THE CITY OF MARATHON

Sustainability and Climate Plan 2012

Final Report

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1.0 Executive Summary

Current trends in society highlight increasing levels of population and consumption and decreasing natural resources and ecosystems including forests, water, wildlife, and soils. At some point the population and increasing consumption will be greater than the ecosystems that support life. "Sustainable" actions are those that work toward reducing the demands and consumption of our ecosystems and also work toward preserving and restoring our forests, water, wildlife, and soils.

Recognizing this challenge, it is now becoming imperative for governments to respond to sustainability issues such as resource scarcity, climate change and energy conservation that are compounding existing challenges to economic growth. But, addressing sustainability is not only a cause for environmentalists. Sustainability intersects with efforts to create employment opportunities in the emerging green economy. Unlike other types of environmental policies, energy efficiency and greenhouse gas ("GHG") reduction efforts can produce direct cost savings in government operations and for citizens as well as "co-benefits" by enhancing the performance of other initiatives. Sustainable communities have the ability to attract potential business investments and a skilled workforce. Implementing this Sustainability and Climate Plan ("SCP") will also result in increased demand for skilled labor, such as that needed for energy efficiency retrofits, solar installations, processing of recyclables and designing, building and maintaining infrastructure that account for new impacts from climate change.

The physical impacts of climate change are already clear and will expand and intensify in the decades ahead. In July of 2009, the U.S. Army Corps of Engineers adopted new guidance for incorporating the direct and indirect physical effects of projected future sea-level change in managing, planning, engineering, designing, constructing, operating, and maintaining their civil projects. It requires planning based on a low, intermediate and high projection the current estimate of 1.7 mm/year increase for global mean sea-level change. The Corps updated this guidance in November 2011, is EC 1165-2-212 "Sea-Level Change Considerations for Civil Works Programs". Recently, the South Florida Water Management District ("SFWMD") published a report planning for a 5-20" increase in sea level by 2060. The U.S. Environmental Protection Agency ("EPA") has also started to aggressively address climate change and energy conservation issues. The physical impacts of a changing climate are matched, and compounded, by social challenges such as rising energy, transportation and health care costs. Low-income and vulnerable citizens, such as our elderly communities, face disproportionate impacts of climate change including having fewer resources to respond to these changes.

Regardless of individual beliefs about climate change, there are inevitable reasons to develop this Sustainability and Climate Plan including:

- The cost of energy is escalating
- This has a multiplier effect on government and community expenses, and
- There are regulatory and stakeholder pressures necessitating action.

This planning effort takes the City from conceptual discussion to specific action. Just as climate change is a major indicator of a non-sustainable society, excessive or unnecessary carbon emissions are an indicator of a non-sustainable organization. Because of its potential to integrate the triple bottom line concerns of ecology, economy, and social equity while simultaneously creating financial value through lower costs, and reduced risk, an increasing number of public and private sector leaders are seeing sustainability as an appropriate framework under which to manage carbon reduction efforts. These

leaders are ushering in what some have called a "new era of sustainability." The purpose of the SCP is to create an open, transparent and participatory dialogue between the City, community members, business members, and other key area partners concerning the City's commitment and process to implement factors related to the triple bottom line: economic, environmental and social.

Sustainability or climate action plans can include many different attributes and address very different areas. Some of the recommendations in the plan require Council approval separate from adoption of the SCP Plan and also require additional funding in order to be implemented. Some of the recommendations are low to no cost policy shifts and changes that can easily be implemented with minimal effort. The key components of the SCP are:

- **Describe the City's GHG emissions sources and how those emissions could be expected to grow.**
- **Recommend ways that the City can achieve GHG reductions and other community benefits such as increased green job opportunities and improved public health.**
- **Provide a timeline for the plan's implementation.**
- **Define an Implementation Strategy for turning this SCP into action and transparently tracking and reporting progress toward its goals, including funding.**

While today's economic challenges are real and will force the City to make hard decisions, the looming threat of climate change elevates the need to protect our global natural environment and resources – not only to mitigate the effects of climate change, but also to ensure that our communities can adapt. The City faces real threats from climate change: sea-level rise disproportionately impacts waterfront communities and ports, the urban heat island effect contributes to poor air quality and increased cooling costs, and changing weather patterns and more disruptive storms may cause flooding and other types of damage.

Implementation of the SCP must be mindful of existing planning and policy making processes. Funding these types of initiatives is a primary challenge to implementation as well. The approach to the SCP includes two major strategies to overcome these obstacles. First, the SCP includes policy recommendations based upon real data that will make the City more competitive for funding sustainability and climate-related initiatives with grant funds because projects are part of a larger cohesive effort outlined in the SCP. Second, the process of tracking the success of the SCP, on an annual basis, in conjunction with its capital planning process allows the City to constantly monitor its successes and setbacks in achieving its goals which are both qualitative and quantitative. With commitment, community education and outreach, the City can implement its SCP in a timely and cost effective manner resulting in cost savings over time and environmental benefits to the community as a whole.

2.0 Background

The City of Marathon incorporated as a municipality in November of 1999. Located in the Middle Florida Keys, within Monroe County, the City includes: Grassy Key, the Crawl Keys, Long Point Key, Fat Deer Key, Key Vaca, Stirrup Key, Boot Key, Hog Key and Knight Key, all of which lie along a 16-mile stretch of the Overseas Highway. The City Charter also recognizes all adjacent off shore islands. The area extends from the east end of the Seven Mile Bridge at mile marker ("MM") 47 to the east end of Grassy Key at MM 60.

Population in Marathon in 2000 was estimated at 10,225 but in comparison to 2010 figures, the City's population was reduced to 8,267.[i] In 1990, Marathon made up 11.4% of Monroe County's total population. This percentage increased to nearly 13% in 2000. Typically, the rate of population growth is the primary determinant of land use requirements, housing supply and demand, and public facility needs and services to support growth. However, in the Florida Keys, residential growth has been managed in accordance with the Rate of Growth Ordinance ("ROGO") and City Permit Allocation System since July 1992, which limits the number of residential units (to 30) that can be constructed annually to ensure maintenance of adequate hurricane evacuation clearance times. This system is now known as the Residential or Commercial Building Permit Allocation System or ("BPAS").

Current and projected population estimates have been divided into two sub-groups: permanent residents and seasonal visitors which is important because of the differentiation in service demands and energy use. According to definitions established by the University of Florida Bureau of Economic and Business Research ("BEBR"), a permanent residence is one's "usual residence, or the place one lives and sleeps most of the time." Seasonal visitors represent persons who reside in the City for less than six (6) months a year. The level of demand for public facilities and land use consumption may vary between the two sub-groups due to different periods of residency and associated activities or events.

It is important to note the types of land uses and potential population growth within the City because this will help drive priorities in terms of energy reductions from the built sector and projections of future energy use both from City operations and the community as a whole.

3.0 Synergy between Energy Use, GHG Emissions, Climate Change and Sustainability

To date, the international community has dealt with climate change, the quintessential sustainability issue of our time, principally by promoting the mitigation of GHGs. The rationale for such mitigation efforts, simply stated, is that if GHG concentrations are stabilized or reduced, ultimately the severity of climate change can be alleviated. While this rationale is justified, it cannot address the current levels of GHGs because the impacts from these emissions are going to occur no matter how effective mitigation measures are at reducing them.

Almost all impacts from climate change relate to increasing air temperatures, with global sea level rise largely attributable to the thermal expansion of the oceans and melting of glaciers and ice sheets. Altered precipitation patterns, heat waves, floods and droughts are all related impacts. But, not all impacts will be uniform and there will be some variation by location due to differences in atmospheric and oceanic circulation. Inundation and erosion will also affect coastal ecosystems. Generally, areas with greater precipitation will see more sewer system overflows, more runoff and nonpoint pollution, and infrastructure overloading. Areas of lesser precipitation will struggle with meeting water demands

and habitat shifts. A great area of uncertainty is the combination and interrelationships of these impacts in the future.

In particular, predicted changes in storm intensity and sea level rise create the need for integrated potable water, storm water, and wastewater infrastructure planning and greater interagency coordination. Cities play an integral role in advancing sustainability, not only because they are contributors to climate change, but also because they are increasingly challenged to control costs associated with energy use. Numerous local governments in the U.S. have enacted energy conservation and efficiency measures along with GHG emissions reduction plans to address the global dimensions of energy problems that extend far beyond their borders. The powers of local governments, especially over land use, make them well suited to play a lead role in sustainability and energy management. This is particularly true in the City which is in a position to highlight the interwoven nature of the sensitive ecological characteristics of its geography with the need to "shift the mindset" of day to day decision-making to more sustainable practices.

3.1 Rising Cost of and Impacts from the Use of Energy

Energy demand growth is projected to continue at about 1% per year through 2035.[ii] Electricity prices in 2035 are projected at 9.5 cents per kilowatt hour (2010 dollars) according to 2012 projections, compared with 9.3 cents per kilowatt hour based upon 2011 projections demonstrating a continued long term increase in energy costs for the next twenty-five (25) years . Energy systems through their operations emit GHGs and contribute to anthropogenic climate change.[iii]

Energy use in homes and businesses is typically a large sector of GHG emissions.[iv] In homes, several factors influence energy use: the physical characteristics of the housing units, the appliances utilized including heating and cooling equipment, demographic characteristics of the household, the types of fuels used, and other information that relates to energy use. According to the Energy Information Administration ("EIA"), commercial buildings include all buildings in which at least half of the floor space is used for a purpose that is not residential, industrial, or agricultural; therefore, they include building types that might not traditionally be considered "commercial," such as schools, correctional institutions, and buildings used for religious worship. This includes retail and wholesale stores, hotels and motels, restaurants, and hospitals. Excluded from the sector are the goods-producing industries: manufacturing, agriculture, mining, forestry and fisheries, and construction. Analysis of the structures, activities, and equipment associated with different types of buildings is the clearest way to evaluate commercial sector energy use. Because of the rising costs of energy, community stakeholders as well as governments can benefit from a reduced bottom line by managing energy use.

3.2 Reducing Greenhouse Gas Emissions

EPA defines "greenhouse effect" as a general warming effect felt on the Earth's surface produced by GHGs. This process occurs naturally and has kept the Earth's temperature about 60 degrees Fahrenheit warmer than it would be otherwise. The greenhouse effect is important; without it, the Earth would not be warm enough for humans to live. Most climate scientists opine that human activity, such as burning fossil fuels, deforestation and certain changes to land use are causing an increase in GHGs in the Earth's atmosphere. The increased GHGs lead to warming in general as well as greater variability and lower predictability which is the basis for the science and popular sentiment recognizing the seriousness of changing weather patterns in many places around the world.

3.3 Local Governments Preparing for Climate Change

The U.S. in general is struggling with the issue of GHG regulation and climate change preparedness. Approaches to these issues continue to evolve based on significant policy debate amidst a constantly changing regulatory and planning landscape. While GHGs produced within the City constitute only a small fraction of national and global quantities, achieving the City's goals requires the City to demonstrate leadership on these critical issues. The City is on the front lines of climate change impacts such as sea level rise and increased hurricane intensity and the Florida Keys can be thought of as the proverbial "canary in the coal mine" due to the unique topography and geography. By recognizing the need to simultaneously mitigate GHGs attributable to energy use and prepare for the gradual, but accelerating, impacts of climate change, the City is beginning to proactively take action.

Local governments throughout the country have begun to demonstrate leadership on climate policy amidst new federal actions addressing both organizational practices as well as various regulatory processes. Local governments can contribute a great deal to U.S. climate change mitigation by reducing emissions within already well-accepted domains of their authority. Coastal and waterfront communities must be ready to respond to, and rebound from, hazards created by weather and climate. The uncertainty about exactly how the climate will change should not stop communities from acting to protect property, businesses and lives.

4.0 The City's Vision and Focus Areas

With fossil fuel use and resulting GHG emissions being the primary drivers of global climate change, the reasons for launching a sustainability program are clear. But, the City also recognizes the quality of life and economic benefits of becoming more sustainable which are also contributing factors to the development of this SCP. To be implemented, the recommendations should be integrated into the City's Comprehensive Plan and Code of Ordinances for implementation. The SCP should not be viewed as a new "project" or "program" but should be holistically integrated into day to day and long term policy making.

The City's Comprehensive Plan serves as the "vision" to manage policies, growth and development. A primary focus for the City is on the revitalization of existing business centers and promoting the availability of housing for residents. From the perspective of the Comprehensive Pan, growth shall be managed to assure that adequate public facilities and services are provided according to adopted level of service standards, the public's ability to fund infrastructure capacity improvements, and the ability to minimize adverse impacts that public facilities place on natural resources and hurricane evacuation times. To achieve quality of life and reflect carrying capacity constraints, the following growth management activities are recommended for implementation by the City in its existing Comprehensive Plan:

- Direct Development/Redevelopment to infill of scarified sites,
- Promoting workforce housing located close to business centers,
- Promote in-fill of platted, scarified lots for new residential units,
- Promote redevelopment of substandard housing,
- Establish Concurrency Management,
- Establish a Program to Retire Development Rights, including a Land Acquisition Program, and
- Establish a Transfer of Development Rights (TDR) Program.

The City recognizes the benefits of initiating a comprehensive approach to sustainability. This Plan is a "roadmap to sustainability" cutting across all City Departments as well as outlining strategies for the community to become more sustainable. These existing principles in the Comprehensive Plan can be furthered by the recommendations in this SCP. It is important to note that the SCP has to operate within an existing legal and policy framework as well as develop new guidance based on data collected during the Plan development process.

4.1 Plan Approach and EECBG Grant

In the 2010 the City was awarded grant funds as part of a partnership including the City of Key West, Islamorada, Village of Islands, Monroe County and other participants. As part of its grant strategy, the City completed 100 energy audits for property owners, an energy audit of its facilities and operations, retrofits and projects from that energy audit, a GHG Inventory and this SCP including recommendations to meet emissions reductions targets. All grant deliverables were completed by May 2012.

Because of the award of these grant funds, the City recognized the important opportunity to use data collected during these grant tasks to complete a Plan to reduce GHG emissions. The City somewhat expanded the scope of the original Plan from being a more narrow "carbon reduction plan" to encompass more areas for sustainable decision-making.

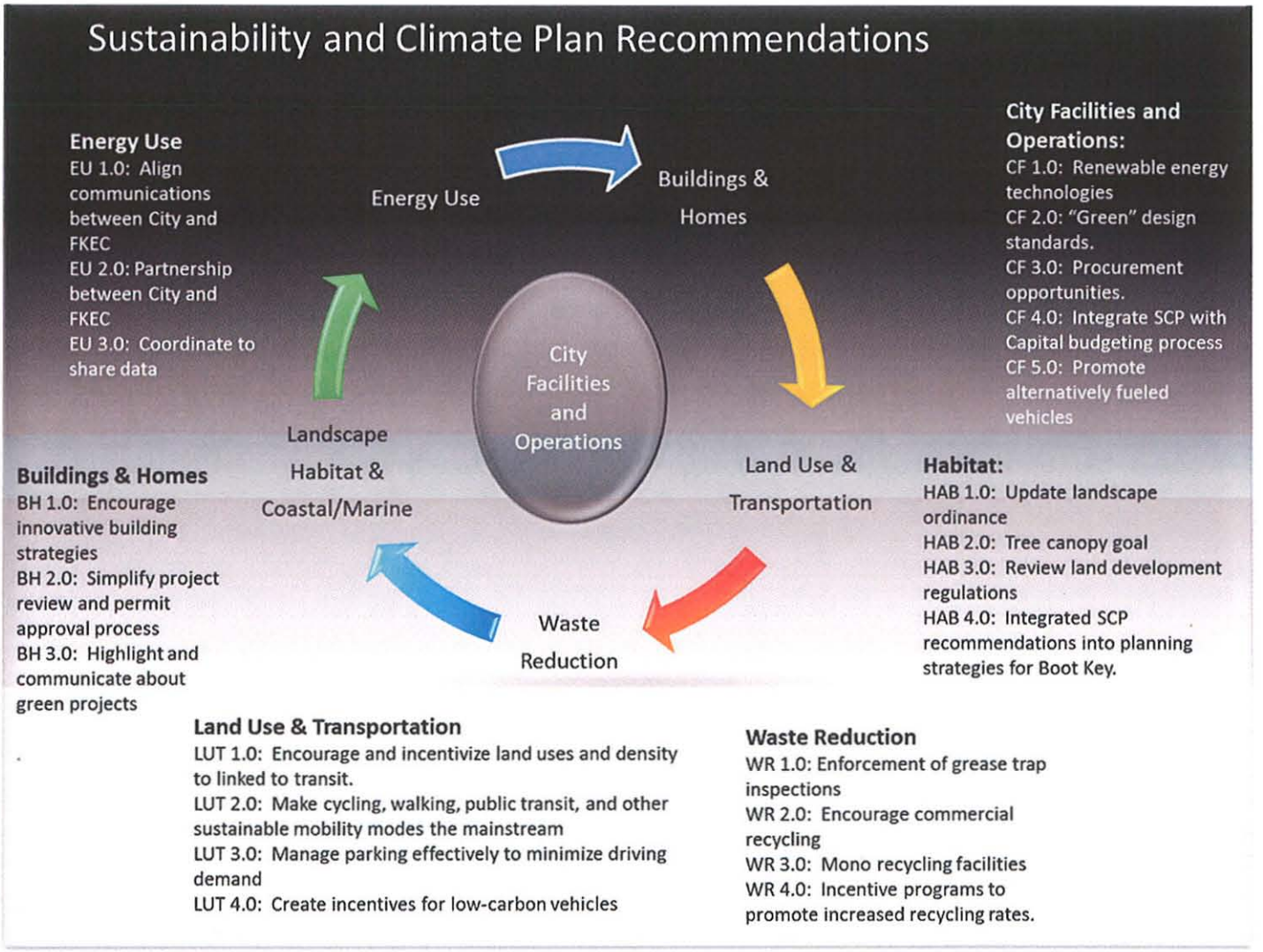
A sustainability plan can be considered a climate action plan with a broader, more holistic view on community "sustainability" issues or meeting the needs of today without compromising the ability to meet the needs of tomorrow. Such a plan focuses primarily on reducing GHG emissions, including emissions resulting from both the local government's operations and from the community as a whole. It typically includes an analysis of the opportunities to reduce GHG emissions resulting from energy use in transportation, solid waste disposal, buildings, lighting, and wastewater treatment and water delivery. Some local governments also include environmental opportunities beyond reducing energy consumption—such as the development of renewable energy resources, the conservation of natural resources, forestry (urban and beyond) and green jobs.[v] The City's approach to this Plan is to combine these two concepts.

With data, the framework and approach to this Plan, the City has developed specific Focus Areas of implement actions to become a more sustainable community and prepare for the realities of climate change. Each Focus Area explains the concepts and challenges facing the City, as well as opportunities for the City to implement the recommendations, and why it is important to concentrate efforts in the subject area. Specific Initiatives and Actions are then recommended for each Focus Area.

4.2 The Plan's Goals and Recommendations

Acknowledging that it is difficult to control or track progress on community behavior, and the fact that the City can control its energy use directly, the SCP sets a target to reduce GHG emissions for City Facilities and Operations at this time. That target is a 5% reduction in GHG emissions by 2014, a 13% reduction in GHG emissions by 2017 and a 20% reduction in GHG emissions by 2025. To achieve the City's reduction targets, and other sustainability and climate goals, the SCP includes twenty-three (23) recommendations within the six (6) Focus Areas to achieve additional communitywide GHG reductions and broader goals.

Sustainability and Climate Plan Recommendations



Energy Use
EU 1.0: Align communications between City and FKEC
EU 2.0: Partnership between City and FKEC
EU 3.0: Coordinate to share data

City Facilities and Operations:
CF 1.0: Renewable energy technologies
CF 2.0: "Green" design standards.
CF 3.0: Procurement opportunities.
CF 4.0: Integrate SCP with Capital budgeting process
CF 5.0: Promote alternatively fueled vehicles

Buildings & Homes
BH 1.0: Encourage innovative building strategies
BH 2.0: Simplify project review and permit approval process
BH 3.0: Highlight and communicate about green projects

Habitat:
HAB 1.0: Update landscape ordinance
HAB 2.0: Tree canopy goal
HAB 3.0: Review land development regulations
HAB 4.0: Integrated SCP recommendations into planning strategies for Boot Key.

Land Use & Transportation
LUT 1.0: Encourage and incentivize land uses and density to linked to transit.
LUT 2.0: Make cycling, walking, public transit, and other sustainable mobility modes the mainstream
LUT 3.0: Manage parking effectively to minimize driving demand
LUT 4.0: Create incentives for low-carbon vehicles

Waste Reduction
WR 1.0: Enforcement of grease trap inspections
WR 2.0: Encourage commercial recycling
WR 3.0: Mono recycling facilities
WR 4.0: Incentive programs to promote increased recycling rates.

5.0 Greenhouse Gas Inventory Overview

The City prepared a GHG emissions inventory for the municipal operations and the community of Marathon as a whole. Both inventories were conducted for calendar year ("CY") 2010. Information from the GHG inventories allows the City to develop a measurable and transparent strategy to reduce emissions, provides baseline data to help monitor the success of future initiatives, and will aid the City in identifying valuable energy (cost) saving measures.

5.1 Methodology

Where possible, the City built their inventories using guidelines in the *Local Government Operations Protocol for the Quantification and Report of Greenhouse Gas Emissions Inventories*.[vi] The LGO Protocol was developed by ICLEI – Local Governments for Sustainability in partnership with the California Air Resources Board, and The Climate Registry ("TCR"). The LGO Protocol is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with government operations. In cases where the LGO protocol did not provide guidance, an alternate protocol or methodology has been referenced.[1]

According to the LGO Protocol, an operational boundary determines the direct and indirect emissions associated with an entity. This assessment allows the entity to determine which operations and sources cause direct and indirect emissions and to decide which emissions are consequences of its operations and decision making. The LGO Protocol follows the WRI/WBCSD GHG Protocol[vii] in categorizing direct and indirect emissions into "scopes" as follows:

> **Scope 1**: All direct GHG emissions from owned or controlled sources.
>
> **Scope 2**: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating or cooling.
>
> **Scope 3**: All other indirect emissions including but not limited to those resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities and waste disposal.

Additionally, the LGO protocol suggests that local governments should assess emissions from all six (6) internationally recognized GHGs regulated under the Kyoto Protocol:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Perfluorocarbons (PFCs);
- Hydrofluorocarbons (HFCs); and
- Sulfur hexafluoride (SF_6).

The inventories include emissions of CO_2, CH_4, and N_2O, which constitute the majority of the City's Municipal operations and Community-wide GHG emissions. HFCs, PFCs and SF_6 were excluded from the

[1] Alternate protocols were used in the development of the City of Marathon's Community-wide inventory. Please see Section 5.3 for a more detailed description of these calculation methodologies and assumptions.

chemical boundary due to the difficulty of collecting the activity data and their small overall contribution to the inventories.[2]

The following sections detail the results of Marathon's Municipal operations and Community-wide CY2010 inventories, as well as define their ambitious, yet achievable, emissions reduction targets and goals.

5.2 City Facilities and Operations

The operational boundary for the Municipal Inventory includes Scope 1 and 2 emissions. Marathon's municipal operations include: office buildings, a vehicle fleet, recreational facilities, a fire department, service department, wastewater treatment plants[3], a police department, and street/emergency lighting.

These emission sources are categorized by scope and listed in **Table 5.1**. There are no landfills within the City limits that the City owns or operates. Scope 3 emissions have been excluded from the operational boundary of the CY 2010 inventories and are not accounted for herein due to the lack of activity and available data.

Table 5.1- Municipal Direct and Indirect Emission Sources

DIRECT EMISSIONS (SCOPE 1)	INDIRECT ENERGY EMISSIONS (SCOPE 2)
• Mobile Combustion – On-road and off-road vehicles using gasoline and diesel. • Stationary Sources – diesel generators; CH_4 emissions from the wastewater treatment plants. • Process Emissions – from nitrification/ denitrification processes at the wastewater treatment plants.	• Electricity Consumption – at government offices and recreational facilities and for street and traffic lighting.

5.2.1 City Energy & Fuel Use

In CY2010, the City collected fuel and energy consumption data for all direct and indirect GHG emission sources as part of the baseline GHG emissions inventory development process. Electricity data was provided by Florida Keys Electric Cooperative Association, Inc. ("FKEC") in Microsoft-Excel format and fuel usage for stationary and mobile combustion sources was based on invoiced purchases.

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[2] HFCs are primarily emitted by refrigeration and air conditioning (AC) systems, PFC emissions are most commonly associated with semiconductor manufacturing and in some fire-suppression systems; and SF6 is primarily found in large electrical equipment, such as transformers.

[3] Only three plants were operational in 2010.

The wastewater treatment facilities were the largest energy use in 2010, accounting for appropriately 39% of the total consumption. The City's on-road diesel vehicle fleet consumed the largest quantity of fuel in 2010. A summary of the City's 2010 energy and fuel consumption is provided in **Table 5.2**.

Table 5.2 - Municipal Operations – Energy & Fuel Consumption

Energy & Fuel Consumption Categories	Calendar Year 2010 Energy & Fuel Consumption
Purchased Electricity- Wastewater Treatment Facilities	927.9 MWh
Purchased Electricity- Street, Traffic, and Outdoor Lighting	449.7 MWh
Purchased Electricity- Fire Department	290.4 MWh
Purchased Electricity- City Hall	155.1 MWh
Purchased Electricity- Recreational Areas	23.9 MWh
Purchased Electricity- All Other Buildings	535.7 MWh
On-Road Vehicle Fleet (Diesel)	13,510 gallons
On-Road Vehicle Fleet (Gasoline)	6,687 gallons
Stationary Combustion (Diesel)	1,080 gallons
Off-Road Vehicle Fleet (Diesel)	291 gallons

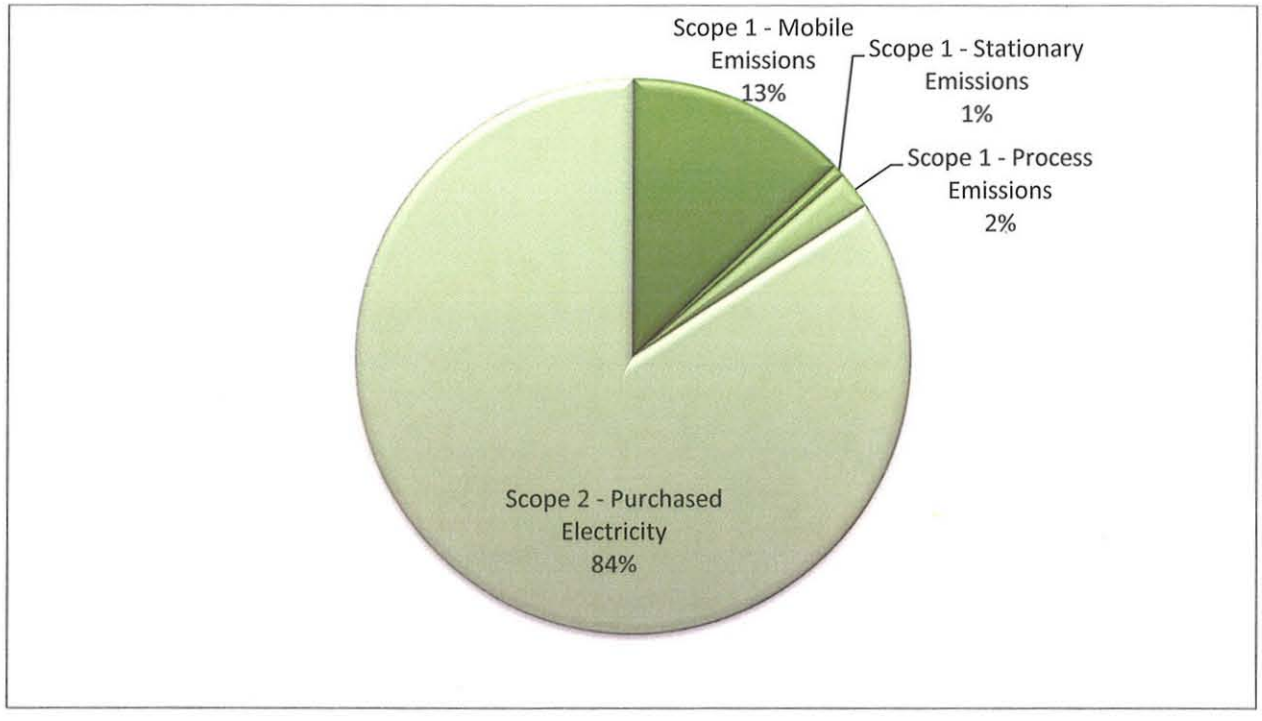
5.2.2 City GHG Emissions

In CY 2010, the City's municipal operations (Scope 1 and Scope 2) resulted in approximately 1,574 metric tons (MT) of CO_2e. Purchased electricity and mobile emissions were the largest source of municipal operations emissions, accounting for 84% and 13% of the total Scope 1 and 2, respectively. The wastewater treatment plants' Scope 1 emissions, which represent 2% of total emissions, are the result of N_2O emissions due to nitrification/denitrification during the wastewater treatment process. **Table 5.3** presents the GHG emissions data for each source category. Figure 5.1 illustrating the total municipal operations emissions by emissions category.

Table 5.3 - CY 2010 Municipal Operations GHG Emissions Summary

			Emissions (metric tons)			
	Quantity	Units	CO_2	CH_4	N_2O	CO_2e
Scope 1						
Mobile Emissions						
Gasoline-On-Road	6,687	gallons	58.71	0.004	0.004	60.06
Diesel-On-Road	13,510	gallons	137.94	0.009	0.010	141.10
Diesel-Off-Road	291	gallons	2.97	0.0002	0.0002	3.04
Total Mobile Emissions			***199.62***	***0.012***	***0.014***	***204.20***
Stationary Emissions						
Diesel	1,080	gallons	11.02	0.0016	0.0001	11.09
Total Stationary Emissions			***11.02***	***0.0016***	***0.0001***	***11.09***
Process Emissions						
WWTP - Nitrification/ Denitrification	-	-	-	-	0.11	33.98
TOTAL SCOPE 1 EMISSIONS			210.65	0.01	0.12	249.26
Scope 2						
Purchased Electricity	2,382.72	MWh	1,318.67	0.04	0.02	1,324.72
TOTAL SCOPE 1 & 2 EMISSIONS			**1529.32**	**0.06**	**0.14**	**1,573.98**

Figure 5.1- CY 2010 Municipal Operations Scope 1 and Scope 2 GHG Emissions



5.2.3 City Metrics, Goals & Targets

The State of Florida has a non-binding Executive Order 07-126, which has not yet been given legal effect in the Florida Statutes. The Executive Order was signed in 2007 as a goal for the State of Florida to reduce its GHG emissions. The targets in that Executive Order would not be appropriate as a basis for the City's GHG reduction targets due to the City's size, the amount of facilities and operations it controls, the lack of control over the primary transportation system features and the various infrastructure upgrades the City has had to make to meet legally mandated water quality requirements. The recommended target for the City's GHG reductions is equivalent to meeting approximately half of those targets in Executive Order 07-126. This constitutes an aggressive, yet achievable target for the City and one that is more reflective of the City's own operating environment. In order to reach the 2025 goal, two (2) interim targets have been established to allow for course correction if it is needed:

- **5% reduction of greenhouse gas emissions below 2010 levels by 2014;**
- **13% reduction of greenhouse gas emissions below 2010 levels by 2017; and**
- **20% reduction of greenhouse gas emissions below 2010 levels by 2025**

Specific goals have not been set for a desired energy mix, renewable energy usage, or reduction in fossil fuel usage for the City because the City has no control over these decisions. A GHG reduction goal has been set for all GHG emissions, including wastewater process and fugitive emissions, as well as those from the combustion of fossil fuels. Given that the City's five (5) new wastewater plants have been designed with numerous energy efficiency measures and operational protocols, and that 39% of the City's electricity consumption is in these facilities, it is unlikely that the City can achieve significant

energy reductions from wastewater operations. The City's greatest potential for GHG reductions is likely in its fleet and any additional energy conservation measures that can be implemented in buildings and facilities.

Metrics, targets, and goals for the City are summarized in **Table 5.4**. Emission totals at each milestone were calculated using a straight percentage reduction from the 2010 emissions total. The State of Florida Executive Order 07-126 requires a percentage-based reduction in GHG emissions (not per capita), so population growth was not factored into these calculations.

Table 5.4 – Greenhouse Gas Reduction Metrics, Targets, and Goals

Emissions Category	Metrics (Total for City Operations on a Per Annum Basis)	CY 2010 Baseline	Target (5% below 2010 levels by 2014)	Target (13% below 2010 levels by 2017)	Goal (25% below 2010 levels by 2025)
Purchased Electricity[1]	MWh; MT CO_2e emissions	2,382.72 MWh 1,324.72 MT CO_2e	2,263.58 MWh 1,258.48 MT CO_2e	2,072.97 MWh 1,152.51MT CO_2e	1,787.04 MWh 993.54 MT CO_2e
Stationary Combustion of Diesel	Gallons of diesel; MT CO_2e	1,080 gallons 11.09 MT CO_2e	1,026 gallons 10.53 MT CO_2e	939.6 gallons 9.65 MT CO_2e	810 gallons 8.32 MT CO_2e
Mobile Combustion of Gasoline	Gallons of gasoline; MT CO_2e emissions	6,687 gallons 60.06 MT CO_2e	6,352.65 gallons 57.06 MT CO_2e	5,817.69 gallons 52.25 MT CO_2e	5,015.25 gallons 45.045 MT CO_2e
Mobile Combustion of Diesel	Gallons of diesel; MT CO_2e emissions	13,801 gallons 144.14 MT CO_2e	13,110.95 gallons 136.93 MT CO_2e	12,006.87 gallons 125.4 MT CO_2e	10,350.75 gallons 108.11 MT CO_2e
Process N_2O Emissions from Wastewater Treatment	MT CO_2e	34 MT CO_2e	32.3 MT CO_2e	29.58 MT CO_2e	25.5 MT CO_2e

The results of the analysis in Table 5.4 are illustrated in **Figure 5.2.** Since the City population is constrained by limited land availability and limited annual permit allocations and the City has just undertaken significant infrastructure upgrades over the last 10 years, municipal operations are not projected to grow significantly in the future. The emission forecast assumes that the municipal operations GHG emissions will remain steady state through 2025, where the baseline equals the forecast. As previously mentioned, emissions reductions were calculated using a straight percentage reduction from the 2010 emissions total.

Figure 5.2- Projected Municipal Operations GHG Emissions

5.3 Communitywide Emissions

The operational boundary for the Community-wide Inventory includes emissions from sources under the operational control of Marathon's residents and commercial, industrial, civic and other non-governmental entities. The Florida Keys Marathon Airport was not included in the community-wide or municipal operations inventories because it is owned and operated by Monroe County. The Community-wide Inventory includes: Scope 1 emissions from mobile and stationary combustion sources, Scope 2 emissions from purchased electricity and limited Scope 3 emissions from pass-through vehicle traffic, as provided in **Table 5.5**.

Although the GHG emissions from municipal operations are also considered part of the total for the community (approximately 1%), they have been segregated for ease of management. The total Community-wide GHG emissions footprint is the sum of emissions as presented in this section and those from municipal operations presented in Section 5.2.

Currently, there is no universally accepted protocol for developing a GHG inventory for an entire community. Although ICLEI is developing a Community GHG Emissions Inventory Protocol, it has not been finalized (as of the date of this report) and the accounting methods for such a protocol are still a topic of vigorous debate. This is partly due to the difficulty in setting boundaries where jurisdiction is divided among residents, businesses, non-governmental organizations, the municipality, County and, in some cases, federal and state governments for roadways and installations under their ownership/control. Further, the issue of cross-boundary emissions from mobile sources coming in and going out of the community makes accounting for them problematic and continues to be addressed differently in community inventories across the country. In the absence of a single protocol where the design of the community-wide inventory has been agreed upon, an approach has been developed for Marathon'

Community-wide Inventory based on a combination of traditional GHG accounting elements of best practice in the literature and some recommendations provided in guidance such as the Bay Area Air Quality Management District ("BAAQMD's") GHG Quantification Guide (BAAQMD, 2010).

Table 5.5- Community-wide Direct and Indirect Emission Sources

DIRECT EMISSIONS (SCOPE 1)	INDIRECT ENERGY EMISSIONS (SCOPE 2)	OTHER INDIRECT EMISSIONS (SCOPE 3)
• Mobile Combustion – On-road vehicles using gasoline or diesel for vehicles. • Mobile Combustion – Off-road marine vessels using gasoline or diesel. • Stationary Combustion – propane combustion.	• Electricity Consumption – Residential, commercial heating/cooling, lighting, business operations.	• Mobile Combustion – On-road vehicles using gasoline or diesel; fuel consumption based on all vehicle miles traveled in Marathon.

The Scope 3 category includes emissions associated with all vehicle miles traveled ("VMT") in Marathon including pass-through traffic, excluding emissions from marine vessels. Based on the data available for Scope 3, it is not feasible to separate out the total emissions from "community-owned/controlled" vehicles that are owned by non-community members driving through Marathon. Therefore, the Scope 3 emissions are not a truly accurate reflection of "pass-through" only. This category includes pass-through emissions plus all in-community travel by vehicles owned by community residents, businesses and the City. This should be considered when making decisions regarding the steps that can be taken to reduce the transportation-related category of emissions.

5.3.1 Communitywide Energy Use

The CY2010 Community-wide Inventory required the collection of activity data in three emissions categories: direct mobile combustion emissions, direct stationary combustion emissions and indirect emissions from purchased electricity. Community-wide residential, commercial, and industrial electricity consumption data was provided by FKEC. No other direct data was available. Therefore, proxy[4] data was used for the other emissions sources that were included in the Community-wide Inventory. A summary of the Marathon's Community-wide energy and estimated fuel consumption for 2010 is provided in **Table 5.6**.

[4] A figure that can be used to represent the value of something in a calculation.

Table 5.6 – Community-wide Energy Consumption

Energy & Fuel Consumption Categories	Calendar Year 2010 Energy & Estimated Fuel Consumption
Purchased Electricity- Commercial	79,997 MWh
Purchased Electricity- Residential	75,044 MWh
On-Road Vehicle Fleet (Gasoline)	3,546,177 gallons
Off-Road Mobile- Marine (Gasoline)	3,033,875 gallons
On-Road Vehicle Fleet (Diesel)	1,467,533 gallons
Off-Road Mobile- Marine (Diesel)	1,074,232 gallons
Stationary Combustion (Propane)	123,163 gallons

5.3.2 Communitywide GHG Emissions

Marathon's estimated Community-wide Scope 1 and Scope 2 emissions total 172,283.13 MT CO_2e. Mobile emissions accounted for 49.6% of the community-wide Scope 1 and Scope 2 total. Purchased electricity accounted for 50% of the total emissions for the community, with stationary combustion of propane comprising the remaining 0.4% of emissions. Commercial usage of purchased electricity accounted for 52% of the total Scope 2 indirect emissions or 44,476 $MTCO_2e$, with the remaining 48% or 41,722 $MTCO_2e$, resulting from residential electricity usage.

Scope 1 emissions from on-road travel by vehicles in CY 2010 are estimated at 176 $MTCO_{2e}$, accounting for 55% of the community-wide total Scope 1 GHG emissions. Gasoline combustion by marine vessel accounted for 44% of the Scope 1 emissions. **Table 5.7** provides a summary of the total community-wide sources of GHG emissions. **Figure 5.3** compares the Scope 1 and Scope 2 emissions.

Scope 3 on-road vehicle emissions totaled 60,517.09 $MTCO_2e$, which was approximately 28% higher than the Scope 1 on-road vehicle emissions. The difference between these two values does not equal the emissions associated with just pass-through traffic because the Scope 3 emissions include in-community travel by Marathon vehicle. However, this number suggests that pass-through traffic is significant.

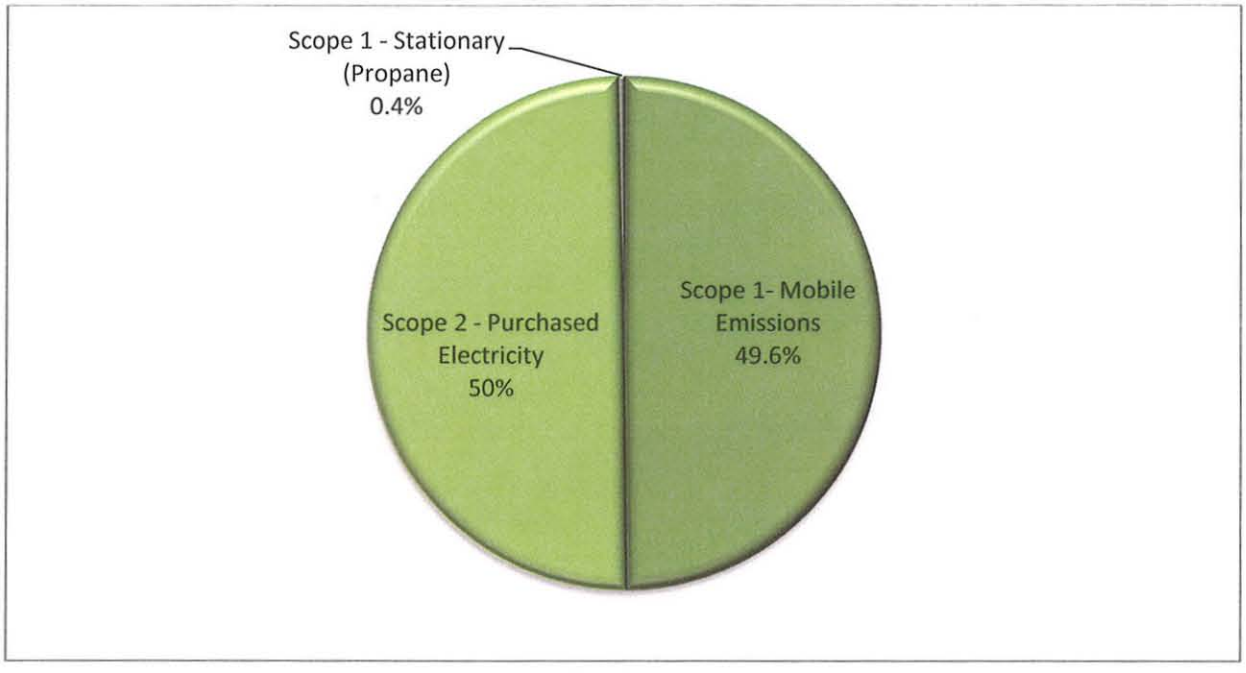
The following emissions sources were assumed to be *de minimis*[5] (small) and were excluded from the scope of the Community-wide Inventory: fugitive emissions from refrigeration and air conditioning, emissions from fossil fuel use in landscaping equipment, grills, motorcycles, ATVs, private planes and other sources owned by Marathon businesses and residents and that do not (when aggregated) represent a significant portion of the Community-wide emissions.

[5] Most GHG registries and reporting programs allow a small (*de minimis*) portion of an entity's emissions (such as 3 or 5 percent) to be excluded from an emissions inventory or estimated using simplified estimation methods.

