Climate Change Action Plan

Florida is considered one of the most vulnerable areas to climate change, with Southeast Florida especially susceptible to impacts such as rising sea levels. Miami-Dade County has been on the forefront of these issues for many years. Our Board of County Commissioners and administrative departments have been implementing policies and initiatives to address climate change, environmental protection and other important sustainability issues including energy efficiency and water conservation. By tracking greenhouse gas (GHG) emissions early and analyzing climate change data, we have taken steps to reduce GHG emissions and avoid or reduce the severity of climate change impacts.

Now is the time to accelerate and build upon those efforts. Miami-Dade County is creating this climate action plan as an integral component of ***GreenPrint***. This initial plan will focus on what steps will be necessary in the next five years to further reduce GHG, as well as better determine the potential impacts and resulting vulnerabilities of climate change in the region and the community. These steps will make Miami-Dade County a more resilient community in the face of a changing climate. It is time to turn the science into action.

Goals

- ***Understand and respond to current and future climate change impacts***
  Integrate local climate change indicators with existing emergency management, storm water planning and infrastructure planning

- ***Reduce greenhouse gas emissions***
  Reduce greenhouse gas emissions by 10 percent by 2015, working towards 80 percent reduction by 2050 to advance the Cool Counties Program commitment

CLIMATE CHANGE ACTION PLAN

"I like to think of mitigation as avoiding the unmanageable, whereas adaptation is managing the unavoidable. We must do both in order to solve the problem of climate change."

- Dr. Jane Lubchenco, U.S. Department of Commerce Under Secretary for Oceans and Atmosphere, White House Listening Session, June 23, 2010 Miami-Dade County, Florida

Strengths & Accomplishments…Opportunities & Actions

I. What is climate change and what does it mean to Miami-Dade?

One of the most significant challenges facing the southeast Florida region and the world is the threat of climate change. Although the planet has experienced natural cycles in atmospheric concentrations of carbon dioxide and temperature for more than 600,000 years, there is now an unprecedented rate of greenhouse gas (GHG) build up in the earth's atmosphere due to human activities. As a result, more and more of the sun's heat energy is trapped. Worldwide, changes are occurring to many interconnected forces that determine precipitation, temperature, severe weather patterns, sea level, ocean currents and acidification. These related systems form complicated feedback loops that are affected by climate change and, in turn, can diminish or intensify climate change impacts. These complex relationships make the extent and timing of climate change impacts difficult to predict, especially at regional and local levels. In the absence of accurate and specific local-impact predictions, we are challenged with identifying and using credible climate scenarios, along with local impact and vulnerability assessments, as a basis for planning our sustainable future. The development of scenarios and planning regimes is challenging.

According to NOAA's July 2010 Global State of the Climate Report, the combined global land and ocean average surface temperature for July 2010 was the second warmest on record, and the global combined land and ocean surface temperature was the warmest January-July period on record.

(United States. Dept. of Commerce. NOAA, "Second Warmest July", n. pag.)

Climate Change versus Global Warming

The term "global warming" has evolved over the past decade to the term "climate change" because we have realized that the greenhouse effect does not merely lead to warmer temperatures. The term "global warming" represents the long-term rise in the average global temperature and can be misleading because the actual weather effects associated with "global warming" can be highly variable, depending on the region. As a result, we now use the term "climate change," which more accurately reflects that our concerns are much broader than global temperature increases. Climate change is defined as a function of increased average temperature over time while the actual weather-related effects of a changing climate can impact variability and extremes – including potential for warmer and cooler temperatures, wetter and dryer conditions, and changes in the intensity, frequency and patterns of storms.

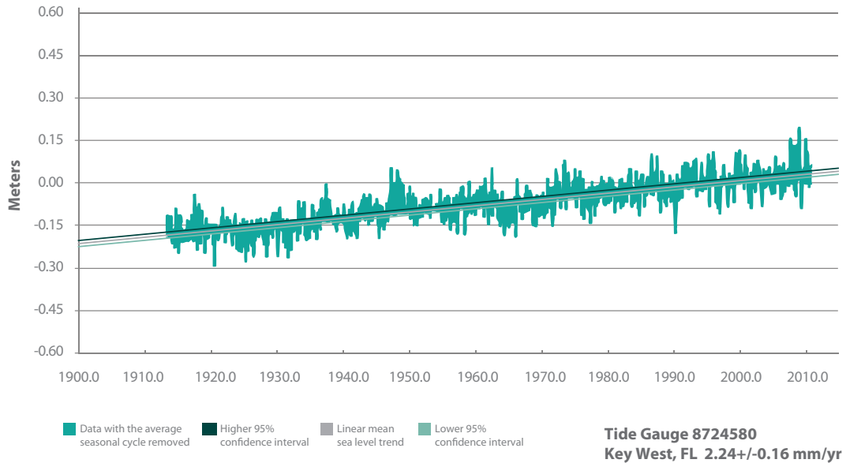
Global temperature increases affect many forces, including global weather patterns, ocean conditions and sea levels. Warming will not be the same for every region; long-term changes in average temperatures will have different impacts in different locations. Current science is projecting that the southeastern United States could experience a general increase in average temperatures anywhere from 4.5°F to 9°F in the coming century (Karl et al, 111), depending on the Intergovernmental Panel on Climate Change greenhouse gas emissions scenario utilized for the projections (Intergovernmental Panel on Climate Change (IPCC), "Special Report" Appendix 1). This temperature change will likely manifest itself as an increase in the number of days over 90°F, with the greatest temperature increases expected during the summer months (Karl et al., 111).

Is sea level rising?

The region's climate, unique natural resources and other distinct characteristics make the community extremely susceptible to some of the effects of changing climate conditions. In particular, our low elevation and porous substrate make the region vulnerable to the many potential effects of sea level rise. Even slight changes in sea levels have the potential to significantly affect our infrastructure, drinking water supply, and risks associated with storm surge, flooding, and coastal erosion. Given the potential consequences, it is imperative that we track changes and projections, closely monitor local conditions, and adopt adaptation strategies.

Key West Sea Level Rise Trend

This figure illustrates a clear trend of sea level rise from 1913 to 2006 at a NOAA tide gauge located in Key West, Florida



Tide Gauge 8724580
Key West, FL 2.24+/-0.16 mm/yr

Source: U.S. Department of Commerce, NOAA, "Tides & Currents," n. pag.

It is important to note that relative sea level trends vary throughout the world. We will use the local sea level or local mean sea level trend for various planning needs associated with climate change adaptation planning. The National Oceanographic and Atmospheric Administration (NOAA) has three gauges located in the Southeast Florida region that measure mean sea level trend; Miami Beach, Vaca Key, and Key West.

According to NOAA, the mean increase in sea level trend at the Key West tide gauge is approximately 2.24 millimeters per year from 1913 to 2006, which is roughly equivalent to a change of 0.73 feet in 100 years (United States. Dept. of Commerce. NOAA, "Tides & Currents", n. pag.). A recent study by NOAA indicates that additional tide gauges in the southeast Florida area would allow for more accurate regional integration of sea level rise and tidal fluctuations. This additional data may be helpful as Miami-Dade County develops inundation maps to assess vulnerable areas and infrastructure. The bottom line, however, is simple: sea level is rising.

Current and Future Regional Threats

Today South Florida is experiencing the extreme conditions detailed below. Although their occurrence may not be directly attributed to climate change at this time, they are key hazard threats that are likely to be impacted by climate change.

Temperature Extremes

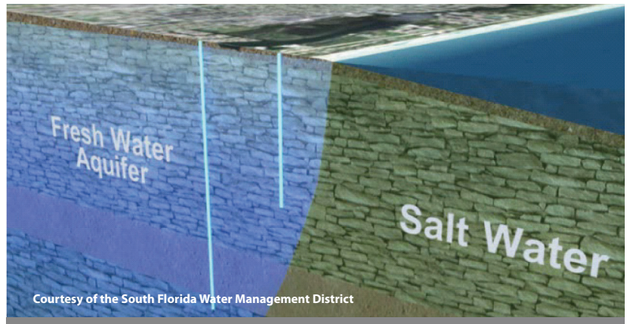
During the first seven months of 2010, southeast Florida experienced first-hand the types of temperature extremes that may occur as a result of climate change. According to the National Weather Service, the time period of December 2009 through February 2010 was "the coldest three months in nearly four decades," with average daily temperatures two to three degrees below normal across the region. Miami Beach experienced its second-coldest winter ever, with average temperatures 5.6 degrees below normal, and broke an all-time coldest January-February mark set in 1958 (United States. Dept. of Commerce. NOAA, "Hottest Summer" n. pag.). In stark contrast, the 2010 summer experienced hotter than normal temperatures. These unusually high temperatures began in May and continued through the summer. In fact, the period of June through August was the hottest summer on record for all four main climate sites in South Florida (Primary Airports in Miami, Ft. Lauderdale, Palm Beach, and Naples) (United States. Dept. of Commerce. NOAA, "Hottest Summer" n. pag.).

Rainfall Extremes

Changes in precipitation patterns are also projected to affect Miami-Dade County's climate. These changes can increase the likelihood of flooding and drought, both of which would have distinct but detrimental impacts on the County's water quality and supply. Since the early 1900's, South Florida's spring, summer and fall precipitation has dropped nearly 10 percent. (United States. Dept. of Commerce. NOAA, "2009 S. FL" 8). Local data indicates there has been an increase in heavy downpours in the region, and a 2009 report by the Florida Oceans and Coastal Council indicates this trend may increase and combine with longer droughts in between. An example of these extremes was seen within a nine month period, between November 2008 and July 2009. The six-month period from November 2008 through April 2009 ranked as the second driest period on record over most of South Florida (United States. Dept. of Commerce. NOAA, "2009 S. FL" 8), which resulted in severe to extreme drought conditions over South Florida from late February through April. In May, this extremely dry season quickly reversed to a very wet rainy season with above-normal rainfall persisting into mid-July. In fact, a summer storm on June 5, 2009 dumped a total of 9.3 inches of rain on South Beach, most of it in less than three hours, overwhelming the gravity-driven stormwater drainage system. This caused severe flooding in areas of South Beach, Miami Beach and downtown Miami, leaving some areas with as much as three feet of standing water. (United States. Dept. of Commerce. NOAA, "2009 S. FL" 8)

Photo courtesy of Eric Blake, National Hurricane Center

Severe flooding from heavy downpour on Miami Beach, June 5, 2009.



Courtesy of the South Florida Water Management District

As sea level rises, the saltwater front may move further inland, threatening drinking water wells.

Salt Water Intrusion and Our Water Supply

Southeast Florida was historically a wetland habitat and therefore still has many low-lying areas, particularly to the west and south (the Everglades). Much of Florida has been under water in the past, during periods of higher sea levels. As sea levels rose and fell, the calcium carbonate from ocean organisms and algae were deposited, forming the sedimentary limestone bedrock (Allen 2). This substrate is extremely porous, allowing water to flow freely throughout the underground bedrock. This porosity hydrologically connects the region's sole source of fresh drinking water, the Biscayne Aquifer, to the salty water of the ocean. Because of this hydrologic connection, increases in sea level may push this salt-front line further inland and closer to drinking water wells, threatening the region's fresh water supply. The porosity of the ground is an additional challenge when it comes to protecting the community from inundation due to rising seas, since traditional walls and other barriers will not likely be effective for southeast Florida.

Coastal Erosion and Shallow Coastal Flooding

Beaches and sand dunes are an important component of the region's coastline and are very dynamic, constantly changing due to natural erosion and movement of sand from wind, currents, and wave action. They can provide a first line of defense from storm surge, and are significant assets that make the region an attractive tourist destination. Various weather events that lead to higher winds, tides, and surf cause additional erosion, which can be severe. Miami-Dade County has been addressing this issue since 1975 with its acclaimed Miami-Dade Beach Erosion Control Project. This program is recognized as a national model and has won numerous national and statewide awards. Although the specific amount varies from year to year and from project to project, Miami-Dade County invests approximately $6 million annually in beach restoration. Communities adjacent to the ocean and intracoastal waterways periodically

Flooding on Miami Beach on October 7, 2010 due to natural high tide exacerbated by on-shore winds, driving tidal waters up in to the streets through the stormwater drainage system.

experience flooding from extreme high tides. These occasional high tides inundate the coastal communities through gravity-driven stormwater drainage systems and over low-lying sea-walls, leading to infrastructure and property damage. Tide levels during June 2009 were six inches to two feet above normal. The cycle of the moon contributed to this event, which is not necessarily unusual. However, the geographic extent of this event along the entire East Coast made this high tide event anomalous. Even a tide .75 to one foot higher than normal can cause similar flooding in low-lying coastal areas if there is a strong on-shore wind, as was the case on October 7, 2010, driving saltwater into the streets of Miami Beach (Molleda, Robert. Personal email communication. October 12, 2010)

Low-lying coastal and inland wetland habitats also play an important role in the region's unique and valuable environmental attributes and are important to both local ecosystems and the economy. Coastal mangrove habitats help stabilize shoreline sediments, play a critical role as spawning grounds and nursery for many marine species, and form a protective line of defense from storm surge. Similarly, Biscayne National Park and Everglades National Park are home to a number of endangered species. In addition to the critical role of protecting and replenishing our region's drinking water supply, the Everglades also provides critical habitat that can serve as a corridor for species migration that may occur due to climate change. However, much of these natural areas have an elevation of less than three feet (United States. Dept. of the Interior 1), and therefore will also be extremely vulnerable to inundation impacts from sea level rise.

Inland Flooding and Stormwater Management

While coastal flooding as a result of climate change is an obvious threat, inland flooding is a threat of equal importance, especially when considering the development density and ground elevation of some urbanized areas in the western portions of the county. While our porous substrate provides some advantages - mitigating flooding and naturally recharging the freshwater aquifer by allowing some rain water to percolate into the ground - it also presents challenges. As sea level rises, the water table will also rise, coming closer to the ground surface and causing surface flooding in areas of lowest elevation. This threat of flooding will be further increased during periods of heavy precipitation since the capacity of the gravity-driven stormwater system and ground to absorb the run-off may be greatly reduced. Additionally, the probability of salt intrusion in the Biscayne Aquifer, which is currently the only source of water supply to the County, could potentially change the characteristics of the ground water.

Extreme Storms & Damage

There is much scientific research on the causes, trends and complex factors affecting tropical storm and hurricane development. A hint of this complexity was presented in a recent South Florida Water Management District (District) Report, which stated, "As the atmosphere warms, sea surface temperatures and wind shear will also increase. These two factors can have opposing effects on tropical storms. The role of sea temperatures is complicated. As the temperatures rise, overall storm frequency may decrease, but intensity of stronger storms may increase" (Ammon et al, 21). Add to this complexity the uncertainty of climate change and its effects on these storms, and the future trends and impacts become extremely unclear. What is clear is that our community will continue to experience these events, and they can have devastating impacts. The region is no stranger to hurricanes, as evidenced by Hurricane Andrew in 1992 and the busy hurricane season of 2005 (Hurricanes Katrina and Wilma).

