COCONUT CREEK, FL

2019 Inventory of Community-Wide Greenhouse Gas Emissions

Prepared For:

Coconut Creek, FL

Produced By:

ICLEI – Local Governments for Sustainability USA
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Letter from the Mayor

City of Coconut Creek Mayor
Joshua Rydell

Dear friends, neighbors, and business owners,

I am delighted to present to you the City of Coconut Creek Community-Wide Greenhouse Gas Inventory Report.

The emissions of greenhouse gases (GHGs) resulting from human activities are driving significant climate change, with far-reaching consequences that pose substantial risks to the future health, well-being, and prosperity of our community. The actions we take today will have a tangible impact on future generations. As demonstrated by the Vision 2030 response, we have collectively prioritized the enhancement of resilience infrastructure, implementation of carbon reduction strategies, and conservation efforts. Additionally, we have recently joined ICLEI's Race to Zero Campaign, demonstrating our commitment to taking further steps to achieve zero carbon emissions by 2050. Furthermore, we will establish an interim reduction goal by 2030 based on scientifically grounded targets.

Thanks to the progressive leadership of the City Commission, we are dedicated to promoting sustainable development, including the implementation of "complete streets" concepts, electric vehicle chargers in the community, and expansion of our electric fleet, among others. These initiatives will reduce our reliance on traditional fossil fuels and reduce our GHG emissions. Moving forward, Coconut Creek will collaborate with Broward County on additional measures to further decrease our GHG emissions.

However, in order to achieve success, we need your assistance. We kindly ask you to join us in our commitment to reducing emissions, enhancing resilience, and conserving resources in your own homes and businesses.

Thank you for your support.

Sincerely,

Joshua Rydell
Mayor

Key Findings

Figure 1 shows community-wide emissions by sector. The largest contributor is Transportation with 49% of emissions. The next largest contributors are Residential Energy (24%) and Commercial Energy (19%). Actions to reduce emissions in all of these sectors will be a key part of a climate action plan. Solid Waste, Water & Wastewater were responsible for the remaining (less than 8.8%) emissions.

The Inventory Results section of this report provides a detailed profile of emissions sources within Coconut Creek; information that is key to guiding local reduction efforts. These data will also provide a baseline against which the city will be able to compare future performance and demonstrate progress in reducing emissions.

EMISSIONS AT A GLANCE

1 **Transportation** 49%

2 **Residential Energy** 24%

3 **Commercial Energy** 19%

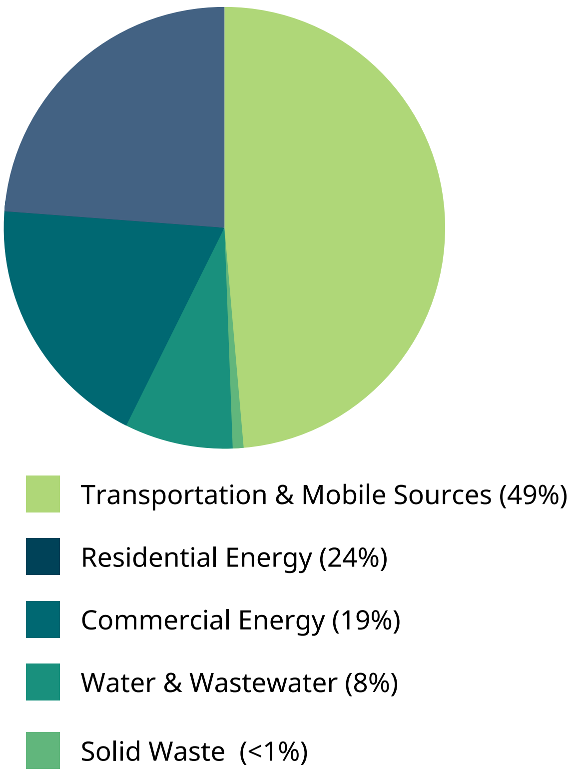

Figure 1: Community-Wide Emissions by Sector

Introduction to Climate Change

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases (GHGs) and changing the global climate. The most significant contributor is burning fossil fuels for transportation, electricity generation, and other purposes, which introduces large amounts of carbon dioxide and other GHGs into the atmosphere.

Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise, threatening the safety, quality of life, and economic prosperity of global communities. Although the natural greenhouse effect is needed to keep the earth warm, a human-enhanced greenhouse effect with the rapid accumulation of GHGs in the atmosphere leads to too much heat and radiation being trapped. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report confirms that human activities have unequivocally caused an increase in carbon emissions [1]. Many regions are already experiencing the consequences of global climate change, and Coconut Creek is no exception.

[1] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [MassonDelmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

According to the 2019 National Climate Assessment, the Southeast U.S. will experience potentially devastating impacts from seasonal changes and hazards occurring at unprecedented magnitudes [2]. Southeast Florida, including Coconut Creek, is at particular risk for hazards, such as flooding from rain, hurricanes that will continue to intensify, and more frequent episodes of extreme heat. So many people visit and move to this region to enjoy the beautiful weather, but its location also puts it at extreme risk. In addition, climate change will continue to produce warmer seasons and extreme temperatures that threaten many sectors within Coconut Creek and the greater region, most notably tourism, public health, and agriculture.

[2] U.S. Global Change Research Program. 2019. National Climate Assessment – Ch 19: Southeast. Retrieved from https://nca2019.globalchange.gov/chapter/19/ .

Coconut Creek is expected to experience extreme localized impacts from heat and flooding due to climate change. Rainfall intensification is an increasingly challenging aspect of compound flood risk impacting Southeast Florida communities, exacerbated by a changing climate. The April 2023 unprecedented rain event in Broward County is statistically considered a thousand-year rain event. Disturbingly, models predict that such extreme flood events will occur more frequently as the world continues to warm [3].

Extreme heat is increasingly understood as one of the most serious climate change risks in Broward County. The average temperature in 2021 was 3.7 degrees Fahrenheit warmer than in 1921 [3]. While Floridians acclimate to heat, rising temperatures and humidity levels already described as oppressive are increasing. Increased heat and humidity affect all populations, especially vulnerable populations such as outdoor workers and elderly individuals. In the case of labor productivity, by the end of the century, heat-related impacts in the southeast will represent a third of all national projected productivity losses [3].

Many communities in the United States have started to take responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing GHG emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, when residents save on energy costs, they are more likely to spend at local businesses and add to the local economy. Reducing fossil fuel use improves air quality, and increasing opportunities for walking and bicycling improves residents' health.

[3] Southeast Florida Regional Climate Compact, June 1, 2022. https://southeastfloridaclimatecompact.org/.

Greenhouse Gas Inventory as a Step Toward Carbon Neutrality

Facing the climate crisis requires the concerted efforts of local governments and their partners, those that are close to the communities directly dealing with the impacts of climate change.

Cities, towns, and counties are well placed to define coherent and inclusive plans that address integrated climate action — climate change adaptation, resilience, and mitigation. Existing targets and plans need to be reviewed to bring in the necessary level of ambition and outline how to achieve net-zero emissions by 2050 at the latest. Creating a roadmap for climate neutrality requires Coconut Creek to identify priority sectors for action, while considering climate justice, inclusiveness, local job creation, and other benefits of sustainable development.

To complete this inventory, Coconut Creek utilized tools and guidelines from ICLEI - Local Governments for Sustainability (ICLEI), which provides authoritative direction for GHG emissions accounting and defines climate neutrality as follows:

> The targeted reduction of GHG emissions and GHG avoidance in government operations and across the community in all sectors to an absolute net-zero emission level at the latest by 2050. In parallel to this, it is critical to adapt to climate change and enhance climate resilience across all sectors, in all systems and processes.

