has a Construction and Demolition material recycling facility in Dade County that processes C&D material to remove any material that can be recycled or reused in the construction industry. We have additional processing capacity at this facility that can be made available to the County.
- Our agreement runs through September 2025 and can be extended for up to twenty additional years through 9/2055.

Additional Insights

- WM appreciates its long-term relationship with the County providing collection, disposal, and recycling services that positively impact the quality of life for the residents of the

County. We stand ready to continue our relationship and expand on the services we provide to meet the needs of the County.

WEF Innovations

Market Research Response

WEF Innovations, LLC

Waste to energy with other benefits

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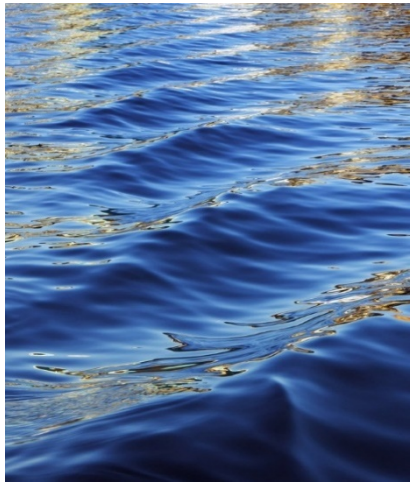
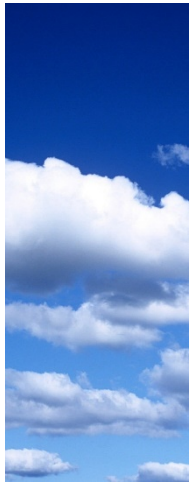
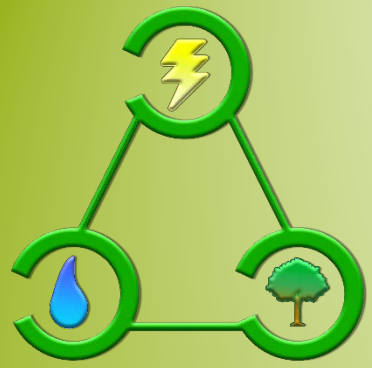





"NOT JUST CLEAN ENERGY BUT ENERGY THAT CLEANS"

Dedicated To Transforming Daily Waste Into:

- Energy
- Food
- Water

While Protecting our environment for the sake of all living creatures

What Does a WEF Innovations Plant Offer?

- Our system simultaneously produces Biodiesel, anaerobic compost, human food, animal feed, and non-potable water with a minimum carbon footprint.
- In some instances, we can alter existing infrastructures to preform many of the process we require with our plants.
- For example, if a customer has anaerobic digesters, our systems can integrate them into our WEF Process
- Our systems are also compatible with municipalities, military instillations, large/multiple resorts, food processing plants, etc...
- WEF Innovations can design the system to include only the desired products the client wants. THE POSSIBILITIES ARE NUMEROUS!!

What Makes WEF Innovations Unique?

- WEF Innovations is the first to develop the production of renewable diesel from sewage sludge
- WEF Innovations is the only entity in the world that has been able to successfully merge seven different technologies into one operating & self-sustained Waste to Energy System whose different segments (benefits) operate in a symbiotic manner
- Once initial start-up has been accomplished, there is NO need for outside electricity to operate the entire and total system
- Excess Electricity produced can be:
  - Sold to electricity providers
  - Used to directly power community
- In addition to the ability to provide all electricity for the operation of ALL project segments WEF system can produce:
  - “Organic” algae animal feed
  - Aquaponic controlled environment for “Organic” fish
  - Hydroponic controlled environment for “Organic” leafy vegetables, herbs & mushrooms
  - Tons of refrigeration capable of being used to support the needs of air conditioning systems & cold storage refrigeration
- Production of Organic Fertilizer
- Extraction of potable water in warm or hot humid climate zones

Current Local & Global Issues We Face

- Abundance of waste
- Poor and ineffective disposal methods
- Food & water insecurity
- Expensive electricity costs

How Will These Issues Effect Us All?

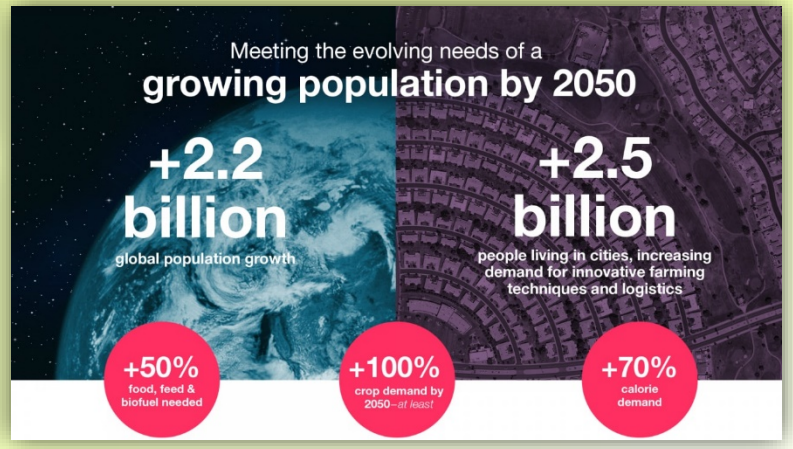
- Largescale spread of disease and dangerous short and long term health issues
- Widespread pollution
  - Air
  - Water
  - Ground
- Increased Greenhouse emissions
- Continued decline in basic quality of life
- Unstable growth of human population
- Economic challenges and decline in most industries

Additional Issues Facing Our Future

- Continued deterioration of environment
- Malnutrition, starvation, sickness and death
- Loss of intellectual potential due to poverty
- Current utility infrastructure and will not be accessible to large portion of population
  - Utilities are not capable of handling continuously increasing population
  - Solar and Wind Power are only able to be used in specific areas and majority of locations are not where majority of population live and reside

WEF Innovations
Comprehensive Solution

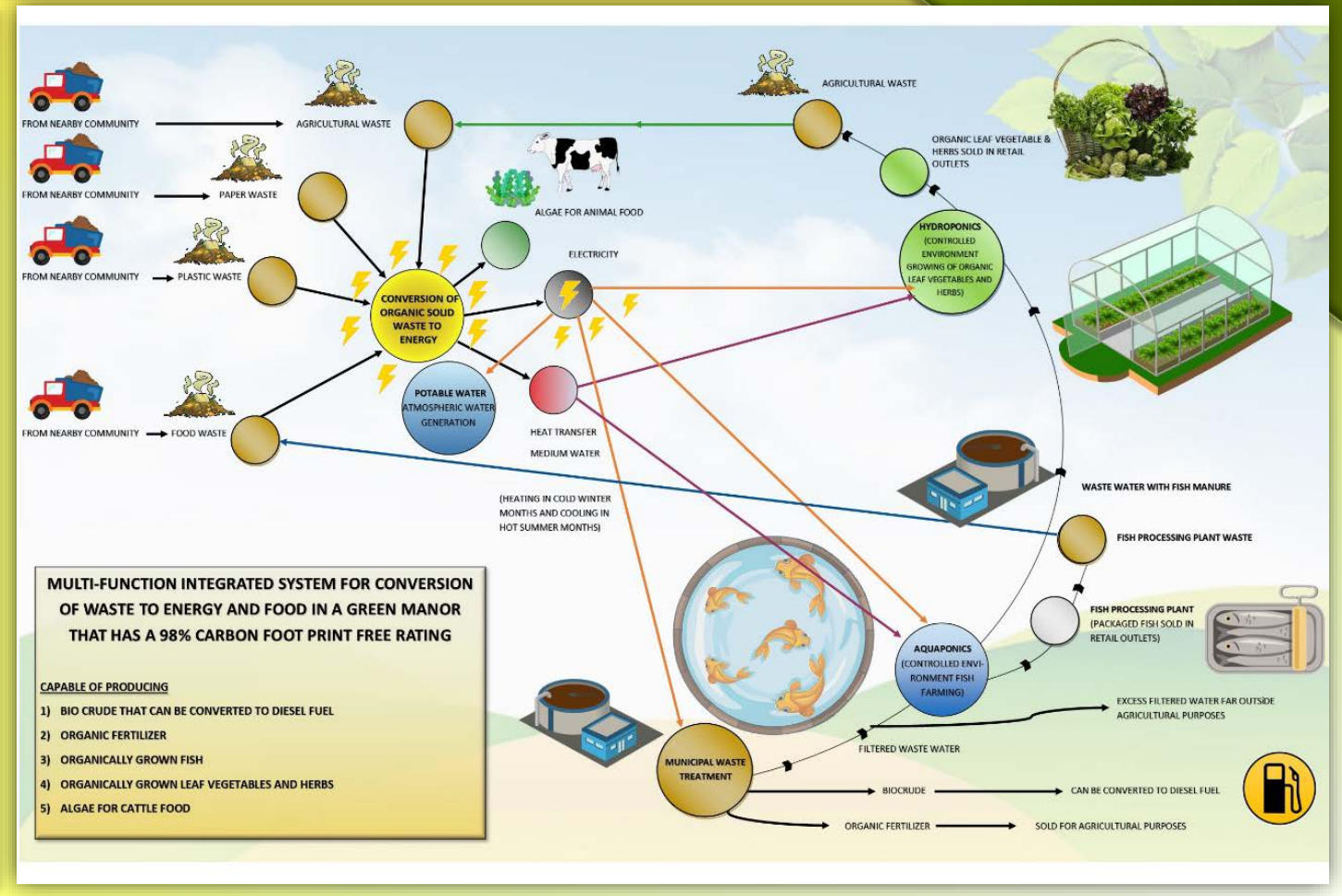
- Removes waste
- Produces electricity
- Provides potable water
- Delivers sustainable food supply
- Creates Jobs
- Provides sustainable growth solutions to an ever-growing population



WEF Innovations
Systems To Provide Solutions

A TRUE "CIRCLE OF LIFE" SYSTEM OF SUSTAINABLITY THAT PROVIDES ELECTRICITY, GAS, FOOD & WATER WHILE REMOVING THE WASTES AND GARBAGE THAT HAVE HAD ZERO VALUE UNTIL NOW

- Waste to Energy
  - Conversion of garbage, recyclables & biowaste into:
    - Usable electricity
    - Biofuel
- Air to Water
  - Conversion of Humidity in air into potable water using electricity from waste to energy to power
- Hydroponics
  - Growing fruits and vegetables
    - Uses water from air water process to hydrate plants
    - Uses waste and fish for fertilizer
- Aquaponics
  - Farming fish to for consumption and sale as well as fertilizer for hydroponic systems
  - Uses water from air to water process



WEF Innovations
Waste To Energy

Current Renewable energy technologies have their limitations as a stand alone process. We have taken a novel approach that integrates several existing technologies for a beneficial SYNERGY

- Our system simultaneously produces biodiesel, anaerobic compost, human food, animal feed, and non-potable water with a minimal carbon footprint
- In some instances we can alter existing infrastructures to perform many of the process we require with our plants
- Our systems are also compatible with:
  - Municipalities
  - Military instillations
  - Large or multiple resorts
  - Food Processing plants
  - Many others
- Systems can be designed to include specific products customer wants making it fit perfect for each client

Boston Municipal Solid Waste Sorting Machine

Anaerobic Digest | BioCycle

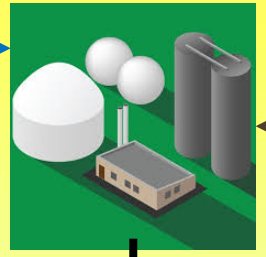
Cultivation systems for algae growth.
(A-B) flat panel photobioreactors...

China 5MW Biomass Gasifier Power Plant

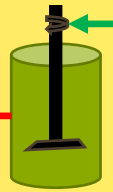
A Municipality Plant Processing Sewage and Solid Waste

MUNICIPAL SOLID WASTE

ANAEROBIC DIGESTOR

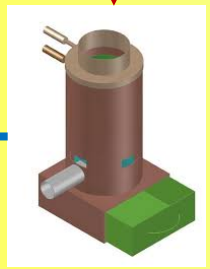


ACID HYDROLYSIS



SUGAR SOLUTION

GASIFIER

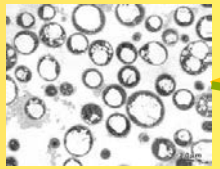


MICROBIAL OIL

+

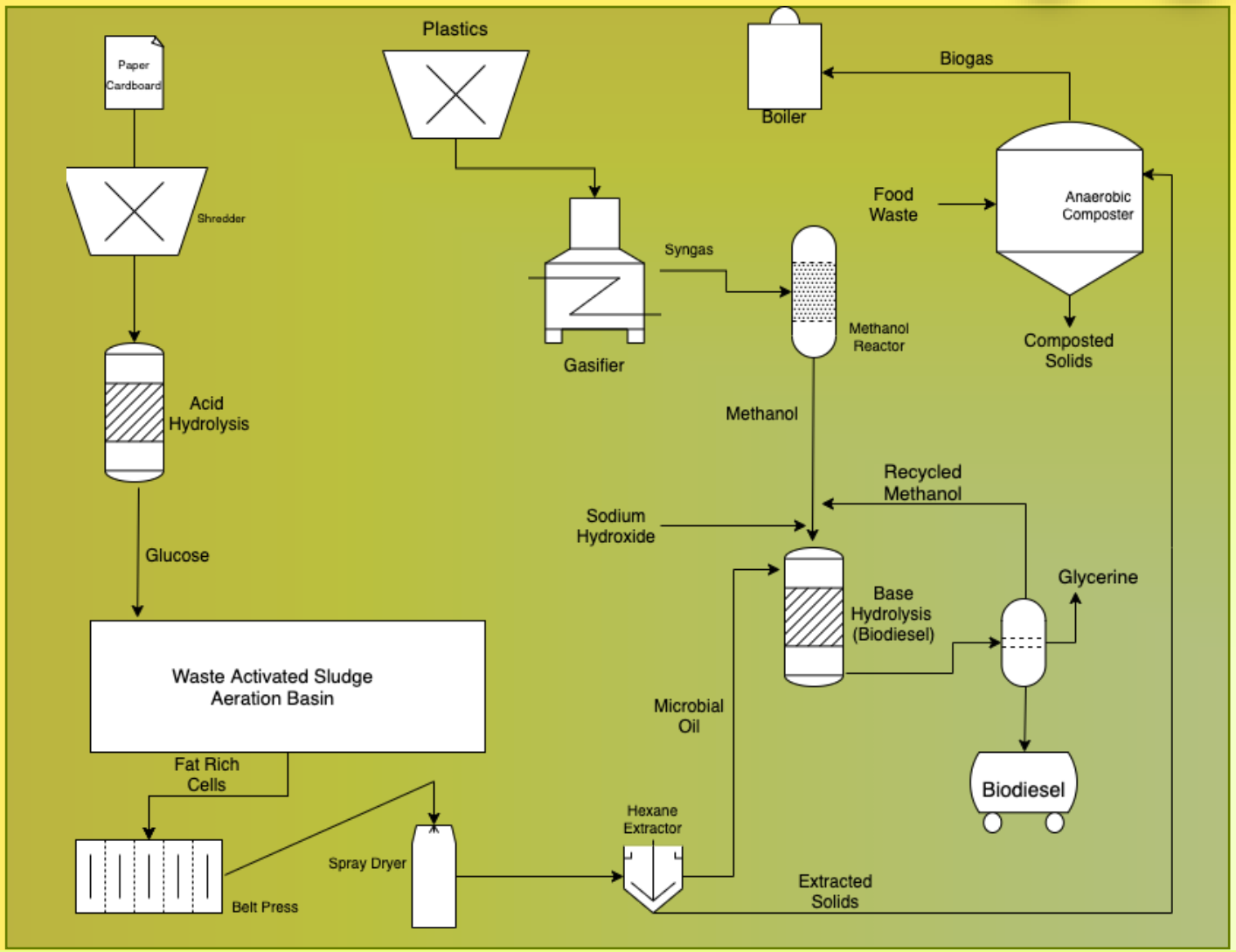
BIODIESEL

MICROBES RICH WITH **FATS**

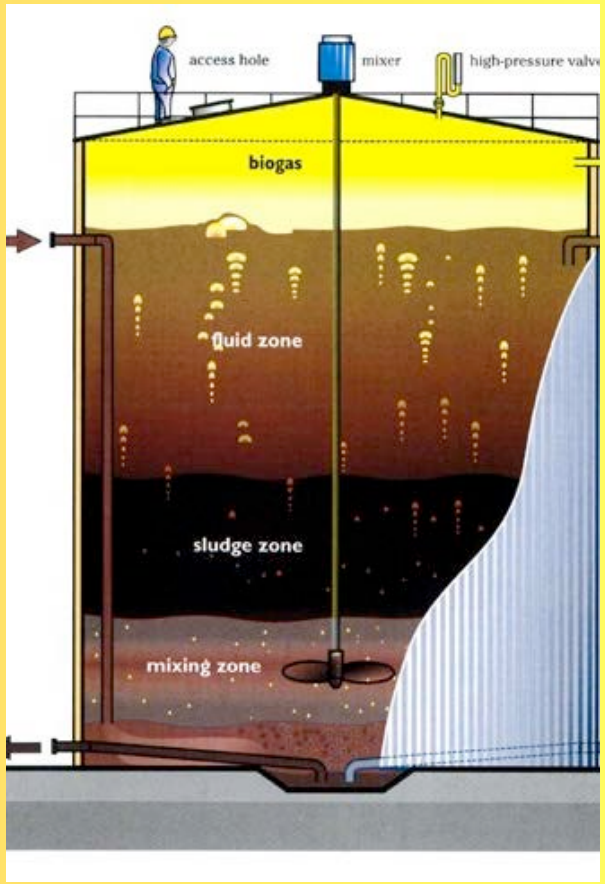


EXTRACTED SOLIDS

Example Biodiesel System

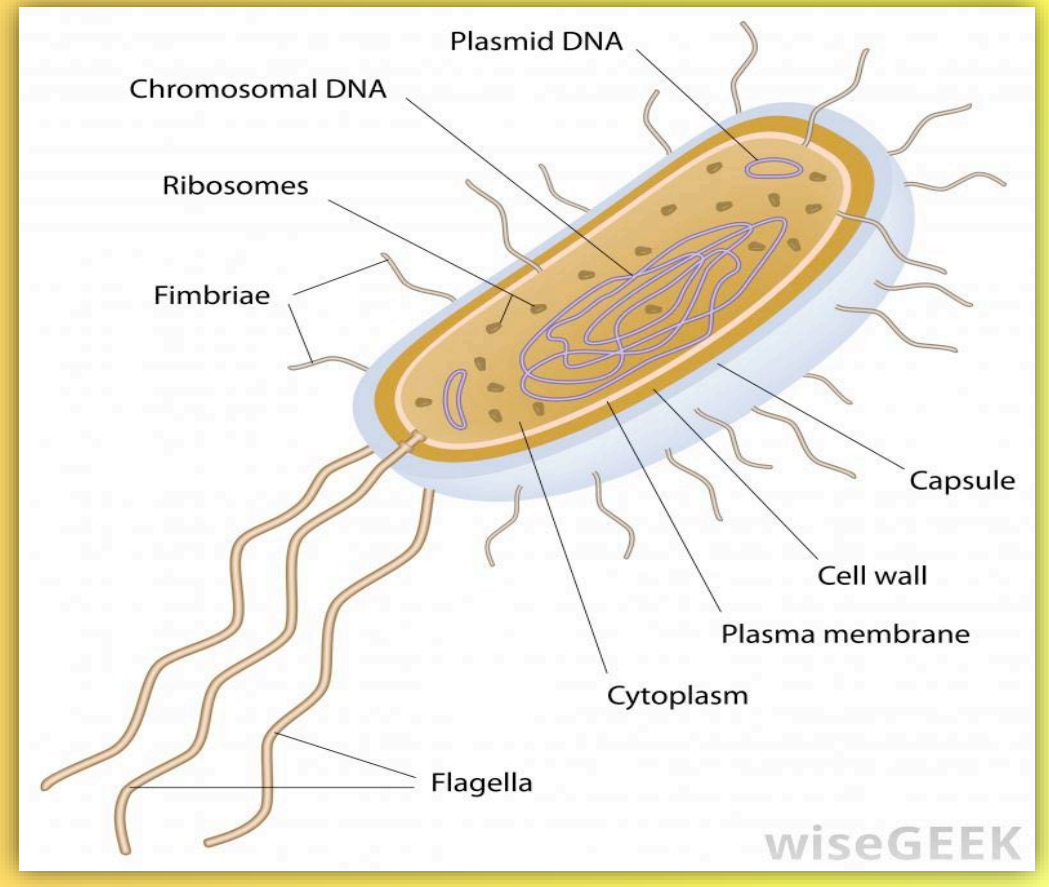


BioGas Production from Human Waste



- Production of Methane and CO2 by anaerobic microorganisms.
- Two kinds of Biogas production pathways
  - Autotrophic
    - CO_2 and H_2
  - Heterotrophic
    - Acetic acid
    - Other organic acids