Impacts Now: Severe Weather
Florida is ranked number one in total damage costs from hurricanes (1900 – 2007), fourth in total damage costs from floods (1955 – 2007), and number one in total damage costs from hurricanes, floods, and tornadoes combined (1955 – 2007). (National Center for Atmospheric Research n. pag.).

Our community will continue to experience these events, and their impacts may be exacerbated through climate change. In addition to greater coastal erosion, for instance, increasing sea levels will likely amplify the height and distance of storm surge that may travel inland, increasing its damage. Furthermore, a higher water table associated with increased sea level may also lead to longer periods of flooding following storm events, delaying or perhaps even preventing the recovery of those communities hardest hit. Buildings, water and sewer networks, solid waste facilities and power utilities could all be at risk. Steps taken to better anticipate, prepare and adapt our community for tropical storms and hurricanes will improve the overall sustainability and resilience of our community.

What is known:
Hurricane frequency and strength have increased dramatically since 1995. Much of the change is attributed to natural cycles.

What is probable:
Warmer temperatures create the potential for stronger hurricanes. Hurricane frequency may remain the same or decrease as part of climate change. A lower number of tropical storms and hurricanes each year could reduce the region's water supply. Likewise, an increase in tropical activity could increase flooding. In either case, hydroperiod changes will be stressful to managed and natural systems.

What is possible:
While the number and strength of tropical storms change naturally, the exact degree to which climate change may alter the natural cycles is uncertain.

Information gaps:
While the number and strength of tropical storms change naturally, the exact degree to which climate change may alter the natural cycles is uncertain.

(Source: Ammon et al, 21)

II. Climate Change Adaptation Plan – Creating a Resilient and Sustainable Future for our Community

Miami-Dade already has knowledge and skill preparing for extreme events due to its experience preparing for and recovering from hurricanes. This experience provides us with an advantage that most other communities do not have. Within County government, our Stormwater Master Plan and Local Mitigation Strategy are two leading initiatives that serve as critical building blocks for community resilience. Further, Miami-Dade County has fostered effective working relationships with state and federal agencies to build local resilience, including the partnership among Federal Emergency Management Agency (FEMA), the State of Florida and Miami-Dade County to increase secondary canal drainage capacity between 2002 and 2006. Further, Miami-Dade County is actively engaged with the South Florida Water Management District, the National Park Service, and the U.S. Army Corps of Engineers on the Comprehensive Everglades Restoration Plan (CERP). Everglades restoration is now more important than ever, "since a restored Everglades will be healthier and more resilient to climate change," (United States. Dept. of the Interior 4).

Miami-Dade County is also working with the U.S. Geological Survey (USGS) to develop a water flow model that integrates surface and groundwater flow, in order to assess existing and future impacts on water resources in South Florida. The model will be capable of assessing the impacts of increasing water demand, changing water management practices, and climate change on the Biscayne Aquifer and the regional canal system in South Florida. It will also be able to assess salt water intrusion as a result of climate change and sea level rise, and will be an important tool in our adaptation planning efforts.

Other agencies are building resilience in Miami-Dade County as well. The District has numerous coastal gravity structures in canals throughout the region. These are designed to discharge excess water during heavy rain and storm events, and to help keep salt water from migrating into the freshwater upstream of the structure. The District has conducted a vulnerability analysis in the South Florida region, identifying several of these structures that have increasing tailwater levels, which is the water on the ocean-side of the structure. As sea level rises, this tailwater level will also rise, which will further reduce the discharge capacity of the structure. The District has specifically identified three structures as a priority for construction of new forward pumps once funding becomes available. These facilities will be designed to maintain a specific level of discharge capacity even with a certain amount of sea level rise.

GreenPrint Adaptation Strategies & Initiatives

A great deal of vital research is now underway that will increase our understanding of regional climate change impacts. Not only are temperatures and sea levels affected, but rainfall, storms, and ecological conditions are all impacted. The exact local impacts are extremely difficult to predict, given the complex drivers and dependencies, but general trends can be modeled. For example, El Niño and La Niña effects are common in the southeast, resulting in dramatic seasonal and year-to-year variations in temperature, precipitation and tropical storm development. In spite of the complexity and uncertainty associated with predicting local climate change impacts, we are able to build cost-effective adaptation strategies from our existing hazards planning efforts. During this first five-year phase of our Climate Change Action Plan (CAP), the majority of adaptation planning efforts outlined below will revolve around gaining a better understanding of the potential future climate changes our region may experience. This better understanding will arm us with critical knowledge necessary to develop planning tools that will help us evaluate potential resulting impacts, which in turn will allow us to better plan and prepare our community.

Strategies

- Track local and regional climate change indicators and trends
- Develop local and regional climate change scenarios depicting various impacts and time frames
- Integrate future climate change impacts into community and government decision-making for capital, operational, and land-use issues

The following initiatives are a step-by-step approach to build upon our current programs and successes, and turn science into action.

1. Track local and regional climate change indicators and trends
- Track local and regional indicators and trends such as sea level rise, temperature, precipitation and tropical storms
- Conduct a pilot project to assess the feasibility of using existing monitoring efforts and determine if the information can be used as vital signs of climate change
- Develop consensus-based graphic communication tools from the pilot project, reporting the monitoring data such as maps, bar graphs, and "stoplights"
- Develop a working group to analyze potential climate change related to public health impacts (for example infectious disease changes and heat related illness)
- Report periodically on the status of climate change indicators and trends

2. Develop local and regional climate change scenarios depicting various impacts and time frames
- Develop local and regional sea level rise scenario maps
- Develop planning maps and tools for Miami-Dade County based on consensus of Southeast Florida Climate Change Compact (Compact) planning scenarios
- Continue existing local surface water, ground water and salt water intrusion modeling projects, incorporating expected climate change impacts (i.e. changes in temperature, precipitation, sea level rise, etc.) and integrating with regional water modeling projects from the District and other South Florida Climate Change Compact partners

3. Integrate future climate change impacts into community and government decision-making for capital, operational, and land-use issues
- Analyze sea level rise scenario maps to model buildable/livable footprints and correlate economic scenarios
- Examine the implications of sea level rise on vulnerable facilities (i.e. solid waste facilities, and water and wastewater utilities)
- Develop mechanisms for organizations to integrate potential climate change impacts into capital and operational decision-making
- Continue to implement the Stormwater Master Plan

Southeast Florida is experiencing events that we can and should use to help us move forward in our understanding and planning for potential climate change impacts. While global climate change cannot be attributed to any one of these events, the longer-term threat to the region is clear. We must take advantage of the experience and knowledge gleaned from each extreme weather event to make our community more resilient to climate change. By informing ongoing planning and management efforts with the best available climate projections, programs such as hazard mitigation, floodplain management, and water resources management can pursue win-win strategies that accomplish multiple goals through coordinated cost-effective actions. We can also pursue a practical approach to climate adaptation by prioritizing actions that can reduce current exposure to hazard losses as well as addressing future vulnerabilities. These actions reap significant current and near-term benefits regardless of how the long-term scenarios unfold. By taking science, knowledge and experience to action, we ensure a more resilient future for our community.

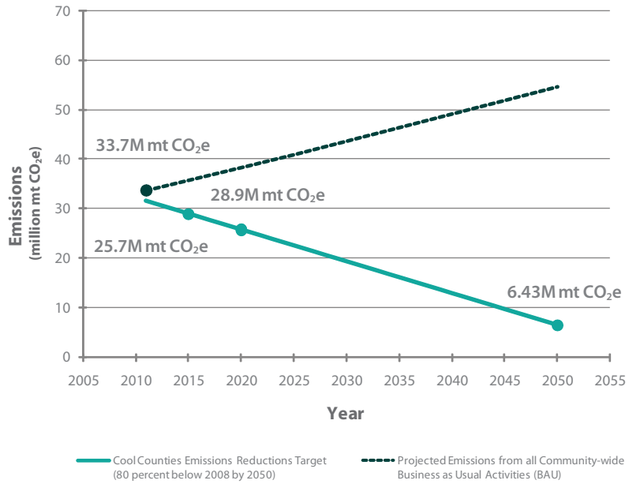
III. Climate Change Mitigation Plan – Reducing Greenhouse Gas Emissions

Our Baseline and Reduction Targets

This portion of the Climate Change Action Plan (CAP) rolls up all the goal area initiatives that reduce or avoid GHGs. Any responsible community must realize that it is equally important to maintain and even increase efforts to mitigate, or reduce GHGs while moving forward with adaptation planning. Miami-Dade County has long been a recognized leader in its commitment to reduce GHGs and has implemented numerous programs and policies over the years. This includes implementation of programs such as the Long-term CO_2 Reduction Plan, creation of the Climate Change Advisory Task Force (CCATF), membership in the Chicago Climate Exchange (CCX) pilot program, participation in the U.S. Cool Counties Program, and the joint establishment of the Southeast Florida Regional Climate Change Compact. ***GreenPrint*** will build upon this foundation by expanding upon the success of existing programs, identifying new opportunities, and leveraging these new opportunities with additional resources.

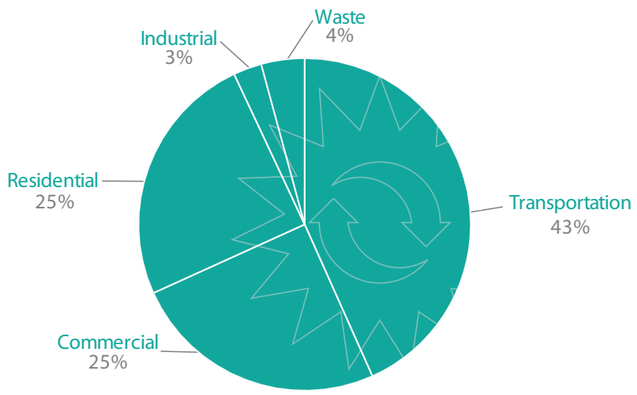
As one of the first participants in ICLEI's Cities for Climate Protection, Miami-Dade County has completed all five milestones and therefore has extensive experience in developing and implementing a formal climate mitigation program. By signing onto the Cool Counties Climate Stabilization Declaration in 2008, the County renewed its commitment and agreed to the terms of, "creating an inventory of county government (operational) GHG emissions and implementing policies, programs and operations to achieve significant, measurable and sustainable reduction of operational GHG emissions" in order to "help contribute to the regional reduction targets of 80 percent below current [2008] levels by 2050."

Miami-Dade County Greenhouse Gas Emissions Business as Usual Versus Reduction Targets



This graph illustrates the gap between doing nothing (business as usual) versus making aggressive changes to the way we operate. The ***GreenPrint*** initiatives begin to address the gap.

Miami-Dade County 2005 Community-wide Emissions Inventory by Community Sector



This chart illustrates total community-wide GHG. Clearly transportation, commercial and residential sectors are major contributors with significant potential for reductions.

This will be achieved by developing a GHG emissions inventory and regional plan that establishes short, mid, and long-term GHG reduction targets, with recommended goals to stop increasing emissions by 2010, and to achieve a 10 percent reduction every five years thereafter through 2050. The CCATF evaluated the Cool Counties commitment and recommended a countywide reduction goal of 20 percent below 2008 emission levels by the year 2020. In order to meet the estimated 2015 emissions target of 28.9 million metric tons of carbon dioxide equivalents (mt CO_2e), we would need to reduce emissions by approximately 6.8 million mt CO_2e at the end of this first five-year phase of ***GreenPrint***. Although the County has been taking steps to reduce GHG since the early 1990's, these new commitments will require us to significantly enhance our efforts, both community-wide and internally.

As one of the first steps in this renewed commitment, Miami-Dade County established a community-wide GHG baseline for calendar year 2005; an estimated 30.7 million mt CO_2e. County staff also calculated an emissions baseline for our internal operations, which totaled approximately 983,000 mt CO_2e, or about three percent of community-wide emissions. Emissions are converted to CO_2e based on their 100-year global warming potential using ICLEI's Clean Air and Climate Protection (CACP) software. The adjacent chart shows the overall community GHG emissions from energy use, broken down by community sectors, as in the CACP software. The emissions under this umbrella include all emission sources, both mobile and stationary. Emissions from the waste sector are primarily due to methane (CH_4) released from the landfills, which is approximately 21 times more potent as a GHG than carbon dioxide (CO_2). The County will measure progress in its emission reduction efforts from both the overall community-wide baseline and the internal government operations baseline. Before proceeding with the discussion of emission reduction efforts, it is helpful to define how a few terms will be used.

Direct versus Indirect Emissions

Direct emissions are emissions produced from sources within the boundary of an organization and as a result of the organization's activities; in other words, direct emissions are from sources that are under a particular organization's ownership and control. For example, the power company that generates electricity in a coal-fired power plant is a direct emitter.

The businesses that purchase the electricity, however, are indirect emitters. Indirect emissions are emissions generated in the wider economy as a consequence of an organization's activities, but occur at sources that are owned or controlled by another organization. Indirect emissions should not be confused with indirect impacts, which are impacts that may not immediately result in emission reductions, but rather impact them indirectly such as, codifying the sustainability planning process and creating a formal leadership structure for ***GreenPrint*** implementation.

In any case, all direct (on-site, internal) and indirect emissions (off-site, external, embodied, upstream and downstream) need to be taken into account when looking at the big picture.

Emission Impacts Defined

There are three types of emission impacts referenced in *GreenPrint*:

1. Emissions Reductions - Decreases in emissions resulting from cutting emissions that are measured in Miami-Dade County's community-wide baseline (think decreasing electricity purchases);
2. Emissions Offsets - Project-based emission reductions made outside the scope of the baseline used to counterbalance or compensate for emissions from other activities (think forest carbon sequestration);
3. Emissions Avoided - Emissions that are prevented from ever occurring through the implementation of a project or program (think carpooling, which takes cars off the road, "avoiding" emissions from those cars).

While "direct" emission reductions directly decrease the GHG footprint of Miami-Dade County, "offsets" and "avoided" emissions also help the cause. The explanations below help explain how.