Table 5.7- Community-Wide GHG Emissions Summary

			Emissions (metric tons)			
	Quantity	Units	CO_2	CH_4	N_2O	CO_2e
Scope 1						
Mobile Emissions						
Gasoline - On-Road Vehicles	3,546,177	Gallons	31,135.43	1.94	2.17	31,848.91
Diesel - On-Road Vehicles	1,467,533	Gallons	14,983.52	0.93	1.04	15,326.87
Gasoline - Off-Road Marine	3,033,875	Gallons	26,637.43	1.66	1.86	27,247.83
Diesel - Off-Road Marine	1,074,232	Gallons	10,967.91	0.68	0.76	10,967.91
Total Mobile Emissions			***83,724.29***	***5.22***	***5.84***	***85,391.52***
Stationary Emissions						
Propane	123,163	Gallons	688.83	0.12	0.01	693.51
TOTAL SCOPE 1 EMISSIONS			**84,413.12**	**5.34**	**5.84**	**86,085.03**
Scope 2						
Purchased Electricity – Commercial	79,997	MWh	41,531.62	1.40	0.52	44,476.12
Purchased Electricity – Residential	75,044	MWh	44,273.19	1.49	0.55	41,721.98
TOTAL SCOPE 2 EMISSIONS			**85,804.81**	**2.90**	**1.07**	**86,198.10**
TOTAL SCOPE 1 & 2 EMISSIONS			**170,217.93**	**8.24**	**6.91**	**172,283.13**
Scope 3						
Mobile Emissions						
Gasoline - On-Road Vehicles	4,926,139	Gallons	43,251.50	2.69	3.01	44,242.62
Diesel - On-Road Vehicles	1,558,265	Gallons	15,909.89	0.99	1.11	16,274.47
Total Mobile Emissions			***59,161.39***	***3.69***	***4.12***	***60,517.09***

Figure 5.3- Community-wide Scope 1 and Scope 2 GHG Emissions



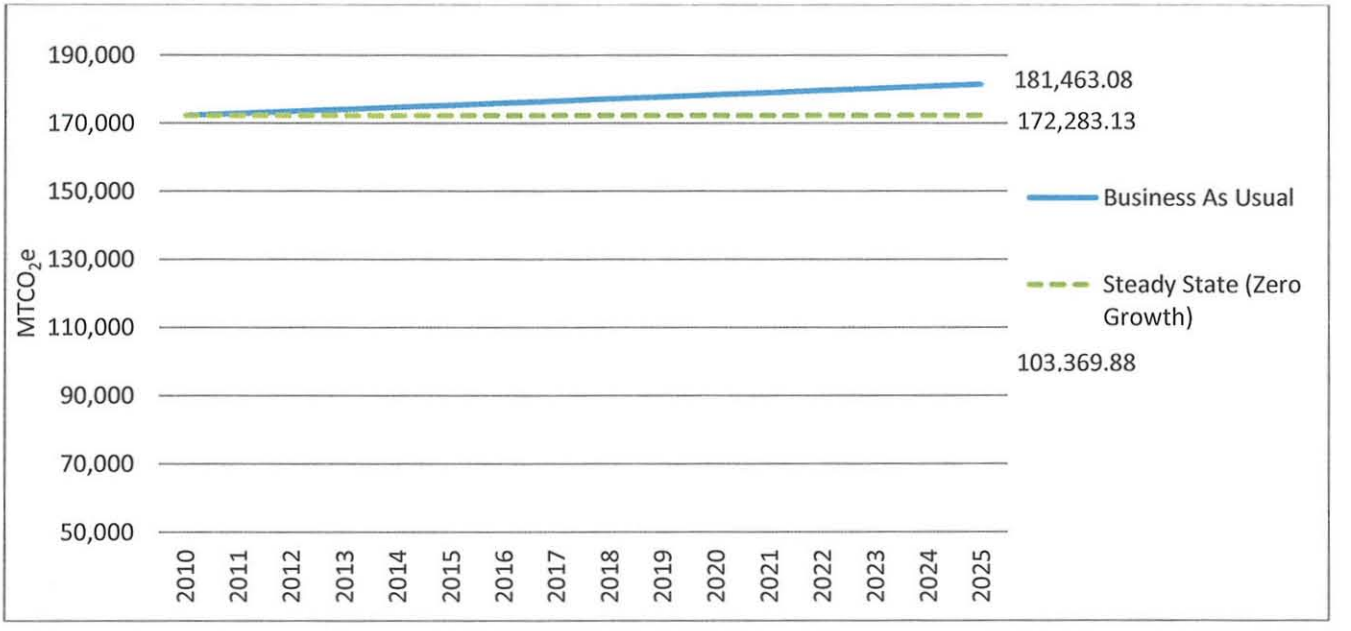
5.3.3 Communitywide Metrics Goals & Targets

While Census data may have indicated a population decline over the previous decade, to conservatively estimate emissions, the forecast assumed a modest population increase[6] beginning in 2011 consistent with the growth projected in City's Comprehensive Plan (2005). It was assumed that a constant number of people would move into the City each year[7] based on projected population for 2020 provided in the City's Comprehensive Plan. In this SCP, the City has not defined a target for community-wide emissions at this time because these emissions are not within the City's direct control. As more collaboration between FKEC and the City occurs with new data from the SCP, the City can revisit setting a communitywide target in the future. Even though a specific reduction target has not been developed, the SCP does include numerous recommendations to reduce energy use from the community and achieve other sustainability and climate goals as a whole.

[6] 4.1% between 2010 and 2020.

[7] Adding the same number of people each year increases the population but results in a slight decline in percent population growth year-over-year.

Figure 5.4 - Projected Community-Wide GHG Emissions



6.0 Climate Change Impacts and Response

Shoreline features of the Atlantic coastline for the City include small tidal creeks, harbors, and embayments. Numerous large channels provide connections between the oceanic and the shallow nearshore waters in the Lower Keys. Shallow water less than 20 feet in depth extends approximately two miles offshore in the Upper Keys, including Marathon.

The body of planning and science related to the impacts from climate change in the Keys is increasingly recognizing the inter-connected nature of the Keys ecosystem from terrestrial to coral reef resources. The low elevation of the Keys highlights the potential for impacts from climate change. The main hazard is from sea-level rise, expected to threaten at least 38% of the current land area by 2100 based on certain planning scenarios.[viii] Storm surges from hurricanes and coastal erosion aggravate that threat. Decisions on the location and assumptions for critical infrastructure must include assumptions to account for these impacts. Based on the geography and topography in the Keys, it is clear the City has a vested stake in proactive planning and decision-making in preparing for climate change. Adopting policies to address those impacts can highlight the unique impacts the City is facing in the future.

6.1 The Projected Impacts– The Keys and Marathon

Climate change will have an ever-increasing impact on the City and community in the future. The following are some of the implications to consider:

- **Impacts on Habitat.** Plant and animal species will be impacted by ecological disturbances related to climate change -e.g. flooding, storms with some habitats changing more rapidly, slowly or just disappearing entirely.

- **Water Supply Impacts**. While the precise amount of sea level rise, or speed with which it rises, may not be known, sea level rise will reduce the amount of fresh water, both from surface and groundwater, available for potable water use.[8]
- **Stormwater Management**. The effectiveness of drainage and stormwater structures to direct and capture stormwater flow will diminish over a gradual progression, reducing the difference between water levels on either side of a flood control structure or increasing the water table closer to the surface.
- **Water Quality Impacts**. More intense storms will result in increased stormwater and non-point runoff which in turn could increase algae growth, result in higher levels of water quality indicators such as fecal coliform bacteria and turbidity, pH changes and overall higher water temperatures.
- **Additional Infrastructure Considerations**. Future impacts to hospitals, schools, libraries, transportation facilities, multi-modal stations and, commercial and residential centers.

The City is already an area of special flood hazard identified by the Federal Emergency Management Agency in the Flood Insurance Study (FIS) for the City, dated February 18, 2005. Planning for adaptation and resilience will initially add a further dimension of complexity into already complex development decisions and City infrastructure projects. Introducing resilience as a new performance requirement into the conventional process of upgrading specific facilities and service systems involves the addition of measures that have not historically been considered such as the following:

- **Ambient Temperature Increase.** Since 1970, the annual average temperature has risen about 2°F (1.1 °C), with the greatest seasonal increase occurring during the winter months. The number of days per year having temperatures of 90°F (32°C) or higher will increase and eventually approach 180 (or half the year), resulting in heat stress for people, plants and animals.[ix] More recently, NOAA has stated that March 2012 is the warmest on record.[x]
- **Sea Level Rise.** The threat of sea-level rise will impact the Florida Keys. The average elevation of the larger islands range from four to seven feet or 1.2 to 2.1 meters (Monroe County 2005). An analysis by The Nature Conservancy shows that even according to the most optimistic IPCC scenario, which predicts an average sea-level rise of 18 cm by the end of the century, 38% of the total Keys area will risk inundation.[xi] This increases to 75% of the total Keys area according to the most pessimistic IPCC scenario, which predicts an average sea-level rise of 59 cm.[xii] The sea level rise projections the City is relying upon are reflected in Figure 5.5.
- **Hurricane Intensity.** There is scientific debate[xiii] as to whether or not there will be more hurricanes, and/or more intense hurricanes, but there is scientific evidence showing that the destructive potential of Atlantic hurricanes has increased since 1970, in correlation with an increase in sea surface temperatures.[xiv] Hurricane effects are of particular interest in the Florida Keys, due to the high frequency of tropical storms, the low elevations (1–3 m) and numerous emergency management issues.
- **Disease Vectors.** Extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems, such as changes in the range of infective parasites, can

[8] While the City does not receive water from directly groundwater withdrawals in its geographical area, ultimately portions of the City's water supply are served by groundwater resources through the FKAA Consumptive Use Permit. Additionally, while the resources are located in Miami-Dade County, the impacts to those water resources will have regional impacts for those that depend upon them.

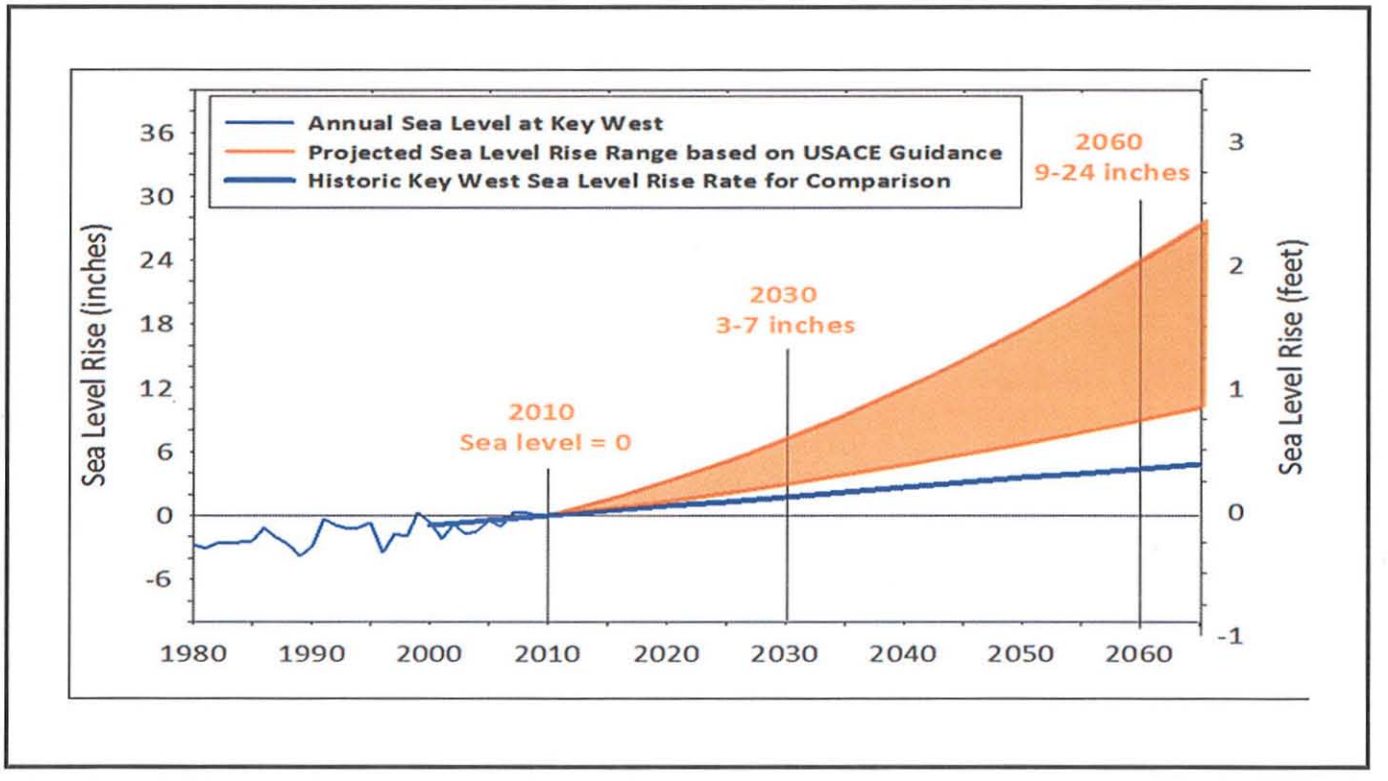
impact the amount of infectious diseases. In addition, warm temperatures can increase air and water pollution, which in turn threaten human health.[xv] Climate change impacts may increase the risk of some infectious diseases, particularly those diseases that appear in warm areas and are spread by mosquitoes and other insects including malaria, dengue fever, yellow fever, and encephalitis.

- **Other Impacts.** The shallow tropical waters in which most corals are found are warming. Heat stress causes corals to expel the symbiotic algae that provide their primary source of nutrition, leaving only remnant portions of the corals behind (coral bleaching). Coral bleaching, which has increased in recent decades, becomes worse as high temperatures last longer and longer. Corals are also being affected by ocean acidification, which is caused by the increase in CO_2. This affects the ability of marine organisms to build their shells and skeletons. Ocean acidification is likely to slow, or even stop, the growth of coral over this century which will impact the entire ocean food chain.[xvi] Climate change will also increase damaging pest infestations, as pests move to and thrive in new or changing habitats and temperatures. Likely species include bark beetles, grasshoppers, fungi, and the aforementioned diseases transmitted by bacteria, parasites, and viruses.
- **Estimated Property and Overall Economic Loss.** Under the most optimistic IPPC scenario – a rise of 18 cm over the next 100 years – $11 billion in property value and 58,800 acres are at risk of inundation in the Florida Keys. Under the highest Rahmstorf estimate, –a 140 cm rise by 2100 – approximately $35 billion in property value and 142,000 acres are at risk in the same area. For the Middle Keys, this translates into anywhere from 4,430 to 17,500 acres at risk ($753,000,000 to $6,400,000,000 in property values).[xvii]

  Climate change is altering the industry's global business landscape and the risk models on which it crucially depends. According to Swiss Re, the average weather-related insurance industry loss in the U.S. was about $3 billion a year in the 1980s compared to approximately $20 billion annually by the end of the past decade. As the National Association of Insurance Commissioners ("NAIC") itself has noted, this fast-emerging threat will have broad impacts across the industry, clouding its ability to price physical perils, creating potentially vast new liabilities and threatening the performance of its huge investment portfolios.[xviii]

Where homeowner's insurance and flood insurance premiums are already challenging, it is important to note that many large private insurers are incorporating climate change into their annual risk management practices, and some are addressing it strategically by assessing its potential long-term industry-wide impacts.[xix] This could have an additional impact on the cost of insurance in the City.

Figure 6.0



6.2 Timeframes of Impacts

While there are a multitude of climate change scenario models, for the purposes of consistency, the sea level rise assumptions underlying the work of the Southeast Regional Climate Compact will serve as the basis for the City's planning purposes. In summary, the projections of sea level rise and timeframes for those projections are contained within Figure 6.0.

6.3 Overview of Responses to the Challenges

Across the nation, individuals, businesses, and federal, state, and local governments are already consciously making decisions to respond to climate change. Individuals are choosing whether to make their homes and transportation more energy efficient by supporting new related policies. Private companies are reducing their carbon footprints, and some are planning for climate impacts. Humanitarian and environmental non-governmental organizations ("NGOs") are deciding how to guide their members and respond to climate change. Resource managers are deciding how to manage water, forests, and coastal ecosystems to reduce the risks of climate change. Cities and states are starting to limit emissions and develop adaptation plans despite the fact that federal, state or local law may not

require it. Today, more than 50% of Americans live in a jurisdiction that has enacted some sort of GHG reduction goal. Responses to climate change can generally be categorized as follows:

- **"No Regrets"** options that are assessed to be worthwhile now (in that they would yield immediate net economic, environmental and/or social benefits) and continue to be beneficial irrespective of the nature of future climate.
- Policies where the cost implications are relatively small while the benefits under future climate change may be potentially large, although uncertain. In these **"Low Regrets"** options the regret associated with the cost of such policies is low or limited (for example policies about building design that promote adaptation to future climate variability or policies encouraging an increase in the margins of safety such as additional allowance in the design of coastal flood defenses).
- No Regrets and Low Regrets decisions are instances where the uncertainty associated with climate change impacts should not greatly constrain policy making. These types of policy decisions are a goal of the SCP.
- Decision makers need to be particularly aware of policies that could constrain or reduce the effectiveness of future options for adaptation, for example allowing housing developments in areas vulnerable to flooding which prevent flood management options in the future. This is an example of a decision that has a **"high level of regret"** for later decision makers.[xx]

Proactive policy planning for climate change adaptation improves the overall preparedness by integrating adaptation considerations into the decision making process overall. Most of these decisions are not necessarily "new" requiring new budget commitments, but may just require a philosophical shift in how to plan for growth, development and capital improvements (infrastructure).

6.3.1 Mitigation

The IPCC defines mitigation as: "An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases."[xxi] At best, mitigation of anthropogenic sources of GHGs can attempt to minimize long-term climate change impacts, but cannot halt or avoid all impacts. Therefore, adapting to the adverse impacts of climate change is a reality, and in some instances the need is immediate. "Mitigation" of GHG emissions will affect the magnitude of the climate change impacts to which "adaption" will need to occur. Mitigation of GHG emissions and adaptation to climate change are inextricably linked, and both are required to reduce the impacts that have been occurring or will occur in the future.

6.3.2 Adaptation

The IPCC defines climate change adaptation as "an adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts."[xxii] Adaptive measures are needed because adverse consequences are expected to occur globally. The current knowledge of climate change associated impacts, has led the global community to the conclusion that "adaptation will be necessary to address impacts from the warming which are already unavoidable due to past emissions."

6.3.3 Vulnerability

"Vulnerability" to climate change refers to the exposure, sensitivity, and adaptive capacity of systems to climate change.[xxiii] Vulnerability is a central concept for climate change adaptation policy and planning,

and can be seen as the connecting thread that links all the adaptation concepts. Climate change vulnerability can be defined as "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and adaptive capacity." Vulnerability is multi-disciplinary in nature, because social, economic, and environmental systems can all be vulnerable to climate change.[xxiv]

6.3.4 Resiliency

Resilience to climate change is the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimal damage to social well-being, the economy and the environment .[xxv] It is this final response of "resilience" that the City seeks to achieve.

6.4 GHG Framework at the Federal Level

The Federal government administers a wide variety of programs and initiatives to reduce U.S. GHG emissions. These programs focus on energy efficiency, renewable energy, methane and other non-CO_2 gases, agricultural practices and implementation of technologies to achieve GHG reductions. The U.S. Global Change Research Program ("USGCRP") coordinates and integrates federal research on changes in the global environment and their implications for society.[xxvi]

In 2007, the U.S. Supreme Court ruled that EPA must regulate CO_2 and other GHGs as pollutants under the Clean Air Act.[xxvii] This led to series of regulations and reporting requirements for GHG emissions resulting in an evolving landscape on GHG management and regulation. In the years after *Mass v. EPA*, several federal level climate or energy bills addressing various sustainability, energy, GHG management and climate principles have been offered but no significant laws or regulations have passed mandating specific GHG reduction levels. The amount of litigation related to GHG management and climate change has risen exponentially ranging from cases involving liability related to the impacts from climate change, poor regulatory or permitting decisions in the face of GHG emissions and climate change, to loss of habitat, insurance company exposure and Endangered Species Act claims. These types of claims have even been the basis for challenging land use and regulatory decisions at the local and state levels as well. It is important to note this evolving pattern because governmental and private sector actions are undergoing increased scrutiny to determine if they are based on reasonable science. In some cases, liability has been imposed for these types of decisions that do not factor this type of climate related data.[xxviii]

Federal Executive Order (E.O.) 13514, Federal Leadership in Environmental, Energy, and Economic Performance, establishes an integrated strategy for sustainability within the Federal Government. In an October 2010 *Progress Report to the President*, the Climate Change Adaptation Task Force recommended that Federal agencies develop and implement coordinated climate adaptation plans. The goal of integration of climate change adaptation planning into the operations, policies, and programs of the Federal Government is to ensure that resources are invested wisely and that Federal services and operations remain effective in current and future climate conditions. This trend in terms of a strategy to prepare agencies and the government for these impacts is being seen across various other state and local governments as well.

6.5 GHG Framework at the State level

In 2006, the Florida Legislature passed the Florida Energy Act (within Chapter 377, F.S.) which, among other things, created the Florida Energy Commission ("FEC"), and provided for renewable energy grants and a solar rebate program. In 2007, Governor Charlie Crist signed a series of executive orders aimed at reducing greenhouse gas emissions and establishing an Action Team on Energy and Climate Change. Other legislation was passed in 2007 directing the Florida Building Commission to create a model green building ordinance and in 2008, legislation was passed directing local governments to include GHG reduction strategies into their Comprehensive Plans. Legislation was also passed in 2008 that requires newly constructed government buildings to meet the rating requirements of the U.S. Green Building Council's Leadership in Energy & Environmental Design ("LEED") or the Florida Green Building Coalition, or another comparable third party "green" building rating system. This provision was later amended to include the International Green Construction Code. In 2008, legislation was passed that mandates the Florida Building Code be significantly increased in its energy efficiency requirements. Finally, in 2010, legislation was passed that provides authority to local governments to create energy financing and retrofitting programs and that revises the state's recycling targets to make them more aggressive.

In the 2007-2009 timeframe, the Florida Energy and Climate Change Action Plan was developed (pursuant to Executive Order 07-128). Phase I of the Report includes 35 findings and 30 recommendations. Among the categories covered are power generation, transportation and government recommendations to lower and diversity energy use and diversity energy sources as well as take steps to start planning for climate change impacts. It called for "organizing the state government for Florida's energy future." Phase2 of the report detailed 50 separate policy recommendations to reduce GHG emissions and provide a framework for climate change adaptation strategies over the coming years and decades. Finally, in 2008 an important amendment to the Florida Forever legislation made properties subject to sea level rise eligible for state land acquisition funding. Section 259.105 (17)(d), F.S.

In recent 2011 revisions to Florida's Community Planning Act, Chapter 163, F.S. local governments are permitted to establish "adaptation action areas" in their comprehensive plans where the community "identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning." Specifically, the law states:

> "At the option of the local government, develop an adaptation action area designation for those low-lying coastal zones that are experiencing coastal flooding due to extreme high tides and storm surge and are vulnerable to the impacts of rising sea level. Local governments that adopt an adaptation action area may consider policies within the coastal management element to improve resilience to coastal flooding resulting from high-tide events, storm surge, flash floods, stormwater runoff, and related impacts of sea level rise. Criteria for the adaptation action area may include, but need not be limited to, areas for which the land elevations are below, at, or near mean higher high water, which have an hydrologic connection to coastal waters, or which are designated as evacuation zones for storm surge."

Other local governments across the country and Florida are addressing these issues through various efforts and in their requisite Comprehensive Plans.[xxix] For instance, Smart Charlotte 2050, the County's

new Comprehensive Plan, (adopted in 2010) addresses climate change and sea level rise in the data and analysis generally. The Plan states that the County would, "Consider climate change in County decisions particularly along the coast". Sarasota County also includes a discussion of sea level rise and climate change in the data and analysis of its Comprehensive Plan. Several cities, including Punta Gorda and Ft. Myers Beach also address these issues in their Comprehensive Plans, as previously stated, even though there is no state law requiring it.

6.6 Southeast Regional Climate Compact and Regional Climate Action Plan

The Southeast Florida Regional Climate Change Compact (the "Compact") is a joint commitment between Monroe, Miami-Dade, Broward and Palm Beach Counties to partner and work together toward mitigating the causes, and adapting to, the consequences of climate change. It was formalized in 2009 following the first Southeast Florida Climate Leadership Summit when elected officials from all participating counties came together to discuss challenges and strategies for responding to the impacts of climate change. The Compact outlines a collaborative effort to participate as a Regional Climate Team working toward the development of a Southeast Florida Regional Climate Change Action Plan. Specifically, the Compact includes commitments on the part of the participating counties relating to joint policy positions, legislative positions and collaborative planning.

There are also several work groups and sub-groups compiling information to complete work products including a Greenhouse Gas Work Group, a Vulnerability Work Group, and a Sea Level Rise Work Group. Finally, the Regional Climate Change Action Plan is currently being developed focusing on priority planning areas, narrowing that focus through vulnerability and risk analysis and integrating it with the concepts of mitigation and adaptation. The priority Areas of the Plan include: Land and Natural Systems, Transportation and the Built Environment. A Draft document was completed in December 2011. Reasons for coordination between this planning effort and the Compact's work include:

- Use of consistent data for timeframes and impacts from sea level rise.
- Assuring a coordinated approach towards any common strategies, to the extent practicable, for reducing GHG emissions and preparing for climate change impacts.
- Recognizing that various policies and initiatives can only be implemented within certain levels of government due to municipal and county home rule powers and respective agency roles, communication on these issues can only be effective if it occurs from the local to the regional level and vice versa.

The City will provide its data and SCP for integration into the Compacts' documents and planning efforts as applicable. The City will also coordinate with the County by providing its data and the SCP. By providing data and the SCP the goal is to enhance outreach and engagement with these entities and the various municipalities within their jurisdictions.

7.0 Focus Area in the Sustainability and Climate Plan

The substantive areas the SCP covers are:

- City Facilities, Infrastructure and Operations
- Energy Use
- Buildings and Homes
- Land Use and Transportation
- Waste Reduction
- Landscape, Habitat and Marine/Coastal Resources

A discussion of each Focus Area follows with an overview of challenges and opportunities as well as recommendations for meeting GHG reduction goals (if applicable) or more generalized sustainability driven goals. While some recommendations are quantitative, others a driven by dates or broader milestones. This approach provides a more flexible approach for measuring progress and integration into the City's existing policy and planning decision-making processes.

7.1 City Facilities, Infrastructure and Operations

Even though the City's GHG emissions are approximately 1% of the community-wide total, the approach to the SCP is to first focus on government operations and policies for a twofold purpose. First, the City recognizes the need to establish an achievable goal to reduce emissions within its control. Second, the City can lead by example and demonstrate to the community that specific targeted actions to reduce emissions can have quantifiable and cost-saving results. To draft this SCP, the City identified the Initiatives and Actions most likely to foster the long-term changes necessary to achieve its goals. Key criteria in developing the actions were the magnitude of emissions reductions (if that linkage could be made with a particular strategy or recommendation), the scale of economic and community benefits from achieving the goals and the feasibility of the actions along with the ability of the City to facilitate their implementation.

To meet the City's established targets, it is apparent that reductions in energy usage will be required in: 1) buildings 2) infrastructure, and 3) fleet.

7.1.1 City Buildings

The City currently controls 14 buildings, included in the GHG and the Performance Based Retrofit Analysis, and additional small facilities such as restrooms serving those buildings and 31 vehicles of varying types. In January 2012, the City finalized a Performance Based Retrofit Analysis to identify retrofit opportunities using the following determining factors; location, maintainability and flexibility of new equipment, indoor air quality, energy efficiency, cost effectiveness, constructability, and any proposed future modifications. The Analysis documented existing conditions, baseline measures and energy conservation measures that would result in a significant energy usage reduction and/or identify energy related capital projects improving the facility's condition and operation while reducing energy consumption. The Analysis included the following facilities:

- City Hall - (2) manufactured buildings that were assembled in 2006 and 2008. Each building has its own electric meter.
- Fire Station 14- 16,782 square foot two story facility constructed in 2007.
- City Marina - (2) one-story buildings consisting of approximately 12,576 square feet in total. The original structure was constructed in 1963 and the newer bathhouse was constructed in 2010.
- Community Park Phase 1 and 2- Multiple small buildings and recreational fields. The buildings combined are approximately 1,900 square feet. .
- Teen Center leased out by the City- Approximately 2,077 square feet and originally constructed in 1965.
- Jesse Hobbs Park- Lighted basketball court and sandy playground.
- Sombrero Beach Park- Park and beach.
- Sombrero Beach Bike Path- Lighting along Sombrero Beach Road.

Completing the remaining projects identified in the Performance Based Retrofit Analysis would result in approximately another 1% of GHG emissions reductions thus achieving the first 5% reduction target by 2014.

After the Analysis was completed, the City undertook the following energy conservation measures:

- Community Park: Retrofit (72) high intensity discharge ("HID") pole top lights with induction retrofit kits. Retrofit (2) HID sign lights with induction kits.
- Sombrero Beach Bike Path Lighting: Retrofit (133) HID decorative post tops with new light emitting diode ("LED") technology.
- Jesse Hobbs: Replace (4) HID basketball flood lights with new induction flood lights. Install new timer switch.
- Sombrero Beach Turtle Lights: Replace (9) HID shoebox fixtures with new amber colored LED technology.
- City Marina:
  - Replace (7) exterior barn lights with induction wallpack
  - Replace (1) flagpole light with induction flood
  - Replace (10) dock lights with new fluorescent vapor tight light fixtures
  - Replace (31) interior lights with new flourescent wraps and strips
- Miscellaneous Work
  - Install 200amp Disconnect at Ampitheater in Community Park to shut off transformer.
  - Install (2) new exhaust fans at Sombrero Restrooms to be controlled by occupancy sensors.
  - Install (8) timer switches at Sombrero Restrooms to replace broken occupancy sensors

After undertaking these projects, based on the GHG assumptions in Section 5.0 and the baseline established in the GHG Inventory, these retrofits achieved approximately a 4% reduction in the City's GHG emissions from the 2010 baseline established through this process. This places the City in an excellent position to meet its first GHG reduction target of 5% by 2014 (below 2010 levels).

7.1.2 City Infrastructure

Based on Florida's concurrency management requirements in Chapter 163, F.S., capacity for certain infrastructure must be available to meet the public facilities needs generated by all future growth and development. According to the City's Comprehensive Plan, growth in the City is managed to assure that adequate public facilities and services including transportation, potable water, surface water management, wastewater, and recreational facilities are provided according to the City's adopted level of service standards.

The energy efficient design of the City's wastewater plants are a prime example of exactly how the City should be planning its infrastructure to reduce GHG emissions as well as overall costs.

Water quality is a central and complex issue for the Florida Keys and there are several specific state and federal laws, rules and regulations that require specific water quality targets to be met. This has an impact on the City's growth, development and infrastructure in terms of what must be constructed and to what level of service. The Florida Keys Reasonable Assurance Plan was developed by DEP in cooperation with local governments, state agencies, and federal agencies within the Florida Keys to set forth and accelerate reduction of nutrient loading in near shore waters so that water quality standards are met and beneficial uses are restored. The Plan was reviewed and accepted by DEP in 2008 and was provided to EPA for review and comment in February 2009. DEP adopted the Reasonable Assurance Plan by Order on February 7, 2012. Therefore, the City is legally required to meet stringent water quality targets through state and federal mandates including the Florida Keys Reasonable Assurance Plan.

To meet these water quality requirements, the City has undertaken many recent stormwater and wastewater infrastructure upgrades and improvements, but the City has already accomplished a significant amount of energy reduction by designing these components with high efficiencies in mind.

7.1.2.1 Water

Available potable water is critical to maintaining the public health and safety within the Florida Keys. The potable water system must take into consideration available capacity to serve existing and future residents and businesses, as well as water volumes and system design (pressure) for fire protection purposes. Potable water is provided to the City by the Florida Keys Aqueduct Authority ("FKAA") which holds a permit to withdraw water from various water resources. The City provides domestic water service through the FKAA, a political subdivision of the State of Florida, created by Special Legislation Chapter 76-441, Laws of Florida, to provide domestic water service to all of the Florida Keys.

FKAA uses the well field and treatment facility in Florida City. Treated water from the Biscayne aquifer is pumped through a transmission main from the Florida City water treatment plant throughout the Florida Keys. The transmission main discharges to distribution systems in each of the Keys before terminating at the storage tanks and pump stations that serve the Key West distribution systems. The water resource alternatives for persons living in the Keys who do not obtain water from FKAA are cisterns, home desalination systems, and bottled water for potable use.

The City already reuses wastewater for irrigation at all of its new wastewater facilities (where it is treated) and it is unlikely that there is any available supply of reuse water for additional users. The City already uses native and drought tolerant landscaping at all of its new wastewater facilities. The City could potentially use more water conservation features at all City facilities and buildings where feasible (or new facilities that are constructed) such as:

- More efficient irrigation systems
- Rainbarrels/cisterns
- Reuse of condensate water from HVAC systems depending on the complexity of the systems

Article IV of the City's Land Development Regulations specifically addresses Water Conservation. The City could explore creating a rain barrel incentive or rebate program (offset through utility bills). As a water conservation strategy, FKAA suggests conversions of older septic systems for rainwater capture purposes. This provides a dual benefit for additional management of run-off and is suggested as a non-structural control to mitigate water quality impacts in the Reasonable Assurance Plan.

7.1.2.2 Stormwater

Surface water runoff from various land uses largely drains to a network of canals, access ways, roadside ditches, the ocean and the Florida Bay. The existing shallow soils allow the rainfall to percolate directly into the porous limestone bedrock. Adjacent to near shore waters discharge occurs in the form of shallow overland flow. Other existing public and private surface water management facilities include storm sewers and retention basins installed by the FDOT along portions of US 1 who is responsible for maintaining facilities along US 1 and State Road 931 (Sombrero Beach Road).

On July 30, 2002, the City adopted Ordinance 02-07-13 titled Master Service assessment Ordinance allowing the City to collect assessments as necessary for infrastructure purposes. On March 10, 2004, FDEP designated the City Of Marathon as a regulated municipality under Phase II of the National Pollutant Discharge Elimination System ("NPDES").[xxx] One of the requirements of this designation was to create a stormwater utility and implement a five year program to prohibit stormwater run-off discharges into Florida Outstanding Waters. On May 10, 2005, the City adopted Ordinance 2005-10 creating the stormwater utility. The stormwater construction project, incorporating all of the City's roads, resulted in approximately $25 million of new infrastructure improvements to meet these requirements. As of 2011, Marathon has completed all targeted stormwater projects.[xxxi]

7.1.2.3 Wastewater

Sections 381.0065 and 381.0066, F.S. require the areas within the Florida Keys to meet certain advanced waste treatment requirements and standards. To meet those standards, this law required local governments to establish wastewater collection, transmission, and treatment facilities by July 1, 2010.

The deadline was then extended to December 31, 2015, with water quality targets expected to be achieved by 2020.

In order to meet these requirements, over the past several years, the City has undertaken approximately $100,000,000 in new and retrofit wastewater and stormwater projects. The projects include construction to install more than 56 miles of vacuum, gravity and low pressure sewage collection lines and six wastewater treatment facilities.

While meeting these legal requirements is positive in terms of improving water quality throughout the Keys it highlights the competing objective of lowering energy use. Approximately 3% of total U.S. electricity is used in the municipal water and wastewater sector. As much as one-quarter to one-half of the electricity used by most U.S. cities is consumed at municipal water and wastewater treatment facilities. The amount of electricity used to collect, treat, and distribute drinking water is slightly greater than the amount used to collect, treat, and dispose or reuse municipal wastewater. However, the treatment of wastewater is significantly more energy intensive than is the treatment of raw water for potable use.

Although the City has made these improvements, the City's new wastewater plants have been designed capturing as many energy saving features possible. All 5 wastewater plants have been designed with energy efficient features and operations including:

- 3 (versus 2) treatment units to allow for portions of the plant to not be operated when demand is lower i.e. in off season.
- Variable frequency drives on blowers to allow for operation of plant treatment units based on actual demand rather than having them constantly run.
- Pneumatic pressure valves for air injection throughout the City's vacuum collection wastewater system reducing the need for energy use throughout the collection system.
- The City uses jet aeration which provides more efficient transfer of oxygen than traditional coarse bubble diffusers, reducing the amount of energy required to provide adequate dissolved oxygen for the biological process.
- Operations of wastewater facilities buildings that reduce lighting use in off-times both through automatic and manual outdoor lighting controls.
- Sludge is dewatered to 22% solids, reducing the number of truck runs into and out of the Keys by 10-fold. One truck load of dewatered sludge = 10 truckloads of liquid sludge equating to less fuel consumption and emissions. For this process to occur, a portable centrifuge was purchased that can travel from site to site, again saving money and footprint for the city.

When, Fats, Oils and Grease ("FOG") is disposed of in the wastewater system, it cools, solidifies and adheres to distribution pipes and equipment. Without proper disposal, FOG products enter the wastewater system creating problems in sewer lines, pump stations and ultimately the wastewater treatment process. Eventually this can cause the system to backup, overflow or reduce the conveyance of materials through the system. Successful FOG management programs require facilities to either install and maintain grease interceptors or to assure pick up of spent products. The City has FOG waste requirements that restaurants are required to install, operate and maintain grease interceptors meeting the requirements specified by the Department of Health ("DOH"). The wastewater discharge from these facilities, even when passed through a properly sized and maintained grease interceptor, may contain elevated levels of Biochemical Oxygen Demand (BOD). A surcharge may be applied to the customer's

wastewater services bill for wastewater discharges with a BOD in excess of 500 parts per million. The City's stormwater regulations also address these issues. Enforcement and inspections to assure that requirements are met are challenging with current staff availability.

7.1.3 Opportunities for Green Infrastructure

"Green infrastructure" approaches have been recognized to help achieve GHG mitigation and climate change adaptation goals because their benefits are also generally related to their ability to moderate the impacts of climate change such as extreme precipitation or temperature. On a smaller scale, the City's green infrastructure includes trees and natural resources, but could include more rain gardens, various porous pavement systems and technologies and green roofs if appropriate and based on product availability. In many instances, maintenance and enhancement of green infrastructure involves stewardship of the natural setting (e.g. preventing and controlling exotic species invasions, maintaining fire regimes, restoring wetlands, etc.). This concept is also known as Ecosystem Based Adaptation ("EBA"). A concurrent benefit is that green infrastructure attributes provide these resiliency benefits at a much lower cost than constructed infrastructure components. For instance in the context of the City, natural communities are just as important for protecting people and the built environment from the negative consequences of climate change as "grey infrastructure" such as seawalls, stormwater drains. While the term is broadly used, what is commonly agreed upon is that implementing a holistically conceived green infrastructure program has many benefits. These include improving stormwater and wastewater management, helping to mitigate impacts from natural hazards and adapt to climate change, and providing other ecological and recreational services.

7.1.4 Other Opportunities for City GHG Reductions.

Policies and programs designed to lower consumption of energy and water as well as reduce the amount of waste generated are often easy to implement and provide the highest impact – generating immediate savings, as well as long term returns from reduced infrastructure needs. These savings can be used as a vehicle to finance other green projects and programs. Several initiatives discussed in this Section do not necessarily require a new cost or budget line item, but merely a cost benefit analysis to see whether savings can offset implementation. Sometimes it can take a period of time to capture these savings so that should be factored into any cost benefit analysis. **The City's greatest opportunities to reduce emissions are likely from vehicle fleet and remaining energy conservation measures that have not been implemented in the Performance Based Retrofit Analysis.**

Biodiesel and waste vegetable oil are both produced or refined from used vegetable oil, though each with different degrees of difficulty and involvement. Biodiesel can be used in diesel-fueled vehicles without any modification of the engine. Additionally, biodiesel can be mixed with petroleum diesel to create different grades of fuel that are labeled based on the percentage of biodiesel in the blend; for example, B10 is 10% biodiesel, 90% petroleum diesel. This means that in times of biodiesel scarcity, vehicles can use a mix of fuels and still function the same way. Conversion kits for vehicles are readily available, though the models they are designed for are limited in number. A vehicle cannot run on WVO alone; it must start and stop on diesel because the engine has to be warmed up and the oil must be heated before use. Both biodiesel and WVO present significant benefits in terms of ease of acquisition and emissions reductions and waste food oil can be obtained from any restaurant. Regarding emissions, biodiesel is the only alternative fuel source to have completed the EPA's Tier I and Tier II health effects testing under the Clean Air Act. By purchasing vehicles that can run on biodiesel mixes and waste

vegetable oil, the City can facilitate growth in these technologies and reduce emissions. Additionally, there are local businesses already tapping into this market. The City can adopt a policy that the City's indoor construction and outdoor landscaping and lighting incorporate the most energy efficient technologies possible (or renewable energy technologies) into all bid and procurement documents.

Initiatives and Actions: CITY FACILITIES AND OPERATIONS

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
CF 1.0: Explore the feasibility and cost benefit of renewable energy technologies to assist in powering buildings and operations.	Reduced energy costs at facilities and buildings. Direct benefits difficult to project because energy produced is highly differential depending on size of renewable system and facility it will power.	1. Coordination with FKEC to determine opportunities for system development and cost benefit. 2. Explore leasing programs with FKEC and other State agencies.	1. Highly variable depending on system and financing strategy. 2. Staff time to coordinate with FKEC and research financing strategies. 3. Explore other financing strategies such as leasing.
CF 2.0: Design all buildings and facilities to the highest but cost effective "green" design standards.[xxxii]	Highly variable depending on design standards and thresholds required. On average LEED buildings have achieved measured energy savings of approximately 28% compared to code baselines, close to the average 25% savings predicted by energy modeling in the LEED submittals.[xxxiii]	Revise Code of Ordinances to adopt municipal green building standards or allow for flexibility in the precise standard depending on building type. 1. Research the available green building options pursuant to Chapter 255, F.S. 2. Determine which will achieve highest energy savings for lowest cost to certify. 3. Pass Resolution or Ordinance codifying standard in the Code.	Staff time for Code revisions and research to develop same. There are many state and national models to draw upon. 1. Staff time to research certification and rating systems used by other local governments. 2. Staff time to research costs of programs and likely energy reductions. 3. Staff time to prepare Resolution or Ordinance.
CF 3.0: Include	Indirect GHG reductions.	Revise Code of	Staff time for Code revisions

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
sustainability criteria in procurement opportunities to the extent practicable.[9]	Focus on equipment, vehicles and preference for vendors that have certain "green" certifications.	Ordinances to adopt municipal green procurement standards.	and research to develop same. Sarasota County is a good example of a green procurement policy.[xxxiv]
CF 4.0: Revisit SCP Initiatives and Actions annually during the capital budgeting process to determine new implementation opportunities.	No direct quantifiable benefit except ongoing commitment to implement SCP recommendations. Largely and implementation strategy.	1. Include as a criteria to review during standard capital planning and budgeting process. 2. Add as a policy in the Capital Improvements Element in the Comprehensive Plan.	Staff time for policy development and research to develop same
CF 5.0: Evaluate options for biodiesel or waste vegetable oil use in City trucks and vehicles (or requiring same from vendors servicing City through "green" procurement requirements)	For a B20 blend (20% biodiesel and 80% petroleum diesel), GHG lifecycle reductions over conventional petroleum diesel range between 10 and 20%, depending on the feedstock used. For a B100 blend (100% biodiesel), GHG lifecycle reductions over conventional petroleum diesel range between 40 and 90%, depending on the feedstock used.[xxxv]	1. Cost-benefit analysis regarding the amount of vehicles and fuel use currently, including cost of WVO conversions. 2. Determine waste vegetable oil and biodiesel supply opportunities. 3. Compare GHG emissions reduction potential with GHG Inventory results.	1. Since biodiesel can be used as an analogue or in a blend with petroleum diesel, there is no cost associated with converting the vehicle. 2. For WVO, costs include the purchase of a conversion kit or a customized conversion installation for the vehicle and filtering equipment. Conversion kits range in price from $1000 to $5000 per vehicle.

[9] Benefits include reduced packaging materials, procuring sustainable vendors that have achieved certain certifications, use of recycled content to the extent practicable and use of green cleaning procedures that support longevity of institutional facilities, buildings, finishes, carpets.

7.2 Energy Use

7.2.1 State Overview on power generation

In Florida, electric cooperatives are nonprofit membership corporations organized under Chapter 425, F.S., to supply electric energy to their member consumers. The Florida Electric Cooperative Association ("FECA"), a not-for-profit trade association organized under Chapter 617, F.S., is the service organization for fifteen (15) electric distribution cooperatives that deliver electricity directly to their member consumers, and two generation and transmission electric cooperatives that transmit and generate (and purchase at wholesale) electricity for their member distribution cooperatives. Power in the City of Marathon is supplied by the Florida Keys Electric Cooperative ("FKEC") constituted under this authority.

Debate continues over how significant the role for renewable energy sources can or should be. Renewable energy currently makes up less than 2% of the state's generation capacity, but a recent assessment of these resources determined that solar, biomass, and offshore wind have the highest technical potential for Florida, given a 2020 planning horizon.

After several years of attempting to pass a comprehensive Florida energy bill, the 2012 Legislature adopted energy legislation which reestablishes millions of dollars in renewable energy tax credits and exemptions, and contains several provisions intended to remove regulatory barriers to promote future investments in Florida renewable energy projects. Specifically, the bill:

- Reestablishes millions of dollars in renewable energy tax credits and exemptions. The renewable energy production credit was reinstated and modified for electricity produced and sold during a certain period.
- A renewable energy technologies sales and use tax exemption was reinstated in the form of a rebate of $1 million per year for all taxpayers for the sale or use of certain equipment, machinery, and other materials.
- This legislation also adds a provision allowing proceeds of the local government infrastructure surtax to be used to provide loans, grants, or rebates to property owners who make "energy efficiency improvements" to their residential or commercial property if a local government ordinance authorizing such use is approved by referendum.

Additionally, in this year's legislative session, Section 366.94, F.S., was created to clarify that electric vehicle charging stations are a service to the public and not the retail sale of electricity so that providing this service will not be subject to any regulatory fees that may be adopted by the Public Service Commission ("PSC") if they were to be considered electricity retailers.

7.2.2 Florida Keys Electric Cooperative

FKEC was formed in 1940 as a rural electric cooperative, owned by the customers it serves. Today, FKEC serves over 31,000 member-owners with two 138,000 volt transmission lines and 23,000 kilowatts of generating capacity. Power is distributed through 6 substations. One additional substation will be added in the near future. FKEC purchases about 99% of its energy needs from FPL. The other one (1) percent is supplied by FKEC generated power. FKEC delivers electricity through a wide-spread network system that includes 802 miles of energized lines.

FKEC has six substations and the main function of these stations is to "step-down" the high voltage power transmitted from mainland power plants to a lower usable voltage. When electricity travels a long distance from a power plant to a service area, it is sent at a very high voltage and low current to reduce transmission losses. When the power arrives, it cannot be transmitted on FKEC's smaller distribution lines, so the massive substation transformers reduce or "step-down" the voltage. The energy can then be sent to homes and businesses. FKEC recently completed a nearly two-year long project upgrading two (2) substations in its service territory.

