City of Hallandale Beach
Greenhouse Gas Inventory

RS&H

City of Hallandale Beach Greenhouse Gas Inventory

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Prepared by RS&H, Inc. at the direction of
the City of Hallandale Beach

RS&H

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1. SUMMARY

RS&H has prepared the first Greenhouse Gas (GHG) emissions inventory and forecast for the City of Hallandale Beach's government operations and the community as a whole (Community).[1] Since local government operations (LGO) emissions are part of the community's, the LGO inventory is a subset of the community inventory. It is included to give the government a detailed picture of emissions it directly controls.

This inventory establishes 2016 as the baseline for the City's GHG emissions. It also includes a business-as-usual (BAU) forecast of LGO and community-wide emissions from the present to 2040. There is great uncertainty in projecting future emissions. This forecast should be viewed as a tool for planning GHG reduction activities.

Together, the LGO and Community inventories and forecast facilitate understanding of present and future emissions trends. They also provide information needed by staff, policy-makers and stakeholders as they design and implement strategic measures to reduce GHG emissions.

In 2016, local government operations (i.e. facilities, vehicles, and infrastructure directly owned and/or controlled by the city) were responsible for emitting **9,623 mtCO_2e**, with city-owned buildings and facilities contributing 43%. The city's vehicle fleet operation and city streetlights also contributed significantly to the total LGO emissions, at 27% and 7%, respectively.

The community's total estimated emissions were **460,733 metric tons of carbon dioxide equivalents (mtCO_2e)**[2], with the Transportation sector contributing the largest single source (49%). The Commercial and Residential sectors also contributed significantly at 26% and 22%, respectively. LGO emission make up just 2% of total community emissions.

If no actions are taken, local government operations emissions could increase by 14.8% to 11,046 mtCO2e by 2040. Community-wide emissions could increase by 14.3% to 526,691 mtCO2e by 2040. This "Business-as-Usual" (BAU) forecast is based on growth factors for energy use, transportation fuel consumption, population growth, and water supply.

Based on results, RS&H has provided a series of recommendations aimed at mitigating GHG emissions. These include recommendations to set GHG emissions reduction targets, quantify the reduction benefits of the City's Sustainability Action Plan (SAP) projects, address gaps through additional climate action planning, pursue third-party certification and conduct regular GHG inventory updates.

[1] For ease of access and future updates, RS&H entered the inventory into ICLEI - Local Governments for Sustainability's ClearPath web-based software.
[2] CO_2e refers to carbon dioxide equivalent (CO_2e), a measure that describes how much warming a given type and amount of a greenhouse gas may cause, using the functionally equivalent amount of carbon dioxide (CO_2) as the reference.

2. INTRODUCTION

Hallandale Beach is a leader in promoting public awareness about the causes and impacts of climate change. This greenhouse gas (GHG) inventory supports the City's long-term efforts to reduce emissions and is critical to understanding the City's contribution to and path toward mitigating climate change.

This report presents estimates of GHG emissions in Hallandale Beach for the calendar year 2016 for each emissions-producing activity that takes place within the city limits. The inventory allows Hallandale Beach to identify opportunities and evaluate progress towards reducing emissions. This report is accompanied by an electronic version of the inventory. Created using Local Governments for Sustainability's ClearPath web-based software, it provides web access to the City's emissions profile, facilitating updates to the City's GHG emissions records in the future.

GHG emissions fall into one of three categories, or "scopes". Scope 1 emissions are those from sources directly controlled by the community and typically located within its boundary. They include emissions associated with fuel combustion; HVAC, fire suppression and electrical equipment; solid waste landfills and incinerators; and wastewater treatment facilities. Scope 2 emissions come from purchased energy such as electricity generated outside the jurisdiction and include energy transmission and distribution (T&D) losses. Scope 3 includes sources not directly controlled by the local government such as community-wide transportation, emissions from landfills or incinerators outside the boundary, and employee commuting.

The first step toward achieving GHG emission reductions requires identifying baseline levels and sources of emissions in the community. The next step is to monitor emissions over time. A standardized approach is necessary to achieve these objectives. The Community portion of the inventory was completed using Local Government for Sustainability (ICLEI) U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1, published July 2013. The LGO portion of this inventory was completed under ICLEI Local Government Operations Protocol, Version 1.1, published May 2010.

At Hallandale Beach, as in most organizations, GHG emissions are not measured at the source. Instead, they are calculated based on activity data and emission factors. The basic equation used is*: Activity Data X Emission Factor = Emissions*. Activity data collected and provided by the City measure energy use, fuel consumption or other indicators of processes that generate emissions. Emissions factors that compare GHG emissions to units of activity data (e.g. metric tons CO_2/kWh of electricity) are used to convert activity data into emissions quantities. Calculations involve several assumptions that are limited by the quality and availability of related data. Accordingly, emission estimates are indicators, rather than exact values.

Emissions estimates in this inventory are presented in units of metric tons of carbon dioxide equivalent ($mtCO_2e$). Because various greenhouse gases have differing global warming potentials, they are commonly converted to equivalent units of CO_2 to allow comparison of their global warming effects.