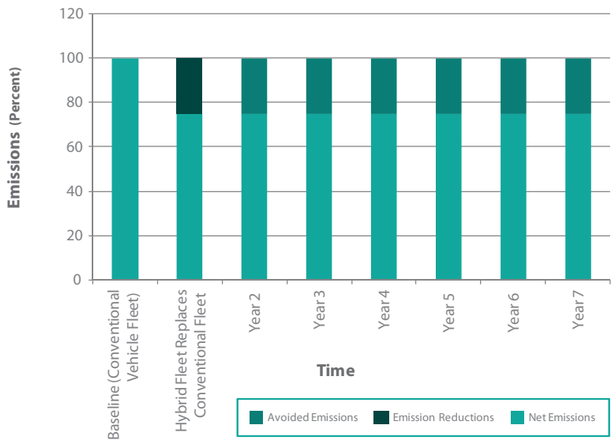
Miami-Dade County Emissions Reductions

Reductions are direct cuts in emissions that reflect decreases in energy or fuel consumption relative to a baseline year. Emission reductions come primarily from reduced and more efficient use of fuel as well as increased energy efficiency and conservation in residential, commercial and industrial buildings. An example of this is the initiative to reduce electricity use in internal County operations by 20 percent of 2007 levels by the year 2014. To achieve this goal, we might retrofit buildings to improve their energy performance and thus reduce their resultant emissions. It is important to note, however, that efficiency does not always result in emission reductions. For example, if we replace a fleet of conventional vehicles with their hybrid counterparts that are 25 percent more fuel efficient, we will achieve emission reductions. However, if we supplement our existing vehicle fleet with hybrid vehicles, despite the increased efficiency, the net impact will be increased emissions. In order to achieve real emission reductions, we must reduce below emission levels in our baseline year. This requires accounting for growth by increasing efficiency in baseline operations. This is a difficult task, since the County has experienced tremendous population growth over the past several decades, and projections show this trend will continue. A way of reconciling this is to also track emission reductions per capita, a useful metric by which to measure progress toward our emission reduction goals. This frames emission reductions in terms relative to growth rather than in absolute terms.

Miami-Dade County Emissions Offsets

Emissions offsets are produced by mitigation projects that sequester, destroy or reduce GHGs. Every active or proposed GHG cap-and-trade program worldwide includes a role for project-based emission reduction credits or offsets. Mitigation projects must meet eligibility standards and undergo independent verification before they can be issued tradable offsets in recognized trading systems. While each project type has its own set of criteria, the defining requirement for offset projects is that they are practice-changing, or go beyond business as usual. Miami-Dade County is currently exploring quantification of offsets from carbon sequestration in trees in our Environmentally Endangered Lands program.

Graphical Representation of Emission Reductions and Avoideances Over Useful Life of a Vehicle



When replacing a fleet of conventional vehicles with their hybrid counterparts that are 25 percent more fuel efficient, after the first year, emissions will be reduced for the fleet by 25 percent. In future years until the end of product's useful life, no further reductions will be accomplished. Instead, emissions will be avoided annually.

Miami-Dade County Emissions Avoided

In the context of ***GreenPrint***, we are using the term "emissions avoided" to capture the emissions not produced over the life of a project's implementation, and in instances where it may be complex to predict emission reductions.

When emission reducing activities are initially put in place, we will see emission reductions, which will count toward our reduction target. By calculating avoided emissions for the life of a project, we can track the emissions that would have otherwise occurred had the project not been implemented. To use the example cited above, if we replace a fleet of conventional vehicles with their hybrid counterparts that are 25 percent more fuel efficient, after the first year, we will have reduced emissions for that fleet by 25 percent. In future years, we will continue realizing those reductions but they will not reduce our net emissions any further. By replacing the conventional vehicles, however, we are avoiding emissions that would have otherwise taken place. A reasonable time to track avoidable emissions is over a product's useful life. For example, the useful life of a vehicle might be seven years.

We can also use avoided emissions to calculate the positive benefits of increasing public transit. While deploying more trains and buses increases overall fuel use, its net impact can be expected to reduce personal vehicle miles traveled, and thus have a positive impact on emissions management overall. While we may not be able to predict or estimate emissions reduced from this type of project, we can develop a measurement for emissions avoided by increasing ridership.

Our Electricity Source

Florida Power and Light (FPL) is the principal provider of electricity for Miami-Dade County. Two FPL power plants lie within Miami-Dade County boundary. Turkey Point, located on Biscayne Bay, holds two nuclear power units and is also an oil and gas facility. The 2,337.5 megawatt (MW) plant has the capacity to meet the annual electricity needs of more than 450,000 homes. Cutler Ridge, an oil and gas plant, has a considerably smaller capacity of 236.5 MW (FPL). Homestead Electric, a municipal-owned utility, also serves Miami-Dade County, but supplies less than one percent of its electricity. In 2008, 219.6 million megawatt hours (MWh) were consumed in the State of Florida, approximately 27.3 million of which were used by Miami-Dade County homes, businesses and government operations (United States. Dept. of Energy. EIA, Florida Electricity Profile n.pag.). Thus, Miami-Dade's electricity consumption represented roughly 12.5 percent of Florida's total consumption, while its residents accounted for about 13.5 percent of the state population.

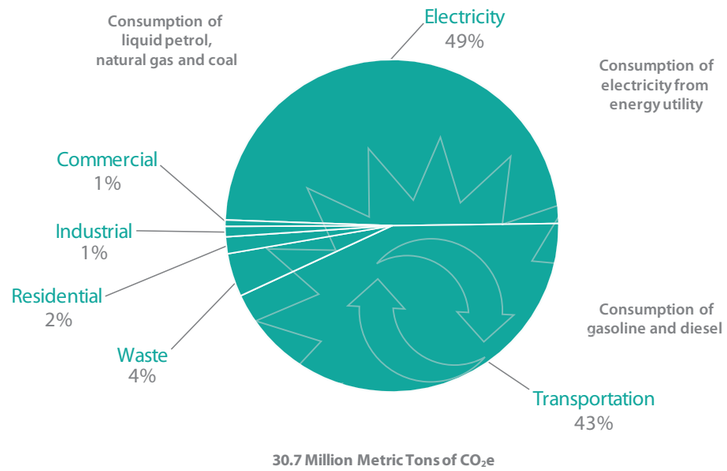
According to FPL, in 2005, 19 percent of its energy came from nuclear power, 42 percent from natural gas, 17 percent from oil and five percent from coal. The remaining 17 percent is purchased power. Because it is difficult to know the emissions associated with the purchased power, which is a significant portion of FPL's energy mix, Miami-Dade County uses verified default emission values from the Southeastern Electric Reliability Council that are integrated into ICLEI's CACP software, as opposed to the factors published by FPL that have not yet been verified by a third party.

Where should we focus?

In order to determine the best strategies to employ to reduce emissions, it is important to look at the emissions data from a different perspective. When the 2005 emissions baseline is viewed by end-use, as in the adjacent figure, it is apparent that electricity and transportation are by far the greatest contributors to community-wide emissions, at 49 percent and 43 percent respectively. The small remaining components shown for residential, industrial and commercial sectors in this chart are from other fossil fuels such as coal and natural gas.

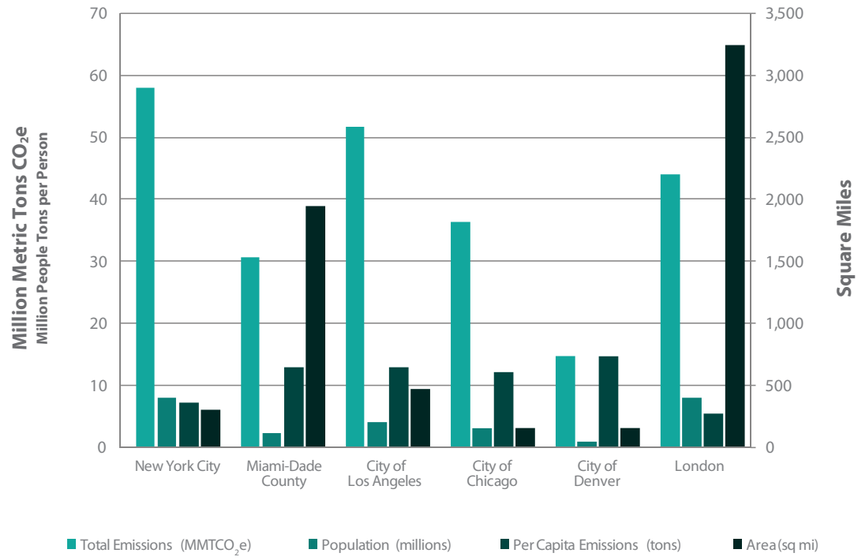
From yet another perspective, we see our overall emissions are not as high as some of our peer communities, but our per capita emissions are higher than several of those communities. Our opportunity and our challenge is to achieve significant emissions reductions through changes in electricity and personal vehicle use.

Miami-Dade County CY 2005 Community-wide Emissions Inventory by Consumption Source and Sector



This chart illustrates that electricity use and transportation are the largest sources of GHG and provide the greatest opportunities for reductions.

Greenhouse Gas Emissions Comparison by City



The graph depicts emissions totals for five major cities and Miami-Dade County. While our GHG are lower than several cities depicted, our non-compact development pattern contributes to a relatively high per capita GHG.

A New Normal

Although the recent downturn in the economy has caused much hardship nationwide, it does present a clear opportunity to begin to move the needle towards efficiency and sustainability. A tougher economy has forced behavior changes to decrease spending, increase savings and shift from gross consumerism to a more frugal lifestyle. Our community has seen obvious indications of this as reflected in a downward trend in the amount of waste in our solid waste management system, lower fuel emissions in our fleet, and increased ridership in our public transportation system during periods of higher fuel prices. The challenge and opportunity is to take advantage of an otherwise negative situation and allow it to become the new normal. How do we as a society and as a government avoid the temptation to grow, build, and pollute to the levels of just a few years ago? How do we manage growth, consume only what we need, conserve water and energy and recycle more? ***GreenPrint*** is our action plan to do so.

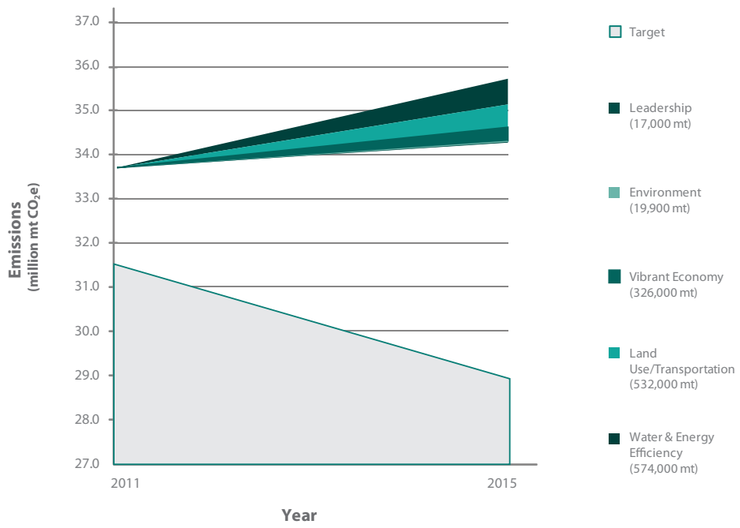
GreenPrint Goal Area Initiatives with Emission Reduction Impacts

The following is a discussion of the ***GreenPrint*** goal area initiatives that specifically contribute towards our climate mitigation goals and efforts, either directly or indirectly. As can be seen here, Water and Energy Efficiency and Responsible Land Use and Smart Transportation are the two goal areas that contribute the greatest estimated emissions reductions towards the reduction target, followed by Vibrant Economy and Strong Leadership, Connections and Commitment. It is important to note that some of these initiatives will not be underway until the second or third year of this first five-year plan, while others may take several years to begin realizing emission-reduction benefits. As a result, we expect emissions benefits from some initiatives will increase significantly during subsequent phases of the long-term ***GreenPrint*** Plan, particularly if additional resources are invested to leverage these initial gains.

GreenPrint Goal Area Emission Reductions & Avoidance Summary

Goal Area	Emission Reductions (mt CO_2e)	Emission Avoidances (mt CO_2e)
Leadership, Connections & Commitment	17,000	26,000
Water & Energy Efficiency	574,000	2,030,000
Our Environment	19,900	66,200
Responsible Land Use & Smart Transportation	532,000	608,000
Vibrant Economy	326,000	326,000
TOTAL	1,470,000	3,050,000

Greenhouse Gas Emission Reductions by GreenPrint Goal Area



This chart shows how quantifiable ***GreenPrint*** initiatives contribute to the 2015 ten percent reduction target established through the Cool Counties commitment. These are the initial steps on a 40-year path to the 2050 target. It is anticipated that the impact will be accelerated in later years.

The Role of Strong Leadership, Connections and Commitment

Strong Leadership, Connections, and Commitment are invaluable elements of the economic, environmental, and social pillars that comprise sustainability. Decision-making by leaders in public and private organizations plays a critical role in ensuring a lasting high quality of life for our residents and visitors. While most of the strategies and initiatives grouped within this goal area have considerable benefits and are connected to other goal areas, many of the emission-reduction benefits are indirect. However, leadership and commitment are the driving forces that will result in the initiatives that produce measureable benefits in the future.

Strong Leadership, Connections and Commitment Strategies Contributing to Climate Action Plan Mitigation Efforts

- Be green government role models

The initiatives in the Strong Leadership, Connections and Commitment Goal Area reduce emissions by 17,000 mt CO_2e and avoid 26,000 mt CO_2e.

Strategy: Be green government role models

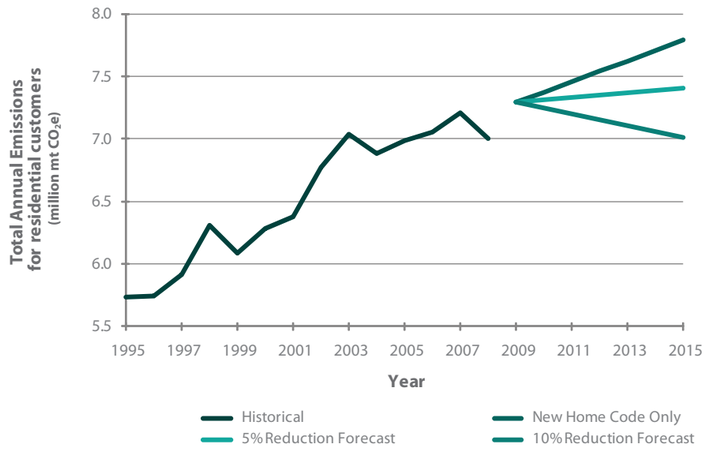
This strategy focuses on leadership initiatives that leverage a broad jurisdictional influence to promote sustainability and reduce GHGs. Miami-Dade County is large in geographic size and population and has expertise in natural resources management, emergency management, public health, transportation, construction, and sustainability. As a result, Miami-Dade County elected officials and administrators can work with partners of public policy at local, regional, state and federal levels. Since many of the County's regulations and policies have countywide jurisdiction, the County is uniquely positioned to work with municipalities to impact local on-the-ground activities that could lead the entire community toward sustainability.

