



**BROWARD COUNTY COMMUNITY-WIDE  
GREENHOUSE GAS  
EMISSIONS INVENTORY**

**For 2007**

**January 1 – December 31, 2007**



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## EXECUTIVE SUMMARY

Reducing greenhouse gas (GHG) emissions is an important component of Broward County's overall commitment to a healthy, sustainable environment. The Broward County Board of County Commissioners (Board) has taken many steps in the development of programs and policies to support climate protection, energy conservation and GHG reductions. On June 24, 2008 the *Broward County Government Operations Climate Change Report* was accepted by the Board. Emissions from government operations is a small fraction of the total community emissions and subsequently the Board approved Resolution 2008-442 (Appendix 1) creating a Climate Change Task Force to develop recommendations for a coordinated county-wide strategy in mitigating the causes, and addressing the local implications, of global climate change. On November 13, 2008, the Board adopted Resolution 2008-822 establishing a GHG reduction target of eighty percent below the current year (2007 emissions inventory) by 2050, and Resolution 2008-823 authorizing membership in the International Council for Local Environmental Initiatives (ICLEI) and supporting the Cities for Climate Protection Campaign. Broward County is following ICLEI's Five Milestones Process for the development of a community-wide action plan.

The inventory of community-wide GHG emissions is a critical step in this framework and will help in developing Broward County's climate action strategy. This community-wide inventory provides the basis for completing other elements of a climate action plan, including the establishment of a numerical reduction target and the development of specific strategies to help achieve emissions reduction goals. This 2007 inventory will serve as the foundation for measuring the success of regional efforts to reduce emissions, and provide the basis for identifying improvements in the regional strategy, as needed.

Broward County community-wide GHG emissions were analyzed within the Residential, Commercial, Industrial, Transportation, Waste and Other sectors using ICLEI methodology and Clean Air Climate Protection (CACCP) software. During calendar year 2007, the Broward community as a whole emitted approximately 22,366,933 metric tons (tonnes) of eCO<sub>2</sub> (Figure ES1) or 12.8 tonnes of eCO<sub>2</sub> per capita (a "tonne", which is approximately 2,200 pounds, is used in this inventory to be consistent with standard practice). This total is projected to increase to 25,896,479 tonnes eCO<sub>2</sub> by 2020. Broward County has a relatively low level of per capita emissions compared to

the State of Florida and the nation; the 2007 per capita GHG emissions are approximately 67% of the states, and about 65% of the nation's per capita GHG emissions<sup>1</sup>.

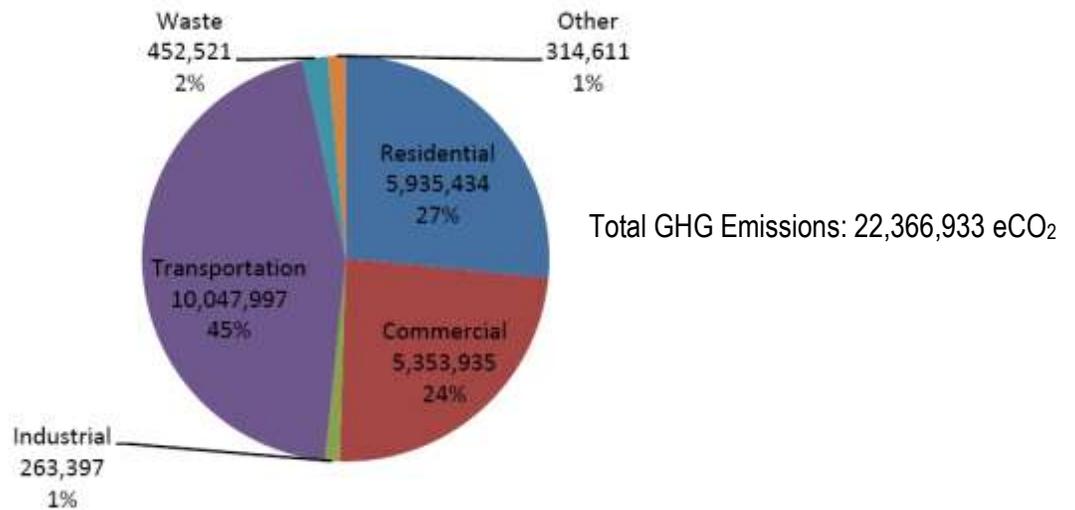


FIGURE ES1: BROWARD COUNTY'S 2007 COMMUNITY-WIDE GHG EMISSIONS

About 45% of Broward County's current GHG emissions are related to the use of gasoline and diesel fuel in the Transportation sector. The next largest source of GHG emissions is the Residential sector, which accounts for 27% of total emissions, due primarily to the use of electricity. Residential sector is followed by the Commercial sector which contributes 24% of community-wide GHG emissions. The remaining GHG sources total less than 4% of the GHG emissions and include Waste, Industrial, and Other (Appendix 5). The Other sector represents emissions from airplanes in Broward County. Combined Residential, Commercial and Transportation activities within Broward County create almost 96% of total community emissions. Refer to Table ES1 for GHG emission inventory results for 2007. For 2007, GHG emissions from Broward County government operations account for only one percent of the total community-wide emissions.

<sup>1</sup>State of Florida 2005 per capita GHG emissions was 19 metric tonnes for a population of 336.6 million according to the Florida Energy and Climate Change Report released in October 2008. The U.S. per capita GHG emissions for 2007 according to the Energy Information Administration was 19.7 metric tonnes.

TABLE ES1: BROWARD COUNTY COMMUNITY-WIDE GHG EMISSIONS INVENTORY RESULTS FOR BASELINE YEAR 2007

Source Category	Equivalent CO <sub>2</sub> (tonnes)	Percent of Total eCO <sub>2</sub>	Energy (kWh)
Residential	5,935,434	27	11,149,533,484
Commercial	5,353,935	24	10,613,730,663
Industrial	263,397	1	994,439,678
Waste	452,521	2	NA
Transportation	10,047,035	45	37,860,245,221
Other (Airplanes)	314,611	1	NA
<b>Total</b>	<b>22,366,933</b>	<b>100</b>	<b>60,617,949,045</b>

The inventory includes information on the majority of emissions from energy use, transportation, waste, and aircrafts but due to software and data limitations, excludes emissions from other sources such as agriculture, lawn equipment, recreational marine vessels and commercial vessels. The technical team will evaluate other models to incorporate these categories in future studies.

The CACP model allows for GHG emissions projections up to 2020. Projections for the year 2020 were estimated based on best metrics as suggested by a combination of the ICLEI CACP software and the agencies providing data for each source category. The 2020 GHG projections reflect a business as usual scenario in the absence of emission reduction actions. The results are summarized in Figure ES2.

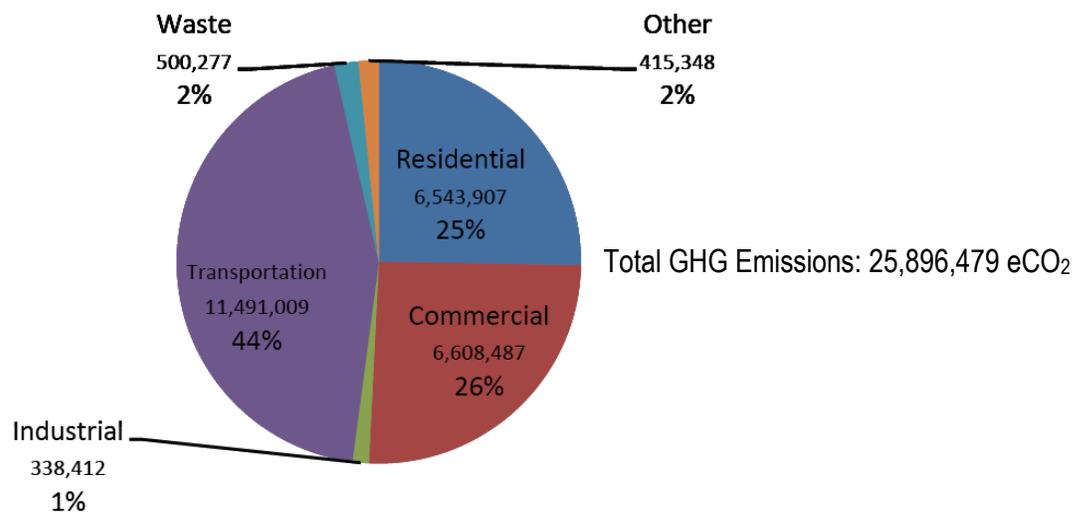


FIGURE ES2: BROWARD COUNTY'S 2020 COMMUNITY-WIDE GHG EMISSION BY SECTOR

On November 13, 2008, the Board adopted Resolution 2008-822 establishing a GHG reduction target of eighty percent below the current year (2007 emissions inventory) by 2050, and Resolution 2008-823 authorizing membership in the International Council for Local Environmental Initiatives (ICLEI) and supporting the Cities for Climate Protection Campaign. Figure ES3 illustrates the current year emissions inventory, 2020 GHG emissions projection with the business as usual scenario, and the reduction target of 80% below current year.

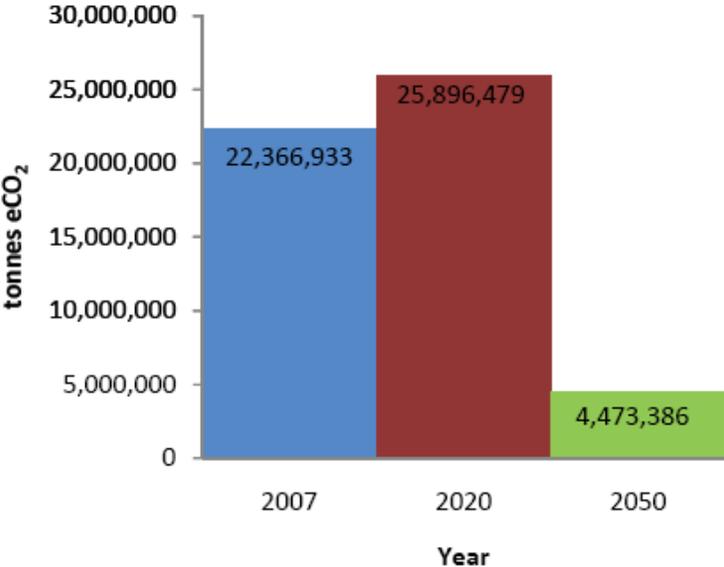


FIGURE ES3: 2007 BASE YEAR, 2020 PROJECTIONS, AND 2050 REDUCTION TARGET

Understanding the overall distribution of Broward County’s GHG emission sources provides information on the relative importance of different activities as sources of GHG emissions. Knowing the specific sources and activities related to GHG emissions in the community will establish a basis for guiding emission reduction strategies, and measuring and tracking progress.

## ACKNOWLEDGEMENTS

Broward County would like to thank the following businesses and organizations that provided data and support in the preparation of the Broward County community-wide greenhouse gas emissions inventory: Broward County's Planning Council, Broward County Metropolitan Planning Organization, Broward County Planning and Redevelopment Division, Broward County Waste Regulation Section, Broward County Waste and Recycling Services, Broward County Air Quality Licensing and Compliance Section, Broward County Office of Public Communications, Broward County Aviation Department, Florida Power & Light, TECO Peoples Gas, Florida City Gas, Florida Department of Transportation, Florida Public Service Commission, Tri-Rail, Amtrak, CSXT, Florida East Coast Railway, Federal Aviation Administration, Fort Lauderdale Executive Airport, Pompano Beach Airpark, and the International Council for Local Environmental Initiatives.

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# Broward County Community-wide Greenhouse Gas Emissions Inventory For 2007

## BACKGROUND INFORMATION

### Broward County

Global climate change is projected to raise Florida's average air temperatures between 4 and 10 degrees Fahrenheit over the next 100 years. Heat waves are likely to become more severe and more common, with new record temperatures and a gradual decline in nighttime cooling. As summers get hotter due to climate change, the urban environment will amplify these effects, unless changes are made<sup>2</sup>. Because Southeast Florida is highly urbanized, there is a lot of concrete absorbing and radiating heat, and fewer green, open areas to offset sweltering summer temperatures. The summer heat index, projected to increase between 8 and 15 degrees Fahrenheit, could be the greatest overall increase in the nation.

Broward County is among the largest of Florida's counties with a total area of 1,196.9 square miles (Figure 2). Despite its large size, 66% of the county is a conservation area. The bulk of the population lives in the 410 square miles east of the conservation area, making Broward County one of the most densely populated counties of Florida. In 2007, the population of Broward County was 1,765,707. In addition to this permanent population, nearly 91,000 part-time residents are present within Broward County at the peak of its "season," and more than 9,000,000 tourists visit the County annually<sup>3</sup>.

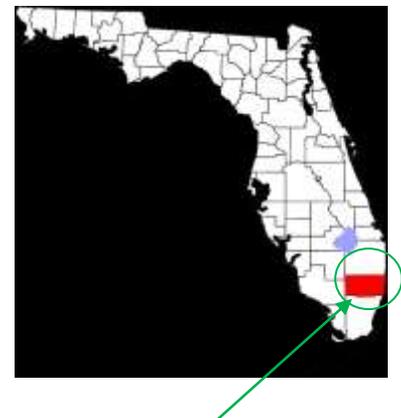


FIGURE 1: BROWARD COUNTY, FLORIDA

<sup>2</sup> South Florida Regional Planning Council, Climate Change Community Toolbox, 2008

<sup>3</sup>Source: Broward County Planning Council, Setting for Countywide Planning

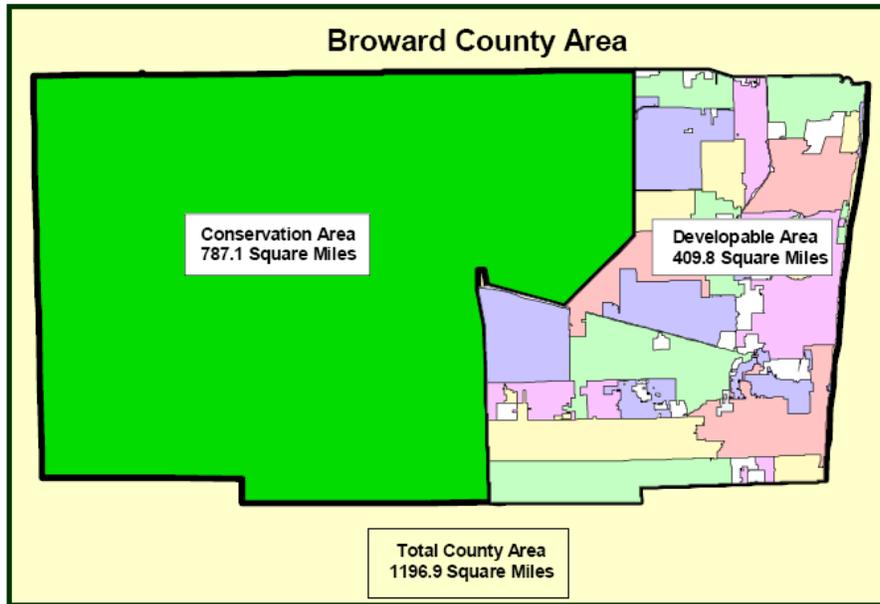


FIGURE 2: BOUNDARY MAP OF BROWARD COUNTY FLORIDA WITH MUNICIPAL BOUNDARIES

There are 31 municipalities within Broward County, each exhibiting different land use, population and development characteristics. These municipalities vary in size from 13 acres (Lazy Lake) to more than 32 square miles (Davie and Pembroke Pines). Their populations vary, from 32 (Lazy Lake) to approximately 167,000 (Fort Lauderdale). Unincorporated Broward County, with land area dispersed throughout the County, encompasses approximately 16 square miles (outside the conservation area).

Reducing greenhouse gas (GHG) emissions is an important component of Broward County's overall commitment to a healthy, sustainable environment. The Broward County Board of County Commissioners (Board) has taken many steps in the development of programs and policies to support climate protection, energy conservation and GHG reductions.