Global warming potential (GWP) values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment were used to convert various greenhouse gases to carbon dioxide equivalents.
RS&H prepared separate forecasts for community-wide and local government emissions over a 24-year time horizon from 2016 through 2040. These "Business as Usual" forecasts assume no further actions taken to control emissions. Growth factors drawn from federal, state and local government sources were used to develop the forecasts. The BAU forecasts are useful for comparing planned emissions reductions to a base case and measuring progress over time.

3. LOCAL GOVERNMENT OPERATIONS

The local government operations inventory allows the City to understand the impact of its operations on the community's emissions and to effectively plan to reduce those emissions over which it has significant influence or direct control. It represents the total amount of greenhouse gas (GHG) emissions associated with local government operations for calendar year 2016.

3.1 LOCAL GOVERNMENT OPERATIONS INVENTORY OVERVIEW

In 2016, LGO emissions from Hallandale Beach totaled **9,623 mtCO_2e**. Table 1 shows local government sectors, activities, and estimated emissions included in this total. Figure 1 shows the percentage of the total contributed by each sector.

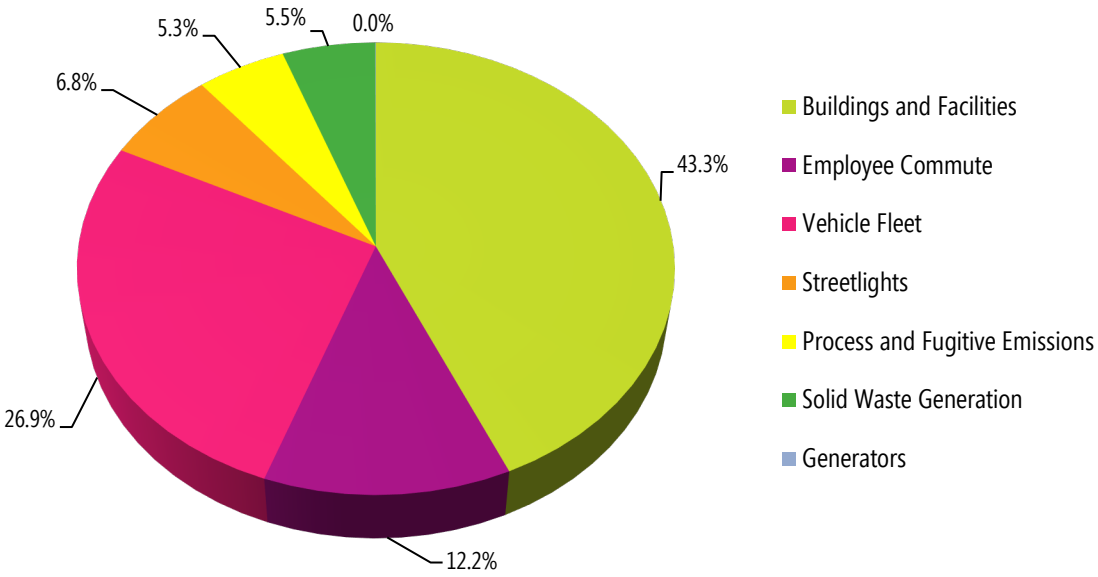
TABLE 1: 2016 LGO INVENTORY SECTORS, ACTIVITIES, AND EMISSIONS

Sector	Activities	Emissions (mtCO_2e)
Buildings / Facilities	Electricity consumption and transmission and distribution losses	4,168
Streetlights	Streetlight electricity consumption and T&D losses	650
Port / Airport Facilities	*Not occurring – there are no city-owned Port/Airport facilities*	NO*
Vehicle Fleet	Fleet emissions for on and off-road vehicles and equipment	2,585
Transit Fleet / Trolley	*Not estimated, no information available*	NE**
Employee Commute	Emissions associated with City employee commuting	1,175
Solid Waste	Waste generation at city facilities	532
Water and Wastewater Treatment Facilities	*See Community Inventory section. Hallandale Beach's Water Treatment Plant is included in Buildings and Facilities. Wastewater is treated outside the jurisdiction.*	-
Power Generation	Generators	3
Fugitive Emissions	Fugitive emissions related to HVAC systems	510
Total		*9,623*

NO* = Not Occurring. The source or activity does not occur or exist within the community.

NE** = Not Estimated. Emissions occur but have not been estimated or reported (e.g., data unavailable, effort required not justifiable).

FIGURE 1: 2016 LOCAL GOVERNMENT OPERATIONS EMISSIONS



3.2 LGO INVENTORY DATA SOURCES AND METHODS

This section details data sources, methods and sources used to complete the emissions estimates for each sector.

3.2.1 Building and Facilities

Buildings and Facilities generate Scope 2 GHG emissions through electricity consumption. Emissions estimates were calculated based on the city's utility billing records, obtained from FPL. To provide more granularity in tracking facility emissions, keyword searches were performed to extract categories of accounts. The GHG emissions in $mtCO_2e$ for each of these categories is as follows:

- Pumps -1779
- Facilities - 1168
- Sewer - 422
- Parks & Recreation - 276
- Other - 240
- Irrigation -19
- Lighting - 18
- Signage -17

The estimate also includes grid loss emissions related to energy lost in transmission (229 $mtCO_2e$), calculated using ICLEI Equation BE 4.1.1.