Cooperative members elect the Board of Trustees. The Board of Trustees establishes policies and reviews operational procedures to promote a financially sound electric utility. FKEC is controlled by bylaws, providing the guidelines for conducting its business operations. With this structure those served by FKEC have direct access to decision making as member-owners, through meetings and through election of the Board of Trustees. Rates charged for service pay for the costs of ongoing maintenance and improvements of the power lines, poles, substations, green initiatives and the other infrastructure necessary to guarantee that electricity is available.

7.2.3 Energy Conservation Initiatives

In 2008, FKEC applied for and received $1 million worth of funding from the Internal Revenue Service's Clean Renewable Energy Bond program. FKEC used the bond proceeds to install approximately 120 total kilowatts of solar power generation. The Marathon array, located next to the Marathon office building, was the first phase with a maximum capacity of 96.6 kilowatts. A smaller array, installed inside FKEC's Crawl Key Substation, was the second phase with a maximum capacity of 21 kilowatts.

The first panels in the Marathon array were connected to FKEC's power grid in November 2008 and the entire array went online later that year. The Marathon array consists of 552 separate 175-watt solar modules tied directly into FKEC's electric grid, and the Crawl Key array adds an additional 120 panels.

FKEC provides free energy audits to homes and businesses with a final written report containing suggestions on steps to take to conserve electricity use and lower monthly electric bills. In early 2007, FKEC converted all of its diesel-fleet to biodiesel, and they were the first fleet operator in the Florida Keys to make that conversation. This conversion can also provide the City information to decide if it wants to take similar actions with its own fleet. The conversion required no modifications to the vehicles but substantially lowered emissions. FKEC also includes numerous other energy saving actions and operations:

- High efficiency chillers in lieu of standard central air
- Digitally controlled air-cooling system
- Fluorescent lighting throughout the business controlled by a programmable master system
- 30,000 gallon cistern for watering and truck washing
- Water-saving toilets with two flush settings
- Louvered red "eyebrow" around exterior of building (directing natural light inside while helping to keep unwanted heat to a minimum)

- Solar-assist water heating and reflective white roof
- Coral rock mined from site reused at minimal cost
- Recycled building materials where possible
- Cross-ventilation system in its warehouse

FKEC began offering solar interconnectivity in 2004, making it easy for solar projects to draw power from the local power grid. The Simple Solar Program is available only to FKEC members and is available to members who support alternative energy but don't want the hassle of designing, permitting, building, maintaining and insuring their own residential solar arrays because they can now lease panels in FKEC's existing array. In return for leasing one or more panels for $999 each, members receive monthly bill credits for the full retail value of the electricity generated by their leased panel(s) for 25 years. One of the major advantages of the program is that FKEC will maintain the solar array so the consumer only pays the one-time cost of the panel. FKEC also has numerous conservation programs such as the installation of Load Management switches.

7.2.4 Opportunities to Reduce GHG Emissions

While not an FKEC project, Keys Energy is exploring the potential for wind in other areas of Monroe County. FKEC is also interested in exploring possibilities for wind and tidal renewable energy resources.

Opportunities for a municipality to reduce energy use communitywide are generally limited because there is an issue of control over the power supply mix and availability of data. Unlike many other areas in the State where a jurisdiction is served by an investor-owned utility with limited direct access to decision-makers, the City enjoys a good relationship with FKEC which is accessible to the constituency served. FKEC is quite progressive in terms of energy conservation for its own facilities and incentive offerings. One of the highest priorities for coordination is the exchange of data so that the City will be able to easily monitor progress towards its GHG reduction goals. Another area for potential coordination is on outreach and education as well as the use of renewable energy in City facilities and operations.

Initiatives and Actions: ENERGY USE

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
EU 1.0: Align communications and outreach between City and FKEC on energy conservation in homes and buildings.	Indirect, but will potentially provide emissions reductions and cost savings opportunities for home and business owners.	1. Develop more formalized coordination process if needed particularly focusing on materials and presence at community events. 2. Potential website coordination.	Staff time for coordination process and potential revisions to website.
EU 2.0: Form more specific partnership between City and FKEC to seek grants and implement common goals.	Indirect, but more grant partnerships stand to provide funding for energy efficiency or renewable energy projects for the City directly, residents or business owners.	Integrate into coordination process in EU 1.0.	Staff time for coordination process and potential research for grant opportunities.
EU 3.0: Coordinate to share data on Plan Implementation, Monitoring and Updating.	Indirect, but more coordination on data exchange will help streamline the process for reporting on SCP success.	Integrate into coordination process in EU 1.0.	Staff time for coordination process focusing on data needs and exchange.

7.3 Buildings and Homes

According to the U.S. Green Building Council ("USGBC"), the resource use of U.S. buildings includes 12% of the nation's water use, 39% of the CO_2 emissions, 65% of the waste output and 71% of the electricity consumed. For the City, commercial and residential GHG emissions from home and building energy use constitute 50% of the communitywide footprint. Opportunities to reduce energy in buildings and homes in the City will be dictated by City policy and incentives to encourage energy efficient development and education and outreach. The City also has opportunities to manage energy use within its own buildings and construct them to the highest energy efficiency standards achievable and that are also cost effective.

Residential land uses, including single-family detached homes, duplexes, mobile homes, multi-family apartments, and mixed–use residential areas are found throughout the City accounting for 51.91% of all land in the City. Single family detached homes are the predominant residential type within the City, and account for 72% of the residential land use category. Multi-family residential development, including apartments and condominiums, occupy the second largest residential land area accounting for 15.6% of the developed residential land. Population projections for the City are determined based on the current rate of growth allocations for residential units. Currently, the City is allocated 30 residential units per each RBPAS allocation year by the State of Florida. According to US Census Bureau Data, the total number of housing units in 2000 was 6,791. At an annual increase of 30 housing units per year, by the year 2020, the City will have added 600 units (30 X 20 = 600) for a projected total of 7,391 housing units in 2020. In 2011, the City requested 1,000 more hotel units over a 10-year period and in early 2012, the City was allotted 100 hotel-room units in recognition of substantial progress with its central sewer and stormwater projects. The allocation of units will ultimately require a Comprehensive Plan amendment for implementation.

7.3.1 Energy Code Requirements for Construction

Energy efficiency standards in construction are regulated by federal and state law. The Model Energy Code ("MEC"), now the International Energy Conservation Code ("IECC"), is the most commonly used residential energy code by states. The IECC also has a commercial section that allows the use of ASHRAE 90.1 for compliance. The U.S. Energy Conservation and Production Act ("ECPA") requires that each state certify that it has a commercial building code that meets or exceeds ANSI/ASHRAE/IESNA Standard 90.1-1999. In this sense, "commercial" means all buildings that are not low-rise residential (three (3) stories or less above grade). This includes office, industrial, warehouse, school, religious, dormitories, and high-rise residential buildings. ASHRAE 90.1 is the most commonly used energy code for commercial and other non-residential buildings.

Florida has independently developed and adopted its own energy code. In 1980, the Florida Energy Efficiency Code for Building Construction ("FEECBC") was developed to be climate-specific for Florida. The 1998 Florida Legislature amended Chapter 553, F.S., Building Construction Standards, to create a single state building code that is enforced by local governments. As of March 1, 2002, the Florida Building Codes supercedes all local building codes. Pursuant to Chapter 553, F.S. (the Florida Building Code) residential, commercial and renovated buildings "shall not be required to meet standards more stringent than the provisions of the Florida Energy Efficiency Code for Building Construction" thus limiting a local government's ability to require higher energy efficiency standards in buildings.[10] In 2008, HB 697 was passed requiring increases in the energy efficiency of the Florida Building Code: 20% percent in the 2010 version, 30% in the 2013 version, 40% in the 2016 version and by 50% in the 2019 version. To meet the state's energy efficiency goals, the Florida Building Commission selected the most current version of the IECC as a foundation code; however, the IECC will be modified by the commission to maintain the nuances of the FEECBC.

Section 255.253(6), F.S. defines a "sustainable building" as "a building that is healthy and comfortable for its occupants and is economical to operate while conserving resources, including energy, water, and raw materials and land, and minimizing the generation and use of toxic materials and waste in its design, construction, landscaping, and operation." The "green building" movement is about constructing better buildings and more livable communities. Green buildings provide numerous benefits: conserve resources, save money on energy and water bills and provide a healthier work and living environment.

[10] Sections 553.904, F.S. (Thermal Efficiency Standards for new nonresidential buildings), 553.905, F.S. (new residential buildings), and 553.906, F.S. (renovated buildings) each contain language that all buildings "shall not be required to meet standards more stringent than the provisions of the Florida Energy Efficiency Code for Building Construction." This does not, however, prohibit "above-code" incentive-based programs.

Consideration should be given to a range of policies and programs, including the use of financial incentives when appropriate and cost effective. Green building could be incentivized in either new construction or when a building undergoes a major renovation, is sold, or is converted to a different type of unit such as transient or condominium. These events are also a good opportunity to conduct targeted outreach and education to residents. When developing any incentives the City should work in conjunction with the local building community to determine what will make a meaningful impact to incentivize green building projects. The City should also create a clear list of criteria to achieve these incentives.

As the City works to improve the service it provides to those seeking building permits, it would be helpful to establish a "specialist" on staff, not necessarily a new employee but someone who achieves some level of green building certification, to assist with green building questions, provide upfront coordination and assistance for builders committed to achieving a high level of green building. With green building, there is a stigma of high cost. Because most developers do not pay for the energy costs of the buildings they construct, they have little motivation to exceed base standards for energy-efficiency. Financial or tax incentives have to encourage developers, existing commercial building and home owners to make energy-saving investments.

7.3.2 Opportunities for GHG Reductions

Behavioral change underlies the success of each of the components outlined above. The City and its partners must combine efforts in the policy arena with targeted education and marketing for residents, businesses and institutions. Personal choice underlies many of the building energy use-related changes that will have to occur in order for the community as a whole to lower GHG emissions. As such, enhancing and expanding current education and outreach efforts is fundamental to this plan. The City must market, reach out and educate, the development community about green building approaches and the City's desire to see them implemented. Strategies include enhancing outreach to encourage developers to adopt national green building and energy performance standards, such as ENERGY STAR, FGBC, the IGCC and LEED. The City should also highlight existing green buildings and cutting edge green technologies through green building tours. An effective technique is to highlight existing green buildings in the City through case studies made available at the City's Community Services and Engineering Department as well as partnering agency websites. The City can also create a green building display in the new City Hall and utilize it to showcase innovative green building materials and practices.

As a logical progression from concentrating on government operations and policies, the way to affect people's behavior and secure long-term commitments to reduce community-wide emissions is through educating the community about the importance of their contribution to achieve the SCP goals. While the City has no direct control over the utilization of electricity and fuel by residents, it is apparent that education about the benefits, primarily cost saving, of reducing energy usage is necessary to reduce the community's GHG emissions.

Initiatives and Actions: BUILDINGS AND HOMES

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
BH 1.0: Encourage innovative building strategies that minimize energy and water consumption, maximize the recycling of construction debris, and provide for a more comfortable indoor environment.	Reduction of homeowner and business owner GHG emissions and energy use are an indirect GHG benefit. Typically a conservative estimate is 20% energy savings for a "green" home or building as opposed to a "code" compliant building.	1. Research and develop provisions to include in the Comprehensive Plan and Code to encourage green building. 2. Research appropriate incentives to encourage green building. 3. Develop staff expertise through designating a staff person to achieve a green building certification. 4. Highlight City successes in green building.	1. Cost for staff training for green building expertise. 2. Staff time to research green building policies, code provisions and incentives. Should be a component of Comprehensive Plan and EAR process.
BH 2.0: Simplify project review and permit approval process to encourage innovative green building measures.	Streamlining process for buildings to achieve green ratings, certifications or components and cost savings accrue to building owners with lessened utility bills.	1. Review existing permit and project approval process to identify methods to expedite green projects. 2. Publish summary of streamlined process on website and for distribution.	1. Cost for staff review of development approval process. 2. Cost for publishing summary and incorporating into website.
BH 3.0: Highlight and communicate about projects that achieve energy efficient or green design.	Featuring good green building techniques performs an education and outreach function thus encouraging more green projects. Benefit is indirect reduction in energy use in homes and businesses.	1. Develop a location on website to highlight green projects. 2. Work with builders and construction professionals to have them provide summaries and photos of projects.	1. Staff time (or outside consultant time) to create portion of website to highlight projects.

7.4 Land Use & Transportation

The challenge of reducing GHG emissions from the transportation sector is a three-legged stool. One leg represents vehicle fuel efficiency; the second leg represents the fuel's carbon content; and the third leg represents the amount vehicles that are driven, known as vehicle miles traveled ("VMT"). Since 1980, the number of miles Americans drive has grown three (3) times faster than the U.S. population, and almost twice as fast as vehicle registrations. Increases in gasoline prices moderate these trends to some degree. But there are challenges in changing the factors that contribute to increasing VMT, such as the level of density for community design and people's decisions about where they want to live.

Reducing transportation emissions cannot be achieved by focusing on the transportation sector in isolation. Shifting the balance toward sustainable transportation modes requires a combination of policies, education initiatives, revenue and effective incentives. In essence, it requires assembling policies and programs that together will reduce VMT and the associated GHG emissions, while also improving community mobility and quality of life. Strategies generally fall within the following categories:

- Transportation Demand Management ("TDM") is defined as a set of specific strategies that promote **increased efficiency of the transportation systems** and resources by promoting and providing a range of local or regional travel-related choices to influence individual travel behavior by mode, time, frequency, trip length, cost, or route.
- Transportation System Management ("TSM") strategies include measures designed to enhance the efficiency and safety of the **intermodal transportation network**, to minimize congestion on existing facilities and to improve the air quality of the region. Strategies include new, modified or expanded infrastructure such as roadways, transit or bicycle facilities, widened sidewalks, improved traffic signalization schemes, enhanced transit service and reserved lanes for high-occupancy vehicles and/or hybrid vehicles.
- Transit-oriented development ("TOD"), promotes denser, mixed-use developments in walking distance of transit, and complete streets, which are safe and accessible to all users, can go a long way toward **reducing dependence on the personal automobile** and, thus, VMT and overall GHG emissions.

Decisions made in land use planning directly impact patterns of travel between residential and employment or commercial centers. Sustainable land planning decisions directly correlate to reduced VMT and lessening GHG emissions. The City currently has a low-density land use pattern and not all of these techniques will be applicable to the City of Marathon at an aggressive scale. The City supports the principle of linking more intense residential land uses with commercial areas with new potential transit opportunities. Given the close relationship between sustainable land and transportation planning, the City has focused on these challenges together in one Focus Area.

7.4.1 The Transportation Network

Marathon's transportation network includes collector and arterial roadways, bicycle and pedestrian paths, and the City's Airport. US 1 is the principal arterial roadway, but it is also considered the "Main Street" for the City. All other roadways in the City are collector or local streets that provide access to adjacent land uses and feed traffic to US 1 at specific locations (approximately 380 streets). The City has maintained responsibility for these streets since its incorporation. These roads assist in reducing traffic

volumes on US 1. Seven signalized intersections are located on US 1 within the City. Two pedestrian signals are located at MM 48.5 and MM 53.0, while the remaining five signals regulate traffic.

Transportation options currently available within the City include the automobile, airplane, bicycling, walking, and boating. Bicycle and pedestrian facilities are located on or adjacent to frontage roads interspersed throughout the City. Marathon Airport is located at MM 51.5. Until recently, there were several daily scheduled flights to/from Miami and Fort Lauderdale.

7.4.2 U.S. Highway 1

The roadway network in the City and the Keys is unique with US 1 serving as the primary link for every island throughout the County. Roadway access entering and exiting the City is only provided via US 1. US 1 has to be considered from a regional context to assure that the Keys' only roadway link will continue to function properly.

The functional classification for US 1 in the City is an urban principal arterial. The entire US 1 corridor is owned by FDOT and as such it is subject to state regulation. These regulations prevent commercial intrusions incompatible with state transportation goals. Typically, the FDOT is responsible for all maintenance activities within the ROW. The FDOT has entered into a number of maintenance agreements with local and other state agencies relative to management of enhanced landscaping and beautification efforts in place along the corridor. This is important to note because the City has no control over the design and functionality of US 1 and therefore there are limited opportunities to reduce VMT along this corridor. That said, there are other opportunities to facilitate GHG emissions reductions along US-1 through coordination with the County and neighboring municipalities.

7.4.3 Land Use

The City is comprised of approximately 5,726 acres of which approximately 2,300 are undeveloped. Approximately 1,000 acres are zoned for residential uses, while commercial and mixed use land uses account for approximately 680 acres. As stated in the previous Section, given the constraints on new development in the City, it is not projected that these land use patterns will significantly shift unless there are major policy and regulatory changes facilitating that growth.

7.4.4 Local Transportation Constraints and Opportunities

Modal split in the City is predominantly dependent upon automobile use because of the lack of transit opportunities, lack of population density and the lack of connectivity between the bicycle/pedestrian paths. The City currently does not operate a standalone transit system but participates with the County and the City of Key West in a local network. The County is currently served by two main public transit systems:

- Miami-Dade Transit ("MDT") in the northern region of the County with two routes (Dade-Monroe Express and Card Sound Express) serving the County from Key Largo to the City; and
- The City of Key West Department of Transportation ("KWDOT") which operates:
    - Key West Transit ("KWT") with four fixed-route bus routes serving the City of Key West and Stock Island,
    - The Lower Keys Shuttle providing service in the southern portion of the County from the City to Key West, and
    - The Key West Park-N-Ride available at The Old Town Garage.

Para-transit service is provided by the County for disadvantaged residents and the Greyhound Bus Company provides regional bus service between Key West and Miami with three daily trips in each direction.

The City contains a network of bicycle facilities that is shared among pedestrians, in-line skaters and other users and pedestrian and bicycling paths are available throughout the community providing opportunities to reduce VMT along US 1. Marine travel also provides new alternative modes of transportation. Because of the lack of limited access highways in the City, no high occupancy vehicle ("HOV") lanes exist. Further, no designated park-and-ride lots exist in the City. Connectivity of transportation modes between residential areas and the principal commercial areas of Marathon is a significant challenge. Solving this issue will provide new opportunities for alternative modes of transportation, thereby decreasing the need to drive to each individual location. Design policies that re-orient the placement of commercial structures along US 1 could also help promote bicycle/pedestrian usage.

The City is a member of the FDOT Technical Advisory Committee for the Keys which could prove valuable as a future coordination mechanism with a more cohesive scope of work or work plan. The City can provide the SCP to the TAC to facilitate coordinated discussion on these issues and the recommendations herein.

"Green Streets" incorporate principles such as landscaping, traffic calming and other unique features to distinguish from other street types. A Green Street has a variety of design and operational treatments, giving priority to pedestrian circulation and open space over other transportation uses. The treatments may include sidewalks, if space and right-of-way permits, landscaping, traffic calming, and other pedestrian-oriented features. The purpose of a Green Street is to enhance and expand desired land use and transportation patterns on appropriate City street rights-of-way. Given existing space constraints, the City should research incorporating Green Streets principles into any redevelopment projects or, for instance, new projects associated with the increased transient allocation the City recently received on the local streets. Design for this project should include multiple transportation and design features to encourage pedestrian, bicycle and alternatively fueled vehicle use. Green Streets principles should also be included. There are numerous resources that have model Green Street design criteria.[xxxvi]

In the Middle Keys, the City is ideally located as a central focal point for facilitating the use of alternatively fueled vehicles. Its central location makes is attractive for electric vehicle charging stations, compressed natural gas filling stations or waste vegetable oil/biodiesel filling stations. The central location of the City also makes it attractive for facilitating linkages for commuting or transit, such as County employees or City staff that must attend meetings in either the northern or southern Keys. For instance, the City should review parking requirements to incentivize and accommodate alternatively fueled vehicle carpool pickup and drop off locations. This geographical importance cannot be understated because in a sense, the City could serve as a leader for transportation related infrastructure improvements to reduce GHG emissions from travel along US 1. The construction of the new City Hall provides a unique opportunity to explore this possibility by siting or co-locating needed commuter, transit or alternatively fueled vehicle or parking infrastructure as the site permits.

Initiatives and Actions: LAND USE AND TRANSPORTATION

Strategy	*Potential Benefits*	*Action Steps*	*Cost (if Applicable)*
LUT 1.0: Encourage and incentivize land uses and density to facilitate development and redevelopment opportunities linked to transit.	To the extent that the City can do this in its development approval process, it would be beneficial to promote the linkage between development projects and transportation options. This could be especially applicable for the additional allocation of CBPAS units the City has received. Benefits are indirect.	1. Review RBPAS and CBPAS application process to determine if there are opportunities to incentivize these linkages. 2. Based on analysis prepare required Comprehensive Plan or Code changes.	Staff time to perform analysis.
LUT 2.0: Make cycling, walking, public transit, and other sustainable mobility modes the mainstream by promoting connectivity and sustainable design standards for transportation infrastructure. Identify	Improving linkages between modes of transit and alternative modes of transportation will promote more use of transit and options for single use of automobiles. This can encourage use of alternative modes of	1. Prioritize analysis during Comprehensive Plan update in terms of data and analysis and policy development. 2. Potentially map where linkages need to occur to	Implement as a component of the Comprehensive Plan and EAR process. Staff or consultant time during process.

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
deficiencies in the transportation and transit network to prioritize policy development.	transportation such as working with the County and City of Key West to implement sustainable design of bus stops, such as including parking space opportunities, shading, bike racks and dissemination of transit stop information.	prioritize integration with capital projects. 3. Review Code to determine if revisions should be made to facilitate policies that promote sustainable design of transportation serving infrastructure. 4. Publish updated transit information on website.	
LUT 3.0: Manage parking effectively to minimize driving demand, promote carpooling and encourage and support alternatives to single occupancy vehicle use.	This could also facilitate designating commuter parking spots, van or car pool pick up locations. Benefits are indirect but regional in application.	1. Analyze existing parking strategies in Code to determine if constraints or opportunities exist to facilitate ride sharing. 2. Research and develop new parking policies to facilitate ride sharing in new development. (Primarily applicable to non-residential development).	Staff time to perform analysis.
LUT 4.0: Create incentives for low-carbon vehicles such as electric vehicles and plug-in hybrids and make transit infrastructure energy efficient.	Promote the City as a "centralized" location for alternatively fueled vehicle "recharging".	1. Determine what alternatively fueled vehicle support needs to be created. 2. Assess waste vegetable oil, biodiesel and compressed natural gas fueling station viability.	Staff time to research can be minimized with online resources that track installations of electric vehicle charging stations. Waste vegetable oil recycling companies exist within Monroe County to provide fuel resources.. In some

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
		3. Research current locations of electric vehicle charging stations if any. 4. Incorporate into plans and design of new City Hall. 5. Incentivize in new CBPAS projects.	instances, charging station companies will minimize or "pilot" infrastructure such as charging stations or unique public private partnerships can be created. For instance Walgreens is expanding its charging station infrastructure in Florida.

7.5 Waste Reduction

7.5.1. Overview of Waste Reduction Issues

In the past 50 years, the amount of municipal solid waste ("MSW") generated in the U.S. has nearly tripled. The collection, transportation and disposal of this waste presents a considerable cost to local government, poses threats to public and environmental health, and when landfilled, or incinerated, results in a permanent loss of valuable materials such as metals, glass, paper and organic matter. The total energy consumed related to waste management activities is a result of direct fuel and electricity consumption associated with raw material acquisition and manufacturing, fuel consumption for transportation, and embedded energy. The EPA Office of Solid Waste and Response concludes that 42% of U.S. 2006 GHG emissions were associated with the manufacturing, use and disposal of materials and products.

Materials management describes how materials are managed as they flow through the economy from resource extraction to product design and manufacture, transport, use, reuse, recycling, and end of life. If consumers, institutions, and businesses understand the lifecycle of products and materials, they will be more likely to adopt a set of best management practices which limit the amount of materials entering the waste stream. Source reduction prevents the generation of waste and pollution. In the materials management framework, it is the reduction of the amount of materials entering the supply stream. Reuse is the reuse of a product by its original user or someone else. Recycling is a series of activities that includes collecting recyclable materials that would otherwise be considered waste, sorting and processing it into raw materials such as fibers, and manufacturing raw materials into new products. Disposal is the placement of waste on land or underground, including proper disposition of a discarded or discharged material.

Construction and demolition debris ("C&D") consists of materials that are generated from residential and commercial building, renovations and various types of demolition. C&D materials include wood, steel, glass, brick, concrete, asphalt, wallboard, rocks, soils, tree remains, trees and other vegetative matter. Only non-water soluble and non-hazardous materials are considered C&D. A large portion of C&D debris is recyclable--approximately 5% is metal, 9% is asphalt, brick or concrete and 30% is wood. Recycling C&D waste not only keeps it from ending up in the landfill, but also reduces the upstream energy consumption required to manufacture new construction materials.

Organic waste materials include food waste, yard trash and paper. The EPA estimates that Americans throw away a quarter of the food we prepare, about 96 billion pounds each year. In 2007, 12.5% of all MSW was food waste and less than 3% was recovered before going into the landfill. The methane produced in landfills, which contributes more per unit to global warming than CO_2, is the product of food decomposition. Composting results in some CO_2 storage (associated with application of compost to agricultural soils), as well as minimal CO_2 emissions from transportation and mechanical turning of the compost piles.

The proportion of electronics — such as televisions, computers, printers, cell phones, stereo equipment, VCR/DVD players and video game consoles — discarded into the waste stream is rising at a rate two-to-three times faster than any other waste segment. According to the U.S. EPA, 82% (1.84 million tons) of the 2.25 million tons of obsolete or unwanted electronics were landfilled in 2007. "E-waste," as it is often termed, presents numerous public and environmental health and safety concerns as discarded items often contain heavy metals that may be toxic (i.e. lead, mercury, cadmium) when released into the air, soil or water through landfills or incinerators.

7.5.2 State Requirements for Recycling

Section 403.7032, F.S. sets the 75% statewide recycling goal (achieved by 2020) although it is not required of every local government. It also directs public entities (schools, state and local public agencies) to report the amount they recycle annually to their counties. Private businesses are encouraged (but not mandated) to report the amount they recycle to their counties. Although this State target is not applicable in Monroe County, the City could review its current recycling rates to determine if its 30% goal should be increased.

The City contracts with Monroe County for garbage and trash collection, which is disposed of at their contractor's resource recovery facility. The capacity of the facility is considered to be "unlimited" by the Monroe County Integrated Solid Waste Management Division.

City solid waste collection is effective under current practices. Approximately 67 tons of solid waste is collected per day. The quantity collected by private haulers from commercial, industrial and certain multifamily land uses is unknown. Special pickups of certain waste categories are pro-vided on an as-needed basis, however hazardous wastes remain the responsibility of the waste generator to dispose through authorized services and agencies outside of the City's collection system.

7.5.3 Opportunities to Reduce GHG Emissions

The greatest opportunities the City has in this area are likely partnerships with the County and the waste hauler to increase recycling rates and reduce waste materials such as through reuse of waste vegetable oil and exploring more applications for its use or composting. To reduce waste vegetable oil, the City can take a two-pronged approach: 1) more aggressive enforcement of its grease trap requirements (with inspections) and supporting the development of the local waste vegetable oil recycling industry. Marathon Bio-Diesel currently provides collection containers for waste vegetable oil to 42 Keys restaurants and organizations, then processes the material into fuel used by vehicle fleets and charter boats. By converting its own fleet the City helps increase demand for recycled waste vegetable oil for vehicles.

The City can also develop incentives to pass on to City residents and businesses for recycling. One such incentive may include some level of direct rebate or offset on utility bills if appropriate. Another incentive may include use of a company or program like that offered by RecycleBank®. This is a program where participants select a green action to be rewarded for and each time there is confirmation of the activities' completion, either through a "points" code or by recycling rates, participants receive RecycleBank "Points".

Finally, improperly discarded monofilament fishing line causes devastating problems for marine mammals, sea turtles, fish and birds. As of May 2011, there were several facilities that provide bins for recycling and these could be highlighted on the City's website.[xxxvii] These animals can be severely injured when they become entangled in or ingest the line and often die as a result. The State of Florida started the Monofilament Recovery & Recycling Program is an effort to educate the public on the problems caused by improperly discarded monofilament fishing line. The program encourages recycling of used fishing line through a network of line recycling bins and drop-off locations, and by conducting volunteer monofilament line cleanup events.

Initiatives and Actions: WASTE REDUCTION

Strategy	*Potential Benefits*	*Action Steps*	*Cost (if Applicable)*
WR 1.0: Determine cost benefit of increasing enforcement of grease trap inspections and requirements.	Large amounts of oil and grease in the waste water can cause sewer lift station failures, wastewater treatment plant problems and other issues which can cost money in terms of operations and maintenance costs.	1. Determine levels of staffing needed to enforce inspections and violations. 2. Determine if fees collected offset increased enforcement.	Increased staff time, increased staff duties or a new part time of full time employee to enforce regulations (among other duties).
WR 2.0: Encourage commercial recycling opportunities by requiring or incentivizing placement of bins for common use.	Increases recycling rate with larger users of packaging and recyclable products.	Facilitate the placement of commercial recycling by requiring or facilitating placement of dumpsters behind businesses.	Staff time to research and draft potential policy revisions.
WR 3.0: Work with marinas to implement monofilament recycling facilities or drop off points. Highlight those that do.	Reduces waste stream and harm to wildlife. This is not an expensive program to implement, but it does require time and continued maintenance. The more support and commitment provided by	Survey marina facilities to determine if programs are far reaching enough or develop partnerships to address any deficiencies.	Staff time to conduct brief phone survey of marine facilities, research and draft any summary or policy recommendations.

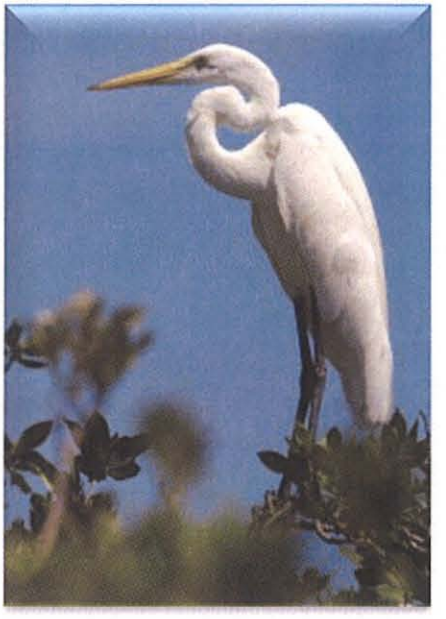
Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
	community members and cooperative organizations, the less costly the program becomes to initiate and sustain.[xxxviii]		
WR 4.0: Research various incentive programs to promote increased recycling rates.	Goal should be to focus on increasing recycling rates for home and business owners. Reduces transportation related emissions with less demand for hauling.	1. Review fees paid associated with waste hauling to be offset by increased recycling rates. 2. Coordinate with County and waste hauler to determine what incentive programs are not yet being implemented. 3. Explore outside programs, such as pay as you throw, that the City can initiate and determine cost-benefit.	Staff time for research and bring forth policy recommendations.

7.6 Landscape, Habitat and Marine/Coastal Resources

Due to the linkages and interdependency between coastal, marine and terrestrial systems in the Florida Keys, this section will provide a brief overview of those systems and best practice recommendations to manage them in the future knowing that these systems are likely be impacted by climate change. These systems face two major challenges in the context of climate change: the rate and extent of climate change and the resiliency of natural systems in Florida to impacts from climate change. While the terrestrial and marine systems in the Keys are already threatened with preservation and management challenges, specifically, the reef system faces new challenges including climate change that creates new stresses such as extremely high and low water temperatures and carbon dioxide-induced ocean acidification. Climate change therefore reinforces the desirability of managing these land-based and marine-based systems in an integrated manner. Managing and preserving our land and marine based ecosystems makes them more resilient to the impacts of climate change such as storm surge. The unavoidability of sea-level rise, even in the longer-term, frequently conflicts with present-day policies on managing and developing land and

coastal ecosystems. Many of the decisions the City makes today will have a significant impact on resources, preservation and the City's ability to respond to climate change for years to come.

7.6.1 Terrestrial Systems and Habitats



Two upland vegetative communities are recognized within the Florida Keys, tropical hardwood hammocks and pinelands. Only the tropical hardwood hammock community occurs within the City. Coastal wetland ecosystems, such as salt marshes and mangroves are particularly vulnerable to rising sea level because they are generally within a few feet of sea level (IPCC, 2007). Landscape ordinances typically provide for the preservation of natural features such as wetlands, erodible slopes, special native habitats and specimen trees. Many communities enact ordinances merely for beauty or economic development but there are other reasons such as a mechanism to implement the goals of this SCP. There are numerous examples of landscape ordinances that address tree canopy and terrestrial resource goals, for instance, Lexington, Kentucky has set standards for the amount of tree canopy and shade that must be provided in each zoning district in the community. Recent local examples of new important landscape codes include the City of Lake Worth (Chapter 23, Article XXI), the City of Oviedo (Article XII) and the City of Greenacres (recently adopted in May 2011) which all include detailed provisions for managing species and removal of trees. The Community Image Advisory Board could be a mechanism to study these issues and make recommendations for the Landscape Code as well as maintenance of City tree canopy goals.

Nationally, urban forests or "terrestrial resources" in the U.S. are estimated to contain about 3.8 billion trees, with an estimated structural asset value of $2.4 trillion. The value of an existing mature tree is exponentially higher than a smaller, younger tree, when one considers ecological services, property values and other measures. Healthy terrestrial resources have several benefits, including:

- Reducing the energy consumption associated with air conditioning buildings by providing shade in the right locations surrounding a building's footprint.
- Reducing local ambient temperatures by shading paved and dark colored surfaces like streets and parking lots that absorb and store energy rather than reflecting it.
- Intercepting and storing rainwater, thereby reducing water runoff volume.
- Improving community quality of life through beautification and by reducing noise pollution and encouraging pedestrian traffic (shading of pedestrian pathways).

When tree characteristics and site characteristics match, the result is "the right tree in the right place", an internationally recognized arboriculture standard. The management of terrestrial resources typically involves a variety of activities such as inventorying tree populations; enacting tree and land use planning ordinances and policies; developing and implementing long-term management and maintenance plans, annual work plans, and budgets; and promoting community education and participation. The first step in the process is to do some type of analysis or "inventory" of the tree resources the community has.

Without such an inventory, it is difficult to set any kind of goal or target for protecting the canopy of the City's terrestrial resources. Rather than paying for an assessment of the City's tree canopy, tools exist to help assess and value trees and terrestrial resources such as:

- The Street Tree Management Tool for Urban Forest Managers ("STRATUM") uses these data to calculate the ecological and economic value of the urban forest.
- The Urban Forest Effects model ("UFORE") assesses the composition, condition, and ecological values of an entire urban forest ecosystem.
- CITYgreen is another tool that analyzes the ecological and economic benefits of tree canopy and other green space.

To maintain natural resources in a sustainable manner, the City must reduce also reduce dependence on chemical fertilizers, pesticides, and herbicides and increase use of Integrated Pest Management ("IPM") strategies for pest management. These types of practices can shift from potentially harmful chemicals to "greening" the maintenance and management of the City's sustainable landscapes. Part of this strategy should include use of composted organic matter to build soil health if appropriate, but not counterproductive to achieving stormwater goals and requirements.

Boot Key, most of which was added to the Florida Keys Ecosystem Florida Forever Project ("FKEFFP") in 1999 at the request of the Florida Fish and Wildlife Conservation Commission, provides an excellent opportunity for these types of issues to be addressed. With five (5) miles of undeveloped shoreline and almost no improvements, acquisition of this island adjacent to the Florida Keys National Marine Sanctuary offers an opportunity to protect critical ecological resources while providing passive, coastal resource-based recreation. Part of the Florida Keys Ecosystem Florida Forever Project, acquisition of Boot Key will protect habitat important for the Florida Keys National Marine Sanctuary and will protect at least fifteen (15) state-listed species and three types of state-imperiled natural communities Boot Key includes Essential Fish Habitat for at least four (4) groups. The City's participation in a grant award for Boot Key was previously discussed herein.

7.6.3 Coastal and Marine Systems

For coastal systems, sea-level rise will increase erosion and associated shoreline recession. Sea-level rise and other climate changes must be taken into consideration in developing and implementing relevant coastal wetland conservation strategies, as these systems face changes in the coming decades that are far greater than in past restoration planning. Sea level rise has already led to the upland migration of mangrove forests, which have been able to take advantage of changing habitat conditions in areas previously dominated by freshwater marsh. A 2006 study of the potential impacts of sea-level rise at nine (9) of the most important sportfishing areas along Florida's coast found that, with a moderate 15 inch eustatic sea-level rise, nearly 50% of critical salt marsh and 84% of tidal flats at these sites would be lost, while mangroves are expected to expand inland, increasing in area by 36%.[xxxix] Under this scenario, the area of dry land is projected to decrease by 14%, and roughly 30% of the areas' ocean beaches and two-thirds of estuarine beaches would disappear. The vast majority of Florida's marine fish and shellfish species depend on salt marshes, tidal flats, and a variety of other habitats found in bays and estuaries, so the projected changes to these habitats due to sea-level rise are likely to have a considerable impact on Florida's commercial and recreational fisheries. The importance of protecting these systems is demonstrated by the fact that in some cases, marshes may be able to accommodate moderate changes in sea level through natural sedimentation and marsh accretion (the build-up of organic and/or

inorganic matter). Prioritizing the preservation of tidal ecosystems will be more important to help protect water quality and stabilize shallow water and intertidal zones.

The surrounding waters in the Keys are designated as Outstanding Florida Waters and include the 2,900 square-nautical-mile Florida Keys National Marine Sanctuary, the second largest marine sanctuary in the United States. An analysis of climate projections indicates that coral bleaching and other climate change impacts such as sea level rise and severe weather events will threaten local reefs through chronic stress or acute physical damage. Ocean acidification (the higher concentration of CO_2 in the atmosphere is directly altering the chemistry of our oceans) and is already decreasing the concentration of calcium carbonate in sea water, limiting the rate at which corals build their hard skeletons. Degradation of coastal ecosystems, especially wetlands and coral reefs, has serious implications for the tourist economy in the Keys. Higher ocean temperatures will cause extensive coral bleaching, enhance marine diseases, alter species' ranges and population abundances, and harm fisheries all impacting local economic development.

Initiatives and Actions: HABITAT

Strategy	*Potential Benefits*	*Action Steps*	*Cost (if Applicable)*
HAB 1.0: Update and expand City's landscape ordinance to maximize tree canopy and encourage exotic removal.	Maximizing preservation policies through RBPAS and CBPAS requirements and landscape ordinance can increase sequestration of GHG emissions.	1. Research and review key landscape codes to compare with City's existing code to identify any deficiencies. 2. Provide recommendations to development review process and landscape code to maximize tree canopy and GHG sequestration benefits.	Staff time to develop recommendations on a process to enhance tree canopy through review of the landscape code.
HAB 2.0: Establish a tree canopy goal and seek assistance from a student or organization to help develop a tree inventory.	GHG emissions are sequestered by maintaining tree canopy goals thus reducing emissions communitywide.	1. Research and identify sources of data that include an inventory of natural resources. 2. Determine if sources can be utilized to complete a tree inventory. If not, determine feasibility of completing a tree inventory with student assistance. 3. Based on inventory either utilize existing coverage or establish a tree canopy goal.	Staff time and resources to provide initial findings if existing data sources can be used in conjunction with an online tool to complete a tree inventory.

Strategy	Potential Benefits	Action Steps	Cost (if Applicable)
HAB 3.0: Review RBPAS, CBPAS and land development regulations for enhancement of policies to prioritize connectivity between and enhancement of natural areas. Prioritize avoidance, minimization, then mitigation for wetlands management.	Maintains GHG sequestration values as well as enhances opportunities for species diversity and habitat transition over time in response to sea level rise. Provides opportunities for migration of coastal and wetland species that will be adapting to sea level rise. Also encourage restoration of site hydrology by filling mosquito ditches, road removal and removal of culverts.	1. Research and review key policies for incorporation into Comprehensive Plan and Code. 2. Provide recommendations for revisions in EAR, Comprehensive Plan and Code.	Staff time to integrate into development of EAR and Comprehensive Plan.
HAB 4.0: Assure recommendations from the SCP are incorporated into planning strategies for Boot Key.	Maintains GHG sequestration values.	Integrate SCP recommendations into Boot Key Planning processes as applicable. Most of the recommendations are already consistent with the City's Comprehensive Plan goals, objectives and policies to for the acquisition and protection of Boot Key.	Staff time to integrate SCP recommendations into Boot Key Planning process as relevant.

7.7 Outreach and Education

While this Plan identifies many potential policies and strategies addressing specific Focus Areas such as Energy Use, successful implementation of the SCP will ultimately hinge on the community's awareness and willingness to take action. The City already has an ecologically minded citizenry. Education and outreach efforts should integrate with, and build upon, existing outreach efforts/programs through networks and partnerships, focus on building long-term leadership and capacity in the community and provide incentives and recognition for outstanding efforts. FKEC is a prime example of how these relationships are already occurring and can be expanded and more formalized.

The City can greatly advance the residents' awareness of what is happening in the community and opportunities for them to contribute by helping to identify existing local efforts and initiatives and publicizing the efforts and contributions of local individuals. The following identify key strategies the City can adopt to encourage and support education and outreach efforts:

Case Study: "Low Carbon Diet: A 30 Day Program to Lose 5000 Pounds" by David Gershon is a fun, accessible, easy to use guide that will show you, step-by-step, how to dramatically reduce your CO2 output in just a month's time. By making simple changes to actions you take every day, you'll learn how to reduce your annual household CO2 output by at least 15%.

- Demonstrate early visible successes so the community can visually connect to the SCP initiatives and actions.
- Use City events to disseminate information about the Plan and its goals.
- Develop strategies to get to landlords of buildings for rental communities and seasonal residents.
- Promote and showcase the positive "green" "sustainable" actions the City is taking as part of the SCP.
- Develop "Rewards" or "Recognition" programs to feature home and business owner success stories on City's website and in utility bills.
- Complete a brief "sustainability report" to the Council on a semi-annual basis. Annually review and report on progress made towards achieving goals.
- Develop a social marketing campaign on Facebook and City blogs for specific energy/sustainability initiatives.
- Promote a Marathon "Climate Action Pledge" as a means by which individuals can commit to reducing their own emissions. The "pledge" is a non-binding means of securing individual commitments to achieving some of the goals in the SCP. Individuals who sign the pledge can periodically receive helpful action ideas for how to fulfill their commitment. The City and its community partners should continue to promote the pledge and work to enhance the climate-related resources and information that individuals have access to once they have made their commitment.
- In collaboration with community partners, launch a "Green Neighborhood Challenge" and "Green Star Household" program. The challenge could utilize friendly competition and recognition as motivators for action. The "Low Carbon Diet" program could serve as the guide for neighborhood- level climate protection activities.
- In partnership with the Marathon and Lower Keys Realtor's Association and the Greater Marathon Chamber of Commerce, design a "welcome package" for new homeowners and business owners that includes resources related to energy use, transportation choices, and waste diversion and reduction.

8.0 Success, Challenges and Opportunities

8.1 Tracking Success (Monitoring, Reporting and Updating)

While certain investments can be distilled to a quantified return on investment, others are not as quantifiable. But, Annual Monitoring and Reporting on the Plan's progress provides a transparent process to continually analyze the benefits of implementation. The Team is recommending several alternatives to annually monitor and track progress towards success in SCP implementation. Those alternatives are discussed in an Appendix to this Plan which includes a template for a "report card" to annually report on success of the Plan. It is recommended that this reporting take place at the beginning of the City's annual capital planning and budgeting process to assure all opportunities for Plan success are realized.

8.2 Challenges for Implementation

The benefits of saving money on energy and reducing GHG emissions are in addition to other societal benefits associated with these actions, such as reduced local air pollutants, improved public health due to more active mobility modes, less reliance on fossil fuels and an increased demand for energy services and green jobs. Implementing the SCP also requires sustained, strategic commitment by the City and resources from other levels of government. Committing to integrate the recommendations from the SCP into the City's existing decision-making process and grant funding will play an important role in helping to provide the education and outreach, services, incentives and capital projects that are needed to achieve the plan's goals.

A key challenge for implementation of any Plan of this kind is continued political leadership and stakeholder support. One way to maintain that support is the implementation of the Monitoring, Reporting and Updating strategies outlined in the appendices and continuing to educate the community about the successes and benefits (cost savings and lowered energy use) through the City's website.