On June 12, 2007, the Board adopted Resolution 2007-391 to reduce GHG emissions in Broward County and in support of the U.S. Mayors' Climate Protection Agreement. This resolution establishes the Board's commitment to climate change protection and initiates the planning and implementation of related measures. Following adoption of this resolution Broward County created a Climate Change Government Operations Workgroup to, 1) compile an inventory 2) develop an action plan, and 3) provide recommendations on GHG reduction strategies for government operations. On June 24, 2008 the *Broward County Government Operations Climate Change Report* was accepted by the Board. Recognizing the need for a coordinated regional approach in addressing the challenges of climate

change for all Broward County, the Board created a regional Climate Change Task Force (Task Force) under Resolution 2008-442 (Appendix 1) tasked with the development of recommendations for a coordinated countywide strategy in mitigating the causes, and addressing the local implications, of global climate change.

The Task Force consist of 25 members appointed by the Board and representing: Broward County Government, at-large members appointments of the County Commission, Broward County School Board, Broward League of Cities, Water Advisory Board, Hospital Districts in Broward County, Broward Sheriff's Office, South Florida Water Management District, academic institutions, environmental organizations, Florida Power and Light, Florida Department of Transportation, South Florida Regional Planning Council, and business and economic interests in Broward County.

The Task Force's duties and responsibilities are outlined in Resolution 2008-442. They include:

- development and implementation of projects that conserve energy and reduce GHG emissions within government operations;
- development of incentives for residents, businesses and organizations to conserve energy and reduce GHG emissions;
- development and implementation of adaptation strategies to alleviate the likely adverse consequences of climate change including rising sea levels, hurricanes and other violent weather events;
- provision of education and outreach to encourage Broward County residents, businesses, and organizations to participate in the program;
- pursuit of federal and state grants, energy costs savings and other financial resources to offset program costs; and
- coordination with the Board, the School Board, municipalities, other governmental agencies, business, private and public organizations, and the state of Florida in the adoption of programs to reduce GHG emissions in a cost-effective and efficient manner that preserves the County's competitiveness in the national and worldwide economy.

## Cities for Climate Protection

On November 13, 2008, the Board adopted Resolution 2008-823 authorizing membership in the International Council for Local Environmental Initiatives (ICLEI) and supporting the Cities for Climate Protection Campaign (CCPC).

By early 2009, over 1052 local governments from 61 different countries had joined the ICLEI and over 800 local governments had joined ICLEI's CCPC. Over 500 of these were from the United States. ICLEI's mission is to build, serve and drive a movement of local governments to advance deep reductions in greenhouse gas emissions and achieve tangible improvements in local sustainability. ICLEI provides valuable tools and resources to local governments to enhance the quality of the regional efforts and a framework to guide the climate change process that consists of five milestones (Figure 3).

### The 5 Milestone Process



FIGURE 3: ICLEI'S 5 MILESTONES PROCESS

As described by ICLEI the five milestones include:

Milestone 1. *Conduct a baseline emissions inventory and forecast.* Based on energy consumption and waste generation, the governing agency calculates greenhouse gas emissions for a base year (e.g. 2000) and for a forecast year (e.g. 2015). The inventory and forecast provide a benchmark against which the area can measure progress.

Milestone 2. *Adopt an emissions reduction target for the forecast year.* The governing agency establishes an emission reduction target for the area. The target both fosters political will and creates a framework to guide the planning and implementation of measures.

Milestone 3. *Develop a Local Action Plan.* Through a multi-stakeholder process, the governing agency develops a Local Action Plan that describes the policies and measures that the local government will take to reduce GHG emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct GHG reduction measures, most plans also incorporate public awareness and education efforts.

Milestone 4. *Implement policies and measures.* The governing agency implements the policies and measures contained in their Local Action Plan. Typical policies and measures implemented by CCPC participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.

Milestone 5. *Monitor and verify results.* Monitoring and verifying progress on the implementation of measures to reduce or avoid GHG emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be use to improve the measures over time.

This Broward County community-wide GHG emissions inventory represents the completion of ICLEI's milestone number one. This inventory will be used by policy makers to track GHG emission trends, develop strategies and policies, and assess progress.

# METHODOLOGY

## Introduction

Broward County's Community-wide GHG emissions inventory captures emissions from all community-related activities (e.g. residential, commercial and industrial buildings, transportation, waste and other sources of GHG emissions including airplanes). The inventory defines a baseline community-wide emissions level that serves as a benchmark against which the County can measure progress.

The technical team used the same software and methodology used in developing the Broward County Government Operations baseline. Broward County's community-wide inventory followed the International Emissions Analysis Protocol developed by ICLEI and Clean Air and Climate Protection (CACP) Software User's Guide. Data from calendar year 2007 (the baseline year) was gathered from the six source categories that produce the majority of community-level emissions: residential buildings, commercial buildings, industrial buildings, transportation sources, waste disposal, and other (which include airplanes at county airports). Contact information for community-wide providers of data for GHG emission sources by source categories are listed in Appendix 2. The year 2007 was selected as the baseline based on the most current data available. The CACP software applies fuel and sector-specific GHG and criteria air pollutant emission factors to inputs of energy use or waste generation to determine GHG emissions. The CACP software converts all GHG emissions data to the equivalent value in CO<sub>2</sub> (eCO<sub>2</sub>) in order to report the information. The focus of the community-wide GHG emissions inventory is on activities that directly produce GHG emissions, and are generally based on direct consumption of energy. It is these types of local activities that can most effectively be addressed and measured by community-level emissions reductions strategies. As a result, the methodology used for this inventory does not currently include energy embedded in consumer goods from outside the community, nor does it include the potential for capture and storage of carbon by living plants (i.e., biomass sequestration).

Geographic boundaries for the inventory were chosen to correspond to those defined in the Florida State Organization Code Section 7.06- County Boundaries – Broward County, Florida (refer to Appendix 3).

### **Community-wide Greenhouse Gas Emissions Inventory Model**

The CACP Software's Community-wide Analysis module was used to develop the GHG emissions inventory and forecast. The software defines six different major emission source categories: Residential, Commercial, Industrial,

Transportation, Waste, and Other. The CACP Software calls these categories “sectors”. For purposes of this inventory, we will call them “source categories” of GHG emissions.

### **Software Limitations and Uncertainty**

This inventory has the following limitations:

- Software Limitations: The CACP model provides for a projection year of up to 2020. ICLEI will be releasing new software in the summer of 2009 that will allow for projections up to 2050.
- Methodology and Data Limitations: Emissions from sea-faring vessels, recreational watercraft, fuel-powered lawn equipment, construction equipment, farming equipment, off-road motor vehicles, agricultural activities, deforestation, prescribed burns, and other direct emissions were not included due to difficulties in collecting operational data and lack of methodology associated with these categories.

The CACP Software provides a template and guidance useful in estimating GHG emissions, however, the software has limitations. The most relevant being, it requires the input of specific data. Some of the data required is not available from service providers; therefore, assumptions and estimations are required to generate the data inputs required by the software. In addition, other sectors of GHG sources and sinks are not included in the CACP model due to data limitations and uncertainties. All assumptions and estimates are detailed in this document and its Appendices.

### **Units**

Because GHGs are pollutants of global concern, common practice is to present quantities in metric units. In this emissions inventory, all values of GHG emissions and sequestration are reported in metric tons (tonnes, 1.102 tons) of carbon dioxide equivalent (eCO<sub>2</sub>). Equivalent means that any non-CO<sub>2</sub> gases included in the total were weighted by their Global Warming Potential (GWP). Table 1 lists the GWP of each gas. The GWP indicates the mass units of carbon dioxide that affects the same amount of global warming as one mass unit of that gas. The higher the GWP, the more potent the GHG. For instance, the GWP of methane is 21, so it requires 21 kilograms of carbon dioxide to produce the same global warming potential as just one kilogram of methane.

*Table 1: Global Warming Potential of Greenhouse Gases (in Kg)*

<b>gas</b>	<b>chemical formula</b>	<b>GWP</b>
carbon dioxide	CO <sub>2</sub>	1
methane	CH <sub>4</sub>	21
nitrous oxide	N <sub>2</sub> O	310

### **Audit Trail**

The Audit Trail will be of little interest to most readers, but it will assist the technical team in future updates. All data relating to the 2007 community-wide emissions inventory, emission data from source categories, population data, and projections resides in the internal Broward County server directory (*G:\AIR\Climate Change\COUNTYWIDE CLIMATE CHANGE TASKFORCE\Community GHG Emissions Inventory*).

The data source files are updated as new data is received from data providers. The source files contain terminology and definitions for the data categories. These files contain the data inputs used and entered in the software. These are the main files as they are the master spreadsheets of all data input. The CACP database files are backed-up daily on the Broward County's internal network H: drive of the computer in which the database is installed.

### **Quality Assurance**

To ensure accuracy and completeness of the emissions inventory, the following quality assurance and quality control procedures were used:

1. Verification of data completeness of each source category and data set;
2. Identification and adherence to the guidelines provided by the CACP Software User's Guide and the International Emission Analysis Protocol;
3. Verification of CACP data inputs; and
4. Accurate documentation of data collected and respective reference source information.

### **Operator's Notes**

Throughout this inventory, a section titled *Method Details* contains operator notes about the data used to generate the inventory. *Method Details* describe data source information and methods used for operating the software during emissions calculations. The *Method Details* will be of little interest to most readers, but they will assist other operators assembling future inventories and provide convenient entryways for potential inventory auditors. For example, the first *Method Detail* below contains general notes applicable to all phases of the inventory for the residential, commercial, and industrial sectors.

## 2007 Community-Wide Baseline Methodology

In order to generate the 2007 community-wide baseline GHG emissions inventory, the technical team identified all data providers in the Broward County community, i.e., Florida Power and Light, and requested that they provide calendar year 2007 data needed for the CACP Software Community Analysis module. As previously mentioned, the community-wide analysis module identifies several source categories of GHG emissions. Data providers were asked to submit source category information/data which the software utilizes to calculate a baseline emissions inventory.

### **Method Details:**

**RESIDENTIAL, COMMERCIAL AND INDUSTRIAL BUILDINGS:** The key information needed for these source categories is fuel and energy consumption. GHG emissions from energy consumption are calculated based on emissions coefficients which specify the amount of GHGs per unit of energy. The coefficients are standard for different fuel types, but vary for electricity consumption depending on the annual average mix of fuel types used to produce the electricity and the region. The software defines regional variations in emission factors from electricity production using the regions of the country as defined by the North American Electric Reliability Council (NERC) and correspond to grid-connected electricity-producing regions. Broward County is located within NERC region 08 – Southeastern Electric Reliability Council/ Florida.

### **RESIDENTIAL:**

According to the Florida Public Service Commission, one electricity and two natural gas utility companies are the primary fuel providers in Broward County. Energy consumption and associated GHG emissions in the residential sector come from single family homes, apartment buildings, and other residential buildings. Broward County residential emissions come primarily from electricity use. Florida Power & Light supplied information on annual residential electricity consumption in kilowatt hours along with total residential customer counts for 2007. The majority of natural gas supplied to the Broward County residents comes from TECO Peoples Gas and Florida City Gas. In calendar year 2007, residential use of natural gas in Broward County totaled 7,633,146 therms. The majority of emissions from residential gas usage in the residential sector were generated by hot water heating and gas ranges/ovens. However emissions were also generated from pool heating.

### **COMMERCIAL**

According to the Florida Public Service Commission, one electricity and two natural gas utility companies are the primary fuel providers in Broward County. Commercial buildings include office facilities, government and

educational facilities, as well as, businesses. Commercial GHG emissions are generated primarily by electricity use. Florida Power & Light supplied information on annual commercial electricity consumption in kilowatt hours along with total commercial customer count for 2007. The majority of natural gas supplied to the Broward County commercial buildings comes from TECO Peoples Gas and Florida City Gas. In calendar year 2007, commercial natural gas usage totaled 36,342,690 therms. The majority of emissions from commercial gas usage in the commercial sector were generated for water heating.

## INDUSTRIAL

According to the Florida Public Service Commission, one electric and two natural gas utility companies are the fuel providers in Broward County. Broward County industrial emissions come primarily from electricity use. Florida Power & Light supplied information on annual industrial electricity consumption in kilowatt hours along with total industrial customers in 2007. Unlike residential and commercial emissions, the "industrial sector" emissions are dominated by fuel used in combustion units or other industrial processes, rather than water heating. Examples of combustion of fuels for industrial processing come from facilities such as asphalt plants, terminal loading facilities, gasoline transfer stations, and industrial combustion engines. The Florida Department of Environmental Protection's, Annual Operating Report (AOR) which contains information on annual fuel usage for industrial combustion units' data was also used. The AOR is a report of certain state air permitted facilities which are required to demonstrate actual yearly fuel use consumption and emissions. Fuel consumption data provided by the AOR report was divided into fuel groups (distillate oil, gasoline, jet fuel, petroleum liquid, etc.). The majority of the fuels in this report are considered "light fuel oil". This designation is composed of distillate, crude and resident oils, gasoline, jet fuel, liquid, and petroleum liquid. Each fuel group which had product being combusted was identified and grouped into fuel types required by the CACP software. Those categories are: heavy fuel oil, light fuel oil, natural gas, and propane. Data for fuel not being combusted such as fuel stored in petroleum storage tanks was not included as part of the CACP software inputs. Fuel information data from both the AOR report and energy consumption data provided by FP&L were both used as inputs in the CACP software in order to calculate community-wide industrial CO<sub>2</sub> emissions.

Like residential and commercial, the majority of natural gas supplied to the Broward County's industrial sector comes from the same two primary suppliers. However, the industrial sector accounts for the smallest percentage of total natural gas usage. In calendar year 2007, the industrial sector totaled 1,455,240 therms. The majority of emissions from industrial natural gas usage in the industrial sector were generated for water heating and heating type of operations for industrial processing or steam generation.

Normalization of Natural Gas Consumption Data: TECO Peoples Gas supplied data on Broward County usage directly in therms. However, Florida City Gas data was provided in dekatherms for the Florida region (Southeast Florida). They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49% of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 to obtain the total natural gas combusted in Broward County (319,720 dekatherms).

Assuming Broward County mimics the region, the percent breakdowns are as follows:

Residential 300,536 dekatherms

(This is 319,720 dekatherms multiplied by 94% and equals residential dekatherms in Broward)

Commercial 15,986 dekatherms

(This is 319,720 dekatherms multiplied by 5% and equals commercial dekatherms in Broward)

Industrial 3,197 dekatherms

(This is 319,720 dekatherms multiplied by 1% and equals industrial dekatherms in Broward)

CONVERSION: DEKATHERMS TO THERMS

1 dekatherm = 10,002.39855 therms [U.S.]

See Tables 2 and 3 for the residential, commercial and industrial data provided. Refer to Table 4 for a list of data providers.

*Table 2: Total Energy Consumption Data Provided by FPL for Residential, Commercial and Industrial Source Categories*

<b>Sector</b>	<b>Annual Consumption (kWh)</b>	<b>Per Unit (kWh)</b>	<b>Annual Consumption Per Capita</b>	<b>Total Customers</b>
<b>Residential</b>	10,925,839,909	11,136	9,915	981,149
<b>Commercial</b>	9,549,552,553	81,151	8,666	117,677
<b>Industrial</b>	436,957,195	152,409	397	2,867

*Table 3: Total Natural Gas Usage in Broward County by Source Category*

<b>Sector</b>	<b>FL City Gas (therms)</b>	<b>TECO Peoples Gas (therms)</b>	<b>Total Natural Gas (therms)</b>
<b>Residential</b>	3,006,090	4,628,503	7,634,593
<b>Commercial</b>	159,898	36,160,174	36,320,072
<b>Industrial</b>	31,980	1,452,683	1,484,663

*Table 4: List of Data Providers and Primary Contact Information for Residential, Commercial, and Industrial Building Source Categories*

<b>Name of Company</b>	<b>Data Provided</b>	<b>Primary Contact</b>	<b>Contact Information</b>
Florida Power & Light	Electricity consumption for all sectors	Lynn Shatas	954-321-2215, <a href="mailto:Lynn_Shatas@fpl.com">Lynn_Shatas@fpl.com</a>
TECO Peoples Gas	Natural gas for all sectors	Lance E. Horton	813-228-4561, <a href="mailto:lehorton@tecoenergy.com">lehorton@tecoenergy.com</a>
Florida City Gas	Natural gas for all sectors	Terry Ryland	404-584-3953, <a href="mailto:tryland@aglresources.com">tryland@aglresources.com</a>
Pollution Prevention, Remediation and Air Quality	AOR Facilities fuel data from industrial facilities	Cliff Bittle	954-519-1220 <a href="mailto:cbittle@broward.org">cbittle@broward.org</a>

## Method Details:

### TRANSPORTATION

The Transportation source category includes total on-road and the off-road emissions in Broward County. The on-road emissions are calculated using Vehicle Miles Traveled (VMT) and include: cars, buses, trucks, and motorcycles. The off-road emissions only include railway, they do not include: watercraft, construction equipment, golf carts, etc. The off-road emissions are calculated using the total fuel used by the local railway companies that run within the geographical boundaries of Broward County. An inventory of GHG emissions generated by airplanes in Broward County was performed using the Federal Aviation Administration's Emissions and Dispersion Modeling System (EDMS) model. See the Other source category method details on page 17 for detailed information and results.