The Climate Change Connection

At this time, we can calculate emissions benefits for the last initiative in this strategy, which is to adopt an existing draft County Ordinance (per Resolution R468-06) requiring water efficiency retrofits at point of home resale (prior to changing ownership) and later update the ordinance to require additional retrofits focusing on energy efficiency. The purpose of this initiative would be to accelerate community-wide water and energy efficiency. Energy conservation retrofits would include home energy uses that are not currently covered by Florida's Energy Code, such as pool pumps, since these uses now account for more than 55 percent of home energy use.

In assessing the GHG emissions impact of point-of-sale home efficiency retrofits, staff used methodology and assumptions that are further detailed in Appendix A. For illustrative purposes, two years of reductions are estimated within the five year time frame of our first ***GreenPrint*** plan. During this time, energy efficiency per household may increase by 17 percent, potentially resulting in 17,000 metric tons of GHG emissions reductions and 25,000 metric tons of GHG emissions avoided. Implementing this ordinance will affect almost one percent of all home energy consumption in just this short time period. The impact of this initiative should continue to grow over the years.

Residential Emissions Projections



This graph illustrates potential impacts from requiring energy retrofits at the time of home sales. Clearly, increasing sales would result in higher energy savings and lead to greater emission reductions. As home sales and retrofits remain consistent, our emissions are reduced to a new normal.

The Role of Water and Energy Efficiency

The relationship between the water sector and the energy sector is complex and highly interdependent. Water treatment and delivery, as well as wastewater treatment, are primarily dependent on electricity, along with other energy sources. These energy sources in Miami-Dade are all significantly fossil-fuel based and therefore, as highlighted earlier, energy and water use contribute heavily to GHG emissions. As water demand grows, so grows energy demand. Since population growth drives demand for both resources, water and energy demand follow similar growth rates. Saving a unit of water reduces the amount of energy used and the GHG generated to collect, treat, deliver, consume, treat, and dispose of it as wastewater. Therefore, every gallon of water saved translates to a GHG emission reduction.

Water and Energy Strategies Contributing to Climate Change Action Plan Mitigation Efforts

- Reduce energy and water consumption through increasing efficiency
- Improve energy planning through public-private partnerships
- Continue Water and Energy efficiency and conservation campaigns
- Expand alternative fuel (biodiesel/waste-based biodiesel) and renewable energy industries
- Be government leaders in energy, fuel, and water efficiency

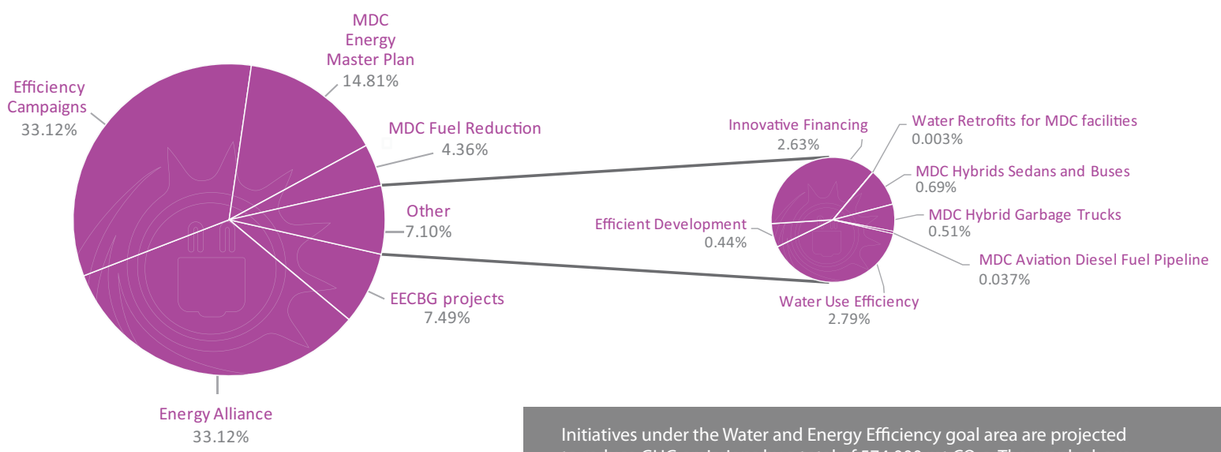
The Climate Change Connection

In Miami-Dade County it is estimated that producing one million gallons of potable water uses approximately 1,203 kWh, 46.4 therms of natural gas and 10.7 gallons of diesel, which translates into 1.03 mt CO_2e.

In addition, energy demand in the water sector will likely increase over time due to a number of factors, including population and urban load growth; increased water and wastewater treatment due to more stringent water quality regulations; and market, economic, regulatory, and legislative changes. By continuing to implement ***GreenPrint***, Miami-Dade County will be on the way to stabilizing GHG emissions from potable water production.

The initiatives in the Water and Energy Efficiency Goal Area reduce emissions by 574,000 mt CO_2e and avoid 2,030,000 mt CO_2e

Percentage Breakdown of Greenhouse Gas Emissions Reductions for Initiatives within the Water and Energy Efficiency Goal Area



Initiatives under the Water and Energy Efficiency goal area are projected to reduce GHG emissions by a total of 574,000 mt CO_2e. The graph above represents the contribution of each initiative towards the total on a percentage basis.

Strategy: Reduce water and energy consumption through increasing efficiency

This strategy is a collection of four initiatives that address community efficiency and conservation of electricity and water: water use efficiency, efficient development, federal Energy Efficiency and Conservation Block Grant (EECBG) projects, and innovative financing. These initiatives include measures intended to achieve high levels of energy efficiency in new homes and buildings, as well as existing buildings undergoing substantial renovation. Our biggest challenges and opportunities to achieve energy efficiency lie within the existing building stock. Enforcing the Florida Energy Code and implementing recommended alterations to the existing code and permitting process in Miami-Dade County, will help ensure that all new construction and substantial rehabilitation projects will achieve energy and water savings that extend over the life of the building. In addition, this strategy extends and builds upon existing successful water conservation initiatives that reduce GHG emissions related to water use by 16,000 mt CO_2e. In summary, when implemented, the initiatives under this strategy will result in projected emissions reductions of 76,630 mt CO_2e over the five-year ***GreenPrint*** period and avoidances of 1.45 million mt CO_2e.

Strategy: Improve energy planning through public-private partnerships

The opportunities for using energy more sustainably in our County are great, but collaboration among sectors is essential to seizing them. The adage "the whole is greater than the sum of its parts" is relevant to the approach our community takes in regard to energy management. Responsible management of energy is as much a societal challenge as it is economic and political. Florida's per capita residential electricity demand is among the highest in the country, due in great part to high air-conditioning use, particularly during hot summer months. Much of this energy is used wastefully; buildings are often shockingly cold. Retailers invite tourists to peruse their shops and restaurants with open doors that exude a frigid draft. Practices will have to change if residents are to change the patterns of our energy use.

An alliance made up of a diverse group of stakeholders can address these complex challenges across sectors and can identify market-based solutions. Whether it launches awareness campaigns, finances building retrofits, or coordinates rebate programs, an alliance can create community-wide programs that reduce and conserve energy and natural resources, achieving important emissions reductions. In addition, an alliance can create linkages with other existing organizations that focus on efficiency and GHG reduction, such as the Building Owners and Managers Association (BOMA). The alliance will seek to broaden the uptake of energy efficiency retrofit projects, and therefore it is estimated to reduce 190,000 mt CO_2e and avoid 305,000 mt CO_2e.

Strategy: Continue energy and water efficiency and conservation campaigns

While great emphasis is placed on new fuels and technologies, it is critical to realize that efficiency and conservation are proven to be the simplest and most cost-effective ways to achieve reductions today. If our community wants to save energy and water, it is important that our residents become aware of the resources they consume, and ways to reduce their consumption. Simple changes in behavior can quickly lead to significant energy and water savings. While it is well known that saving energy and water is a good thing, people are also often motivated by opportunities to save money. Through water and energy efficiency and conservation campaigns, County residents and business owners are challenged and empowered with the tools to reduce their consumption and their utility bills, through a series workshops, saving challenges, rebates, retrofits and exchanges. Participating residents can see the costs associated with energy and water go down while protecting energy and water resources. Overall this strategy has the potential to reduce 190,000 mt CO_2e and avoid 305,000 mt CO_2e.

Strategy: Expand alternative fuel (biodiesel/waste-based biodiesel) and renewable energy industries

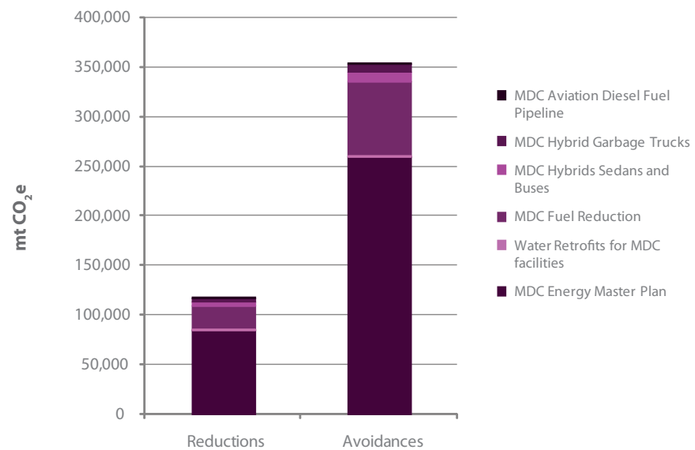
As stated earlier, the most accessible and cost-effective way to reduce water and energy consumption is through efficiency and conservation initiatives. Keeping this in mind, initiatives within this strategy take the next step by encouraging the use of renewable energy sources that can provide overall sustainability benefits to our community: sustainably-sourced biodiesel (including waste-based biodiesel) and renewable energy. The use of these non-traditional energy sources can be accelerated through the deployment of technology and building local infrastructure. Since the State of Florida does not have a renewable portfolio standard, and our community is not aggressively pursuing distributed solar installations (decentralized solar electricity generation) or energy-efficiency (except for peak-demand management), initiatives under this strategy address the need to incentivize the market for renewable energy. Because the first step to renewable energy deployment is to perform energy efficiency retrofits (to avoid oversizing systems which worsens performance and increases costs), this should stimulate the energy efficiency market as well.

Because all renewable and alternative fuels are not the same, new fuels should be analyzed to ensure that they are sustainably sourced and have net environmental benefits. To estimate the impacts of renewable and alternative fuels on GHG emissions, the entire fuel lifecycle including fossil fuel extraction or feedstock growth, fuel production, distribution, and combustion should be evaluated.

No emissions reductions were calculated for this strategy; however, it is clear that by displacing the use of fossil fuels, vast GHG emissions reductions can potentially be achieved.

This is a graphical depiction of the emissions reductions and avoidances associated with County-specific Water and Energy initiatives. These are new initiatives that will build upon existing and recurring efforts.

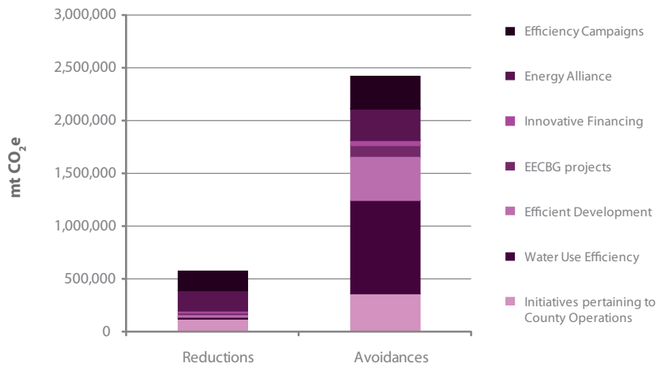
Emissions Impact Benefits of Miami-Dade County Operations Initiatives from the Water and Energy Efficiency Goal Area



Strategy: Be government leaders in energy, fuel, and water efficiency

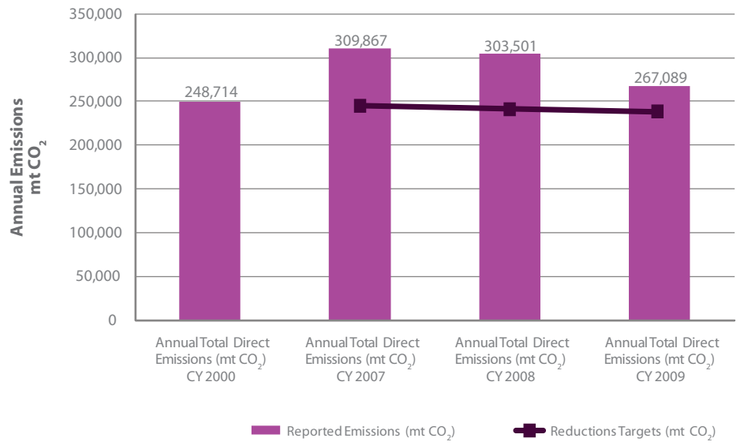
This strategy is a collection of 10 initiatives that address conservation of electricity, fuel and water in Miami-Dade County government operations. This strategy contains initiatives that build on current successes such as collecting energy-related data and reporting emissions. For example, when the CCX pilot program for direct emissions ends, the County will continue to collect data and report these emissions related to government operations. This will ensure continued leadership in the area of energy, fuel and water efficiency. This strategy area also contains new initiatives such as developing and implementing a government energy efficiency master plan. In many cases these initiatives involve developing new procedures and intensive data gathering that enable the County to identify operations that use the most resources; this information will then be used to prioritize future actions to reduce energy and water consumption even more and in a cost-effective manner. Initiatives that facilitate new procedures or expanded use of technological solutions will be assessed to ensure net sustainability benefits. Overall these initiatives will reduce GHG emissions by 117,128 mt CO_2e and avoid 355,000 mt CO_2e.

Emissions Impact Benefits of Community-wide Initiatives from the Water and Energy Efficiency Goal Area



This is a graphical depiction of the emissions reductions and avoidances associated with Water and Energy initiatives. The bulk of initiatives will provide greater impact beyond the ***GreenPrint*** 2015 timeline.