3.2.2 Streetlights

City owned or operated streetlights contribute to emissions through electricity consumption. Emissions for streetlights were calculated based on the city's utility billing data, and include grid loss emissions related to energy lost in transmission were also calculated for these sources, using ICLEI Equation BE 4.1.1. Streetlight energy consumption and grid loss emissions amounted to 614 and 36 $mtCO_2e$, respectively.

3.2.3 Vehicle Fleet

The City operates fleets of on-road vehicles. It also operates a fleet of off-road vehicles and equipment. These vehicles contribute to emissions through use of gasoline or diesel fuel. Vehicle Fleet emissions were calculated based on 2016 fuel purchase records supplied by the City's Fleet Administrator.

3.2.4 Transit Vehicles

Fuel use data related to Transit vehicles (i.e. Minibuses) was not available. The contractor did not track fuel consumption in 2016, although it has been tracked in subsequent years. This emissions source should be included in future editions of the City's GHG inventory. In addition to fuel type and usage, the City should track information on the make, model, model year and vehicle miles travelled for these vehicles.

3.2.5 Employee Commute

Anonymized 2016 employee home addresses and work locations provided by the City were used to calculate commuting distances. Addresses were converted to a Google Earth KML file using the Batch Geocode web application. Some addresses had to be manually corrected in cases where errors prevented geocoding. A few addresses were unable to be resolved, for instance if a post office box were entered instead of a physical address. The average commuting distance was assigned to five addresses that could not be reconciled, 1.2% of the total 422 addresses. The KML file was converted to an ESRI shapefile using QGIS and ArcMap. The ArcGIS Online "Connect Origins to Destinations" Tool was used to calculate shortest-route distances in miles over the roadway network from home to work location for each employee.

The City of Hallandale Beach supplied the number of holidays per year in 2016 (10). Additionally, the national average number of vacation days per employee (10) was also deducted, leaving 345 working days per year. RS&H assumed 2 trips per employee per day (to and from work). Part-time employees, who made up 29% of the work force in 2016, were assumed to work only 2 days per week based on the 13.1 hour weekly part-time average provided by the City.

The average age of a passenger vehicle in the U.S. in 2016 was 11.6 years, making the average vehicle a 2004 model. The average combined fuel economy of 2004 combined cars / light-duty trucks was 21.0 mpg. This fuel economy number was used to estimate the gallons of gasoline consumed to travel the total estimated commuting mileage. For the purposes of the analysis, all vehicles were assumed to be gasoline fueled.

3.2.6 Solid Waste Facilities

Hallandale Beach waste is transported outside the community boundary for landfill disposal. Because the landfill is not owned by Hallandale Beach, and is located outside the community boundary, waste generation is a Scope 3 emission source. ICLEI strongly encourages communities to include Scope 3 waste generation emissions in their inventories, since local governments have some control over this source.

Waste from City facilities is first taken to a local transfer facility operated by Waste Connections of Florida. This company then transports 100% of the City's solid waste to the John E. Drury (JED) Landfill in Orlando (1501 Omni Way, St Cloud, FL 32773). JED has a landfill gas control system in place. The distance from Hallandale Beach to the JED Landfill Is approximately 180 miles.

The City does not track the actual weight or volume of waste in its containers when they are picked up. Waste volume for 2016 was estimated based on the container size and the frequency of pickup. Containers were assumed to be 80% full at time of pickup. The 2016 waste estimate is consistent with the waste baseline in the City's 2018 Sustainability Action Plan.

Because the City has not completed a waste characterization study, the October 2010 Miami-Dade County Waste Composition Study was used to estimate the percentage of each waste type. A municipal waste audit would improve the quality of the estimated emissions related to government operations waste generation, as would more accurate record keeping of pickup weights/volumes.

3.2.7 Water and Wastewater Treatment Facilities

The City of Hallandale Beach's Water is treated at the Central Water Treatment Plant, located at 200 SW 6th Street. There is no record for this facility in EPA's Flight map service. The City provided water flows and electricity consumption at the facility. The City did not provide natural gas consumption totals for its facilities, indicating natural gas usage is minimal. As a result, water treatment emissions are estimated only for electricity use at the facility. Because the facility's electricity usage is already accounted for in the LGO Inventory in the "Building and Facilities" category, this record is marked "information only" to avoid double-counting.

3.2.8 Generators

Emissions from generators were calculated from City records of generator fuel consumption. The City has both gasoline and diesel generators. The City reported no gasoline consumption for generators in 2016. Diesel generators used 328.54 gallons of fuel with an energy content of 45.14 MMBTU in 2016. Diesel fuel used contained 5% biodiesel per City records. To account for this, GHG emissions for 5% of the total fuel quantity were calculated using emissions factors for biodiesel.

3.2.9 Fugitive Emissions

Pressurized chemicals, such as the refrigerants used in heating, ventilation and air conditioning (HVAC) systems, leak or are released via maintenance activities. These substances are very potent greenhouse gases, so small releases have a significant climate impact. Emissions can be reduced by replacing the strongest greenhouse gases with less potent alternatives, as well as enhanced maintenance processes. No direct data on HVAC system capacity, leakage or recharge was available. Note that under Section 608 of the Clean Air Act (40 CFR Part 82, Subpart F), owners and operators of refrigeration and HVAC equipment are required to document dates, refrigerant charge amounts and information related to service of this equipment. Fugitive emissions were estimated by RS&H using the World Resources Institute (WRI) screening method. The City supplied lists of facilities and square footages that were used to develop the estimate. This estimate of $MTCO_2e$ for 2016 may be higher than actual fugitive emissions. In the future, tracking HVAC system specifications, maintenance and refrigerant usage would result in a more accurate estimate and ensure compliance with Federal regulations.