On-road emissions: GHG emissions from all on-road vehicles were calculated using Annual Average Daily Traffic (AADT) data generated by the Florida Department of Transportation (FDOT) monitoring sites located along the major roadways within Broward County. The daily VMT for Broward County in 2007 was 46,572,803. In order to calculate the total vehicle mile data for calendar year 2007, the 46,572,803 was multiplied by 365 days in the year. The total VMT for Broward County in 2007 was 16,999,073,095. Because total county VMT includes all types of vehicles (buses, cars, trucks, etc.), the CACP software Transportation Assistant was used to estimate fuel usage distribution based on total VMT, fuel efficiency, and vehicle breakdown in the community. The Daily VMT for public roads in Florida is calculated by the FDOT Transportation Statistics Office which prepares an annual report of centerline miles and daily VMT on all of the public roads in Florida. The estimates include three different road types: roads on the State Highway System, roads off the State Highway System (functionally classified as Collector or above), and roads that are functionally classified as Local.

Off-road emissions: There are two main rail lines in Broward County: the Florida East Coast Railways (FEC) and CSX Transportation (CSXT). Whereas only FEC freight trains run on the FEC line, both AmTrak and Tri-Rail as well as CSXT freight trains use the CSXT rail line. According to ICLEI, seasonal adjustments are not appropriate for this category as rail traffic does not vary seasonally.

County-wide fuel consumption data for CSXT was required by the CACP software. This was calculated by dividing the Gross Ton Mile (GTM), which is the number of tons pulled by the locomotive multiplied by the distance moved by the road freight trains (308,000,000 GTM), by the system-wide fuel efficiency (867 GTM per gallon). CSXT

reported that for calendar year 2007, the estimated fuel usage in Broward County was 355,381 gallons; a 50/50 split in the use of diesel and ultra low sulfur diesel fuel was assumed.

Fuel data provided by Tri-Rail was calculated by multiplying the 2007 total revenue miles in Broward County (333,083) by the average Tri-Rail locomotive fuel efficiency (2.4 gallons/mile). This resulted in an estimated 799,399 gallons per calendar year. Tri-Rail indicated that both ultra low sulfur diesel and diesel were used in 2007, but were not able to provide a further breakdown distribution, since it varied based on price fluctuations and availability. For the purposes of this analysis, a 50/50 split was assumed.

AmTrak runs four trains daily on the Seaboard Coastline Railroad which has approximately 25 miles of track throughout Broward County. Amtrak trains travel 100 miles per day or 36,500 miles per year in Broward County. Amtrak indicated that the national average diesel fuel efficiency is 2.4 gallons per mile for their trains. Based on these numbers, Amtrak estimated that during 2007 they combusted 87,600 gallons of diesel fuel within Broward County.

Florida East Coast Railway freight trains run 17 one-locomotive jobs per week in Broward County with an average fuel consumption of 7 gallons/hour. FEC estimates used of 2,492,568 gallons of diesel fuel during calendar year 2007. See Table 5 for a list of data providers.

The CACP Software User’s Guide and the International Emission Analysis Protocol do not include emissions produced by off-road engines (i.e. lawnmowers, golf carts and etc.) due to because of the difficulties faced by communities in accurately tracking the use of these types of equipment and in accurately calculating the GHG emissions associated with these sources.

*Table 5: List of data providers and primary contact information for the Transportation sector*

<b>Name of Company</b>	<b>Data Provided</b>	<b>Primary Contact</b>	<b>Contact Information</b>
Florida Department of Transportation	Total Vehicle Miles Traveled	Morgan Gordan	750-414-4848, gordan.morgan@dot.state.fl.us
CSXT	Total Fuel Usage	Rick Nath	904-359-1499, Rick_Nath@csx.com
Tri-Rail	Total Fuel Usage	Marcin Gadek	954-788-7950, gadekm@sfrta.fl.gov
Amtrak	Total Fuel Usage	Craig Caldwell	215-349-6968, CaldweC@amtrak.com
Florida East Coast Railway	Total Fuel Usage	Juan Betancourt	305-889-5613, juan.betancourt@railamerica.com

## **Method Details:**

### WASTE

The Waste sector calculates emissions for the decomposition of waste under a variety of disposal scenarios including landfilling and controlled incineration. Virtually all the waste that is generated in Broward County is handled through Broward County's Waste-to-Energy plants, landfilling, and recycling programs.

The Method used is called the Methane Commitment which quantifies the net lifetime of GHG emissions from waste which is disposed of in the active year. In other words, although each site/practice will emit gases over time, the Methane Commitment method attributes all future emissions to the year in which the waste was produced.

Broward County is fortunate to have a community-level solid waste and recycling program. Data available through this program represent residential and commercial solid waste production in tons for calendar year 2007. This waste data is based on the April 1, 2007 Governor's Office Broward County population estimates (1,765,707), and includes waste collection from all cities and unincorporated areas in Broward County. This data was recorded and managed by Broward County Waste and Recycling Services (WRS) that analyzed municipal solid waste collection and recycling from (January 1, 2007 through December 31, 2007). The waste type percentages (material type tons) were also provided by WRS. The most recent waste characterization report available was generated using data from 2002.

*Note: Certain information reflected in the CACP entries have not been certified by the Florida Department of Environmental Protection (FDEP) and according to Broward County Waste and Recycling may not be certified by the FDEP until August 2009.*

See Table 6 for the 2007 waste disposed data used for the community-wide baseline inventory. According to the data provided by WRS, in 2007, Broward County recycled 844,444 tons of material, avoiding an estimated 2,719,784 tonnes of GHG emissions. See Table 7 for the waste composition estimates and Table 8 for the list of data providers.

Table 6: Total Waste Disposed in Broward County in Calendar Year 2007

Disposal Method	Waste Disposed (tons)
Landfilled (tons)	1,307,678
Waste To Energy (tons)	1,191,972
Recycled (tons)	844,444

Table 7: Waste Composition Estimates for Broward County in Calendar Year 2007

Type of Waste	Percentage of Total Waste Stream Landfill	Percentage of Total Waste Stream Combusted (Waste to Energy)
Paper	12.3%	17.4%
Food Waste	1.8%	7.2%
Plant Debris	17.6%	13.7%
Wood/ Textiles	8.6%	10.6%
All Other	59.7%	51.1%

Table 8: List of data providers and primary contact information for the waste sector

Name of Company	Data Provided	Primary Contact	Contact Information
Broward County Waste & Recycling Services	Total Solid Waste & Recycling Data for 2007 and 2020 projections	Peter Foye	954-577-2395 pfoye@broward.org
Broward County Planning and Redevelopment Division	Population Data	Bill Leonard	954-357-6033 tleonard@broward.org

## Other

At this time, the other category consists of airplane emissions. Emissions from sea-faring vessels, recreational watercraft, fuel-powered lawn equipment, agricultural activities, prescribed burns, and other direct emissions were not included due to difficulties in collecting operational data and lack of methodology associated with these categories.

## Airplanes

Community-wide GHG emissions from most sources in Broward County have been accounted for in this inventory through use of county-wide consumption data for fuel (i.e. electricity, natural gas, gasoline, and diesel fuel) or for the decomposition or disposal of waste by the ICLEI CACP software. This includes sources of emissions from the four airports in the county, but excludes airplane emissions. Emissions from airplanes were determined using the Federal Aviation Administration's (FAA) Emissions and Dispersion Modeling System (EDMS). Since 1998, the EDMS has been the Federal Aviation Administration (FAA) required model for determining emissions, modeling ambient concentrations, and performing air quality analysis of pollutants (e.g., criteria pollutants, hazardous air pollutants, and other organic gases) from aviation sources. While the EDMS model assesses air quality impacts of airport emission sources (aircrafts, auxiliary power units, ground support equipment, ground access vehicles, and stationary sources) at this time the model calculates CO<sub>2</sub> emissions for aircrafts only. The EDMS utilizes the latest aircraft engine emission factors from the International Civil Aviation Organization (ICAO) Engine Exhaust Emissions Data Bank<sup>4</sup> to calculate CO<sub>2</sub> emissions.

The model requires at minimum, identification of the airports being modeled, year modeled, and aircraft activity. Airports information is intrinsic to the model and airports must be identified by use of International Air Transport Association (IATA) Code, International Civil Aviation Organization (ICAO) Code, or FAA Code. Aircraft activity data is comprised of aircraft-engine combination data to identify the emission source and the number of yearly operations at the airport in question (i.e., departures, arrivals, and touch & go's).

The four airports in Broward County are Fort Lauderdale-Hollywood International Airport (FLL), Fort Lauderdale Executive Airport (FXE), North Perry Airport (HWO), and Pompano Beach Airpark (PMP). Aircraft activity is monitored by the FAA and the Bureau of Transportation Statistics (BTS). Airport operations are divided into two categories: local and itinerant. Local operations are aircrafts operating in the local traffic pattern, aircraft operating

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<sup>4</sup> [http://www.faa.gov/about/office\\_org/headquarters\\_offices/aep/models/edms\\_model](http://www.faa.gov/about/office_org/headquarters_offices/aep/models/edms_model)

within sight of a tower, aircraft known to be departing for/ arriving from flight in local practice areas, or aircraft executing simulated instrument approaches at the airport. Generally, local operations are characterized as training operations. Itinerant operations are all aircraft arrivals and departures other than local operations. Itinerant operations are aircrafts operating with a specific origin or destination away from the airport. Furthermore, local operations are generally divided into civil and military operations, while itinerant operations are divided into air carrier, air taxi, general aviation, and military operations.

While the FAA and the BTS monitor airport operations, information on the aircraft-engine combination is not easily located. This information is tracked for larger aircraft by both of these agencies. However, engine information is not provided in either agency's database. In addition, information on aircraft-engine combinations for smaller aircrafts is not easily found. Guidance and verbal approval of the methodology used to populate the EDMS for the Broward County airports was obtained from Mr. Ralph Iovinelli of the FAA.

The methodology used relied on the FAA's Operations Network, OPSNET<sup>5</sup> and the Enhanced Traffic Management System Counts, ETMSC<sup>6</sup>, as well as the BTS Research and Innovative Technology Administration (RITA) T-100 Segment (all carriers) database<sup>7</sup>. The OPSNET database lists the total flights into and out of airports by aircraft category (i.e., air carrier, air taxi, general aviation, or military) and flight type (i.e., itinerant or local). The ETMSC database lists aircraft operations (arrivals, departures, and touch and go's) by aircraft model for the timeframe desired, in this case calendar year 2007. The BTS T-100 database is similar to the ETMSC database, but uses different codes to describe the aircraft model. Most air carrier and air taxi flights are documented in either the ETMSC or BTS T-100 databases. However, minimal information is available about military and general aviation flights. For this reason, flight operations count data found in the ETMSC and BTS T-100 databases do not match with those found in the OPSNET database. In order to properly account for the flights into and out of the airports in Broward County, the ETMSC and BTS T-100 databases for each of the airports were merged, duplicates were removed. The total identifiable operations for each airport were determined. For the purpose of this analysis, military operations were not included since most military operations are a matter of national security, and as such, flight details, including aircraft information is often not provided in either the FAA or BTS databases. This sum of the identifiable operations at each airport was subtracted from the OPSNET operations total (minus the military operations) for each airport. The remaining unidentified aircrafts from ETMSC, BTS T-100 and OPSNET databases

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<sup>5</sup> <http://aspm.faa.gov/opsnet/sys/>

<sup>6</sup> <http://aspm.faa.gov/etms/sys/>

<sup>7</sup> <http://www.transtats.bts.gov/>

were allocated as follows. For the major commercial airport (FLL), flights were divided among the common general aviation aircrafts in the proportions shown in the *Fort Lauderdale – Hollywood International Airport: Environmental Impact Statement*, Appendix G: Air Quality, pp. 30 - 32<sup>8</sup>. For the smaller general aviation airports (FXE, HWO, and PMP), the flights were divided among the common general aviation aircrafts using the airport as provided by an authority of the airport (see Table 9 below for listing of data sources).

Once all operations were identified, the data was entered into the EDMS. Flights were given identifiers to coincide with either the BTS or FAA given code in the merged ETMSC and BTS T-100 database. None of the databases available include engine information. The EDMS provides default aircraft-engine combinations information for planes used in the United States. Default engines were used when available. If several engines were listed for an aircraft, then the aircraft was researched to find the common engine used. That engine was selected for the aircraft in the EDMS. Once aircraft, engine, and operations data was entered into the EDMS, the model was run to estimate CO<sub>2</sub> emissions for local and itinerant flights from all Broward County airports. The EDMS estimated that airplane activity at FLL emits 291,537 tonnes eCO<sub>2</sub>, while FXE, HWO, and PMP emit 15,756 tonnes, 3,212 tonnes, and 4,105 tonnes of eCO<sub>2</sub>, respectively. The EDMS output for all airports total 314,611 tonnes of eCO<sub>2</sub> was entered into the CACP model as an “Other” source since this model cannot directly calculate emissions from airplanes. The EDMS output is shown in Appendix 4.

*Table 9: List of data providers and primary contact information for the Other Airplanes sector*

<b>Name of Agency</b>	<b>Data Provided</b>	<b>Primary Contact</b>	<b>Contact Information</b>
Federal Aviation Administration	Guidance on use of EDMS.	Ralph Iovinelli	202-267-3566 ralph.iovinelli@faa.gov
Broward County Aviation Department	Information on location of previous air quality and environmental impact statement reports conducted at the Fort Lauderdale – Hollywood International Airport.	Michael Pacitto	954-359-6103 mpacitto@broward.org
		Brad Ostendorf	954-359-2395 bostendorf@broward.org
Fort Lauderdale Executive Airport	Information on estimated breakdown of airplanes which fly into/out of the FXE airport.	Florence Straugh	954-828-4955 fstraugh@fortlauderdale.gov

<sup>8</sup> [http://www.broward.org/airport/community\\_airportexpansion\\_eis.htm](http://www.broward.org/airport/community_airportexpansion_eis.htm)

Name of Agency	Data Provided	Primary Contact	Contact Information
Broward County Aviation Department	Information on estimated breakdown of airplanes which fly into/out of the FLL and HWO airports.	Jonathan E. Clark	954-359-6146 jeclark@broward.org
Pompano Beach Airpark	Information on estimated breakdown of airplanes which fly into/out of the PMP airpark.	Steve Rocco	954-786-4135 steve.rocco@copbfl.com

## ANALYSIS OF INVENTORY FINDINGS

During calendar year 2007, Broward County as a whole produced approximately 22,366,933 metric tonnes eCO<sub>2</sub> in the proportions shown in (Figure 4).