To achieve ambitious emissions reduction, and move toward climate neutrality, Coconut Creek will need to set a clear goal and act rapidly following a holistic and integrated approach. Climate action is an opportunity for our community to experience a wide range of co-benefits, such as creating socio-economic opportunities, reducing poverty and inequality, and improving the health of people and nature.

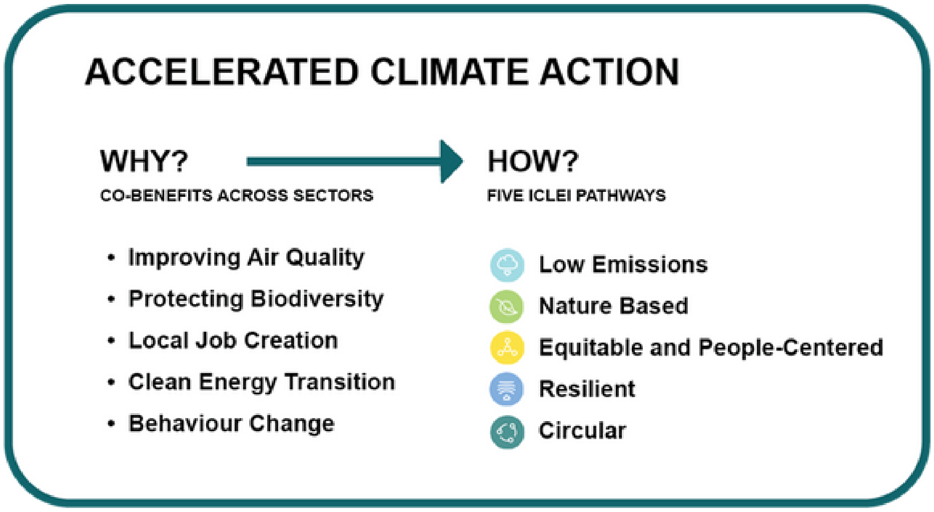

Figure 2: Co-Benefits and ICLEI Pathways to Accelerated Climate Action

ICLEI Climate Mitigation Milestones

In response to the climate emergency, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of GHG emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing GHG emissions within their boundaries, as well as influencing regional emissions through partnerships and advocacy. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts.

ICLEI provides a framework and methodology for local governments to identify and reduce GHG emissions, organized along with Five Milestones, also shown in Figure 2:

1. Conduct an inventory and forecast of local GHG emissions;
2. Establish a GHG emissions Science-Based Target [4];
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

This report represents the completion of ICLEI's Climate Mitigation Milestone One, and provides a foundation for future work to reduce GHG emissions in Coconut Creek.

Figure 3: ICLEI Climate Mitigation Milestones

[4] Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent your community's fair share of the ambition necessary to meet the Paris Agreement commitment of keeping warming below 1.5°C. To achieve this goal, the Intergovernmental Panel on Climate Change (IPCC) states that we must reduce global emissions by 50% by 2030 and achieve climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible GHG emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the Coconut Creek community as a whole. The government operations inventory is mostly a subset of the community inventory, as shown in Figure 4. For example, data on commercial energy use by the community include energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

As local governments continue to join the climate protection movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the approach and methods provided by the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol) and the Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions (LGO Protocol), both of which are described below.

Figure 4: Relationship of Community and Government Operations Inventories

Three greenhouse gases are included in this inventory: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Many of the charts in this report represent emissions in "carbon dioxide equivalent" (CO2e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 5th Assessment Report.

Table 1: Global Warming Potential Values (IPCC, 2014)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO2)	1
Methane (CH4)	28
Nitrous Oxide (N2O)	265

Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions [5] was released by ICLEI in 2019, and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The community inventory in this report includes emissions from the five Basic Emissions Generating Activities required by the Community Protocol. These activities are:

- Use of electricity by the community
- Use of fuel in residential and commercial stationary combustion equipment
- On-road passenger and freight motor vehicle travel
- Use of energy and other emissions in potable water and wastewater treatment and distribution
- Generation of solid waste by the community

The community inventory also includes the following activities:

- Wastewater treatment processes

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to GHG emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by “sources” located within the community boundary, and 2) GHG emissions produced as a consequence of community “activities.”