4. COMMUNITY

The community-scale inventory represents the total amount of greenhouse gas (GHG) emissions within Hallandale Beach's jurisdictional boundary. This total includes emissions from municipal government operations and activities. As result the LGO inventory is a subset of the community inventory.

4.1 COMMUNITY INVENTORY OVERVIEW

In 2016, community-wide emissions from Hallandale Beach totaled **460,733 mtCO$_2$e**. Table 2 shows community sectors, activities, and estimated emissions included in this total. Figure 2 shows the percentage of the total contributed by each sector.

TABLE 2: 2016 COMMUNITY INVENTORY SECTORS, ACTIVITIES, AND EMISSIONS

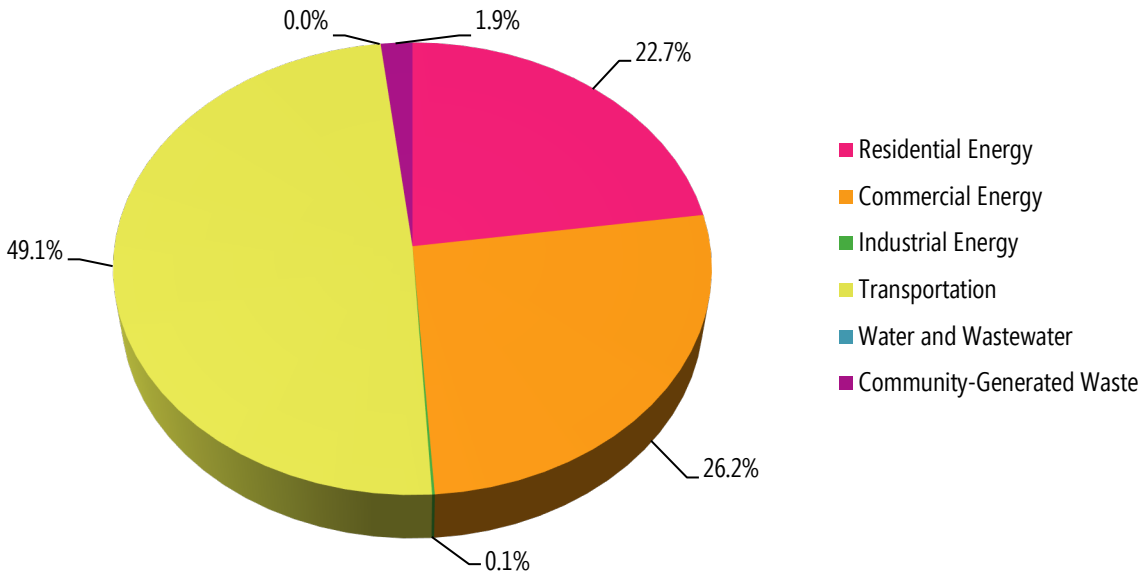
Sector	Activities	Emissions (mtCO$_2$e)
Residential	Electricity consumption	104,306
	Propane/LPG consumption	291
	Natural Gas consumption	147
Commercial	Electricity consumption	120,669
	Propane/LPG consumption	NE***
	Natural Gas consumption	NE***
Industrial	Electricity consumption	590
	Propane/LPG consumption	NE***
	Natural Gas consumption	NE***
Transportation	Vehicle Miles Travelled (VMT) emissions	226,088
Water and Wastewater	Potable Water Treatment	47*
	Wastewater treatment – process (N20)	91.68*
	Wastewater treatment - effluent	NE***
	Wastewater treatment – process (methane)	14,739*
	Septic system fugitive emissions	NO**
Agriculture	*Not occurring in the community*	NO**
Community-generated Waste	Solid waste generation / incineration	6,850
	Solid waste transportation	1,792
Process and Fugitive Emissions	*Not estimated – no data available*	NE***
Upstream Impacts of Activities	*Not estimated – no data available*	NE***
Consumption-Based Emissions	*Not estimated – no data available*	NE***
Total		*460,733*

* = Information Only – not included in inventory total. The source is accounted for elsewhere in the inventory or is located outside the community boundary.

NO** = Not Occurring. The source or activity does not occur or exist within the community.

NE*** = Not Estimated. Emissions occur but have not been estimated or reported (e.g., data unavailable, effort required not justifiable).

FIGURE 2: 2016 COMMUNITY-WIDE EMISSIONS



4.2 COMMUNITY INVENTORY DATA SOURCES AND METHODS

This section details data sources and methods used to complete the emissions estimates for each sector. Unless otherwise noted, data was collected and provided by Hallandale Beach.