BioGas



- Microorganisms responsible
  - Archae
    - Methanobacterium sp.
    - Methanococcus sp.
    - Etc.
  - Acetogens
  - Hydrogen producing MO
    - Clostridium

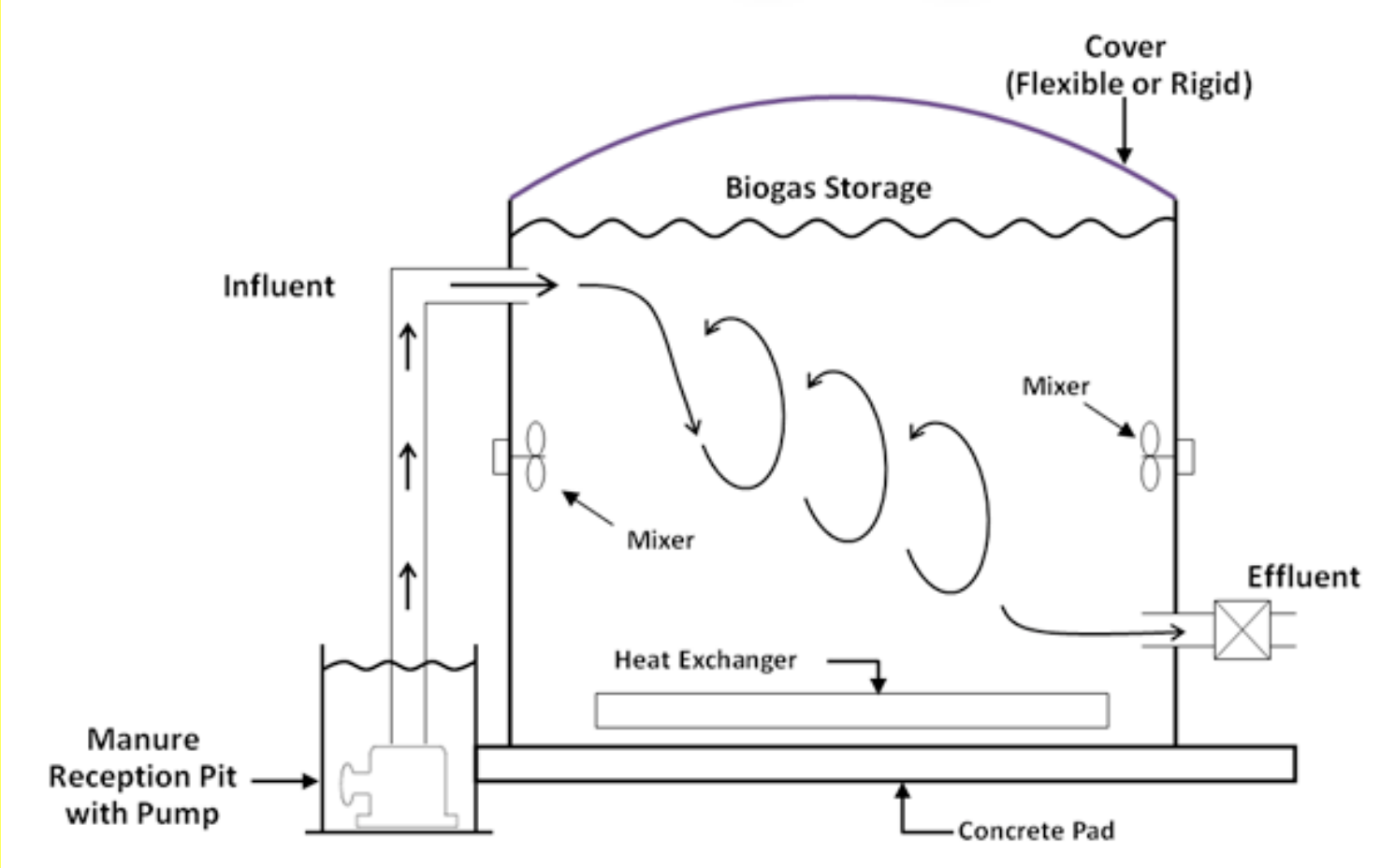
Why Anaerobic?

Terminal electron acceptor	End product	Process name	Organism
O_2	H_2O	Aerobic respiration	*Steptomyces*
NO_3	NO_2, N_2	Denitrification	*Pseudomonas denitrificans*
SO_4	S or H_2S	Sulphate reduction	*Desulfovibrio desulfuricans*
Fumarate	Succinate	Anaerobic respiration	*Escherichia*
CO_2	Methane (CH_4)	Methanogenesis	*Methanococcus*

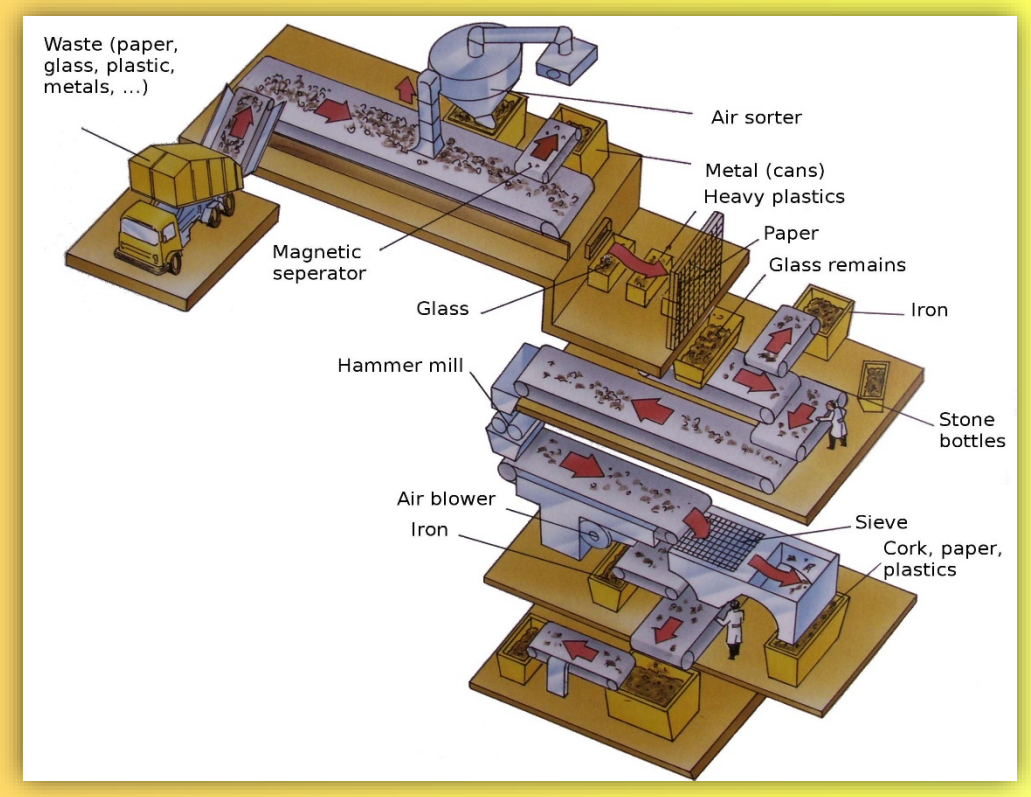
- These reaction are not favored in the presences of oxygen.
- Require very reduced conditions
- If Oxygen is present reaction will not occur

What are the Advantages?

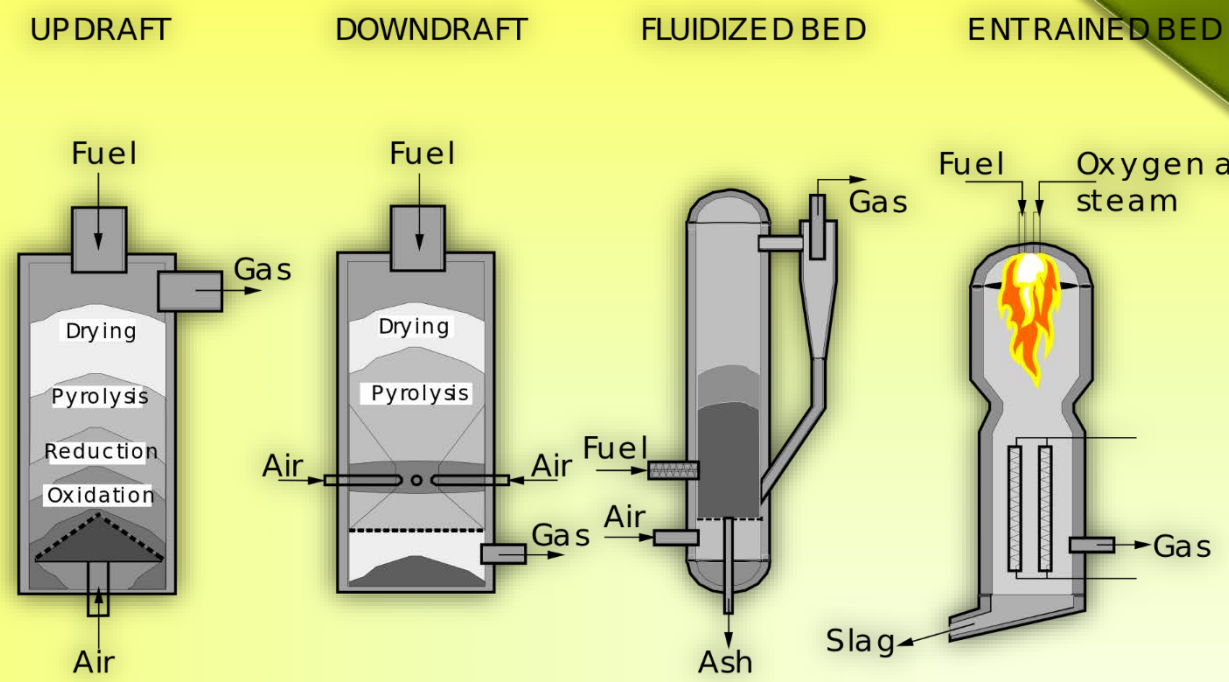
- Relatively low cost to construct.
- Easy to maintain
- Not very affected by inputs



Seperating MSW

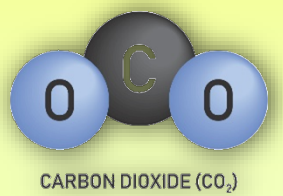


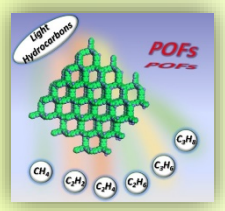
Gasification



Syngas Composition

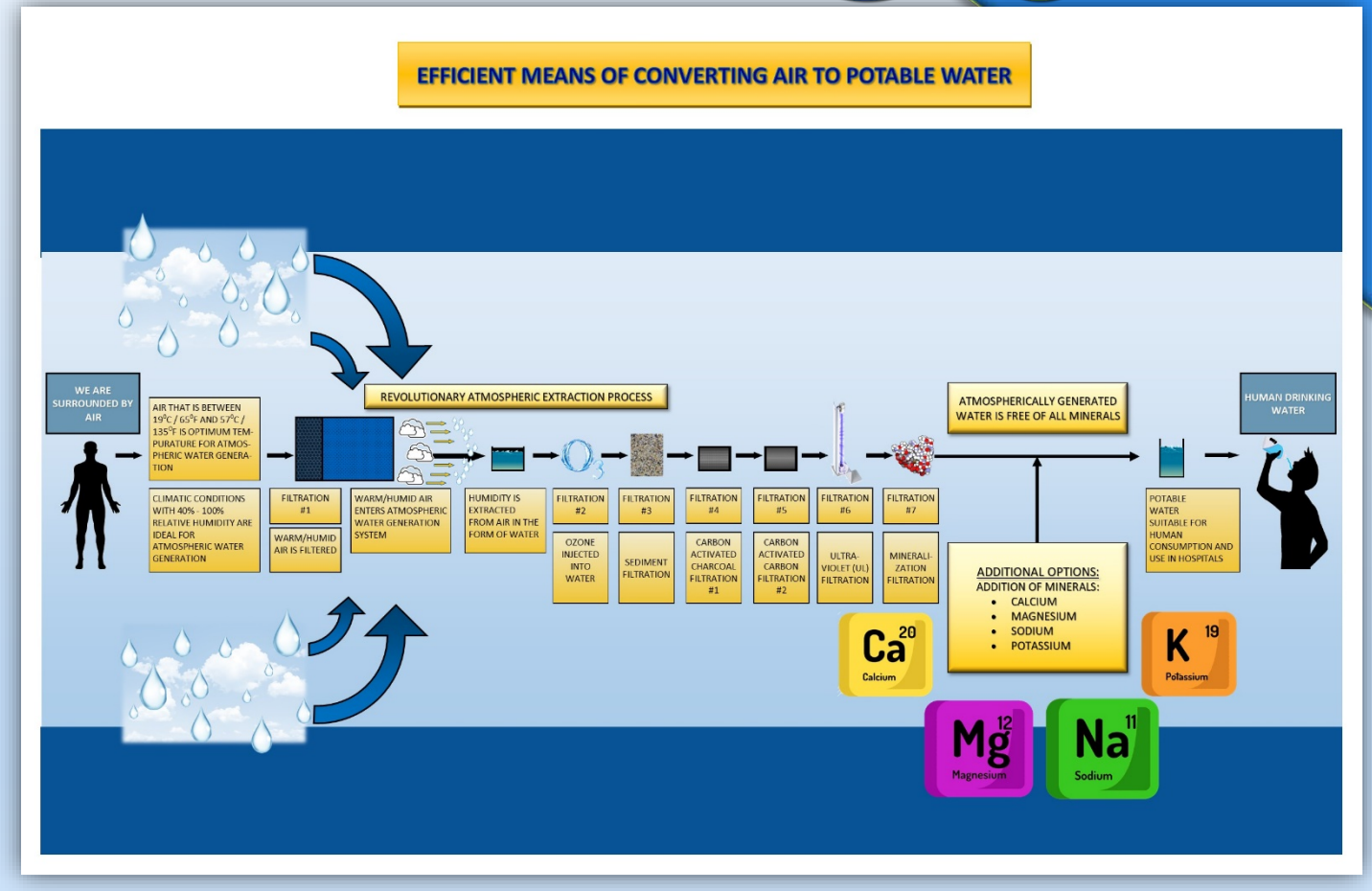
Component	Volume %
Hydrogen	45 - 50
Carbon Monoxide	20 - 25
Carbon Dioxide	15 - 16
Methane	10 - 14
Light Hydrocarbons	2 - 4