8.3 Opportunities to Achieve Goals

The City has many opportunities to reach out to other local governments to learn from their successes in implementing sustainability strategies. For instance, as mentioned previously, the City has a good opportunity in retrofitting its fleet. According to City data, seven (7) vehicles are planned for replacement in the next two (2) years and could be prioritized for alternatively fuel technologies. The benefits of these conversions or compatible vehicles to run on biodiesel or waste vegetable oil are already mentioned, but the City can weigh the cost-benefit with the potential review of starting with these seven (7) vehicles. Most new diesel cars and trucks are built so that they can run within a certain biodiesel rating. While the real value of biodiesel is not found so much in mileage, there is a tremendous gas mileage savings over traditional unleaded gasoline engines. When compared to a gas engine, a biodiesel engine could save the driver up to $2,000 a year. According to the U.S. Environmental Protection Agency (EPA), B-20 biodiesel blend cuts unburned hydrocarbons by 20%, carbon monoxide by 12%, and particulate matter by 12%, compared to conventional diesel. Biodiesel operates in conventional diesel engines with few, if any, modifications and is distributed using today's infrastructure, enabling fleets to keep spare parts' inventories, leverage central fueling stations, and utilize skilled diesel mechanics, which keeps costs low. The Department of Energy through its Alternative Fuels and Advanced Vehicles Data Center ("AFDC") which provides information, data, and tools to help fleet and other transportation decision makers find ways to reduce petroleum

consumption through the use of alternative and renewable fuels, advanced vehicles, and other fuel-saving measures.[xl]

Another opportunity the City has is to strengthen and formalize its relationship with FKEC. Given FKEC's progressive programs and commitment to green energy sources, the City through this partnership could explore creative financing mechanisms to incorporate photovoltaic or thermal photovoltaic projects to provide power for its own initiatives. Additionally, advances in technology can be part of this dialogue. For instance if the City wanted to include electric vehicle charging stations in its new City Hall, the partnership could assess the viability of using PV panels to power an electric vehicle charging station. There are tools to assist with that assessment process.[xli]

8.3.1 Funding

While the current fiscal crisis most local governments are undergoing, and limited growth, hamper government investment in energy efficiency and sustainability programs, many cities and counties are nevertheless implementing economical programs to continue progress toward their environmental goals. Cities and counties can use low-cost strategies to build and maintain momentum in their sustainability programs. To address funding issues, the Team looked for opportunities to identify new funds such as grants or create programs that self-generate revenue that can be targeted to implement more initiatives of the SCP.

City Leadership must recognize and be willing to accept the fact that while programs to increase energy efficiency or sustainability are cost effective in the long-run, they may divert resources away from other policy priorities in the short-run. For instance many of the code recommendations can be implemented by minimizing expenses by reviewing other jurisdictions' green building code language, application checklists, and other permitting and enforcement procedures.

The 2011 SCP actions will be funded using the following funding sources: existing operating department budgets, federal and state grant funding, and cost sharing and partnerships. Due to budget challenges, the initiatives are generally limited to what the City can do with existing resources. In some cases, the funding source is identified in the action step.

The Team has already completed a preliminary evaluation of grant programs available over the last year to help prioritize some potential grant opportunities for the City (attached as an Appendix).

8.4 Estimated Cost

The emission of GHGs and their associated impact on global climate change presents policymakers with extensive technical, economic and policy challenges. Different GHG reduction measures have different costs. Some measures are economical; the adoption of such a measure should occur regardless of its GHG reduction benefits. Energy efficiency measures generally fall into this category because the energy savings are sufficient to more than pay for the cost of the measure. Any additional direct benefits, such as a reduction of GHG emissions, would only make that measure even more cost-effective.

Other measures have costs that exceed the narrowly defined economic benefits before their impact on GHG emissions and other co-benefits are accounted for. For instance, reduced emissions should translate into lower increases in global temperatures and should therefore lower the net economic and

other costs associated with global climate change. Other benefits may also occur that are not related to global climate changes, such as reductions in other air emissions or improved flood control.

Bottom line costs associated with this SCP are widely speculative, but at this time costs would include capital costs associated with the remaining energy conservation measures. When implementing the various recommendations it is important to integrate pre and post policy costs into the annual reporting process where feasible. But the following are important to consider for actual and potential cost savings from SCP recommendations:

- Based on the energy retrofits completed from the grant funds, the City can expect to save approximately $12,300/year in energy costs.
- The remaining projects from the Performance Audit are approximately $75,000 with payback periods of anywhere from 4 to 14 years due to the differing nature of the projects.
- If the City converted all of its 14,590 gallons of diesel fuel use (stationary and mobile use) to biodiesel it could see a cost savings of approximately $8,800/year in fuel costs.[11] By purchasing vehicles that can run off of biodiesel mixes in the next replacement cycle (2014-2015), the City could begin experiencing these cost savings immediately. The City could also convert existing vehicles to run from waste vegetable oil, but the cost savings in fuel would have to be offset by the average cost to convert the vehicle ($2,500) and its remaining useful life. Biodiesel retrofit costs are minimal to none depending on the age of the vehicle and the biodiesel mix utilized.
- Cost savings from the integration of renewable energy technologies to power City buildings and infrastructure are highly variable depending on financing approach and power output, but FKEC could assist with helping to analyze the costs and benefits of solar projects for the City. The City and FKEC could also explore innovative leasing arrangements for equipment to lower costs and maximize available tax incentives.
- Environmentally preferred purchasing policies can save on overall operations and maintenance costs for a local government. The City of Santa Monica[xlii] achieved the following results:
    - Five percent reduction in spending on custodial supplies by replacing 15 or 17 products with less toxic or non-toxic alternatives,
    - Switching to an integrated pest management program that cost up to 30% less than traditional pesticide application used before.
    - Using re-refined motor oil that cost the City 25% less than virgin motor oil.

[11] Cost savings estimated at $3.75/gallon of biodiesel and $4.35/gallon of diesel.

[i] Florida Keys Area of Critical State Concern Annual Report, 2011.
http://fl-monroecounty.civicplus.com/Files/AgendaCenter/Items/389/L4_201111071103201847.pdf

[ii] U.S. Energy Information Administration, AEO2012 Early Release Overview,
http://www.eia.gov/forecasts/aeo/er/early_prices.cfm.

[iii] Each GHG has active radiative (or heat-trapping) properties. To compare GHGs emissions from different sources, they are indexed according to their global warming potential. Global warming potential (GWP) is the ability of a GHG to trap heat in the atmosphere relative to an equal amount of carbon dioxide. According to the Intergovernmental Panel on Climate Change (IPCC), over a 100-year time span carbon dioxide (CO2) assumes the value of 1. The two other GHGs of importance in this analysis are methane (CH4) and nitrous oxide (N2O) which, according to a re-evaluation of the IPCC in 2001, take a value of 23 and 296 respectively. Prior to 2001 the IPCC has assumed a 100 year GWP of 21 and 310 for CH4 and N2O respectively, which may explain for some minor differences in the results of studies preceding 2001. Daniel Weisser, "A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies".

[iv] U.S. Energy Information Administration, Primary Use by Sector, 2011.
http://205.254.135.7/consumption/

[v] Local Governments for Sustainability (ICLEI), What is a Sustainability Plan?
http://www.icleiusa.org/action-center/planning/ICLEI_What%20Is%20a%20Sustainability%20Plan.pdf

[vi] LGO Protocol, 2010.

[vii] WRI/WBCSD, 2004.

[viii] FKNMS/NOAA Socio-Economic Research and Monitoring Program. The Physical Vulnerability of the Florida Keys, Climate Change and the Florida Keys,
http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/vulnerability.pdf

[ix] Hans Hoegh-Guldberg, Climate Change and the Florida Keys, July 2010.
http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/climateflkeys_main.pdf (pp 111-116)

[x] The average temperature of 51.1°F was 8.6 degrees above the 20th century average for March and 0.5°F warmer than the previous warmest March in 1910. Of the more than 1,400 months (117+ years) that have passed since the U.S. climate record began, only one month, January 2006, has seen a larger departure from its average temperature than March 2012. National Oceanic and Atmospheric Administration, National Climatic Data Center.

[xi] The Nature Conservancy and Chris Bergh, Initial Estimates of the Ecological and Economic Consequences of Sea Level Rise on the Florida Keys through the Year 2100 (February 17, 2011).

[xii] Hans Hoegh-Guldberg, Climate Change and the Florida Keys, July 2010.
http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/climateflkeys_main.pdf

[xiii] While some scientists have attempted to link this increase to anthropogenic global warming, others have pointed out that Atlantic hurricanes exhibit long-term cycles, and that this latest upswing is simply a return to

conditions that characterized earlier decades in the 20th century. Ferguson, Robert. Hurricane Threat to Florida Climate Change or Demographics? (2007).

[xiv] Hans Hoegh-Guldberg, Climate Change and the Florida Keys, July 2010. http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/climateflkeys_main.pdf

[xv] http://www.epa.gov/climatechange/effects/health.html

[xvi] National Research Council.Ecological Impacts of Climate Change (2009).

[xvii] The Nature Conservancy and Chris Bergh, Initial Estimates of the Ecological and Economic Consequences of Sea Level Rise on the Florida Keys through the Year 2100 (February 17, 2011).

[xviii] Sharlene Leurig, Ceres. Climate Risk Disclosure by Insureres: Evaluating Insurer Responses to the NAIC Climate Disclosure Survey (2011).

[xix] United States Government Accountability Office. Climate Change, Financial Risks to Federal and Private Insurers in Coming Decades Are Potentially Significant (2007). http://www.gao.gov/new.items/d07285.pdf

[xx] CAG Consultants, London, Office of the Deputy Prime Minister: The Planning Response to Climate Change Advice on Better Practice(September 2004).London

[xxi] International Panel on Climate Change. Fourth Assessment Report: Climate Change (2007).

[xxii] *Id.*

[xxiii] *Id.*

[xxiv] Ira R. Feldman and Joshua H. Kahan. Preparing for the Day After Tomorrow: Frameworks for Climate Change Adaptation (2007).

[xxv] Council on Environmental Quality "CEQ". Progress Report of the Interagency Climate Change Adaptation Task Force "Federal Actions for a Climate Resilient Nation" (2010).

[xxvi] The USGCRP began as a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606), which called for "a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."

[xxvii] *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007).

[xxviii] In re: Katrina Canal Breaches Litigation, No. 10-30249 c/w Nos. 10-31054 and 11-30808, 5th Cir.; 2012 U.S. App. LEXIS 4372).

[xxix] Patricia E. Salkin, Sustainability and Land Use Planning: Greening State and Local Land Use Plans and Regulations to Address Climate Change Challenges and Preserve Resources for Future Generations, 34 Wm. & Mary Envtl. L. & Pol'y Rev. 121 (2009), http://scholarship.law.wm.edu/wmelpr/vol34/iss1/4.

[xxx] Pursuant to Title 40, Code of Federal Regulations, Part 123.35 and Rule 62-624, Florida Administrative Code.

[xxxi] Florida Keys Area of Critical State Concern Annual Report, 2011.
http://fl-monroecounty.civicplus.com/Files/AgendaCenter/Items/389/L4_201111071103201847.pdf

[xxxii] Section 255.253(7), F.S. defines "Sustainable building rating or national model green building code" as a rating system established by the United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) rating system, the International Green Construction Code (IGCC), the Green Building Initiative's Green Globes rating system, the Florida Green Building Coalition standards, or a nationally recognized, high-performance green building rating system as approved by the department.

[xxxiii] Energy Performance of LEED® for New Construction Buildings, FINAL REPORT March 4, 2008

[xxxiv] Sarasota Procurement Code, Ordinance 2003-084.
http://www.scgov.net/Sustainability/documents/EPP2003084.pdf

[xxxv] Biodiesel Vehicle Fuel: GHG Reductions, Air Emissions, Supply and Economic Overview DISCUSSION PAPER C3 – 015.
http://www.climatechangecentral.com/files/attachments/DiscussionPapers/015Biodiesel_Discussion_Paper.pdf

[xxxvi] The Low Impact Design Center is a very good resource for Green Streets criteria.
http://www.lowimpactdevelopment.org/greenstreets/

[xxxvii] http://lauderdalefishing.com/2011/03/s-e-florida-fishing-line-recycling-bins/

[xxxviii] Monofilament Recovery & Recycling Program (MRRP). Program Guide.
http://mrrp.myfwc.com/media/1517/MRRPProtocol.pdf. See also: www.FishingLineRecycling.org. Existing locations for bins in Monroe County can be found at: http://mrrp.myfwc.com/recycling-locations.aspx

[xxxix] Florida Coastal and Ocean Coalition, "Preparing For A Sea Change In Florida" (2008).

[xl] U.S. Department of Energy. Alternative Fuels and Advanced Vehicle Data Center.
http://www.afdc.energy.gov/afdc/

[xli] Minnesota Renewable Energy Society.
http://mnrenewables.org/EVplusPV

[xlii] City of Ft. Collins. Purchasing Measures to Reduce Greenhouse Gas Emissions.
http://www.fcgov.com/airquality/pdf/ch9-purchasing.pdf

Appendix A: Implementation Strategy & Monitoring

Appendix A: Implementation Strategy & Monitoring

In developing the SCP, the perception could be that the Plan requires a new financial or staffing "commitment" for implementation. Recognizing that financial resources are constrained, as are staffing resources, the Team has worked to incorporate implementation of the SCP into the City's existing policy and decision-making process the City already employs. The SCP creates no new "process" for implementation in reality. It does not take a new financial commitment to achieve solid progress towards the goals and recommendations in the SCP. It does take a paradigm shift in the City's mindset to integrate the principles in this document into every day decisions and "look" for opportunities to implement the recommendations through grants, partnerships, revisions to policies and procedures and new strategic thinking.

Monitoring will take place with a two-pronged strategy: utilizing a tool that monitors annual energy use and use of an annual reporting "template".

The City's Evaluation and Appraisal Report ("EAR") is scheduled for completion August 1, 2012 and the SCP recommendations should be folded into that process setting the stage for incorporation in the City's Comprehensive Plan updates after the EAR is finalized. Since the City's Code of Ordinances implements the Comprehensive Plan, the concept is that the recommendations in the SCP would be folded into that process from EAR, to Comprehensive Plan to Code revisions.

The Team is recommending a two-pronged approach to monitoring that annually reports on SCP successes and challenges. The first approach is to utilize a free benchmarking tool such as EPA's Portfolio Manager for integration with exiting data establishing an energy use baseline that can periodically updated.[i] There are numerous free resources for simple training on the software.[ii] Portfolio Manager is an interactive energy management tool that allows you to track and assess energy and water consumption across your entire portfolio of buildings in a secure online environment. Portfolio Manager also includes several other tools and benefits:

- Managing energy & water consumption for all building types
- Rating building energy performance
- Estimating CO_2 emissions
- Setting investment priorities
- Verifying and track progress of improvement projects
- Gaining EPA recognition through labeling and awards

The spreadsheets utilized to formulate the GHG Inventory and targets for the SCP, as well as the Performance Audit data, are easily compatible with this tool with some early effort to transfer the data. This could be accomplished through City staff or, if resources are completely unavailable, an internship project could be designed and offered to

students at Florida Keys Community College. The FKCC Strategic Plan makes recommendations for certification offerings in the sustainability field.

Additionally, the Team is providing a recommended template for annual reporting so that the City can provide updates to the community and City's leadership.[iii] This Annual Report should occur at the beginning of the City's budgeting and capital planning process to capture all opportunities to integrate SCP recommendations into that process. With this two-pronged approach the City will be able to report and track both quantifiable reductions towards its own GHG reduction goals as well as determine if it is meeting date specific recommendations such as integration of the SCP recommendations with planning initiatives or creating new partnerships with FKEC and exploring grants or renewable energy project opportunities.

Annual Report Card

Scorecard Perspective	Recommendations	Measure	Target/Trend	Priority/Timeframe	Status	Grade
City Facilities and Operations	CF 1.0: Explore the feasibility and cost benefit of renewable energy technologies to assist in powering buildings and operations.	Number of renewable energy projects on City buildings and facilities.	Increase	Short	Should launch discussion with FKEC as a cornerstone of increased coordination.	
	CF 2.0: Design all buildings and facilities to the highest but cost effective "green" design standards.	Number of renewable energy projects on City buildings and	Increase	Medium	City is already implementing with design of new Fire Station.	
	CF 3.0: Include sustainability criteria in procurement opportunities to the extent practicable.	Policies and codes facilitating green products and services.	Increase	Short	Easy to implement and numerous examples from other local government codes.	
	CF 4.0: Revisit SCP Initiatives and Actions annually during the capital budgeting process to determine new implementation opportunities.	Numberof recommendations included in annual budget/planning process.	Annual	Ongoing	Coordinate dates with beginning of capital planning and budgeting process.	
	CF 5.0: Evaluate options for biodiesel or waste vegetable oil use in City trucks and vehicles (or requiring same from vendors servicing City through "green" procurement requirements)	Number of alternatively fueled vehicles.	Increase	Medium	Begin analysis with new vehicles and complete cost benefit of conversions on existing vehicles. Coordinate to receive information from FKEC experiences.	

 Some Progress

 Success!

[i] http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

[ii] ICLEI, Using EPA's Portfolio Manager Software. http://www.icleiusa.org/action-center/tools/using-epas-portfolio-manager-software

[iii] Baltimore's Annual Report is a good model for a template: http://cleanergreener.highrockhosting2.com/uploads/files/AnnualReport.2010.ForWeb.pdf

Appendix B: Comprehensive Plan and Code Recommendations

Appendix B: Comprehensive Plan and Code Recommendations

SCP Strategy	Comprehensive Plan Section	Code Section
CF 1.0: Explore the feasibility and cost benefit of renewable energy technologies to assist in powering buildings and operations.	• Evaluate as a mechanism electricity costs for operations and maintenance of facilities, buildings and infrastructure under Objective 6-1.4	
CF 2.0: Design all buildings and facilities to the highest but cost effective "green" design standards.	• Incorporate as a new capital improvement evaluation priority under Objective 6-1.4. • Also include incentives or requirements in Policy 1-3.5.8 regarding public construction of public facilities. • Include energy and water efficiency as criteria in the development of public infrastructure and add a Policy under Goal 3-1 encouraging this evaluation. • Consider adding "green infrastructure" design principles to the Land Development Regulations or as a Policy to do so under Goal 3-4. • Consider the unified sea level rise projections contained within the SCP in relation to infrastructure decisions such as those in Policy 4-1.15.1.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 1, consider adoption of green building code provisions for public facilities.
CF 3.0: Include sustainability criteria in procurement opportunities to the extent practicable.	• Primarily a Code issue. • Coordinate environmentally preferred pest management practices within Objective 8-1.3.	• Marathon, Florida, Code of Ordinances, Part II, Chapter 2, Article VI, Division 2., Section 2-168, define environmentally preferred procurement policy. • Add new Section to Division that specifies the types of green products and services the City desires purchasing.

SCP Strategy	Comprehensive Plan Section	Code Section
CF 4.0: Revisit SCP Initiatives and Actions annually during the capital budgeting process to determine new implementation opportunities.	• Add a Policy under Goal 6-1 to integrate SCP recommendations with the Capital Improvement Program and Budgeting process. • Consider adding language to Policy 1-2.2.3 including concepts of adaptation and mitigation planning related to climate change and sea level rise. • Include SCP data and recommendations in Evaluation and Appraisal Report and Comprehensive Plan update per Objective 9-1.3.	
CF 5.0: Evaluate options for biodiesel or waste vegetable oil use in City trucks and vehicles (or requiring same from vendors servicing City through "green" procurement requirements)	• Add a Policy under Goal 6-1 that includes cost-benefit analysis for alternatively fueled vehicles as evaluation criteria for capital improvements.	• Marathon, Florida, Code of Ordinances, Part II, Chapter 2, Article VI, Division 1., Section 2-14, include a goal of purchasing alternatively fueled vehicles when cost effective.
EU 1.0: Align communications and outreach between City and FKEC on energy conservation in homes and buildings.	• Add as a new Policy under Objective 5-1.1.	
EU 2.0: Form more specific partnership between City and FKEC to seek grants and implement common goals.	• Add as a new Policy under Objective 5-1.1.	
EU 3.0: Coordinate to share data on Plan Implementation, Monitoring and Updating.	• Add as a new Policy under Objective 5-1.1.	

SCP Strategy	Comprehensive Plan Section	Code Section
BH 1.0: Encourage innovative building strategies that minimize energy and water consumption, maximize the recycling of construction debris, and provide for a more comfortable indoor environment.	• Consider adding criteria to Policy 1-1.1.2 that includes water and energy efficient design standards in the Land Development Regulations. • Add incentives to Policy 1-3.2.4 providing for increased density opportunities with affordable housing that meets certain water and energy efficiency standards. • Include criteria in Policy 1-3.3.1 promoting the use of green building techniques for redevelopment projects. • Consider including point allocations in Policy 1-3.5.4.3 & 7 encouraging the achievement of energy and water efficient design or green building standards. • Analyze the feasibility or incorporating incentives into the TDR program for energy and water efficient construction standards (Policy 1-3.5.16). • Include a Policy under Objective 2-1.1 focusing on all new housing programs including elements of energy and water efficient design having an ancillary benefit of reducing utilities costs. This is also applicable to Policy 2.1.1. and Policy 2-1.3.1. • Add "green infrastructure" design principles as a Policy under Goal 3-4 as well as Policy 4-1.3.3. • Include incentives to encourage highly water efficient design and construction standards for new development and redevelopment under Objective 3-5.5.	• Marathon, Florida, Code of Ordinances, Part II, Chapter 14, Article IV, consider incentives to promote high water efficiency features in new construction and renovations such as Water Sense. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 1, consider adoption of incentives to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.

SCP Strategy	Comprehensive Plan Section	Code Section
BH 2.0: Simplify project review and permit approval process to encourage innovative green building measures.	• Include concepts of streamline permitting for projects that achieve certain levels of green building certification (see Policy 1-3.1.3). See also Policy 2-1.1.2.	• Marathon, Florida, Code of Ordinances, Part II, Appendix, Chapter 102, could be revised to add streamlined permitting processes for certain types of green projects. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense.
BH 3.0: Highlight and communicate about projects that achieve energy efficient or green design.	• Implement through Policies 1-3.5.4.3 & 7.	
LUT 1.0: Encourage and incentivize land uses and density to facilitate development and redevelopment opportunities linked to transit.	• Implement through Policies 1-3.5.4.3 & 7.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 1, consider adoption of incentives to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.

SCP Strategy	Comprehensive Plan Section	Code Section
LUT 2.0: Make cycling, walking, public transit, and other sustainable mobility modes the mainstream by promoting connectivity and sustainable design standards for transportation infrastructure. Identify deficiencies in the transportation and transit network to prioritize policy development.	• Include the concepts of connectivity to enhance linkages between modes of transportation in Policy 1-1.2.2. • Coordinate this recommendation also with FDOT through Policy 5-1.2.6. • Coordinate implementation also with Objective 8-1.3 in Recreation and Open Space. • Coordinate also with Policy 9-1.2.1.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 1, consider adoption of incentives to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.
LUT 3.0: Manage parking effectively to minimize driving demand, promote carpooling and encourage and support alternatives to single occupancy vehicle use.	• Implement through Policies 1-1.1.4, 1-3.5.4.3 & 7. See also Policy 1-3.5.17.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 1, consider adoption of incentives to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.

SCP Strategy	Comprehensive Plan Section	Code Section
LUT 4.0: Create incentives for low-carbon vehicles such as electric vehicles and plug-in hybrids and make transit infrastructure energy efficient.	• Identify impediments and obstacles to implementation of Policy 4-1.10.5. • Identify infrastructure needs and linkages to connect modes of transportation and assure infrastructure is available to serve alternatively fueled vehicles Policy 4-1.10.5.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 105, consider development of design standards to promote high water efficiency features in new construction and renovations such as Water Sense.
WR 1.0: Determine cost benefit of increasing enforcement of grease trap inspections and requirements.	• Add as a Policy under Objective 3-2.2 and/or Objective 3-2.3.	• Marathon, Florida, Code of Ordinances, Part II, Chapter 34, Article II, Division 8, strengthen wastewater treatment grease interceptor enforcement provisions including increased surcharges to cover costs of enforcement.
WR 2.0: Encourage commercial recycling opportunities by requiring or incentivizing placement of bins for common use.	• Add as a Policy under Objective 3-3.2.	
WR 3.0: Work with marinas to implement monofilament recycling facilities or drop off points. Highlight those that do.	• Add the concept to Policy 4-1.12.2 that will update the marina inventory with information about facilities to accept monofilament fishing line for recycling.	
WR 4.0: Research various incentive programs to promote increased recycling rates.	• Promote recycling of construction and demolition debris in Policy 2-1.3.7. • Include as a Policy under Objective 3-3.2.	

SCP Strategy	Comprehensive Plan Section	Code Section
HAB 1.0: Update and expand City's landscape ordinance to maximize tree canopy and encourage exotic removal.	• Add a Policy or modify Policy 4-1.5.2 to address the carbon sequestration values associated with native habitat and tree canopy. See also Policy 4-1.5.5. • Utilize tree canopy goals in furtherance of Policy 4-1.5.7 to require clustering of development.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 106, Article 2, consider modification of landscape provisions to maximize protection of tree canopy for carbon sequestration benefits and incorporate tree canopy goals. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 8, consider adoption of incentives to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.
HAB 2.0: Establish a tree canopy goal and seek assistance from a student or organization to help develop a tree inventory.	• Commit to a date to complete a tree canopy survey under Objective 4-1.5. See also Policy 4-1.5.4. • Integrate as a new Policy under Objective 8-1.1.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 106, Article 2, consider modification of landscape provisions to maximize protection of tree canopy for carbon sequestration benefits and incorporate tree canopy goals. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, Article 8, consider adoption of incentives to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.

SCP Strategy	Comprehensive Plan Section	Code Section
HAB 3.0: Review RBPAS, CBPAS and land development regulations for enhancement of policies to prioritize connectivity between and enhancement of natural areas. Prioritize avoidance, minimization, then mitigation for wetlands management.	• Integrate carbon sequestration and climate change adaptation and mitigation values into land acquisition strategies such as Policy 1-3.5.15 & 16 within the TDR program. • Include Policies regarding the protection of natural systems in furtherance of mitigating and adapting to climate change impacts under Objective 3-4.2. • Modify language in Goal 4-1 to including the need to manage and conserve natural resources for the value they have on mitigating the impacts of climate change and sea level rise. • Consider adding a Policy under Objective 4-1.1 to prioritize city and communitywide reductions in greenhouse gas reductions. • Consider adding areas under Objective 4-1.2 that are priorities for protection due to their ability to mitigate the impacts of sea level rise or are vulnerable to its impacts. Prioritize acquisition of these areas through coordinated efforts under Policy 4-1.2.14. • Add "safety" as a concept under Objective 4-1.3 to address concepts of climate change and sea level rise. Add these concepts to Policy 4-1.3.1 and the Land Development Regulations addressing the reasons for protecting natural areas. • Consider the impacts of sea level rise under Policy 4-1.3.5. • Update considerations under Policy 4-1.4.9 related to Mean High Water Line and the unified sea level rise projections contained within the SCP. See also Policy 4-1.13.2.	• Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 106, Article 3, 4, 8, 9 & 10, Chapter 107, Article 8, consider modification of provisions to maximize natural area preservation for adaptation and mitigation values. • Marathon, Florida, Code of Ordinances, Part II, Appendix A, Chapter 107, consider adoption of incentives (in various Articles) to encourage green building and developing green building code provisions. Incentivize through BPA weighting criteria.

SCP Strategy	Comprehensive Plan Section	Code Section
	• Add a Policy under Objective 4-1.6 to prioritize restoration of areas already exhibiting stress or impact from sea level rise impacts. • Add a Policy under Objective 4-1.10 to identify and prioritize protection for Historical, Cultural, or Archaeological Features that are vulnerable to sea level rise impacts. • Review Policy 4-1.11.11 in light of the unified sea level rise projections contained within the SCP. See also Policy 4-1.13.1. • Consider any needed revisions to the coastal high hazard area designations in light of particularly vulnerable areas due to sea level rise projections. See Policy 4-1.17.1. • Assure the unified sea level rise projections are coordinated with emergency management planning activities pursuant to Objective 4-1.17, Objective 4-1.19, Objective 4-1.20 and Objective 4-1.22. • Participate in regional discussions regarding the impact of climate and resource issues pursuant to Objective 5-1.2.	
HAB 4.0: Assure recommendations from the SCP are incorporated into planning strategies for Boot Key.	• Integrate with Policies under Objective 8-1.1.	

Appendix C: Marathon GHG Inventory

CITY OF MARATHON, FLORIDA
REPORT:
MUNICIPAL OPERATIONS AND COMMUNITY-WIDE
CY 2010 GREENHOUSE GAS EMISSIONS INVENTORIES

PREPARED BY:

Cameron-Cole

200 E. Government Street, Suite 100
Pensacola, Florida 32502

March 30, 2012

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TABLE OF CONTENTS, CONT'D

This Greenhouse Gas Emissions Inventory Report for the City of Marathon, Florida is presented in two sections. Section I presents all of the information associated with the municipal operation GHG inventory. Section II presents all of the information and the results of the community-wide GHG inventory.

SECTION I. MUNICIPAL

1.0 INTRODUCTION

Cameron-Cole was contracted to prepare the municipal operations calendar year (CY) 2010 greenhouse gas (GHG) emissions inventory for the City of Marathon, Florida ("the Municipal Inventory"). In this section, the results of this inventory along with the procedures and guidelines used to prepare it are summarized. The results will serve as a baseline for setting GHG emissions reduction targets, in concert with the City's efforts to reduce overall energy consumption. GHG emissions forecasts for municipal operations are also presented in this report.

1.1 Protocol

Preparation of the Municipal Inventory was informed by the *Local Government Operations Protocol for the Quantification and Report of Greenhouse Gas Emissions Inventories* (LGO Protocol, 2010), developed by ICLEI – Local Governments for Sustainability in partnership with the California Air Resources Board, and The Climate Registry (TCR). The LGO Protocol is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with government operations. The standardized inventorying of GHG emissions helps local governments track emissions reduction progress over time and allows for comparison of per capita GHG emissions among these government entities.

1.2 Objectives

The objective of the Municipal Inventory is to obtain baseline data on the sources and quantities of GHG emissions produced from local government activities within the City of Marathon. The baseline data collected will be used to determine emissions reduction targets for the forecast year. Another objective of the Municipal Inventory is to clearly identify all data sources, assumptions and methodologies so that it may be replicated year-on-year.

1.3 City Description

The City of Marathon is located in Monroe County, Florida and was incorporated in 1999. The City consists of approximately 8.44 square miles and, based upon U.S. Census Bureau 2010 data, is occupied by 8,297 residents. The boundaries are defined as "from the east end of the Seven Mile Bridge approximately mile marker (MM) 47 to the west end of Toms Harbor Bridge, approximately MM 60". The islands of Marathon are Boot Key, Knight Key, Hog Key, Vaca Key, Stirrup Key, Crawl and Little Crawl Key, East and West Sister's Island, Deer Key and Fat Deer Key, Long Pine Key and Grassy Key.

2.0 INVENTORY DESIGN

2.1 Temporal Boundary

The baseline year for the Municipal Inventory is CY 2010 and the forecast year is CY 2025. The forecast year was selected based on the widespread use of 2025 among other Florida local governments as a GHG emissions reduction goal horizon, and the use by its use in the State of Florida's Executive Order 07-126 (2007) as a target to achieve statewide emissions reductions.

2.2 Geographical Boundary

The geographical boundary is the City limits of Marathon, which encompasses 8.44 square miles. An aerial photo of the City is shown in **Figure 1.1** below.

Figure 1.1: Geographical Boundary

2.3 Chemical Boundary

According to the LGO Protocol, local governments should assess emissions from all six internationally recognized GHGs regulated under the Kyoto Protocol:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Perfluorocarbons (PFCs);
- Hydrofluorocarbons (HFCs); and
- Sulfur hexafluoride (SF_6).

The Municipal Inventory includes emissions of CO_2, CH_4, and N_2O, which constitute the majority of the GHG emissions from the City of Marathon's municipal operations. HFCs are primarily emitted by refrigeration and air conditioning (AC) systems, PFC emissions are most commonly associated with semiconductor manufacturing and in some fire-suppression systems; and SF_6 is primarily found in large electrical equipment, such as transformers. HFCs, PFCs and SF_6 were excluded from the chemical boundary due to budget constraints and the difficulty in collecting the activity data. Cameron-Cole includes a recommendation in Section 5.0 regarding revisiting these exclusions in future inventories.

2.4 Organizational Boundary

In setting the organizational boundary, the LGO Protocol states that local governments should account for and report their emissions according to one of two approaches: operational control or financial control. The LGO Protocol defines operational and financial control as follows:

> *A local government has operational control over an operation if it has the full authority to introduce and implement its operating policies at the operation. A local government has financial control over an operation if the operation is fully consolidated in financial accounts.*

The City of Marathon has set its organizational boundary using the operational control approach as defined by the LGO Protocol.

2.5 Operational Boundary

An operational boundary determines the direct and indirect emissions associated with an entity. This assessment allows the entity to determine which operations and sources cause direct and indirect emissions and to decide which indirect emissions to include that are a consequence of its operations. The LGO Protocol follows the WRI/WBCSD GHG Protocol (WRI/WBCSD, 2004) in categorizing direct and indirect emissions into "scopes" as follows:

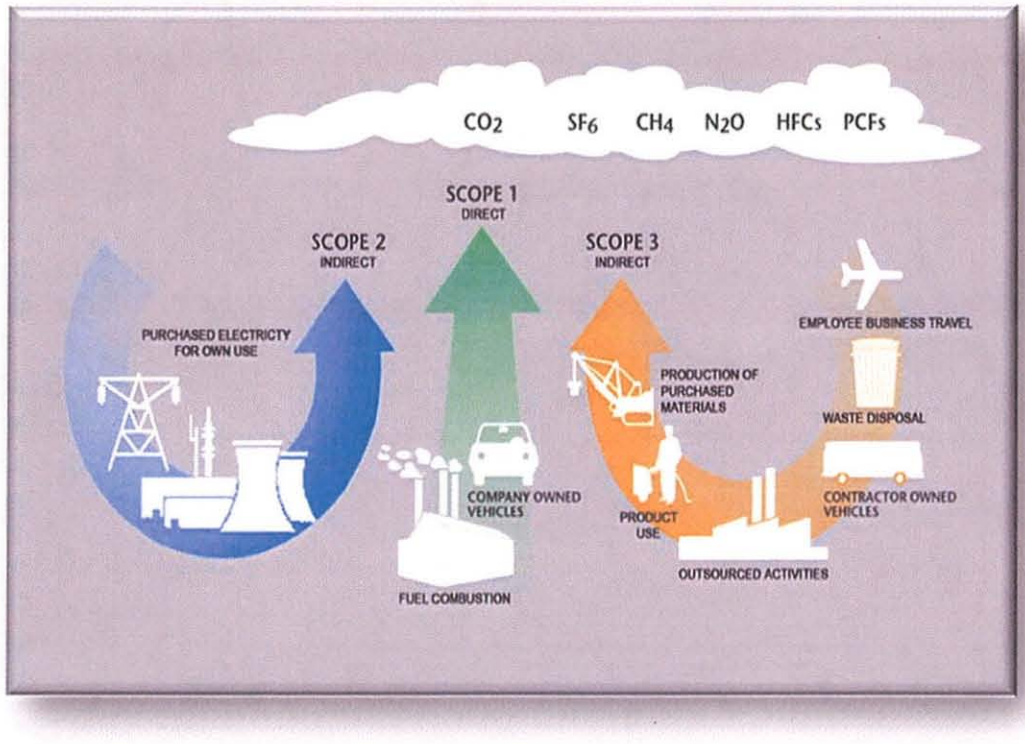
Scope 1: All direct GHG emissions from owned or controlled sources.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating or cooling.

Scope 3: All other indirect emissions including but not limited to those resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities and waste disposal.

Direct and indirect emission sources are depicted below in **Figure 1.2**.

Figure 1.2: Direct and Indirect Emissions Sources (WRI/WBCSD, 2004)



The operational boundary for the Municipal Inventory includes Scope 1 and 2 emissions. Marathon's municipal operations include: office buildings, a vehicle fleet, recreational facilities, a fire department, service department, four wastewater treatment plants[1], police department and street/emergency lighting.

Emission sources for the Municipal Inventory are categorized by scope and listed in **Table 1.1**. There are no landfills within the City limits that the City owns or operates. Scope 3 emissions have been excluded

[1] Only three plants were operational in 2010.

from the operational boundary of the CY 2010 inventories and are not accounted for herein. In 2011, the City may reconsider this decision and expand its operational boundary to include Scope 3 emissions if the activity data can be easily accessed and gathered, and the resources are available to do so.

Table 1.1: Municipal Direct and Indirect Emission Sources

DIRECT EMISSIONS (SCOPE 1)	INDIRECT ENERGY EMISSIONS (SCOPE 2)
• Mobile Combustion – On-road and off-road vehicles using gasoline and diesel. • Stationary Sources – diesel generators • Process Emissions – from nitrification/ denitrification processes at the wastewater treatment plants.	• Electricity Consumption – at government offices and recreational facilities and for street and traffic lighting.

3.0 METHODOLOGY

3.1 Municipal Operations Data Collection

A data collection spreadsheet was submitted by Cameron-Cole to the City of Marathon to gather activity data[2] related to municipal operations. The spreadsheet was used to collect the following information (spreadsheet tab names are in bold font):

- **General Information:** contact details and City operations;
- **Electricity Consumption (1) (2) (3):** CY 2010 information for each electricity meter including: dates of service, usage in kilowatt hours (kWh), and meter and account information; square footage and building activity description information for leased buildings where no direct electricity usage information could be obtained;
- **Mobile – On-Road Vehicle Fuels:** a summary of fuel delivery (for use in on-road vehicles) and tracking methods; monthly consumption volumes for propane, liquefied petroleum gas (LPG), compressed natural gas (CNG), diesel, biodiesel, gasoline and gasoline/ethanol blends using the best available data (i.e. supplier invoices, actual receipts, expense reports, or logs of vehicle fuel purchases);
- **Mobile – Off-Road Vehicle Fuels:** a summary of fuel delivery and tracking methods (for use in off-road vehicles); monthly consumption volumes for propane, LPG, CNG, diesel, biodiesel, gasoline and gasoline/ethanol blends using the best available data;
- **Stationary Sources – Fuels:** all stationary combustion sources that burn fuel including stand-by generators, stationary processing equipment, and acetylene or argon/ CO_2 torches; fuel type and annual consumption for each fuel type and for each stationary source using the best data available; and,
- **Wastewater Treatment:** this tab was created after the data collection spreadsheet was provided to the City. The tab includes the calculation inputs for the City's three wastewater treatment plants and the estimated process N_2O emissions.

Electricity data was provided by Florida Keys Electric Cooperative Association, Inc. (FKEC) in Microsoft-Excel format and input to the data collection spreadsheet by Cameron-Cole. The fuel usage for stationary and mobile combustion sources was based on invoiced purchases.

[2] Activity data, according to the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, are defined as data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time. See: http://goo.gl/vlOey

3.2 Quantification Methodologies

The GHG inventory calculations were conducted in Microsoft Excel®. An emissions calculations tab was inserted into the data collection spreadsheet that was originally sent to the City. Direct mobile emissions from gasoline combustion were calculated using Equation 7.2 from the LGO Protocol with the following emission factors: 8.78 kg CO_2/gallon, CH_4[3] = 0.0000623 % of CO_2, N_2O[1] = 0.0000697 % of CO_2. Direct mobile emissions from diesel combustion were calculated using Equation 7.2 from the LGO Protocol with the following emission factors: 10.21 kg CO_2/gallon, CH_4 = 0.0000623 % of CO_2, N_2O = 0.0000697 % of CO_2. Direct stationary emissions from diesel combustion were calculated using Equation 6.2 from the LGO Protocol with the emission factors of 10.21 kg CO_2/gallon, CH_4 = 11 g CH_4/MMBtu and N_2O = 0.6 g N_2O/MMBtu.

Emissions from the City's three wastewater treatment plants were calculated using Equation 10.7 from the LGO Protocol. The equation required input of the total population served by the wastewater treatment plants. The population served was based on the 2010 City of Marathon permanent population (U.S. Census Bureau 2010 data). To account for seasonal occupants, the permanent population was increased by 50.49% (Monroe County, 2011) for a six month period.[4] Emissions from nitrification and denitrification were included based on operational information provided by the City.

Indirect emissions from electricity purchases were calculated using Equation 6.10 from the LGO Protocol with the 2010 U.S. EPA eGRID[5] Subregion FRCC emission factors of 1220.11 lbs CO_2/megawatt hour (MWh), 41.19 CH_4/gigawatt hour (GWh) and 15.25 lbs N_2O/GWh. The City of Marathon is located in the FRCC[6] Subregion.

The CH_4 and N_2O emissions were then converted to CO_2 equivalent (CO_2e) using global warming potential (GWP) factors from the Intergovernmental Panel on Climate Change Second Assessment Report published in 1995 (ICLEI, 2010), in line with best practice. The GWPs for CH_4 and N_2O are 21 and 310, respectively.

[3] Since mileage data was not available, CH_4 and N_2O were based on CO_2 emissions using guidance issued by The Climate Registry (TCR, 2009).

[4] Seasonal visitors are defined as transient persons residing in the City less than six months per year (City of Marathon, 2005).

[5] The LGO Protocol includes 2007 eGRID emission factors. 2010 eGRID factor were used to provide the most accurate emissions estimates possible.

[6] The FRCC Subregion encompasses most of Florida.

4.0 RESULTS AND ANALYSIS

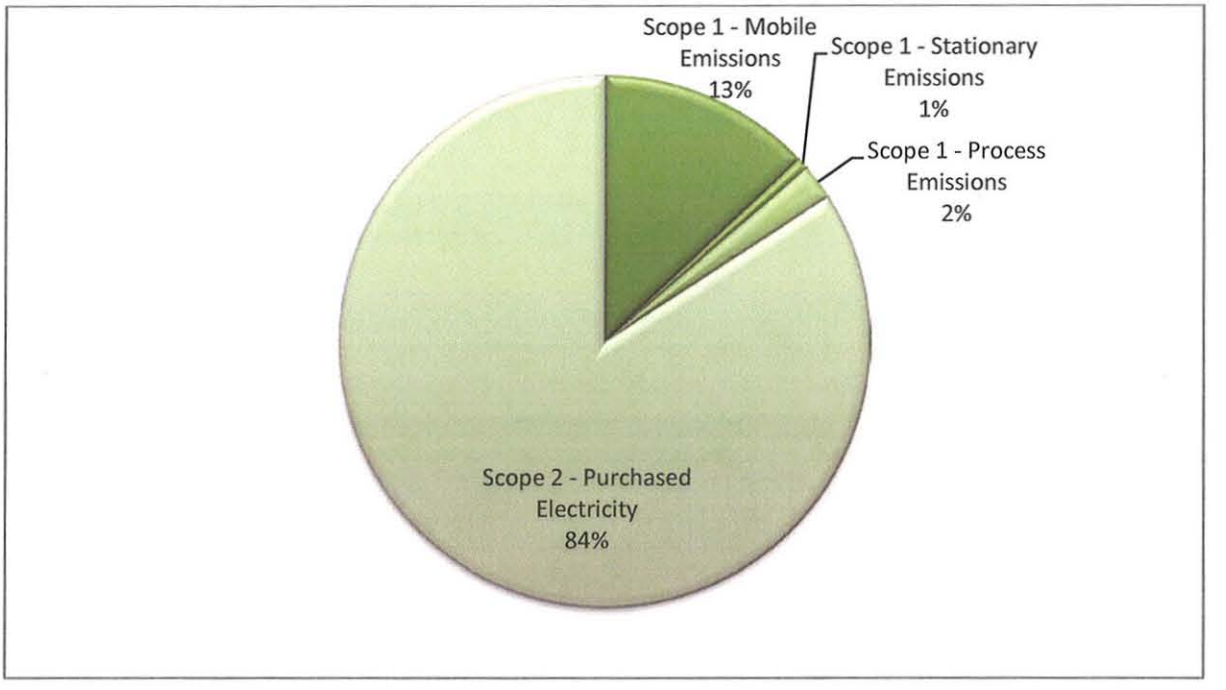
4.1 2010 Municipal Baseline

In CY 2010, the City's municipal operations (Scope 1 and Scope 2) resulted in approximately 1,574 metric tons (MT) of CO_2e. Purchased electricity and mobile emissions were the largest source of municipal operations emissions, accounting for 84% and 13% of the total Scope 1 and 2, respectively. The wastewater treatment plants' Scope 1 emissions, which represent 2% of total emissions, are the result of N_2O emissions due to nitrification/denitrification during the wastewater treatment process. **Table 1.2** summarizes the GHG emissions totals for Scopes 1 and 2 for municipal operations, with **Figure 1.3** illustrating the total municipal emissions by emissions category.