Table 2: Source vs. Activity for Greenhouse Gas Emissions

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere.	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

[5] ICLEI. 2012. US Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/tools/ghg-protocol/community-protocol

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Coconut Creek's community GHG emissions inventory utilizes 2019 as its baseline year because it is the most recent year for which the necessary data are available.

Quantification Methods

GHG emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of GHG emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used:

Activity Data x Emission Factor = Emissions

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see the appendices for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath Climate Planner tool.

Community Emissions Inventory Results

The total community-wide emissions for the 2019 inventory are shown in Table 3 and Figure 5.

Table 3: Community-Wide Emissions Inventory

Sector	Fuel or Source	2019 Usage	Usage Unit	2019 Emissions (Mt CO2e)
Residential Energy	Electricity	307,026,124	kWh	93,069
	Propane	2,510	MMBtu	156
	Distillate Fuel Oil No. 2	284	MMBtu	21
Residential Energy Total				**93,246**
Commercial Energy	Electricity	224,039,354	kWh	67,913
	Natural Gas	870,198	Therms	4,628
Commercial Energy Total				**72,541**
Industrial Energy	Electricity	719,162	kWh	218
Industrial Energy Total				**218**
Transportation & Mobile Sources	Gasoline	336,453,380.55	VMT	140,497
	Diesel	34,845,796.09	VMT	51,340
Transportation & Mobile Sources Total				**191,837**
Solid Waste	Waste Sent to Landfill	48,168.34	Tons	29,620
Solid Waste Total				**29,620**
Water & Wastewater	N2O - Wastewater Treatment	60,490	People	140
	N2O - Effluent Discharge	60,490	People	440
	Electricity - Wastewater Treatment	8,584,747	kWh	2,602
Water & Wastewater Total				**3,182**
Process & Fugitive Emissions	Natural Gas Distribution	87,019.8	MMBtu	151
Process & Fugitive Emissions Total				**151**
Total Gross Emissions				**390,795**

*Blank cells are a result of variability in the format of available data by sector and fuel or source type.

Table 3: Community-Wide Emissions Inventory (continued)

Sector	Fuel or Source	Usage Unit	2019 Emissions (Mt CO2e)
Forests and Trees	Forest to Other Non-forest	Hectares	8
	Undisturbed Forest	Hectares	-2,014
	Disturbed Forest	Hectares	220
	Forest to Settlement	Hectares	0
	Trees Outside of Forests	Hectares	-3,070
	Non-forest to Forest	Hectares	-7
	Forest to Settlement	Hectares	2
Forests and Trees Total			**-4,860**
Total Emissions with Sequestration			**385,935**

*Blank cells are a result of variability in the format of available data by sector and fuel or source type.

Figure 5 shows the distribution of community-wide emissions by sector. Transportation is the largest contributor, followed by Residential & Commercial Energy.