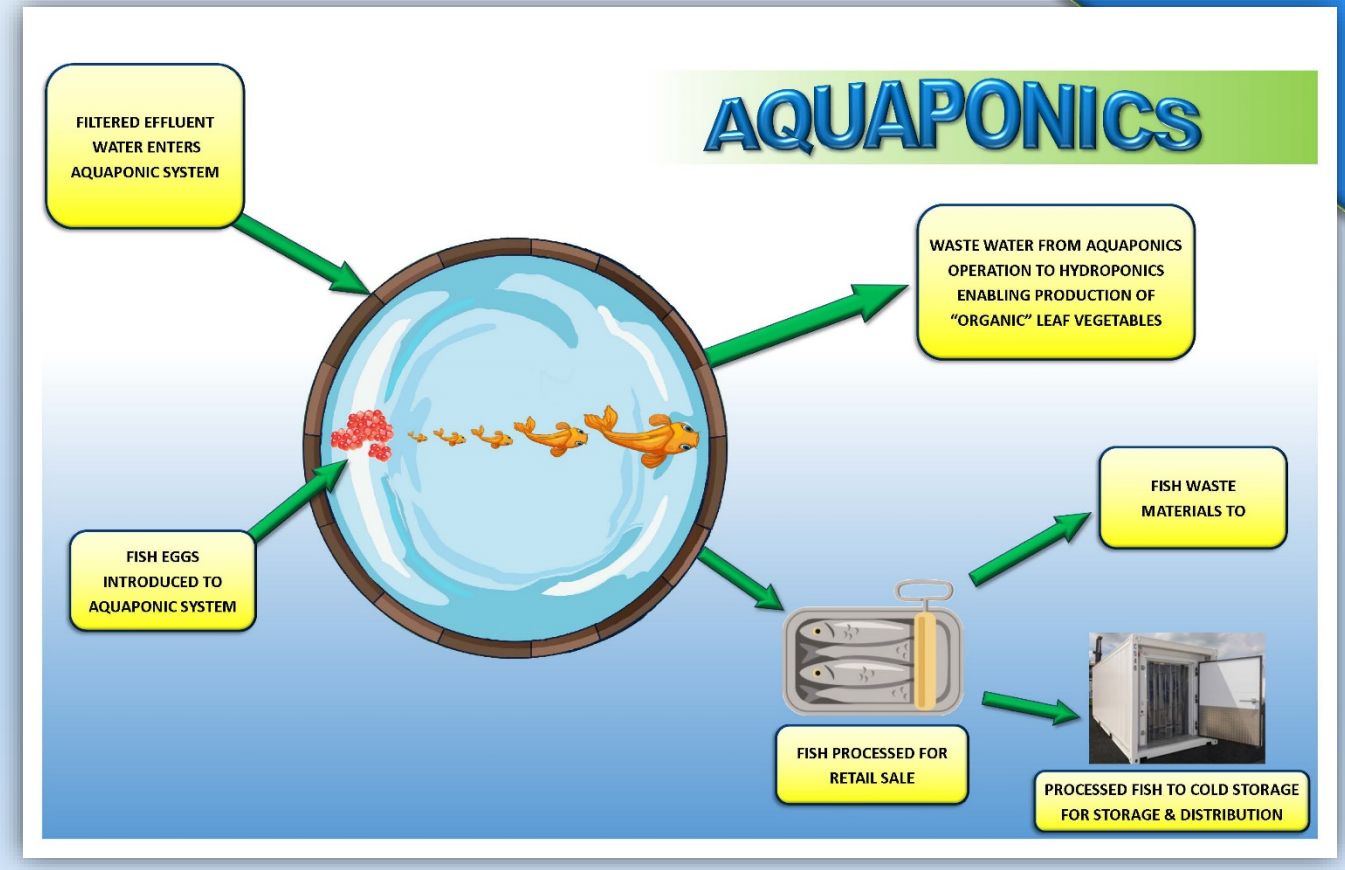
WEF Innovations
Air to Water

- Revolutionary Atmospheric Extraction Process
- Pulls moisture from humidity in surrounding air in the form of water
- Filtration process to purify water
- Atmospherically generated water does not contain any minerals but desired minerals can be added as needed



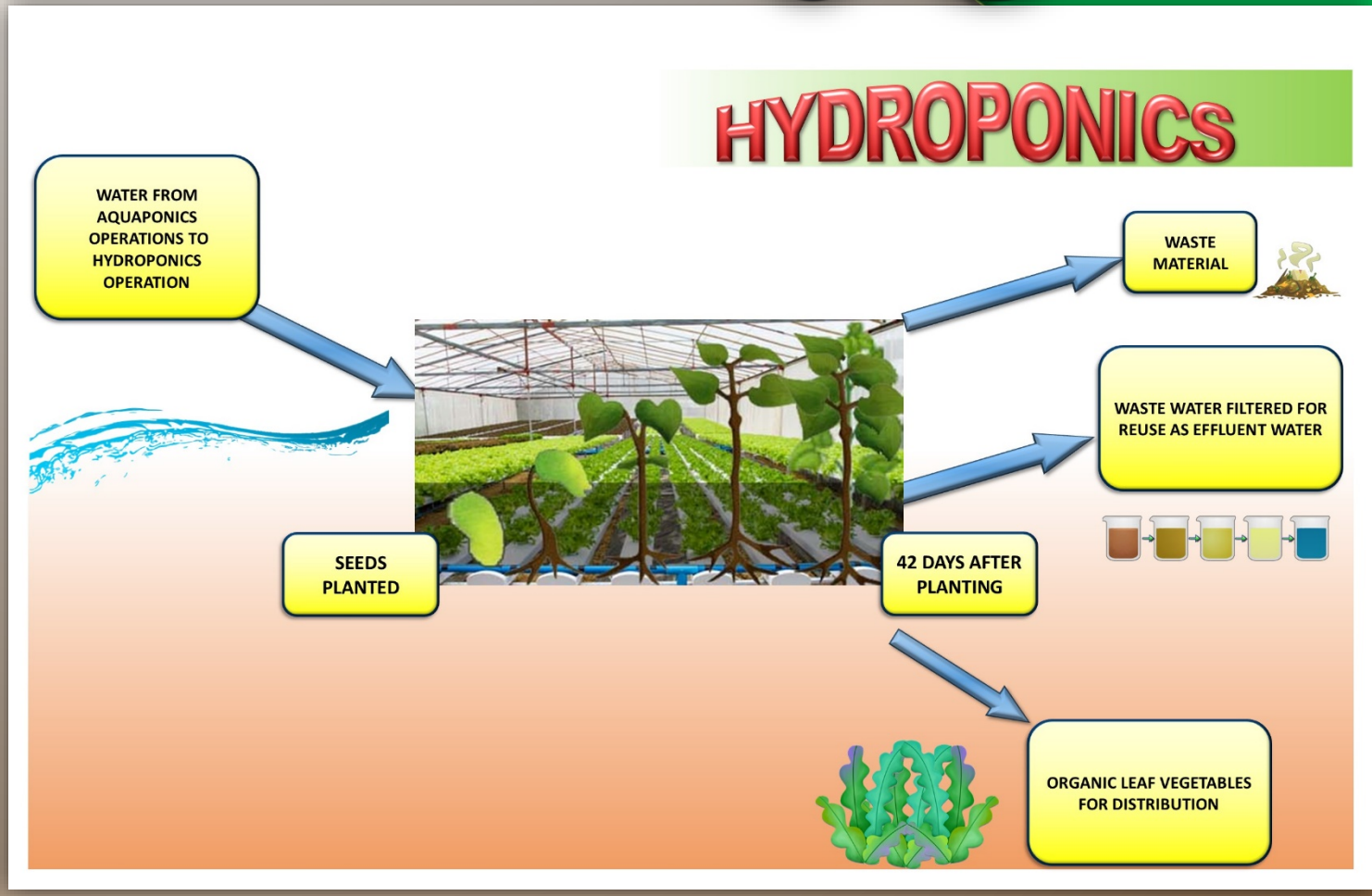
WEF Innovations
Aquaponics

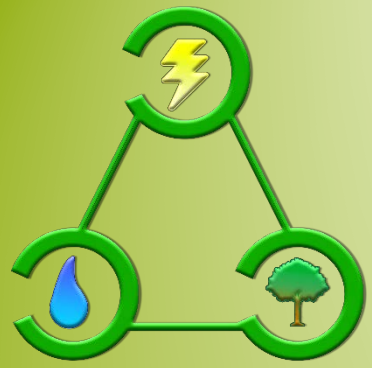
- Filtered effluent water enters aquaponic system
- Fish eggs added to aquaponic tanks
- Full grown fish are processed for retail sail
  - Processed fish sent to cold storage to await distribution
  - Fish waste materials are used for fertilizer for hydroponics and waste to energy processes
- Waste water sent to be use in hydroponics operation



WEF Innovations
Hydroponics

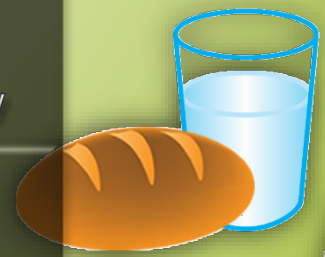
- Water from Aquaponics operations received by Hydroponics
- Seeds for desired organic vegetation are planted
  - Leaf vegetables
  - Fuits
  - Any additional type of desired plants
- 42 days after planting, Organic leafy vegetables are ready for harvest and distribution
- Waste water filtered and reused as effluent water
- Waste materials are sent to waste to energy operations

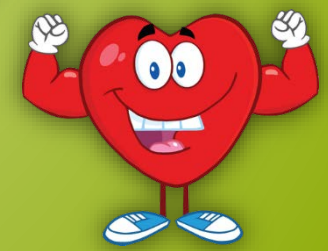




What Does Having A WEF System Mean For You?

- New Jobs
  - Labor Jobs
  - Skilled Labor Jobs
- Electricity and fuel that you can use to power your communities or sell for profit to others
- Food & Water
  - Sold to feed and nourish local communities
  - Waste from food and people eating it will be able to be used to generate more electricity
- Money & Profit based on:
  - How much electricity and fuel you wish to sell
  - How much garbage and waste you use for process
  - Amount of food you farm and water you generate to sell
- Eliminate issues of waste and pollution
  - Once landfills are emptied, value of land will increase and be able to be sold or used for more desirable and valuable options
  - Oceans full of plastics and waste can be cleaned with no more need for dumping waste
- Increased heath and wellness for local populations
  - Less pollution = less health issues and sickness
  - Easier access and ability to eat vegetables, fruits and water mean healthier people





WEF Innovations, LLC

Waste to energy with other benefits

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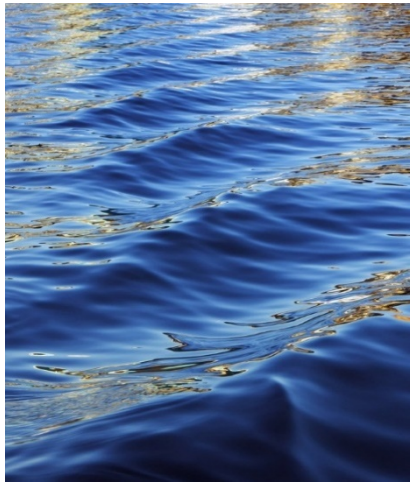
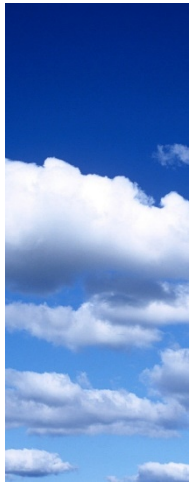
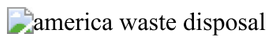
Web: www.wefinnovations.com

Do you Know What Happens When a Landfill is Full?


america waste disposal

America has got a waste problem. An average American produces about 4.40 pounds of garbage per day and approximately **three-quarters of a tonne per year.** If you are thinking “this can’t possibly be right, there is no way I produce THAT MUCH”, get ready for another blow. The U.S.A holds the record of producing the highest amount of garbage in the world, more than Russia, India, and even China.

All that trash has to end up somewhere and as a result, the 2,000 active landfills in the US are reaching their capacity. What will happen when we run out of the room? Well, let’s ask a better question. What can we do to manage our waste better and prevent a catastrophe?

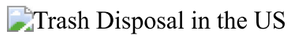
Overfilled landfills are a big problem. Some states decide to simply burn the landfills, as burning reduces the volume of the trash in the landfill significantly. This frees up a lot of space, but the problem of toxic gasses and fumes being released into the atmosphere persists. Not only do these gasses contribute to climate change, but they can also deteriorate human health and end up costing millions in medical expenses.

On the other hand, simply leaving the landfills as they pose other issues. The chemical and biological reactions taking place in landfills can create a lot of issues as these chemicals leach into the ground and contaminate water that municipalities may extract for use in their water systems. The piles of organic garbage also release harmful methane, a greenhouse gas more 86 times more potent than carbon dioxide. So, what can be done to alleviate these issues?

Landfills in the US

How is the produced trash disposed of? According to the **United States Environmental Protection Agency (EPA)**, about 32 percent of the trash is recycled or composted, 12 percent is burned and 50 percent is buried in landfills.

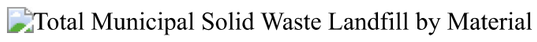
Considering the early practices of simply discarding the trash by throwing it in rivers, the amount of trash that is recycled or composted is very encouraging. More trash is recycled than ever, but additional efforts, especially in plastic recycling and energy recovery need to be made to ensure that the planet we live in is a clean and a safe place.


Trash Disposal in the US

In 2017, that converted in approximately 139.6 million tons of waste being landfilled in the U.S. What materials are most often found in landfill sites? Food scraps were the largest component at about 22 percent, followed by plastics, paper, and paperboard, rubber, leather, and textiles.

The biggest contributor to the volume of landfills was food scraps and other food waste, such as supermarket discards. The best thing to do with this type of waste is to divert it to aerobic digestors, which can turn it into a rich compost for use in fields and gardens. The biggest side-product of this practice is heat, which many American farmers have used for decades to heat their homes and farms for free.

Another great way to reduce the amount of food, paper and cardboard that goes to the landfills is to send it to anaerobic digestors. These digestors produce little heat, but the anaerobic microorganisms that break down organic matter rather create methane. Although this gas is a big contributor to climate change, it can also be purified and used instead of gas in our cars and agricultural machinery. The rest of the organic matter is turned into humus, a rich addition to our soils and gardens.


Total Municipal Solid Waste Landfill by Material

Source: United States Environmental Protection Agency (EPA)

There are large disparities in waste management across each U.S. state. Approximately one-quarter of all U.S. landfills are situated in the country's west. California is covered in landfill sites – there are 13 in the Los Angeles area alone. On the other hand, Indiana, Michigan, Ohio, and Illinois **have the highest rate of filling up landfill sites,** each year adding approximately 2 tonnes of new land waste per capita to their sites.

What happens when a state produces more garbage than what it can accommodate in its landfill sites? One such example is New York where The Big Apple alone generates more than 14 million tonnes of garbage a year and spends around $2.3bn disposing of it, often as far away as in Alabama. New Yorkers aren't the only ones. The **trash trade** is a $4 billion industry, so many states are happy enough to accommodate other states' disposals.

The United States is also home to thousands of inactive landfills, many of which have been repurposed as parks and public spaces.

Landfill Evolution

In the past, most Americans lived in sparsely populated rural farming communities, burning the majority of their solid waste in open dumps. Some of the waste didn't end up being burned but started to accumulate in these open dumps – the world's early landfill sites – with no effort to compact or cover up the waste.

Over the years, landfill sites have improved in design, regulation, and capacity. Modern landfills are constructed with a clay or plastic lining to contain leachate, with trash compacted in order to increase stability, and covered to prevent any attraction of pests.

The Trash in Landfills Per Person, By State

And now the moment of truth – which state produces the highest amount of garbage per person? The answer might surprise you – it's Nevada. Apparently, Nevada is not only home to the City of Sin (Las Vegas), but also to the highest average amount of landfill waste per capita – **a staggering 38.4 tonnes per capita.** On the other side of the spectrum is Idaho, with only a negligible 4.1 tonnes of garbage per person. How do you keep it so clean, Idaho?

Waste in landfills per person by state

The Danger of Landfill Gases

You might be asking – alright, I get it but what's wrong with accumulating waste in landfills? Well, the sad news is that a million-ton waste pile doesn't create only an esthetic problem, but also an environmental one. The bacterial decomposition of organic material, such as food waste results in the emissions of both methane and carbon dioxide.

You are probably familiar with carbon dioxide, as a harmful greenhouse gas that is generated for example by burning coal. But it's methane that the scientists trying to solve America's landfill gas problem are worrying about.

In the first two decades after its release, **methane** is 84 times more potent than **carbon dioxide**. While **methane** doesn't linger as long in the atmosphere as **carbon dioxide**, it is initially far more devastating to the climate because of how effectively it absorbs heat. And there is plenty of reasons to worry –a recently published extensive research led by EDF uncovered 60% more methane emissions between the years of 2012 – 2018, than originally estimated by the government, amounting to an approximately $2 billion issue.

State landfill gas production

U.S. State	Trash in landfills (tonnes per person)	Landfill gas produced by state (MMSCFD*)
Alabama	21.6	55.3
Alaska	15.4	9.4
Arizona	16.5	47
Arkansas	12.8	20.6
California	35	419.6
Colorado	35.2	43.2
Connecticut	7.3	5.4
Delaware	26.6	7.6
Florida	14.7	174.9
Georgia	16	109.5
Hawaii	15.4	4.3
Idaho	4.1	11.2

U.S. State	Trash in landfills (tonnes per person)	Landfill gas produced by state (MMSCFD*)
Illinois	34.2	171.6
Indiana	32.3	123.1
Iowa	20.3	27.1
Kansas	24.9	41.8
Kentucky	28.7	63.3
Louisiana	21.5	41.3
Maine	12.8	10.3
Maryland	13.7	31.4
Massachusetts	10.8	28.8
Michigan	23.1	179.6
Minnesota	12.4	22.2
Mississippi	27.9	31.6
Missouri	22.3	59.3
Montana	14.3	5
Nebraska	19.5	15.6
Nevada	38.4	26.6
New Hampshire	16.2	5.7
New Jersey	25.4	48.8
New Mexico	12.7	11.2
New York	16.5	139
North Carolina	16.8	86.3
North Dakota	5.2	3.8
Ohio	31	168.9
Oklahoma	15.5	36.8
Oregon	18.2	32.8
Pennsylvania	35.4	202.9
Rhode Island	12.7	20.9
South Carolina	19	43.9
South Dakota	17.7	4.9
Tennessee	21	71.1
Texas	17.8	331.8
Utah	14.7	15.2
Vermont	20.2	8.8
Virginia	22.4	123.8
Washington	19.3	58
West Virginia	13.3	16.4
Wisconsin	26	85
Wyoming	13.7	1.6

*Millions of cubic feet of methane gas

Going Green – The Power of Recycling

At this point in the article, you are probably thinking “I am ready for some good news now.” Here it comes. According to the EPA, Americans in 2017 recycled or composted **94.2 million tons of yard waste**, approximately 32.5%. Compared with only about 6% in the 1960s, America deserves a pat on the back for a job well done.

More specifically, sixty-six percent of discarded paper and cardboard was recycled, followed by 27 percent of glass and 8 percent of plastic materials in 2017. Another piece of good news is that the recycling industry has brought in nearly $17.5 billion into the US economy, generating approximately 40,000 jobs in 2017.

But there is still work to be done. To date, only 25 states have passed laws making state-wide electronic waste recycling mandatory. More than 60 million plastic bottles still find their way to landfills and incinerators every day.

Each of us can make small changes to our day-to-day routines and be a part of the solution, rather than the problem. If you haven’t yet, start recycling and make a difference to our planet!

FAQs

How much trash is in landfills?