Table 1.2: CY 2010 Municipal Operations GHG Emissions Summary

			Emissions (metric tons)			
	Quantity	**Units**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Scope 1						
Mobile Emissions						
Gasoline-On-Road	6,687	gallons	58.71	0.004	0.004	60.06
Diesel-On-Road	13,510	gallons	137.94	0.009	0.010	141.10
Diesel-Off-Road	291	gallons	2.97	0.0002	0.0002	3.04
Total Mobile Emissions			*199.62*	*0.012*	*0.014*	*204.20*
Stationary Emissions						
Diesel	1,080	gallons	11.02	0.0016	0.0001	11.09
Total Stationary Emissions			*11.02*	*0.0016*	*0.0001*	*11.09*
Process Emissions						
WWTP - Nitrification/ Denitrification	-	-	-	-	0.11	33.98
TOTAL SCOPE 1 EMISSIONS			210.65	0.01	0.12	249.26
Scope 2						
Purchased Electricity	2,382.72	MWh	1,318.67	0.04	0.02	1,324.72
TOTAL SCOPE 1 & 2 EMISSIONS			1529.32	0.06	0.14	1,573.98

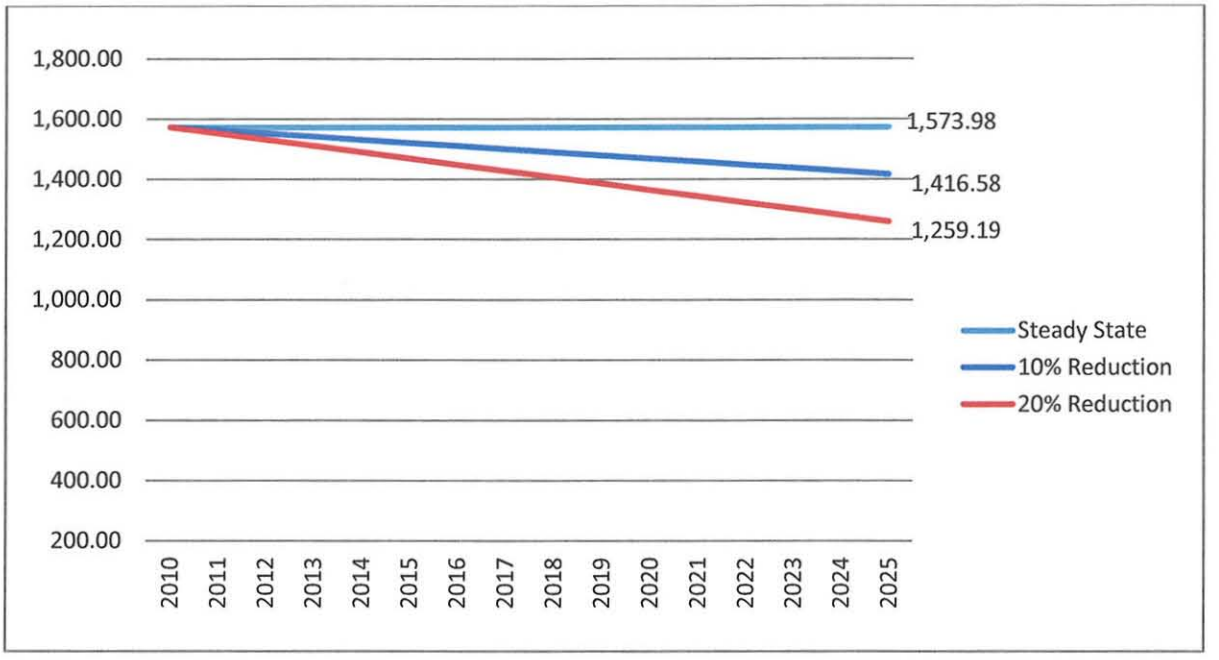
Figure 1.3: CY 2010 Municipal Operations Scope 1 and Scope 2 GHG Emissions



4.2 Emissions Forecast

Since the City of Marathon population is constrained by limited land availability and a complex building permit process, municipal operations are not projected to grow significantly in future years. The emissions forecast assumes that the municipal operations GHG emissions will remain steady state through 2025, where the baseline equals the forecast. Emission projections for the two reduction scenarios were calculated using a straight percentage reduction from the 2010 emissions total. The State of Florida Executive Order 07-126 requires a percentage-based reduction in GHG emissions (not per capita), so population growth was not factored into those projections. The emission projections for the three scenarios are presented in **Figure 1.4**.

Figure 1.4: Projected Municipal Operations GHG Emissions



5.0 RECOMMENDATIONS

This Municipal Inventory is Marathon's first, in what should be an annual effort to collect and analyze information pertaining to its GHG emissions. To improve the accuracy and completeness of future inventories, Cameron-Cole recommends the following:

1. The Scope 1 emissions category should be expanded to include all six GHGs for the municipal operations GHG inventory. It is possible that HFCs and PFCs are emitted within the City limits. HFC-based refrigerants are commonly used in building and vehicle AC units, and fire suppression systems may use PFCs. Guidance for estimating HFCs and PFC emissions is provided in the LGO Protocol (see Chapter 11). Although highly unlikely, SF_6 should be investigated to confirm that there are no emissions of this gas within City limits.

2. Since waste disposal is a significant source of GHG emissions, the Municipal Inventory should be expanded to include Scope 3 emissions from waste generated by City operations/disposed outside of the City limits. As organic waste decomposes, CH_4 is generated. The total volumes of Marathon's waste disposed in a landfill can be used to estimate its Scope 3 CH_4 emissions.

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SECTION II. COMMUNITY-WIDE

1.0 INTRODUCTION

Cameron-Cole was contracted to prepare the community-wide calendar year (CY) 2010 greenhouse gas (GHG) emissions inventory ("the Community-wide Inventory") for the City of Marathon, Florida. This section of the report provides the results of the Community-wide inventory along with the procedures and guidelines used to prepare it. The Community-wide Inventory will serve as a baseline for setting GHG emissions reduction targets, in concert with the Community's efforts to reduce overall energy consumption.

1.1 Protocol

Currently, there is no widely accepted protocol for developing a GHG inventory for an entire community. Although ICLEI is developing a Community GHG Emissions Inventory Protocol, it has not been finalized (as of the date of this report) and the accounting methods for such a protocol are still a topic of vigorous debate. This is partly due to the difficulty in setting boundaries where jurisdiction is divided among residents, businesses, non-governmental organizations, the municipality, County and, in some cases, federal and state governments for roadways and installations under their ownership / control. Further, the issue of cross-boundary emissions from mobile sources coming in and going out of the community makes accounting for them problematic and continues to be addressed differently in community inventories across the country.

In the absence of a single protocol where the design of the community-wide inventory has been agreed upon, Cameron-Cole has developed an approach to the design of Marathon' Community-wide Inventory based on a combination of traditional GHG accounting elements of best practice in the literature and some recommendations provided in guidance such as the BAAQMD's GHG Quantification Guide (BAAQMD, 2010).

1.2 Objectives

The objective of the Community-wide Inventory is to obtain baseline data on the sources and quantities of GHG emissions produced from non-government activities within the City of Marathon. The baseline data will be used to determine emissions reduction targets for the forecast year. Another objective of the Community-wide Inventory is to clearly identify all data sources, assumptions and methodologies so that it may be replicated year-on-year.

1.3 City Description

The City of Marathon is located in Monroe County, Florida and was incorporated in 1999. The City consists of approximately 8.44 square miles and is occupied by 8,297 residents. According to U.S. Census Bureau data for 2010, there were a total 4,380 households within Marathon.

2.0 INVENTORY DESIGN

2.1 Temporal Boundary

The baseline year for the community-wide GHG inventory is CY 2010 and the forecast year is CY 2025. The forecast year was selected based on the widespread use of 2025 among other Florida local governments as a GHG emissions reduction goal horizon, and the use by its use in the State of Florida's Executive Order 07-126 (2007) as a target to achieve statewide emissions reductions.

2.2 Geographical Boundary

The geographical boundary is the City limits of Marathon, which encompasses 8.44 square miles. An aerial photo of the City is shown in **Figure 2.1** below.

Figure 2.1: Geographical Boundary

2.3 Chemical Boundary

According to the LGO Protocol, local governments should assess emissions from all six internationally recognized GHGs regulated under the Kyoto Protocol:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Perfluorocarbons (PFCs);
- Hydrofluorocarbons (HFCs); and
- Sulfur hexafluoride (SF_6).

The inventory includes emissions of CO_2, CH_4, and N_2O, which constitute the majority of the City of Marathon's Community-wide GHG emissions. HFCs are primarily emitted by refrigeration and air conditioning (AC) systems, PFC emissions are most commonly associated with semiconductor manufacturing and in some fire-suppression systems; and SF_6 is primarily found in large electrical equipment, such as transformers. HFCs, PFCs and SF_6 were excluded from the chemical boundary due to budget constraints and the difficulty in collecting the activity data. Cameron-Cole includes a recommendation in Section 5.0 regarding revisiting these exclusions in future inventories.

2.4 Organizational Boundary

As noted, there is no widely accepted accounting protocol for community-wide inventories. Therefore, the organizational boundary for Marathon's Community-wide Inventory was set in line with that used for municipal operations: operational control. This means that residents and "non-residential" entities (commercial/industrial businesses, civic organizations, other entities) that are domiciled within the City limits are included in the organizational boundary of the Community-wide Inventory. Although the GHG emissions from municipal operations are also considered part of the total for the community, they have been segregated for ease of management. The total Community-wide GHG emissions footprint is the sum of emissions as presented in this section and those from municipal operations presented in Section 1.

2.5 Operational Boundary

The LGO Protocol follows the WRI/WBCSD GHG Protocol in categorizing direct and indirect emissions into "scopes" as follows:

Scope 1: All direct GHG emissions from owned or controlled sources.

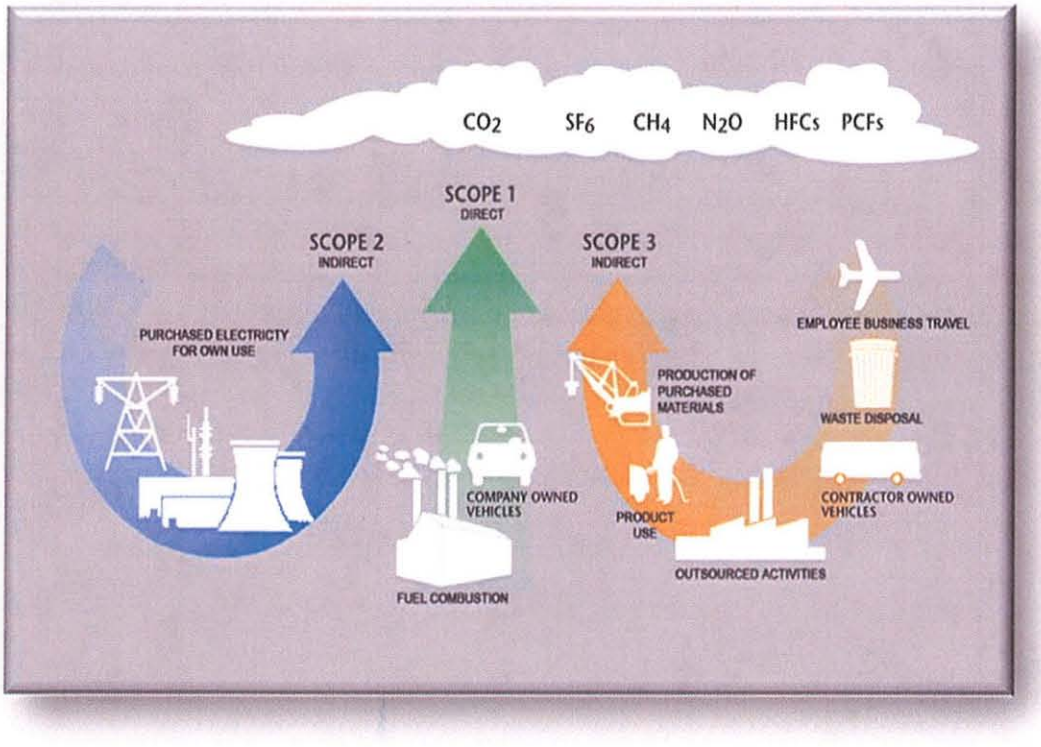
Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating or cooling.

Scope 3: All other indirect emissions including but not limited to those resulting from the

extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities and waste disposal.

Direct and indirect emission sources are depicted below in **Figure 2.2**.

Figure 2.2: Direct and Indirect Emissions Sources (WRI/WBCSD, 2004)



The operational boundary for the Community-wide Inventory includes emissions from sources under the operational control of Marathon's residents and commercial, industrial, civic and other non-governmental entities. The Florida Keys Marathon Airport was not included in the community-wide or municipal operations inventories because it is owned and operated by Monroe County. The Community-wide Inventory includes: Scope 1 emissions from mobile and stationary combustion sources, Scope 2 emissions from purchased electricity and limited Scope 3 emissions from pass-through vehicle traffic, as provided in Table 2.1.

Table 2.1: Community-Wide Direct and Indirect Emission Sources

DIRECT EMISSIONS (SCOPE 1)	INDIRECT ENERGY EMISSIONS (SCOPE 2)	OTHER INDIRECT EMISSIONS (SCOPE 3)
• Mobile Combustion – On-road vehicles using gasoline or diesel for vehicles. • Mobile Combustion – Off-road marine vessels using gasoline or diesel. • Stationary Combustion – propane combustion.	• Electricity Consumption – Residential, commercial heating/cooling, lighting, business operations.	• Mobile Combustion – On-road vehicles using gasoline or diesel; fuel consumption based on all vehicle miles traveled in Marathon.

Again, no universally accepted accounting approach exists for transportation emissions in community-wide inventories. Developing emissions estimates from transport for a community involves defining the inventory boundary and determining what trips are included and what data are available. Depending on how these issues are addressed, an inventory for the same city can report significantly different results (WRI, 2010). In order to have a complete understanding of transportation emissions that emanate from sources owned/controlled in the City as well as those that are emitted within its boundaries, Cameron-Cole used two separate scenarios to estimate emissions and categorized them in Scope 1 and Scope 3, respectively to account for where the community has ownership/control of the mobile sources and where it only has influence (i.e., where someone outside of the community owns/controls the source). The Scope 1 category of this inventory includes mobile combustion emissions for all vehicles and boats registered in Marathon regardless of where the emissions occurred.

The Scope 3 category includes emissions associated with all vehicle miles traveled in Marathon including pass-through traffic, excluding emissions from marine vessels. Based on the data available for Scope 3, it is not feasible to separate out the total emissions from "community-owned/controlled" vehicles that are owned by non-community members driving through Marathon. Therefore, the Scope 3 emissions are not a truly accurate reflection of "pass-through" only. This category includes pass-through emissions plus all in-community travel by vehicles owned by community residents, businesses and the City. This should be considered when making decisions regarding the steps that can be taken to reduce this category of emissions. Detailed information regarding the calculation methodologies and assumptions are included in Section 3.

3.0 METHODOLOGY

3.1 Community-Wide Data Collection

Community-wide electricity consumption data was provided by FKEC. No other direct data was available. Therefore, proxy[7] data was used for the other emissions sources that were included in the Community-wide Inventory.

The following emissions sources were assumed to be *de minimis*[8] (small) and were excluded from the scope of the Community-wide Inventory: emissions from fossil fuel use in landscaping equipment, grills, motorcycles, ATVs, private planes and other sources owned by Marathon businesses and residents and that do not (when aggregated) represent large emissions numbers.

Off-road heavy equipment was included in the operational boundary, but such equipment was not directly identified within the City limits. To determine this, a search of the Florida Department of Environmental Protection Storage Tank Facility Information website (FDEP, 2011) was conducted to determine whether there were any fueling tanks at non-residential locations that may indicate the existence of off-road heavy equipment. Based on this search, it was assumed that there were no non-residential pieces of large off-road equipment (owned/controlled by businesses or other organizations) within Marathon.

The Community-wide Inventory had three emissions categories: direct emissions from mobile combustion, direct emissions from stationary combustion and indirect emissions from purchased electricity. As previously mentioned, FKEC provided electricity data for all residential, commercial, and industrial properties located in Marathon.

For the Scope 1 emissions category, the quantities of diesel and gasoline combusted by on-road vehicles were derived using the following methodology and assumptions:

- Average of total number of vehicles registered in Monroe County in January and December of 2010 (FDHSV, 2011).[9]
- Number of registered vehicles was prorated based on the ratio of the City population to the County population.
- Annual total vehicle miles traveled (VMT) by vehicle class based on Federal Highway Administration annual averages (FHWA, 2011).

---

[7] A figure that can be used to represent the value of something in a calculation

[8] Most GHG registries and reporting programs allow a small (de minimis) portion of an entity's emissions (such as 3 or 5 percent) to be excluded from an emissions inventory or estimated using simplified estimation methods.

[9] Mobile homes (stationary – not RV), travel trailers, and trailers were excluded because they are not motorized. Motorcycles were outside of the inventory scope. "Tools" were assumed to have the same fuel economy as buses.

- "Autos & Pickups" were assumed to use gas; "Heavy Trucks" and "Buses & Tools[10]" were assumed to use diesel.
- The number of gallons of fuels (gasoline and diesel) was calculated using the vehicle class fuel economy (USDOT, 2011; USEPA, 2010).

The quantities of diesel and gasoline combusted by marine vessels for the Scope 1 emissions estimates were derived using the following methodology and assumptions:

- Percent vessel class was calculated from the average of total number of vessels registered in Monroe County in 2010 (FLHSMV, 2010).
- Registered vessels prorated based on the ratio of the City population to the county population.
- Run time for pleasure vessels was assumed to be 50%, while run time for commercial vessels was assumed to be 100% while in use.
- Pleasure and commercial vessels were assumed to use diesel if they were 40' or greater in length. Vessels less than 40' were assumed to use gasoline.

Information provided by the City indicates that some residents and businesses use propane. An unsuccessful effort was made by the City to obtain the actual usage information directly from the fuel vendors. Since direct data could not be obtained, proxy data was used to estimate the quantities of propane combusted in Marathon using the following methodology and assumptions:

- Best available data for propane usage[11] (PERC, 2011) within the State of Florida was identified.
- Per capita propane usage was calculated for the State of Florida using the 2010 population (U.S. Census Bureau, 2011).
- Propane usage was calculated using the City's population.

For the Scope 3 emissions category, the quantities of diesel and gasoline combusted by on-road vehicles were derived using the following methodology and assumptions:

- Percent vehicle class was calculated from the average of total number of vehicles registered in Monroe County in January and December of 2010 (FDHSV, 2011).[12]
- The vehicle class percentages were applied to the total VMT[13] (Daily VMT x 365) for Monroe County (FDOT, 2011).
- VMT was prorated based on the ratio of the City population to the County population.

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[10] Tractor Cranes, Power Shovels, Well Drillers and other such vehicles, so constructed and designed as a tool and not a hauling unit, used on the roads and highways incidental to the purpose for which designed (FDHSV, 2009).

[11] 2010 propane usage for all usage categories except agriculture

[12] Mobile homes (stationary – not RVs), travel trailers and trailers were excluded because they are not motorized. Motorcycles were outside the inventory scope. "Tools" were assumed to have the same fuel economy as buses.

[13] The VMT includes pass-through highway traffic and inter-regional travel. Vehicle travel on highways or other forms of inter-regional travel should be included in the GHG inventory to the extent that VMT occurs with the geographic boundary of the jurisdiction (BAAQMD, 2010).

- "Autos & Pickups" were assumed to use gas; "Heavy Trucks" and "Buses & Tools" were assumed to use diesel.
- The number of gallons of fuels (gasoline and diesel) was calculated using the vehicle class fuel economy (USDOT, 2001; USEPA, 2010).

3.2 Quantification Methodologies

The GHG inventory calculations were conducted in Microsoft Excel®. An emissions calculations tab was inserted into the data collection spreadsheet. Mobile emissions from gasoline and diesel combustion were calculated using Equation 7.2 from the LGO Protocol. The following emission factors were used for gasoline and diesel, respectively: 8.78 kg CO_2/gallon and 10.21 kg CO_2/gallon. The following emission factors were used for both fuel types[14], CH_4 = 0.0000623 % of CO_2, N_2O[1] = 0.0000697 % of CO_2. Direct stationary emissions from propane combustion were calculated using Equation 6.2 from the LGO Protocol. The propane emission factors were 5.59 kg CO_2/gallon, 11 g CH_4/MMBtu and 0.6 g N_2O/MMBtu.

Indirect emissions from electricity purchases were calculated using Equation 6.10 from the LGO Protocol with the 2010 U.S. EPA eGRID[15] Subregion FRCC emission factors of 1220.11 lbs CO_2/megawatt hour (MWh), 41.19 CH_4/gigawatt hour (GWh) and 15.25 lbs N_2O/GWh. The City of Marathon is located in the FRCC[16] Subregion.

The CH_4 and N_2O emissions were then converted to CO_2 equivalent (CO_2e) using global warming potential (GWP) factors from the Intergovernmental Panel on Climate Change Second Assessment Report published in 1995 (ICLEI, 2010), in line with best practice. The GWPs for CH_4 and N_2O are 21 and 310, respectively.

[14] Since mileage data was not available, CH_4 and N_2O were based on CO_2 emissions using guidance issued by The Climate Registry (TCR, 2009).
[15] The LGO Protocol includes 2007 eGRID emission factors. 2010 eGRID factor were used to provide the most accurate emissions estimates possible.
[16] The FRCC Subregion encompasses most of Florida.

4.0 RESULTS AND ANALYSIS

4.1 CY 2010 Community-Wide Baseline

Marathon's community-wide Scope 1 and Scope 2 emissions are an estimated total of 172,283.13 metric tons (MT) CO_2e. Mobile emissions accounted for 49.6% of the community-wide Scope 1 and Scope 2 total. Purchased electricity accounted for 50% of the total emissions for the community, with stationary combustion of propane comprising the remaining 0.4% of emissions. Commercial usage of purchased electricity accounted for 52% of the total Scope 2 indirect emissions or 44,476 MT CO_2e, with the remaining 48% or 41,722 MT CO_2e, resulting from residential electricity usage.

Scope 1 emissions from on-road travel by vehicles in CY 2010 are an estimated 47,176 MT CO_2e, accounting for just under 55% of the community-wide total Scope 1 GHG emissions. Marine vessel combustion of gasoline comprised over 44% of the Scope 1 emissions. On the following page, **Table 2.2** provides an analysis of the total community-wide sources of GHG emissions. **Figure 2.3** compares the Scope 1 and Scope 2 emissions totals for the Community-wide Inventory. A comparison of residential versus commercial electricity consumption is presented in **Figure 2.4**.

Scope 3 on-road vehicle emissions totaled 60,517.09 MT CO_2e, which was approximately 28 per cent higher than the Scope 1 on-road vehicle emissions. As discussed in Section 2.5, the difference between these two values does not equal the emissions associated with just pass-through traffic because the Scope 3 emissions includes in-community travel by vehicles registered in Marathon. However, this number does suggest that pass-through traffic is a significant source of emissions.

Table 2.2: Community-Wide GHG Emissions Summary

			Emissions (metric tons)			
	Quantity	**Units**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Scope 1						
Mobile Emissions						
Gasoline - On-Road Vehicles	3,546,177	gallons	31,135.43	1.94	2.17	31,848.91
Diesel - On-Road Vehicles	1,467,533	gallons	14,983.52	0.93	1.04	15,326.87
Gasoline - Off-Road Marine	3,033,875	gallons	26,637.43	1.66	1.86	27,247.83
Diesel - Off-Road Marine	1,074,232	gallons	10,967.91	0.68	0.76	10,967.91
Total Mobile Emissions			*83,724.29*	*5.22*	*5.84*	*85,391.52*
Stationary Emissions						
Propane	123,163	gallons	688.83	0.12	0.01	693.51
TOTAL SCOPE 1 EMISSIONS			84,413.12	5.34	5.84	86,085.03
Scope 2						
Purchased Electricity - Commercial	79,997	MWh	41,531.62	1.40	0.52	44,476.12
Purchased Electricity - Residential	75,044	MWh	44,273.19	1.49	0.55	41,721.98
TOTAL SCOPE 2 EMISSIONS			85,804.81	2.90	1.07	86,198.10
TOTAL SCOPE 1 & 2 EMISSIONS			**170,217.93**	**8.24**	**6.91**	**172,283.13**
Scope 3						
Mobile Emissions						
Gasoline - On-Road Vehicles	4,926,139	gallons	43,251.50	2.69	3.01	44,242.62
Diesel - On-Road Vehicles	1,558,265	gallons	15,909.89	0.99	1.11	16,274.47
Total Mobile Emissions			*59,161.39*	*3.69*	*4.12*	*60,517.09*

Figure 2.3: Community-Wide Scope 1 and Scope 2 GHG Emissions

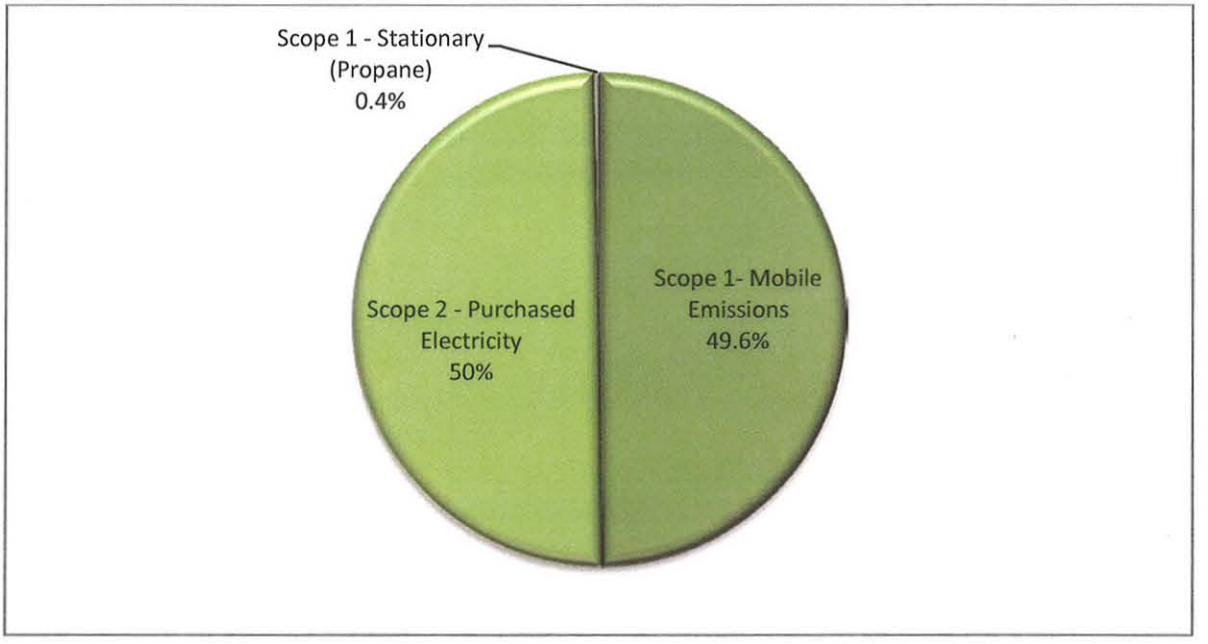
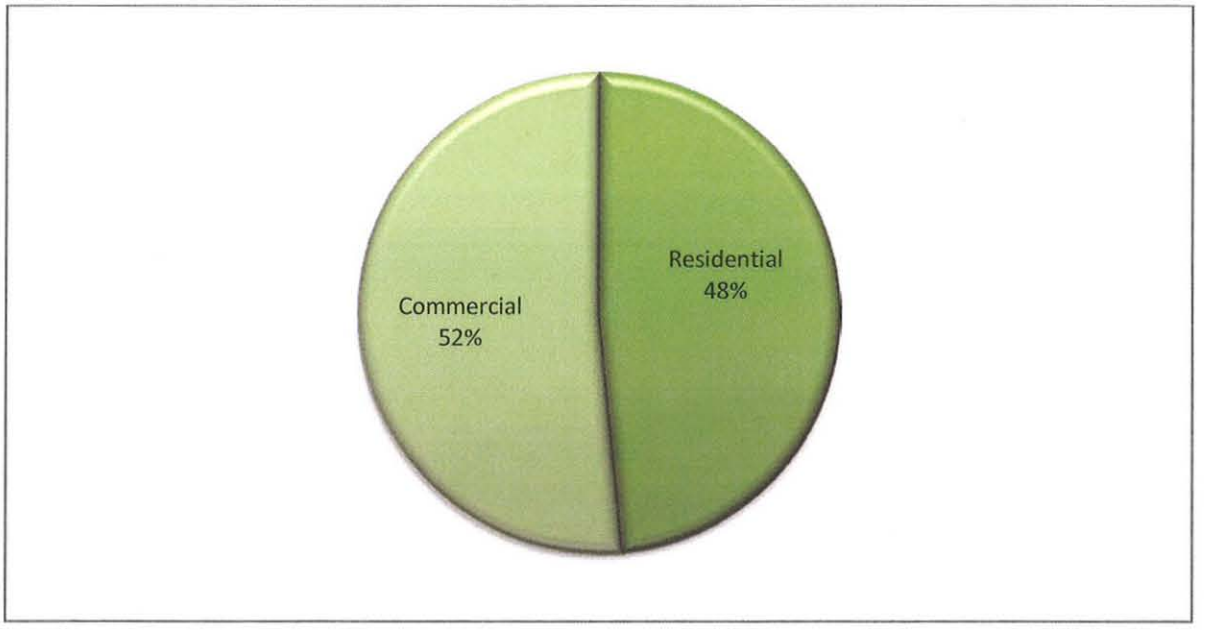


Figure 2.4: Community-Wide Electricity Usage by Sector (MWh)



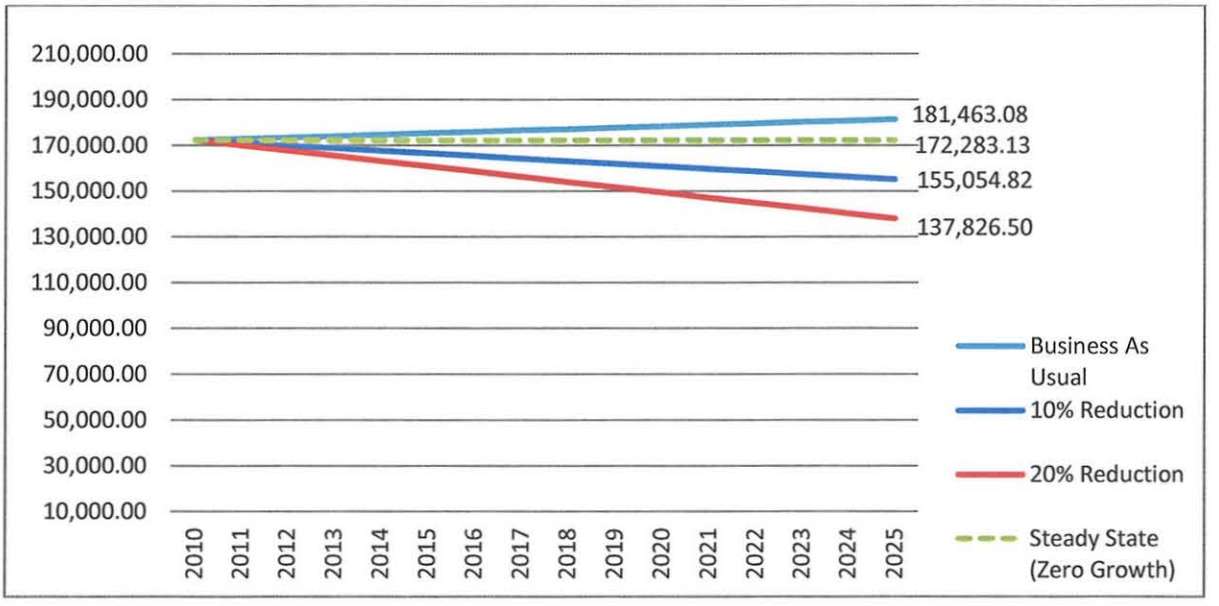
4.2 Emissions Forecast

A forecast of the community-wide GHG emissions from the CY 2010 baseline were developed for three different scenarios: business-as-usual, a 10% percent emissions reduction and a 20% emissions reduction. Under all three scenarios, emissions are estimated through 2025.

The projected emissions under the business-as-usual scenario were estimated using the 2010 per capita emissions applied to an increasing population using a base population adjusted to account for seasonal visitors. To account for seasonal occupants, the permanent population was increased by 50.49% (Monroe County, 2011) for a six month period.[17] U.S. Census Bureau 2010 data indicated a decrease in the population of the City of Marathon from 2000 to 2010. While Census data may have indicated a population decline over the previous decade, the emissions forecast assumed a modest population increase[18] beginning in 2011 consistent with the growth projected in City of Marathon's Comprehensive Plan (2005). It was assumed that a constant number of people would move into the City of Marathon each year[19] based on projected population for 2020 provided in Marathon's Comprehensive Plan.

Emission projections for the two reduction scenarios were calculated using a straight percentage reduction from the 2010 emissions total. The State of Florida Executive Order 07-126 requires a specific percentage reduction in GHG emissions (not per capita), so population growth was not factored into those projections. The emission projections for the three scenarios are presented in **Figure 2.5** below.

Figure 2.5: Projected Community-Wide GHG Emissions



[17] Seasonal visitors are defined as transient persons residing in the City less than six months per year (City of Marathon. 2005).

[18] 4.1% between 2010 and 2020

[19] Adding the same number of people each year increases the population but results in a slightly decline in percent population growth year-over-year.

5.0 RECOMMENDATIONS

CY 2010 was Marathon's first Community-wide Inventory year. To improve the accuracy and completeness of future Community-wide Inventories, Cameron-Cole has developed the following recommendations:

1. Since waste disposal is a significant source of GHG emissions, the Community-wide Inventory should be expanded to include Scope 3 emissions from waste generated by residents and businesses and disposed outside of the City limits. As organic waste decomposes, CH_4 is generated. The total volumes of Marathon's waste disposed at landfills outside of the City limits can be used to estimate its Scope 3 CH_4 emissions.

2. The Scope 1 emissions category should be expanded to include all six GHGs for the Community-wide Inventory. It is possible that HFCs and PFCs are emitted within the City limits. HFC-based refrigerants are commonly used in building and vehicle AC units, and fire suppression systems may use PFCs. Guidance for estimating HFCs and PFC emissions is provided in the LGO Protocol. Confirmation of the absence of SF_6 should be made, assuming that no businesses within the City limits deal with this GHG.

3. To calculate more accurate emissions associated with marine vessels, a request should be made to local fuel vendors for annual marine fuel purchases and use the purchased quantities as the basis for emissions estimates.

4. To calculate more accurate emissions associated with stationary combustion of propane, additional attempts should be made to obtain usage information from City's propane vendors.

6.0 REFERENCES

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Sponsored by: Hernstadt

CITY OF MARATHON, FLORIDA
RESOLUTION 2012-52

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, APPROVING AND ADOPTING THE CITY OF MARATHON SUSTAINABILITY AND CLIMATE PLAN; AND PROVIDING FOR AN EFFECTIVE DATE

WHEREAS, there is consensus among the world's leading scientists that a warming climate is among the most significant problems facing the world today; and

WHEREAS, Florida is considered one of the most vulnerable areas in the country to the consequences of climate change, with Southeast Florida on the frontline to experience the impacts of climate change, especially sea level rise; and

WHEREAS, preparing for climate change impacts provides multiple benefits by building a more resilient economy, and by helping to reduce the physical impacts and costs to people, property and resources associated with a changing climate; and

WHEREAS, one of the required tasks associated with the $450,000.00 Energy Efficiency and Conservation Block Grant received by the City was the completion of a greenhouse gas inventory and create a sustainability and climate plan for the City of Marathon; and

WHEREAS, approving this plan states that Marathon is serious about making wise decisions in the future for the sustainability of the ecosystems that support life and preserving and restoring our water, wildlife, and soils.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, THAT:

Section 1. The above recitals are true and correct and incorporated herein.

Section 2. The City Council approves and adopts the City of Marathon Sustainability and Climate Plan attached hereto as Exhibit "A."

Section 3. This resolution shall take effect immediately upon its adoption.

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF MARATHON, FLORIDA, THIS 8th DAY OF MAY, 2012.

THE CITY OF MARATHON, FLORIDA

Pete Worthington, Mayor

AYES: Cinque, Keating, Ramsay, Snead, Worthington
NOES: None
ABSENT: None
ABSTAIN: None

ATTEST:

Diane Clavier, City Clerk

(City Seal)

APPROVED AS TO FORM AND LEGALITY FOR THE USE AND RELIANCE OF THE CITY OF MARATHON, FLORIDA ONLY:

City Attorney

1.0 Executive Summary

Current trends in society highlight increasing levels of population and consumption and decreasing natural resources and ecosystems including forests, water, wildlife, and soils. At some point the population and increasing consumption will be greater than the ecosystems that support life. "Sustainable" actions are those that work toward reducing the demands and consumption of our ecosystems and also work toward preserving and restoring our forests, water, wildlife, and soils.

Recognizing this challenge, it is now becoming imperative for governments to respond to sustainability issues such as resource scarcity, climate change and energy conservation that are compounding existing challenges to economic growth. But, addressing sustainability is not only a cause for environmentalists. Sustainability intersects with efforts to create employment opportunities in the emerging green economy. Unlike other types of environmental policies, energy efficiency and greenhouse gas ("GHG") reduction efforts can produce direct cost savings in government operations and for citizens as well as "co-benefits" by enhancing the performance of other initiatives. Sustainable communities have the ability to attract potential business investments and a skilled workforce. Implementing this Sustainability and Climate Plan ("SCP") will also result in increased demand for skilled labor, such as that needed for energy efficiency retrofits, solar installations, processing of recyclables and designing, building and maintaining infrastructure that account for new impacts from climate change.

The physical impacts of climate change are already clear and will expand and intensify in the decades ahead. In July of 2009, the U.S. Army Corps of Engineers adopted new guidance for incorporating the direct and indirect physical effects of projected future sea-level change in managing, planning, engineering, designing, constructing, operating, and maintaining their civil projects. It requires planning based on a low, intermediate and high projection the current estimate of 1.7 mm/year increase for global mean sea-level change. The Corps updated this guidance in November 2011, is EC 1165-2-212 "Sea-Level Change Considerations for Civil Works Programs". Recently, the South Florida Water Management District ("SFWMD") published a report planning for a 5-20" increase in sea level by 2060. The U.S. Environmental Protection Agency ("EPA") has also started to aggressively address climate change and energy conservation issues. The physical impacts of a changing climate are matched, and compounded, by social challenges such as rising energy, transportation and health care costs. Low-income and vulnerable citizens, such as our elderly communities, face disproportionate impacts of climate change including having fewer resources to respond to these changes.

Regardless of individual beliefs about climate change, there are inevitable reasons to develop this Sustainability and Climate Plan including:

- The cost of energy is escalating
- This has a multiplier effect on government and community expenses, and
- There are regulatory and stakeholder pressures necessitating action.

This planning effort takes the City from conceptual discussion to specific action. Just as climate change is a major indicator of a non-sustainable society, excessive or unnecessary carbon emissions are an indicator of a non-sustainable organization. Because of its potential to integrate the triple bottom line concerns of ecology, economy, and social equity while simultaneously creating financial value through lower costs, and reduced risk, an increasing number of public and private sector leaders are seeing sustainability as an appropriate framework under which to manage carbon reduction efforts. These leaders are ushering in what some have called a "new era of sustainability." The purpose of the SCP is to create an open, transparent and participatory dialogue between the City, community members, business members, and other key area partners concerning the City's commitment and process to implement factors related to the triple bottom line: economic, environmental and social.

Sustainability or climate action plans can include many different attributes and address very different areas. Some of the recommendations in the plan require Council approval separate from adoption of the SCP Plan and also require additional funding in order to be implemented. Some of the recommendations are low to no cost policy shifts and changes that can easily be implemented with minimal effort. The key components of the SCP are:

- Describe the City's GHG emissions sources and how those emissions could be expected to grow.
- Recommend ways that the City can achieve GHG reductions and other community benefits such as increased green job opportunities and improved public health.
- Provide a timeline for the plan's implementation.
- Define an Implementation Strategy for turning this SCP into action and transparently tracking and reporting progress toward its goals, including funding.

While today's economic challenges are real and will force the City to make tough decisions, the looming threat of climate change elevates the need to protect our global natural environment and resources – not only to mitigate the effects of climate change, but also to ensure that our communities can adapt. The City faces real threats from climate change: sea-level rise disproportionately impacts waterfront communities and ports, the urban heat island effect contributes to poor air quality and increased cooling costs, and changing weather patterns and more disruptive storms may cause flooding and other types of damage.

Implementation of the SCP must be mindful of existing planning and policy making processes. Funding these types of initiatives is a primary challenge to implementation as well. The approach to the SCP includes two major strategies to overcome these obstacles. First, the SCP includes policy recommendations based upon real data that will make the City more competitive for funding these initiatives with grant funds because projects are part of a larger cohesive effort. Second, the process of tracking the success of the SCP, on an annual basis, in conjunction with its capital planning process allows the City to constantly monitor its successes and setbacks in achieving its goals. With commitment, community education and outreach, the City can implement its SCP in a timely and cost effective manner resulting in cost savings over time and environmental benefits.

2.0 Background

Marathon incorporated as a municipality in November of 1999. Located in the Middle Florida Keys, within Monroe County, the City includes: Grassy Key, the Crawl Keys, Long Point Key, Fat Deer Key, Key Vaca, Stirrup Key, Boot Key, Hog Key and Knight Key, all of which lie along a 16-mile stretch of the Overseas Highway. The City Charter also recognizes all adjacent off shore islands. The area extends from the east end of the Seven Mile Bridge at mile marker ("MM") 47 to the east end of Grassy Key at MM 60.

Population in Marathon in 2000 was estimated at 10,225 but in comparison to 2010 figures, the City's population was reduced to 8,267.[i] In 1990, Marathon made up 11.4% of Monroe County's total population. This percentage increased to nearly 13% in 2000. Typically, the rate of population growth is the primary determinant of land use requirements, housing supply and demand, and public facility needs and services. However, in the Florida Keys, residential growth has been managed in accordance with the Rate of Growth Ordinance ("ROGO") and City Permit Allocation System since July 1992, which limits the number of residential units (to 30) that can be constructed annually to ensure maintenance of adequate hurricane evacuation clearance times.

Current and projected population estimates have been divided into two sub-groups: permanent residents and seasonal visitors. According to definitions established by the University of Florida Bureau of Economic and Business Research ("BEBR"), a permanent residence is one's "usual residence, or the place one lives and sleeps most of the time." Seasonal visitors represent persons who reside in the City for less than six months a year. The level of demand for public facilities and land use consumption may vary between the two sub-groups due to different periods of residency and associated activities or events.

It is important to note the types of land uses and potential population growth within the City because this will help drive priorities in terms of energy reductions from the built sector and projections of future energy use both from City operations and the community as a whole.

3.0 Synergy between Energy Use, GHG Emissions, Climate Change and Sustainability

To date, the international community has dealt with climate change, the quintessential sustainability issue of our time, principally by promoting the mitigation of GHGs. The rationale for such mitigation efforts, simply stated, is that if GHG concentrations are stabilized or reduced, ultimately the severity of climate change can be alleviated.

Almost all impacts from climate change relate to increasing air temperatures with global sea level rise largely attributable to the thermal expansion of the oceans and melting of glaciers and ice sheets. Altered precipitation patterns, heat waves, floods and droughts are all related impacts. But, not all impacts will be uniform and there will be some variation by location due to differences in atmospheric and oceanic circulation. Inundation, erosion and flooding are also resulting impacts. Areas with greater precipitation will see more sewer overflows, more runoff and nonpoint pollution, and infrastructure overloading. Areas of lesser precipitation with struggle with meeting water demands and

habitat shifts. A great area of uncertainty is the combination and interrelationships of these impacts in the future. In particular, predicted changes in storm intensity and sea level rise create the need for integrated potable water, storm water, and wastewater infrastructure planning and greater interagency coordination. Cities play an integral role in advancing sustainability, not only because they are contributors to climate change, but also because they are increasingly challenged to control costs associated with energy use. Numerous local governments in the U.S. have enacted energy conservation and efficiency measures along with GHG emissions reduction plans to address the global dimensions of energy problems that extend far beyond their borders. The powers of local governments, especially over land use, make them well suited to play a lead role in sustainability and energy management.

3.1 Rising Cost of Energy

Energy demand growth is projected to continue at about 1% per year through 2035.[ii] Electricity prices in 2035 are projected at 9.5 cents per kilowatt hour (2010 dollars) in 2012 projections, compared with 9.3 cents per kilowatt hour in the 2011 projections demonstrating a continued long term increase in energy costs for the next 25 years which is the reality of the increased cost of energy use. Energy systems emit GHG and contribute to anthropogenic climate change.[iii]

Energy use in homes and businesses is typically a large sector of GHG emissions.[iv] In homes, several factors influence energy use: the physical characteristics of the housing units, the appliances utilized including heating and cooling equipment, demographic characteristics of the household, the types of fuels used, and other information that relates to energy use. According to the EIA, commercial buildings include all buildings in which at least half of the floor space is used for a purpose that is not residential, industrial, or agricultural; therefore, they include building types that might not traditionally be considered "commercial," such as schools, correctional institutions, and buildings used for religious worship. This includes retail and wholesale stores, hotels and motels, restaurants, and hospitals. Excluded from the sector are the goods-producing industries: manufacturing, agriculture, mining, forestry and fisheries, and construction. Analysis of the structures, activities, and equipment associated with different types of buildings is the clearest way to evaluate commercial sector energy use. Because of the rising costs of energy, community stakeholders as well as governments can benefits from a reduced bottom line by managing energy use.

3.2 Reducing Greenhouse Gas Emissions

EPA defines "greenhouse effect" as a general warming effect felt on the Earth's surface produced by GHGs. This process occurs naturally and has kept the Earth's temperature about 60 degrees Fahrenheit warmer than it would be otherwise. The greenhouse effect is important; without it, the Earth would not be warm enough for humans to live. Most climate scientists opine that human activity, such as burning fossil fuels, deforestation and certain changes to land use are causing an increase in GHGs in the Earth's atmosphere. The increased GHGs lead to warming in general as well as greater variability and lower predictability which is the basis for the science and popular sentiment recognizing the seriousness of changing weather patterns in many places around the world.