4.2.1 Purchased Electricity

Emissions in the Residential, Commercial and Industrial sectors are related to purchased electricity (Scope 2 emissions) and the combustion of fuels for heating or industrial processes. Data to calculate electricity was provided by Florida Power and Light (FPL). Emissions from purchased electricity were estimated using ICLEI method BE2.2. Residential Natural Gas Consumption totals were not available; however, statewide data for 2016 from the Energy Information Agency (EIA) was available. Using this data and the American Community Survey (ACS), natural gas and propane emissions were estimated using ICLEI method BE1.2.

4.2.2 Transportation

Transportation emissions estimates were developed using vehicle miles travelled (VMT) data within the city limits interpolated from the Southeast Florida Regional Planning Model (SERPM) Version 7. The estimate includes both passenger and freight vehicles, and all common fuel types. The model was run for an annual average weekday condition in 2016. Therefore, it may be regarded as an average estimate for community-wide transportation emissions. It includes estimates of the following greenhouse gas emissions (Methane and Nitrous Oxide are included in the Carbon Dioxide equivalent total):

- Carbon Dioxide Equivalents (CO_2e)
- Methane (CH_4)
- Nitrous Oxide (N_2O)

The model output estimates daily emissions of each pollutant in grams by road functional class (Table 3). Daily emissions are multiplied by 365 to arrive at annual emissions.

TABLE 3: 2016 SUMMARY OF DAILY COMMUNITY-WIDE TRANSPORTATION GHG EMISSIONS FOR HALLANDALE BEACH

Road Functional Classes (HPMS)	VMT (Miles)	N_2O (Grams)	CH_4 (Grams)	CO_2e (Grams)
Urban Interstate	389,119	553	3,748	186,422,024
Urban Freeway	84,590	115	846	41,174,293
Urban Arterial	685,834	2,084	6,862	337,311,629
Urban Minor Arterial and Collector	114,953	327	1,108	54,510,432
Total	1,274,495	3,080	12,564	619,418,377
Total (Metric Tons)	-	*0.003*	*0.013*	*619.42*

4.2.3 Water / Wastewater

The City of Hallandale Beach's water is treated at the Central Water Treatment Plant, located at 200 SW 6th Street. This facility does not report emissions to EPA's Flight map service. The City provided water flows and electricity consumption at the facility. The City did not provide natural gas consumption totals for its facilities, and indicated natural gas usage is minimal. As a result, water treatment emissions are estimated only for electricity use at the facility, which is already accounted for in the community-wide industrial sector electricity consumption source. To avoid double-counting, this record is marked "information only".

The City of Hallandale Beach's wastewater is treated at the Southern Regional Wastewater Treatment Plant (SRWWTP), located at 1621 N. 14 Avenue in Hollywood, Florida. Since wastewater is treated outside the community boundary, records related to this activity are marked "information only" and excluded from the inventory total. The emissions source is Scope 3 because the SRWWTP is not owned or operated by the City of Hallandale Beach, and is considered part of the City of Hollywood's GHG emissions total.

Population-based calculations were used to estimate wastewater treatment methane emissions for Hallandale Beach in 2016. Population estimates were obtained from the US Census Bureau. The City indicated no households are served by septic systems; all are on the public wastewater system. ICLEI Equation WW.6 - Alternate Methane Emissions from lagoons was used to estimate CH4 emissions for 2016.

4.2.4 Agriculture

Since there are no significant agricultural land uses occurring in Hallandale Beach, this category was omitted from the inventory.

4.2.5 Solid Waste

Hallandale Beach's community waste generation is a Scope 3 emissions source because waste is transported outside the community boundary for disposal at a landfill not owner/operated by the City. The City supplied 2016 waste tonnages tabulated from its waste haulers. See section 3.2.6 for details on the landfill facility.

The October 2010 Miami-Dade County Waste Composition Study was used for percentage of each waste type. A municipal waste audit for Hallandale Beach would improve the quality of the estimated Scope 3 emissions related to community-wide waste generation.

ClearPath's updated Waste Generation calculator was used to develop the estimate of GHG emissions related to landfill disposal of waste generated within the community. ClearPath's Collection & Transport Emissions calculator was used to develop an estimate for emissions associated with collection and transfer of waste to the JED facility. ICLEI Equation SW.6 was used to verify the result.

4.2.6 Process and Fugitive Emissions, Upstream Impacts of Activities and Consumption-Based Emissions

Due to a lack of available information, the categories Process and Fugitive Emissions, Upstream Impacts of Activities, and Consumption-Based Emissions have been excluded from the inventory. These categories are considered optional under the ICLEI Community Protocol. Although emissions related to these activities occur, they are beyond the scope of the present inventory. Process and Fugitive Emissions are Scope 1, but likely insignificant in the context of overall community emissions. Upstream and Consumption based emissions are Scope 3 because they occur outside the City's boundary.

Process and Fugitive emissions include leaks of greenhouse gases used in HVAC systems and fire suppression equipment used in residential, commercial and industrial buildings community-wide. Certain electrical transmission equipment can also release fugitive emissions. Estimating these emissions would require an inventory of building data throughout the community with the heated/cooled area of each building. Ideally, it would include information on the mechanical and fire suppression systems within those buildings.

Upstream emissions are those associated with the production and transport of fossil fuels used by the community.

Consumption-based inventories emissions include offsite emissions associated with the production of goods and services purchased and consumed by the community, including energy use associated with the production and transportation of consumer goods.