**Total Emissions: 22,366,933 metric tonnes eCO<sub>2</sub>**

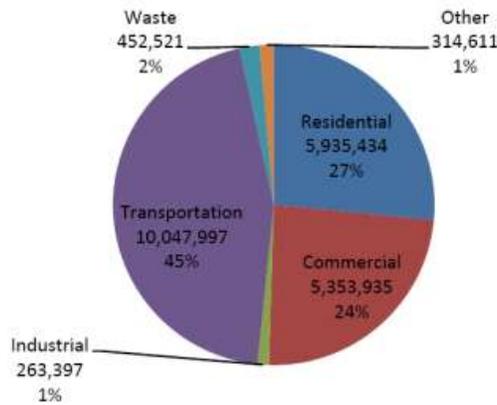


FIGURE 4: BROWARD COUNTY'S 2007 COMMUNITY-WIDE GHG EMISSIONS

- The Transportation source category was responsible for approximately 45% of the community's GHG emissions and was the largest single source of emissions.
- The Residential source category accounts for 27% of total GHG emissions, due primarily to the use of electricity.
- The Commercial source category contributes 24% of community-wide GHG emissions.
- The remaining GHG sources account for less than 4% of the total GHG emissions in the county.
- Combined Residential, Commercial, and Transportation activities within Broward County produce almost 96% of total community-wide emissions (Appendix 5).

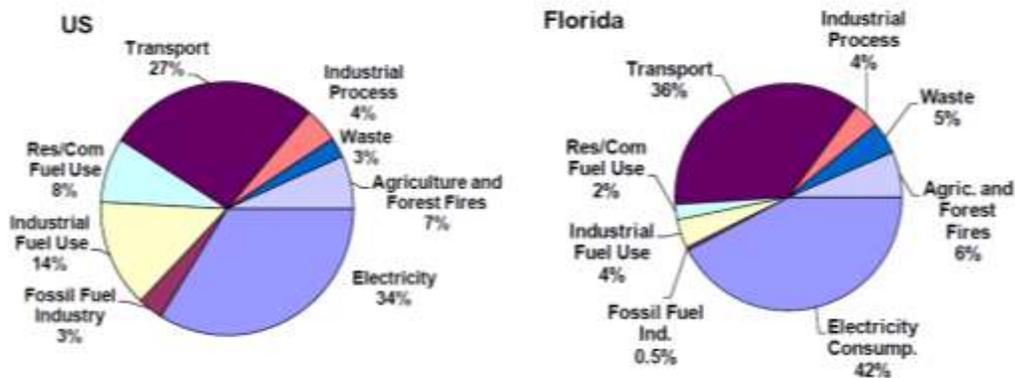
The GHG emissions from Broward County government operations represent approximately one percent of the total community-wide emissions<sup>9</sup>. Table 10 provides a summary of the GHG emissions in the county, including percent distribution and energy consumption by source category. The county's GHG emissions profile is similar to that determined for the state of Florida in Florida's Energy and Climate Change Action Plan<sup>10</sup>. The principal sources of GHG emissions in 2005 in Florida were electricity consumption and transportation, accounting for 42% and 36% respectively. Figure 5 depicts the 2005 gross GHG emissions by each of the source categories in Florida and the entire United States (US).

*Table 10: Broward County Community-wide GHG Emissions Inventory Results for Baseline Year 2007*

<b>Source Category</b>	<b>Equivalent CO<sub>2</sub> (tonnes)</b>	<b>Percent of Total eCO<sub>2</sub></b>	<b>Energy (kWh)</b>
Residential	5,935,434	27	11,149,533,484
Commercial	5,353,935	24	10,613,730,663
Industrial	263,397	1	994,439,678
Waste	452,521	2	NA
Transportation	10,047,035	45	37,860,245,221
Other	314,611	1	NA
<b>Total</b>	<b>22,366,933</b>	<b>100</b>	<b>60,617,949,045</b>

<sup>9</sup> <http://www.broward.org/climatechange/govops2009report.pdf>

<sup>10</sup> [http://www.dep.state.fl.us/climatechange/actionplan\\_08.htm](http://www.dep.state.fl.us/climatechange/actionplan_08.htm)



Source: Florida's Energy and Climate Change Action Plan

FIGURE 5: GROSS GHG EMISSIONS BY SECTOR, 2005: FLORIDA AND THE US

It is difficult to compare per capita emissions with different communities because of the differing methodologies, years studied, and emission sources. Broward County's community-wide emissions are 12.8 tonnes per capita. Broward County has a relatively low level of per capita emissions compared to the state of Florida and the nation. Broward County's 2007 per capita GHG emissions are approximately 67% of the statewide average per capita emissions, and about 65% of the national per capita emissions<sup>11</sup>. In 2005, Miami-Dade and Sarasota County per capita GHG emissions were 13.5 and 16.0 respectively<sup>12</sup>. It is important to note that the national, state, and county emissions inventories referenced used different emission sources when calculating GHG emissions. For example, the State emissions inventory includes agriculture and forest fires as sources of GHG emissions and the industrial sector at the State level is considerably larger compared to Broward County. Sarasota County emissions inventory considered boat registration information for the transportation sector and they reported a net sink (negative value) of GHG emissions due to waste recycling and composting programs. Miami-Dade County GHG emissions inventory did not include emissions from waste and airplanes however their industrial sector is significantly larger than Broward County. As previously stated, these per capita comparisons are based on available GHG emissions data for communities that differ in scale, size, year studied, inventory methodologies, and emission sources.

## 2020 PROJECTION ESTIMATES

The CACP Software incorporates "Forecast Builder" which helps determine future emission levels if no reduction measures were implemented. The forecast builder projects future emissions under a "business as usual" scenario

<sup>11</sup> State of Florida 2005 per capita GHG emissions was 19 metric tonnes for a population of 336.6 million according to the Florida Energy and Climate Change Report released in October 2008. The U.S. per capita GHG emissions for 2007 according to the Energy Information Administration was 19.7 metric tonnes.

<sup>12</sup> Sarasota County GHG Emissions Analysis Report, February 2008

until 2020 using net growth estimates. Accounting for net emissions growth provides a baseline against which the impact of an action can be measured. ICLEI is in the process of upgrading the CACP software to update the emissions coefficients and include a “Forecast Builder” scenario until 2050. The CACP software upgrade will be released later this summer. The “Forecast Builder” was used for the residential, commercial, and industrial source categories for projections to the year 2020. Population data, VMT net growth, and railroad fuel use data were used to forecast the transportation and waste GHG emissions to the year 2020.

Below are the 2020 forecast indicators by sector used for the CACP software:

- Residential sector: Projected number of households in the community
- Commercial sector: Projected commercial employment estimates
- Industrial sector: Projected industrial employment estimates and population growth
- Transportation sector: Projected VMT net growth and railroad fuel use
- Waste sector: Projected population growth
- Other sector - Airplanes: Forecast growth in the metrics “passenger enplanements” and “airport operations” for FLL based on the Fort Lauderdale – *Hollywood International Airport: Environmental Impact Statement Appendix D: Purpose and Need: Aviation Activity Forecasts, Sections 3 to 4, pp. 8 – 14*<sup>13</sup> was used to forecast 2020 GHG emissions from FLL. The *Continuing Florida Aviation Systems Planning Process*, CFASPP reports<sup>14</sup> for each of the 3 general aviation airports in Broward County were used to forecast the 2020 GHG emissions based on the metric “based aircraft” at each airport.

## **Residential**

According to the ICLEI CACP Users Manual, the growth rate for number of households in an area of interest is used to calculate the projections for the residential source category fuel consumption. The business-as-usual (BAU) emissions scenario provides a projection of potential emissions in 2020 if no new emission reduction measures are implemented. Using the household count data from the Broward County MPO 2035 Long Range Transportation Plan Update, the growth rate for Broward County households to 2020 was determined. This growth rate was used in the Forecast Builder to calculate, residential grid average electricity usage for forecast year 2020. For the residential source category, the baseline year annual residential energy consumption is 10,925,839,909 kilowatt hours. Using the Forecast Builder, with the MPO’s household growth factor of 0.73%, the 2020 annual residential energy consumption is forecast to be 12,009,354,757 kilowatt hours. For natural gas, TECO Peoples Gas

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<sup>13</sup> <http://www.broward.org/airport/feis.htm>

<sup>14</sup> <http://www.cfaspp.com/>

projected no growth and Florida City Gas had no projection information. For the purpose of this analysis, no growth was assumed in all natural gas projections in the residential sector.

### **Commercial**

Using the Broward County MPO 2035 Long Range Transportation Plan Update commercial employment data, the annual growth rate for Broward County commercial employment between years 2007 (and 2035 was determined. This growth rate was used to estimate 2020 commercial employment. The baseline year annual consumption energy use is 9,549,552,553 kilowatt hours. Using the Forecast Builder, with the MPO's commercial employment growth factor of 1.662%, the 2020 energy use for grid average electricity is forecast to be 11,828,628,518 kilowatt hours. TECO Peoples Gas projected no growth and Florida City Gas had no projection information for natural gas usage, thus, for the purpose of this analysis, no growth was assumed in all natural gas projections in the commercial sector.

### **Industrial**

Per ICLEI CACP Users Manual guidance, employment is the best indicator for applying projected rates of growth in industrial sector. The BAU emissions reduction scenario provides a projection of potential emissions in 2020 if no new emission reduction measures were implemented within Broward County. Using the Broward County MPO 2035 Long Range Transportation Plan Update industrial employment data, the percent change in total Broward County industrial employment between years 2007 (baseline year) and 2035 was determined. The annual percent change was used to estimate the 2020 industrial employment. A 1.976 % annual industrial employment growth was used in the CACP Forecast Builder as the annual growth rate. The Forecast Builder calculates the "fuel type" of Electricity (grid average) figure for forecast year 2020. The same growth rate was applied to the Annual Operating Report (AOR) Industrial fuel consumption information for Light Fuel Oil and Propane. For industrial inputs, the baseline year Annual Consumption Energy Use is 436,957,195 kWh. Using the Forecast Builder, with 1.976% increase, the forecast year Energy Use for Electricity is 563,524,161 kWh. In 2007, Light Fuel Oil was 1,854 thousand US gallons and in 2020, it is projected to be 2,390 thousand US gallons. For the "fuel type" biomethane, population growth estimates were used to determine net growth. The population for 2007 was 1,753,272 based on the Broward County's Planning and Redevelopment Division's application of the Broward County Forecast Model. The population estimate for 2020 is 2,000,888 with an annual growth rate of 1.086%. The annual percent change for biomethane was entered in the Forecast Builder for the 2020 forecast. In 2007, biomethane was 1,428 million cubic feet and in 2020, biomethane's forecast is 1,643 million cubic feet. For natural gas, TECO Peoples Gas

projected no growth and Florida City Gas had no projection information. For the purpose of this analysis, no growth was considered for all natural gas projections in the industrial sector.

**Waste**

The waste source category growth projections were based on the Broward County Planning and Redevelopment Division’s Forecast Model. This is a Cohort-Survival Model, in which forces that cause the population to change over time are used to predict future populations. Simply stated, aging, births, deaths, in-migration, and out-migration rates are superimposed on the population distribution provided by the 2000 Census to determine future populations. It is important to note that in the *Draft Broward County Population, 2000 through 2035* from the Broward County Population Forecast Model short-term population changes do not establish long-term trends. Thus, the model assumes that in the future, housing costs will return to a more long-term average level and, as a result, population growth fueled by increased in-migration will also return to a near long-term average level. The total population includes residents of group homes (i.e., prisons, hospitals, nursing homes, etc.).

In order to determine the tons of waste per capita, the 2007 total waste of 3,344,094 tons was divided by the 2007 population, calculated to be 1.89 tons of waste per capita per year. The baseline year of 2007 and the 2020 projection year were calculated in the same manner. According to Broward County WRS, the growth projections between now and 2050 will be 10% less than current. He stated that in the future, we will combust and reclaim more energy than at present. Waste tonnage projections and the waste stream percentage share are listed below in Figures 6 and 7.



2020 population x waste per capita = total waste for 2020  
 $2,000,888 \times 1.893912184 = 3,789,506 \text{ tons}$

Waste to Energy = **1,541,018 tons**  
 Equivalent to 401,013 tonnes eCO<sub>2</sub>.

Landfill = **911,950 tons**  
 Equivalent to 99,264 tonnes eCO<sub>2</sub>.

Recycling = **1,336,538 tons**

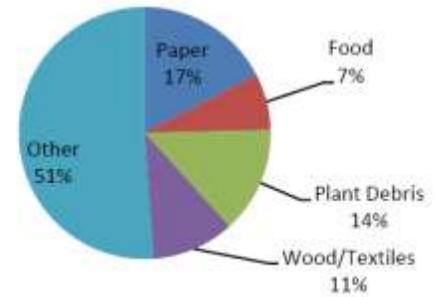
Figure 6: Waste Projection distribution estimates for 2020

**Waste Projection Assumptions**

- Waste per capita and the composition of waste stream percentages is constant from 2007 to 2020.

- The compositions of the waste stream for Waste to Energy include the following: Paper 17.4%; Food 7.2%; Plant Debris 13.7%; Wood / Textiles 10.6%; and Other 51.1%. These sources are directly related to the equivalent CO<sub>2</sub> production.
- The compositions of the waste stream for Landfill include the following: Paper 12.3%; Food 1.8%; Plant Debris 17.6%; Wood / Textiles 8.6%; and Other 59.7%. These sources are directly related to the equivalent CO<sub>2</sub> production.
- WRS is working on conceptual plan to achieve a 30% waste reduction goal in the next few years.
- Unexpected factors (e.g., hurricanes, natural disasters, national economic situation, and new regulations) are not accounted for when making these projections.
- This report captures community-wide emissions and does not account for avoided disposal. Therefore, recycling data was not entered into the model. However, Broward County recycled 25% of its waste in 2007 and is projected to recycle an estimated 35% by 2020.

### Composition of Waste Stream for Waste to Energy



### Composition of Waste Stream for Landfill

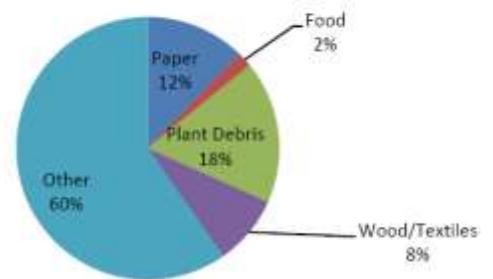


Figure 7: Composition of waste

## Transportation

### On-Road

On-Road projections of Vehicle Miles Traveled (VMT) were developed using 2030 travel demand model data provided by the Broward County MPO. This data includes the implementation of the transportation improvement projects described in the Broward County MPO Long Range Transportation Plan for 2030. The VMT is the result of multiplying the daily traffic volume on a specific roadway link by the length of that link in miles. The county VMT is the aggregate of all roadway links in the county. VMT is often estimated using the travel forecast model. However, that estimate covers only the roadway network coded in the model, which includes collectors and above facilities. In order to obtain an accurate comparison to FDOT traffic counts, which includes all of the roadways in Broward County, the FDOT total VMT was broken down to include only the urban collector and above roadways. The

136.07% growth rate in VMT was determined by dividing the 2030 VMT projection of 51,435,308 by the FDOT 2007 adjusted VMT of 37,800,313. This resulted in a new 2030 VMT projection (including all roadways) of 63,372,133 miles per day. The VMT on local roads is estimated by the Florida Department of Transportation (FDOT)<sup>15</sup>. Projections for 2020 were made using a linear regression analysis of yearly VMT data from the years 2000, 2007, and 2030. The VMT for 2020 is 20,449,895 thousand vehicle miles traveled. VMT data projections for 2030 were provided by Lina Kulikowski, Principal Planner of the Broward Metropolitan Planning Organization.

### **Off-Road**

Amtrak has no plans to expand service in Broward County and, thus, estimates no growth in operation by 2020. Subsequently, the 2007 data was used for the 2020 projection. They acknowledge the uncertainties with estimating projections. Amtrak states that they have not increased the number of trains in operation since the year 2000. Projection data was provided by Craig Caldwell, AmTrak Environmental Superintendent.