3.3 Local Governments Preparing for Climate Change

The U.S. in general is struggling with the issue of GHG regulation and climate change preparedness. Approaches to these issues continue to evolve based on significant policy and regulatory debate amidst a constantly changing regulatory and planning landscape. While GHGs produced within the City constitute only a small fraction of national and global quantities, achieving the City's goals requires the City todemonstrate leadership on these critical issues. The City is on the front lines of climate change impacts such as sea level rise and increased hurricane intensity. By recognizing the need to simultaneously mitigate GHGs attributable to energy use and prepare for the gradual, but accelerating, impacts of climate change, the City is beginning to proactively take action.

Local governments throughout the country have begun to demonstrate leadership on climate policy amidst new federal actions. Local governments can contribute a great deal to U.S. climate change mitigation by reducing emissions within already well-accepted domains of authority. Coastal and waterfront communities must be ready to respond to and rebound from hazards created by weather and climate. The uncertainty about exactly how the climate will change should not stop communities from acting to protect property and lives.

4.0 The City's Vision and Focus Areas

With fossil fuel use and resulting GHG emissions being the primary drivers of global climate change, the reasons for launching a sustainability program are clear. But, the City also recognizes the quality of life and economic benefits of becoming more sustainable which are also contributing factors to the development of this SCP. To be implemented, the recommendations should be integrated into the City's Comprehensive Plan and Code of Ordinances where appropriate.

The City's Comprehensive Plan serves as the "vision" used by the City to manage policies, growth and development. A primary focus for the City is on the revitalization of existing business centers and promoting the availability of housing for residents. From the perspective of the Comprehensive Pan, growth shall be managed to assure that adequate public facilities and services are provided according to adopted level of service standards, the public's ability to fund infrastructure capacity improvements, and the ability to minimize adverse impacts that public facilities place on natural resources and hurricane evacuation times. To achieve quality of life and reflect carrying capacity constraints, the following growth management activities are recommended for implementation by the City in its existing Comprehensive Plan:

- Direct Development/Redevelopment to infill of scarified sites
- Promoting workforce housing located close to business centers
- Promote in-fill of platted, scarified lots for new residential units
- Promote redevelopment of substandard housing
- Establish Concurrency Management
- Establish a Program to Retire Development Rights, including a Land Acquisition Program
- Establish a Transfer of Development Rights (TDR) Program

The City recognizes the benefits of initiating a comprehensive approach to sustainability. This Plan is a "roadmap to sustainability" cutting across all City Departments and Divisions as well as outlining strategies for the community to become more sustainable too. It is important to note that the SCP has to operate within an existing legal and policy framework as well as develop new guidance based on data collected during the Plan development process. These existing principles in the Comprehensive Plan can be furthered by the recommendations in this SCP.

4.1 Plan Approach

A sustainability plan can be considered a climate action plan with a broader, more holistic view on community sustainability issues. Such a plan focuses primarily on reducing GHG emissions, including emissions resulting from both the local government's operations and from the community as a whole. It typically includes an analysis of the opportunities to reduce GHG emissions resulting from energy use in transportation, solid waste disposal, buildings, lighting, and waste water treatment and water delivery. Some local governments also include environmental opportunities beyond reducing energy consumption—such as the development of renewable energy resources, the conservation of natural resources, forestry (urban and beyond) and green jobs.[v] The City's approach to this Plan is to combine these two concepts.

With data, the framework and approach to this Plan, the City has developed specific areas of focus to implement actions to become a more sustainable community and prepare for the realities of climate change. Each Focus Area explains the concepts and challenges facing the City and why it is important to concentrate efforts in the subject area. Specific Initiatives and Actions are then recommended for each Focus Area.

4.2 The Plan's Goals and Recommendations

Because the City can control its energy use directly, the SCP sets a target to reduce GHG emissions for only City Facilities and Operations at this time. That target is a 5% reduction in GHG emissions by 2014, a 13% reduction in GHG emissions by 2017 and a 20% reduction in GHG emissions by 2025. To achieve the City's reduction target and other sustainability goals, the SCP includes 24 recommendations within the six (6) Focus Areas to achieve additional communitywide GHG reductions. The City has set a target for its own GHG reductions at this point because that is where they have operational control over energy use and can track progress.

5.0 Greenhouse Gas Inventory Overview

The City prepared a GHG emissions inventory for the municipal operations and the community of Marathon as a whole. Both inventories were conducted for calendar year (CY) 2010. Information from the GHG inventories allows the City to develop a measurable and transparent strategy to reduce emissions, provides baseline data to help monitor the success of future initiatives, and will aid them in identifying valuable energy saving measures.

5.1 Methodology

Where possible, the City built their inventories using guidelines in the *Local Government Operations Protocol for the Quantification and Report of Greenhouse Gas Emissions Inventories*.[vi] The LGO Protocol was developed by ICLEI – Local Governments for Sustainability in partnership with the California Air Resources Board, and The Climate Registry ("TCR"). The LGO Protocol is designed to provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with government operations. In cases where the LGO protocol did not provide guidance, an alternate protocol or methodology has been referenced.[1]

According to the LGO Protocol, an operational boundary determines the direct and indirect emissions associated with an entity. This assessment allows the entity to determine which operations and sources cause direct and indirect emissions and to decide which emissions are consequences of its operations and decision making. The LGO Protocol follows the WRI/WBCSD GHG Protocol[vii] in categorizing direct and indirect emissions into "scopes" as follows:

> **Scope 1**: All direct GHG emissions from owned or controlled sources.
>
> **Scope 2**: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating or cooling.
>
> **Scope 3**: All other indirect emissions including but not limited to those resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity (e.g., employee commuting and business travel), outsourced activities and waste disposal.

Additionally, the LGO protocol suggests that local governments should assess emissions from all six (6) internationally recognized GHGs regulated under the Kyoto Protocol:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Perfluorocarbons (PFCs);
- Hydrofluorocarbons (HFCs); and
- Sulfur hexafluoride (SF_6).

The inventories include emissions of CO_2, CH_4, and N_2O, which constitute the majority of the City's Municipal operations and Community-wide GHG emissions. HFCs, PFCs and SF_6 were excluded from the

[1] Alternate protocols were used in the development of the City of Marathon's Community-wide inventory. Please see Section 5.3 for a more detailed description of these calculation methodologies and assumptions.

chemical boundary due to the difficulty of collecting the activity data and their small overall contribution to the inventories.[2]

The following sections detail the results of Marathon's Municipal operations and Community-wide CY2010 inventories, as well as define their ambitious, yet achievable, emissions reduction targets and goals.

5.2 City Facilities and Operations

The operational boundary for the Municipal Inventory includes Scope 1 and 2 emissions. Marathon's municipal operations include: office buildings, a vehicle fleet, recreational facilities, a fire department, service department, wastewater treatment plants[3], a police department, and street/emergency lighting.

These emission sources are categorized by scope and listed in **Table 5.1**. There are no landfills within the City limits that the City owns or operates. Scope 3 emissions have been excluded from the operational boundary of the CY 2010 inventories and are not accounted for herein due to the lack of activity and available data.

Table 5.1- Municipal Direct and Indirect Emission Sources

DIRECT EMISSIONS (SCOPE 1)	INDIRECT ENERGY EMISSIONS (SCOPE 2)
• Mobile Combustion – On-road and off-road vehicles using gasoline and diesel. • Stationary Sources – diesel generators; CH_4 emissions from the wastewater treatment plants. • Process Emissions – from nitrification/ denitrification processes at the wastewater treatment plants.	• Electricity Consumption – at government offices and recreational facilities and for street and traffic lighting.

5.2.1 City Energy & Fuel Use

In CY2010, the City collected fuel and energy consumption data for all direct and indirect GHG emission sources as part of the baseline GHG emissions inventory development process. Electricity data was provided by Florida Keys Electric Cooperative Association, Inc. ("FKEC") in Microsoft-Excel format and fuel usage for stationary and mobile combustion sources was based on invoiced purchases.

[2] HFCs are primarily emitted by refrigeration and air conditioning (AC) systems, PFC emissions are most commonly associated with semiconductor manufacturing and in some fire-suppression systems; and SF6 is primarily found in large electrical equipment, such as transformers.

[3] Only three plants were operational in 2010.

The wastewater treatment facilities were the largest energy use in 2010, accounting for appropriately 39% of the total consumption. The City's on-road diesel vehicle fleet consumed the largest quantity of fuel in 2010. A summary of the City's 2010 energy and fuel consumption is provided in **Table 5.2**.

Table 5.2 - Municipal Operations – Energy & Fuel Consumption

Energy & Fuel Consumption Categories	Calendar Year 2010 Energy & Fuel Consumption
Purchased Electricity- Wastewater Treatment Facilities	927.9 MWh
Purchased Electricity- Street, Traffic, and Outdoor Lighting	449.7 MWh
Purchased Electricity- Fire Department	290.4 MWh
Purchased Electricity- City Hall	155.1 MWh
Purchased Electricity- Recreational Areas	23.9 MWh
Purchased Electricity- All Other Buildings	535.7 MWh
On-Road Vehicle Fleet (Diesel)	13,510 gallons
On-Road Vehicle Fleet (Gasoline)	6,687 gallons
Stationary Combustion (Diesel)	1,080 gallons
Off-Road Vehicle Fleet (Diesel)	291 gallons

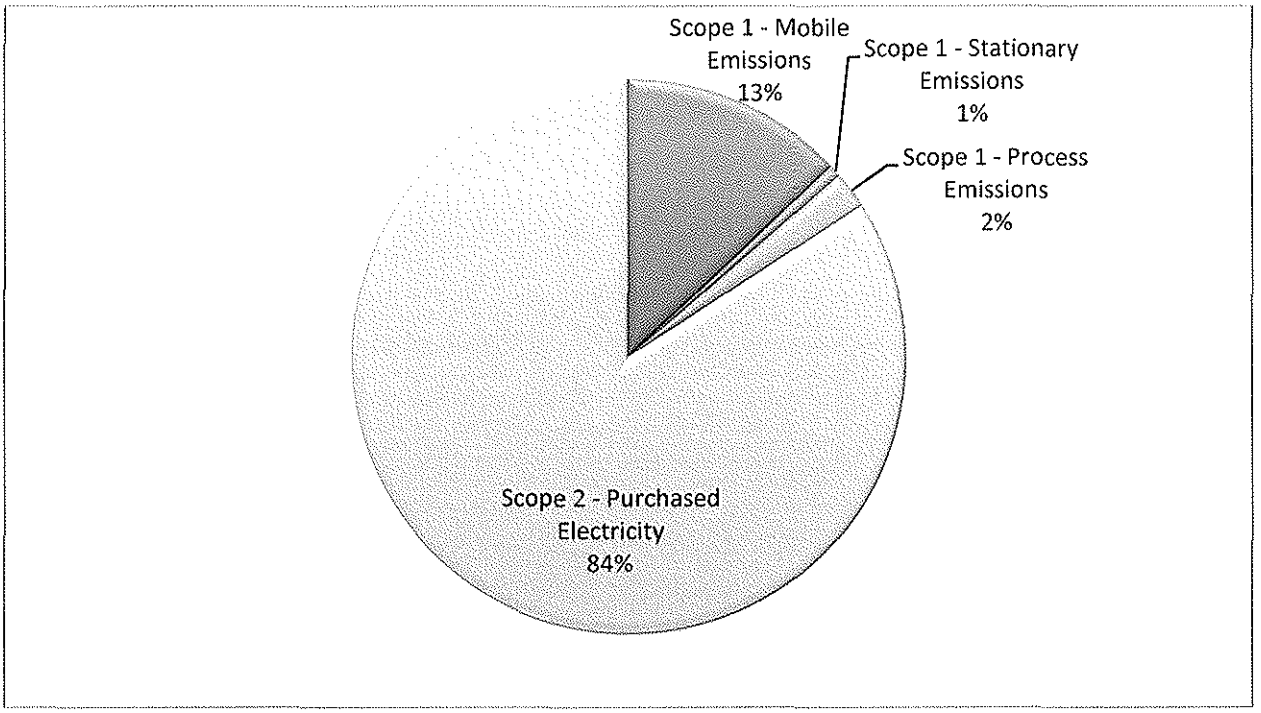
5.2.2 City GHG Emissions

In CY 2010, the City's municipal operations (Scope 1 and Scope 2) resulted in approximately 1,574 metric tons (MT) of CO2e. Purchased electricity and mobile emissions were the largest source of municipal operations emissions, accounting for 84% and 13% of the total Scope 1 and 2, respectively. The wastewater treatment plants' Scope 1 emissions, which represent 2% of total emissions, are the result of N2O emissions due to nitrification/denitrification during the wastewater treatment process. Table 5.3 presents the GHG emissions data for each source category. Figure 5.1 illustrating the total municipal operations emissions by emissions category.

Table 5.3 - CY 2010 Municipal Operations GHG Emissions Summary

			Emissions (metric tons)			
	Quantity	**Units**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
Scope 1						
Mobile Emissions						
Gasoline-On-Road	6,687	gallons	58.71	0.004	0.004	60.06
Diesel-On-Road	13,510	gallons	137.94	0.009	0.010	141.10
Diesel-Off-Road	291	gallons	2.97	0.0002	0.0002	3.04
Total Mobile Emissions			*199.62*	*0.012*	*0.014*	*204.20*
Stationary Emissions						
Diesel	1,080	gallons	11.02	0.0016	0.0001	11.09
Total Stationary Emissions			*11.02*	*0.0016*	*0.0001*	*11.09*
Process Emissions						
WWTP - Nitrification/ Denitrification	-	-	-	-	0.11	33.98
TOTAL SCOPE 1 EMISSIONS			210.65	0.01	0.12	249.26
Scope 2						
Purchased Electricity	2,382.72	MWh	1,318.67	0.04	0.02	1,324.72
TOTAL SCOPE 1 & 2 EMISSIONS			1529.32	0.06	0.14	1,573.98

Figure 5.1- CY 2010 Municipal Operations Scope 1 and Scope 2 GHG Emissions



5.2.3 City Metrics, Goals & Targets

The State of Florida has a non-binding Executive Order 07-126, which is not included in the Florida Statutes. The Executive Order was signed in 2007 as a goal for the State of Florida to reduce its GHG emissions. The targets in that Executive Order would not be appropriate as a basis for the City's GHG reduction targets due to the City's size, the amount of facilities and operations it controls, the lack of control over the primary transportation system features and the various infrastructure upgrades the City has had to make to meet legally mandated water quality requirements. The recommended target for the City's GHG reductions is equivalent to meeting half of those targets in Executive Order 07-126. This constitutes an aggressive, yet achievable target for the City and one that is more reflective of the City's own operating environment. In order to reach the 2025 goal, two (2) interim targets have been established to allow for course correction if it is needed.

- 5% reduction of greenhouse gas emissions below 2010 levels by 2014;
- 13% reduction of greenhouse gas emissions below 2010 levels by 2017; and
- 20% reduction of greenhouse gas emissions below 2010 levels by 2025

Specific goals have not been set for a desired energy mix, renewable energy usage, or reduction in fossil fuel usage for the City because the City has no control over these decisions. A GHG reduction goal has been set for all GHG emissions, including wastewater process and fugitive emissions, as well as those from the combustion of fossil fuels. Given that the City's five (5) new wastewater plants have been designed with numerous energy efficiency measures and operational protocols, and that 39% of the City's electricity consumption is in these facilities, it is unlikely that the City can achieve significant

energy reductions from wastewater operations. The City's greatest potential for GHG reductions is likely in its fleet and any additional energy conservation measures that can be implemented in buildings and facilities.

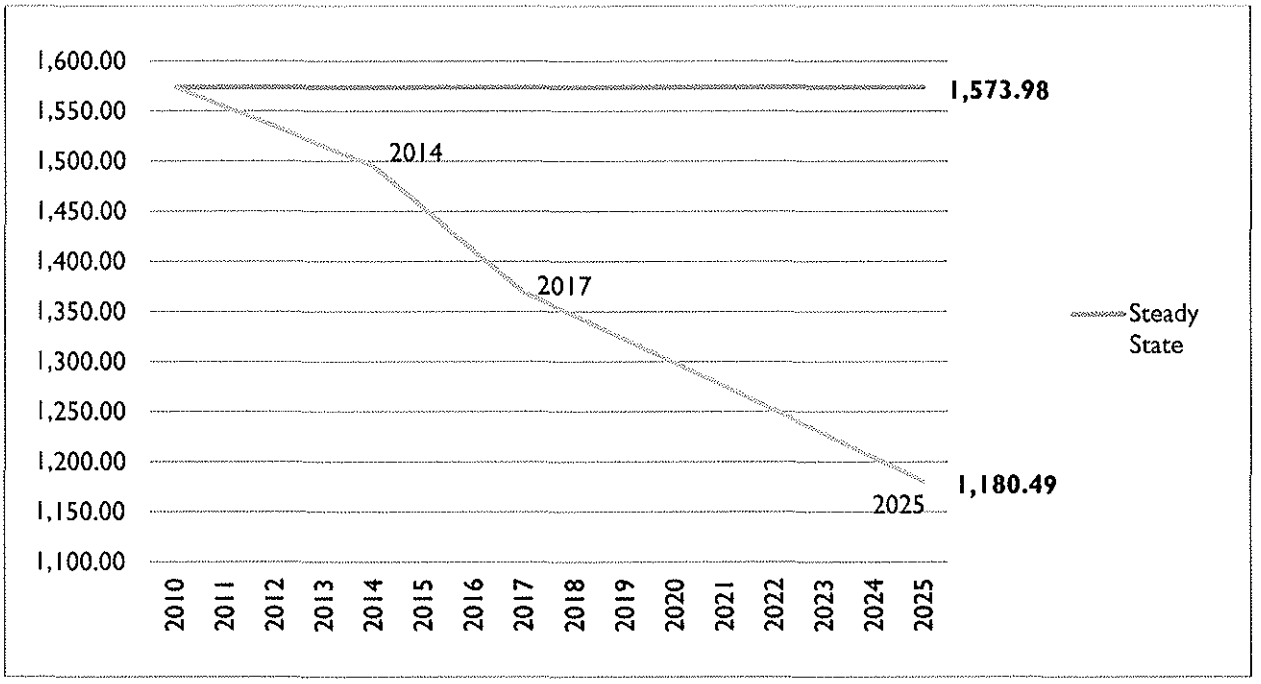
Metrics, targets, and goals for the City are summarized in **Table 5.4.** Emission totals at each milestone were calculated using a straight percentage reduction from the 2010 emissions total. The State of Florida Executive Order 07-126 requires a percentage-based reduction in GHG emissions (not per capita), so population growth was not factored into these calculations.

Table 5.4 – Greenhouse Gas Reduction Metrics, Targets, and Goals

Emissions Category	Metrics (Total for City Operations on a Per Annum Basis)	CY 2010 Baseline	Target (5% below 2010 levels by 2014)	Target (13% below 2010 levels by 2017)	Goal (25% below 2010 levels by 2025)
Purchased Electricity[1]	MWh; MT CO_2e emissions	2,382.72 MWh 1,324.72 MT CO_2e	2,263.58 MWh 1,258.48 MT CO_2e	2,072.97 MWh 1,152.51MT CO_2e	1,787.04 MWh 993.54 MT CO_2e
Stationary Combustion of Diesel	Gallons of diesel; MT CO_2e	1,080 gallons 11.09 MT CO_2e	1,026 gallons 10.53 MT CO_2e	939.6 gallons 9.65 MT CO_2e	810 gallons 8.32 MT CO_2e
Mobile Combustion of Gasoline	Gallons of gasoline; MT CO_2e emissions	6,687 gallons 60.06 MT CO_2e	6,352.65 gallons 57.06 MT CO_2e	5,817.69 gallons 52.25 MT CO_2e	5,015.25 gallons 45.045 MT CO_2e
Mobile Combustion of Diesel	Gallons of diesel; MT CO_2e emissions	13,801 gallons 144.14 MT CO_2e	13,110.95 gallons 136.93 MT CO_2e	12,006.87 gallons 125.4 MT CO_2e	10,350.75 gallons 108.11 MT CO_2e
Process N_2O Emissions from Wastewater Treatment	MT CO_2e	34 MT CO_2e	32.3 MT CO_2e	29.58 MT CO_2e	25.5 MT CO_2e

The results of the analysis in Table 5.4 are illustrated in **Figure 5.2.** Since the City population is constrained by limited land availability and limited annual permit allocations and the City has just undertaken significant infrastructure upgrades over the last 10 years, municipal operations are not projected to grow significantly in the future. The emission forecast assumes that the municipal operations GHG emissions will remain steady state through 2025, where the baseline equals the forecast. As previously mentioned, emissions reductions were calculated using a straight percentage reduction from the 2010 emissions total.

Figure 5.2- Projected Municipal Operations GHG Emissions



5.3 Communitywide Emissions

The operational boundary for the Community-wide Inventory includes emissions from sources under the operational control of Marathon's residents and commercial, industrial, civic and other non-governmental entities. The Florida Keys Marathon Airport was not included in the community-wide or municipal operations inventories because it is owned and operated by Monroe County. The Community-wide Inventory includes: Scope 1 emissions from mobile and stationary combustion sources, Scope 2 emissions from purchased electricity and limited Scope 3 emissions from pass-through vehicle traffic, as provided in **Table 5.5**.

Although the GHG emissions from municipal operations are also considered part of the total for the community (approximately 1%), they have been segregated for ease of management. The total Community-wide GHG emissions footprint is the sum of emissions as presented in this section and those from municipal operations presented in Section 5.2.

Currently, there is no universally accepted protocol for developing a GHG inventory for an entire community. Although ICLEI is developing a Community GHG Emissions Inventory Protocol, it has not been finalized (as of the date of this report) and the accounting methods for such a protocol are still a topic of vigorous debate. This is partly due to the difficulty in setting boundaries where jurisdiction is divided among residents, businesses, non-governmental organizations, the municipality, County and, in some cases, federal and state governments for roadways and installations under their ownership/control. Further, the issue of cross-boundary emissions from mobile sources coming in and going out of the

community makes accounting for them problematic and continues to be addressed differently in community inventories across the country. In the absence of a single protocol where the design of the community-wide inventory has been agreed upon, an approach has been developed for Marathon' Community-wide Inventory based on a combination of traditional GHG accounting elements of best practice in the literature and some recommendations provided in guidance such as the BAAQMD's GHG Quantification Guide (BAAQMD, 2010).

Table 5.5- Community-wide Direct and Indirect Emission Sources

DIRECT EMISSIONS (SCOPE 1)	INDIRECT ENERGY EMISSIONS (SCOPE 2)	OTHER INDIRECT EMISSIONS (SCOPE 3)
• Mobile Combustion – On-road vehicles using gasoline or diesel for vehicles. • Mobile Combustion – Off-road marine vessels using gasoline or diesel. • Stationary Combustion – propane combustion.	• Electricity Consumption – Residential, commercial heating/cooling, lighting, business operations.	• Mobile Combustion – On-road vehicles using gasoline or diesel; fuel consumption based on all vehicle miles traveled in Marathon.

The Scope 3 category includes emissions associated with all vehicle miles traveled in Marathon including pass-through traffic, excluding emissions from marine vessels. Based on the data available for Scope 3, it is not feasible to separate out the total emissions from "community-owned/controlled" vehicles that are owned by non-community members driving through Marathon. Therefore, the Scope 3 emissions are not a truly accurate reflection of "pass-through" only. This category includes pass-through emissions plus all in-community travel by vehicles owned by community residents, businesses and the City. This should be considered when making decisions regarding the steps that can be taken to reduce the transportation-related category of emissions.

5.3.1 Communitywide Energy Use

The CY2010 Community-wide Inventory required the collection of activity data in three emissions categories: direct mobile combustion emissions, direct stationary combustion emissions and indirect emissions from purchased electricity. Community-wide residential, commercial, and industrial electricity consumption data was provided by FKEC. No other direct data was available. Therefore, proxy[4] data was used for the other emissions sources that were included in the Community-wide Inventory. A summary of the Marathon's Community-wide energy and estimated fuel consumption for 2010 is provided in **Table 5.6**.

[4] A figure that can be used to represent the value of something in a calculation.

Table 5.6 – Community-wide Energy Consumption

Energy & Fuel Consumption Categories	Calendar Year 2010 Energy & Estimated Fuel Consumption
Purchased Electricity-Commercial	79,997 MWh
Purchased Electricity-Residential	75,044 MWh
On-Road Vehicle Fleet (Gasoline)	3,546,177 gallons
Off-Road Mobile- Marine (Gasoline)	3,033,875 gallons
On-Road Vehicle Fleet (Diesel)	1,467,533 gallons
Off-Road Mobile- Marine (Diesel)	1,074,232 gallons
Stationary Combustion (Propane)	123,163 gallons

5.3.2 Communitywide GHG Emissions

Marathon's estimated Community-wide Scope 1 and Scope 2 emissions total 172,283.13 metric tons (MT) CO_2e. Mobile emissions accounted for 49.6% of the community-wide Scope 1 and Scope 2 total. Purchased electricity accounted for 50% of the total emissions for the community, with stationary combustion of propane comprising the remaining 0.4% of emissions. Commercial usage of purchased electricity accounted for 52% of the total Scope 2 indirect emissions or 44,476 MT CO_2e, with the remaining 48% or 41,722 MT CO_2e, resulting from residential electricity usage.

Scope 1 emissions from on-road travel by vehicles in CY 2010 are estimated at 176 MT CO_2e, accounting for 55% of the community-wide total Scope 1 GHG emissions. Gasoline combustion by marine vessel accounted for 44% of the Scope 1 emissions. **Table 5.7** provides a summary of the total community-wide sources of GHG emissions. **Figure 5.3** compares the Scope 1 and Scope 2 emissions.

Scope 3 on-road vehicle emissions totaled 60,517.09 MT CO_2e, which was approximately 28% higher than the Scope 1 on-road vehicle emissions. The difference between these two values does not equal the emissions associated with just pass-through traffic because the Scope 3 emissions include in-community travel by Marathon vehicle. However, this number suggests that pass-through traffic is significant.

The following emissions sources were assumed to be *de minimis*[5] (small) and were excluded from the scope of the Community-wide Inventory: fugitive emissions from refrigeration and air conditioning, emissions from fossil fuel use in landscaping equipment, grills, motorcycles, ATVs, private planes and

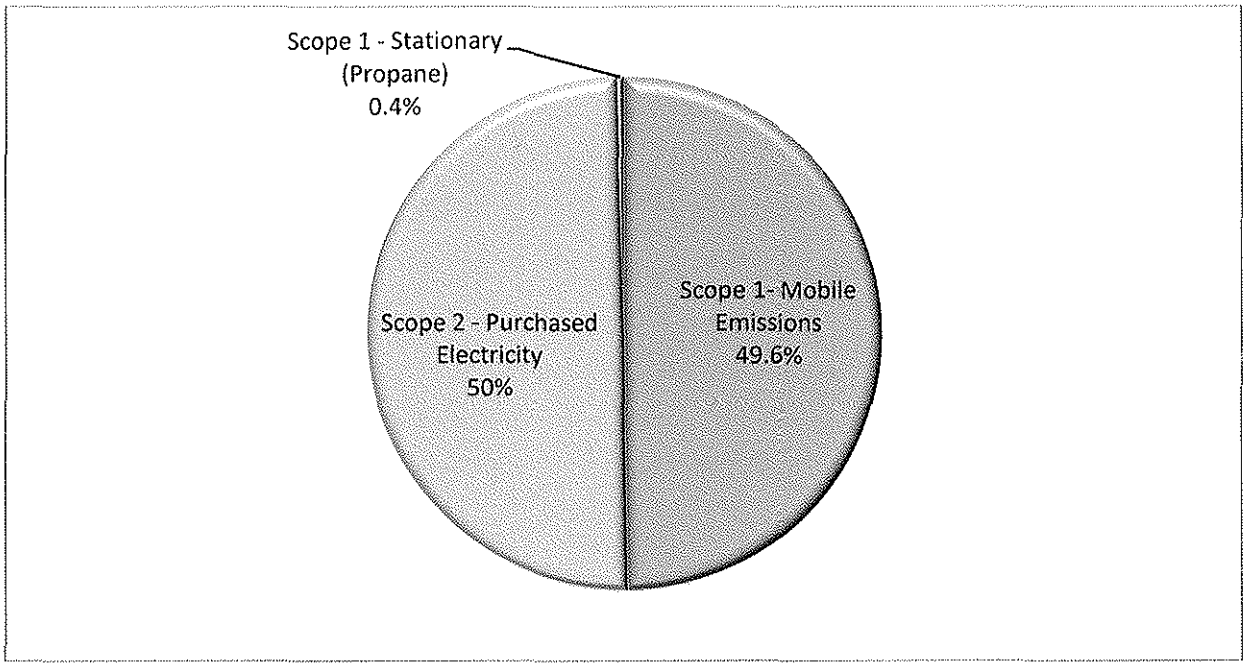
[5] Most GHG registries and reporting programs allow a small (*de minimis*) portion of an entity's emissions (such as 3 or 5 percent) to be excluded from an emissions inventory or estimated using simplified estimation methods.

other sources owned by Marathon businesses and residents and that do not (when aggregated) represent a significant portion of the Community-wide emissions.

Table 5.7- Community-Wide GHG Emissions Summary

			Emissions (metric tons)			
	Quantity	Units	CO_2	CH_4	N_2O	CO_2e
Scope 1						
Mobile Emissions						
Gasoline - On-Road Vehicles	3,546,177	gallons	31,135.43	1.94	2.17	31,848.91
Diesel - On-Road Vehicles	1,467,533	gallons	14,983.52	0.93	1.04	15,326.87
Gasoline - Off-Road Marine	3,033,875	gallons	26,637.43	1.66	1.86	27,247.83
Diesel - Off-Road Marine	1,074,232	gallons	10,967.91	0.68	0.76	10,967.91
Total Mobile Emissions			*83,724.29*	*5.22*	*5.84*	*85,391.52*
Stationary Emissions						
Propane	123,163	gallons	688.83	0.12	0.01	693.51
TOTAL SCOPE 1 EMISSIONS			84,413.12	5.34	5.84	86,085.03
Scope 2						
Purchased Electricity – Commercial	79,997	MWh	41,531.62	1.40	0.52	44,476.12
Purchased Electricity – Residential	75,044	MWh	44,273.19	1.49	0.55	41,721.98
TOTAL SCOPE 2 EMISSIONS			85,804.81	2.90	1.07	86,198.10
TOTAL SCOPE 1 & 2 EMISSIONS			**170,217.93**	**8.24**	**6.91**	**172,283.13**
Scope 3						
Mobile Emissions						
Gasoline - On-Road Vehicles	4,926,139	gallons	43,251.50	2.69	3.01	44,242.62
Diesel - On-Road Vehicles	1,558,265	gallons	15,909.89	0.99	1.11	16,274.47
Total Mobile Emissions			*59,161.39*	*3.69*	*4.12*	*60,517.09*

Figure 5.3- Community-wide Scope 1 and Scope 2 GHG Emissions



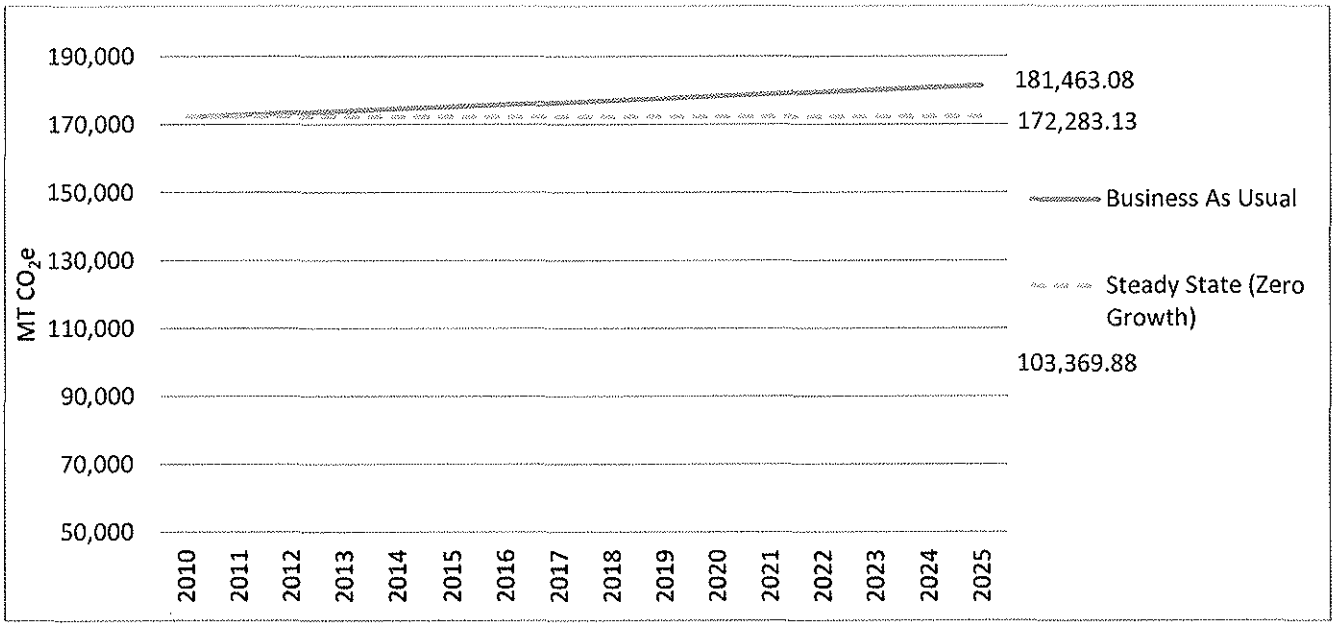
5.3.3 Communitywide Metrics Goals & Targets

While Census data may have indicated a population decline over the previous decade, to conservatively estimate emissions, the forecast assumed a modest population increase[6] beginning in 2011 consistent with the growth projected in City's Comprehensive Plan (2005). It was assumed that a constant number of people would move into the City each year[7] based on projected population for 2020 provided in the City's Comprehensive Plan. In this SCP, the City has not defined a target for community-wide emissions at this time because these emissions are not within the City's direct control. As more collaboration between FKEC and the City occurs with new data from the SCP, the City can revisit setting a communitywide target in the future. Even though a specific reduction target has not been developed, the SCP includes numerous recommendations to reduce energy use from the community as a whole.

[6] 4.1% between 2010 and 2020.

[7] Adding the same number of people each year increases the population but results in a slight decline in percent population growth year-over-year.

Figure 5.4 - Projected Community-Wide GHG Emissions



6.0 Climate Change Impacts and Response

Shoreline features of the Atlantic coastline include small tidal creeks, harbors, and embayments. Numerous large channels provide connections between the oceanic and the shallow nearshore waters in the Lower Keys. Shallow water less than 20 feet in depth extends approximately two miles offshore in the Upper Keys, including Marathon.

The body of planning and science related to the impacts from climate change in the Keys is increasingly recognizing the inter-connected nature of the Keys ecosystem from terrestrial to coral reef resources. The low elevation of the Keys highlights the potential for impacts from climate change. The main hazard is from sea-level rise, expected to threaten at least 38% of the current land area by 2100 based on certain planning scenarios.[viii] Storm surges from hurricanes and coastal erosion aggravate that threat. Decisions on the location and assumptions for critical infrastructure must include assumptions to account for these impacts. Based on the geography and topography in the Keys, it is clear the City has a vested stake in proactive planning and decision-making in preparing for climate change.

6.1 The Projected Impacts– The Keys and Marathon

Climate change will have an ever-increasing impact on the City and community in the future. The following are some of the implications to consider:

- **Impacts on Habitat.** (Plant and animal species will be impacted by ecological disturbances related to climate change -e.g. flooding, storms with some habitats changing more rapidly, slowly or just disappearing entirely).

- **Water Supply Impacts**. (While the precise amount of sea level rise, or speed with which it rises, may not be known, sea level rise will reduce the amount of fresh water, both from surface and groundwater, available for potable water use).[8]
- **Stormwater Management**. (The effectiveness of drainage and stormwater structures to direct and capture stormwater flow will diminish over a gradual progression, reducing the difference between water levels on either side of a flood control structure or increasing the water table closer to the surface).
- **Water Quality Impacts**. (More intense storms will result in increased stormwater and non-point runoff which in turn could increase algae growth, result in higher levels of water quality indicators such as fecal coliform bacteria and turbidity, pH changes and overall higher water temperatures).
- **Additional Infrastructure Considerations**. (Future impacts to hospitals, schools, libraries, transportation facilities, multi-modal stations and, commercial and residential centers).

The City is already an area of special flood hazard identified by the Federal Emergency Management Agency in the Flood Insurance Study (FIS) for the City of Marathon, dated February 18, 2005. Planning for adaptation and resilience will initially add a further dimension of complexity into already complex development decisions and City infrastructure projects. Introducing resilience as a new performance requirement into the conventional process of upgrading specific facilities and service systems involves the addition of measures that have not historically been considered such as the following:

- **Ambient Temperature Increase.** Since 1970, the annual average temperature has risen about 2°F (1.1 °C), with the greatest seasonal increase occurring during the winter months. The number of days per year having temperatures of 90°F (32°C) or higher will increase and eventually approach 180 (or half the year), resulting in heat stress for people, plants and animals.[ix] More recently, NOAA has stated that March 2012 is the warmest on record.[x]
- **Sea Level Rise.** The threat of sea-level rise will impact the Florida Keys. The average elevation of the larger islands range from four to seven feet or 1.2 to 2.1 meters (Monroe County 2005). An analysis by The Nature Conservancy shows that even according to the most optimistic IPCC scenario, which predicts an average sea-level rise of 18 cm by the end of the century, 38% of the total Keys area will risk inundation.[xi] This increases to 75% of the total Keys area according to the most pessimistic IPCC scenario, which predicts an average sea-level rise of 59 cm.[xii] The sea level rise projections the City is relying upon are reflected in Figure 5.5.
- **Hurricane Intensity.** There is scientific debate[xiii] as to whether or not there will be more hurricanes, and/or more intense hurricanes, but there is scientific evidence showing that the destructive potential of Atlantic hurricanes has increased since 1970, in correlation with an

[8] While the City does not receive water from direct groundwater withdrawals, ultimately portions of the City's water supply are served by groundwater resources through the FKAA Consumptive Use Permit. Additionally, while the resources are located in Miami-Dade County, the impacts to those water resources will have regional impacts for those that depend upon them.

increase in sea surface temperatures.[xiv] Hurricane effects are of particular interest in the Florida Keys, due to the high frequency of tropical storms and the low elevations (1–3 m).

- **Disease Vectors.** Extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems, such as changes in the range of infective parasites, can impact the amount of infectious diseases. In addition, warm temperatures can increase air and water pollution, which in turn threaten human health.[xv] Climate change impacts may increase the risk of some infectious diseases, particularly those diseases that appear in warm areas and are spread by mosquitoes and other insects including malaria, dengue fever, yellow fever, and encephalitis.
- **Other Impacts.** The shallow tropical waters in which most corals are found are warming. Heat stress causes corals to expel the symbiotic algae that provide their primary source of nutrition, leaving only remnant portions of the corals behind (coral bleaching). Coral bleaching, which has increased in recent decades, becomes worse as high temperatures last longer and longer. Corals are also being affected by ocean acidification, which is caused by the increase in CO_2. This affects the ability of marine organisms to build their shells and skeletons. Ocean acidification is likely to slow, or even stop, the growth of coral over this century which will impact the entire ocean food chain.[xvi] Climate change will also increase damaging pest infestations, as pests move to and thrive in new or changing habitats and temperatures. Likely species include bark beetles, grasshoppers, fungi, and the aforementioned diseases transmitted by bacteria, parasites, and viruses.

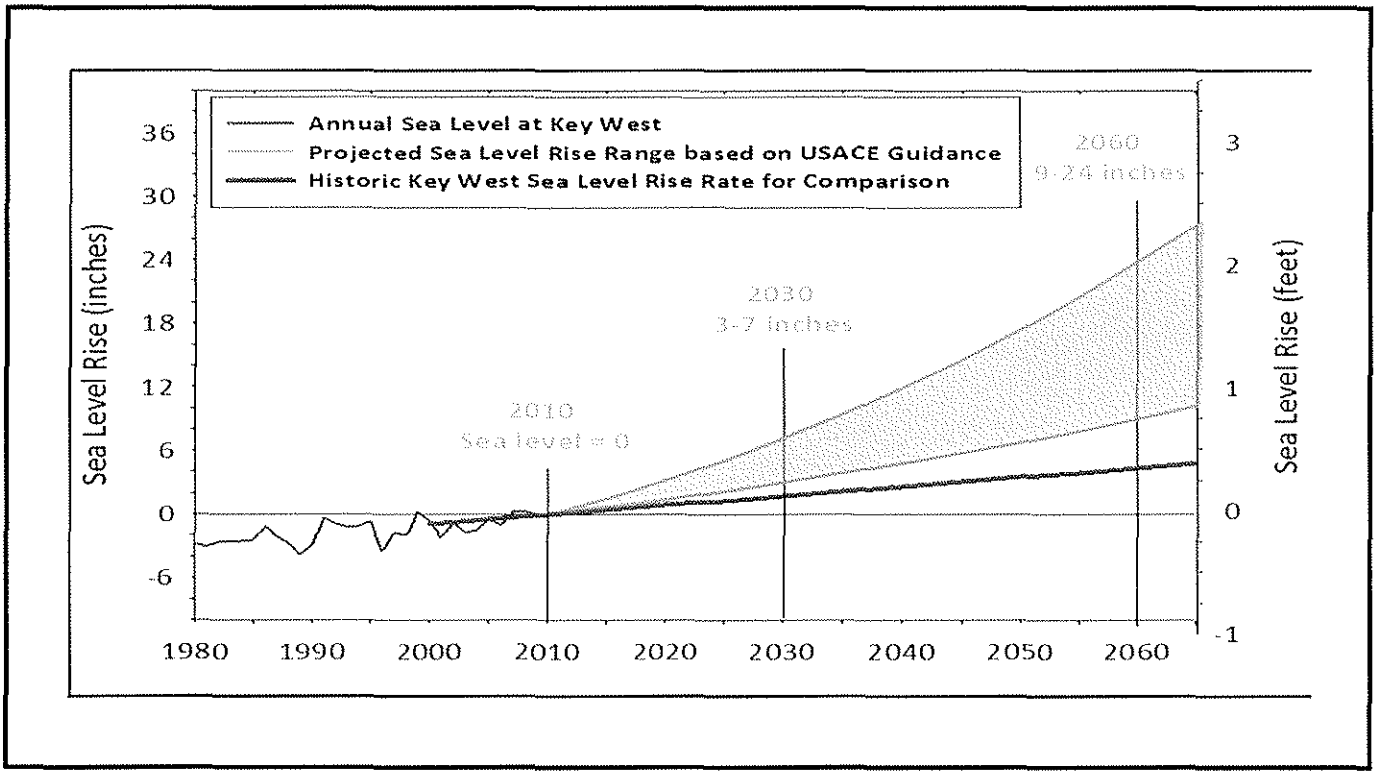


Figure 6.0

- **Estimated Property and Overall Economic Loss.** Under the most optimistic IPPC scenario – a rise of 18 cm over the next 100 years – $11 billion in property value and 58,800 acres are at risk of inundation in the Florida Keys. Under the highest Rahmstorf estimate, –a 140 cm rise by 2100 – approximately $35 billion in property value and 142,000 acres are at risk in the same area. For the Middle Keys, this translates into anywhere from 4,430 to 17,500 acres at risk ($753,000,000 to $6,400,000,000 in property values).[xvii]

  Climate change is altering the industry's global business landscape and the risk models on which it crucially depends. According to Swiss Re, the average weather-related insurance industry loss in the U.S. was about $3 billion a year in the 1980s compared to approximately $20 billion annually by the end of the past decade. As the National Association of Insurance Commissioners (NAIC) itself has noted, this fast-emerging threat will have broad impacts across the industry, clouding its ability to price physical perils, creating potentially vast new liabilities and threatening the performance of its huge investment portfolios.[xviii]

  Where homeowner's insurance and flood insurance premiums are already challenging, it is important to note that many large private insurers are incorporating climate change into their annual risk management practices, and some are addressing it strategically by assessing its potential long-term industry-wide impacts.[xix] This could have an additional impact on the cost of insurance in the City.

6.2 Timeframes of Impacts

While there are a multitude of climate change scenario models, for the purposes of consistency, the sea level rise assumptions underlying the work of the Southeast Regional Climate Compact will serve as the basis for the City's planning purposes. In summary, the projections of sea level rise and timeframes for those projections are contained within Figure 6.0.