Fuel Emissions of County Government Operations Chicago Climate Exchange



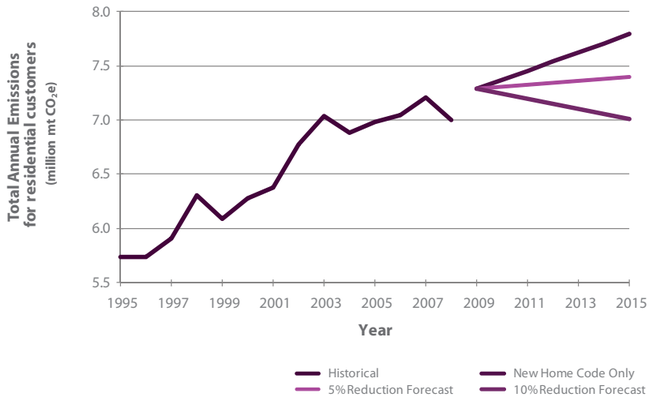
The adjacent chart shows data from the Chicago Climate Exchange (CCX) Program, one of Miami-Dade County's ongoing initiatives for tracking and reducing direct fuel emissions resulting from government operations. In this case, data was collected and emissions calculated according to CCX protocol. While CCX targets have not been met, the trend is in the right direction.

Miami-Dade reduced its fuel-related direct emissions by 42,778 metric tons of CO_2 from 2007 to 2009.

Furthering Emissions Reductions

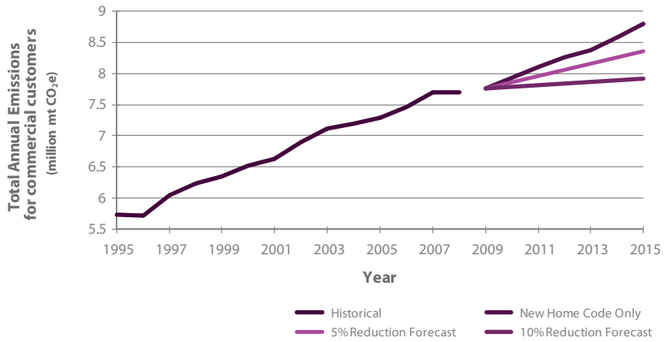
The strategies and initiatives to reduce energy and water use are, in almost every case, supportive of the ***GreenPrint*** Climate Action Plan's mission. By using energy and water more efficiently and more conservatively, we realize GHG emission reduction benefits. It is important to keep in mind that the projected GHG emission reductions are estimates based on realistic goals achievable within a foreseeable timeframe. In almost all cases, the potential for GHG emission reductions are greater than the plan reflects; some of them may increase exponentially after the first five years. Further reductions can be achieved by increasing financial investments in the initiatives, developing broader marketing plans, and adopting policies that enable greater participation in programs.

Forecast Scenario for Miami-Dade County Residential Sector Emissions Projections due to Electricity Consumption



These figures show additional emissions reductions based on electricity forecast for the residential and commercial sector if customers opt to improve existing buildings five percent or ten percent beyond what is required by the Florida Energy Code, thus resulting in more efficient buildings. As depicted in the graphs, more aggressive reductions in energy consumption result in greater emission reductions.

Forecast Scenario for Miami-Dade County Commercial Sector Emissions Projections due to Electricity Consumption



This can be illustrated by examining the strategy to incentivize energy efficient development. This initiative involves increasing energy efficiency in existing buildings and reaching total compliance with the Florida Energy Code for new construction. As a result of increasing the energy efficiency of buildings, their associated emissions are also reduced. The initiative milestones include: implementing recommendations from the Sustainable Code and Permitting Project (underway) pertaining to sustainable development; developing an incentive package such as reduced impact fees, intensity bonuses, and expedited permitting for green projects; developing a training program for building inspectors in order to attain total compliance with the Florida Energy Code; and marketing the program to property owners through websites and educational workshops. The projected emission reductions are based on a participation of 350 residential projects and 150 commercial renovation or expansion projects. These figures show projections in the emissions output of the average residential and commercial electric utility customer at different levels of energy performance. The more customers that opt to participate, the more emissions will be reduced; likewise, to the degree that the buildings are more efficient than required by code, the more emissions they reduce as a result.

Every initiative in the Water and Energy Efficiency goal area is designed to be scalable and achieve greater GHG emissions reductions than can be realized over the intial five-year period. In meeting its ***GreenPrint*** energy aspirational goal, emissions are projected to be reduced by 7.1 million mt CO_2e. However, emissions reductions for the Water and Energy Efficiency goal area are estimated at 574,000 mt CO_2e. While this is a first step toward meeting our reduction targets, it is important to note that further investments must be made in order to achieve County-adopted mandates.

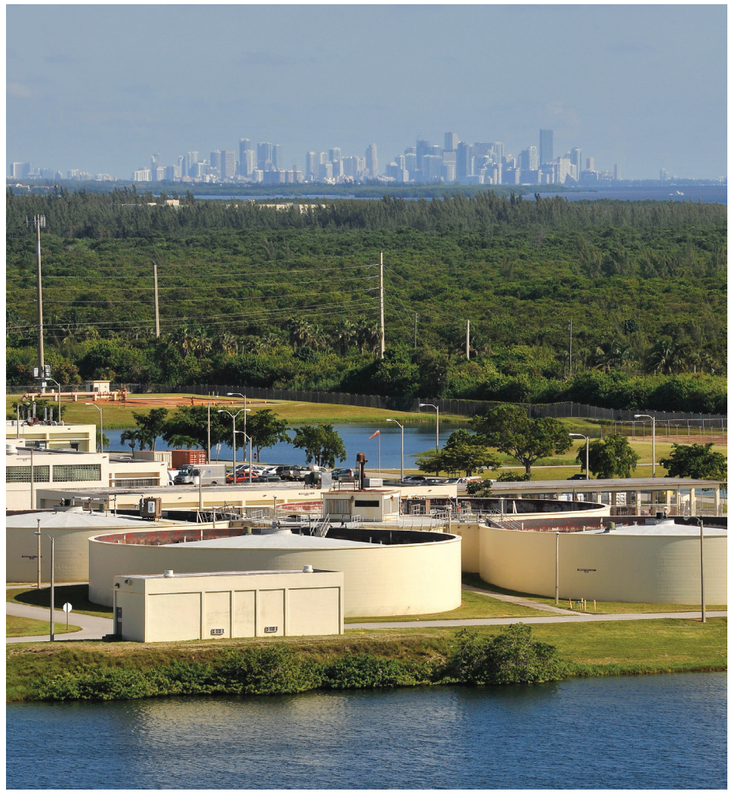
The Role of Our Environment

Our Environment is critical for the well-being of our residents, our ecosystems, and our economy. Quality air, water, marine resources, coastal habitats and wetlands are invaluable, and we work aggressively to improve and protect them. For purposes of the ***GreenPrint*** Climate Change Action Plan, the strategies and initiatives generally do not result in significant carbon emission decreases. Other sustainability benefits are numerous and tangible through storing and sequestering carbon emissions and providing healthy and livable environments. Strategies that have a beneficial impact on carbon storage, sequestration or emissions are included below.

Our Environment Strategies Contributing to Climate Action Plan Mitigation Efforts

- Implement wastewater reuse to provide future water supply and benefit the environment
- Protect environmental and other lands important for ecosystem and community resilience
- Protect, enhance, and restore our natural resources
- Develop a sustainable Solid Waste System and Master Plan, using waste to benefit our economy and environment

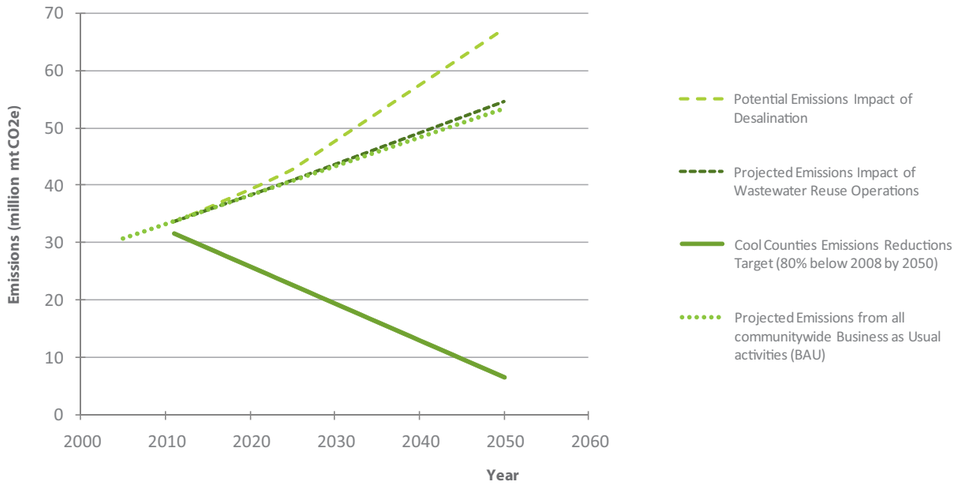
The initiatives in Our Environment Goal Area reduce emissions by 19,900 mt CO_2e and avoid 66,200 mt CO_2e.



Strategy: Implement wastewater reuse to provide future water supply and benefit the environment

This strategy includes initiatives to implement water reuse projects to recharge the Biscayne Aquifer and a pilot study to rehydrate wetlands and Biscayne Bay. As highlighted in the Water and Energy Efficiency goal area, water conservation and efficiency efforts have been successful and may even result in the postponement of planned wastewater reuse projects. Wastewater reuse projects have a clear long-term sustainability focus: preserving our drinking water supply in light of projected population increases and for ecosystem needs. On the other hand, wastewater reuse operations require more energy than current treatment. As illustrated in the next figure, these increased energy needs are significantly less than the alternative option of desalination. In fact, it is estimated that seawater desalination could use over 10 times the energy as reclaimed waste water (Cooley, Gleik, and Wolf).

Emissions Impact Comparison of Wastewater Reuse to Desalination



The above figure illustrates that increased emissions associated with wastewater reuse operations are significantly less than the alternative option of desalination.

Strategy: Protect environmental and other lands that may be important for ecosystem and community resilience

This strategy contains initiatives to acquire environmentally valuable lands and explore alternative funding sources through a carbon offset program. The Environmentally Endangered Lands (EEL) Program was established in 1990 through a countywide referendum that approved a two-year tax increase to acquire, restore and maintain environmentally endangered lands. Acquisition ensures that these lands are shielded from development and will continue to thrive as natural habitats. Current acquisitions exceed 20,000 acres and include rockridge pinelands, tropical hardwood hammocks, freshwater wetlands, coastal wetlands and scrub habitat.

The Climate Change Connection

By adopting a precautionary approach that maximizes the amount of open land retained over time, opportunities to adapt to the effects of climate change are preserved over the long term. Preservation of these lands also provides considerable carbon storage and sequestration value. The following table illustrates this value for current and future acquisitions. Raising additional revenue through a carbon offset program would extend the sustainability of the current trust fund which covers both purchases and management. Determining the potential revenue stream associated with such a program will be explored within year one of the ***GreenPrint*** Implementation Plan.

The retention of natural and open land provides many critical public services such as replenishing drinking water supplies, greater flexibility in protecting against saltwater intrusion, contributing to the implementation of regional restoration efforts, conserving native wildlife and habitats, and providing recreational space. Open and undeveloped lands, whether currently under some mechanism of protection or not, offer the greatest opportunities to provide for adaptation to the effects of climate change.

Benefits of Environmentally Endangered Lands for Carbon Storage and Sequestration

Environmentally Endangered Lands (acres)	Acres	Total Carbon Stored (Metric Tons)	Total Yearly Accumulation Carbon (Metric Tons)
EEL-owned lands	20,000	4,756,287.9	9,226.05
EEL-managed lands	2,800	268,501.2	2,108.6
Total	22,800	5,024,789.1	11,334.65
Remaining acres to be acquired	17,538.1	4,004,351.7	8,216.8

Sources: (Florida Fish and Wildlife Conservation Commission, National Council for Air and Stream Improvement and the United States Department of Agriculture Forest Service, South Florida Water Management District)

The table above demonstrates the existing carbon storage and annual sequestration value we gain from preserving environmentally endangered lands. It shows currently held lands as well as those that remain on the program acquisition list. More than five million metric tons of carbon is currently stored due to the EEL program.

Strategy: Protect, enhance, and restore our natural resources

This strategy contains multiple natural resource sustainability initiatives contributing to each sustainability pillar. Natural systems provide vital habitats for fish, wildlife, and tropical plant communities, including globally imperiled species. These settings contribute to recreational and economic opportunities for residents and visitors. The beach dunes, reefs and mangrove shoreline provide a buffer against costly storm erosion. Wetlands and other open lands are natural water reserves, storing and filtering fresh water and recharging the aquifer. Air quality is generally reflective of vehicle emissions and progressive pollution controls and has direct human health impacts. Air quality is frequently used when assessing clean cities and countries.

The Climate Change Connection

Wetlands, forests, and submerged plant communities also sequester carbon, contributing to reduction in GHGs. Reducing vehicle use directly reduces air pollution as well as carbon emissions. There is significant carbon sequestration value in the initiatives to minimize the impact of development on natural resources and continue to enhance and restore coastal habitats important to the health of Biscayne Bay. Wetlands and mangroves are protected in Miami-Dade County, and many restoration projects include their creation or enhancement as well. Layers of soil and peat that make up the mangrove substrate have a high carbon content of 10 percent or more. When disturbed, carbon is released back into the atmosphere, further contributing to increased carbon emissions (Ong).

Simply stated, undisturbed wetlands and mangroves are essential in capturing carbon. The existing acreage of wetlands is estimated at more than 800,000 acres, storing more than 212 million metric tons of carbon. 451 acres of coastal habitat have been enhanced by Miami-Dade County, and this number will grow to 535 acres within the ***GreenPrint*** timeframe. Determining the existing acreage of coastal mangroves within these habitats will be determined during year one of the ***GreenPrint*** Implementation Plan.

The Benefits of Wetlands Preservation and Restoration for Carbon Storage and Sequestration

Approximate Existing Wetlands within Miami-Dade County	Acres	Total Carbon Stored (Metric Tons)	Total Yearly Accumulation Carbon (Metric Tons)
Existing wetlands (excluding EEL acres reported in Table 1)	129,617	31,945,266	54,553
Existing wetlands acres within Everglades National Park wetlands	712,670	175,643,881	299,950
Total	860,870	212,169,093	362,325

The table above demonstrates the existing carbon storage and annual sequestration value we gain from preserving estimated existing wetlands. It is estimated that more than 212 million metric tons of carbon is currently stored.

Strategy: Develop a sustainable Solid Waste System and Master Plan, using waste to benefit our economy and environment

An essential component of Our Environment is the management of the resources we use. The amount and type of waste generated by a community - and the strategies employed to manage or treat that waste - contribute to human health, the environment, land use and economic development. The initiatives within this strategy include developing a sustainable Solid Waste Master Plan, using waste and landfill gas as energy, composting and recycling.

The Climate Change Connection

Currently, the County converts waste to energy (WTE). In FY 2008-09, this equaled 304,098,000 kWh, enough electricity to power approximately 21,000 homes. This amount offsets CO_2 emissions that would have been generated by the electric utility. Since this is an existing operation, it will not count directly towards any emission reductions within the ***GreenPrint*** planning timeframe. However, the Solid Waste Master Plan may result in WTE increases or decreases that would impact the quantity of emissions as compared to alternative options.