According to the United States Environmental Protection Agency (EPA), about 55 percent of all garbage in the U.S. is buried in landfills, more than 139 million tons.

What happens to garbage in a landfill?

Landfill sites are not designed to break down the garbage, merely to bury it. Materials put in a landfill breaks down very slowly, thanks to the lack of oxygen and little moisture inside. Because of the lack of oxygen, the bacteria produce methane gas, which is highly flammable and dangerous if allowed to collect underground. It is also a potent greenhouse gas and contributes to global warming.

Will we run out of landfill space?

According to EPA, the current landfill capacity is sufficient at a national level, but there are some regions that are becoming more limited in their disposal options. Seven states are looking at running out of disposal space in the next five years, one state will reach capacity in five to 10 years and three states have 11 to 20 years to go. These states will be at the mercy of other U.S. states, willing to accommodate the produced waste.

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2. Landfill Methane Outreach Program (LMOP)
3. LMOP Landfill and Project Database

Project and Landfill Data by State

LMOP tracks key data for landfill gas (LFG) energy projects and municipal solid waste (MSW) landfills in the United States. The LMOP Landfill and Landfill Gas Energy Database (LMOP Database) contains information about projects in various stages such as planning, under-construction, operational and shutdown, and is also a data repository for more than 2,600 MSW landfills.

Select a state on the map or in the table below to access an Excel file of landfills and projects located in that state. This map also provides a snapshot of the operational project and candidate landfill counts by state.

Map showing operational and candidate landfills by state.
**LMOP does not have information on candidate landfills in this state.
Counts on national map are current as of September 2024.

The Excel files provided here are current as of September 2024 and contain all the landfills and all the project records (of any status) in the LMOP Database for the state you select. The ‘Summary’ tab in each file provides the count of unique landfills and the count of unique operational projects in each state, per the LMOP Database. Excel files can be viewed with the Free Microsoft Excel Viewer.

State-Level Project and Landfill Totals from the LMOP Database

This table shows the counts of operational projects, candidate landfills and all landfills by state, as contained in the LMOP Database. The LMOP Database is not purported to contain every MSW landfill in the country.

State	Operational Projects	Candidate Landfills	All Landfills
Alabama (September 2024) (xlsx) (35.74 KB)	4	15	43
Alaska (September 2024) (xlsx) (25.8 KB)	1	3	8
Arizona (September 2024) (xlsx) (34.67 KB)	1	18	40
Arkansas (September 2024) (xlsx) (31.68 KB)	3	14	29
California (September 2024) (xlsx) (111.26 KB)	53	33	299
Colorado (September 2024) (xlsx) (32.71 KB)	2	15	37

State	Operational Projects	Candidate Landfills	All Landfills
Connecticut (September 2024) (xlsx) (29.54 KB)	2	1	24
Delaware (September 2024) (xlsx) (26.42 KB)	4	**	4
Florida (September 2024) (xlsx) (48.69 KB)	24	12	75
Georgia (September 2024) (xlsx) (45.3 KB)	17	22	77
Hawaii (September 2024) (xlsx) (27.46 KB)	0	4	15
Idaho (September 2024) (xlsx) (31.47 KB)	4	1	31

State	Operational Projects	Candidate Landfills	All Landfills
	18	18	96

Illinois (September 2024) (xlsx) (51.61 KB)

	23	8	89

Indiana (September 2024) (xlsx) (48.87 KB)

	7	16	48

Iowa (September 2024) (xlsx) (35.7 KB)

	7	5	64

Kansas (September 2024) (xlsx) (38.17 KB)

	11	8	39

Kentucky (September 2024) (xlsx) (34.38 KB)

	7	11	37

Louisiana (September 2024) (xlsx) (34.3 KB)

State	Operational Projects	Candidate Landfills	All Landfills
	3	**	19

Maine (September 2024) (xlsx) (28.9 KB)

	7	9	48

Maryland (September 2024) (xlsx) (36.06 KB)

	8	2	50

Massachusetts (September 2024) (xlsx) (37.97 KB)

	41	14	60

Michigan (September 2024) (xlsx) (49.62 KB)

	5	6	35

Minnesota (September 2024) (xlsx) (34 KB)

	6	10	27

Mississippi (September 2024) (xlsx) (31.1 KB)

State	Operational Projects	Candidate Landfills	All Landfills
	14	6	106

Missouri (September 2024) (xlsx) (47.44 KB)

	2	3	30

Montana (September 2024) (xlsx) (30.83 KB)

	7	6	32

Nebraska (September 2024) (xlsx) (32.43 KB)

	2	4	26

Nevada (September 2024) (xlsx) (29.83 KB)

	5	**	47

New Hampshire (September 2024) (xlsx) (35.36 KB)

	10	2	28

New Jersey (September 2024) (xlsx) (36.47 KB)

State	Operational Projects	Candidate Landfills	All Landfills
	2	9	17

New Mexico (September 2024) (xlsx) (28.6 KB)

	21	3	86

New York (September 2024) (xlsx) (51.99 KB)

	25	10	123

North Carolina (September 2024) (xlsx) (56.75 KB)

	2	2	14

North Dakota (September 2024) (xlsx) (27.49 KB)

	13	15	73

Ohio (September 2024) (xlsx) (46.61 KB)

	6	15	37

Oklahoma (September 2024) (xlsx) (33.94 KB)

State	Operational Projects	Candidate Landfills	All Landfills
	7	2	24

Oregon (September 2024) (xlsx) (31.29 KB)

	39	11	74

Pennsylvania (September 2024) (xlsx) (51.52 KB)

	3	5	32

Puerto Rico (September 2024) (xlsx) (31.63 KB)

	3	**	5

Rhode Island (September 2024) (xlsx) (25.84 KB)

	14	5	48

South Carolina (September 2024) (xlsx) (37.28 KB)

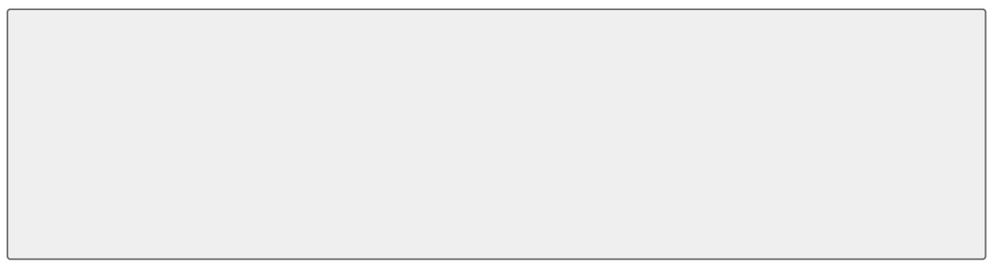
	2	3	9

South Dakota (September 2024) (xlsx) (26.42 KB)

State	Operational Projects	Candidate Landfills	All Landfills
	11	13	128
Tennessee (September 2024) (xlsx) (52.49 KB)			
	29	44	129
Texas (September 2024) (xlsx) (60.99 KB)			
	5	7	55
Utah (September 2024) (xlsx) (35.97 KB)			
	2	**	9
Vermont (September 2024) (xlsx) (27.66 KB)			
	30	12	74
Virginia (September 2024) (xlsx) (47.18 KB)			
	0	1	2
Virgin Islands (September 2024) (xlsx) (24.43 KB)			

State	Operational Projects	Candidate Landfills	All Landfills
	3	6	54
Washington (September 2024) (xlsx) (36.33 KB)			
	3	10	22
West Virginia (September 2024) (xlsx) (29.48 KB)			
	24	2	56
Wisconsin (September 2024) (xlsx) (42.54 KB)			
	0	2	5
Wyoming (September 2024) (xlsx) (25.17 KB)			
Totals	542	444	2,639

Landfill Methane Outreach Program (LMOP)



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- Benefits of LFG Energy Projects
- LMOP Landfill and Project Database
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Andy Jo, *Founder*
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1. Who we are.

Soilmate is a Florida-based composting operation, with primary focus in Miami-Dade County, serving residential, commercial, and event-based members. We are committed to diverting food waste and compostable products from landfills and to making nutrient-rich fertilizer that can be utilized in agriculture and gardens instead.

1.1. Our Mission.

We aim to return food waste to its rightful place: the soil. Food waste was once born in the soil and is destined to return. Soilmate gives the tools and resources everyone needs to help the environment.

Everything we do follows our values:

- Practicality: you can depend on us to make composting easy and accessible.
- Committed: we care about you, your time, and the environment. That's why we are dedicated to finding solutions for your needs.
- Empowering: inspiring people to be kinder to the environment. We want to bring awareness to the problems and help everyone solve them.
- Refreshing: the environment is a serious topic, and we do take it seriously, but we also want to address it in a manageable way - not overwhelm you.

1.2. Our Story.

Soilmate was created in 2022 out of frustration with the lack of an easy, affordable, and practical way to compost residential food waste. We could not find an alternative that allowed for convenience without disrupting our home aesthetic and core beliefs.

We decided to build a solution that quickly encountered a growing demand from South Florida residents and evolved to serve the business community who desperately searched for ways to align to their sustainability values.

We have found a niche that is rapidly becoming the mainstream in people seeking for easier and systemic ways to address climate change – and found composting is one of the best ways to do so. Now, we have leveraged private capital and are committed to growing into a solid infrastructure that can support Miami-Dade County, and South Florida in general, in addressing the solid waste crisis.

1.3. Our Core Team.

Andy Jo, Founder & CEO

Before founding Soilmate, Andy had over 10 years of experience in business management, operations and finance working in a variety of industries. She came up with the idea for Soilmate from personal frustration searching for a composting solution that worked for her. South Florida had very limited access to composting, both public and private, and the available solutions were not suitable for her home - whether due to aesthetics or quality of the service. Andy is responsible for sales and account management, marketing, and finance.

Jessie Bravo, Founder & COO

As a Miami-native, Jessie is deeply committed to protecting South Florida's natural environments and has firsthand experience with the effects of climate change. Her training in biology made her the perfect fit to focus her energy on creating a composting service that recycles food waste right here at home. Jessie is responsible for logistics, personnel, truck routes and management.

Frank Azcuy, Composting Engineer

An engineer by training with a passion for composting science, Frank has over 12 years of experience as an engineer for a diversity of industries dealing with industrial and agricultural machinery. He is the master of all vans, bobcats, dump trucks, carts, sifters, and any other wheeled equipment. Frank is responsible for operations at the composting facility, including piling, turning, and sifting; plus, regular maintenance for all machinery and vehicles.

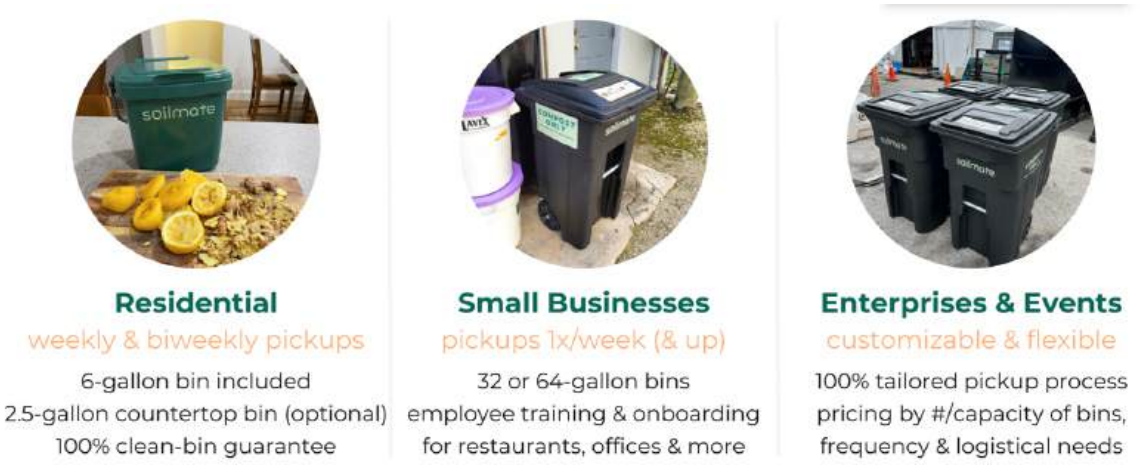
1.4. Minority- and Women-owned Status.

Both our founders, Andy and Jessie, are Hispanic and female. We are proud to carry the Peruvian and Cuban backgrounds to connect with our Miami community, understand their needs, and provide the best composting service we can.

We are certified by the Office of Supplier Diversity (OSD) at the Florida Department of Management Services.

1.5. Our Services & Differentiators.

Soilmate offers three types of services:



We are the most reliable composting service in South Florida, we adapt to our members' needs with trucks on the road in multiple routes per day, 6 days per week. Our key differentiator is our customer service, allowing our members to have flexibility on pickup schedules and resolving any issue that may arise. We work with response times of 1 hour and resolution time of 24 hours.

We aim to make composting an accessible alternative for waste management by collaborating with our members to:

1. Assess their supply chain of compostables (i.e. plates, cutlery, napkins, etc.) by testing products in our facility to confirm degradability.
2. Adapt the frequency and capacity of the composting service to changes in their waste stream.
3. Increase capacity for one-off events like special events.
4. Address contaminants with additional training and signage.
5. Create content and promotion (upon mutual agreement).

Soilmate becomes your sustainable waste management partner, going beyond the composting service and committing to your sustainability practices.

1.6. Our Geographic Coverage.

Soilmate serves residential and commercial members in both Miami-Dade and Broward counties. We are expanding our reach to include Monroe County.

Unfortunately, due to flow control regulations in Palm Beach County, we are not able to serve this area.

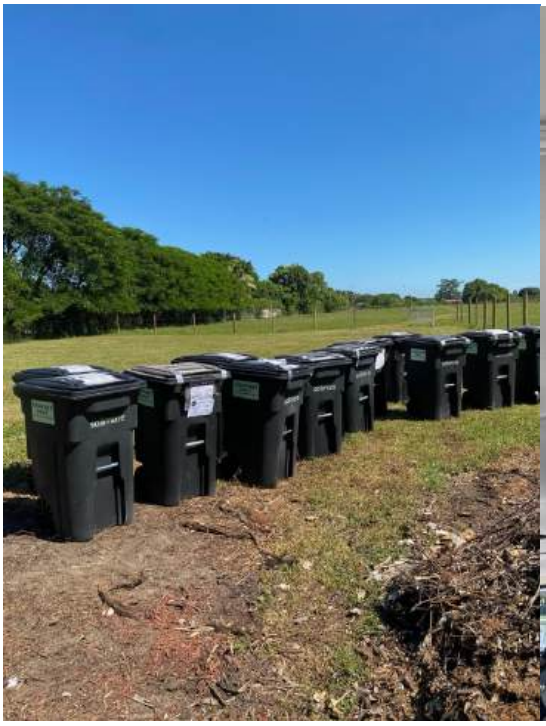
1.7. Experience.

We have experience handling small-to-large scale commercial customers in a diversity of industries – including restaurants, venues, weddings, and office spaces.

Soilmate has become a core sustainability partner for our members in the transition to more sustainable practices. Some of our key customers include:

- **Kaseya Center (Downtown Miami Sports Venue):** food waste and compostable products used in the stadium; we have conducted several rounds of degradability testing.

- **LIV Golf Tournament (Doral Golf Course):** serving recurring events with over 40,000 attendees. The April 2025 installment diverted nearly 9,000lbs from landfills.



- **Top 10 Miami Restaurants:** multiple locations serving ~800 diners per day.

1.8. Community Impact.

Soilmate has collaborated with local and national organizations to support sustainability causes and collectively broaden our reach towards a zero-waste South Florida. Some examples include:

- Education and awareness at farmers and sustainability markets.

- Education programs at schools, ranging from elementary to universities.

- Free composting awareness and education workshops for businesses.

- Free pumpkin composting events.

- General composting awareness and education with local radio and organizations.

1.9. Disaster & Emergency Preparedness Plan.

Our preparedness plan covers pre- and post-disaster stages:

1. Preparation: depending on the level of a potential storm, our response includes securing bins in place, assessing indoor location for containers and removing containers from your location.
2. Recovery: our team will arrive at your location within 24 hours after being deemed safe. Cleaning services will be provided, and full containers will be replaced as necessary.

Contact information is provided prior to the commencement of hurricane season.

2. Waste Management Solution Description.

2.1. Composting Solution.

Estimates by the EPA calculate that "in the U.S., food is the single most common material sent to landfills, comprising 24.1 percent of municipal solid waste. When yard trimmings, wood and paper/paperboard are added to food, these organic materials comprise 51.4 percent of municipal solid waste in landfills."[1]

In Miami-Dade County, almost 3 million tons of waste[2] are landfilled every year; using the EPA estimates, over 1.5 million tons are compostable materials that could have been composted instead of ending up in landfills or, previously, at the incinerator. When we incinerate waste or collect waste in landfills, a toxic sludge called leachate is created as organic waste mixes with trash; plus, greenhouse gases (such as carbon dioxide and methane) are released into the atmosphere and contribute to trapping the sun's heat and warm the planet. Rising global temperature affect many things like extreme weather, human health, ecosystems, and food supply.

Composting, a process of controlled decomposition, not only removes organic material from the waste stream, but also creates nutrient-dense soil that can be used to fertilize plants and grow food. All compost ingredients generally fall under one of two categories, green or brown. Greens (nitrogen-rich) are fresh, moist materials such as food scraps or grass cuttings. Browns (carbon-rich) are dry materials such as mulch, hay or even paper/paperboard products. For organic (once living) material to decompose properly, the

[1] U.S. EPA, Advancing Sustainable Materials Management: 2018 Fact Sheet
[2] Florida DEP Miami-Dade County Report 2020

right proportion of nitrogen-rich and carbon-rich material is combined in the appropriate ratios to create the optimal environment for microorganisms to thrive and break down materials. In the end, the finished product is humus, dark brown organic matter which builds up soil, saves space in the landfill and can teach schoolchildren about the circular food system.

2.2. Effectiveness

Composting is considered a top alternative for waste management solutions across the world, with very clear success stories. For example:

San Francisco, CA[3]

In 2021, San Francisco celebrated 25 years of organics recovery – "hailed as the most successful, comprehensive, and innovative composting program in the country". Back then, the city collected more than 500 tons per day from their "green bin".

The program implemented in San Francisco had many expansions throughout the years, including the State legislature passing Senate Bill 1383, requiring "all jurisdictions to provide organic collection services to residents and businesses by 2022."