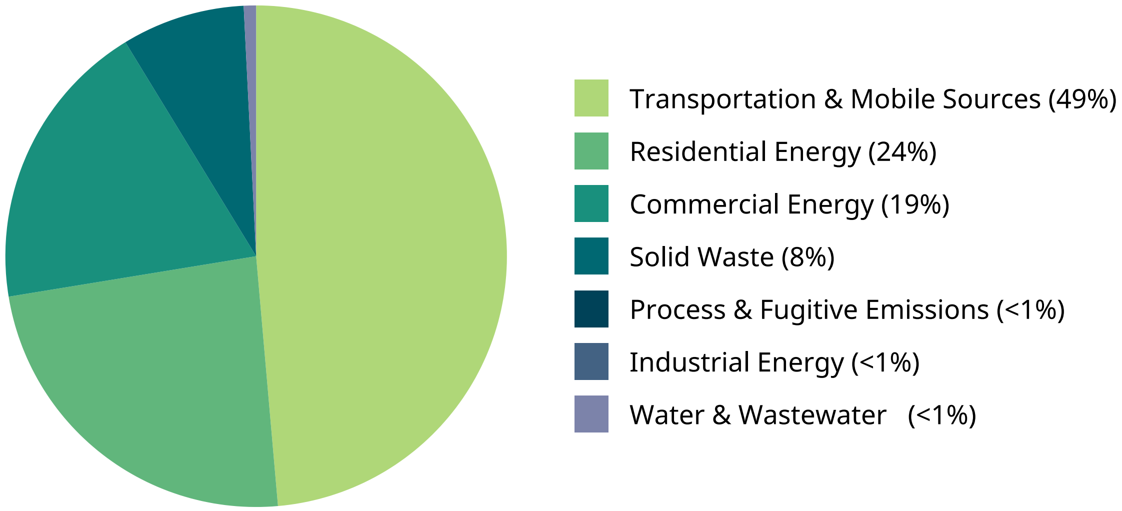

Figure 5: Community-Wide Emissions by Sector

Tree Canopy Analysis

The manner in which GHG inventories are estimated for different types of land use is more complicated than for other sectors. In addition to both emitting and removing GHGs, there are multiple carbon pools that respond differently to management activities and natural disturbances, interannual variability is high, and measurements may not be as precise as it is in other sectors (See the USCP, Appendix J). Beginning in 2019, a number of updates to protocols and guidance to estimating carbon from the Agriculture, Forestry, and Other Land Use (AFOLU) sector required that communities include the "net flux" of carbon emissions and removals - carbon emitted to the atmosphere from the land and carbon removed from the atmosphere to the land.

In coordination with ICLEI USA, Coconut Creek was able to use the US Community Protocol's Land Emissions and Removals Navigator (LEARN) tool to estimate the net flux of AFOLU emissions from 2016-2019 [6]. This analysis reported six "land use" categories which were defined by data on land cover—forest land, grassland, cropland, wetland, settlement and other land (barren, snow, ice). In 2019, Coconut Creek's total land base is approximately 3,037 hectares (7,505 acres), with nearly 80.6% settlement (i.e. developed areas of varying intensity), around 11.7% forest, 1.3% grassland (which includes hay/pasture, shrub/scrub and other herbaceous cover), 0.7% cropland, 5.2% wetland and 0.4% other land. Over the period 2016 to 2019, the Net GHG balance of forests and trees was -4,861 t CO_2e per year. Total GHG emissions for Coconut Creek across all sectors could be reduced if additional forests/trees were added to its land base, and/or if losses of trees were reduced further.

While GHG Inventories are recommended to comprise data from a single year, AFOLU data measures changes over the course of multiple years. Therefore, this analysis could not be used to measure emissions and sequestrations specifically for 2019.

[6] US Community Protocol's Land Emissions And Removals Navigator (LEARN) tool. Available at https://icleiusa.org/LEARN/

Next Steps

The inventory should be used to focus and prioritize actions to reduce emissions. Based on the inventory results, the following areas have the greatest potential for emissions reduction:

- On-road transportation
    - Vehicle electrification- Transition from internal combustion engine vehicles (passenger, transit fleets, municipal fleets, etc.) to electric-powered
    - Land use/infrastructure planning- Improving infrastructure to incentivize public transit usage, walking, and biking
    - Work with communities to expand public transportation options
- Community electricity use
    - Increase distributed solar
    - Coordinate with local electric utilities to aid in decarbonization planning
- Solid Waste
    - Improve recycling and composting programs to reduce organic waste content in waste streams

Completion of another GHG inventory in two to five years is recommended to assess progress resulting from any actions implemented. The detailed methodology section of this report, as well as notes and attached data files in the ClearPath Climate Planner tool and a master data Excel file provided to Coconut Creek, will be helpful to complete a future inventory consistent with this one.