Community-wide and Residential Recycling

As a community, we recycled approximately 21 percent of the waste stream in 2009, according to the State of Florida recycling rate methodology. This includes the County's residential curbside recycling program, the conversion of yard trash into biomass fuel, the extraction of metals from garbage at the WTE plant, and the collection of white goods. It also includes municipal recycling programs and private sector recycling efforts. Miami-Dade County has conducted residential recycling since 1994. In 2008, we transitioned from a dual to a single-stream program, increasing annual collection tonnage by 88 percent.

In assessing the GHG emissions impact of recycling, the ICLEI Clean Air and Climate Protection (CACP) software and methodology demonstrates that the overall community recycling tonnage generates 1.5 million tons of CO_2e emissions offsets in comparison to landfilling. The County residential recycling program offset 155,000 CO_2e emissions. However, impacts specific to Miami-Dade County are more complex, and a life-cycle analysis approach is necessary. This would illustrate a comparative analysis of recycling material types and disposal methods. It would incorporate energy use and associated GHG emissions for recyclable goods that are land filled in comparison to being incinerated or recycled. This effort is incorporated in the Solid Waste Master Plan, with results expected in 2011.

The Role of Responsible Land Use and Smart Transportation

Each strategy and initiative in the Responsible Land Use and Smart Transportation area contributes to the goals of the Climate Change Action Plan. These are a collection of existing and new strategies that address land use patterns, community and transit design, services provided on the system, as well as strategies to improve system efficiencies associated with growth and mobility. The actions in this goal area are expected to achieve cross-cutting benefits from reducing emissions by facilitating a shift in trips made in the personal automobile to walking, biking and public transportation, to facilitating healthier communities through actions targeting street design, parks, and bicycle and walking facilities. It recognizes the need to prioritize sustainable modes of transportation in the long term while continuing to provide increased connectivity and improved traffic flow on the existing transportation network.

Responsible Land Use and Smart Transportation Strategies Contributing to Climate Action Plan Mitigation Efforts

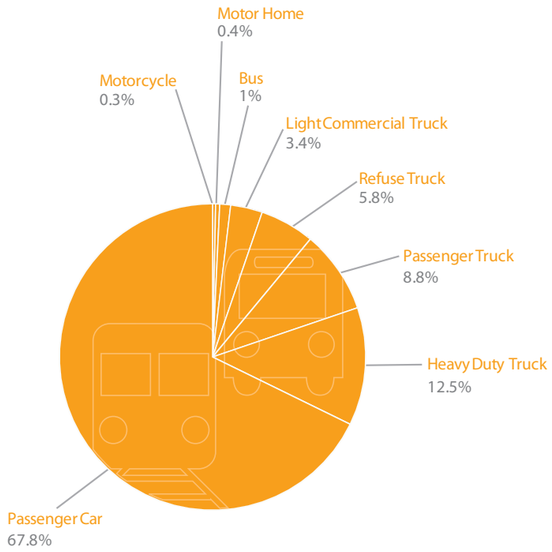
- Better integrate planning and prioritize investments
- Support existing communities and value neighborhoods
- Increase bicycling & walking
- Increase transit ridership
- Improve connectivity and mobility on the existing system

The initiatives in the Responsible Land Use and Smart Transportation Goal Area reduce emissions by 532,000 mt CO_2 e and avoid 608,000 mt CO_2e

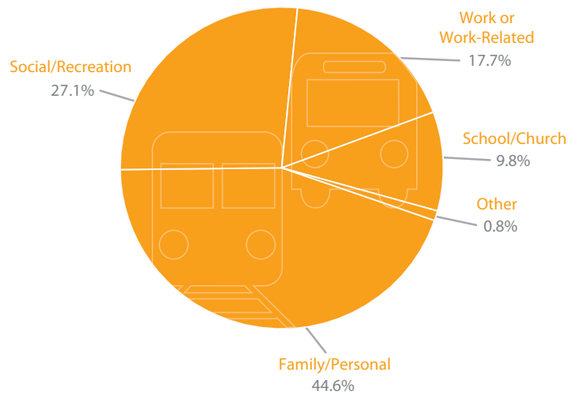
Decreasing the distances between where people live, work, play, and shop will reduce driving distances and perhaps avoid some automobile trips altogether. The figure below illustrates that the personal automobile will continue to be the greatest contributor to CO_2e emissions (10 metric tons/year), following the completion of transportation projects planned and funded through 2015 (MPO, "Emissions Scenarios"). The breakdown of trips by purpose from the U.S. Department of Transportation estimates that most trips are not work-related, but are trips that are shorter and personal, such as errands and shopping. Therefore, achieving more compact development in urban and suburban settings would make a great impact on reducing vehicle miles traveled (VMT) on the system (Urban Land Institute 5).

The personal automobile is expected to continue to be the largest source of GHG emissions within the transportation sector in 2015, contributing 68 percent of the GHG emissions . This estimate is based on transportation modeling, which includes transportation projects planned through 2015. (MPO, "Emissions Scenarios" Figure 12)

2015 Estimated Daily Greenhouse Gas Emissions by Vehicle Type



Breakdown of Trips by Purpose



Most trips are not work-related. Compact development can help people reduce car use for errands, shopping , and other personal trips. (Urban Land Institute 5)

Compact development strategies are not typically highlighted in climate change mitigation because they are considered indirect measures. They may reduce driving, but it is difficult to quantify the reductions caused by land use and zoning policies that encourage infill development. Several recent studies have analyzed and documented the effect of compact development on driving. A study published by the Urban Land Institute, "Growing Cooler: The Evidence on Urban Development and Climate Change," estimates that the five "Ds" of compact development— density, diversity, design, destination, and distance to transit—can lead to 12 to 18 percent reductions in VMT by 2050 (Urban Land Institute 20). The studies reported a wide range of reductions in VMT, five to 60 percent, which is an indication of how much there is to be learned about the effect of compact development on driving. An additional economic benefit of VMT reductions is reducing the vulnerability of residents and businesses to sudden increases in gasoline prices. For purposes of estimating the benefits through implementing this plan, a five percent decrease in VMT from compact development strategies and initiatives has been established. The target was chosen in light of the wide ranges established in the studies and is likely very conservative based on the Transit Oriented Development and rezoning efforts over the past 11 years in areas designated as urban centers. Applying a five percent reduction target to projected GHG emissions from the system in 2015, reveals a potential reduction of 500,000 metric tons of CO_2e.

What is Compact Development?

Successful compact development is a land use settlement pattern that features most or all of the following:

- Concentrations of population and/or employment;
- Medium to high densities appropriate to context;
- A mix of uses;
- Interconnected streets;
- Innovative and flexible approaches to parking;
- Pedestrian, bicycle and transit-friendly design; and
- Access and proximity to transit.

Compact development can be built anywhere. It encompasses residential and commercial development and can be adapted to urban, suburban, and rural settings. Single-family houses, townhomes, and apartments all have a place in compact development. Employment centers are also important candidates for compact development.

(Urban Land Institute 3)

To focus on how ***GreenPrint*** strategies will reduce emissions and aid in future planning and decision-making, calculations are provided below for those initiatives for which assumptions were feasible to develop. Initiatives are organized in the following strategy groupings:

Strategies: Better Integrate Planning and Prioritize Investments & Support Existing Communities and Value Neighborhoods

These strategies include a collection of initiatives addressing planning, land use, and community design, which are expected to cumulatively and indirectly achieve significant GHG emissions reductions. The overarching strategy to "Better Integrate Planning and Prioritize Investments" is designed to make future investments in an efficient transportation system that provides more choices, reduces household transportation costs, supports our unique economic engines and create close-knit, self-sufficient neighborhoods connected by sustainable transportation services. It also includes initiatives to explore opportunities to shift current funding revenue streams and to identify new and innovative funding sources and mechanisms to support transit and other sustainable modes. The second strategy to "Support Existing Communities and Value Neighborhoods" includes initiatives aimed at driving development to infill areas and redevelopment areas through such initiatives as lowering barriers to increasing densities in infill and redevelopment areas and providing incentives. Some barriers identified through the planning process include water and sewer infrastructure, poor design, and minimal connectivity. Other initiatives include providing for meaningful open spaces and recreation areas, designing pedestrian and bicycle friendly neighborhoods and providing for housing diversity.

The Climate Change Connection

The initiatives in these strategies are expected to lead to significant emissions reductions through VMT reductions prompted by more compact development. GHG emissions reduction estimates were made for the initiative "Increase Transit-Oriented Development" as indicated below. One such approach is to establish housing and mixed-use facilities near Metrorail stations. Actual ridership percentage gains realized through the affordable housing development at the Santa Clara Metrorail Station were applied to two projects scheduled for completion by 2015.

Quantified Emission Reductions Associated with Strategies

Initiative	Total Projected VMT Reduced (miles/yr)	Total Projected Reduced Emissions (mt CO_2e)
Implementation of policies and initiatives leading to compact development	5 percent decrease	500,000
Initiatives contributing to the overall 5 percent decrease, for which VMT estimates were made:		
Transit-Oriented Development-Brownsville a 467-unit affordable housing building (expected completion by 2014)	7,633,397	4,206
Transit-Oriented Development-Northside a 350-unit affordable housing building (expected completion by 2014)	14,138,547	7,791

Strategy: Increase Bicycling & Walking

This strategy is a collection of initiatives expected to shift from trips in the personal automobile to bicycling or walking trips. Actions include providing more bicycle and pedestrian facilities and amenities such as parking and end-of-trip facilities. Two innovative and potentially game-changing initiatives are to adopt a complete streets policy that will drive the prioritization of alternative and more sustainable modes of transportation in street design and construction, and the initiative to reduce the automobile parking requirements in the zoning code.

The Climate Change Connection
The goal is to increase the percentage of trips taken by walking or bicycling from 10 to 16 percent, consistent with the Federal Highway Administration's goal of 15.8 percent. Also listed are the emissions reductions expected from two specific projects where assumptions and methodologies could be established:

Quantified Emission Reductions Associated with Strategy

Initiative	Total Projected Reduced Emissions (mt CO_2e)
Increase the percentage of total trips taken by walking or bicycling from 10 percent to 16 percent of all travel trips *(over plan period of 5 years)*	128,622
Fund & Construct Priority non-motorized multi-use trails 8.4 miles of Black Creek Trail *(expected completion by July 2012)*	643
Include designated bicycle space within Metrorail cars (*1,750 bikes on trains/year beginning in 2014)*	984
Total	130,249*

***Note: - These emissions are a component of the emissions reductions estimated from compact development strategies (500,000 mtons CO_2e) and initiatives and will be discounted from those estimates in emissions summary tables. CO_2e and initiatives and will be discounted from those estimates in emissions summary tables.**

The estimated emissions reductions for the aspirational goal were established using data from the National Household Travel Survey (U.S. DOT n. pag.), which includes the Miami-Ft. Lauderdale Consolidated Metropolitan Statistical Area (CMSA) and was prorated by population as follows:

Emission Reductions to Achieve a Six Percent Increase in Walking and Biking Trips

Trip Mode	Total add. Trips 2010-2015	Miles per trip	Vehicle miles reduced	Emissions reduced (mt C02e)
Biking	85,288,323	2	170,576,647	94,007
Walking	465,430,565	0.5	232,715,282	128,252
			Total	222,259
			At 58 percent (Miami-Dade vs. Broward population)	130,249

Strategy: Increase Transit Ridership
This strategy is a collection of initiatives that include implementable transportation improvements along priority corridors, linking the Metrorail to Miami International Airport (MIA), establishing strategically located Park & Ride facilities, and other service and efficiency improvements. With limited funding for new capital projects and increasing operation and maintenance costs, a series of low-cost efficiency actions are being prioritized. These initiatives are not listed below as they do not provide direct emissions reductions but are expected to increase ridership, particularly boosting "choice ridership," attracting those individuals who could drive their cars but who choose to ride transit instead because of the conveniences and other benefits. Non-quantified initiatives include developing social marketing campaigns to make riding transit "cool," continuing to improve safety, increasing technology features including real time bus signage announcing arrival times and Wi-Fi availability, and improving access and amenities at transit stops and stations for all users.

The Climate Change Connection
All initiatives in this strategy contribute to achieving the overarching aspirational goal to add 10 million boardings to our public transportation system through increased services, enhancing convenience, comfort, and timely service. True to the interlinked nature of land use and transportation, initiatives grouped under the first strategy in this area, such as increasing transit-oriented development, also contribute to an increase in ridership. Other contributions to reductions are expected from initiatives that target transit service improvements and other low-cost efficiency improvement-type actions.

The table below illustrates the aspirational goal of increasing transit ridership by 10 percent, or 10 million boardings, along with estimated gains from additional percentage increases:

Emission Reductions from Increasing Transit Ridership

Miami-Dade County	Metro Bus	Metrorail	Metro Mover	Total
If we increase transit ridership by	Reduced emissions from ridership increase in mt CO_2e			mt CO_2e
10 percent	18,747	7,238	463	26,448
20 percent	37,495	14,476	926	52,897
30 percent	56,242	21,714	1389	79,345
40 percent	74,990	28,952	1852	105,794
50 percent	93,737	36,191	2315	132,242

Specific reductions calculations were possible for a few initiatives within this strategy, one of which is to improve transit services and to develop transit ridership within priority corridors so premium transit service, such as bus rapid transit or a rail transit system, can be implemented successfully when deemed feasible. Corridor improvements include articulated hybrid buses, improved transit stops, Wi-Fi, traffic signal priority, improved headways, and Park and Ride facilities. (MPO, "Draft Near Term"15). Ridership projections were made for these planned improvements and are the basis for the emissions reduction estimates. Estimates were also calculated for Park and Ride facilities planned for specific locations based on parking capacities of several planned facilities. Opportunities for public-private partnerships to establish Park-and-Ride facilities, as a part of transportation concurrency requirements for new developments, are being pursued. Finally, ridership increases were projected for the AirportLink system expansion connecting the Metrorail to the Miami Intermodal Center and, eventually, MIA.

airportlink

An additional two million Metrorail boardings expected each year with the completion of the Airport Link, which connects the Metrorail to Miami International Airport.