4.3 GHG EMISSIONS COMPARISON WITH PEER LOCAL GOVERNMENTS

Hallandale Beach's GHG emissions can be compared to those of other communities. However, every community is different, with varying infrastructure, services, housing stock, transportation networks, waste disposal and commerce. These differences translate into varying rates of GHG emissions, even when values are presented on a per capita basis. For example, Hallandale Beach's wastewater is treated outside its jurisdictional boundary in the City of Hollywood. Therefore, its wastewater treatment emissions are considered part of Hollywood's inventory. This arrangement could make Hallandale's emissions look smaller than Hollywood's on a per capita basis. In addition, communities complete inventories on varying schedules and at varying intervals. Comparisons between different inventory years are less valid than those between the same year, and validity decreases as the time difference increases. Inventory methodologies may vary between communities as well. Comparisons of community GHG emissions should be used with caution.

Table 5 shows Hallandale Beach and other Southeast Florida communities' communitywide and per capita GHG emissions and the percentage of the total attributable to electricity and stationary energy consumption, transportation sources, and other sources. The "Other' category includes sources such as fugitive emissions, waste disposal and wastewater treatment.

TABLE 4: PER CAPITA GHG EMISSIONS, SOUTHEAST FLORIDA COMMUNITIES

Base Year	Local Government	Community Emissions (mtCO2e)	Per Capita Emissions (mtCO2e)	Electricity & Stationary Energy (%)	Transportation (%)	Other (%)
2014	Village of Pinecrest*	220,309	11.6	47%	52%	1%
2016	Hallandale Beach*	460,733	11.7	49%	49%	2%
2006	Miami^	4,800,000	12.5	58%	39%	3%
2005	Miami-Dade County^	30,700,000	12.8	53%	43%	4%
2014	Miami Beach^	1,223,848	13.3	76%	18%	6%
2016	Sunrise*	1,318,300	14.1	36%	59%	5%
2017	Delray Beach*	998,446	14.5	39%	60%	1%
2005	Key West^	399,593	16.8	66%	28%	6%
2010	Fort Lauderdale^	2,827,747	17.1	NA	NA	NA
2017	Coral Gables*	914,473	17.9	49%	48%	3%
2008	West Palm Beach^	5,513,890	30.1	33%	27%	40%

* Inventory completed by RS&H

^ Data from City of Miami Beach presentation "Greenhouse Gas inventory: 2015 Community Wide and Government Operations"
NA: Information Not Available

5. GHG EMISSIONS FORECAST

5.1 FORECAST METHODOLOGY

While establishing an emissions baseline lays the groundwork for measuring and reporting emissions, it is also useful to forecast how emissions might change in the absence of actions to reduce them (i.e. a business-as-usual (BAU) scenario). RS&H prepared BAU forecasts for both local government operations and the community over a 24-year time horizon from 2016 through 2040.

Due to the high number of variables and unforeseen events that could affect future emissions, the forecast is best viewed as a planning tool. Elaborate forecast methods are not likely more accurate predictions of future emissions than methods based on trends in energy and population growth. Publicly available, consistently updated information from government sources that can be referenced for future forecast updates is are used as the basis of these forecasts. These include three sources for growth rate indicators. Population growth projections from the Broward County Population Forecast and Allocation Model for 2017 were used to estimate population growth through 2040.[3] For categories related to energy use (e.g. transportation and facilities energy consumption) the U.S. Energy Information Agency (EIA) Annual Energy Outlook 2018 total energy projection for the southeast region was used.[4] For water and wastewater demand, the 2018 South Florida Water Management District (SFWMD) Lower East Coast Water Supply Plan projection for increase in water demand was used.[5]

5.2 LOCAL GOVERNMENT INVENTORY FORECAST RESULTS

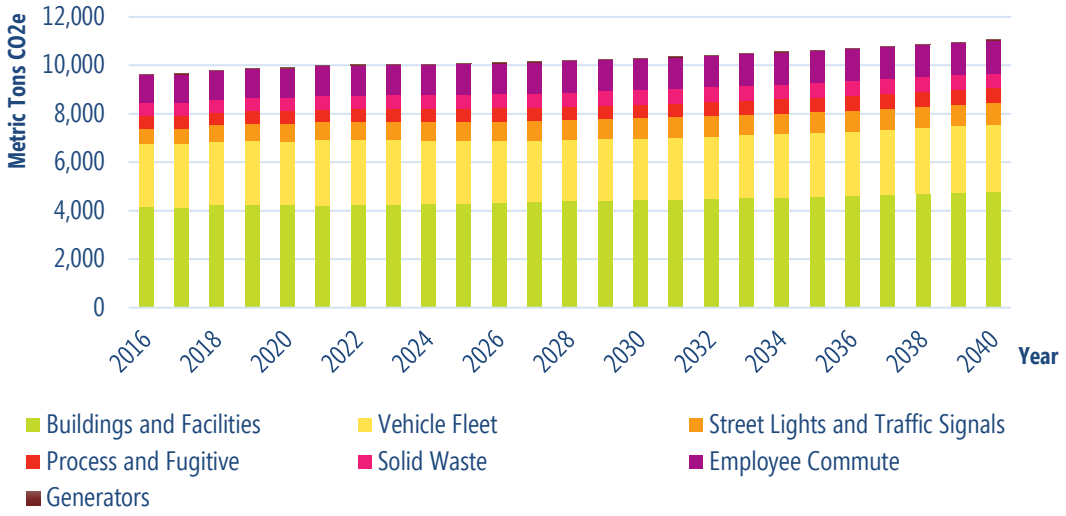
The local government GHG Emissions forecast indicates GHG emissions will gradually increase by 14.8% under a BAU scenario to 11,046 mtCO2e by 2040, as shown in Figure 3. The greatest emissions growth is projected to occur in the streetlight and traffic signals (40%), followed by employee commute (16%), solid waste (16%) and process and fugitive emissions (16%).