Ultimately, the composting program operated by having residents and businesses collecting food scraps and landscape debris in the "green bin" and transported to Recology's Blossom Valley Organics, a state-of-the-art facility near Vernalis, California. There, contaminants like plastics are sorted from the organic material and the filtered material is then shredded, laid out in windrows and carefully managed to balance moisture in the air. After 60 days, the compost material is sold to local farmers to amend their soils.

San Francisco's curbside food scrap collection program has diverted more than 2.5 million tons of compostable material from landfill disposal.

Charleston, SC[4][5]

In 2021, the Charleston Compost program started with three drop-off sites and by October 2024, it had expanded to a total of 20 drop-off sites.

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[3] San Francisco Environment Department. https://www.sfenvironment.org/press/san-francisco-celebrates-major-climate-success-25-years-composting
[4] Charleston County Resilience and Sutainability. https://charlestoncounty.org/ccrs/recycle-composting.php
[5] ABC News. https://abcnews4.com/news/local/charleston-composting-program-expands-due-to-phenomenal-response-wciv-abc-news-4-city-of-charleston-sustainability-environmental-management

The Program Director of Charleston County Environmental Management indicates that about 25% of landfill is food, and it is estimated that the life of the Charleston County Landfill can be extended an additional 12 to 15 years by diverting food waste.

Food scraps collected from the drop-off sites are taken to the compost facility at the Charleston County Landfill and Recovery Center in West Ashley. At the facility, organic material is mixed with ground-up yard waste and is available for purchase at $1 per bucket after 12 weeks.

The Compost Site Manager has indicated the volume of compost created at the facility has been increasing by 30% annually.

2.3. Quantity.

The EPA "estimates that more food reaches landfills than any other single material in our everyday trash, constituting 24 percent of municipal solid waste."[6] These estimates do not include additional volume from flowers, yard waste, grass clippings and compostable products.

Soilmate Composting accepts the following materials:

- Fruits
- Vegetables
- Meat, eggs, seafood, and bones
- Dairy
- Coffee grounds, tea leaves, and paper tea bags
- Nuts and nut shells
- Grains, bread, and pasta
- Soiled paper towels, bags, and napkins
- Flowers and grass clippings
- Compostable containers and trays

Soilmate does not accept the following materials:

- Cans
- Bottles
- Glass
- Condiments packages

[6] EPA. https://www.fda.gov/food/consumers/food-loss-and-waste#:~:text=EPA%20estimates%20that%20more%20food,percent%20of%20municipal%20solid%20waste.

- Plastic wrappers
- Coffee cups
- Produce stickers
- Bread clips
- Gloves
- Plastic of any kind
- Styrofoam
- Bulk oils

Due to county and state regulations, our existing facility is limited to processing 100 cubic yards of organic material at any given time. Our site size allows for processing of 10x our current volume. More information regarding solutions to grow capacity and necessary infrastructure in section 3.2. Size, Site Ownership & Capacity to Scale.

2.4. Technologies.

Composting[7] is the natural process of recycling organic matter, such as leaves and food scraps, into a valuable fertilizer that can enrich soil and plants. Composting accelerates the process of decomposition by "providing an ideal environment for bacteria, fungi, and other decomposing organisms to do their work." The resulting decomposed matter is called compost, "fondly referred to by farmers as "black gold" as it is rich in nutrients and can be used in gardening, horticulture, and agriculture.

The compost methodology we use is known as *Windrow Composting*.

"Windrow composting consists of forming long, narrow rows or "windrows" roughly twice as wide as they are high and as long as space allows. Windrows are the most common method of composting in the United States. Windrows can be turned periodically [...] to allow air flow. Small to large volumes and a wide variety of materials can be composted using this method, which makes it adaptable to many scales."[8]

At our Soilmate facility, we have a strict Composting Protocol to ensure optimal environments for degradation. Upon arrival, all organic material is sifted so obvious contaminants are removed; then, organic material is layered with mulch (known as brown materials) in the shape of windrows.

Windrows are aerated, or turned, weekly or every two weeks depending on the stage of composting. During the first 4-6 weeks, the pile is in *active phase* which requires a lot of

[7] NRDC. https://www.nrdc.org/stories/composting-101#whatis
[8] U.S. Environmental Protection Agency (EPA) Approaches to Composting

oxygen as microorganisms degrade larger waste into smaller and smaller pieces. The pile stabilizes around the 6-8 weeks in *maturity phase*, which requires less and less turning until it reaches *curing phase* when the compost dries out slightly. At this point, the compost is ready to be sifted and be used as fertilizer.

2.5. Benefits.

The benefits[9] of composting include:

- Cuts methane emissions from landfills: typically, when organic matter decomposes, it undergoes aerobic decomposition, meaning that it's broken down by microorganisms that require oxygen. When compostable waste goes to landfill, it gets buried under massive amounts of other trash, cutting off a regular supply of oxygen for the decomposers. The waste then ends up undergoing anaerobic decomposition, being broken down by organisms that can live without free-flowing oxygen. During anaerobic decomposition, biogas is created as a by-product. The biogas is roughly 50 percent methane and 50 percent carbon dioxide, both of which are potent greenhouse gases, with methane being 28 to 36 times more effective than carbon dioxide at trapping heat in the atmosphere over a century. Although most modern landfills have methane capture systems, these do not capture all of the gas; according to the EPA, landfills are the third-largest source of human-generated methane emissions in the United States.
- Improves soil health and lessens erosion: compost contains three primary nutrients needed by garden crops (nitrogen, phosphorus, and potassium). It also includes traces of other essential elements like calcium, magnesium, iron, and zing. Instead of relying on synthetic fertilizers that contain harmful chemicals, composting offers an organic alternative.
- Conserves water: research has shown the water-retaining capacities of soil increase with the addition of organic matter. In fact, each 1 percent increase in soil organic matter helps soil hold 20,000 gallons more water per acre. By using compost to foster healthy soil, farmers do not have to use as much water and can still have higher yields compared with farming with degraded soil.
- Creates awareness around recycling and waste reduction efforts.
- Generates broader learning opportunities related to ethics, personal responsibility, and environmental citizenship.

[9] NRDC. https://www.nrdc.org/stories/composting-101#benefits

2.6. Challenges.

While composting can be an effective way to dispose of organic waste, there are challenges[10] to overcome in establishing a large-scale composting program.

- County-wide composting programs require resources, including specialized equipment, trained personnel, and a dedicated space for collection.
- Large-scale sites are also more likely to attract unwanted pests and wildlife, which can create public health risks and damage property.
- Improperly managed compost piles can emit strong odors, which can create problems for nearby residents and businesses.
- Local and State regulations are obsolete and unclear regarding composting and limit the interpretation of local regulatory entities to allow for regulatory compliance.

3. Implementation Approach

3.1. Infrastructure for Proposed Solution.

We propose to implement composting in Miami Dade County via three short-term initiatives and two medium-term initiatives, not excluding other potential alternatives the County may wish to consider.

Composting Proposed Short-term Initiatives (1-3 years):

1. Community drop-off sites
2. Business composting program and certification
3. School Board composting pilot and implementation

Composting Proposed Medium-term Initiatives (3-5 years):

1. Curbside residential organic waste collection
2. Curbside commercial organic waste collection

Through this response to the market research request, we have focused on the Proposed Short-term Initiatives. Implementation details for Medium-term Initiatives are dependent on County direction regarding funding and legislature required for execution of curbside organic waste collection.

[10] Boise State University. https://www.boisestate.edu/cobe/blog/2023/08/composting-complications-and-concerns/

Community Drop-off Sites

We recommend setting up at least ten (10) community composting drop-off sites, distributed across Miami Dade County, covering key neighborhoods with an estimated maximum 15-mile radius for residents across the county. (Pins are for guidance only, final locations to be defined.)

Each community composting drop-off site will be equipped with four (4) 64-gallon bins, housed under a shed and labeled with signage of the accepted materials. We recommend starting with pickups twice weekly, until community demand is fully assessed. The number of pickups per week can be immediately adjusted should it be required.

We recommend community drop-off stations do not accept meat, bones or dairy to reduce the risk of pests and odors.

Supplies provided by Soilmate for each community composting drop-off station:

- Four (4) 64-gallon bins

- Shed bolted / secured (depending on location)
- Rolls of 6-gallon compostable liners for residents to take home
- Signage of accepted materials

5.3. Out-of-scope Supplies.

- Bins for at-home collection.

Business Composting Program and Certification

We propose creating a similar program to Plastic Free 305, which will be focused on encouraging and incentivizing businesses to implement composting in their operations.

This program would highlight businesses and organizations dedicated to diverting organic waste from landfills through the implementation of composting of food waste and compostable products.

Benefits to businesses would include but not be limited to:

- Inclusion in County directory of businesses certified in the program.
- Promotional material (stickers, online badges, access to program logo) to be used in business-related marketing.

- Testimonials and success stories video and image content posted on Miami Dade County social channels.
- Preference in County procurement processes and events.
- Potential tax credits or benefits.
- Participation at the Earth Day celebration hosted by Miami-Dade Mayor.

Soilmate's commercial service is suitable for businesses of a variety of industries: entertainment, restaurants, schools, flower shops, grocery stores, and many more!

We are happy to onboard businesses who are ready to start composting programs and we also provide the following incentives for businesses who are considering composting as an alternative:

- **Trial period:** we provide two (2) weeks of free composting service so the business has time to adapt and confirm the amount of waste that can be composted.
- **Cost analysis:** (if the business is comfortable) we can assess existing waste management costs to calculate potential savings from redirecting organic waste to composting.
- **Marketing resources:** (if the business is comfortable) we create content of the transition to composting and other sustainability practices, including testimonials, interviews, community events, educational programs, volunteer events, etc.

School Board Composting Pilot and Implementation

We recommend the implementation of the pilot composting program evaluated for RFI-23-031-VF by the Miami-Dade County Public Schools.[11] The Request for Information (RFI) invited "interested parties to submit conceptual ideas and information for the development of a Food Recovery and Compost Pilot Program to be utilized in Elementary, Middle and High Schools. The scope of the program is to reduce the waste stream by composting cafeteria organics."

In the same document, the Miami-Dade Public Schools indicated their "desired effect is to pilot 27 schools (3 per Board member district)."

The Soilmate Composting proposal included the following implementation plan:

We recommend the ramp up of schools to be divided in 3 stages. The first stage will allow us to gather learnings from one Elementary School, one Middle School, and one High

[11] http://procurement.dadeschools.net/bidsol/pdf/bids/RFI-23-031-VF.PDF

School. Thereafter, implementations will become more systematic – allowing the second stage to include three Elementary Schools, three Middle Schools, and three High Schools; and the third stage to include five Elementary Schools, five Middle Schools, and five High Schools. Timing for implementation per school will decrease as we progress and gather learnings.

The completion of the implementation of the Composting Program Pilot will take approximately 6 months, as represented by the following timeline:

	Weeks											
Ramp up Stages	2	4	6	8	10	12	14	16	18	20	22	24
Stage 1: 1ES, 1MS, 1HS												
Stage 2: 3ES, 3MS, 3HS												
Stage 3: 5ES, 5MS, 5HS												

Our full proposal for the Miami-Dade Public Schools Request for Information can be found here:
https://drive.google.com/file/d/1sgk9TsSF6ZRP4ZNn88n86zFYGg4qPgC_/view?usp=sharing

Role of Soilmate Composting in Implementation of Short-term Initiatives

Onboarding & Training.

Our onboarding for businesses includes discovery of our customers' needs to create the composting program best suited for them. We arrange training sessions as required by our members; the training includes presentation, poster boards, props and printed educational materials.

soilmate

COMPOSTING SET UP GUIDE

Let's return food waste to its rightful place: the soil.

your-soilmate.com
team@your-soilmate.com

HOW: Step by Step Set-up for your location

- **Step 1:** Contact us at team@your-soilmate.com or fill our inquiry Form. Our staff will set up a discovery call or do a walk-thru to determine appropriate bins and service.
- **Step 2:** Figure out logistics. We will collaborate with you to define where smaller bins need to be placed, how it will be transported to the toters and where signage is needed to promote composting adoption.
- **Step 3:** Let everybody know! We provide sample text for announcing the arrival of composting and provide training for your staff.
- **Step 4:** Set up! We deliver your bins, appropriate signage and educational material.
- **Step 5:** Maintenance. We monitor the contents of your toters for contamination at every pickup and communicate with you as needed. Plus, you get quarterly reports of the pounds of waste diverted from landfills and your impact on our environment!

WHAT: What is compostable?

Compostable items include food waste and disposables specially made to break-down into a soil-like substance in a short period of time. This compost is then used as a soil amendment and fertilizer to grow new food and create healthy soil!

Container Distribution.

Soilmate provides 64-gallon bins or 3-yard dumpsters for collection of food waste and compostable products, including paper products, certified compostable utensils, and plates, etc. We deliver the waste collection containers at each location upon the agreed date and time. All containers are labeled in both English and Spanish to aid during sorting.

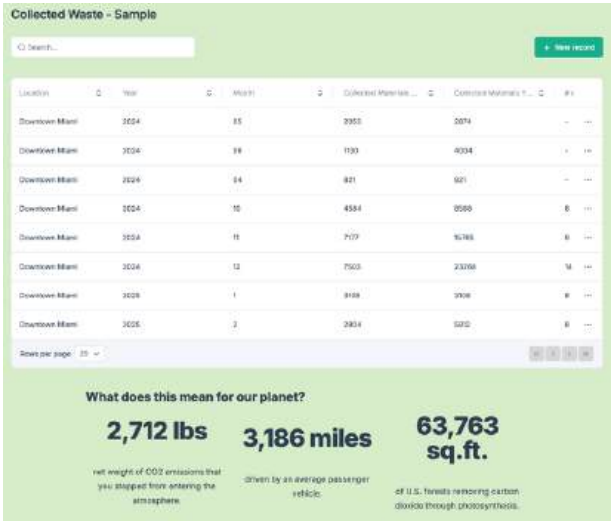
Organic Waste Transport & Processing.

All content collected is transported to our facility in Homestead, FL, where we examine for contaminants, mix, aerate and sift until the product is finished as compost.

Tracking & Reporting Collected Materials.

Every collected bin is weighed upon arrival at our facility, weights are inputted into our internal volume logs after every pick-up and updated to our customer portal at the end of every week.

Customers can access our customer portal from our website to view the volume of organic waste diverted from landfills and the equivalence in net weight of carbon dioxide emissions that were stopped from entering the atmosphere.



We provide quarterly and annual reporting on pounds of waste collected and environmental impact. For customers with several locations, our reporting includes an Excel detailing each metric by location and the following consolidated PDF document:

Finished Compost Distribution & Donation.

Final compost can be distributed to residential and commercial members who opt in during our distribution seasons. Additional compost is donated to local farms and nurseries. Sale of compost is a potential additional revenue stream.

Composting Education Programs.

It is essential that the community is educated about the impact of composting in our local communities and the larger fight against climate change. We recommend several education and engagement strategies that can be adopted:

- Composting 101 webinars and in-person sessions for residents or businesses.
- Inclusion of composting in school curriculum, including potential topics in art, biology, ecology, chemistry, and many more.
- School competitions for posters about composting to post around school and the community. This could be a project undertaken by the Green Team alone or could be part of an art class. It may offer prizes for posters that teach about composting or motivate students to sort their waste correctly.
- County-sponsored video discussing the “why” and “how” of composting. The video may be shared within schools and other community groups.
- Social media campaign. Develop tik-toks, Instagram posts, etc. all about composting.

- Composting display in local libraries including books that discuss composting. This is a great opportunity to include resources on sustainable food systems and climate justice, as well.
- Earth week programs such as having the kids grow seeds in soil / compost mix.
- Making community events zero waste.

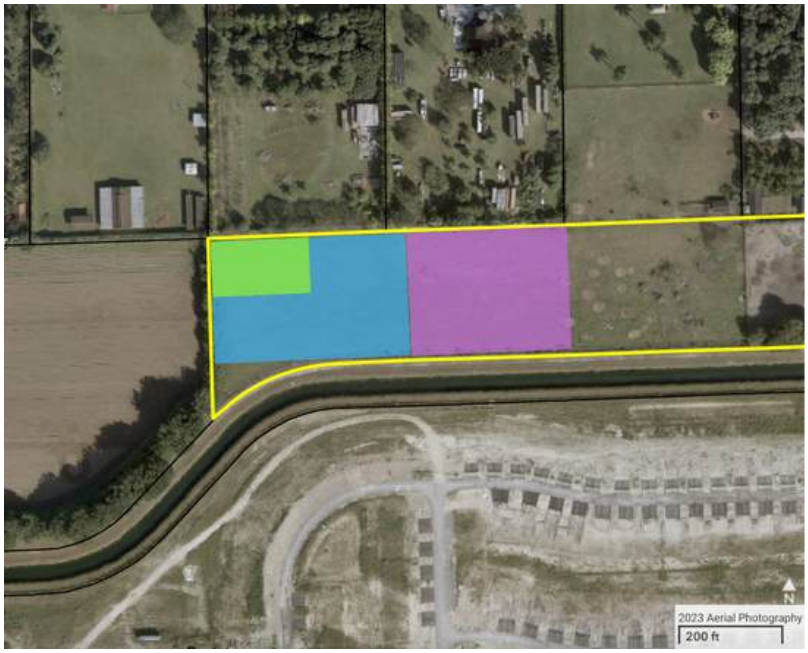
3.2. Size, Site Ownership & Capacity to Scale.

Our Soilmate Composting facility is located in Homestead, FL and is privately owned. The property lies within the unincorporated boundaries of the County and has zoning designation Agricultural Use “AU”.

We are committed to scaling our operations to serve South Florida residents and businesses with a 10-year development plan. Soilmate has secured private financing to continue to invest in equipment, infrastructure, and an additional fleet to serve the growing demand for composting services.

Our location is currently limited to only a portion of the space committed by our farm partner for our composting activities, as shown by the satellite image of our location below:

Existing Soilmate facility Phase 2 Expansion Phase 3 Expansion



The main constraint and delay to this expansion project is the current permitted use for the AU zoning district. The permitted uses for the AU zoning district are set forth in Section

33-279 of the County's Code of Ordinances, but the Code does not directly contemplate composting.

We expected composting would be permitted as part of the category of "use ancillary to and directly supportive of agriculture"; these expectations had originated from the Comprehensive Development Master Plan (CDMP)'s reference stating that uses ancillary to and directly supportive of agriculture are defined as "those uses related to preserving, processing, packaging or selling of agricultural products from Florida… Uses that are directly supportive of agriculture but not ancillary to an on-site agricultural use may occur in this area where it can be demonstrated that the use is primarily addressing a need of the local agricultural industry or that the use significantly furthers agritourism to the agricultural area."