Tri-Rail has increased its daily number of trains in Broward County from 28 in 2005, to 40 in 2006, to 50 in 2007. Tri-Rail estimated that by 2050 they would be running approximately double the number of daily trains as in 2007. The CACP software only allows for projections until 2020, therefore regression analysis was used to obtain fuel consumption in 2020. Based on the results, fuel usage is projected to be 1,041.08 thousand gallons of biodiesel. The 2007 and 2050 projection estimates were provided by Mr. Marcin Gadek, Operations Compliance Officer, South Florida Regional Transportation Authority. *Note: TriRail uses B99 fuel; however, the CACP software is limited to the use of B100 fuel.*

Florida East Coast Railway (FEC) is estimating no growth in operations by 2020. Subsequently, the 2007 data was used for the 2020 projection. FEC states that the fuel consumption numbers that were provided for the 2007 baseline year for the community-wide GHG inventory would be applicable from 2002 to 2007. Based on these numbers, FEC estimates that they used 47,934 gallons of diesel fuel per week, or 2,492,568 gallons of diesel fuel per calendar year. Data and estimates provided by Juan Betancourt, Manager of Environmental Compliance of Florida East Coast Railway.

Mr. Rick Nath, Manager of Environmental Programs for CSXT, estimates no growth in operations by 2020. Subsequently, the 2007 data was used for the 2020 projection. CSXT provided fuel consumption data for the

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<sup>15</sup> <http://www.dot.state.fl.us/planning/statistics/mileage-rpts/public.shtm>

geographical boundaries of Broward County for years 2005, 2006 and 2007. In 2005, CSXT used 459,576 gallons of fuel with a system wide fuel efficiency of 842 (Gross Ton Miles/gal). In 2006, CSXT estimated 457,812 gallons of diesel fuel with a system wide fuel efficiency of 853 GTM/gal. CSXT estimated fuel usage in gallons within the geographical boundaries of Broward County was 455,381 gallons for 2007. CSXT assumptions were based on a 50/50 split in the use of diesel and ultra low sulfur diesel fuel.

#### **Other: Airplanes**

Estimates of future CO<sub>2</sub> emissions from aircraft at FLL for 2020 were based on information provided for the metrics “passenger enplanements” and “airport operations” in the *Fort Lauderdale – Hollywood International Airport: Environmental Impact Statement*, Appendix D: Purpose and Need: Aviation Activity Forecasts, Sections 3 to 4, pp. 8 - 14<sup>14</sup>.

Estimates of future CO<sub>2</sub> emissions from aircraft at FXE, HWO, and PMP for 2020 was prorated based on a linear regression analysis of the “based aircraft” metric from the Continuing Florida Aviation Systems Planning Process (CFASPP) reports for each of the airports projected to the year of interest (i.e., 2020). The CFASPP was established by the FAA and the FDOT as a method for continually monitoring and maintaining a viable statewide aviation environment and determining the development requirements to best meet projected aviation demands<sup>16</sup>.

The reports for the airports can be found at the CFASPP website:

<b>Airport</b>	<b>Website</b>
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FXE	<a href="http://www.cfaspp.com/FASP/AirportPDFs/fort_lauderdale_executive_%28july2008%29.pdf">http://www.cfaspp.com/FASP/AirportPDFs/fort_lauderdale_executive_%28july2008%29.pdf</a>
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HWO	<a href="http://www.cfaspp.com/FASP/AirportPDFs/north_perry_%28sept2008%29.pdf">http://www.cfaspp.com/FASP/AirportPDFs/north_perry_%28sept2008%29.pdf</a>
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PMP	<a href="http://www.cfaspp.com/FASP/AirportPDFs/pompano_beach_airpark_%28feb2009%29.pdf">http://www.cfaspp.com/FASP/AirportPDFs/pompano_beach_airpark_%28feb2009%29.pdf</a>
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The choice of metric used for the future projection for each of the airports in Broward County is based on the *Airport Cooperative Research Program (ACRP Synthesis 2): Airport Aviation Activity Forecasting Report* by the

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<sup>14</sup> <http://www.cfaspp.com/>

<sup>15</sup> Airport Aviation Activity Forecasting Report by the Transportation Research Board of the National Academies

Transportation Research Board of the National Academies<sup>15</sup>. The ACRP was created in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. In October 2005, the FAA executed a contract with the National Academies, acting through its Transportation Research Board (TRB), to serve as manager of the ACRP. Program oversight and governance are provided by representatives of airport operating agencies. The ACRP report states that “*there are several activity measures typically included in airport aviation activity forecasts; the two most commonly used for commercial airports are aircraft operations and passenger enplanements, while for general aviation airports, based aircraft counts are important at general aviation airports because they drive the need for hangars, fueling, and other facilities.*”

Based on the *Fort Lauderdale – Hollywood International Airport: Environmental Impact Statement*, passenger enplanements at FLL are expected to grow at a rate of 2.9% from 2006 to 2020 while airport operations are expected to grow at a rate of 2.2% from 2006 to 2012 and 2.3% from 2012 to 2020. These numbers were averaged to generate a growth rate of 2.575% for 2020. Based on the linear regression analysis of the data presented in the CFASPP report for the FXE, HWO, and PMP, based aircraft are expected to increase at rates of 1.34%, 1.24%, and 1.87%, respectively per year to the years 2020. Linear regression analyses for these future projections can be found in Appendix 4 of this document.

Thus, estimated eCO<sub>2</sub> emissions from airplanes at the four Broward County Airports in 2020 are 415,348 tonnes. The breakdown by airport is shown in the table below (Table 11).

*Table 11: Estimated eCO<sub>2</sub> emissions from airplanes in Broward County for year 2020*

<b>Airport</b>	<b>Year</b>	<b>Estimated eCO<sub>2</sub> emission (tonnes)</b>
Fort Lauderdale-Hollywood International	2020	389,129
Fort Lauderdale Executive	2020	18,497
North Perry Airport	2020	3,729
Pompano Beach Airpark	2020	3,993

## 2020 PROJECTION SUMMARY

Overall GHG emissions are forecast to increase 16% over the next 11 years to 2020 under a business as usual scenario, with the greatest increase expected in the Other Source Category (emissions from Airplanes, 32%), followed by Industrial and Commercial energy consumption at 28% and 23% respectively. The largest source of GHG emissions in Broward County, Transportation (made up mostly of on-road vehicles) is expected to increase by 14%.

Figure 8: 2020 GHG Emission Projection Estimates for Broward County in the Business as Usual Scenario

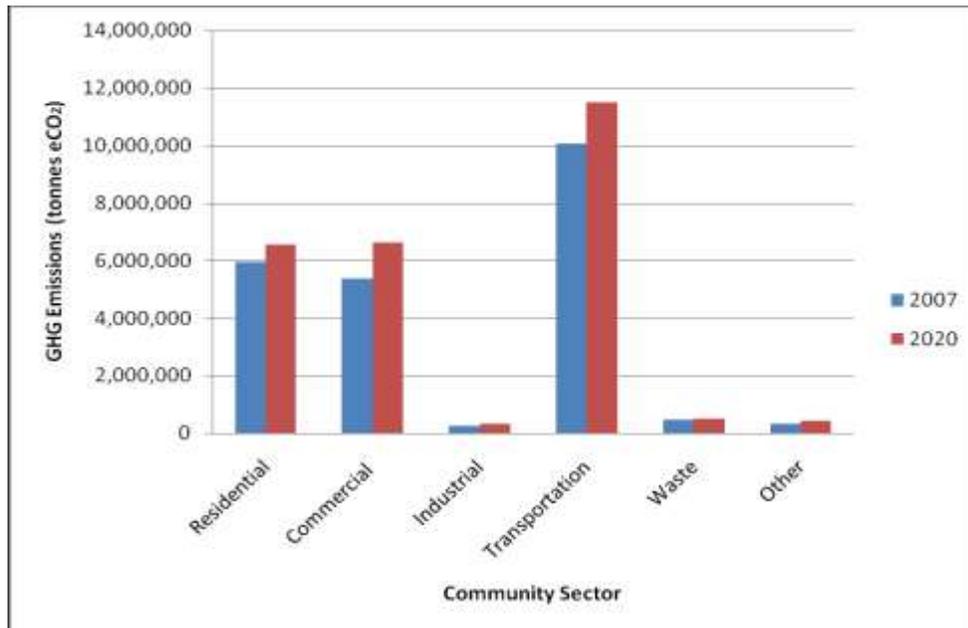
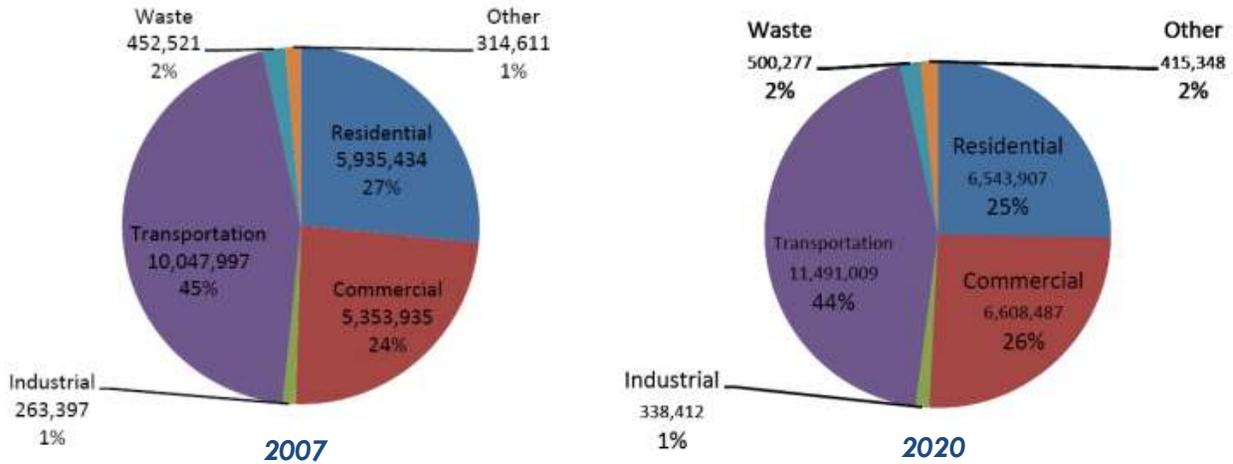


Table 12: Broward County Community-wide GHG Emissions for Baseline Year 2007 and Projection Year 2020

Source Category	2007	2020	GHG emissions Increase by 2020
	GHG emissions (tonnes eCO <sub>2</sub> )	GHG emissions (tonnes eCO <sub>2</sub> )	
Residential	5,935,434	6,543,907	10%
Commercial	5,353,935	6,608,487	23%
Industrial	263,397	338,412	28%
Transportation	10,047,035	11,490,047	14%
Waste	452,521	500,277	11%
Other	314,611	415,348	32%
<b>All Sources</b>	<b>22,366,933</b>	<b>25,896,479</b>	<b>16%</b>

Figure 9: 2007 and 2020, respectively, Broward County Community-wide GHG Emissions Distribution by Source Category



On November 13, 2008, the Board adopted Resolution 2008-822 that supports the Cool Counties Program establishing a GHG reduction target of eighty percent below the current year (2007 emissions inventory) by 2050, and Resolution 2008-823 authorizing membership in the International Council for Local Environmental Initiatives (ICLEI) and supporting the Cities for Climate Protection Campaign. Figure 10 illustrates the current year emissions inventory, 2020 GHG emissions projection with the business as usual scenario, and the reduction target of 80% below current year.

Figure 10: 2007 Base Year, 2020 Projections, and 2050 Reduction Target

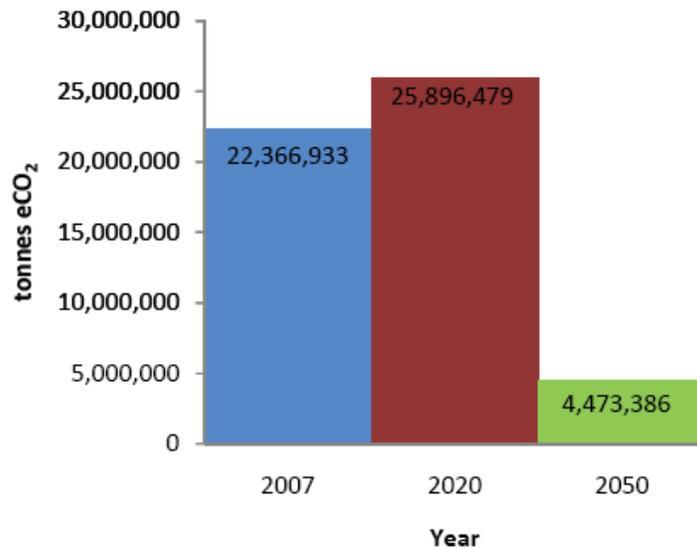


Table 13: Summary of 2020 Forecast Indicator and Net Growth Estimates by Sector

Source Category	2020 Forecast Indicator	Forecast Estimates: 2007 to 2020*
Residential	Projected number of households in the community.	9.9% net growth in electricity use (FPL) 0% net growth in natural gas use (TECO) 0% net growth in natural gas use (People's Gas)
Commercial	Projected commercial employment estimates.	23.9% net growth in electricity use (FPL) 0% net growth in natural gas use(TECO) 0% net growth in natural gas use (People's Gas)
Industrial	Projected industrial employment estimates and population growth.	29% net growth in light fuel oil use (Air Quality Licensed facilities (a.k.a. AOR)) 29% net growth in electricity use (FPL) 15% net growth in biomethane use (Air Quality Licensed facilities (a.k.a. AOR)) 0% net growth in natural gas use (TECO) 0% net growth in natural gas use (People's Gas)
Waste	Population growth and Broward County Waste and Recycling Services (WRS) data.	13.3% net growth in waste produced (BC WRS)
Transportation	Projected Vehicles Miles Traveled (VMT) net growth and railroad fuel usage growth.	20% net growth in VMT (buses, cars, trucks, etc.) 30% net growth in fuel usage (TriRail) 0% net growth in fuel usage (Amtrak) 0% net growth in fuel usage (Florida East Coast Railway) 0% net growth in fuel usage (CSXT)
Other (Airplanes)	Fort Lauderdale-Hollywood International Airport (FLL): Projected passenger enplanements and airport operations. <sup>1</sup>  Fort Lauderdale Executive (FXE), North Perry Airport (HWO), and Pompano Beach Airpark (PMP): Projected based aircraft counts <sup>2</sup> .	33.5% net growth in passenger enplanements and airport operations (FLL) 17.5% net growth in based aircraft counts (FXE) 16.1% net growth in based aircraft counts (HWO) 23.9% net growth in based on aircraft counts (PMP)

\*Assumes business as usual. For additional information, refer to the Source category sections in this report.

<sup>1</sup>Refer to the *Fort Lauderdale – Hollywood International Airport: Environmental Impact Statement*

<sup>2</sup> Refer to the *Continuing Florida Aviation Systems Planning Process* reports

## IMPORTANT CONSIDERATIONS

This 2007 analysis is based on GHG emissions due to activities within the Broward community. While reductions in consumer goods transported over long distances could reduce GHG emissions elsewhere, this would not be reflected as a reduction of GHG emissions within Broward County in the current inventory methodology. Although reducing consumption of imported goods and increased recycling of consumer waste are not directly measured within this “community” GHG emissions inventory, strategies encouraging purchasing goods with recycled content, buying locally, and reducing packaging of consumer goods, still have environmental benefits on a wider scale. The scope of this inventory focuses on community-wide levels and sources of GHG emissions from different economic source categories and fuel sources. However, there are a number of other factors that should be considered when establishing GHG reduction targets and action strategies. For example, fuel sources vary in their emission of other pollutants such as, oxides of nitrogen, oxides of sulfur, other sulfur and nitrogen compounds, particulate matter, and air toxics, all of which have negative environmental impacts. Awareness of these other factors when designing GHG reduction strategies will help to avoid unintended environmental consequences. The broader socio-economic and environmental impacts of GHG emission reduction strategies need to be considered in order to develop a truly sustainable climate change action plan.