[3] "Broward County Population Forecast and Allocation Model for 2017", Broward County

[4] "Energy Consumption by Sector and Source, South Atlantic, Reference case", accessed November 26, 2018 at http://www.eia.gov/forecasts/aeo/supplement/suptab_5.xlsx

[5] "2018 Lower East Coast Water Supply Plan Update", South Florida Water Management District

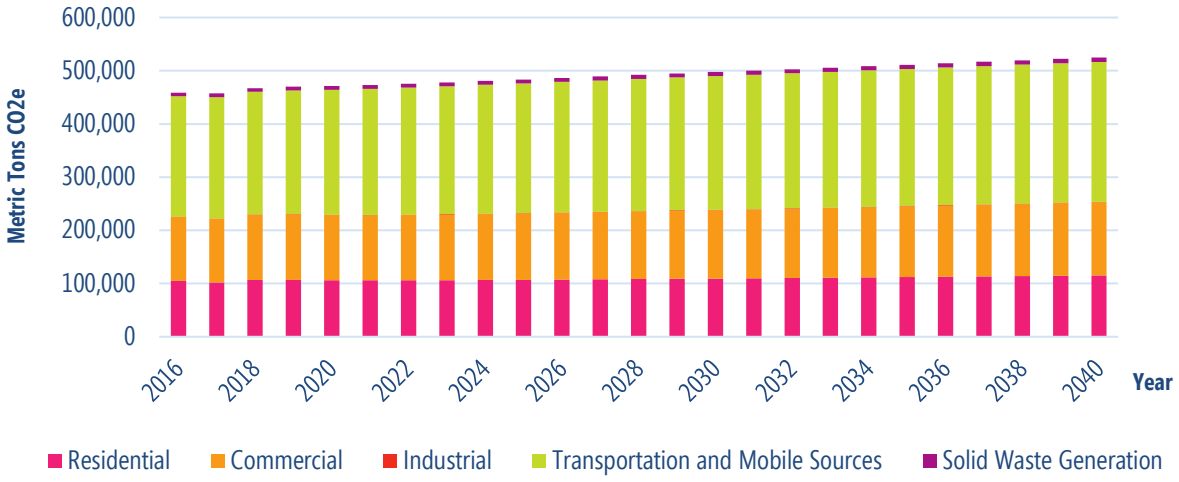
FIGURE 3: HALLANDALE BEACH LGO EMISSIONS FORECAST, 2017 – 2040



5.3 COMMUNITY INVENTORY FORECAST RESULTS

The community GHG emissions forecast indicates emissions will gradually increase by 14.3% to 526,691 $mtCO_2e$ under a BAU scenario by 2040 (Figure 4). The greatest emissions growth is projected to occur in the transportation sector (40%) followed by solid waste generation (16%) and water and wastewater (16%).

FIGURE 4: HALLANDALE BEACH COMMUNITY EMISSIONS FORECAST, 2017 – 2040



6. CLIMATE ACTION RECOMMENDATIONS

6.1 EMISSIONS REDUCTION TARGETS

Hallandale Beach set a target for GHG emissions reduction based on levels specified in the Paris Climate Accord (Paris Accord) and the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5°C (SR15) issued by the.[6] SR15 goes beyond the Paris Accord,. It finds that reducing emissions 45% by 2030 and 100% by 2055 is required to avoid catastrophic climate impacts. Striving to meet this target, the City is motivated to implement GHG reduction projects and track their performance. This target also helps the City tell a compelling story about its GHG emissions reduction efforts.

The City's target does not specify the baseline year against which emissions reductions are to be measured. RS&H recommends the City select 2016, which is the baseline year for its greenhouse gas inventory. This will allow future emissions reductions to be accurately measured. While, the Paris Accord uses 2010 as a baseline year, the difference between 2010 and 2016 is not significant. For example, the Southeast Florida Climate Compact Regional Greenhouse Gas Inventory shows a 3.37% increase in total emissions between 2010 and 2015. Although population growth has increased transportation emissions in the four-county region, energy efficiency improvements have decreased GHG emissions from residential, commercial and industrial sources.

South Florida governments have taken a variety of approaches to setting GHG emissions reduction targets. Targets typically consist of three parts: a percent reduction, a baseline year and a target year. Targets have been set for the community and / or government operations. Table 4 shows targets set by peer governments in South Florida. Hallandale Beach's targets are more ambitious than many of its South Florida peers.