Quantified Emission Reductions Associated with Strategy

Initiative	Total Projected Reduced Emissions (mt CO_2e)
Add 10 million boardings to our public transportation system through increased services, enhancing convenience, comfort, and timely service - over plan period of five years	13,901
Increase the number of enhanced bus corridors – Service improvements on four priority corridors over the plan period of five years	3,258
Increase the number of Park and Ride facilities. Establishing six facilities by 2015	892
Complete the Airport Link – connection of the Metrorail to Miami International Airport – completion by April 2012	8,397
Total	26,448*

***Note: - The initiatives in this strategy contribute to the estimated emissions reductions from the aspirational goal of increasing transit ridership by 10 percent, or 10 million boardings (26,448 mtons CO2e) as established in the previous table.**

Strategy: Improve Connectivity and Mobility on the Existing System

This strategy is a collection of existing and new initiatives that address the need to increase connectivity and improve traffic flow on the existing transportation network. Initiatives include providing critical connections throughout the network, improving freight movement and access to our economic engines, expanding proven strategies to smooth traffic flows, and promoting ridesharing programs within our region. Initiatives in this area also include prioritizing projects that improve connectivity and mobility between major economic drivers and major activity hubs such as the Port of Miami, MIA, sports and arts venues, and convention centers. This effort recognizes the need to focus on those projects that provide for the greatest number of jobs as well as those that improve the economic competiveness of our communtity.

The Climate Change Connection

In terms of emissions reductions, the improved movement or flow of people and freight accomodated through these projects is expected to reduce travel times and, in the case of freight projects, ease the conflict between commercial trucks and personal passenger vehicles on urban streets and major roadways. Another significant opportunity for communities to reduce idling time of vehicles on the network is through the implementation of traffic system management solutions including improved signal timing, or Advanced Traffic Management System (ATMS). As of August 31, 2010, the County completed installation of 94.8 percent of ATMS on designated intersections. The emissions reduction benefits from this program are not included in this plan because they were put in place prior to plan development. The emissions reductions associated are expected to be significant from a decrease in overall fuel consumption as a result of increased traffic flow, reduction of traffic stops, and an overall reduction in traveling time.

The following are initiatives for which assumptions and methodologies were developed to estimate emissions reductions:

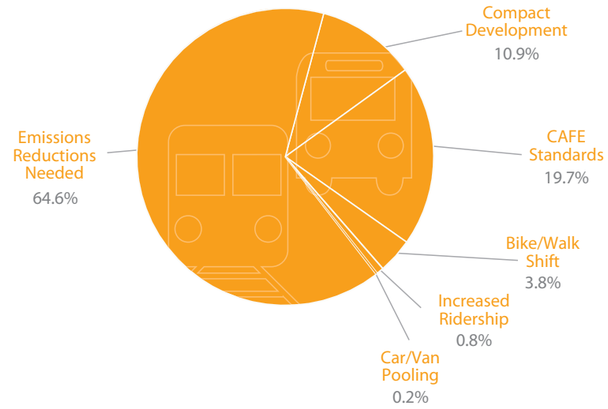
Quantified Emission Reductions Associated with Strategy

Initiative	Total Projected Reduced Emissions (mt CO_2e)
Work in partnership with the Metropolitan Planning Organization (MPO) and South Florida Commuter Services to expand carpooling and vanpooling programs Increase carpool participation by five percent/year Increase Vanpool fleet by 12 vans/year	Carpooling 3,892
	Vanpooling 1,613
Expand the express bus service between Miami-Dade and Broward counties through extending the I-95 managed/express lanes from Golden Glades Interchange to I-595 (expected completion of construction by December 2013)	337
Total	5,842

Is it enough?

Overall emissions would need to be decreased by 6.78 million metric tons of CO_2 by 2015 to reach adopted targets. Recognizing the transportation sector accounts for approximately half of all GHG emissions, adopting a proportional target reduction would require a reduction of 3.39 million metric tons of CO_2 emissions by 2015 from the transportation sector. The culmination of emissions reductions estimates from the strategies and initiatives in this area, as well as the expected emissions reduction gains from the phasing in of cars with higher fuel efficiency as a result of the current Corporate Average Fuel Economy (CAFE) Standards, is depicted in the below figure.

Percent Contribution to Greenhouse Gas Emissions Reduction Target from the Land Use and Transportation Goal Area



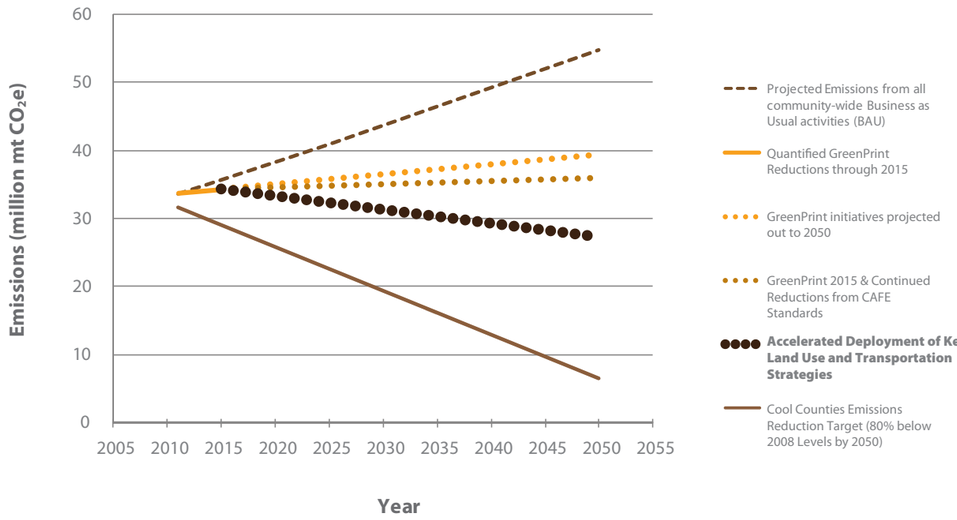
This figure illustrates the need for reductions necessary to reach our aggressive long-term target. It is important to understand that this plan includes actionable initiatives implementable within the five-year time frame. It is an important beginning that informs the next critical steps. While the transportation sector provides one of the greatest opportunities for emissions reductions, it also provides the greatest challenges given the high cost of multimodal investments and our existing development pattern. This includes changes in land uses, compact and mixed-use developments that are dependent on market and overall economic conditions, and investments needed to establish a true multimodal transportation system. This plan endeavors to establish a framework by which priorities and investments are made.

Based on emissions produced, the transportation sector must play a significant role in reduction: roughly 50 percent. This chart represents the quantifiable percent contribution from the initiatives and highlights the remaining opportunities for reduction. Reductions in this goal area will need to be accelerated to reach the 80 percent reduction goal by 2050.

Closing the Gap

There is no silver bullet solution, especially in light of economic constraints. Perhaps the first step is to agree on our destination, to agree that we will take deliberate and concerted steps to shape our community, to make decisions in policies, investments, processes, that are driven by the expected benefits to our community and our future. The strategies within the Leadership, Connections, and Commitment Goal Area and strategies outlined here set that path. Accelerated benefits could be realized by pushing key ***GreenPrint*** strategies further and faster. The figure below illustrates deployment scenarios for some key strategies to close the gap: moderate to aggressive implementation of compact development strategies, increasing the rate at which vehicles are replaced with higher fuel efficient vehicles, and increasing the percentage of trips made by alternative modes, particularly by mass transit.

Greenhouse Gas Emissions Scenarios for the Land Use and Transportation Goal Area



This graph depicts the emissions reductions of varying implementation scenarios of key land use and transportation strategies and their potential acceleration. Acceleration includes intensifying compact development efforts, expediting vehicle replacements that meet CAFE standards, and shifting 10 percent of overall trips on the system from the personal automobile to walking, biking, and transit trips.

Growing Smarter

Intensifying the deployment of a compact and efficient urban form through more density, diversity, design, destination, and distance to transit could realize a 12 to 18 percent reduction in VMT by 2050 (Urban Land Institute 20). According to recent studies, this could contribute a 6.4 million to 9.6 million metric tons CO_2e reduction to long-term emissions.

Shifting to More Fuel Efficient Vehicles

Fuel economy standards currently are, as they have been since its creation in 1975, set through the CAFE standards, administered by the National Highway Traffic Safety Administration (NHSTA). On April 1, 2010, EPA and NHTSA announced a joint final rule requiring passenger cars, light-duty trucks, and medium-duty passenger vehicles meet an estimated combined average emissions level of 250 grams of carbon dioxide per mile, equivalent to 34.1 miles per gallon (MPG) (U.S. EPA n. pag.). The standards apply to model years 2012 through 2016. The EPA and NHTSA are now working on rulemaking to establish national standards for model years 2017 and beyond.

Current standards could cut greenhouse gas emissions by an estimated 670,000 metric tons CO2e over the first period of this plan, based on an estimated 1.7 percent MPG increase per year across the fleet.

It is important to note that the average rate of increase in fuel efficiency for vehicles entering the fleet over the last 10 years was used to project emissions for the years beyond 2017. This is likely a conservative estimate considering the EPA recently released proposed standards ranging from 47 to 62 MPG for model years 2017 to 2025 (U.S. EPA n. pag.). An increase in MPG for model years beyond 2017 would increase the rate of introduction of more fuel efficient vehicles into the community fleet. For example, assuming a 2.1 percent increase per year rather than a 1.7 percent increase would accelerate the amount of emissions reductions that could be realized by 2050, illustrated in the chart to the left. Miami-Dade County could be at the forefront of the efforts to advocate for rapid implementation of the new CAFE standards and for federal, state and local incentive programs. This is an area where the County is leading by example with its fleet purchases, which include 329 active gasoline-electric hybrid sedans, three of which are plug-in hybrid electric vehicles (PHEVs).

Making Mass Transit a Viable Option

The personal automobile contributes 68 percent of the emissions from the transportation sector. Our current public transportation system supports four percent, or 326,000 (MPO, "Draft Near Term" 9) out of approximately eight million daily trips on the network (MPO "Long Range" 55). Considering this, adopting a scenario of doubling current ridership would not make a significant impact on reducing emissions relative to the target. Shifting 10 percent of the eight million daily trips to walking, biking, and mass transit would result in emissions reductions of 650,000 mt CO_2e by 2050, and is a component of the emissions reductions represented by the accelerated deployment scenario. The County's current direction for transit is improving services and developing transit ridership within priority corridors so that when a rail transit system is deemed feasible it can be implemented successfully (MPO, "Draft Near Term" 15). The acceleration of this phased-in approach is critical not only to realizing sustainability benefits for residents but also to achieving emissions reductions needed to mitigate climate change.

Initiatives addressing the barriers to increasing densities in infill and redevelopment areas and incentivizing effective development are essential for acceleration, as is significant support from leadership, both in terms of policy and funding.

Absent the resources to move the needle on emissions reductions that quickly, it is still important to make the improvements outlined in the strategies and initiatives. It all adds up to a more sustainable community. "Combinations of strategies create synergies that enhance the potential reductions from individual measures. In particular, land use changes combined with expanded transit services achieve stronger GHG reductions than when only one option is implemented" (Cambridge 1).

The Role of Vibrant Economy

The strategies and initiatives in this portion of the plan have indirect emissions reductions as well as direct impacts that will be determined though the ***GreenPrint*** implementation process.

Vibrant Economy Strategies Contributing to Climate Action Plan Mitigation Efforts

- Build a sustainable economy and promote green business

The initiatives in the Vibrant Economy Goal Area reduce emissions by 326,000 mt CO_2e and avoid 326,000 mt CO_2e.

Strategy: Build a sustainable economy and promote green business

The focus of Vibrant Economy is building upon our successful economic engines and transforming operations into more sustainable practices. From the airport and seaport to trade, tourism and agriculture, we can build a sustainable economy and promote green business. Miami-Dade County benefits from a diverse economy, not solely relying on one or two industries. While tourism, trade and agriculture are key economic drivers, Miami-Dade County also enjoys a thriving small business sector.

A recent article in "Environment 360" posed this intriguing question, "how significant would it be if America's 29 million small businesses increased their energy efficiency and reduced their emissions?" (Bowman n.pag.) Running a more energy-efficient business and sustainable operation is easier than reaching consensus on sea level rise maps. Given the number of small businesses that make up the diverse Miami-Dade economy, there is great potential to reduce emissions.

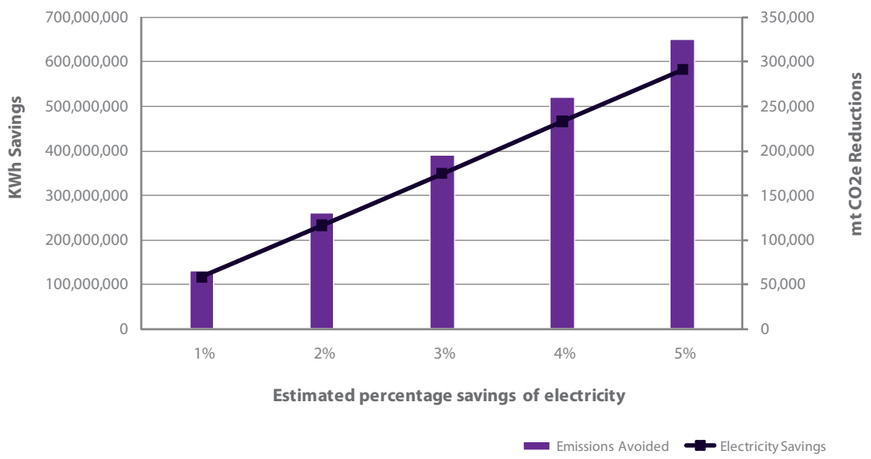
The Climate Change Connection

The cornerstone of this strategy is the Miami-Dade Green Business Certification Program, which is being developed to help local enterprises maximize their social, ecological and financial performance. Local small businesses are by definition sustainable business: they tend to hire locally, buy locally and sell locally. The program will document savings and help market the benefits to educated and eco-conscious consumers. The new program aims to help businesses become more resource-efficient with energy, water, raw materials and waste production. The program is in the development phase; therefore, businesses are encouraged to perform self audits now, based on a checklist of program standards. Green businesses conserve energy by using energy-efficient lighting and Energy Star-rated equipment; conserve water through the use of low-flow toilets and water flow restrictors; and reduce waste by recycling, composting and using materials with recycled content. These practices also create a safe and healthy workplace for employees and customers.

This figure illustrates the relationships between savings in electricity and reductions in CO_2 emissions. As the business becomes more efficient, it saves money and the community as a whole benefits from the CO_2 reductions.

If all businesses registered through the Miami-Dade County Tax Collector reduce electrical consumption by the percentages shown they will also reduce greenhouse gas emissions as illustrated.

Potential Energy and Emissions Savings as Commercial Businesses Become More Energy Efficient



The Role of Healthy Communities

The Healthy Communities goal is important to the well-being of our residents. By encouraging outdoor activities and promoting local, organic fresh food, we are helping to combat obesity and lifestyle diseases such as diabetes and cardiovascular disease. Although the strategies and initiatives in this area do not all result in obvious or easily measurable carbon emission decreases, their sustainability benefits are significant. Strategies that have a beneficial impact on carbon storage, sequestration, or emissions are included below.