We firmly believe composting operations are ancillary to agriculture and contributes to agricultural raw materials (compost or fertilizer), agricultural infrastructure (healthier soil and soil structure), and agricultural resource management (reduction in water run-off and use of chemical fertilizers).

Nevertheless, after discussions with County staff, the use of this space for composting above the 100 cubic yard threshold would require approval of an *unusual use* or and amendment to the County's Code of Ordinances to make composting permitted *as of right* in the AU zoning district.

3.3. Licenses and Permits.

Our operations are located on Agricultural zoning and limited to the one hundred (100) cubic yards of materials at any given time. The Organics Recycling Facility Regulations (Chapter 62-709-305) of the Florida Administrative Code exempts us from permit requirements.

We are committed to growing responsibly, following all indicated regulations and requirements to operate a safe and environmentally friendly composting facility.

3.4. Timing.

Our installed capacity allows us to immediately collect and process an additional 50 tons of organic waste per month. We include additional timelines for each short-term initiative and facility expansion:

Community Drop-off Sites

- Site locations definition (TBD with Miami-Dade County)

- Sites set-up: includes shed, four 64-gallon bins, sorting visual signage, and compostable liners. (1 month)
- Five residential composting training sessions (2 months)
- Communication and adoption strategies (6 months – 1 year)

Business Composting Program and Certification

- Program characteristics and incentives (TBD with Miami-Dade County)
- Five commercial composting training sessions (2 months)
- Onboarding and composting set up (14 days per business)
- Communication and adoption strategies (6 months – 1 year)

Miami Dade Public Schools Pilot Composting Program

Estimated Timeline for Individual School Implementation (2-3 months): *implementation time per school will decrease as the ramp up advances.*

	Weeks									
Phases	1	2	3	4	5	6	7	8	9	10
Getting Organized & Gathering Support										
Refine Implementation Plan & Preparation										
Infrastructure Set-up & Community Outreach										
Start Composting & Gather Feedback										
Expand & Improve the Program										

The completion of the implementation of the Composting Program Pilot in 27 schools will take approximately 6 months, as represented by the following timeline:

	Weeks											
Ramp up Stages	2	4	6	8	10	12	14	16	18	20	22	24
Stage 1: 1ES, 1MS, 1HS												
Stage 2: 3ES, 3MS, 3HS												
Stage 3: 5ES, 5MS, 5HS												

Soilmate Composting Facility Expansion (5x-10x current capacity)

- Approval of unusual use or amendment to the County's Code of Ordinances (TBD Miami-Dade County)

- Define public-private partnership to estimate demand and establish long-term capacity projections (TBD Miami-Dade County)
- Design oversight, roles and responsibilities in public-private partnership (TBD Miami-Dade County)
- Finalize private capital investment (6 months)
- Design and construction of expanded facility (6 months – 1 year)
- Secure equipment and machinery (6 months – 1 year)
- Secure additional labor and training (6 months – 1 year)

3.5. Health / Safety / Environmental.

We are committed to growing responsibly, following all indicated regulations and requirements to operate a safe and environmentally friendly composting facility. Therefore, we will comply with all directives and requirements as established by the Miami-Dade County, RER, DERM, MDC Environmental Quality Control Board (EQCB), Florida Department of Environmental Protection (DEP), and Florida Department of Agriculture and Consumer Services (FDACS).

4. Financial Approach.

4.1. Costs.

We have detailed the costs associated with Soilmate Composting's proposed short-term initiatives:

Community Drop-off Sites

Each site, equipped with four (4) 64-gallon bins, rolls of 6-gallon compostable liners, and housed under a shed with two (2) pickup per week has an estimated monthly cost of $592.00.

This cost includes collection, transportation and processing of the materials; plus, two setup training sessions and ongoing support.

Business Composting Program and Certification

The program would come to no direct cost to the County regarding composting services, as businesses would cover the cost directly.

Costs associated with this implementation would be administrative and marketing related.

School Board Pilot Composting Program

School composting will vary by capacity required in each school. With pickups 2 times per week, estimated costs would be:

Number of 64-gallon bins	Estimated monthly cost
2	$432.00
4	$592.00
6	$664.00
8	$792.00

Regarding our facility expansion, final cost estimates will be dictated by the scale required and shall be determined in collaboration with Miami-Dade County as part of the public-private partnership.

4.2. Funding Model.

We are proposing a mix of private financing, public-private partnership, federal and state grants, and county funds.

Federal and state grants include EPA and USDA grants available to Miami Dade County.

4.3. Revenue.

We identify two potential revenue streams.

1. Material recovery: from a variety of sources. For example, setting a monthly fee for drop-off site access, or businesses paying monthly for composting services.
2. Sale of products: finished compost is a valuable resource for farmers, landscapers and residents who garden alike.

5.5 APPENDIX E – WASTE CHARACTERIZATION SUMMARY

AtkinsRéalis

MIAMI-DADE COUNTY

Waste Characterization

Miami-Dade County Department of Solid Waste

April 2025

MIAMI-DADE COUNTY WASTE CHARACTERIZATION SUMMARY

Notice

This document and its contents have been prepared and are intended solely as information for the Miami-Dade County Department of Solid Waste Management and use in relation to the Miami-Dade Waste to Energy Project.

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This document has 18 pages including the cover.

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Client

Client	Miami-Dade County Department of Solid Waste
Project	MIAMI-DADE WASTE TO ENERGY PROJECT
Project No.	E22-DSWM-02
Contract Number	18482-DSWM22-DCP

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1. Waste Management Context

The County's solid waste program, operated by the Department of Solid Waste Management (DSWM) handles roughly 40% of the waste generated countywide, including 351,257 households and 1,131 commercial establishments as of 2023[1]. The remaining waste is collected under separate collection contracts as determined by each municipality. The majority of commercial waste is understood to be collected by private hauler. Considering three of the total five cells are already filled and closed at the South Dade Landfill (SDLF) and that the North Dade landfill (NDLF) is projected to exhaust its capacity between 2027 and 2029[2], balancing waste management with development remains a complex task for the County.

Following loss of the County's Waste to Energy (WtE) Facility, referred to as the Resource Recovery Facility (RRF), the situation has been further exacerbated, with an average of some 750,000 tons per year of waste which was previously diverted from landfill, now being sent to County disposal sites[3]. As such, the need for new alternative methods of managing the residual municipal waste quantities is urgent, and a key driving force for new waste infrastructure solutions.

The following section provides an overview of current approaches to waste management within the County.

1.1 Waste Collection

Municipal solid waste collection in Miami-Dade County falls under one of three key categories:

- Garbage - general residual municipal waste predominantly collected from households but also select commercial developments (restaurants, hotels, shopping malls, businesses etc.), collected twice weekly;
- Trash - comprising of both bulky waste (discarded furniture and similar oversized items), and yard waste (i.e. green waste, garden and landscaping trimmings), collected on a service on request basis. Tires, electronics, auto parts, central air units, fiberglass insulation, liquids, household chemicals, rocks, dirt or sand and any single item weighing more than 150 pounds are not accepted as part of the service; and
- Source separated recyclables - mixed recyclables comprising of items such as paper, cardboard packaging, carton, metal cans, plastic and glass bottles, plastic packaging containers etc.

After collection, waste is transferred to one of the three regional transfer stations, where waste from various sources, including County municipal, and private waste/ commercial haulers, is consolidated before further processing or disposal.

Recyclables are processed at a Materials Recovery Facility (MRF) owned and operated by WMI located in Pembroke Pines. Targeted materials are baled and shipped to companies for onward recycling into new products. The Contract was extended in March 2023 for an additional two years. It is understood a new more advanced recycling facility was recently completed in 2025 by WMI to serve south Florida, located on the same site.

In 2023, the DSWM received waste from 16 of the 34 municipalities in the County.

[1] Miami-Dade County (2023), 'Annual Comprehensive Financial Report.'
[2] Arcadis (2023), 'Landfill Capacity Analysis for DSWM Active Landfills as of July 1, 2023.'
[3] Net average proportion of municipal solid waste processed at the RRF, between 2014 and 2022, excluding ash disposal as reported in Miami-Dade County (2023), 'Annual Comprehensive Financial Report.'

1.2 Waste Facilities

The DSWM currently owns and operates three transfer stations, three landfills (one of which includes the former ash disposal site for the RRF), two HC2 Centers, and 13 neighborhood trash and recycling centers (TRCs) for the drop off of domestic trash, tree and yard cuttings, construction and demolition (C&D) waste, automobile tires, and white goods (ovens, washers, dryers, fridges, freezers etc.). Prior to February 2023, the system included the RRF, which processed roughly 43% of the County's garbage. A map of facilities in Miami-Dade County is shown in Figure 1-1.

Transfer Stations

The Northeast, Central and West transfer stations contribute to the efficiency of waste services by optimizing transfer distances. In 2023 some 780,000 tons of waste passed through these facilities[4]. Once waste has been delivered and processed at these sites, it is transported by 85-cubic yard vehicles to one of the County landfills (and previously the RRF) for final deposition. In addition to these sites, there are also ongoing operations at the NDLF and SDLF for the transport of waste to other facilities, such as shredded tires and yard waste.

North Dade Landfill

NDLF is permitted to accept and process Class III waste only. The FDEP define this as yard waste, construction and demolition debris, processed tires, asbestos, carpet, cardboard, paper, glass, plastic, furniture other than appliances, or other materials approved by the Department, that are not expected to produce leachate that poses a threat to public health or the environment. Residents can dispose of waste at the active landfills for a fee. Assuming no additional disposal capacity is constructed, and future waste placement rates and in-place densities are as expected, the NDLF is estimated to reach capacity between 2027 and 2029[5].

South Dade Landfill

SDLF is permitted to accept and process Class I waste only (defined as solid waste which is not hazardous waste by the FDEP). County, municipal and private haulers can bring a variety of waste including garbage, trash and yard trash, tires, construction and demolition debris, and asbestos (with prior approval) to the landfill. Assuming no additional disposal capacity is constructed, and future waste placement rates and in-place densities are as expected, the SDLF is estimated to reach capacity between 2028 and 2029[5].

Contracted Landfill Capacity

The disposal capacity in the County includes available capacity in County landfills and contracted disposal capacity. Contracts are currently held with WMI, allowing disposal at the Medley Landfill, Monarch Hill Landfill, the Okeechobee Landfill, as well as other WMI facilities (to total 1.25 million tons of agreed capacity per year), and Progressive, covering use of the JED Landfill (including 500,000 tons of agreed capacity per year). Across the four facilities there is an annual disposal capacity of 1.75 million tons. Both contracts are agreed until September 30th 2035, and are extendable with two five-year options-to-renew.

It is understood that most of the waste which falls under the contracted disposal capacity is deposited to the Okeechobee Landfill under the current disposal agreement with WMI. With the closure of the RRF, and limited County disposal capacity, the County is dependent on these private contracts.

[4] Miami-Dade County (2023), 'Comprehensive Annual Financial Report.'
[5] Arcadis (2023), 'Landfill Capacity Analysis for DSWM Active Landfills as of July 1, 2023.'

Neighborhood Trash and Recycling Centers

The waste collection service includes access to 13 TRCs located throughout the waste collection service area for DSWM fee-paying customers and prepaid permitted landscaping contractors for disposal of yard waste working in the community. Commercial or business use of TRCs is prohibited. In 2023 the County reported that 689 tons of electronic waste was recycled through a program conducted at eight TRCs (as well as a drop off station at the City of Homestead Solid Waste Operations yard, and the HC2 Centers)[6].

Home Chemical Collection Centers

Miami-Dade has two HC2 Centers, open seven days a week for all Miami-Dade residents for the safe disposal of hazardous household chemicals including cleaning products, old paint, motor oil, automobile batteries etc. The centers also provide a reuse service for new, or almost new home chemicals to help mitigate against the need for disposal. During 2023 residents disposed of 395 tons of chemical hazardous wastes and 248 tons of latex paint at HC2 sites, with a further 41,941 gallons of used oil recycled across both HC2 Centers and TRCs[6].

Resource Recovery Facility

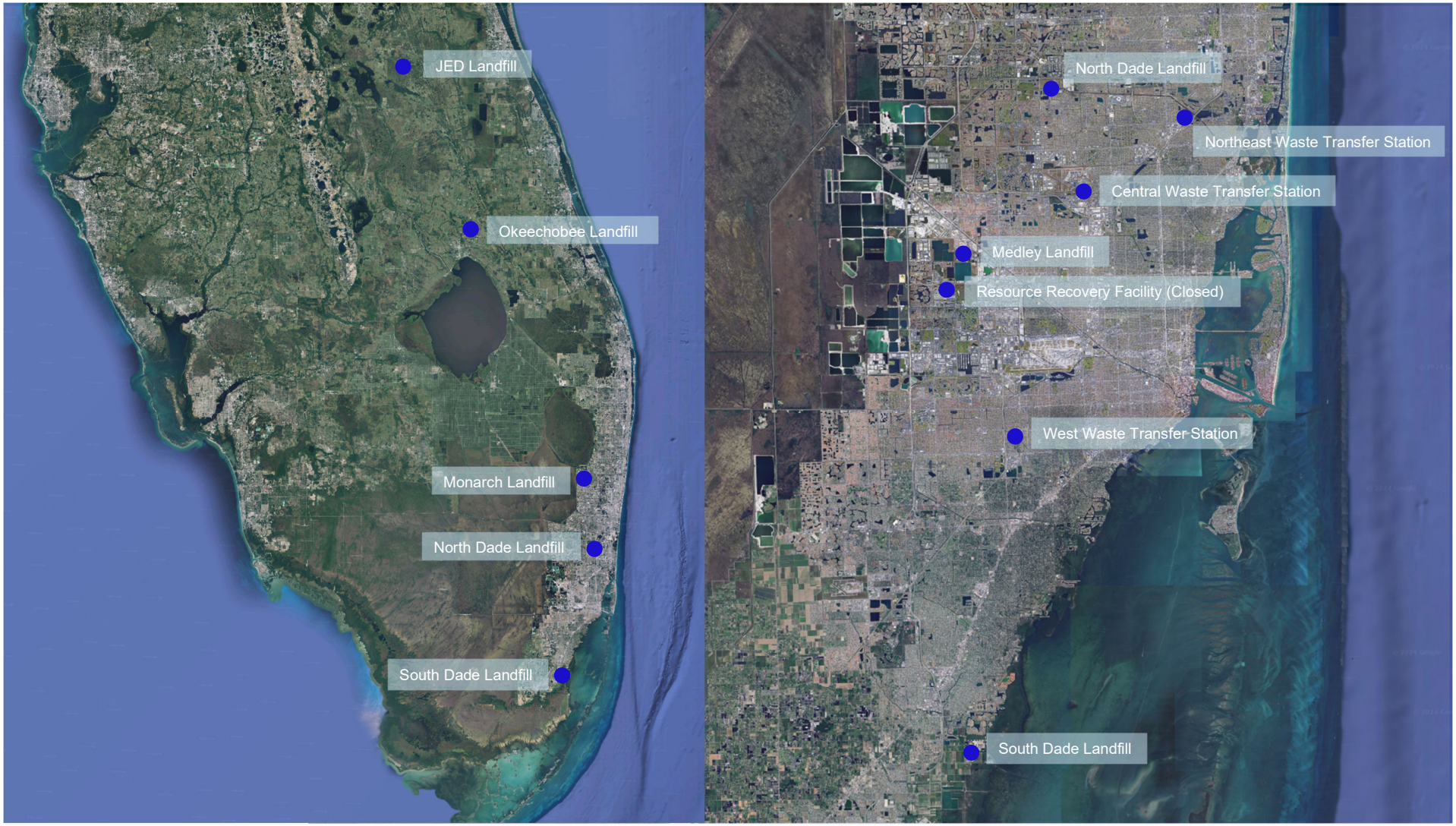
The RRF begun commercial operations in 1985 being originally operated by Montenay Power Corp. until 2010 when the O&M Agreement was transferred to Covanta Energy through a contractual agreement with the County. The facility had a nominal throughout of 1 million tons of waste annually, processing both garbage and trash, with a design output of 77-megawatts, sufficient to power around 35,000 homes.

Upon arrival to the plant garbage and trash were processed in two separated operations. Metals were removed from the garbage, with the remaining material shredded into Refuse Derived Fuel (RDF) for input into the plant. Trash underwent further sorting, prior to shredding, with metals removal, and soils screened through a series of trommels. Following combustion, the ash byproduct was disposed of in a co-located landfill, adjacent to the facility, the Resource Recovery Facility Ash Fill (RRFAF).

In February 2023 a fire resulted in significant damage to the facility and its ultimate closure. Since its' loss solid waste has been diverted to landfill. In 2022, prior to the fire, it was estimated the RRF processed some 43% of the 2.1 million tons of overall solid waste generated in the County. The County is currently seeking alternative options to replace the closed plant, including a new modern mass burn waste-to-energy facility.

[6] Miami-Dade County (2023), 'Annual Comprehensive financial Report.'

Figure 1-1 - Miami-Dade County Waste Management Facilities



2. Solid Waste Quantification

2.1 Historical Waste Tonnages

Waste Tonnage information is provided in the DSWM Annual Comprehensive Financial Report (ACFR)[7]. Total Revenue Tons in 2023 amounted to some 2.2 million tons, with over 1.3 million tons of garbage, 600,000 tons of trash and 200,000 tons of reduced fee cover material[8], with smaller quantities of other items such as tires and special wastes. Of this, approximately 720,000 tons was disposed of to the SDLF, 120,000 tons to the NDLF, and 1 million tons via contract disposal, with 200,000 tons processed at the RRF prior to its closure. A breakdown is provided in Table 2-1 and

Table 2-2. Note, there is a discrepancy between total revenue tons and net disposed of. It is assumed this accounts for material diverted elsewhere i.e. through recycling or other processing.

Garbage, Trash and Clean Yard Trash are likely to represent the principal components which could potentially makeup feedstock for any new facility or facilities. Non-profit tonnage (composition dependent) and tires, could provide viable feedstock, depending on the technology options, though are relatively less significant in terms of reported quantities. A proportion of storm debris, though generated on an inconsistent basis in relation to annual storm events, may also be feasible. The majority of special waste is likely to be more challenging to determine viable processing routes given the nature of its reported contents (i.e. ash, dead animals, asbestos, contaminated soil, oversize tires, sludge and sterile medical waste), though elements of it will be processable via appropriate means.