6.3 Overview of Responses to the Challenges

Across the nation, individuals, businesses, and federal, state, and local governments are already consciously making decisions to respond to climate change. Individuals are choosing whether to make their homes and transportation more energy efficient by supporting new related policies. Private companies are reducing their carbon footprints, and some are planning for climate impacts. Humanitarian and environmental non-governmental organizations (NGO's) are deciding how to guide their members and respond to climate change. Resource managers are deciding how to manage water, forests, and coastal ecosystems to reduce the risks of climate change. Cities and states are starting to limit emissions and develop adaptation plans despite the fact that federal, state or local law may not require it. Today, more than 50% of Americans live in a jurisdiction that has enacted some sort of GHG reduction goal. Responses to climate change can generally be categorized as follows:

- **"No Regrets"** options that are assessed to be worthwhile now (in that they would yield immediate net economic, environmental and/or social benefits) and continue to be beneficial irrespective of the nature of future climate.
- Policies where the cost implications are relatively small while the benefits under future climate change may be potentially large, although uncertain. In these **"Low Regrets"** options the regret associated with the cost of such policies is low or limited (for example policies about building design that promote adaptation to future climate variability or policies encouraging an increase in the margins of safety such as additional allowance in the design of coastal flood defenses).
- No Regrets and Low Regrets decisions are instances where the uncertainty associated with climate change impacts should not greatly constrain policy making. These types of policy decisions are a goal of the SCP.
- Decision makers need to be particularly aware of policies that could constrain or reduce the effectiveness of future options for adaptation, for example allowing housing developments in areas vulnerable to flooding which prevent flood management options in the future. This is an example of a decision that has a **"high level of regret"** for later decision makers.[xx]

Proactive policy planning for climate change adaptation improves the overall preparedness by integrating adaptation considerations into the decision making process overall. Most of these decisions are not necessarily "new" requiring new budget commitments, but may just require a philosophical shift in how to plan for growth, development and capital improvements (infrastructure).

6.3.1 Mitigation

The IPCC defines mitigation as: "An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases."[xxi] At best, mitigation of anthropogenic sources of GHGs can attempt to minimize long-term climate change impacts, but cannot halt or avoid all impacts. Therefore, adapting to the adverse impacts of climate change is a reality, and in some instances the need is immediate. "Mitigation" of GHG emissions will affect the magnitude of the climate change impacts to which "adaption" will need to occur. Mitigation of GHG emissions and adaptation to climate change are inextricably linked, and both are required to reduce the impacts that have been occurring or will occur in the future.

6.3.2 Adaptation

The IPCC defines climate change adaptation as "an adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts."[xxii] Adaptive measures are needed because adverse consequences are expected to occur globally. The current knowledge of climate change associated impacts, has led the global community to the conclusion that "adaptation will be necessary to address impacts from the warming which are already unavoidable due to past emissions."

6.3.3 Vulnerability

"Vulnerability" to climate change refers to the exposure, sensitivity, and adaptive capacity of systems to climate change.[xxiii] Vulnerability is a central concept for climate change adaptation policy and planning, and can be seen as the connecting thread that links all the adaptation concepts. Climate change vulnerability can be defined as "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and adaptive capacity." Vulnerability is multi-disciplinary in nature, because social, economic, and environmental systems can all be vulnerable to climate change.[xxiv]

6.3.4 Resiliency

Resilience to climate change is the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimal damage to social well-being, the economy and the environment .[xxv] It is this final response of "resilience" that the City seeks to achieve.

6.4 GHG Framework at the Federal Level

The Federal government administers a wide variety of programs and initiatives to reduce U.S. GHG emissions. These programs focus on energy efficiency, renewable energy, methane and other non-(non-CO_2 gases, agricultural practices and implementation of technologies to achieve GHG reductions. The U.S. Global Change Research Program ("USGCRP") coordinates and integrates federal research on changes in the global environment and their implications for society.[xxvi]

In 2007, the U.S. Supreme Court ruled that EPA must regulate CO_2 and other GHGs as pollutants under the Clean Air Act.[xxvii] This has led to series of regulations and reporting requirements for GHG emissions so the landscape is evolving on GHG management and regulation. In the years after *Mass v. EPA*, several federal level climate or energy bills addressing various sustainability, energy, GHG management and climate principles have been offered but no significant laws or regulations have passed mandating specific GHG reduction levels. The amount of litigation related to GHG management and climate change has risen exponentially ranging from cases involving liability related to the impacts from climate change, poor regulatory or permitting decisions in the face of GHG emissions and climate change, to loss of habitat, insurance company exposure and Endangered Species Act claims. These types of claims have even been the basis for challenging land use decisions at the local level.

Federal Executive Order (E.O.) 13514, Federal Leadership in Environmental, Energy, and Economic Performance, establishes an integrated strategy for sustainability within the Federal Government. In an October 2010 *Progress Report to the President*, the Climate Change Adaptation Task Force recommended that Federal agencies develop and implement coordinated climate adaptation plans. The goal of integration of climate change adaptation planning into the operations, policies, and programs of the Federal Government is to ensure that resources are invested wisely and that Federal services and operations remain effective in current and future climate conditions.

6.5 GHG Framework at the State level

In 2006, the Florida Legislature passed the Florida Energy Act (within Chapter 377, F.S.) which, among other things, created the Florida Energy Commission ("FEC"), and provided for renewable energy grants and a solar rebate program. In 2007, Governor Charlie Crist signed a series of executive orders aimed at reducing greenhouse gas emissions and establishing an Action Team on Energy and Climate Change. Other legislation was passed in 2007 directing the Florida Building Commission to create a model green building ordinance and in 2008, legislation was passed directing local governments to include GHG reduction strategies into their Comprehensive Plans. Legislation was also passed in 2008 that requires newly constructed government buildings to meet the rating requirements of the U.S. Green Building Council's Leadership in Energy & Environmental Design ("LEED") or the Florida Green Building Coalition, or another comparable third party "green" building rating system. This provision was later amended to include the International Green Construction Code. In 2008, legislation was passed that mandates the Florida Building Code be significantly increased in its energy efficiency requirements. Finally, in 2010, legislation was passed that provides authority to local governments to create energy financing and retrofitting programs and that revises the state's recycling targets to make them more aggressive.

In the 2007-2009 timeframe, the Florida Energy and Climate Change Action Plan was developed (pursuant to Executive Order 07-128). Phase I of the Report includes 35 findings and 30 recommendations. Among the categories covered are power generation, transportation and government recommendations to lower and diversity energy use and diversity energy sources as well as take steps to start planning for climate change impacts. It called for "organizing the state government for Florida's energy future." Phase2 of the report detailed 50 separate policy recommendations to reduce GHG emissions and provide a framework for climate change adaptation strategies over the coming years and decades. Finally, in 2008 an important amendment to the Florida Forever legislation made properties subject to sea level rise eligible for state land acquisition funding. Section 259.105 (17)(d), F.S.

In recent 2011 revisions to Florida's Community Planning Act, Chapter 163, F.S. local governments are permitted to establish "adaptation action areas" in their comprehensive plans where the community "identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning." Specifically, the law states:

> "At the option of the local government, develop an adaptation action area designation for those low-lying coastal zones that are experiencing coastal flooding due to extreme high tides and storm surge and are vulnerable to the impacts of rising sea level. Local governments that adopt an adaptation action area may consider policies within the coastal management element to improve resilience to coastal flooding resulting from high-tide events, storm surge, flash floods, stormwater runoff, and related impacts of sea level rise. Criteria for the adaptation action area may include, but need not be limited to, areas for which the land elevations are below, at, or near mean higher high

water, which have an hydrologic connection to coastal waters, or which are designated as evacuation zones for storm surge."

Other local governments across the country and Florida are addressing these issues through various efforts and in their requisite Comprehensive Plans.[xxviii] For instance, Smart Charlotte 2050, the County's new Comprehensive Plan, (adopted in 2010) addresses climate change and sea level rise in the data and analysis generally. The Plan states that the County would, "Consider climate change in County decisions particularly along the coast". Sarasota County also includes a discussion of sea level rise and climate change in the data and analysis of its Comprehensive Plan. Several cities, including Punta Gorda and Ft. Myers Beach also address these issues in their Comprehensive Plans, as previously stated, even though there is no state law requiring it.

6.6 Southeast Regional Climate Compact and Regional Climate Action Plan

The Southeast Florida Regional Climate Change Compact (the "Compact") is a joint commitment between Monroe, Miami-Dade, Broward and Palm Beach Counties to partner and work together toward mitigating the causes and adapting to the consequences of climate change. It was formalized in 2009 following the first Southeast Florida Climate Leadership Summit when elected officials from all participating counties came together to discuss challenges and strategies for responding to the impacts of climate change. The Compact outlines a collaborative effort to participate as a Regional Climate Team working toward the development of a Southeast Florida Regional Climate Change Action Plan. Specifically, the Compact includes commitments on the part of the participating counties relating to joint policy positions, legislative positions and collaborative planning.

There are also several work groups and sub-groups compiling information to complete work products including a Greenhouse Gas Work Group, a Vulnerability Work Group, and a Sea Level Rise Work Group. Finally, the Regional Climate Change Action Plan is currently being developed with a strategy of focusing on priority planning areas, narrowing that focus through vulnerability and risk analysis and integrating it with the concepts of mitigation and adaptation. The priority Areas of the Plan include: Land and Natural Systems, Transportation and the Built Environment. A Draft document was completed in December 2011. Reasons for coordination between this planning effort and the Compact's work include:

- Use of consistent data for timeframes and impacts from sea level rise.
- Assuring a coordinated approach towards common strategies for reducing GHG emissions and preparing for climate change impacts to the extent practicable when appropriate.
- Recognizing that various policies and initiatives can only be implemented within certain levels of government due to municipal and county home rule powers and respective agency roles.

The City will provide its data and SCP for integration into the Compacts' documents and planning efforts as applicable. The City will also coordinate with the County by providing its data and the SCP. By providing data and the SCP the goal is to enhance outreach and engagement with these entities and the various municipalities within their jurisdiction.

7.0 Focus Area in the Sustainability and Climate Plan

- The substantive areas the SCP covers are:City Facilities, Infrastructure and Operations
- Energy Use
- Buildings and Homes
- Land Use and Transportation
- Waste Reduction
- Landscape, Habitat and Marine/Coastal Resources

A discussion of each Focus Area follows with an overview of challenges and opportunities as well as recommendations for meeting GHG reduction goals (if applicable) or more generalized sustainability driven goals.

7.1.1 City Facilities, Infrastructure and Operations

Even though the City's GHG emissions are approximately 1% of the community-wide total, the approach to the SCP is to first focus on government operations and policies for a twofold purpose. First, the City recognizes the need to establish an achievable goal to reduce emissions within its control. Second, the City can lead by example and demonstrate to the community that specific targeted actions to reduce emissions can have quantifiable and cost-saving results. To draft this SCP, the City identified the Initiatives and Actions most likely to foster the long-term changes necessary to achieve its goals. Key criteria in developing the actions were the magnitude of emissions reductions (if that linkage could be made with a particular strategy or recommendation), the scale of economic and community benefits from achieving the goals and the feasibility of the actions along with the ability of the City to facilitate their implementation.

To meet the City's established targets, it is apparent that reductions in energy usage will be required in: 1) buildings 2) infrastructure, and 3) fleet.

7.1.2 City Buildings

The City has 14 buildings and additional small facilities such as restrooms serving those buildings and 31 vehicles of varying types. In January 2012, the City finalized a Performance Based Retrofit Analysis to identify retrofit opportunities using the following determining factors; location, maintainability and flexibility of new equipment, indoor air quality, energy efficiency, cost effectiveness, constructability, and any proposed future modifications. The Analysis documented existing conditions, baseline measures and energy conservation measures that would result in a significant energy usage reduction and/or identify energy related capital projects improving the facility's condition and operation while reducing energy consumption. The Analysis included the following facilities:

- City Hall- 2 manufactured buildings that were assembled in 2006 and 2008. Each building has its own electric meter.
- Fire Station 14- 16,782 square foot two story facility constructed in 2007.

- City Marina-2 one-story buildings consisting of approximately 12,576 square feet in total. The original structure was constructed in 1963 and the newer bathhouse was constructed in 2010.
- Community Park Phase 1 and 2- Multiple small buildings and recreational fields. The buildings combined are approximately 1,900 square feet. .
- Teen Center leased by the City- Approximately 2,077 square feet and originally constructed in 1965.
- Jesse Hobbs Park- Lighted basketball court and sandy playground.
- Sombrero Beach Park- Park and beach.
- Sombrero Beach Bike Path- Lighting along Sombrero Beach Road.

Completing the remaining projects identified in the Performance Based Retrofit Analysis would result in approximately another 1% of GHG emissions reductions thus achieving the first 5% reduction target by 2014.

After the Analysis was completed, the City undertook the following energy conservation measures:

- Community Park: Retrofit 72 high intensity discharge ("HID") pole top lights with induction retrofit kits. Retrofit 2 HID sign lights with induction kits.
- Sombrero Beach Bike Path Lighting: Retrofit 133 HID decorative post tops with new light emitting diode ("LED") technology.
- Jesse Hobbs: Replace 4 HID basketball flood lights with new induction flood lights. Install new timer switch.
- Sombrero Beach Turtle Lights: Replace 9 HID shoebox fixtures with new amber colored LED technology.

- City Marina:
    - Replace (7) exterior barn lights with induction wallpack at Marina
    - Replace (1) flagpole light with induction flood at Marina
    - Replace (10) dock lights with new fluorescent vapor tight light fixtures at Marina
    - Replace (31) interior lights at Marina with new flourescent wraps and strips

- Miscellaneous Work
    - Install 200amp Disconnect at Ampitheater in Community Park to shut off transformer.
    - Install (2) new exhaust fans at Sombrero Restrooms to be controlled by occupancy sensors.
    - Install (8) timer switches at Sombrero Restrooms to replace broken occupancy sensors

The energy efficient design of the City's wastewater plants are a prime example of exactly how the City should be planning its infrastructure to reduce GHG emissions as well as overall costs.

After undertaking these projects, based on the GHG assumptions in Section 5.0 and the baseline established in the GHG Inventory, these retrofits achieved approximately a 4% reduction in the City's GHG emissions from the 2010 baseline established through this process. This places the City in an excellent position to meet its first GHG reduction target of 5% by 2014 (below 2010 levels).

7.1.3 City Infrastructure

Based on Florida's concurrency management requirements in Chapter 163, F.S., capacity for certain infrastructure must be available to meet the public facilities needs generated by all future growth and development. According to the City's Comprehensive Plan, growth in the City is managed to assure that adequate public facilities and services including transportation, potable water, surface water management, wastewater, and recreational facilities are provided according to the City's adopted level of service standards.

Water quality is a central and complex issue for the Florida Keys and there are several specific state and federal laws, rules and regulations that require specific water quality targets to be met. This has an impact on the City's growth, development and infrastructure in terms of what must be constructed and to what level of service. The Florida Keys Reasonable Assurance Plan was developed by DEP in cooperation with local governments, state agencies, and federal agencies within the Florida Keys to set forth and accelerate the actions taken to reduce nutrient loadings in near shore waters throughout the Florida Keys so that water quality standards are met and beneficial uses are restored. The Plan was reviewed and accepted by DEP in 2008 and was provided to EPA for review and comment in February 2009. DEP adopted the Reasonable Assurance Plan by Order on February 7, 2012. Therefore, the City is legally required to meet stringent water quality targets through state and federal mandates including the Florida Keys Reasonable Assurance Plan.

To meet these water quality requirements, the City has undertaken many recent stormwater and wastewater infrastructure upgrades and improvements, but the City has already accomplished a significant amount of energy reduction by designing these components with high efficiencies in mind.

7.1.3.1 Water

Available potable water is critical to maintaining the public health and safety within the Florida Keys. The potable water system must take into consideration available capacity to serve existing and future residents and businesses, as well as water volumes and system design (pressure) for fire protection purposes. Potable water is provided to the City by the Florida Keys Aqueduct Authority ("FKAA") which holds a permit to withdraw water from various water resources. The City provides domestic water

service through the FKAA, a political subdivision of the State of Florida, created by Special Legislation Chapter 76-441, Laws of Florida, to provide domestic water service to all of the Florida Keys.

FKAA uses the well field and treatment facility in Florida City. Treated water from the Biscayne aquifer is pumped through a transmission main from the Florida City water treatment plant throughout the Florida Keys. The transmission main discharges to distribution systems in each of the Keys before terminating at the storage tanks and pump stations that serve the Key West distribution systems. The water resource alternatives for persons living in the Keys who do not obtain water from FKAA are cisterns, home desalination systems, and bottled water for potable use.

The City already reuses wastewater for irrigation at all of its new wastewater facilities (where it is treated) and it is unlikely that there is any available supply of reuse water for additional users. The City already uses native and drought tolerant landscaping at all of its new wastewater facilities. The City could potentially use more water conservation features at all City facilities and buildings where feasible (or new facilities that are constructed) such as:

- More efficient irrigation systems
- Rainbarrels/cisterns
- Reuse of condensate water from HVAC systems depending on the complexity of the systems

Article IV of the City's Land Development Regulations specifically addresses Water Conservation. The City could explore creating a rain barrel incentive or rebate program (offset through utility bills). As a water conservation strategy, FKAA suggests conversions of older septic systems for rainwater capture purposes. This provides a dual benefit for additional management of run-off and is suggested as a non-structural control to mitigate water quality impacts in the Reasonable Assurance Plan.

7.1.3.2 Stormwater

Surface water runoff from various land uses largely drains to a network of canals, access ways, roadside ditches, the ocean and the Florida Bay. The existing shallow soils allow the rainfall to percolate directly into the porous limestone bedrock. Adjacent to near shore waters discharge occurs in the form of shallow overland flow. Other existing public and private surface water management facilities include storm sewers and retention basins installed by the FDOT along portions of US 1 who is responsible for maintaining facilities along US 1 and State Road 931 (Sombrero Beach Road).

On July 30, 2002, the City adopted Ordinance 02-07-13 titled Master Service assessment Ordinance allowing the City to collect assessments as necessary for infrastructure purposes. On March 10, 2004, FDEP designated the City Of Marathon as a regulated municipality under Phase II of the National Pollutant Discharge Elimination System ("NPDES").[xxix] One of the requirements of this designation was to create a stormwater utility and implement a five year program to prohibit stormwater run-off discharges into Florida Outstanding Waters. On May 10, 2005, the City adopted Ordinance 2005-10 creating the stormwater utility. The stormwater construction project, incorporating all of the City's

roads, resulted in approximately $25 million of new infrastructure improvements to meet these requirements. As of 2011, Marathon has completed all targeted stormwater projects.[xxx]

7.1.3.3 Wastewater

Sections 381.0065 and 381.0066, F.S. require the areas within the Florida Keys to meet certain advanced waste treatment requirements and standards. To meet those standards, this law required local governments to establish wastewater collection, transmission, and treatment facilities by July 1, 2010. The deadline was then extended to December 31, 2015, with water quality targets expected to be achieved by 2020.

In order to meet these requirements, over the past several years, the City has undertaken an approximately $100,000,000 in new and retrofit wastewater and stormwater projects. The projects include construction to install more than 56 miles of vacuum, gravity and low pressure sewage collection lines and six wastewater treatment facilities.

While meeting these legal requirements is positive in terms of improving water quality throughout the Keys it highlights the competing objective of lowering energy use. Approximately 3% of total U.S. electricity is used in the municipal water and wastewater sector. As much as one-quarter to one-half of the electricity used by most U.S. cities is consumed at municipal water and wastewater treatment facilities. The amount of electricity used to collect, treat, and distribute drinking water is slightly greater than the amount used to collect, treat, and dispose or reuse municipal wastewater. However, the treatment of wastewater is significantly more energy intensive than is the treatment of raw water for potable use.

Although the City has made these improvements, the City's new wastewater plants have been designed capturing as many energy saving features possible. All 5 wastewater plants have been designed with energy efficient features and operations including:

- 3 (versus 2) treatment units to allow for portions of the plant to not be operated when demand is lower i.e. in off season.
- Variable frequency drives on blowers to allow for operation of plant treatment units based on actual demand rather than having them constantly run.
- Pneumatic pressure valves for air injection throughout the City's vacuum collection wastewater system reducing the need for energy use throughout the collection system.
- The City uses jet aeration which provides more efficient transfer of oxygen than traditional coarse bubble diffusers, reducing the amount of energy required to provide adequate dissolved oxygen for the biological process.
- Operations of wastewater facilities buildings that reduce lighting use in off-times both through automatic and manual outdoor lighting controls.
- Sludge is dewatered to 22% solids, reducing the number of truck runs into and out of the Keys by 10-fold. One truck load of dewatered sludge = 10 truckloads of liquid sludge equating to less

fuel consumption and emissions. For this process to occur, a portable centrifuge was purchased that can travel from site to site, again saving money and footprint for the city.

When FOG is disposed of in the wastewater system, it cools, solidifies and adheres to distribution pipes and equipment. Without proper disposal, Fats, Oils and Grease ("FOG") products enter the wastewater system creating problems in sewer lines, pump stations and ultimately the wastewater treatment process. Eventually this can cause the system to backup, overflow or reduce the conveyance of materials through the system. Successful FOG management programs require facilities to either install and maintain grease interceptors or to assure pick up of spent products. The City has FOG waste requirements that restaurants are required to install, operate and maintain grease interceptors meeting the requirements specified by the Department of Health ("DOH"). The wastewater discharge from these facilities, even when passed through a properly sized and maintained grease interceptor, may contain elevated levels of Biochemical Oxygen Demand (BOD). A surcharge may be applied to the customer's wastewater services bill for wastewater discharges with a BOD in excess of 500 parts per million. The City's stormwater regulations also address these issues. Enforcement and inspections to assure that requirements are met are challenging with current staff availability.

7.1.4 Opportunities for Green Infrastructure

"Green infrastructure" approaches have been recognized to help achieve GHG mitigation and climate change adaptation goals because their benefits are also generally related to their ability to moderate the impacts of climate change such as extreme precipitation or temperature. On a smaller scale, the City's green infrastructure includes trees and natural resources, but could include more rain gardens, various porous pavement systems and technologies and green roofs if appropriate and based on product availability. In many instances, maintenance and enhancement of green infrastructure involves stewardship of the natural setting (e.g. preventing and controlling exotic species invasions, maintaining fire regimes, restoring wetlands, etc.). This concept is also known as Ecosystem Based Adaptation ("EBA"). A concurrent benefit is that green infrastructure attributes provide these resiliency benefits at a much lower cost than constructed infrastructure components. For instance in the context of the City, natural communities are just as important for protecting people and the built environment from the negative consequences of climate change as "grey infrastructure" such as seawalls, stormwater drains. While the term is broadly used, what is commonly agreed upon is that implementing a holistically conceived green infrastructure program has many benefits. These include improving stormwater and wastewater management, helping to mitigate impacts from natural hazards and adapt to climate change, and providing other ecological and recreational services.

7.1.5 Other Opportunities for City GHG Reductions.

Policies and programs designed to lower consumption of energy and water as well as reduce the amount of waste generated are often easy to implement and provide the highest impact – generating immediate savings, as well as long term returns from reduced infrastructure needs. These savings can be used as a vehicle to finance other green projects and programs. Several initiatives discussed in this Section do not necessarily require a new cost or budget line item, but merely a cost benefit analysis to

see whether savings can offset implementation. Sometimes it can take a period of time to capture these savings so that should be factored into any cost benefit analysis. The City's greatest opportunities to reduce emissions are likely from vehicle fleet and remaining energy conservation measures that have not been implemented in the Performance Based Retrofit Analysis.

Biodiesel and waste vegetable oil are both produced or refined from used vegetable oil, though each with different degrees of difficulty and involvement. Biodiesel can be used in diesel-fueled vehicles without any modification of the engine. Additionally, biodiesel can be mixed with petroleum diesel to create different grades of fuel that are labeled based on the percentage of biodiesel in the blend; for example, B10 is 10% biodiesel, 90% petroleum diesel. This means that in times of biodiesel scarcity, vehicles can use a mix of fuels and still function the same way. Conversion kits for vehicles are readily available, though the models they are designed for are limited in number. A vehicle cannot run on WVO alone; it must start and stop on diesel because the engine has to be warmed up and the oil must be heated before use. Both biodiesel and WVO present significant benefits in terms of ease of acquisition and emissions reductions and waste food oil can be obtained from any restaurant. Regarding emissions, biodiesel is the only alternative fuel source to have completed the EPA's Tier I and Tier II health effects testing under the Clean Air Act. By purchasing vehicles that can run on biodiesel mixes and waste vegetable oil, the City can facilitate growth in these technologies and reduce emissions. Additionally, there are local businesses already tapping into this market. The City can adopt a policy that the City's indoor construction and outdoor landscaping and lighting incorporate the most energy efficient technologies possible (or renewable energy technologies) into all bid and procurement documents.

Initiatives and Actions:

Strategy	***Potential Benefits***	***Action Steps***	***Cost (if Applicable)***
CF 1.0: Explore the feasibility and cost benefit of renewable energy technologies to assist in powering buildings and operations.	Reduced energy costs at facilities and buildings. Direct benefits difficult to project because energy produced is highly differential depending on size of renewable system and facility it will power.	1. Coordination with FKEC to determine opportunities for system development and cost benefit. 2. Explore leasing programs with FKEC and other State agencies.	1. Highly variable depending on system and financing strategy. 2. Staff time to coordinate with FKEC and research financing strategies. 3. Explore other financing strategies such as leasing.
CF 2.0: Design all buildings and facilities to the highest but cost effective "green" design standards.	Highly variable depending on design standards and thresholds required. On average LEED buildings have achieved measured energy savings of approximately 28%	Revise Code of Ordinances to adopt municipal green building standards or allow for flexibility in the precise standard depending on	Staff time for Code revisions and research to develop same. There are many state and national models to draw upon.

	compared to code baselines, close to the average 25% savings predicted by energy modeling in the LEED submittals.[xxxi]	building type.	
CF 3.0: Include sustainability criteria in procurement opportunities to the extent practicable.[9]	Indirect GHG reductions.	Revise Code of Ordinances to adopt municipal green building standards.	Staff time for Code revisions and research to develop same. Sarasota County is a good example of a green procurement policy.
CF 4.0: Revisit SCP Initiatives and Actions annually during the capital budgeting process to determine new implementation opportunities.	No direct quantifiable benefit except ongoing commitment to implement SCP recommendations. Largely and implementation strategy.	1. Include as a criteria to review during standard capital planning and budgeting process. 2. Add as a policy in the Capital Improvements Element in the Comprehensive Plan.	Staff time for policy development and research to develop same
CF 5.0: Evaluate options for biodiesel or waste vegetable oil use in City trucks and vehicles (or requiring same from vendors servicing City through "green" procurement requirements)	For a B20 blend (20% biodiesel and 80% petroleum diesel), GHG lifecycle reductions over conventional petroleum diesel range between 10 and 20%, depending on the feedstock used. For a B100 blend (100% biodiesel), GHG lifecycle reductions over conventional petroleum diesel range between 40 and 90%, depending on the feedstock used.[xxxii]	1. Cost-benefit analysis regarding the amount of vehicles and fuel use currently, including cost of WVO conversions. 2. Determine waste vegetable oil and biodiesel supply opportunities. 3. Compare GHG emissions reduction potential with GHG Inventory results.	1. Since biodiesel can be used as an analogue or in a blend with petroleum diesel, there is no cost associated with converting the vehicle. 2. For WVO, costs include the purchase of a conversion kit or a customized conversion installation for the vehicle and filtering equipment. Conversion kits range in price from $1000 to $5000 per vehicle.

[9] Benefits include reduced packaging materials, procuring sustainable vendors that have achieved certain certifications, use of recycled content to the extent practicable and use of green cleaning procedures that support longevity of institutional facilities, buildings, finishes, carpets.

CF 6.0: Assure all City facilities and operations are built to the highest green standards practicable maximizing cost savings and compliance with Chapter 255, F.S.	Provides direct cost savings to City as facilities and operations become more efficient. Time in preparing background to adopt standard is likely offset by energy saved with new construction.	1. Research the available green building options pursuant to Chapter 255, F.S. 2. Determine which will achieve highest energy savings for lowest cost to certify. 3. Pass Resolution or Ordinance codifying standard in the Code.	1. Staff time to research certification and rating systems used by other local governments. 2. Staff time to research costs of programs and likely energy reductions. 3. Staff time to prepare Resolution or Ordinance.

7.2 Energy Use

7.2.1 State Overview on power generation

In Florida, electric cooperatives are nonprofit membership corporations organized under Chapter 425, F.S., to supply electric energy to their member consumers. The Florida Electric Cooperative Association ("FECA"), a not-for-profit trade association organized under Chapter 617, F.S., is the service organization for fifteen (15) electric distribution cooperatives that deliver electricity directly to their member consumers, and two generation and transmission electric cooperatives that transmit and generate (and purchase at wholesale) electricity for their member distribution cooperatives. Power in the City of Marathon is supplied by the Florida Keys Electric Cooperative ("FKEC") constituted under this authority.

Debate continues over how significant the role for renewable energy sources can or should be. Renewable energy currently makes up less than 2% of the state's generation capacity, but a recent assessment of these resources determined that solar, biomass, and offshore wind have the highest technical potential for Florida, given a 2020 planning horizon.

After several years of attempting pass a comprehensive Florida energy bill, the 2012 Legislature adopted energy legislation which reestablishes millions of dollars in renewable energy tax credits and exemptions, and contains several provisions intended to remove regulatory barriers to promote future investments in Florida renewable energy projects. Specifically, the bill:

- Reestablishes millions of dollars in renewable energy tax credits and exemptions. The renewable energy production credit was reinstated and modified for electricity produced and sold during a certain period.

- A renewable energy technologies sales and use tax exemption was reinstated in the form of a rebate of $1 million per year for all taxpayers for the sale or use of certain equipment, machinery, and other materials.
- This legislation also adds a provision allowing proceeds of the local government infrastructure surtax to be used to provide loans, grants, or rebates to property owners who make "energy efficiency improvements" to their residential or commercial property if a local government ordinance authorizing such use is approved by referendum.

Additionally, in this year's legislative session, Section 366.94, F.S., was created to clarify that electric vehicle charging stations are a service to the public and not the retail sale of electricity so that providing this service will not be subject to any regulatory fees that may be adopted by the Public Service Commission ("PSC") if they were to be considered electricity retailers.

7.2.2 Florida Keys Electric Cooperative

FKEC was formed in 1940 as a rural electric cooperative, owned by the customers it serves. Today, FKEC serves over 31,000 member-owners with two 138,000 volt transmission lines and 23,000 kilowatts of generating capacity. Power is distributed through 6 substations. One additional substation will be added in the near future. FKEC purchases about 99% of its energy needs from FPL. The other one (1) percent is supplied by FKEC generated power. FKEC delivers electricity through a wide-spread network system that includes 802 miles of energized lines.

FKEC has six substations and the main function of these stations is to "step-down" the high voltage power transmitted from mainland power plants to a lower usable voltage. When electricity travels a long distance from a power plant to a service area, it is sent at a very high voltage and low current to reduce transmission losses. When the power arrives, it cannot be transmitted on FKEC's smaller distribution lines, so the massive substation transformers reduce or "step-down" the voltage. The energy can then be sent to homes and businesses. FKEC recently completed a nearly two-year long project upgrading two (2) substations in its service territory.

Cooperative members elect the Board of Trustees. The Board of Trustees establishes policies and reviews operational procedures to promote a financially sound electric utility. FKEC is controlled by bylaws, providing the guidelines for conducting its business operations. With this structure those served by FKEC have direct access to decision making as member-owners, through meetings and through election of the Board of Trustees. Rates charged for service pay for the costs of ongoing maintenance and improvements of the power lines, poles, substations, green initiatives and the other infrastructure necessary to guarantee that electricity is available.

7.2.3 Energy Conservation Initiatives

In 2008, FKEC applied for and received $1 million worth of funding from the Internal Revenue Service's Clean Renewable Energy Bond program. FKEC used the bond proceeds to install approximately 120 total kilowatts of solar power generation. The Marathon array, located next to the Marathon office building,

was the first phase with a maximum capacity of 96.6 kilowatts. A smaller array, installed inside FKEC's Crawl Key Substation, was the second phase with a maximum capacity of 21 kilowatts.

The first panels in the Marathon array were connected to FKEC's power grid in November 2008 and the entire array went online later that year. The Marathon array consists of 552 separate 175-watt solar modules tied directly into FKEC's electric grid, and the Crawl Key array adds an additional 120 panels.

FKEC provides free energy audits to homes and businesses with a final written report containing suggestions on steps to take to conserve electricity use and lower monthly electric bills. In early 2007, FKEC converted all of its diesel-fleet to biodiesel, and they were the first fleet operator in the Florida Keys to make that conversation. This conversion can also provide the City information to decide if it wants to take similar actions with its own fleet. The conversion required no modifications to the vehicles but substantially lowered emissions. FKEC also includes numerous other energy saving actions and operations:

- High efficiency chillers in lieu of standard central air
- Digitally controlled air-cooling system
- Fluorescent lighting throughout the business controlled by a programmable master system
- 30,000 gallon cistern for watering and truck washing
- Water-saving toilets with two flush settings
- Louvered red "eyebrow" around exterior of building (directing natural light inside while helping to keep unwanted heat to a minimum)
- Solar-assist water heating and reflective white roof
- Coral rock mined from site reused at minimal cost
- Recycled building materials where possible
- Cross-ventilation system in its warehouse

FKEC began offering solar interconnectivity in 2004, making it easy for solar projects to draw power from the local power grid. The Simple Solar Program is available only to FKEC members and is available to members who support alternative energy but don't want the hassle of designing, permitting, building, maintaining and insuring their own residential solar arrays because they can now lease panels in FKEC's existing array. In return for leasing one or more panels for $999 each, members receive monthly bill credits for the full retail value of the electricity generated by their leased panel(s) for 25 years. One of the major advantages of the program is that FKEC will maintain the solar array so the consumer only pays the one-time cost of the panel. FKEC also has numerous conservation programs such as the installation of Load Management switches.

7.2.4 Opportunities to Reduce GHG Emissions

While not an FKEC project, Keys Energy is exploring the potential for wind in other areas of Monroe County. FKEC is also interested in exploring possibilities for wind and tidal renewable energy resources.

Opportunities for a municipality to reduce energy use communitywide are generally limited because there is an issue of control over the power supply mix and availability of data. Unlike many other areas in the State where a jurisdiction is served by an investor-owned utility with limited direct access to decision-makers, the City enjoys a good relationship with FKEC which is accessible to the constituency served. FKEC is quite progressive in terms of energy conservation for its own facilities and incentive offerings. One of the highest priorities for coordination is the exchange of data so that the City will be able to easily monitor progress towards its GHG reduction goals. Another area for potential coordination is on outreach and education as well as the use of renewable energy in City facilities and operations.

Initiatives and Actions:

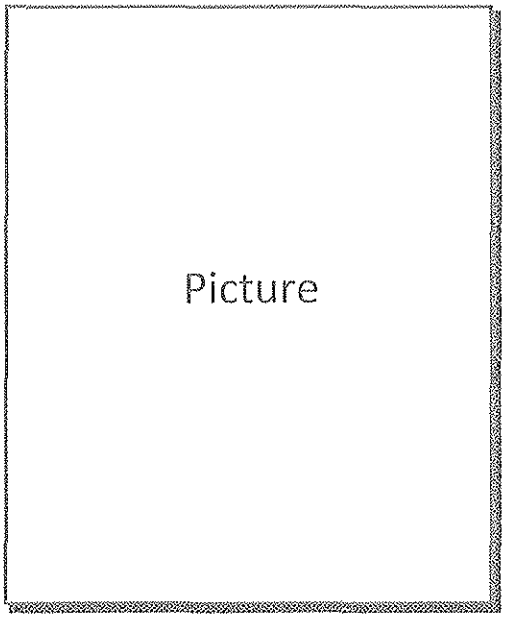
Strategy	*Potential Benefits*	*Action Steps*	*Cost (if Applicable)*
EU 1.0: Align communications and outreach between City and FKEC on energy conservation in homes and buildings.	Indirect, but will potentially provide emissions reductions and cost savings opportunities for home and business owners.	1. Develop more formalized coordination process if needed particularly focusing on materials and presence at community events. 2. Potential website coordination.	Staff time for coordination process and potential revisions to website.
EU 2.0: Form more specific partnership between City and FKEC to seek grants and implement common goals.	Indirect, but more grant partnerships stand to provide funding for energy efficiency or renewable energy projects for the City directly, residents or business owners.	Integrate into coordination process in EU 1.0.	Staff time for coordination process and potential research for grant opportunities.
EU 3.0: Coordinate to share data on Plan Implementation, Monitoring and Updating.	Indirect, but more coordination on data exchange will help streamline the process for reporting on SCP success.	Integrate into coordination process in EU 1.0.	Staff time for coordination process focusing on data needs and exchange.

7.3 Buildings and Homes

According to the U.S. Green Building Council ("USGBC"), the resource use of U.S. buildings includes 12% of the nation's water use, 39% of the CO_2 emissions, 65% of the waste output and 71% of the electricity

consumed. For the City, commercial and residential GHG emissions from home and building energy use constitute 50% of the communitywide footprint. Opportunities to reduce energy in buildings and homes in the City will be dictated by City policy and incentives to encourage energy efficient development and education and outreach. The City also has opportunities to manage energy use within its own buildings and construct them to the highest energy efficiency standards achievable and that are also cost effective.

Residential land uses, including single-family detached homes, duplexes, mobile homes, multi-family apartments, and mixed–use residential areas are found throughout the City accounting for 51.91% of all land in the City. Single family detached homes are the predominant residential type within the City, and account for 72% of the residential land use category. Multi-family residential development, including apartments and condominiums, occupy the second largest residential land area accounting for 15.6% of the developed residential land. Population projections for the City are determined based on the current rate of growth allocations for residential units. Currently, the City is allocated 30 residential units per each ROGO allocation year by the State of Florida. According to US Census Bureau Data, the total number of housing units in 2000 was 6,791. At an annual increase of 30 housing units per year, by the year 2020, the City will have added 600 units (30 X 20 = 600) for a projected total of 7,391 housing units in 2020. In 2011, the City requested 1,000 more hotel units over a 10-year period and in early 2012, the City was allotted 100 hotel-room units in recognition of substantial progress with its central sewer and stormwater projects. The allocation of units will ultimately require a Comprehensive Plan amendment for implementation.



7.3.1 Energy Code Requirements for Construction

Energy efficiency standards in construction are regulated by federal and state law. The Model Energy Code ("MEC"), now the International Energy Conservation Code ("IECC"), is the most commonly used residential energy code by states. The IECC also has a commercial section that allows the use of ASHRAE 90.1 for compliance. The U.S. Energy Conservation and Production Act ("ECPA") requires that each state certify that it has a commercial building code that meets or exceeds ANSI/ASHRAE/IESNA Standard 90.1-1999. In this sense, "commercial" means all buildings that are not low-rise residential (three (3) stories or less above grade). This includes office, industrial, warehouse, school, religious, dormitories, and high-rise residential buildings. ASHRAE 90.1 is the most commonly used energy code for commercial and other non-residential buildings.

Florida has independently developed and adopted its own energy code. In 1980, the Florida Energy Efficiency Code for Building Construction ("FEECBC") was developed to be climate-specific for Florida. The 1998 Florida Legislature amended Chapter 553, F.S., Building Construction Standards, to create a single state building code that is enforced by local governments. As of March 1, 2002, the Florida Building Codes supercedes all local building codes. Pursuant to Chapter 553, F.S. (the Florida Building Code) residential, commercial and renovated buildings "shall not be required to meet standards more stringent than the provisions of the Florida Energy Efficiency Code for Building Construction" thus limiting a local government's ability to require higher energy efficiency standards in buildings.[10] In 2008, HB 697 was passed requiring increases in the energy efficiency of the Florida Building Code: 20% percent in the 2010 version, 30% in the 2013 version, 40% in the 2016 version and by 50% in the 2019 version. To meet the state's energy efficiency goals, the Florida Building Commission selected the most current version of the IECC as a foundation code; however, the IECC will be modified by the commission to maintain the nuances of the FEECBC.

Section 255.253(6), F.S. defines a "sustainable building" as "a building that is healthy and comfortable for its occupants and is economical to operate while conserving resources, including energy, water, and raw materials and land, and minimizing the generation and use of toxic materials and waste in its design, construction, landscaping, and operation." The "green building" movement is about constructing better buildings and more livable communities. Green buildings provide numerous benefits: conserve resources, save money on energy and water bills and provide a healthier work and living environment. Consideration should be given to a range of policies and programs, including the use of financial incentives when appropriate and cost effective. Green building could be incentivized in either new construction or when a building undergoes a major renovation, is sold, or is converted to a different type of unit such as transient or condominium. These events are also a good opportunity to conduct targeted outreach and education to residents. When developing any incentives the City should work in conjunction with the local building community to determine what will make a meaningful impact to incentivize green building projects. The City should also create a clear list of criteria to achieve these incentives.

As the City works to improve the service it provides to those seeking building permits, it would be helpful to establish a "specialist" on staff, not necessarily a new employee but someone who achieves some level of green building certification, to assist with green building questions, provide upfront coordination and assistance for builders committed to achieving a high level of green building. With green building, there is a stigma of high cost. Because most developers do not pay for the energy costs of the buildings they construct, they have little motivation to exceed base standards for energy-efficiency. Financial incentives have to encourage developers, existing commercial building and home owners to make energy-saving investments.

[10] Sections 553.904, F.S. (Thermal Efficiency Standards for new nonresidential buildings), 553.905, F.S. (new residential buildings), and 553.906, F.S. (renovated buildings) each contain language that all buildings "shall not be required to meet standards more stringent than the provisions of the Florida Energy Efficiency Code for Building Construction." This does not, however, prohibit "above-code" incentive-based programs.

7.3.2 Opportunities for GHG Reductions

Behavioral change underlies the success of each of the components outlined above. The City and its partners must combine efforts in the policy arena with targeted education and marketing for residents, businesses and institutions. Personal choice underlies many of the building energy use-related changes that will have to occur in order for the community to achieve its GHG reduction goal. As such, enhancing and expanding current education and outreach efforts is fundamental to this plan. The City must market and educate the development community about green building approaches. Strategies include enhancing outreach to encourage developers to adopt national green building and energy performance standards, such as ENERGY STAR, FGBC, the IGCC and LEED. The City should also highlight existing green buildings and cutting edge green technologies through green building tours. An effective technique is to highlight existing green buildings in the City through case studies made available at the City's Community Services and Engineering Department as well as partnering agency websites. The City can also expand the green building display in the new City Hall and utilize it to showcase innovative green building materials and practices.

As a logical progression from concentrating on government operations and policies, the way to affect people's behavior and secure long-term commitments to reduce community-wide emissions is through educating the community about the importance of their contribution to achieve the SCP goals. While the City has no direct control over the utilization of electricity and fuel by residents, it is apparent that education about the benefits, primarily cost, of reducing energy usage is necessary to reduce the community's GHG emissions.

Initiatives and Actions:

Strategy	*Potential Benefits*	*Action Steps*	*Cost (if Applicable)*
BH 1.0: Encourage innovative building strategies that minimize energy and water consumption, maximize the recycling of construction debris, and provide for a more comfortable indoor environment.	Reduction of homeowner and business owner GHG emissions and energy use are an indirect GHG benefit. Typically a conservative estimate is 20% energy savings for a "green" home or building as opposed to a "code" compliant building.	1. Research and develop provisions to include in the Comprehensive Plan and Code to encourage green building. 2. Research appropriate incentives to encourage green building. 3. Develop staff expertise through designating a staff person to achieve a green building	1. Cost for staff training for green building expertise. 2. Staff time to research green building policies, code provisions and incentives. Should be a component of Comprehensive Plan and EAR process.

		certification. 4. Highlight City successes in green building.	
BH 2.0: Simplify project review and permit approval process to encourage innovative green building measures.	Streamlining process for buildings to achieve green ratings, certifications or components.	1. Review existing permit and project approval process to identify methods to expedite green projects. 2. Publish summary of streamlined process on website and for distribution.	1. Cost for staff review of development approval process. 2. Cost for publishing summary and incorporating into website.
BH 3.0: Highlight and communicate about projects that achieve energy efficient or green design.	Featuring good green building techniques performs an education and outreach function thus encouraging more green projects. Benefit is indirect reduction in energy use in homes and businesses.	1. Develop a location on website to highlight green projects. 2. Work with builders and construction professionals to have them provide summaries and photos of projects.	1. Staff time (or outside consultant time) to create portion of website to highlight projects.

7.4 Land Use & Transportation

The challenge of reducing GHG emissions from the transportation sector is a three-legged stool. One leg represents vehicle fuel efficiency; the second leg represents the fuel's carbon content; and the third leg represents the amount vehicles that are driven, known as vehicle miles traveled ("VMT"). Since 1980, the number of miles Americans drive has grown three (3) times faster than the U.S. population, and almost twice as fast as vehicle registrations. Increases in gasoline prices moderate these trends to some degree. But there are challenges in changing the factors that contribute to increasing VMT, such as the level of density for community design and people's decisions about where they want to live.

Reducing transportation emissions cannot be achieved by focusing on the transportation sector in isolation. Shifting the balance toward sustainable transportation modes requires a combination of

policies, education initiatives, revenue and effective incentives. In essence, it requires assembling policies and programs that together will reduce VMT and the associated GHG emissions, while also improving community mobility and quality of life. Strategies generally fall within the following categories:

- Transportation Demand Management ("TDM") is defined as a set of specific strategies that promote **increased efficiency of the transportation systems** and resources by promoting and providing a range of local or regional travel-related choices to influence individual travel behavior by mode, time, frequency, trip length, cost, or route.
- Transportation System Management ("TSM") strategies include measures designed to enhance the efficiency and safety of the **intermodal transportation network**, to minimize congestion on existing facilities and to improve the air quality of the region. Strategies include new, modified or expanded infrastructure such as roadways, transit or bicycle facilities, widened sidewalks, improved traffic signalization schemes, enhanced transit service and reserved lanes for high-occupancy vehicles and/or hybrid vehicles.
- Transit-oriented development ("TOD"), promotes denser, mixed-use developments in walking distance of transit, and complete streets, which are safe and accessible to all users, can go a long way toward **reducing dependence on the personal automobile** and, thus, VMT and overall GHG emissions.