## APPENDICES

Appendix 1:

Resolution 2008-442

Resolution 2008-442

1  
2  
3 A RESOLUTION OF THE BROWARD COUNTY BOARD OF  
4 COUNTY COMMISSIONERS CREATING A BROWARD  
5 COUNTY CLIMATE CHANGE TASK FORCE;  
6 ESTABLISHING THE PURPOSE AND GOALS OF THE  
7 TASK FORCE; AND PROVIDING FOR AN EFFECTIVE  
8 DATE.

9 WHEREAS, there is widespread international consensus among climate  
10 scientists that climate change is occurring and that greenhouse gas emissions caused  
11 by human activities may be a contributing cause; and

12 WHEREAS, on March 6, 2007, Florida Governor Charlie Crist announced in his  
13 State of the State Address: "Florida is more vulnerable to rising ocean levels and violent  
14 weather patterns than any other state"; and

15 WHEREAS, subsequently Governor Crist signed Executive Orders 07-126,  
16 07-127, and 07-128 on July 13, 2007, establishing immediate actions to reduce  
17 greenhouse gas emissions in the state of Florida, and requiring development of an  
18 Energy and Climate Change Action Plan; and

19 WHEREAS, the 2008 Florida Legislature approved HB 7135, landmark  
20 energy/climate change legislation that builds on the policy framework established in  
21 Executive Orders 07-126, 07-127, and 07-128 and moves Florida a step closer to  
22 mitigating greenhouse gas emissions, becoming energy independent, and adapting to  
23 the consequences of climate change; and

24 WHEREAS, on December 19, 2007, President George W. Bush signed into law  
the Energy Independence and Security Act of 2007, that contains the first increase in  
fuel economy standards since 1974; and

1           WHEREAS, the U.S. Congress is currently considering far-reaching legislation  
2 related to greenhouse gas targets, an emissions tracking and monitoring system, a cap  
3 and trade system, and renewable fuel standards; and

4           WHEREAS, due to its geographic location and low-lying topography, Broward  
5 County is especially susceptible to the likely consequences of climate change, such as  
6 sea-level rise, flooding, beach erosion, salt water intrusion to potable water supplies,  
7 inundation of the Everglades and coastal wetlands, more intense tropical storms, and  
8 detrimental changes to South Florida ecosystems, coral reefs, marine life, and similar  
9 natural resources; and

10          WHEREAS, such impacts could have significant adverse economic and  
11 environmental impacts on Broward County and its residents; and

12          WHEREAS, there is increasing local, state, and national interest in taking action  
13 to reduce greenhouse gas emissions, with many states and municipalities, including  
14 more than twenty Broward County municipalities, and major U.S. corporations having  
15 already implemented, or planning to implement, measures to reduce greenhouse gas  
16 emissions; and

17          WHEREAS, Broward County is a member of the National Association of  
18 Counties (NACO) and the members of NACO support immediate and long-range efforts  
19 to mitigate possible sources of climate change; and

20          WHEREAS, through resolution efforts to mitigate sources of climate change,  
21 NACO has supported and encouraged counties to take local action; and

22          WHEREAS, the Water Advisory Board to the Broward County Board of County  
23 Commissioners identified climate change as a critical factor influencing the sustainability  
24 of the County's water resources and associated infrastructure; and

1           WHEREAS, the Water Advisory Board convened a technical subcommittee to  
2 give focus to the discussion of water resource implications of climate change and  
3 subsequently recommended county-wide coordination of climate change mitigation and  
4 adaptation programs, and efforts through the creation of a formal task force; and

5           WHEREAS, at its meeting of June 12, 2007, the County Commission passed a  
6 resolution supporting the U.S. Conference of Mayors Climate Protection Agreement  
7 ("Agreement"), signed onto the Agreement, and encouraged all city and town  
8 governments in Broward County to sign onto the Agreement; and

9           WHEREAS, the Broward County Board of County Commissioners is taking a  
10 proactive role in developing and implementing programs that result in the reduction of  
11 greenhouse gases, as reflected in the Broward County Government Operations Climate  
12 Change Report, dated May 30, 2008; and

13           WHEREAS it is in the best interest of the residents of Broward County to  
14 undertake cost-effective actions to mitigate the potential economic and environmental  
15 impacts of climate change; NOW, THEREFORE,

16  
17           BE IT RESOLVED BY THE BROWARD COUNTY BOARD OF COUNTY  
18 COMMISSIONERS:

19  
20           Section 1. A Climate Change Task Force is hereby established by the  
21 Broward County Board of County Commissioners.

22           Section 2. The purpose of the Climate Change Task Force shall be to develop  
23 a county-wide Climate Change Program (Program) to mitigate the causes and adapt to  
24 the consequences of climate change; and, if appropriate, advise on its implementation.

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- a) The goals of the Program shall include, but not be limited to:
  - i. Development and implementation of projects that conserve energy and reduce greenhouse gas emissions within government operations
  - ii. Development of incentives for residents, businesses, and organizations to conserve energy and reduce greenhouse gas emissions
  - iii. Development and implementation of adaptation strategies to alleviate the likely adverse consequences of climate change, including rising sea levels, hurricanes, and other violent weather events
  - iv. Provision of education and outreach to encourage Broward County residents, businesses, and organizations to participate in the Program
  - v. Pursuit of federal and state grants, energy cost savings, and other financial resources to offset Program costs
  
- b) The Climate Change Task Force shall coordinate with the Board of County Commissioners, the School Board, municipalities, other governmental agencies, businesses, private and public organizations, and the state of Florida in the adoption of programs to reduce greenhouse gas emissions in a cost-effective and efficient manner that preserves the County's competitiveness in the national and worldwide economy.

1 c) The Climate Change Task Force shall be appointed by the Broward  
2 County Board of Commissioners and consist of the following categorical  
3 representation:

- 4 1) Three (3) members representing Broward County government who  
5 shall be identified by position by the Broward County Board of  
6 County Commissioners, of which one shall be identified by the  
7 Board of County Commissioners to serve as Chair;
- 8 2) Two (2) at-large members;
- 9 3) One (1) member nominated by the Water Advisory Board to the  
10 Broward County Board of County Commissioners;
- 11 4) One (1) member nominated by the Broward County School Board;
- 12 5) Two (2) members nominated by the Broward League of Cities;
- 13 6) One (1) member nominated by a Hospital District in Broward  
14 County;
- 15 7) One (1) member nominated by the Broward Sheriff's Office;
- 16 8) One (1) member nominated by the South Florida Water  
17 Management District;
- 18 9) Two (2) members nominated by academic institutions with  
19 educational interests in Broward County and with appropriate  
20 scientific knowledge and experience in issues relating to climate  
21 change;
- 22 10) Two (2) members nominated by environmental organizations or  
23 interests in Broward County;
- 24 11) One (1) member nominated by the Florida Power & Light Company;

- 1           12) Three (3) members nominated by business and economic interests  
2           in Broward County;  
3           13) One (1) member nominated by the Florida Department of  
4           Transportation; and  
5           14) One (1) member nominated by the South Florida Regional Planning  
6           Council.

7           The Climate Change Task Force shall report directly to the Broward County  
8           Board of County Commissioners.

9  
10          Section 3. The Broward County Board of County Commissioners encourages  
11 and supports federal, state, and local initiatives to reduce greenhouse gas emissions.

12  
13          Section 4. EFFECTIVE DATE.

14          This Resolution shall become effective upon adoption.

15  
16          ADOPTED this 24th day June, 2008. # 88 B

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Appendix 2:  
Contact Information

**APPENDIX 2:** The table below illustrates the source categories and the companies that reported the data with examples of the type of data that was requested from each agency.

Name of Company	Data Provided	Primary Contact	Contact Information
Florida Power & Light	Electricity consumption for all source categories	Lynn Shatas	954-321-2215, Lynn_Shatas@fpl.com
TECO Peoples Gas Natural Gas	Natural gas for all source categories	Lance E. Horton	813-228-4561, lehorton@tecoenergy.com
Florida City Gas	Natural gas for all source categories	Terry Ryland	404-584-3953, tryland@aglresources.com
Pollution Prevention, Remediation and Air Quality	AOR Facilities fuel data from industrial facilities	Cliff Bittle	954-519-1220, cbittle@broward.org
Florida Department of Transportation	Total Vehicle Miles Traveled	Morgan Gordan	750-414-4848, gordan.morgan@dot.state.fl.us
Metropolitan Planning Organization	Total Vehicle Miles Traveled	Lina Chen Kulikowski	954-357-6610, lkulikowski@broward.org
CSXT	Total Fuel Usage	Rick Nath	904-359-1499, Rick_Nath@csx.com
Tri-Rail	Total Fuel Usage	Marcin Gadek	954-788-7950, gadekm@sfrta.fl.gov
Amtrak	Total Fuel Usage	Craig Caldwell	215-349-6968, CaldweC@amtrak.com
Florida East Coast Railway	Total Fuel Usage	Juan Betancourt	305-889-5613, juan.betancourt@railamerica.com
Broward County Waste & Recycling	Total Solid Waste & Recycling Data for 2007 and 2020 projections	Peter Foye	954-577-2395, pfoye@broward.org
BC Planning and Redevelopment Division	Population Data	Bill Leonard	954-357-6033, tleonard@broward.org
Federal Aviation Administration	Guidance on use of EDMS	Ralph Iovinelli	202-267-3566, ralph.iovinelli@faa.gov
Broward County Aviation Department	Information on location of previous air quality and environmental impact statement reports conducted at the Fort Lauderdale – Hollywood International Airport	Michael Pacitto Brad Ostendorf	954-359-6103, <a href="mailto:mpacitto@broward.org">mpacitto@broward.org</a> 954-359-2395, bostendorf@broward.org
Fort Lauderdale Executive Airport	Information on estimated breakdown of airplanes which fly into/out of the FXE airport	Florence Straugh	954-828-4955, fstraugh@fortlauderdale.gov
Broward County Aviation Department	Information on estimated breakdown of airplanes which fly into/out of the FLL and HWO airports	Jonathan E. Clark	954-359-6146, jeclark@broward.org
Pompano Beach Airpark	Information on estimated breakdown of airplanes which fly into/out	Steve Rocco	954-786-4135, steve.rocco@copbfl.com

**Appendix 3:**

**Broward County Boundaries**

# **Florida State Organization Code Section 7.06 - County Boundaries - Broward County.**

## **Title II STATE ORGANIZATION**

### **Chapter 7 COUNTY BOUNDARIES**

**7.06 Broward County.**--The boundary lines of Broward County are as follows: Beginning on the east boundary of the State of Florida at a point where the south boundary of township forty-seven south of range forty-three east, produced easterly, would intersect the same; thence westerly on said township boundary to its intersection with the axis or center line of Hillsborough State Drainage Canal, as at present located and constructed; thence westerly along the center line of said canal to its intersection with the section line dividing sections twenty-six and thirty-five of township forty-seven south, of range forty-one east; thence westerly on the said section line dividing sections twenty-six, thirty-five and other sections to the northwest corner of said section thirty-one of township forty-seven south of range forty-one, east; thence south on the range line dividing ranges forty and forty-one east, of township forty-seven south, to the northeast corner of section twenty-five of township forty-seven, south, of range forty east, a distance of one hundred and six feet, more or less; thence due west on the north boundaries of the sections numbered from twenty-five to thirty, inclusive, of townships forty-seven south, of ranges thirty-seven to forty east, inclusive, as the same have been surveyed, or may hereafter be surveyed, by the authority of the Board of Trustees of the Internal Improvement Trust Fund, to the northwest corner of section thirty of township forty-seven south, of range thirty-seven east; thence continuing due west to the range line between ranges thirty-four and thirty-five east; thence southerly on the range line dividing ranges thirty-four and thirty-five east, to the southwest corner of township fifty-one south, of range thirty-five east; thence east following the south line of township fifty-one south, across ranges thirty-five, thirty-six, thirty-seven, thirty-eight, thirty-nine and forty, to the southwest corner of township fifty-one south of range forty-one east; thence north on the range line dividing ranges forty and forty-one to the northwest corner of section thirty-one of township fifty-one south, of range forty-one east; thence east on the north boundary of section thirty-one and other sections to the waters of the Atlantic Ocean; thence easterly to the eastern boundary of the State of Florida; thence northerly along said eastern boundary to the point of beginning. In addition, the boundary lines of Broward County include the following: Begin at the northwest corner of section thirty-five, township fifty-one south, range forty-

two east, Dade County, Florida; thence, southerly following the west line of section thirty-five, township fifty-one south, range forty-two east to the intersection with a line which is two hundred and thirty feet south of and parallel to the north line of section thirty-five, township fifty-one south, range forty-two east; thence, easterly following the line which is two hundred and thirty feet south of and parallel to the north line of section thirty-five, township fifty-one south, range forty-two east, to the intersection with the west boundary line of the Town of Golden Beach; thence, northerly following the west boundary line of the Town of Golden Beach to the intersection with the north line of section thirty-five, township fifty-one south, range forty-two east; thence, westerly following the north line of section thirty-five, township fifty-one south, range forty-two east to the point of beginning.

**History**--s. 1, ch. 6934, 1915; RGS 60; CGL 66; ss. 27, 35, ch. 69-106; s. 1, ch. 78-119.

*Last modified: November 21, 2006*

Appendix 4:  
EDMS Model Output

EDMS 5.1 Emissions Inventory Report  
Emissions Inventory Summary  
Study: Broward County Florida  
Scenario - Airport: Baseline  
Year: 2007  
Units: Metric Tons per Year  
Generated: 04/22/09 16:55:13

Category	CO <sub>2</sub>	CO	THC	NMHC	VOC	TOG	NO <sub>x</sub>	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>Ft. Lauderdale - Hollywood International Airport (FLL)</b>										
Aircraft	291,537	1,611.33	272.37	313.95	312.20	314.318	954.54	119.387	16.764	16.764
GSE	N/A	1,692.24	N/A	55.63	57.89	63.992	182.73	9.621	5.471	5.259
APUs	N/A	43.99	2.82	3.26	3.24	3.256	39.40	5.359	5.111	5.111
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Grand Total</b>	<b>291,537</b>	<b>3,347.56</b>	<b>275.19</b>	<b>372.84</b>	<b>373.33</b>	<b>381.565</b>	<b>1,176.67</b>	<b>134.366</b>	<b>27.345</b>	<b>27.133</b>
<b>Ft. Lauderdale Executive Airport (FXE)</b>										
Aircraft	15,756	1,418.97	98.48	106.49	105.07	109.275	20.23	6.452	0.861	0.861
GSE	N/A	163.18	N/A	5.44	5.66	6.263	17.68	0.845	0.441	0.423
APUs	N/A	2.02	0.05	0.06	0.06	0.059	0.53	0.094	0.086	0.086
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Grand Total</b>	<b>15,756</b>	<b>1,584.17</b>	<b>98.53</b>	<b>111.98</b>	<b>110.78</b>	<b>115.598</b>	<b>38.44</b>	<b>7.390</b>	<b>1.387</b>	<b>1.369</b>
<b>North Perry Airport (HWO)</b>										
Aircraft	3,212	909.25	29.82	28.31	27.45	30.643	1.33	1.315	0.000	0.000
GSE	N/A	13.58	N/A	0.59	0.62	0.670	3.31	0.274	0.115	0.111
APUs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Grand Total</b>	<b>3,212</b>	<b>922.83</b>	<b>29.82</b>	<b>28.91</b>	<b>28.07</b>	<b>31.313</b>	<b>4.64</b>	<b>1.589</b>	<b>0.115</b>	<b>0.111</b>
<b>Pompano Beach Airpark (PMP)</b>										
Aircraft	4,105	766.42	39.31	40.86	40.11	42.597	2.93	1.681	0.321	0.321
GSE	N/A	46.43	N/A	1.59	1.65	1.825	5.63	0.314	0.152	0.146
APUs	N/A	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Grand Total</b>	<b>4,105</b>	<b>812.86</b>	<b>39.31</b>	<b>42.45</b>	<b>41.77</b>	<b>44.422</b>	<b>8.56</b>	<b>1.995</b>	<b>0.473</b>	<b>0.467</b>
<b>All Broward County Airports</b>	<b>314,611</b>	<b>6,667.41</b>	<b>442.84</b>	<b>556.18</b>	<b>553.95</b>	<b>572.898</b>	<b>1,228.31</b>	<b>145.340</b>	<b>29.320</b>	<b>29.080</b>

Appendix 5:  
CACP Model Output

# Broward County

## Community Greenhouse Gas Emissions in 2007

### Summary Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO <sub>2</sub> (%)	Energy (kWh)
<b>Residential</b>	5,935,434	26.5	11,149,533,484
<b>Commercial</b>	5,353,935	23.9	10,613,730,663
<b>Industrial</b>	263,397	1.2	994,439,678
<b>Transportation</b>	10,047,035	44.9	37,860,245,221
<b>Waste</b>	452,521	2.0	
<b>Other</b>	314,611	1.4	
<b>Total</b>	22,366,933	100.0	60,617,949,045

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
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### Residential

#### Broward County, Florida

##### Electricity Usage (FPL)

Electricity	5,892,643	26.3	10,925,839,909
<b>Subtotal Electricity Usage (FPL)</b>	<b>5,892,643</b>	<b>26.3</b>	<b>10,925,839,909</b>

Of the total annual consumption of electricity, the annual residential consumption is 10,925,839,909 kWh. Total residential customers=981,149. Per residential unit is 11,136 kWh. Per Capita for the residential sector is 9,915 kWh. Within the residential sector, energy is consumed for such end-uses as water heating, appliances, lighting and space cooling.