TABLE 5: SELECTED GHG EMISSIONS REDUCTION TARGETS SET BY SOUTH FLORIDA GOVERNMENTS

City / County	Target					Sector
Hallandale Beach	45%	below	TBD levels	by	2030	Community
	100%	below	TBD levels	by	2055	Community
Broward County	80%	below	2007 levels	by	2050	Community
Fort Lauderdale	20%	below	2010 levels	by	2010	LGO
Sunrise	7%	below	2016 levels	by	2030	LGO
	43%	below	2016 levels	by	2060	LGO
Miami-Dade County	20%	below	2008 levels	by	2020	Community
	80%	below	2008 levels	by	2050	Community
Miami	25%	below	2007 levels	by	2015	LGO
	25%	below	2006 levels	by	2020	Community
Coral Gables	20%	below	2013 levels	by	2035	LGO
Village of Pinecrest	7%	below	2012 levels	by	2030	LGO
West Palm Beach	25%	below	2013 levels	by	2025	Community
	Net-zero			by	2050	Community
	37%	below	2008 levels	by	2025	LGO
Boynton Beach	18%	below	2006 levels	by	2035	LGO

[6] City of Hallandale Beach Resolution No. 2019-021, March 6, 2019.

In 2010, the United Nations Framework Convention on Climate Change (UNFCCC) agreed that future global warming should be limited below 2°C relative to pre-industrial levels based on current scientific consensus.[7] This equates to an emissions reduction of about 80% to 90% below 1990 levels by 2050 for industrialized areas.

The UNFCCC has influenced many local government GHG reduction targets, with many adopting an 80% reduction and the 2050 target year (e.g. Broward and Miami-Dade County). Most local governments have found establishing a 1990 baseline year infeasible due to lack of data. Instead they have established base years as practical.[8]

6.2 QUANTIFY GHG EMISSIONS REDUCTION BENEFITS

Now that the City has established a baseline for GHG emissions, it can calculate the GHG emissions reduction benefits of its various sustainability and resiliency initiatives. This should include the projects included in its Sustainability Action Plan, completed in 2018. These values can be calculated for projects which have benefits in the form of energy savings, fuel savings, water savings, VMT reductions, and waste reduction. Emissions reduction benefits can also be calculated for projects related to urban street tree programs, renewable energy projects, and any project which either conserves resources or sequesters carbon.

Quantifying emissions reduction benefits will help the City communicate about its carbon mitigation efforts and will help prioritize projects for funding and implementation. Once emissions reduction values are calculated, they can be converted into layman-friendly equivalent terms (i.e. avoided vehicle miles, gallons of gas saved, number of trees or acres of forest conserved, etc.) for education and outreach efforts.

6.3 CLIMATE ACTION PLANNING

After quantifying the GHG reduction potential of projects included in its SAP, as well as any other relevant initiatives, the City should evaluate the gap between the total emissions reduction potential of these actions and its target level. It should then plan additional actions to close the gap. As the City's Sustainability Action Plan was designed as a living document, these climate actions may be added to the SAP.

When planning projects or policies to reduce GHG emissions, the City should consider inventory results and prioritize those which correspond to the largest emissions sources. For the community these include transportation, and commercial and residential energy consumption. For government operations, they include buildings, facilities and streetlight energy use and employee commuting.

Initiatives which reduce emissions in these areas will have sustainability co-benefits related to community health and mobility, criteria air pollutant reductions, and energy cost savings for residents, business, and the City government.

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[7] The 2°C global temperature target represents the current scientific consensus for prevention of dangerous anthropogenic interference with the climate. However, the global temperature increase associated with an unacceptable global temperature increase has not been scientifically affirmed. The Paris Agreement proposed to keep the increase in global temperature to below 2.0°C and pursue efforts to limit it to 1.5°C above pre-industrial levels.

[8] US emissions have increased by about 2.5% since 1990. As a result, this approach remains meaningful relative to the objective of limiting warming to 2°C.

6.4 PURSUE THIRD-PARTY CERTIFICATION

Completing a Greenhouse Gas Inventory makes the City eligible for certain third-party certification programs, such as LEED for Cities. Many Florida local governments have pursued LEED for Cities Certification, including Broward, Monroe, Lee and Pinellas counties, and the cities of Orlando, West Palm Beach, St. Petersburg and Pinecrest. Based on the this GHG Inventory and the success the City has had implementing the Sustainability Action Plan, RS&H believes the City would be a good candidate for LEED for Cities certification.

LEED for Cities certification has many benefits, including demonstrating the city's commitment to sustainability and measuring its success. The certification process helps cities improve data management. It can also be used to identify best management practices. Finally, it clearly communicates the City's sustainability leadership to the world.

6.5 PLAN REGULAR GHG INVENTORY UPDATES

The GHG inventory establishes a baseline from which to measure future progress. However, future inventory updates will be required to establish a GHG emissions trend, and track progress towards emissions reduction goals. Most communities with active greenhouse gas mitigation programs update their inventories on a regular basis, typically annually or on a 3- or 5-year basis. The City should establish a regular schedule for GHG inventory updates.

This process is facilitated by the web-based ClearPath tool used to document this inventory. Regular updates will require energy, fuel, waste and other emissions source data to be tracked and maintained. RS&H recommends the City procure or develop a data management tool to track this information. This will also help the Green Initiatives Coordinator monitor performance of sustainability initiatives.