On the basis of this information, some 2 million tons of waste may be available for a proposed facility or facilities, as of 2023. This may be lower or higher depending on the sources of generated waste considered and the extent of recycling. In 2023 the ACFR identified that some 63,000 tons of material was recycled, excluding facility recycling which ended upon the RRF's closure. A breakdown is shown in Table 2-3.

It is important to note that not all waste will be viable as a feedstock for a given process. Due to the nature of waste, and particularly trash, contents may include construction and demolition (C&D) waste, white goods, appliances, and other incompatible materials or oversized items. Such materials would likely be removed prior to reaching a proposed facility, or through standard pre-sorting processes. As such the tonnage which could be considered as suitable feedstock is likely to be lower. The most recent study of trash, undertaken by SCS Engineers in 2024, found some 46% of trash by volume comprised of green waste, 17% comprised of treated and untreated wood, with various other smaller proportions of materials such as cardboard, furniture, metals and inert materials.

[7] Miami-Dade County (2023), 'Annual Comprehensive Financial Report.'

[8] Material which is considered suitable for final cover in landfill.

Table 2-1 - Total Revenue Tons in DSWM Areas of Operation[9]

Revenue Tons	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Clean Yard Trash	9,978	11,427	10,627	13,024	14,739	10,133	9,692	8,971	9,335	15,328
Garbage	1,106,235	1,120,854	1,091,352	1,094,340	1,065,015	1,096,245	1,147,963	1,209,931	1,291,353	1,331,262
Trash[10]	501,340	542,244	550,474	535,060	555,229	553,537	580,230	643,144	618,875	631,514
Subtotal	**1,617,553**	**1,674,525**	**1,652,453**	**1,642,424**	**1,634,983**	**1,659,915**	**1,737,885**	**1,862,046**	**1,919,563**	**1,978,104**
Storm Related Waste	-	-	-	26,088	227,235	-	-	-	-	-
Construction and Demolition	3	2	-	-	-	-	-	-	-	2
Whole Tires[11]	4,171	4,680	5,192	5,820	6,295	6,989	6,940	11,049	14,005	13,073
Special Waste[12]	1,270	1,241	1,404	1,095	1,018	1,523	977	948	1,198	931
Burned Debris[13]	-	-	-	-	-	-	-	-	-	27,055
Reduced Fee Cover Material[14]	24,538	7,416	-	-	-	17,728	6,499	190,950	515,731	203,576
Non-Profit Tonnage[15]	3,220	3,506	4,216	10,850	11,069	10,837	9,664	10,967	10,674	10,545
Subtotal	**33,202**	**16,845**	**10,812**	**43,853**	**245,617**	**37,077**	**24,080**	**213,914**	**541,608**	**255,182**
Total	**1,650,755**	**1,691,370**	**1,663,265**	**1,686,277**	**1,880,600**	**1,696,992**	**1,761,965**	**2,075,960**	**2,461,171**	**2,233,286**

[9] Miami-Dade County (2023), 'Annual Comprehensive Financial Report.'
[10] Trash includes oversize tires to North Dade Landfill.
[11] Whole tires are accepted at Resources Recovery only.
[12] Special waste is accepted at South Dade Landfill only and includes ash, dead animals, asbestos, contaminated soil, oversize tires, sludge and sterile medical waste.
[13] Burned debris was a result of the fire at Resources Recovery Facility, and is an anomaly to typical operation.
[14] This figure varies based on the quality of the cover material accepted.
[15] Includes all material types brought-in by Non-Profits. The composition of this material is not reported in the ACFR.

Table 2-2 - Net Disposed Tons[16]

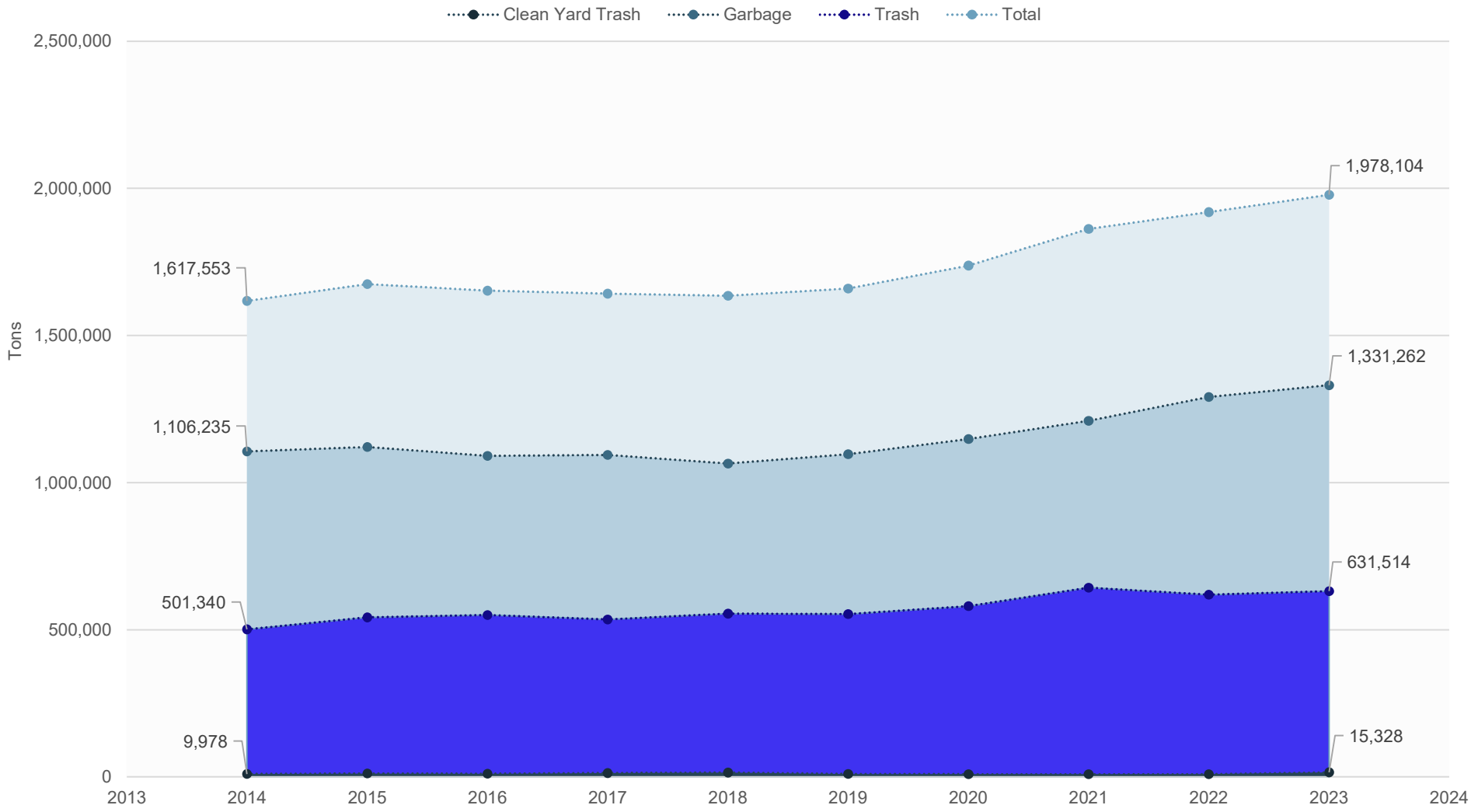
Location	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
South Dade Landfill	376,421	389,056	364,653	361,078	488,796	394,537	448,452	535,596	556,925	721,203
North Dade Landfill	131,823	178,492	199,740	221,577	290,594	197,491	227,540	248,438	200,532	126,059
RRF Net Incinerated	831,692	845,547	816,033	782,668	727,772	675,056	684,159	756,846	645,835	198,995[17]
RRF Ashfill	164,573	163,515	153,818	146,114	146,745	154,632	138,752	125,317	110,154	43,332
Contract Disposal	219,172	249,666	252,809	261,409	374,259	438,621	414,332	354,316	531,243	1,003,172[18]
Total	**1,723,681**	**1,826,276**	**1,787,053**	**1,772,846**	**2,028,166**	**1,860,337**	**1,913,235**	**2,020,513**	**2,044,689**	**2,092,761**

Table 2-3 - Recycling[16,19]

Source	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
White Goods (TRC)	992	1,309	2,091	2,299	2,153	2,191	2,377	2,676	2,456	2,473
Curbside Recyclables	61,923	60,187	59,894	58,365	58,448	58,120	61,700	61,708	57,640	60,165
Subtotal	**62,915**	**61,496**	**61,985**	**60,664**	**60,601**	**60,311**	**64,077**	**64,384**	**60,096**	**62,638**
Tires to Vendors	-	-	-	-	-	-	-	-	-	620
Metal to Vendors	23,361	21,023	21,966	22,126	21,072	47,599	20,335	23,705	19,507	
RTI Biomass Fuel[20]	76,454	51,158	59,989	53,844	16,878	1,873				7,240[17]
RTI Fines Recycling[21]	34,021	40,664	51,406	52,113	48,552	40,355	41,458	38,092	21,420	-
Subtotal	**133,836**	**112,845**	**133,361**	**128,083**	**86,502**	**89,827**	**61,793**	**61,797**	**40,927**	**7,860**
Total	**196,751**	**174,341**	**195,346**	**188,747**	**147,103**	**150,138**	**125,870**	**126,181**	**101,023**	**70,498**

[16] Miami-Dade County (2023), 'Annual Comprehensive Financial Report.'
[17] Decrease attributed to fire at Resource Recovery Facility.
[18] Increase due to waste being redirected from Resource Recovery Facility to Medley.
[19] Unclear if the ACFR documents all recycling herein as it is understood home chemicals and Waste Electrical and Electronic Equipment (WEEE) are also captured at TRCs and H2Cs.
[20] RRF initiative the Recyclable Trash Improvements facility May 1991, which produced fuel pellets for cogeneration. Figure includes fines to NDLF.
[21] Not applicable as of 2023, and Fifth Amended and Restated Operations and Management Agreement between Miami Dade County and Covanta Dade Renewable.

Figure 2-1 - Trash and Garbage in DSWM Areas of Operation



2.2 Future Waste Tonnages

Historical waste tonnages and population projections provide a basis for informing future waste quantities. Nominal low, moderate and high population growth rates published by the Bureau of Economic and Business Research (BEBR) account for potential different situations which may occur[22]. The forecasts include:

- A low growth scenario at an average annual change of -0.26%
- A medium growth scenario at an average annual change of 0.42%
- A high growth scenario at an average annual change of 0.96%

This allows for scenarios where population, and thus waste growth, may be higher or lower than anticipated. To project potential future waste quantities, a nominal waste generation rate per capita has been applied, quantified according to historic population and Garbage, Trash and Clean Yard Trash waste generation between 2014 and 2023. This equated to an average of 3.56 lbs/ capita/ year.

For the purposes of the forecast the per capita waste generation rate is assumed to remain static. In reality this will fluctuate as disposal habits and commercial enterprises change. In general, it is considered more likely that rates will fall in the long term on the basis that environmental awareness may increase, alongside an associated evolution in manufacturer and consumer practices, supported by government initiatives and regulation.

The waste forecast is shown in Table 2-4 and Figure 2-2.

Table 2-4 - Miami-Dade Household Waste Growth Forecasts (tons per annum)

Year	Low Growth	Medium Growth	High Growth
2025	1,736,843	1,828,256	1,919,669
2030	1,730,216	1,890,952	2,051,688
2035	1,709,231	1,936,756	2,164,346
2040	1,681,294	1,972,164	2,263,035
2045	1,652,577	2,003,155	2,353,668
2050	1,625,419	2,031,742	2,438,129
2055	1,598,532	2,060,572	2,524,374

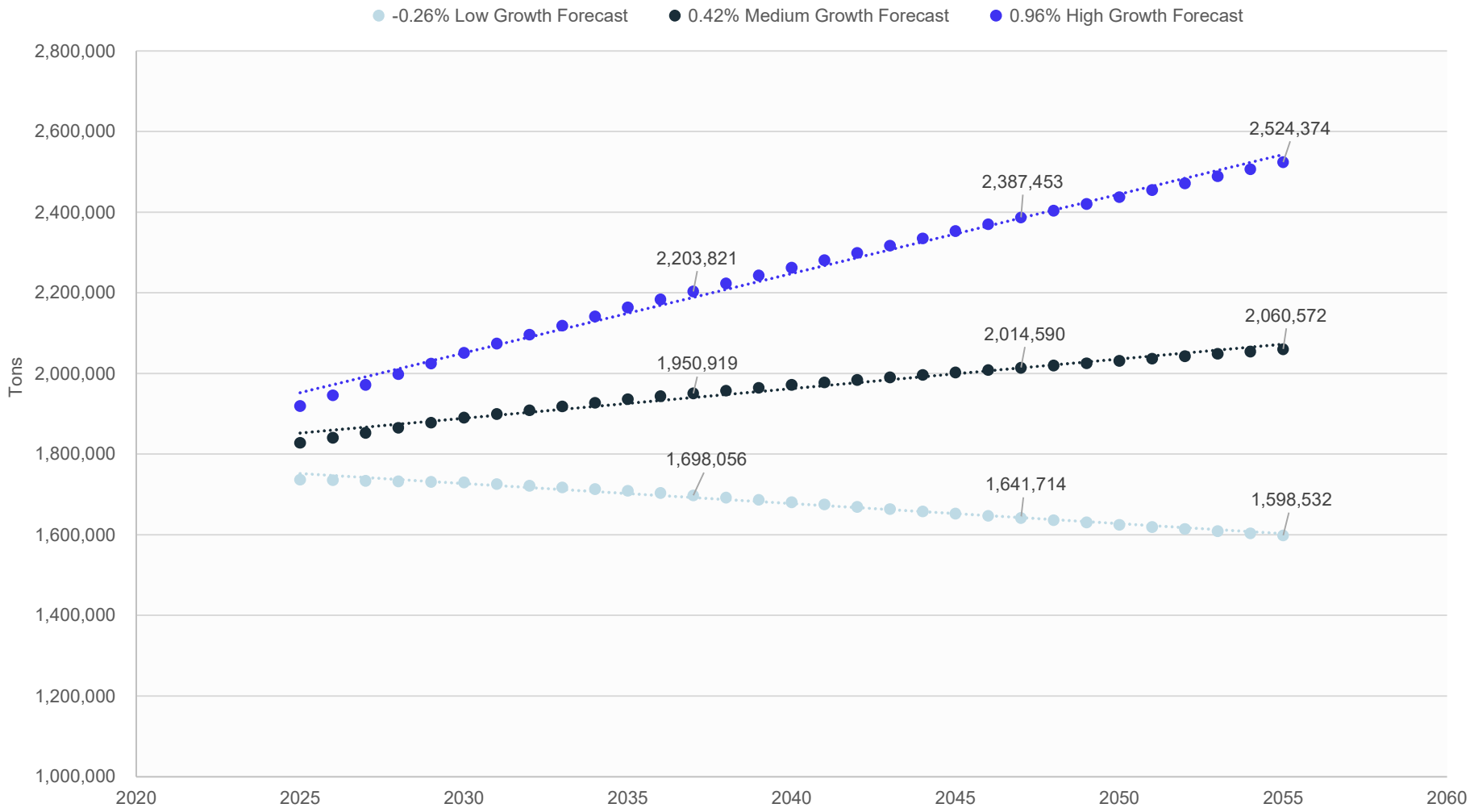
These indicative values provide a range of possible tonnages which could be considered for the purposes of assessing, at a high level, the future waste material which may be available. This will vary according to the developing circumstances in the region, subject to a wide range of influencing factors (demographics, waste generation rates, compositional suitability, political developments etc.).

As previously mentioned, it should be recognized that a proportion of the available waste, particularly trash, may not prove viable as a feedstock for a given facility (i.e. C&D waste, bulky and oversized items etc.). As such suitable feedstock may be lower depending on the technology considered.

Further to this, the forecast does not account for potential changes in the recycling rate, and where it should be assumed that the DSWM, through their mandate to serve the County, will seek to improve recycling rates over time. This may result in further removal of material from the available waste stream should recycling further develop.

[22] Florida Demographic Estimating Conference, February 2023 and UF, BEBR, Florida Population Studies, Volume 56, Bulletin 195, April 2023 medium county projections.

Figure 2-2 - Waste Growth Forecasts Annual (Tons per Annum)



2.3 Waste Composition

A number of studies have been undertaken in Miami-Dade to date and which have analyzed the available proportion of components within select waste streams generated. Studies which have been made available include:

- SCS Engineers (2024), AtkinsRéalis for Miami-Dade County Waste Characterization Study;
- SCS Engineers, (2023), Miami-Dade County Residential Recyclable Materials Composition Study;
- University of Florida (2021), Miami-Dade County Waste Composition Study;
- University of Florida (2021), State of Practice Review to Assess the Cost and Market Potential for Yard Waste Management Practices in Miami Dade County; and
- HDR Engineering (2010), Technical Memorandum 2.6 Waste Composition Study.

The most recent study was conducted in December 2024, by SCS Engineers. This was the first phase of a two season waste characterization study which will be completed later in 2025. The study included physical sampling of 88 residential and 12 commercial municipal waste samples at the West WTS, and visual sampling of 125 loads of trash/ bulky waste from neighborhood TRCs, undertaken at the SDLF.

As well as seeking to determine the relative proportions of each of the waste streams within the overall compositions, the study also included collection of laboratory samples of household municipal waste for analysis. This had not previously been captured in any other studies in the region. This analysis captured valuable information such as the observed component moisture content and calorific value.

A summary of the most recent study of trash is shown in Table 2-5, whilst the collated results for garbage and commercial waste from all the studies received is shown in Table 2-6 and Figure 2-3.