##### Natural Gas Usage

Natural Gas	42,790	0.2	223,693,575
<b>Subtotal Natural Gas Usage</b>	<b>42,790</b>	<b>0.2</b>	<b>223,693,575</b>

TECO Peoples Gas supplied data on Broward County usage directly in therms (4,628,503).

However, Florida City Gas data was provided in dekatherms for the Florida region. They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49 percent of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 resulting in the total natural gas combusted in Broward County (319,720 dekatherms).

Assuming Broward County mimics the region, the percent breakdown for residential is:

Residential        300,536 dekatherms

CONVERSION: DEKATHERMS TO THERMS

1 dekatherm = 10,002,398.55 therms [U.S.]

Residential Therms        3,006,090

<b>Subtotal Residential</b>	<b>5,935,434</b>	<b>26.5</b>	<b>11,149,533,484</b>
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### Commercial

#### Broward County, Florida

##### Electricity Usage (FPL)

Electricity	5,150,369	23.0	9,549,552,553
<b>Subtotal Electricity Usage (FPL)</b>	<b>5,150,369</b>	<b>23.0</b>	<b>9,549,552,553</b>

Of the total annual consumption of electricity, the annual commercial consumption is 9,549,552,553 kWh. Total commercial customers=117,677. Per commercial unit is 81,151 kWh. Per Capita for the commercial sector is 8,666 kWh. Within the commercial sector, energy is consumed for such end-uses as water heating, lighting and space cooling.

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
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### *Natural Gas Usage (TECO & Florida City)*

Natural Gas	203,566	0.9	1,064,178,110
<b>Subtotal Natural Gas Usage (TECO &amp; Florida City)</b>	<b>203,566</b>	<b>0.9</b>	<b>1,064,178,110</b>

TECO Peoples Gas supplied data on Broward County usage directly in therms (36,160,174).

However, Florida City Gas data was provided in dekatherms for the Florida region. They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49 percent of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 resulting in the total natural gas combusted in Broward County (319,720 dekatherms).

Assuming Broward County mimics the region, the percent breakdown for commercial:

Commercial 15,986 dekatherms

CONVERSION: DEKATHERMS TO THERMS

1 dekatherm = 10,002,398.55 therms [U.S.]

Commercial Therms 159,898

<b>Subtotal Commercial</b>	<b>5,353,935</b>	<b>23.9</b>	<b>10,613,730,663</b>
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### **Industrial**

#### **Broward County, Florida**

#### *AOR Industrial*

Light Fuel Oil	19,408	0.1	76,007,367
Propane	4	0.0	17,223
Biomethane	0	0.0	437,957,266
<b>Subtotal AOR Industrial</b>	<b>19,412</b>	<b>0.1</b>	<b>513,981,857</b>

Unlike residential and commercial emissions, the "industrial sector" emissions are dominated from energy used for fuel manufacturing or other industrial processes, rather than water heating. Examples of combustion of fuels for industrial processing come from facilities such as asphalt plants, gasoline transfer stations, and industrial combustion engines. The Annual Operating Report (AOR) containing a query of the annual fuel usage and process data was used. This is a report required for certain state permitted facilities in order to demonstrate actual yearly fuel use consumption and emissions. The first step was taking combusted fuels data and dividing them into fuel groups (distillate oil, gasoline, jet fuel, petroleum liquid, etc.). Only combustion units were identified and grouped into the respective fuel types required for the CACP software. Those categories are light fuel oil, biomethane and propane. The fuel type-light fuel oil contains diesel, distillate oil, residual oil and liquid waste oil. Data for fuel that was not being combusted was not included, such as storage tanks, fugitive gases, vapor recovery units and vapor combustion units.

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
<i>Electricity Usage (FPL)</i>			
Electricity	235,665	1.1	436,957,195
<b>Subtotal Electricity Usage (FPL)</b>	<b>235,665</b>	<b>1.1</b>	<b>436,957,195</b>

Of the total annual consumption of electricity, the annual industrial consumption is 436,957,195 kWh. Total industrial customers= 2,867. Per industrial unit is 152,409 kWh. Per Capita for the industrial sector is 397 kWh.

Within the industrial sector, energy is consumed for such end-uses as water heating, lighting and space cooling.

### *Natural Gas Usage*

Natural Gas	8,321	0.0	43,500,626
<b>Subtotal Natural Gas Usage</b>	<b>8,321</b>	<b>0.0</b>	<b>43,500,626</b>

TECO Peoples Gas supplied data on Broward County usage directly in therms (1,452,683).

However, Florida City Gas data was provided in dekatherms for the Florida region. They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49 percent of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 resulting in the total natural gas combusted in Broward County (319,720 dekatherms).

Assuming Broward County mimics the region, the percent breakdown for industrial is:

Industrial            3,197 dekatherms

CONVERSION: DEKATHERMS TO THERMS

1 dekatherm = 10,002,398.55 therms [U.S.]

Industrial Therms 31,980

<b>Subtotal Industrial</b>	<b>263,397</b>	<b>1.2</b>	<b>994,439,678</b>
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### **Transportation**

#### **Broward County, Florida**

#### *Amtrak Railroad*

Diesel	841	0.0	3,131,710
<b>Subtotal Amtrak Railroad</b>	<b>841</b>	<b>0.0</b>	<b>3,131,710</b>

AmTrak runs four trains daily on the Seaboard Coastline railroad which has approximately 25 miles of track throughout Broward County. Amtrak trains travel 100 miles per day or 36,500 miles per year in Broward County. Amtrak indicated that the national average diesel fuel usage is 2.4 gallons per mile. Based on these numbers, Amtrak estimates that during 2007 they used 87,600 gallons of diesel fuel within Broward County. Data was provided by Craig Caldwell (CaldweC@amtrak.com) 215-349-6968.

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
<i>CSXT Railroad</i>			
Diesel	1,706	0.0	6,352,473
Diesel (ULSD)	1,711	0.0	6,371,157
<b>Subtotal CSXT Railroad</b>	<b>3,416</b>	<b>0.0</b>	<b>12,723,630</b>

There are two main rail lines in Broward County: the Florida East Coast Railways (FEC) and CSX Transportation (CSXT). Whereas only FEC freight trains run on the FEC line, both AmTrak and Tri-Rail as well as CSXT freight trains use the CSXT rail line. Seasonal adjustments are not appropriate for this category as rail traffic do not vary seasonally.

In order to determine the system wide fuel consumption for CSXT, calculations had to be made on the Gross Ton Mile (GTM) which is the number of tons behind the locomotive multiplied by the distance moved by the road freight trains. The estimated fuel consumed for the county was calculated by taking the county GTM (308,000,000) and dividing that by the system wide fuel efficiency (867 GTM per gallon). CSXT reported that for calendar year 2007 the estimated fuel usage in gallons within the geographical boundaries of Broward County was 355,381 gallons. Assumptions were made that there was a 50/50 split in the use of diesel and ultra low sulfur diesel fuel. Rick Nath(Rick\_Nath@csx.com) (904) 359-1499.

### *Florida East Coast Railway*

Diesel	23,927	0.1	89,109,586
<b>Subtotal Florida East Coast Railway</b>	<b>23,927</b>	<b>0.1</b>	<b>89,109,586</b>

The Florida East Coast Railway runs three jobs 5 days a week in Broward County with one locomotive per job with a fuel consumption average of 7 gallons/hour. This totaled 840 gallons of fuel used. On the weekend FEC operates one job per day totaling 56 gallons of fuel used. Based on these numbers FEC estimates that they used 47,934 gallons of diesel fuel per week which translates into total estimated fuel consumption for FEC locomotives operating in Broward County to be 2,492,568 gallons of regular diesel fuel during calendar year 2007. Data was provided by Juan Betancourt ([juan.betancourt@railamerica.com](mailto:juan.betancourt@railamerica.com)) 305-889-5613.

### *Total Vehicle Miles Traveled*

Gasoline	8,260,830	36.9	31,213,497,272
Diesel	1,750,335	7.8	6,513,162,392
<b>Subtotal Total Vehicle Miles Traveled</b>	<b>10,011,166</b>	<b>44.8</b>	<b>37,726,659,664</b>

GHG emissions from vehicles were calculated using Annual Average Daily Traffic (AADT) data generated by the Florida Department of Transportation (FDOT) monitoring sites located along the major roadways within Broward County. The daily VMT for Broward County in 2007 was 46,572,803. In order to calculate the total VMT data for calendar year 2007, the 46,572,803 was multiplied by 365 days in the year to come up with a total of 16,999,073,095 VMT in calendar year 2007. Because VMT includes all types of vehicles (buses, cars, trucks, etc.), the CACP model Transportation Assistant was used to help estimate fuel usage based on total VMT, fuel efficiency, and vehicle breakdown in the community. The Daily VMT for public roads in Florida is calculated by the Transportation Statistics Office who prepares an annual report of centerline miles and daily VMT on all of the public roads in Florida. The methodology used for these estimates is to calculate the VMT separately for three different road types: roads on the State Highway System; roads off the State Highway System functionally classified as Collector or above; and roads that are functionally classified as Local.

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
<i>Tri-Rail Railroad</i>			
Diesel	3,837	0.0	14,289,302
Diesel (ULSD)	3,848	0.0	14,331,329
<b>Subtotal Tri-Rail Railroad</b>	<b>7,685</b>	<b>0.0</b>	<b>28,620,631</b>
<p>Fuel data provided by Tri-Rail was calculated by using the total revenue miles in Broward County, which is 333,083 revenue miles. The revenue miles were multiplied by the average fuel mileage of 2.4 gallons/mile resulting in an estimated 799,399 gallons. Tri-Rail indicated that both ultra low sulfur diesel and diesel were used in 2007 but they were not able to provide the percentage usage. Tri-Rail claimed that it varied based on price fluctuations and availability. For the purpose of this analysis a 50/50 split was used. Data was provided by Marcin Gadek (gadekm@sfrta.fl.gov) 954-788-7950.</p>			
<b>Subtotal Transportation</b>	<b>10,047,035</b>	<b>44.9</b>	<b>37,860,245,221</b>

### Waste

#### Broward County, Florida

#### *Solid Waste- Landfilled*

#### *Disposal Method - Managed Landfill*

Paper Products	176,607	0.8	
Food Waste	24,122	0.1	
Plant Debris	-33,694	-0.2	
Wood/Textiles	-24,696	-0.1	
<b>Subtotal Solid Waste- Landfilled</b>	<b>142,339</b>	<b>0.6</b>	

This data is based on the April 1, 2007 Governor's Office Broward County population estimates (1,765,707).

The data includes landfill collection from all cities and unincorporated areas of Broward County.

The information was recorded and managed by Broward County Waste and Recycling Services (WRS) that analyzed Municipal Solid Waste Collection and recycling (January 1, 2007 through December 31, 2007). The waste type percentages(material type tons) were added together and are reflected in the waste type percentages above. For additional information, please contact BC Air Quality at 954-519-1220.

Note: Certain information reflected in the CACP entries have not been certified by the Florida Department of Environmental Protection and according to Broward County Waste and Recycling may not be certified by the FDEP until August 2009, when Broward County Pollution Prevention Remediation and Air Quality Program/ Waste Regulation Section submits the 2007 Benchmarks to the FDEP.

Contacts:

Peter Foye, BC Waste and Recycling Coordinator

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO <sub>2</sub> (%)	Energy (kWh)
<i>Solid Waste-Incineration (Waste-to-Energy)</i>			<i>Disposal Method - Controlled Incineration</i>
Paper Products	15,182	0.1	
Food Waste	6,282	0.0	
Plant Debris	11,954	0.1	
Wood/Textiles	9,249	0.0	
All Other Waste	267,516	1.2	
<b>Subtotal Solid Waste-Incineration (Waste-to-Energy)</b>		<b>1.4</b>	

This data is based on the April 1, 2007 Governor's Office Broward County population estimates (1,765,707).

The data includes landfill collection from all cities and unincorporated areas of Broward County.

The information was recorded and managed by Broward County Waste and Recycling Services (WRS) that analyzed Municipal Solid Waste Collection and recycling (January 1, 2007 through December 31, 2007). The waste type percentages(material type tons) were added together and are reflected in the waste type percentages above. For additional information, please contact BC Air Quality at 954-519-1220.

Note: Certain information reflected in the CACP entries have not been certified by the Florida Department of Environmental Protection and according to Broward County Waste and Recycling may not be certified by the FDEP until August 2009, when Broward County Pollution Prevention Remediation and Air Quality Program/ Waste Regulation Section submits the 2007 Benchmarks to the FDEP.

Contacts:

Peter Foye, BC Waste and Recycling Coordinator

<b>Subtotal Waste</b>	452,521	2.0
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### Other

#### Broward County, Florida

##### All Broward County Airports

Carbon Dioxide	314,611	1.4
<b>Subtotal All Broward County Airports</b>	<b>314,611</b>	<b>1.4</b>

This includes all emissions from the following Broward County Airports:

Ft. Lauderdale - Hollywood International Airport (FLL)

Ft. Lauderdale Executive Airport (FXE)

North Perry Airports (HWO)

Pompano Beach Airport (PMP)

Contact Info.:

Federal Aviation Administration: Ralph Lovinelli; 202-267-3566

Broward County Aviation Department: Michael Pacitto; 954-359-6103

Broward County Aviation Department: Brad Ostendorf; 954-359-2395

Fort Lauderdale Executive Airport: Florence Straugh; 954-828-4955

## Community Greenhouse Gas Emissions in 2007 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)		Energy (kWh)
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Broward County Aviation Department: Jonathan E. Clark: 954-359-6146  
 Pompano Beach Airpark: Steve Rocco: 954-786-4135

For specific details, please refer to the Report.

<b>Subtotal Other</b>	314,611	1.4		
<b>Total</b>	22,366,933	100.0		60,617,949,045

# Broward County

## Community Greenhouse Gas Emissions in 2020

### Summary Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO <sub>2</sub> (%)	Energy (kWh)
<b>Residential</b>	6,543,907	25.3	12,233,048,331
<b>Commercial</b>	6,608,487	25.5	12,895,832,209
<b>Industrial</b>	338,412	1.3	1,209,052,144
<b>Transportation</b>	11,490,047	44.4	43,346,761,793
<b>Waste</b>	500,277	1.9	
<b>Other</b>	415,348	1.6	
<b>Total</b>	25,896,479	100.0	69,684,694,478

## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
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### Residential

#### Broward County, Florida

##### Electricity Usage (FPL)

Electricity	6,501,117	25.1	12,009,354,757
<b>Subtotal Electricity Usage (FPL)</b>	<b>6,501,117</b>	<b>25.1</b>	<b>12,009,354,757</b>

Of the total annual consumption of electricity, the annual residential consumption is 10,925,839,909 kWh. Total residential customers=981,149. Per residential unit is 11,136 kWh. Per Capita for the residential sector is 9,915 kWh. Within the residential sector, energy is consumed for such end-uses as water heating, appliances, lighting and space cooling.