Conclusion

This inventory marks the completion of Milestone One of the Five ICLEI Climate Mitigation Milestones. The next steps are to forecast emissions, set an emissions-reduction target, and build upon the existing Coconut Creek initiatives with a more robust climate action plan that identifies specific quantified strategies that can cumulatively meet that target.

The Intergovernmental Panel on Climate Change (IPCC) states that to meet the Paris Agreement commitment of keeping warming below 1.5°C we must reduce global emissions by 50% by 2030 and reach climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%. More than ever, it is imperative that countries, regions, and local governments set targets that are ambitious enough to slash carbon emissions between now and mid-century.

Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent a community's fair share of the global ambition necessary to meet the Paris Agreement commitment. Community education, involvement, and partnerships will be instrumental to achieve a science-based target. To meet and exceed our science-based target, Coconut Creek has officially committed to reducing its emissions to zero by 2050 through ICLEI's Race to Zero.

To support the bold climate action of Coconut Creek, ICLEI has calculated the city's Science-Based Targets [7]:

- **Per-Capita SBT: 62.8%**
- **Absolute SBT: 62.4%**

Science-Based Targets are climate goals in line with the latest climate science. They represent the city's fair share of the ambition necessary to meet the Paris Agreement commitment to keep warming below 1.5°C.

In addition, Coconut Creek will continue to track key energy use and emissions indicators on an on-going basis. It is recommended that communities update their inventories on a regular basis, especially as plans are implemented to ensure measurement and verification of impacts. Regular inventories also allow for "rolling averages" to provide insight into sustained changes and can help reduce the change of an anomalous year being incorrectly interpreted. This inventory shows that residential and commercial energy as well as community-wide transportation patterns will be particularly important to focus on. Through these efforts and others, Coconut Creek can achieve environmental, economic, and social benefits beyond reducing emissions.

[7] "Science Based Climate Targets: A Guide for Cities." Science Based Targets Network, November 4, 2021. https://sciencebasedtargetsnetwork.org/.

Appendix: Methodology Details

Energy

Table 4: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Residential, Commercial, and Industrial Electricity	Florida Power & Light Company	
Residential Non-Utility Fuels	US Census, EIA	Estimates are extrapolated from state-level estimates
Commercial Natural Gas	TECO Energy	

Table 5: Emissions Factors for Electricity Consumption

Emissions Factor/ Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)	Data Gaps and Assumptions
Florida Power and Light (2019)	665	55	7	

Transportation

Table 6: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
On-road transportation	Google EIE	Data does not include public transit

For vehicle transportation, it is necessary to apply average miles per gallon and emissions factors for CH4 and N2O to each vehicle type. The factors used are shown in Table 8.

Table 7: MPG and Emissions Factors by Vehicle Type

Fuel	Vehicle Type	MPG	CH4 (g/mile)	N2O (g/mile)
Gasoline	Passenger car	24.1	0.0183	0.0083
Gasoline	Light truck	17.6	0.0193	0.0148
Gasoline	Heavy truck	5.4	0.0785	0.0633
Gasoline	Motorcycle	24.1	0.0183	0.0083
Diesel	Passenger car	24.1	0.0005	0.001
Diesel	Light truck	17.6	0.001	0.0015
Diesel	Heavy truck	6.4	0.0051	0.0048

Wastewater

Table 8: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Wastewater Electricity, Process N20, Wastewater effluent, potable water electricity	Broward County, US Census, Florida Power & Light Company	Data from extrapolated from Broward County 2019 inventory using US Census populations

Solid Waste

Table 9: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Coconut Creek Total MSW + C&D	Wheelabrator	

Fugitive Emissions

Table 10: Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Commercial Natural Gas Distribution	TECO Energy	

Inventory Calculations

The 2019 inventory was calculated following the US Community Protocol and ICLEI's ClearPath Climate Planner Climate Planner software. As discussed in Inventory Methodology, the IPCC 5th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO2 equivalent units. ClearPath Climate Planner's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final carbon dioxide equivalent (CO2e) emissions.