Healthy Communities Strategies Contributing to Climate Action Plan Mitigation Efforts

- Facilitate active and safe lifestyles for residents through the Open Space Master Plan and other community initiatives
- Plant more trees
- Promote fresh, local, organic foods in all neighborhoods through grocers, farmers' markets, and community gardens

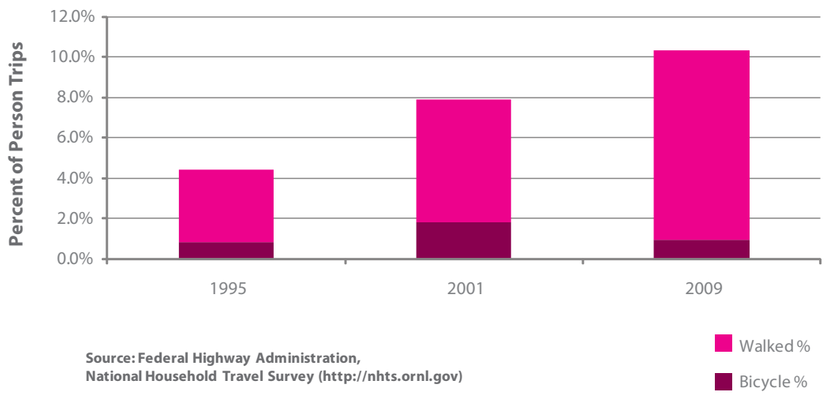
Strategy: Facilitate active and safe lifestyles for residents through the Open Space Master Plan and other community initiatives

This strategy includes various initiatives to promote walking and biking. Half of the trips in the United States could be completed within a 20-minute bike ride, and a quarter of trips are within a 20-minute walk (Rails to Trails Conservancy). Nonetheless, most of these trips are taken by car. This is certainly the case in South Florida, with its hot, humid climate and car-centric culture. Some progress has been made, as shown in the figure below. Between 1995 and 2009 the percentage of person trips taken by walking or biking in South Florida increased from approximately four percent to 10 percent. The 2009 figure is slightly below the national average of 12 percent (National Household Transportation Survey).

The Climate Change Connection

The County estimates that increasing biking and walking to 16 percent of total trips by 2015 could result in emissions reductions of 130,249 metric tons.

Biking and Walking as a Percentage of All Trips Miami-Ft Lauderdale Consolidated Metropilitan Statistical Area (CMSA)



Source: Federal Highway Administration, National Household Travel Survey (http://nhts.ornl.gov)

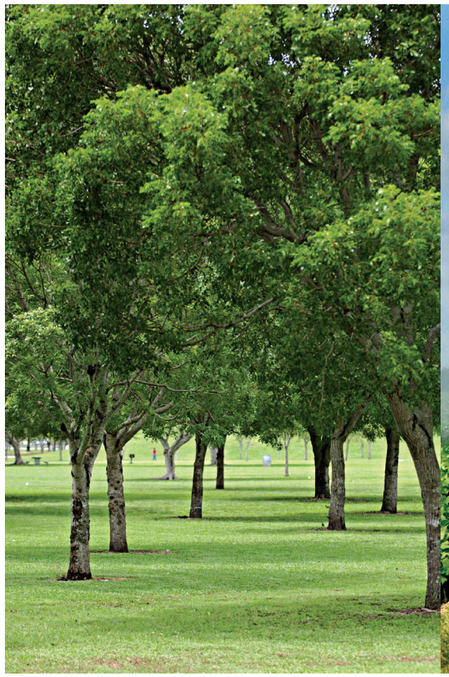
South Floridians walked more frequently in 2009 than in 1995. However, the portion of trips taken by bike fluctuated over the same time period. All trips include biking, walking, transit, and vehicles.

Strategy: Plant more trees

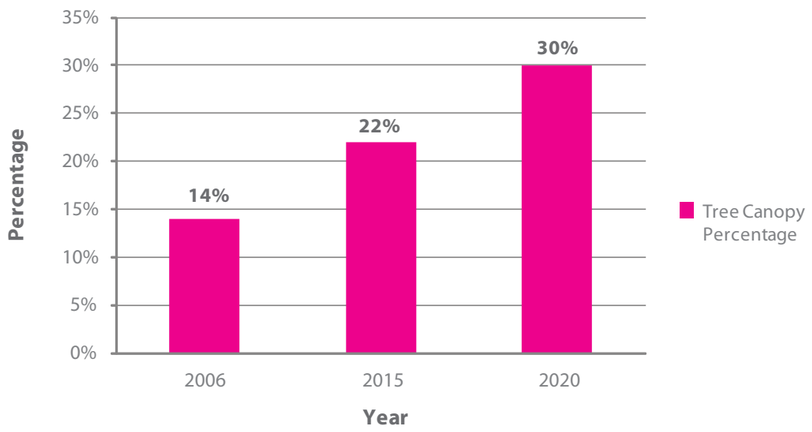
This strategy includes initiatives to plant more trees and promote proper tree selection and maintenance, thus increasing our tree canopy from 14 percent in 2006 to 30 percent by 2020. Trees reduce air pollution by absorbing or intercepting pollutants such as carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone and particulates. A single mature tree can absorb carbon dioxide at a rate of 48 pounds per year, and release enough oxygen into the atmosphere to support two human beings. Three hundred trees can counterbalance the amount of pollution one person produces in a lifetime (Alexander n.pag.). Additionally, tree leaves and branches intercept rainfall, hold it and then release it slowly, thereby reducing runoff, increasing infiltration into the soil, and helping to maintain water quality. One study from the U.S. Forest Service estimated that over a 50 year lifetime a tree generates $31,250 worth of oxygen, provides $62,000 worth of air pollution control, recycles $37,500 worth of water, and controls $31,250 worth of soil erosion (Alexander n.pag.).

The Climate Change Connection

Trees can sequester and store small amounts of carbon from the atmosphere, helping to reduce GHG levels. More significantly, trees can be a natural air conditioner, reducing the need for electrical cooling and, as such, reducing GHG. The evaporation from a single large tree can produce the cooling effect of 10 room-size air conditioners operating 24 hours per day (McPherson and Simpson n.pag.). A recent study by American Forests found that the maximum potential annual savings from energy-conserving landscapes around a typical home ranged from a low of 13 percent in Madison, Wisconsin to a high of 38 percent in Miami (Alexander n.pag.). Another modeling study estimated that the direct energy savings from shading alone by trees and vegetation could reduce carbon emissions in various U.S. metropolitan areas by roughly 1.5 to five percent (U.S. Environmental Protection Agency). In addition to the previously mentioned sustainability benefits, trees play an important role in encouraging outdoor health-promoting activity like walking and biking, especially in South Florida's climate, which can reduce the use of personal vehicles for short trips. Shade trees can also keep parked cars—particularly their gas tanks—cooler, which lowers evaporative emissions.



Percentage of Tree Canopy in Miami-Dade County



Source (2006): Presentation by Francisco Escovedo, Assistant Professor, University of Florida, at the Fourth Annual Tree Summit held June 25, 2010 at Florida International University

Our goal is to increase tree plantings to achieve a total tree canopy from the 2006 level of 14 percent to 22 percent in 2015, and ultimately to 30 percent in 2020. The 30 percent tree canopy target was established by the Board of County Commissioners through the 2007 Street Tree Master Plan and the Comprehensive Development Master Plan.

Strategy: Promote fresh, local, organic food in all neighborhoods through grocers, farmers' markets, and community gardens

This strategy focuses on promoting local and organic farming, as well as increasing the availability of this produce to the general public and urban communities. It is difficult to calculate the environmental impact of fresh, local food initiatives since the carbon footprint of food depends on many factors, including food type and methods of production and distribution. However, there is broad general consensus that local, organically produced and unprocessed foods promote sustainability.

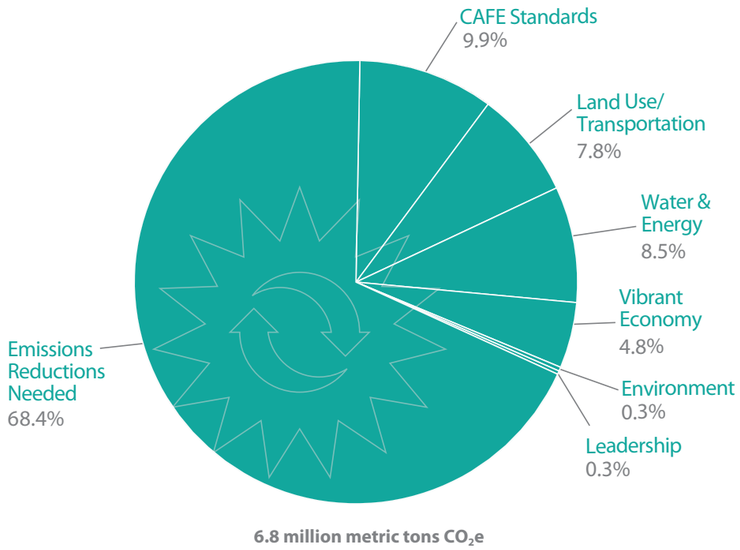
The Climate Change Connection

Producing food locally may reduce the GHG related to transportation and marketing of food, and reducing pesticide and chemical fertilizer use can reduce emissions associated with the manufacturing, distribution and application of these products, reduce erosion and improve soil quality. Some studies have shown that organically farmed soil sequesters significantly more carbon than conventionally farmed soil (Fernandez Rysavy n.pag.). Community gardens that produce local food have additional sustainability benefits, including the reduction of heat island effects in urban areas, which decreases the need for air conditioning, water filtration, and reduction of soil erosion and run-off.

Moving Forward

From this first five-year phase of our Miami-Dade Climate Change Action Plan, two things are clear: one, our community is a true leader in tackling climate change issues, and we have tremendous success and experience to build upon; and two, we have a lot of work to do to reach our mitigation goals and make our community more resilient to current hazards and future impacts. The figure below illustrates the ***GreenPrint*** contributions towards emission reductions, as well as the gap expected despite implementation of these initiatives. This action plan has clearly laid out potential opportunities to close that gap and leverage resources, and it is up to us as a community to work together to make this happen.

GreenPrint Contribution Toward the Cool Counties Greenhouse Gas Reduction Target



6.8 million metric tons CO_2e

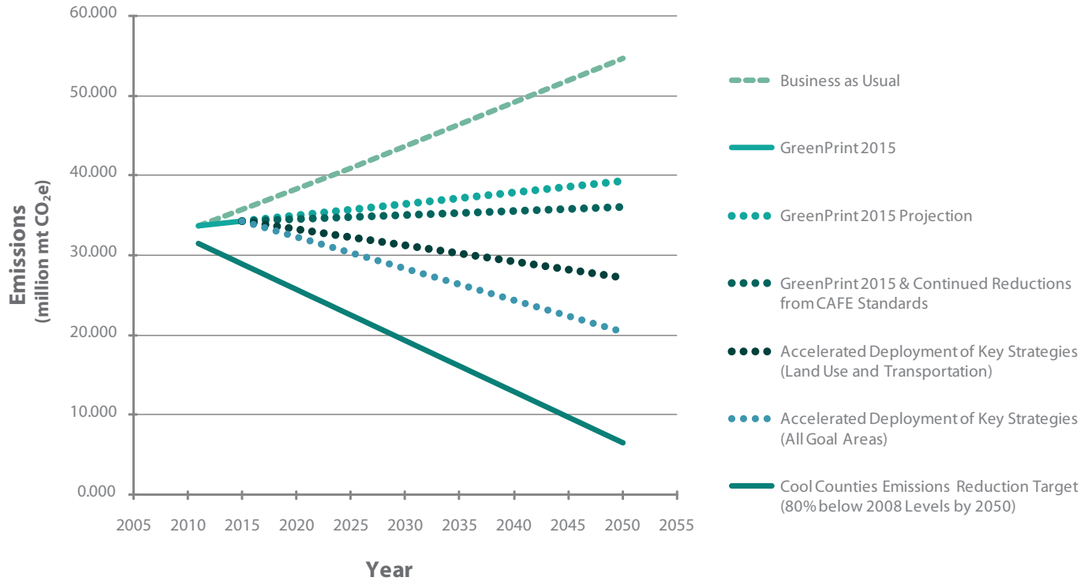
This chart shows how quantifiable ***GreenPrint*** initiatives contribute to the 2015 ten percent reduction target established through the Cool Counties commitment. Again, these are the initial steps on a 40-year path to the 2050 target. It is anticipated that the impact will be accelerated in later years.

Looking further ahead, the figure on the next page illustrates the tremendous potential to make significant strides towards the Cool Counties GHG goal of 80 percent reduction by 2050. Through full, and in some cases accelerated, deployment of key strategies across all goal areas, we can close that projected gap considerably. This would include fully implementing compact development strategies, shifting the mode for the percentage of the population utilizing public transit from four percent to 10 percent, increasing the penetration rate of vehicles with newer CAFE standards to accomplish a complete fleet turnover in 20 years rather than 25 years, decreasing residential and commercial average electricity consumption by 20 percent, and achieving a 25 percent electricity consumption reduction for targeted local businesses. Even if these accelerated deployment endeavors are realized, a remaining 14 million metric tons of CO_2e would still need to be reduced to reach our target. While this may seem daunting, it emphasizes the need for the continuous development of initiatives that will further contribute to GHG emissions reductions in future ***GreenPrint*** updates. Better economic conditions and improved technology and innovation, as expected in the future, will serve to make this goal even more attainable.

As a coastal community identified as one of the most vulnerable to climate change, it is incumbent upon us to harden ourselves against current hazards and improve the resiliency to prepare for, respond to, and recover from, future climate change. Recent occurrences of temperature and rainfall extremes provide a glimpse of potential future impacts. These events, as well as tropical storms that periodically impact our region, can cause significant infrastructure and socio-economic damage, but they can also present important learning opportunities that provide valuable experience and knowledge for current and future progress.

GreenPrint is a 40-year journey. We are embarking upon this initial phase and will build upon our existing knowledge and experience. It is our challenge and opportunity to use this initial five-year phase to build upon successes and create a foundation to move forward. This will help provide the tools and information so critical to educating the community and decision-makers. By combining our opportunities and knowledge with the resources provided through our regional, state, and federal partnerships, we have the tools that will allow us to chip away at that gap and help our community remain strong and adapt to a new normal of a changing climate. Let us now take that knowledge and experience and turn science into action.

Greenhouse Gas Emission Reduction Scenarios



This chart compares a business-as-usual scenario with our aggressive Cool Counties commitment target. ***GreenPrint's*** contribution is shown, as well as hypothetical accelerated emission reduction strategies.