##### Natural Gas Usage

Natural Gas	42,790	0.2	223,693,575
<b>Subtotal Natural Gas Usage</b>	<b>42,790</b>	<b>0.2</b>	<b>223,693,575</b>

TECO Peoples Gas supplied data on Broward County usage directly in therms (4,628,503).

However, Florida City Gas data was provided in dekatherms for the Florida region. They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49 percent of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 resulting in the total natural gas combusted in Broward County (319,720 dekatherms).

Assuming Broward County mimics the region, the percent breakdown for residential is:

Residential        300,536 dekatherms

CONVERSION: DEKATHERMS TO THERMS

1 dekatherm = 10,002,398.55 therms [U.S.]

Residential Therms        3,006,090

<b>Subtotal Residential</b>	<b>6,543,907</b>	<b>25.3</b>	<b>12,233,048,331</b>
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### Commercial

#### Broward County, Florida

##### Electricity Usage (FPL)

Electricity	6,404,921	24.7	11,831,654,100
<b>Subtotal Electricity Usage (FPL)</b>	<b>6,404,921</b>	<b>24.7</b>	<b>11,831,654,100</b>

Of the total annual consumption of electricity, the annual commercial consumption is 9,549,552,553 kWh. Total commercial customers=117,677. Per commercial unit is 81,151 kWh. Per Capita for the commercial sector is 8,666 kWh. Within the commercial sector, energy is consumed for such end-uses as water heating, lighting and space cooling.

## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
<i>Natural Gas Usage (TECO &amp; Florida City)</i>			
Natural Gas	203,566	0.8	1,064,178,110
<b>Subtotal Natural Gas Usage (TECO &amp; Florida City)</b>	<b>203,566</b>	<b>0.8</b>	<b>1,064,178,110</b>
TECO Peoples Gas supplied data on Broward County usage directly in therms (36,160,174).			
However, Florida City Gas data was provided in dekatherms for the Florida region. They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49 percent of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 resulting in the total natural gas combusted in Broward County (319,720 dekatherms).			
Assuming Broward County mimics the region, the percent breakdown for commercial:			
Commercial	15,986 dekatherms		
CONVERSION: DEKATHERMS TO THERMS			
1 dekatherm = 10,002,398.55 therms [U.S.]			
Commercial Therms	159,898		
<b>Subtotal Commercial</b>	<b>6,608,487</b>	<b>25.5</b>	<b>12,895,832,209</b>
<b>Industrial</b>			
<b>Broward County, Florida</b>			
<i>AOR Industrial</i>			
Light Fuel Oil	25,029	0.1	98,023,304
Propane	5	0.0	22,212
Biomethane	0	0.0	503,981,841
<b>Subtotal AOR Industrial</b>	<b>25,034</b>	<b>0.1</b>	<b>602,027,357</b>

Unlike residential and commercial emissions, the "industrial sector" emissions are dominated from energy used for fuel manufacturing or other industrial processes, rather than water heating. Examples of combustion of fuels for industrial processing come from facilities such as asphalt plants, gasoline transfer stations, and industrial combustion engines. The Annual Operating Report (AOR) containing a query of the annual fuel usage and process data was used. This is a report required for certain state permitted facilities in order to demonstrate actual yearly fuel use consumption and emissions. The first step was taking combusted fuels data and dividing them into fuel groups (distillate oil, gasoline, jet fuel, petroleum liquid, etc.). Only combustion units were identified and grouped into the respective fuel types required for the CACP software. Those categories are light fuel oil, biomethane and propane. The fuel type-light fuel oil contains diesel, distillate oil, residual oil and liquid waste oil. Data for fuel that was not being combusted was not included, such as storage tanks, fugitive gases, vapor recovery units and vapor combustion units.

## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
<i>Electricity Usage (FPL)</i>			
Electricity	305,057	1.2	563,524,161
<b>Subtotal Electricity Usage (FPL)</b>	<b>305,057</b>	<b>1.2</b>	<b>563,524,161</b>
Of the total annual consumption of electricity, the annual industrial consumption is 436,957,195 kWh. Total industrial customers= 2,867. Per industrial unit is 152,409 kWh. Per Capita for the industrial sector is 397 kWh. Within the industrial sector, energy is consumed for such end-uses as water heating, lighting and space cooling.			
<i>Natural Gas Usage</i>			
Natural Gas	8,321	0.0	43,500,626
<b>Subtotal Natural Gas Usage</b>	<b>8,321</b>	<b>0.0</b>	<b>43,500,626</b>
TECO Peoples Gas supplied data on Broward County usage directly in therms (1,452,683). However, Florida City Gas data was provided in dekatherms for the Florida region. They supplied a unit count for Broward County (3,629) and total units in the region. With that information, it was determined that 3.49 percent of the meters are located within Broward County (assuming every meter is broken down evenly across the region, we get 3.49% of the total fuel usage belonging to Broward). The total 9,157,000 (total regional dekatherms) was multiplied by .0349 resulting in the total natural gas combusted in Broward County (319,720 dekatherms). Assuming Broward County mimics the region, the percent breakdown for industrial is: Industrial            3,197 dekatherms CONVERSION: DEKATHERMS TO THERMS 1 dekatherm = 10,002 398 55 therms [U.S.] Industrial Therms 31,980			
<b>Subtotal Industrial</b>	<b>338,412</b>	<b>1.3</b>	<b>1,209,052,144</b>

### Transportation

#### Broward County, Florida

##### Amtrak Railroad

Diesel	841	0.0	3,131,710
<b>Subtotal Amtrak Railroad</b>	<b>841</b>	<b>0.0</b>	<b>3,131,710</b>

Amtrak has no plans to expand their service throughout Broward County and estimate no growth in operation until 2020. Subsequently the same procedure used for estimating 2007 fuel data was used for 2020 projection. They acknowledge the uncertainties with estimating projections. Amtrak states that they have not increased the number of trains in operation since the year 2000. As a result, the fuel consumption numbers that were provided for the 2007 baseline year for the community wide greenhouse gas inventory would be applicable for any of the years prior to 2007. Based on this assumption, in the years 2005 and 2006 Amtrak ran four trains daily on the Seaboard Coastline railroad which has approximately 25 miles of track throughout Broward County. Amtrak trains travel 100 miles per day or 36,500 miles per year in Broward County. Amtrak indicated that the national average diesel fuel usage is 2.4 gallons per mile. Based on these numbers, Amtrak estimates that during 2005 and 2006 they used 87,600 gallons of diesel fuel per year within Broward County. Projection data was provided by Craig Caldwell ([CaldweC@amtrak.com](mailto:CaldweC@amtrak.com)) 215-349-

## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
6968.			
<i>CSXT Railroad</i>			
Diesel	1,706	0.0	6,352,455
Diesel (ULSD)	1,711	0.0	6,371,139
<i>Subtotal CSXT Railroad</i>	3,416	0.0	12,723,594

Projection data was provided by Rick Nath, Manager of Environmental Program for CSXT and they estimate no growth in operations till 2020. Subsequently the same procedure used for estimating 2007 fuel data was used for 2020 projection. CSXT acknowledges the uncertainties involved in projecting till 2020 and that forecasting to 2050 depends on factors such as the US and world economies. CSXT provided fuel consumption data for the geographical boundaries of Broward County for 2005, 2006 and 2007. In 2005 CSXT stated that they used 459,576 gallons of fuel with a system wide fuel efficiency of 842 (Gross Ton Miles/gal). In 2006 CSXT calculated that they used an estimated 457,812 gallons of diesel fuel with a system wide fuel efficiency of 853 GTM/gal. CSXT reported that for calendar year 2007 the estimated fuel usage in gallons within the geographical boundaries of Broward County was 355,381 gallons. CSXT assumptions were based on a 50/50 split in the use of diesel and ultra low sulfur diesel fuel. ([Rick\\_Nath@csx.com](mailto:Rick_Nath@csx.com)). 904-359-1499.

### *Florida East Coast Railway*

Diesel	23,927	0.1	89,109,586
<i>Subtotal Florida East Coast Railway</i>	23,927	0.1	89,109,586

Florida East Coast Railway (FEC) indicated that they are estimating no growth in operations through 2020. Subsequently the same procedure used for estimating 2007 fuel data was used for 2020 projection. FEC states that the fuel consumption numbers that were provided for the 2007 baseline year for the community wide greenhouse gas inventory would be applicable from 2002-2007. Based on these numbers FEC estimates that they used 47,934 gallons of diesel fuel per week which translates into total estimated fuel consumption for FEC locomotives operating in Broward County to be 2,492,568 gallons of regular diesel fuel per calendar year. Juan Betancourt of FEC ([juan.betancourt@railamerica.com](mailto:juan.betancourt@railamerica.com)) 305-889-5613.

### *Total Vehicle Miles Traveled*

Gasoline	9,357,046	36.1	35,375,242,550
Diesel	2,104,731	8.1	7,832,072,298
<i>Subtotal Total Vehicle Miles Traveled</i>	11,461,777	44.3	43,207,314,848

The On-Road projections of vehicle miles traveled (VMT) in 2030 that were developed by a travel demand model by the Broward County Metropolitan Planning Organization Division, based on the implementation of the transportation improvement projects contained within the Broward County MPO Long Range Transportation Plan. The Vehicle Mile Traveled (VMT) is the result of multiplying the daily traffic volume on a specific roadway link time the length of that link in miles. The county VMT is the aggregate of all roadway links in the county. VMT is often estimated using the travel forecast model. However, that estimate covers only the roadway network coded in the model, which includes collectors and above facilities. In order to obtain an accurate comparison to FDOT traffic counts, which includes all of the roadways in Broward County, the FDOT total VMT was broken down to include only the urban collector and above roadways. The 136.07% growth rate was determined by dividing the 2030 VMT projection of 51,435,308 by the FDOT 2007 adjusted VMT of 37,800,313. This resulted in a new 2030 VMT projection of which includes all roadways to be 63,372,133 miles per day. The VMT on local roads is estimated by the Florida Department of Transportation (FDOT) <<http://www.dot.state.fl.us/planning/statistics/mileage-rpts/public.shtm>>. Projections for 2020 and 2050 were made using linear

## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
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regression plotting the yearly VMT data from the years 2000, 2007, and 2030. Through these calculations we were able to determine that the VMT for 2020 is 20,449,895 reported in thousand vehicle miles traveled. VMT data projections for 2030 were provided by Lina Kulikowski (lkulikowski@broward.org) 954-357-6610 of the Broward Metropolitan Planning Organization of the Environmental Protection and Growth Management Department.

### *Tri-Rail Railroad*

Biodiesel (B100)	85	0.0	34,482,056
<b>Subtotal Tri-Rail Railroad</b>	85	0.0	34,482,056

Tri-Rail has increased the daily number of trains from 28 in 2005 to 40 in 2006 to 50 in 2007. Tri-Rail did some calculations and estimated that in 2050 they would be running approximately double, 100, the amount of trains daily as they were in 2007. The CACP model only allows for projections until 2020, therefore regression analysis was used to obtain fuel consumption in 2020. Based on the results fuel usage is projected to be 1,041.08 thousand gallons of biodiesel (1,041,080). The 2007 and 2050 projection estimates were provided by Marcin Gadek ([gadekm@sfrta.fl.gov](mailto:gadekm@sfrta.fl.gov)). 954-788-7950.

Note: Eventhough TriRail uses B99 the CACP software is limited to the use of B100.

<b>Subtotal Transportation</b>	11,490,047	44.4	43,346,761,793
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### **Waste**

#### **Broward County, Florida**

<i>Solid Waste- Landfilled</i>		<i>Disposal Method - Managed Landfill</i>
Paper Products	123,162	0.5
Food Waste	16,822	0.1
Plant Debris	-23,498	-0.1
Wood/Textiles	-17,223	-0.1
<b>Subtotal Solid Waste- Landfilled</b>	99,264	0.4

In order to determine the tons of waste per capita, the 2007 total waste of 3,344,094 tons (provided by Peter Foye of Waste and Recycling) was divided by the 2007 population. The tons of waste per capita was calculated to be 1.89 tons of waste per capita per year. The baseline year of 2007, the 2020 projection year as well as the 2050 projection year were calculated in the same manner. According to Mr. Peter Foye, BC WRS, the growth projections between now and 2050 will be 10% less than current. He stated that in the future, we will combust and reclaim energy greater than we are now. Waste tonnage projections and the waste stream percentage share are listed below.

#### Assumptions:

Assume that waste per capita and the composition of waste stream percentages stays the same from 2007 through 2050.

Unexpected factors are not accounted for when making these projections. For example: hurricanes, natural disasters, economic situation of the Country, and new regulations.

This report captures community-wide emissions and does not account for avoided disposal. Therefore, recycling data was not entered into the model, but based on the data provided in 2007 Broward County recycled 25% of the waste, and is projected to recycle

## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO <sub>2</sub> (%)	Energy (kWh)
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an estimated 35% by 2020.

Contact Information:

Broward County Waste and Recycling: Peter Foye: pfoye@broward.org

Bill Leonard, Senior Planner Broward County Planning and Redevelopment Division Broward County Environmental Protection and Growth Management Dept. blennard@broward.org.

<i>Solid Waste-Incineration (Waste-to-Energy)</i>	<i>Disposal Method - Controlled Incineration</i>	
Paper Products	19,628	0.1
Food Waste	8,122	0.0
Plant Debris	15,454	0.1
Wood/Textiles	11,957	0.0
All Other Waste	345,852	1.3
<b>Subtotal Solid Waste-Incineration (Waste-to-Energy)</b>	<b>1.5</b>	

In order to determine the tons of waste per capita, the 2007 total waste of 3,344,094 tons (provided by Peter Foye of Waste and Recycling) was divided by the 2007 population. The tons of waste per capita was calculated to be 1.89 tons of waste per capita per year. The baseline year of 2007, the 2020 projection year as well as the 2050 projection year were calculated in the same manner. According to Mr. Peter Foye, BC WRS, the growth projections between now and 2050 will be 10% less than current. He stated that in the future, we will combust and reclaim energy greater than we are now. Waste tonnage projections and the waste stream percentage share are listed below.

Assumptions:

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Unexpected factors are not accounted for when making these projections. For example: hurricanes, natural disasters, economic situation of the Country, and new regulations.

This report captures community-wide emissions and does not account for avoided disposal. Therefore, recycling data was not entered into the model, but based on the data provided in 2007 Broward County recycled 25% of the waste, and is projected to recycle an estimated 35% by 2020.

Contact Information:

Broward County Waste and Recycling: Peter Foye: pfoye@broward.org

Bill Leonard, Senior Planner Broward County Planning and Redevelopment Division Broward County Environmental Protection and Growth Management Dept. blennard@broward.org.

<b>Subtotal Waste</b>	500,277	1.9
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## Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO <sub>2</sub> (tonnes)	Equiv CO (%)	Energy (kWh)
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### Other

#### Broward County, Florida

#### *All Broward County Airports*

Carbon Dioxide	415,348	1.6	
<b>Subtotal All Broward County Airports</b>	<b>415,348</b>	<b>1.6</b>	

This includes all emissions from the following Broward County Airports:

Ft. Lauderdale - Hollywood International Airport (FLL)

Ft. Lauderdale Executive Airport (FXE)

North Perry Airports (HWO)

Pompano Beach Airport (PMP)

#### Contact Info.:

Federal Aviation Administration: Ralph Lovinelli; 202-267-3566

Broward County Aviation Department: Michael Pacitto: 954-359-6103

Broward County Aviation Department: Brad Ostendorf: 954-359-2395

Fort Lauderdale Executive Airport: Florence Straugh: 954-828-4955

Broward County Aviation Department: Jonathan E. Clark: 954-359-6146

Pompano Beach Airpark: Steve Rocco: 954-786-4135

For specific details, please refer to the Report.

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<b>Subtotal Other</b>	<b>415,348</b>	<b>1.6</b>	
<b>Total</b>	<b>25,896,479</b>	<b>100.0</b>	<b>69,684,694,478</b>