Decisions made in land use planning directly impact patterns of travel between residential and employment or commercial centers. Sustainable land planning decisions directly correlate to reduced VMT and lessening GHG emissions. The City currently has a low-density land use pattern and not all of these techniques will be applicable to the City of Marathon at an aggressive scale. The City supports the principle of linking more intense residential land uses with commercial areas with new potential transit opportunities. Given the close relationship between sustainable land and transportation planning, the City has focused on these challenges together in one Focus Area.

7.4.1 The Transportation Network

Marathon's transportation network includes collector and arterial roadways, bicycle and pedestrian paths, and the City's Airport. US 1 is the principal arterial roadway, but it is also considered the "Main Street" for the City. All other roadways in the City are collector or local streets that provide access to adjacent land uses and feed traffic to US 1 at specific locations (approximately 380 streets). The City has maintained responsibility for these streets since its incorporation. These roads assist in reducing traffic volumes on US 1. Seven signalized intersections are located on US 1 within the City. Two pedestrian signals are located at MM 48.5 and MM 53.0, while the remaining five signals regulate traffic.

Transportation options currently available within the City include the automobile, airplane, bicycling, walking, and boating. Bicycle and pedestrian facilities are located on or adjacent to frontage roads interspersed throughout the City. Marathon Airport is located at MM 51.5. Until recently, there were several daily scheduled flights to/from Miami and Fort Lauderdale.

7.4.2 U.S. Highway 1

The roadway network in the City and the Keys is unique with US 1 serving as the primary link for every island throughout the County. Roadway access entering and exiting the City is only provided via US 1. US 1 has to be considered from a regional context to assure that the Keys' only roadway link will continue to function properly.

The functional classification for US 1 in the City is an urban principal arterial. The entire US 1 corridor is owned by FDOT and as such it is subject to state regulation. These regulations prevent commercial intrusions incompatible with state transportation goals. Typically, the FDOT is responsible for all maintenance activities within the ROW. The FDOT has entered into a number of maintenance agreements with local and other state agencies relative to management of enhanced landscaping and beautification efforts in place along the corridor. This is important to note because the City has no control over the design and functionality of US 1 and therefore there are limited opportunities to reduce VMT along this corridor. That said, there are other opportunities to facilitate GHG emissions reductions along US-1 through coordination with the County and neighboring municipalities.

7.4.3 Land Use

The City is comprised of approximately 5,726 acres of which approximately 2,300 are undeveloped. Approximately 1,000 acres are zoned for residential uses, while commercial and mixed use land uses account for approximately 680 acres. As stated in the previous Section, given the constraints on new development in the City, it is not projected that these land use patterns will significantly shift unless there are major policy and regulatory changes facilitating that growth.

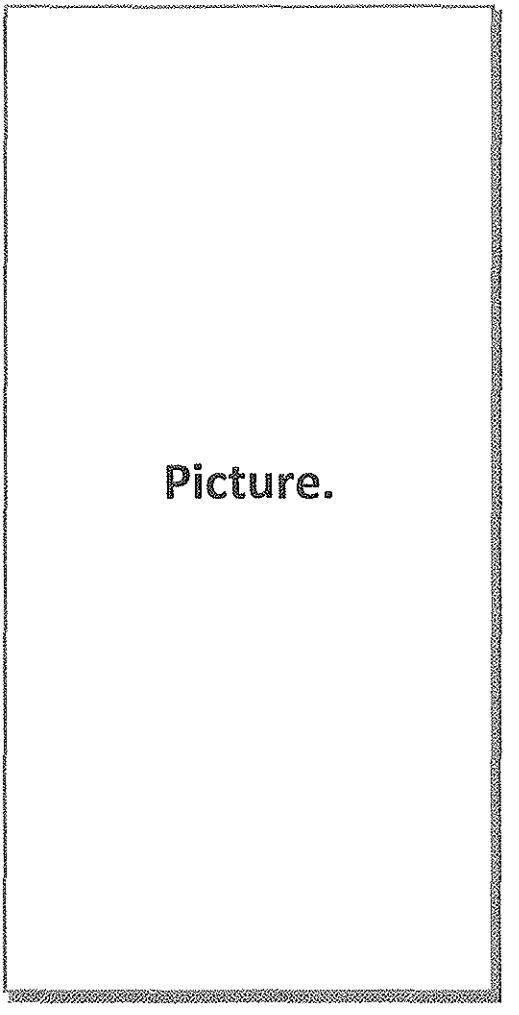
7.4.4 Local Transportation Constraints and Opportunities

Modal split in the City is predominantly dependent upon automobile use because of the lack of transit opportunities, lack of population density and the lack of connectivity between the bicycle/pedestrian paths. The City currently does not operate a standalone transit system but participates with the County and the City of Key West in a local network. The County is currently served by two main public transit systems:

- Miami-Dade Transit ("MDT") in the northern region of the County with two routes (Dade-Monroe Express and Card Sound Express) serving the County from Key Largo to the City; and
- The City of Key West Department of Transportation ("KWDOT") which operates:
    - Key West Transit ("KWT") with four fixed-route bus routes serving the City of Key West and Stock Island,
    - The Lower Keys Shuttle providing service in the southern portion of the County from the City to Key West, and
    - The Key West Park-N-Ride available at The Old Town Garage.

Para-transit service is provided by the County for disadvantaged residents and the Greyhound Bus Company provides regional bus service between Key West and Miami with three daily trips in each direction.

The City contains a network of bicycle facilities that is shared among pedestrians, in-line skaters and other users and pedestrian and bicycling paths are available throughout the community providing opportunities to reduce VMT along US 1. Marine travel also provides new alternative modes of transportation. Because of the lack of limited access highways in the City, no HOV lanes exist. Further, no designated park-and-ride lots exist in the City. Connectivity of transportation modes between residential areas and the principal commercial areas of Marathon is a significant challenge. Solving this issue will provide new opportunities for alternative modes of transportation, thereby decreasing the need to drive to each individual location. Design policies that re-orient the placement of commercial structures along US 1 could also help promote bicycle/pedestrian usage.



The City is a member of the FDOT Technical Advisory Committee for the Keys which could prove valuable as a future coordination mechanism with a more cohesive scope of work or work plan. The City can provide the SCP to the TAC to facilitate coordinated discussion on these issues and the recommendations herein.

"Green Streets" incorporate principles such as landscaping, traffic calming and other unique features to distinguish from other street types. A Green Street has a variety of design and operational treatments, giving priority to pedestrian circulation and open space over other transportation uses. The treatments may include sidewalks, if space and right-of-way permits, landscaping, traffic calming, and other pedestrian-oriented features. The purpose of a Green Street is to enhance and expand desired land use and transportation patterns on appropriate City street rights-of-way. Given existing space constraints, the City should research incorporating Green Streets principles into any redevelopment projects or, for instance, new projects associated with the increased transient allocation the City recently received on the local streets. Design for this project should include multiple transportation and design features to encourage pedestrian, bicycle and alternatively fueled vehicle use. Green Streets principles should also be included. There are numerous resources that have model Green Street design criteria.[xxxiii]

In the Middle Keys, the City is ideally located as a central focal point for facilitating the use of alternatively fueled vehicles. Its central location makes is attractive for electric vehicle charging stations, compressed natural gas filling stations or waste vegetable oil/biodiesel filling stations. The central location of the City also makes it attractive for facilitating linkages for commuting or transit, such as County employees or City staff that must attend meetings in either the northern or southern Keys. For instance, the City should review parking requirements to incentivize and accommodate alternatively fueled vehicle carpool pickup and drop off locations. This geographical importance cannot be understated because in a sense, the City could serve as a leader in transportation related infrastructure to reduce GHG emissions from travel along US 1. The construction of the new City Hall provides a unique opportunity to explore this possibility by siting or co-locating needed commuter, transit or alternatively fueled vehicle infrastructure as the site permits.

Initiatives and Actions:

Strategy	***Potential Benefits***	***Action Steps***	***Cost (if Applicable)***
LUT 1.0: Encourage and incentivize land uses and density to facilitate development and redevelopment opportunities linked to transit.	To the extent that the City can do this in its development approval process, it would be beneficial to promote the linkage between development projects and transportation options. This could be especially applicable for the additional allocation of NROGO units the City has received. Benefits are indirect.	1. Review ROGO and NROGO application process to determine if there are opportunities to incentivize these linkages. 2. Based on analysis prepare required Comprehensive Plan or Code changes.	Staff time to perform analysis.
LUT 2.0: Make cycling, walking, public transit, and other sustainable mobility modes the mainstream by promoting connectivity and sustainable design standards for transportation infrastructure. Identify deficiencies in the transportation and transit network to prioritize policy development.	Improving linkages between modes of transit and alternative modes of transportation will promote more use of transit and options for single use of automobiles. This can encourage use of alternative modes of transportation in working with the County and City of Key West to implement sustainable design of bus stops, such as including shading, bike racks and dissemination of transit stop information.	1. Prioritize analysis during Comprehensive Plan update in terms of data and analysis and policy development. 2. Potentially map where linkages need to occur to prioritize integration with capital projects. 3. Review Code to	Implement as a component of the Comprehensive Plan and EAR process. Staff or consultant time during process.

		determine if revisions should be made to facilitate policies that promote sustainable design of transportation serving infrastructure. 4. Publish updated transit information on website.	
LUT 3.0: Manage parking effectively to minimize driving demand, promote carpooling and encourage and support alternatives to single occupancy vehicle use.	This could also facilitate designating commuter parking spots, van or car pool pick up locations. Benefits are indirect but regional in application.	1. Analyze existing parking strategies in Code to determine if constraints or opportunities exist to facilitate ride sharing. 2. Research and develop new parking policies to facilitate ride sharing in new development. (Primarily applicable to non-residential development).	Staff time to perform analysis.
LUT 4.0: Create incentives for low-carbon vehicles such as electric vehicles and plug-in hybrids and make transit infrastructure energy efficient.	Promote the City as a "centralized" location for alternatively fueled vehicle "recharging".	1. Determine what alternatively fueled vehicle support needs to be created. 2. Assess waste vegetable oil, biodiesel and compressed natural gas fueling station viability. 3. Research current locations of	Staff time to research can be minimized with online resources that track installations of electric vehicle charging stations. Waste vegetable oil recycling companies exist within Monroe County to provide fuel resources..

		electric vehicle charging stations if any. 4. Incorporate into plans and design of new City Hall.	

7.5 Waste Reduction

7.5.1. Overview of Waste Reduction Issues

In the past 50 years, the amount of municipal solid waste ("MSW") generated in the U.S. has nearly tripled. The collection, transportation and disposal of this waste presents a considerable cost to local government, poses threats to public and environmental health, and when landfilled, or incinerated, results in a permanent loss of valuable materials such as metals, glass, paper and organic matter. The total energy consumed related to waste management activities is a result of direct fuel and electricity consumption associated with raw material acquisition and manufacturing, fuel consumption for transportation, and embedded energy. The EPA Office of Solid Waste and Response concludes that 42% of U.S. 2006 GHG emissions were associated with the manufacturing, use and disposal of materials and products.

Materials management describes how materials are managed as they flow through the economy from resource extraction to product design and manufacture, transport, use, reuse, recycling, and end of life. If consumers, institutions, and businesses understand the lifecycle of products and materials, they will be more likely to adopt a set of best management practices which limit the amount of materials entering the waste stream. Source reduction prevents the generation of waste and pollution. In the materials management framework, it is the reduction of the amount of materials entering the supply stream. Reuse is the reuse of a product by its original user or someone else. Recycling is a series of activities that includes collecting recyclable materials that would otherwise be considered waste, sorting and processing it into raw materials such as fibers, and manufacturing raw materials into new products. Disposal is the placement of waste on land or underground, including proper disposition of a discarded or discharged material.

Construction and demolition debris ("C&D") consists of materials that are generated from residential and commercial building, renovations and various types of demolition. C&D materials include wood, steel, glass, brick, concrete, asphalt, wallboard, rocks, soils, tree remains, trees and other vegetative matter. Only non-water soluble and non-hazardous materials are considered C&D. A large portion of C&D debris is recyclable--approximately 5% is metal, 9% is asphalt, brick or concrete and 30% is wood. Recycling C&D waste not only keeps it from ending up in the landfill, but also reduces the upstream energy consumption required to manufacture new construction materials.

Organic waste materials include food waste, yard trash and paper. The EPA estimates that Americans throw away a quarter of the food we prepare, about 96 billion pounds each year. In 2007, 12.5% of all MSW was food waste and less than 3% was recovered before going into the landfill. The methane produced in landfills, which contributes more per unit to global warming than CO_2, is the product of food decomposition. Composting results in some CO_2 storage (associated with application of compost to agricultural soils), as well as minimal CO_2 emissions from transportation and mechanical turning of the compost piles.

The proportion of electronics — such as televisions, computers, printers, cell phones, stereo equipment, VCR/DVD players and video game consoles — discarded into the waste stream is rising at a rate two-to-three times faster than any other waste segment. According to the U.S. EPA, 82% (1.84 million tons) of the 2.25 million tons of obsolete or unwanted electronics were landfilled in 2007. "E-waste," as it is often termed, presents numerous public and environmental health and safety concerns as discarded items often contain heavy metals that may be toxic (i.e. lead, mercury, cadmium) when released into the air, soil or water through landfills or incinerators.

7.5.2 State Requirements for Recycling

Section 403.7032, F.S. sets the 75% statewide recycling goal (achieved by 2020) although it is not required of every local government. It also directs public entities (schools, state and local public agencies) to report the amount they recycle annually to their counties. Private businesses are encouraged (but not mandated) to report the amount they recycle to their counties. Although this State target is not applicable in Monroe County, the City could review its current recycling rates to determine if its 30% goal should be increased.

The City contracts with Monroe County for garbage and trash collection, which is disposed of at their contractor's resource recovery facility. The capacity of the facility is considered to be "unlimited" by the Monroe County Integrated Solid Waste Management Division.

City solid waste collection is effective under current practices. Approximately 67 tons of solid waste is collected per day. The quantity collected by private haulers from commercial, industrial and certain multifamily land uses is unknown. Special pickups of certain waste categories are pro-vided on an as-needed basis, however hazardous wastes remain the responsibility of the waste generator to dispose through authorized services and agencies outside of the City's collection system.

7.5.3 Opportunities to Reduce GHG Emissions

The greatest opportunities the City has in this area are likely partnerships with the County and the waste hauler to increase recycling rates and reduce waste materials such as through reuse of waste vegetable oil and exploring more applications for its use. To reduce waste vegetable oil, the City can take a two-pronged approach: 1) more aggressive enforcement of its grease trap requirements (with inspections) and supporting the development of the local waste vegetable oil recycling industry. Marathon Bio-Diesel currently provides collection containers for waste vegetable oil to 42 Keys restaurants and

organizations, then processes the material into fuel used by vehicle fleets and charter boats. By converting its own fleet the City helps increase demand for recycled waste vegetable oil for vehicles.

The City can also develop incentives to pass on to City residents and businesses for recycling. One such incentive may include some level of direct rebate or offset on utility bills if appropriate. Another incentive may include use of a company or program like that offered by RecycleBank®. This is a program where participants select a green action to be rewarded for and each time there is confirmation of the activities' completion, either through a "points" code or by recycling, participants receive RecycleBank "Points".

Finally, improperly discarded monofilament fishing line causes devastating problems for marine mammals, sea turtles, fish and birds. As of May 2011, there were several facilities that provide bins for recycling and these could be highlighted on the City's website.[xxxiv] These animals can be severely injured when they become entangled in or ingest the line and often die as a result. The State Of Florida started the Monofilament Recovery & Recycling Program is an effort to educate the public on the problems caused by improperly discarded monofilament fishing line. The program encourages recycling of used fishing line through a network of line recycling bins and drop-off locations, and by conducting volunteer monofilament line cleanup events.

Initiatives and Actions:

Strategy	***Potential Benefits***	***Action Steps***	***Cost (if Applicable)***
IWR 1.0: Determine cost benefit of increasing enforcement of grease trap inspections and requirements.	Large amounts of oil and grease in the waste water can cause sewer lift station failures, wastewater treatment plant problems and other issues which can cost money in terms of operations and maintenance costs.	1. Determine levels of staffing needed to enforce inspections and violations. 2. Determine if fees collected offset increased enforcement.	Increased staff time, increased staff duties or a new part time of full time employee to enforce regulations (among other duties).
IWR 2.0: Encourage commercial recycling opportunities by requiring or incentivizing placement of bins for common use.	Increases recycling rate with larger users of packaging and recyclable products.	Facilitate the placement of commercial recycling by requiring or facilitating placement of dumpsters behind businesses.	Staff time to research and draft potential policy revisions.
IWR 3.0: Work with marinas to implement monofilament recycling facilities or drop off points. Highlight those that do.	Reduces waste stream and harm to wildlife.	Survey marina facilities to determine if programs are far reaching enough or develop partnerships to address any deficiencies.	Staff time to conduct brief phone survey of marine facilities, research and draft any summary or policy recommendations.
IWR 4.0: Research various incentive programs to	Goal should be to focus on increasing recycling rates	1. Review fees paid associated with	Staff time for research and bring forth policy

promote increased recycling rates.	for home and business owners. Reduces transportation related emissions with less demand for hauling.	waste hauling to be offset by increased recycling rates. 2. Coordinate with waste hauler to determine what incentive programs are not yet being implemented. 3. Explore outside programs that the City can initiate and determine cost-benefit.	recommendations.

7.6 Landscape, Habitat and Marine/Coastal Resources

Due to the linkages and interdependency between coastal, marine and terrestrial systems in the Florida Keys, this section will provide a brief overview of those systems and best practice recommendations to manage them in the future knowing that these systems are likely be impacted by climate change. These systems face two major challenges in the context of climate change: the rate and extent of climate change and the resiliency of natural systems in Florida to impacts from climate change. While the terrestrial and marine systems in the Keys are already threatened with preservation and management challenges, specifically, the reef system faces new challenges including climate change that creates new stresses such as extremely high and low water temperatures and carbon dioxide-induced ocean acidification. Climate change therefore reinforces the desirability of managing these land-based and marine-based systems in an integrated manner. Managing and preserving our land and marine based ecosystems makes them more resilient to the impacts of climate change such as storm surge. The unavoidability of sea-level rise, even in the longer-term, frequently conflicts with present-day policies on managing and developing land and coastal ecosystems. Many of the decisions the City makes today will have a significant impact on resources, preservation and the City's ability to respond to climate change for years to come.

7.6.1 Terrestrial Systems and Habitats

Two upland vegetative communities are recognized within the Florida Keys, tropical hardwood hammocks and pinelands. Only the tropical hardwood hammock community occurs within the City. Coastal wetland ecosystems, such as salt marshes and mangroves are particularly vulnerable to rising sea level because they are generally within a few feet of sea level (IPCC, 2007). Landscape ordinances typically provide for the preservation of natural features such as wetlands, erodible slopes, special

native habitats and specimen trees. Many communities enact ordinances merely for beauty or economic development but there are other reasons such as a mechanism to implement the goals of this SCP. There are numerous examples of landscape ordinances that address tree canopy and terrestrial resource goals, for instance, Lexington, Kentucky has set standards for the amount of tree canopy and shade that must be provided in each zoning district in the community. Recent local examples of new important landscape codes include the City of Lake Worth (Chapter 23, Article XXI), the City of Oviedo (Article XII) and the City of Greenacres (recently adopted in May 2011) which all include detailed provisions for managing species and removal of trees. The Community Image Advisory Board could be a mechanism to study these issues and make recommendations for the Landscape Code as well as maintenance of City tree canopy goals.

Nationally, urban forests or "terrestrial resources" in the U.S. are estimated to contain about 3.8 billion trees, with an estimated structural asset value of $2.4 trillion. The value of an existing mature tree is exponentially higher than a smaller, younger tree, when one considers ecological services, property values and other measures. Healthy terrestrial resources have several benefits, including:

- Reducing the energy consumption associated with air conditioning buildings by providing shade.
- Reducing local ambient temperatures by shading paved and dark colored surfaces like streets and parking lots that absorb and store energy rather than reflecting it.
- Intercepting and storing rainwater, thereby reducing water runoff volume.
- Improving community quality of life through beautification and by reducing noise pollution and encouraging pedestrian traffic (shading of pedestrian pathways).

When tree characteristics and site characteristics match, the result is "the right tree in the right place", an internationally recognized arboriculture standard. The management of terrestrial resources typically involves a variety of activities such as inventorying tree populations; enacting tree and land use planning ordinances and policies; developing and implementing long-term management and maintenance plans, annual work plans, and budgets; and promoting community education and participation. The first step in the process is to do some type of analysis or "inventory" of the tree resources the community has. Without such an inventory, it is difficult to set any kind of goal or target for protecting the canopy of the City's terrestrial resources. Rather than paying for an assessment of the City's tree canopy, tools exist to help assess and value trees and terrestrial resources such as:

- The Street Tree Management Tool for Urban Forest Managers ("STRATUM") uses these data to calculate the ecological and economic value of the urban forest.
- The Urban Forest Effects model ("UFORE") assesses the composition, condition, and ecological values of an entire urban forest ecosystem.
- CITYgreen is another tool that analyzes the ecological and economic benefits of tree canopy and other green space.

To maintain natural resources in a sustainable manner, the City must reduce also dependence on chemical fertilizers, pesticides, and herbicides and increase use of Integrated Pest Management ("IPM") strategies for pest management. These types of practices can shift from potentially harmful chemicals

to training maintenance and management of the City's sustainable landscapes. Part of this strategy should include use of composted organic matter to build soil health if appropriate and not counterproductive to achieving stormwater goals and requirements.

Boot Key, most of which was added to the Florida Keys Ecosystem Florida Forever Project ("FKEFFP") in 1999 at the request of the Fish and Wildlife Conservation Commission, provides an excellent opportunity for these types of issues to be addressed. With five miles of undeveloped shoreline and almost no improvements, acquisition of this island adjacent to the Florida Keys National Marine Sanctuary offers an opportunity to protect critical ecological resources while providing passive, coastal resource-based recreation. Part of the Florida Keys Ecosystem Florida Forever Project, acquisition of Boot Key will protect habitat important for the Florida Keys National Marine Sanctuary and will protect at least 15 state-listed species and three types of state-imperiled natural communities Boot Key includes Essential Fish Habitat for at least four groups. The City's participation in a grant award for Boot Key was previously discussed herein.

7.6.3 Coastal and Marine Systems

For coastal systems, sea-level rise will increase beach erosion and associated shoreline recession. Sea-level rise and other climate changes must be taken into consideration in developing and implementing relevant coastal wetland conservation strategies, as these systems face changes in the coming decades that are far greater in past restoration planning. Sea level rise has already led to the upland migration of mangrove forests, which have been able to take advantage of changing habitat conditions in areas previously dominated by freshwater marsh. A 2006 study of the potential impacts of sea-level rise at nine of the most important sportfishing areas along Florida's coast found that, with a moderate 15 inch eustatic sea-level rise, nearly 50% of critical salt marsh and 84% of tidal flats at these sites would be lost, while mangroves are expected to expand inland, increasing in area by 36%.[xxxv] Under this scenario, the area of dry land is projected to decrease by 14%, and roughly 30% of the areas' ocean beaches and two-thirds of estuarine beaches would disappear. The vast majority of Florida's marine fish and shellfish species depend on salt marshes, tidal flats, and other habitats found in bays and estuaries, so the projected changes to these habitats due to sea-level rise are likely to have a considerable impact on Florida's commercial and recreational fisheries. The importance of protecting these systems is demonstrated in the fact that in some cases, marshes may be able to accommodate moderate changes in sea level through natural sedimentation and marsh accretion (the build-up of organic and/or inorganic matter). Prioritizing the preservation of tidal wetlands will be more important to help protect coastal water quality and stabilize shallow water and intertidal zones. Preventing wetland loss would also protect essential habitat for important prey species, including shrimp, crabs, and smaller fish dependent on the Keys' marine food web. Because these coastal systems are expected to "fluctuate" good planning and land management becomes more important to preserve areas in anticipation of expected wetland migration.

The surrounding waters in the Keys are designated as Outstanding Florida Waters and include the 2,900 square-nautical-mile Florida Keys National Marine Sanctuary, the second largest marine sanctuary in the

United States. An analysis of climate projections indicates that coral bleaching and other climate change impacts such as sea level rise and severe weather events will threaten local reef survival through chronic stress or acute physical damage. Ocean acidification (the higher concentration of CO2 in the atmosphere is directly altering the chemistry of our oceans) is already decreasing the concentration of calcium carbonate in sea water, which limits the rate at which corals build their hard skeletons and will eventually start dissolving available calcium carbonate from the ocean's living and fossil reefs. Degradation of coastal ecosystems, especially wetlands and coral reefs, has serious implications for the tourist economy in the Keys. Higher ocean temperatures will cause extensive coral bleaching, enhance marine diseases, alter species' ranges and population abundances, and harm fisheries all impacting local economic development.

Initiatives and Actions:

Strategy	***Potential Benefits***	***Action Steps***	***Cost (if Applicable)***
HAB 1.0: Update and expand City's landscape ordinance maximize tree canopy and encourage exotic removal.	Maximizing preservation policies through ROGO requirements and landscape ordinance can increase sequestration of GHG emissions.	1. Research and review key landscape codes to compare with City's existing code to identify any deficiencies. 2. Provide recommendations to strengthen development review process and landscape code to maximize tree canopy and GHG sequestration benefits.	Staff time to develop recommendations on a process to enhance tree canopy through review of the landscape code.
HAB 2.0: Establish a tree canopy goal and seek assistance from a student or organization to help develop a tree inventory.	GHG emissions are sequestered by maintaining tree canopy goals.	1. Research and identify sources of data that include an inventory of natural resources. 2. Determine if sources can be utilized to complete a tree inventory. If not, determine feasibility of completing a tree inventory.	Staff time and resources to provide initial findings if existing data sources can be used in conjunction with an online tool to complete a tree inventory.

		3. Based on inventory either utilize existing coverage or establish a tree canopy goal.	
HAB 3.0: Review ROGO, NROGO and land development regulations for enhancement of policies to prioritize connectivity between and enhancement of natural areas. Prioritize avoidance, minimization, then mitigation for wetlands management.	Maintains GHG sequestration values as well as enhances opportunities for species diversity and habitat transition over time in response to sea level rise. Provides opportunities for migration of coastal and wetland species that will be adapting to sea level rise. Also encourage restoration of site hydrology by filling mosquito ditches, road removal and removal of culverts.	1. Research and review key policies for incorporation into Comprehensive Plan and Code. 2. Provide recommendations for revisions in EAR, Comprehensive Plan and Code.	Staff time to integrate into development of EAR and Comprehensive Plan.
HAB 4.0: Assure recommendations from the SCP are incorporated into planning strategies for Boot Key.	Maintains GHG sequestration values.	Integrate SCP recommendations into Boot Key Planning processes as applicable. Most of the recommendations are already consistent with the City's Comprehensive Plan goals, objectives and policies to for the acquisition and protection of Boot Key.	Staff time to integrate SCP recommendations into Boot Key Planning process as relevant.

7.7 Outreach and Education

While this Plan identifies many potential policies and strategies addressing specific Focus Areas such as Energy Use, successful implementation of the SCP will ultimately hinge on the community's awareness and willingness to take action. The City already has an ecologically minded citizenry. Education and outreach efforts should integrate with, and build upon, existing outreach efforts through networks and partnerships, focus on building long-term leadership and capacity in the community and provide incentives and recognition for outstanding efforts. FKEC is a prime example of how these relationships are already occurring and can be expanded and more formalized.

The City can greatly advance the residents' awareness of what is happening in the community and opportunities for them to contribute by helping to identify existing local efforts and initiatives and publicizing the efforts and contributions of local individuals. The following identify key strategies the City can adopt to encourage and support education and outreach efforts that were offered during the public outreach process (and through researching other Plans):

Case Study: "Low Carbon Diet: A 30 Day Program to Lose 5000 Pounds" by David Gershon is a fun, accessible, easy to use guide that will show you, step-by-step, how to dramatically reduce your CO2 output in just a month's time. By making simple changes to actions you take every day, you'll learn how to reduce your annual household CO2 output by at least 15%.

- Demonstrate early visible successes so the community can visually connect to the SCP initiatives and actions.
- Use City events to disseminate information about the Plan and its goals.
- Develop strategies to get to landlords of buildings for rental community and seasonal residents.
- Promote and showcase the positive "green" "sustainable" actions the City is taking as part of the SCP.
- Develop "Rewards" or "Recognition" programs to feature home and business owner success stories on City's website and in utility bills.
- Complete a brief "sustainability report" to the Council or semi-annual basis. Annually review and report on progress made towards achieving goals.
- Develop a social marketing campaign on Facebook and City blogs for specific energy/sustainability initiatives.
- Promote a Marathon "Climate Action Pledge" as a means by which individuals can commit to reducing their own emissions. The "pledge" is a non-binding means of securing individual commitments to achieving some of the goals in the SCP. Individuals who sign the pledge can periodically receive helpful action ideas for how to fulfill their commitment. The City and its community partners should continue to promote the pledge and work to enhance the climate-related resources and information that individuals have access to once they have made their commitment.
- In collaboration with community partners, launch a "Green Neighborhood Challenge" and "Green Star Household" program. The challenge could utilize friendly competition and recognition as motivators for action. The "Low Carbon Diet" program could serve as the guide for neighborhood- level climate protection activities.
- In partnership with the Marathon and Lower Keys Realtor's Association and the Greater Marathon Chamber of Commerce, design a "welcome package" for new homeowners and

business owners that includes resources related to energy use, transportation choices, and waste diversion and reduction.

8 Success, Challenges and Opportunities

8.1 Tracking Success (Monitoring, Reporting and Updating)

While certain investments can be distilled to a return on investment, others are not as quantifiable. But, Annual Monitoring and Reporting on the Plan's progress provides a transparent process to continually quantify the benefits of implementation. The Team is recommending several alternatives to annually monitor and track progress towards success in SCP implementation. Those alternatives are discussed in an Appendix to this Plan which includes a template for a "report card" to annually report on success of the Plan. It is recommended that this reporting take place at the beginning of the City's annual capital planning and budgeting process to assure all opportunities for Plan success are realized.

8.2 Challenges for Implementation

The benefits of saving money on energy and reducing GHG emissions are in addition to other societal benefits associated with these actions, such as reduced local air pollutants, improved public health due to more active mobility modes, less reliance on fossil fuels, and an increased demand for energy services and green jobs. Implementing the SCP also requires sustained, strategic commitment by the City, and resources from other levels of government. Committing to integrate the recommendations from the SCP into the City's existing decision-making process and grant funding will play an important role in helping to provide the education and outreach, services, incentives and capital projects that are needed to achieve the plan's goals.

A key challenge for implementation of any Plan of this kind is continued political leadership and stakeholder support. One way to maintain that support is the implementation of the Monitoring, Reporting and Updating strategies outlined in the appendices and continuing to educate the community about the successes and benefits (cost savings and lowered energy use) through the City's website.

8.3 Opportunities to Achieve Goals

The City has many opportunities to reach out to other local governments to learn from their successes in implementing sustainability strategies. For instance, as mentioned previously, the City has a good opportunity in retrofitting its fleet. According to City data, seven (7) vehicles are planned for replacement in the next two (2) years and could be prioritized for alternatively fuel technologies. The benefits of these conversions or compatible vehicles to run on biodiesel or waste vegetable oil are already mentioned, but the City can weigh the cost-benefit with the potential review of replacing these seven (7) vehicles. Most new diesel cars and trucks are built so that they can work with up to a certain biodiesel rating. While the real value of biodiesel is not found in how much mileage it gets, there is a tremendous gas mileage savings over traditional unleaded gasoline engines. When compared to a gas engine, a biodiesel engine will save the driver up to $2,000 a year. According to the U.S. Environmental

Protection Agency (EPA), B-20 biodiesel blend cuts unburned hydrocarbons by 20 percent, carbon monoxide by 12 percent, and particulate matter by 12 percent, compared to conventional diesel. Biodiesel operates in conventional diesel engines with few, if any, modifications and is distributed using today's infrastructure, enabling fleets to keep spare parts' inventories, leverage central fueling stations, and utilize skilled diesel mechanics, which keeps costs low. The Department of Energy has the Alternative Fuels and Advanced Vehicles Data Center (AFDC) which provides information, data, and tools to help fleets and other transportation decision makers find ways to reduce petroleum consumption through the use of alternative and renewable fuels, advanced vehicles, and other fuel-saving measures.[xxxvi]

Another opportunity the City has is to strengthen and formalize its relationship with FKEC. Given FKEC's progressive programs and commitment to green energy sources, the City through this partnership could explore creative financing mechanisms to incorporate photovoltaic or thermal photovoltaic projects to provide power for its own initiatives. Additionally, advanced in technology can be part of this dialogue. For instance if the City wanted to include electric vehicle charging stations in its new City Hall, the partnership could assess the viability of using PV panels to power an electric vehicle charging station. There are tools to assist with that assessment process.[xxxvii]

8.3.1 Funding

While the current fiscal crisis and limited growth hamper government investment in energy efficiency and sustainability programs, many cities and counties are nevertheless implementing economical programs to continue progress toward their environmental goals. Cities and counties can use low-cost tactics and strategies to build and maintain momentum in their sustainability programs. To address funding issues, the Team looked for opportunities to identify new funds such as grants or create programs that self-generate revenue that can be targeted to implement more initiatives of the SCP.

City Leadership must recognize and be willing to accept the fact that while programs to increase energy efficiency or sustainability are cost effective in the long-run, they may divert resources away from other policy priorities in the short-run. For instance many of the code recommendations can be implemented a minimal expense by reviewing other jurisdictions' green building code language, application checklists, and other permitting and enforcement procedures.

The 2011 SCP actions will be funded using the following funding sources: existing operating department budgets, federal and state grant funding, and cost sharing and partnerships. Due to budget challenges, the initiatives are generally limited to what the City can do with existing resources. In some cases, the funding source is identified in the action step.

The Team has already completed a preliminary evaluation of grant programs available over the last year to help prioritize some potential grant opportunities for the City (attached as an Appendix).

8.4 Estimated Cost

The emission of GHGs and their associated impact on global climate change presents policymakers with extensive technical, economic and policy challenges. Different GHG reduction measures have different costs. Some measures are economical; the adoption of such a measure should occur regardless of its GHG reduction benefits. Energy efficiency measures generally fall into this category because the energy savings are sufficient to more than pay for the cost of the measure. Any additional direct benefits, such as a reduction of GHG, would only make that measure even more cost-effective.

Other measures have costs that exceed the narrowly defined economic benefits before their impact on GHG emissions and other co-benefits are accounted for. For instance, reduced emissions should translate into lower increases in global temperatures and should therefore lower the net economic and other costs associated with global climate change. Other benefits may also occur that are not related to global climate changes, such as reductions in other air emissions or improved flood control.

Bottom line costs associated with this SCP are widely speculative, but at this time would include capital costs associated with the remaining energy conservation measures. But the following are important to consider:

- The remaining projects from the Performance Audit are approximately $60,000 with payback periods of anywhere from 4 to 13 years.
- If the City converted all of its 14,590 gallons of diesel fuel use (stationary and mobile use) to biodiesel it could see a cost savings of approximately $8,800/year in fuel costs.[11] By purchasing vehicles that can run off of biodiesel mixes in the next replacement cycle (2014-2015), the City could begin experiencing these cost savings immediately. The City could also convert existing vehicles to run from waste vegetable oil, but the cost savings would have to be offset by the average cost to convert the vehicle ($2,500). Biodiesel retrofit costs are minimal to none depending on the age of the vehicle and the biodiesel mix utilized.
- Cost savings from the integration of renewable energy technologies to power City buildings and infrastructure are highly variable depending on financing approach and power output, but FKEC could assist with helping to analyze the costs and benefits of solar projects for the City.

[11] Cost savings estimated at $3.75/gallon of biodiesel and $4.35/gallon of diesel.

Appendix A: Implementation Strategy & Monitoring

In developing the SCP, it is clear that the perception could be that the Plan requires a new financial or staffing "commitment" for implementation. Recognizing that financial resources are constrained, as are staffing resources, the Team has worked to incorporate implementation of the SCP into the City's existing policy and decision-making process the City already employs. The SCP creates no new "process" for implementation in reality. It does not take a new financial commitment to achieve progress towards the goal and recommendations in the SCP. It does take a paradigm shift in the City's mindset to integrate the principles in this document into every day decisions and "look" for opportunities to implement the recommendations through grants, partnerships, revisions to policies and procedures and new strategic thinking.

The City's Evaluation and Appraisal Report ("EAR") is scheduled for completion by August 1, 2012 and these recommendations should be folded into that process thus setting the stage for incorporation in the City's Comprehensive Plan updates which would occur after the EAR is finalized. Since the City's Code of Ordinances implements the Comprehensive Plan, the concept is that the recommendations in the SCP would be folded into that process from EAR, to Comprehensive Plan to Code revisions as that process takes place.

The Team is recommending a two-pronged approach to monitoring to report on SCP successes and challenges annually. The first approach is to utilize a free benchmarking tool such as EPA's Portfolio Manager to integrate existing data to establish a baseline.[xxxviii] The spreadsheets utilized to formulate the GHG Inventory and targets for the SCP, as well as the Performance Audit data, are easily compatible with this tool with some level of effort in the beginning to transfer the data. This could be accomplished through City staff or if resources are completely unavailable an internship project could be designed and offered to students at Florida Keys Community College. The Colleges Strategic Plan is looking at certification offerings in the sustainability field.

Monitoring will take place with a two-pronged strategy: utilizing a tool that monitors annual energy use and use of an annual reporting "template".

Additionally, the Team is providing a recommended template for annual reporting so that the City can provide updates to the community and City's leadership.[xxxix] This Annual Report should occur at the beginning of the City's budgeting and capital planning process to incorporate all opportunities to integrate SCP recommendations into that process. With this two-pronged approach the City will be able to report and track both quantifiable reductions towards its own GHG reduction goals as well as determine if it is meeting date specific recommendations such as integration of the SCP recommendations with planning initiatives or creating new partnerships with FKEC and exploring grants or renewable energy project opportunities.

For instance, the template would include the following information

Strategy	*Potential Benefits*	*Action Steps*	*Status of Strategy*
LUT 1.0: Encourage and incentivize land uses and density to facilitate development and redevelopment opportunities linked to transit. *Completed 10/01/12*	To the extent that the City can do this in its development approval process, it would be beneficial to promote the linkage between development projects and transportation options. This could be especially applicable for the additional allocation of NROGO units the City has received. Benefits are indirect.	1. Review ROGO and NROGO application process to determine if there are opportunities to incentivize these linkages. 2. Based on analysis prepare required Comprehensive Plan or Code changes.	**The City staff analyzed ROGO and NROGO criteria to determine if revisions could reward integration of transit stops, bicycle racks and priority parking of alternatively fueled vehicles. This strategy should be incorporated into NROGO but will yield little benefit for residential projects.** City staff have determined that no Code or Comprehensive Plan changes are necessary to implement this strategy.

Or alternatively, the Annual Report could "code" progress towards achieving the Strategy:

Strategy	*Potential Benefits*	*Action Steps*	*Cost (if Applicable)*
IWR 1.0: Determine cost benefit of increasing enforcement of grease trap inspections and requirements. *Status: In process.*	Large amounts of oil and grease in the waste water can cause sewer lift station failures, wastewater treatment plant problems and other issues which can cost money in terms of operations and maintenance costs.	1. Determine levels of staffing needed to enforce inspections and violations. 2. Determine if fees collected offset increased enforcement.	Increased staff time, increased staff duties or a new part time of full time employee to enforce regulations (among other duties).

This final Plan will include a recommended format / template for Annual Reporting.

Appendix B: Comprehensive Plan and Code Recommendations

Appendix C: Potential Grant Resources

Appendix D: Greenhouse Gas Inventory

[i] http://fl-monroecounty.civicplus.com/Files/AgendaCenter/Items/389/L4_201111071103201847.pdf

[ii] U.S. Energy Information Administration, AEO2012 Early Release Overview, http://www.eia.gov/forecasts/aeo/er/early_prices.cfm

[iii] Each GHG has active radiative (or heat-trapping) properties. To compare GHGs emissions from different sources, they are indexed according to their global warming potential. Global warming potential (GWP) is the ability of a GHG to trap heat in the atmosphere relative to an equal amount of carbon dioxide. According to the Intergovernmental Panel on Climate Change (IPCC), over a 100-year time span carbon dioxide (CO2) assumes the value of 1. The two other GHGs of importance in this analysis are methane (CH4) and nitrous oxide (N2O) which, according to a re-evaluation of the IPCC in 2001, take a value of 23 and 296 respectively. Prior to 2001 the IPCC has assumed a 100 year GWP of 21 and 310 for CH4 and N2O respectively, which may explain for some minor differences in the results of studies preceding 2001. Daniel Weisser, "A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies".

[iv] Citation.

[v] http://www.icleiusa.org/action-center/planning/ICLEI_What%20Is%20a%20Sustainability%20Plan.pdf

[vi] LGO Protocol, 2010.

[vii] WRI/WBCSD, 2004.

[viii] http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/vulnerability.pdf

[ix] http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/climateflkeys_main.pdf (pp 111-116)

[x] The average temperature of 51.1°F was 8.6 degrees above the 20th century average for March and 0.5°F warmer than the previous warmest March in 1910. Of the more than 1,400 months (117+ years) that have passed since the U.S. climate record began, only one month, January 2006, has seen a larger departure from its average temperature than March 2012. National Oceanic and Atmospheric Administration, National Climatic Data Center.

[xi] Initial Estimates of the Ecological and Economic Consequences of Sea Level Rise on the Florida Keys through the Year 2100

[xii] http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/climateflkeys_main.pdf

[xiii] While some scientists have attempted to link this increase to anthropogenic global warming, others have pointed out that Atlantic hurricanes exhibit long-term cycles, and that this latest upswing is simply a return to conditions that characterized earlier decades in the 20th century. Ferguson, Robert. Hurricane Threat to Florida Climate Change or Demographics? (2007).

[xiv] http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/climateflkeys_main.pdf

[xv] http://www.epa.gov/climatechange/effects/health.html

[xvi] Ecological Impacts of Climate Change (2009), a report by an independent panel of experts convened by the National Research Council.

[xvii] The Nature Conservancy. Initial Estimates of the Ecological and Economic Consequences of Sea Level Rise on the Florida Keys through the Year 2100

[xviii] Ceres, CLIMATE RISK DISCLOSURE BY INSURERS: Evaluating Insurer Responses to the NAIC Climate Disclosure Survey (2011).

[xix] http://www.gao.gov/new.items/d07285.pdf

[xx] The Planning Response to Climate Change Advice on Better Practice, September 2004, CAG Consultants, London Oxford Brookes University, Oxford, Office of the Deputy Prime Minister: London

[xxi] IPCC Fourth Assessment Report: Climate Change 2007.

[xxii] *Id.*

[xxiii] *Id.*

[xxiv] CLIMATE CHANGE ADAPTATION IN IPCC AND KYOTO PROCESSES

[xxv] Council on Environmental Quality "CEQ" 2010.

[xxvi] The USGCRP began as a presidential initiative in 1989 and was mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606), which called for "a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change."

[xxvii] *Massachusetts v. Environmental Protection Agency*, 549 U.S. 497 (2007).

[xxviii] Patricia E. Salkin, Sustainability and Land Use Planning: Greening State and Local Land Use Plans and Regulations to Address Climate Change Challenges and Preserve Resources for Future Generations, 34 Wm. & Mary Envtl. L. & Pol'y Rev. 121 (2009), http://scholarship.law.wm.edu/wmelpr/vol34/iss1/4.

[xxix] Pursuant to Title 40, Code of Federal Regulations, Part 123.35 and Rule 62-624, Florida Administrative Code.

[xxx] http://fl-monroecounty.civicplus.com/Files/AgendaCenter/Items/389/L4_201111071103201847.pdf

[xxxi] Energy Performance of LEED® for New Construction Buildings, FINAL REPORT March 4, 2008

[xxxii] Biodiesel Vehicle Fuel: GHG Reductions, Air Emissions, Supply and Economic Overview DISCUSSION PAPER C3 – 015http://www.climatechangecentral.com/files/attachments/DiscussionPapers/015Biodiesel_Discussion_Paper.pdf

[xxxiii] The Low Impact Design Center is a very good resources for Green Streets criteria. http://www.lowimpactdevelopment.org/greenstreets/

[xxxiv] http://lauderdalefishing.com/2011/03/s-e-florida-fishing-line-recycling-bins/

[xxxv] Florida Coastal and Ocean Coalition, "Preparing For A Sea Change In Florida" (2008).

[xxxvi] http://www.afdc.energy.gov/afdc/

[xxxvii] http://mnrenewables.org/EVplusPV

[xxxviii] http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

[xxxix] Baltimore's Annual Report is a good model for a template:
http://cleanergreener.highrockhosting2.com/uploads/files/AnnualReport.2010.ForWeb.pdf