Table 2-5 - Compositional Summary of Trash

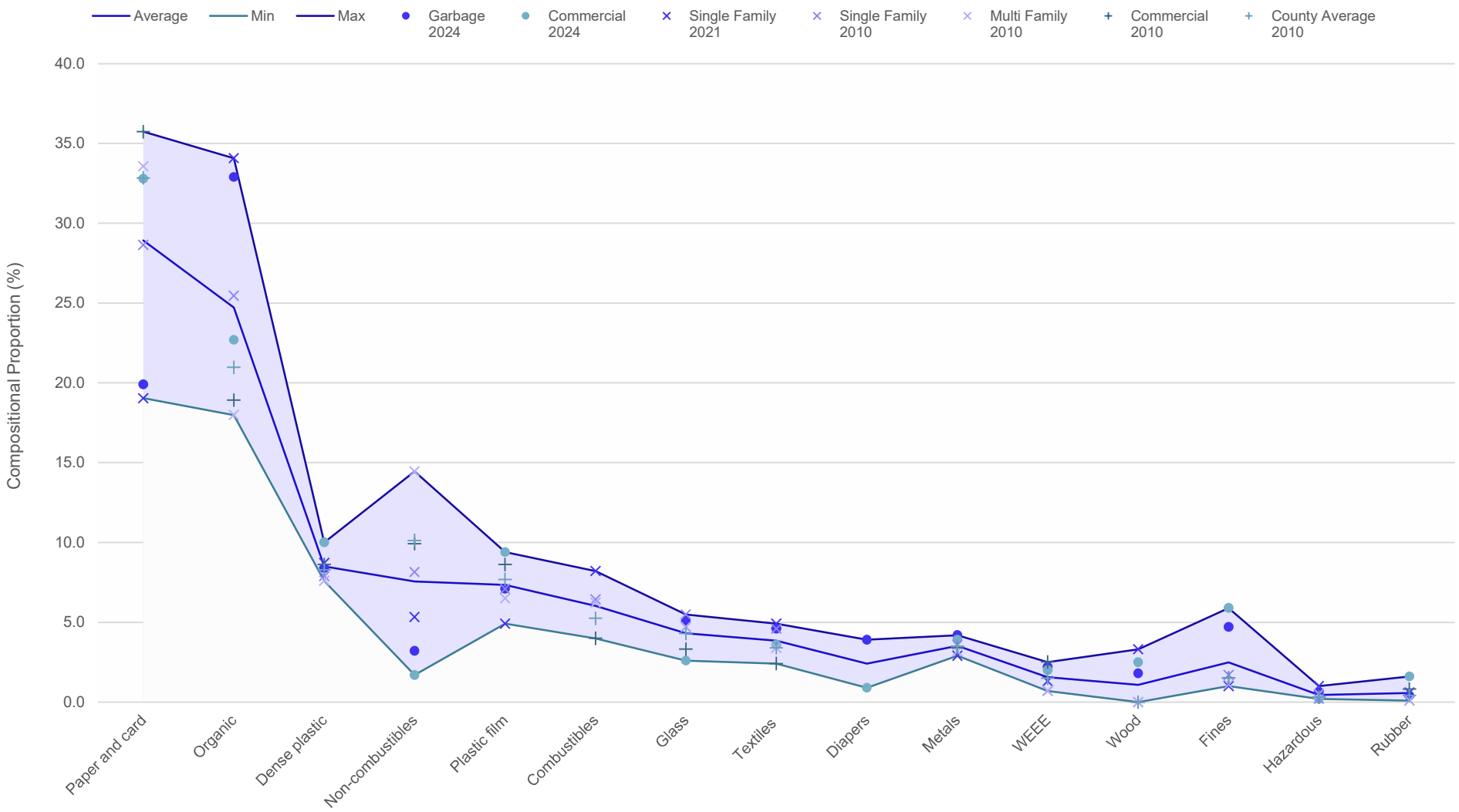
Waste Fraction	**Trash 2024**
Green Waste	46.1%
Wood	17.4%
Cardboard	8.6%
Inert	8.4%
Furniture	6.0%
Bagged Waste	6.0%
Metals	4.0%
Other	3.4%
Total	**100%**

Table 2-6 - Compositional Summary of Available Studies, Garbage and Commercial Waste

Waste Fraction	Garbage 2024	Commercial 2024	Overall[23] 2024	Single Family 2021	Single Family 2010	Multi Family 2010	Commercial 2010	County Average 2010	Min	Max
Paper and card	19.9%	32.8%	21.5%	19.0%	28.6%	33.6%	35.7%	32.8%	19.0%	35.7%
Organic	32.9%	22.7%	31.7%	34.1%	25.4%	18.0%	18.9%	21.0%	18.0%	34.1%
Non-combustibles	3.2%	1.7%	3.0%	5.3%	8.1%	14.5%	9.9%	10.1%	1.7%	14.5%
Dense plastic	8.4%	10.0%	8.6%	8.7%	7.9%	7.6%	8.6%	8.3%	7.6%	10.0%
Plastic film	7.1%	9.4%	7.4%	4.9%	7.1%	6.5%	8.6%	7.7%	4.9%	9.4%
Combustibles	-	-	-	8.2%	6.4%	6.2%	4.0%	5.2%	4.0%	8.2%
Glass	5.1%	2.6%	4.8%	4.7%	5.5%	4.7%	3.3%	4.3%	2.6%	5.5%
Textiles	4.6%	3.6%	4.5%	4.9%	4.6%	3.4%	2.4%	3.4%	2.4%	4.9%
Metals	4.2%	3.9%	4.1%	2.9%	3.6%	3.2%	3.4%	3.5%	2.9%	4.2%
Fines	4.7%	5.9%	4.9%	1.0%	1.7%	1.1%	1.5%	1.5%	1.0%	5.9%
Diapers	3.9%	0.9%	3.5%						0.9%	3.9%
WEEE	2.2%	2.0%	2.2%	1.3%	0.7%	0.7%	2.5%	1.5%	0.7%	2.5%
Hazardous	0.6%	0.2%	0.6%	1.0%	0.2%	0.5%	0.3%	0.3%	0.2%	1.0%
Rubber	0.4%	1.6%	0.5%	0.6%	0.1%	0.1%	0.8%	0.4%	0.1%	1.6%
Wood	1.8%	2.5%	1.9%	3.3%	-	-	-	-	1.8%	3.3%
Other	0.9%	0.4%	0.8%	-	-	-	-	-	0.4%	0.9%
Total	**100%**	**100%**	**100%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**-**	**-**

[23] It is understood that this is an overall average of samples taken), and is not a normalised total based on the proportions of DSWM household to commercial waste tonnages as no information was available. It is considered that the weighting of commercial tonnages is likely to be lower than may be reflected by the overall average shown which reflects a ratio of 88% household waste to 12% commercial waste. On this basis it is advised to use the associated garbage composition shown as a baseline. Further details of DSWM commercial tonnages will help to resolve this discrepancy.

Figure 2-3 - Compositional Summary of Available Studies, Garbage and Commercial Waste



2.4 Waste Properties

The SCS Engineers study is the only available study which has attempted to determine a meaningful insight into some of the key properties of the municipal waste stream. This was based on assessing 36 samples of various components for moisture, energy content, sulfur, chlorine, total volatile solids and ash. The results of this study are shown in Table 2-7 and Table 2-8. It was noted, that variability in municipal waste presents inherent challenges with analytical tests, with results being impacted by the materials present in each sample, and with each sample's composition varying. As a result the results should be considered as a guideline only. Further analysis shall be undertaken in the summer season study to be undertaken later in 2025. This will help provide some further insight.

Table 2-7 - Laboratory Analysis Results

Waste Fraction	Percent Moisture (%)	Energy (Btu/lb)	Sulfur (mg/kg)	Chlorine (mg/kg)	Total Volatile Solids (%)	Ash (%)
Organics (Food)	62.7	3,046.7	659.0	4,440.0	91.7	9.3
Organics (Green)	59.0	1,863.3	581.3	10,875.0	91.7	8.4
Plastic Film	24.1	18,233.3	185.3	883.0	94.0	6.1
Dense Plastic	5.8	15,400.0	178.5	1,012.7	97.3	3.9
Paper	26.7	4,920.0	529.3	1,590.0	87.7	12.5
Cardboard	8.9	8,496.7	781.3	483.0	89.0	10.9
Wood	36.7	6,243.3	205.5	1,102.7	97.7	2.4
Inert	25.2	936.7	27,709.3	80.5	8.9	91.0
Textiles	11.3	13,406.7	223.5	616.7	79.7	20.3
Rubber	1.8	13,033.3	1,373.7	397.3	84.3	15.7
Mixed Waste	49.8	7,076.7	1,012.0	428.0	82.0	18.0
Fines	**62.3**	**1,950.0**	**922.3**	**1,073.7**	**79.3**	**20.7**

Table 2-8 - Adjusted Impacts of Moisture and Energy Content Based on Composition

Waste Fraction	Garbage (%)	Moisture (%)	Moisture Contribution (%)	Energy (Btu/ lb)	Energy Content Contribution (Btu)
Organics (Food)	20.7%	62.7%	13.0%	3,046.7	630.7
Organics (Green)	11.3%	59.0%	6.7%	1,863.3	210.6
Plastic Film	7.1%	24.1%	1.7%	18,233.3	1,294.6
Dense Plastic	8.4%	5.8%	0.5%	15,400.0	1,293.6
Paper	11.2%	26.7%	3.0%	4,920.0	551.0
Cardboard	8.7%	8.9%	0.8%	8,496.7	739.2
Wood	1.8%	36.7%	0.7%	6,243.3	112.4
Inert	3.2%	25.2%	0.8%	936.7	30.0
Textiles	4.4%	11.3%	0.5%	13,406.7	589.9
Rubber	0.4%	1.8%	0.0%	13,033.3	52.1
Mixed Waste	18.1%	49.8%	9.0%	7,076.7	1,280.9
Fines	4.7%	62.3%	2.9%	1,950.0	91.7
Total	**100.0%**	**-**	**39.5%**	**-**	**6,876.5**

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5.6 APPENDIX F – WASTE-TO-ENERGY RESPONDENT SUMMARY TABLE

Entity	Consortium or Group/Capability	Proposed solution	Estimated CAPEX	Estimated OPEX	Estimated Acreage	Estimated Schedule	Funding Arrangement
FCC	FCC Environmental Services MasTec - EPC Contractor B&W - Equipment supplier The consortium has relevant experience to execute the proposed offering. Collectively the Consortium brings over 370+ years of experience	The overall solution offered is for 2.4M TPY 1,000,000 TPY to WTE 550,000 TPY - Bulk & C&D Waste Recycle 150,000 TPY - Composting 60,000 TPY - MRF Recycle 600K TPY going to Landfill.	WTE: $1,500M to $1,900M ($50 to $63/Ton/30 years) Bulk and C&D Waste: $40M to $60M Composting: $10M to $15M MRF Recycle: $60M to $100M Landfilling: Per current arrangement	WTE: $45 to $75/Ton Bulk and C&D Waste: $40 to $60/Ton Composting: $35 to $50/Ton MRF Recycle: $60 to $100/Ton Landfilling: Per current arrangement	50 to 80+ Acres for Ecopark	The EcoPark will take approximately 4 to 8 years Permitting - 1 to 3 years Design build – 3 to 5 years Operations - 25 to 30 years WTE - 3 to 5 years MRF - 2 to 4 years Bulk Facility - 2 to 4 years Composting - 2 to 4 years	Project Finance as Project Developers (PPP) - The project will be leveraging a New-Build-Finance-Rates model Consortium entity to design, build, finance, operate, and maintain the Campus via a concession agreement with the County. The Consortium acts as the implementation partner and is responsible for all activities related to the implementation, management, monitoring, and reporting of the project throughout the project's crediting period. Miami-Dade County and the Consortium entity can share the revenue from the recycled waste streams generated from the project.
FPL	FPL (Florida Power & Light) - Utility Company ReWorld Holding Corp; former Covanta Holding Corp. - O&M Kanadevia Inova (KVI), former Hitachi Zosen Inova - Equipment supplier & EPC CDM Smith Inc. - Environmental Consulting Engineering The consortium has relevant experience to execute the proposed offering. Collectively the Consortium brings over 230+ years of experience	The overall solution offered is for 2.4M TPY 1,300,000 TPY to WTE 180,000 TPY - Anaerobic digestion w/composting 600K TPY going to Landfill.	Based on our industry experience, the county's cost estimates for the identified sites are within industry standards and align with projections previously provided by the county's experts. (See Table 5.1.2-2)	Based on our industry experience, the county's cost estimates for the identified sites are within industry standards and align with projections previously provided by the county's experts. (See Table 5.1.2-2)	40 to 60 Acres	Development of a new WTE facility typically occurs over a seven- to 10-year timeframe contingent upon several key milestones	Partnering with FPL, an investor-owned, state-regulated electric utility, in a P3 model FPL to provide capital investment and 30-year operational costs associated with the respondent's solution. County responsible for site selection, ownership and lease back to FPL. County will own improvements after the contract term ends. FPL will charge tipping fee
Insoftel (Synergy Conversion Solution	Insoftel (Synergy Conversion Solution) <u>Proposed Equipment</u> industrial-grade shredders, specifically SatrindTech T20/200 and 3R20/320 models or their equivalent; ShieldsMagnetics technology, Pennati type 701/210 tunnel dryer. Converter Units: Each Converter™ unit operates autonomously, efficiently converting specified batches of waste into N-RDF; Cooling and Electrical Infrastructure The proposed technology seems feasible, however the respondent has not provided the following: Number of employees and related experience designing and building the proposed facility Details regarding the partners or groups that will design, build operate and maintain the facility Details regarding previous installations deployed. Details regarding a proposed site for the facility Inconsistency of information provided regarding power production - 160 MW total vs 55Mw per 100 Metric tons of N-RDF	The overall solution offered is for 2.4M TPY Waste to RDF 4,000 metric tons (4409 US Tons) of municipal solid waste (MSW) per day; 1.46 million metric tons (1,609,375 US Tons) annually 790,625 TPY to Landfill	Waste-to-Energy facility is between $1.625 to $2.1 billion USD encompassing all engineering, procurement, and construction activities associated with the deployment of 37 processing modules and 8 Organic Rankine Cycle (ORC) turbines	Annual maintenance expenditures are projected at approximately $35 million USD	~ 99 Acres	Schedule based on Modular expansion: 25% operational capacity - Year 2 50% operational capacity - Year 3 75% operational capacity - Year 4 Full operational capacity - Year 6	Partnership and Agreement Structure: Synergy is structured to engage in a variety of partnership agreements and operating models including, Synergy sells, builds and commissions a system for an owner (owner funds the project) Synergy sells, builds and commissions a system for an owner (Synergy funds the project) Synergy works with a funder to build and commissions a system for a project sponsor, where the system is owned by the funder and operated by Synergy or by the project sponsor or a third party – as a service project Synergy is open to other project structures.
Giant Green Leaf	Giant Green Leaf OEM partner VOsPS	Waste-to-Energy – 184 TPD waste processed per module. 6 modules proposed for 1,100 TPD (401,500 TPY). 40 MW electric or 70 MW thermal. 18-22 modules required for 4,000 TPD goal 1,998,000 TPY to Landfill to make up the difference to 2,400,000 TPY	The total projected investment for a 6-module system is $306.43 million from engineering to operation	Total annual estimate $15 million. Operation of the plant will support 60 personnel, estimated at $6.7 million per year. System maintenance and support is estimated at $8.3 million per year	A typical 570MM UWTE system (1,100 tpd) requires ~12 acres for full operations. A system capable of processing 4,000 tpd (Miami-Dade's estimated need) would require ~ 28-37 acres, including: 6–8 acres for feedstock reception and processing 10–15 acres for UWTE modules, power systems, utilities 6–8 acres for stack infrastructure, vehicle access, and buffer zones Optional: 6+ acres for evaporative ponds or green landscaping	Feasibility & site Selection - 6 months Design and Engineering - 4 to 6 months Construction - 12 to 18 months Commissioning and Start-up - 2 to 3 months Total time to operation 24 to 36 months	P3 -county provides land, permitting, capital, infrastructure, retains ownership and regulatory control. GGL and partners design, build, and operate. Build Operate Transfer – GGL privately finances. Build Own Operate – GGL privately finances. Public – GGL pursues grants, tax credits, and carbon credits. ESG Capital – partners pursue grants and loans from ESG sources.
Frontline Waste	Frontline Waste	Proposed Solution - Modular, slow-pyrolysis waste-to-energy systems Each JF60 system could treat 100 tons/day (about 35,000 tons per years) and generate about 4MWhe A JF60 Slow-Pyrolysis System, includes a pyrolysis reactor, drying cyclone system, and our bespoke power generator. Multiple modular JF60 systems can be housed together, with its configuration based on the number of systems ordered Smaller-scale (say 10,000 tons/year) for under $4M as a pilot (the JF20 System), and could eventually be scaled up to divert between 300,000 tons and 450,000 tons of non-recyclable plastics, paper and green biomass waste per year. JF Pyrolysis - Recycle MRF, dried sargassum, and all the single-stream recycling materials collected by the County, including plastic waste and paper waste as feedstock	The total deployed CapEx cost would be between $70M to $120M for 10 to 15 JF60 Systems depending on actual waste tonnages. 10 JF60 Systems would have the capacity to produce approximately 40 MWs of power, and a total of 330,000 MWh's per year. Each JF60 System would cost approximately $7M to $8.5M, Small unit 10,000 tons/year under $4M as a pilot (the JF20 System), and could eventually be scaled up to divert between 300,000 tons and 450,000 tons of non-recyclable plastics, paper and green biomass waste per year	No Opex provided	No estimated acreage provided	Full deployment of these modular systems would occur within 36 months, depending on a phased approach, as each new system has an estimated 12 month build time. This solution can be implemented within 12-18 months at a smaller scale (say 10,000 tons/year)	Frontline Waste is a manufacturer. We would sell our JF20 pilot unit as well as subsequent JF60 Units directly to Miami-Dade County. We would be open to partnering with another 3rd party waste management firm to put together a formal implementation plan We are open to partnerships with other waste management companies.
WEF Innovations LLC	WEF Innovations LLC	WEF Innovations LLC provided limited information and the following information was note provided: Operating plants or facilities currently deployed or running in the US or worldwide using the proposed technology. They cited a facility in Sierra Leon, West Africa however this was not verified Brochure indicates - Boston Municipal Solid Waste Sorting Machine - No details provided Anaerobic digest Biocycle - No details provided Cultivation systems for algae growth. (A-B) flat panel photobioreactors - No details provided China 5MW Biomass Gasifier Power Plant - No details No information on number of employees in US or worldwide or company history. All that was provided are the graphics presentations with no back-up verifiable data According to the Brochure provided: WTE - conversion of garbage, recyclables & biowaste to electricity and Biofuel Air to Water - conversion of humidity in air to potable water, Hydroponics - growing fruits and plants Aquaponics - Farming fish for consumption or sale	No information provided	No information provided	No information provided	No information provided	No information provided

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