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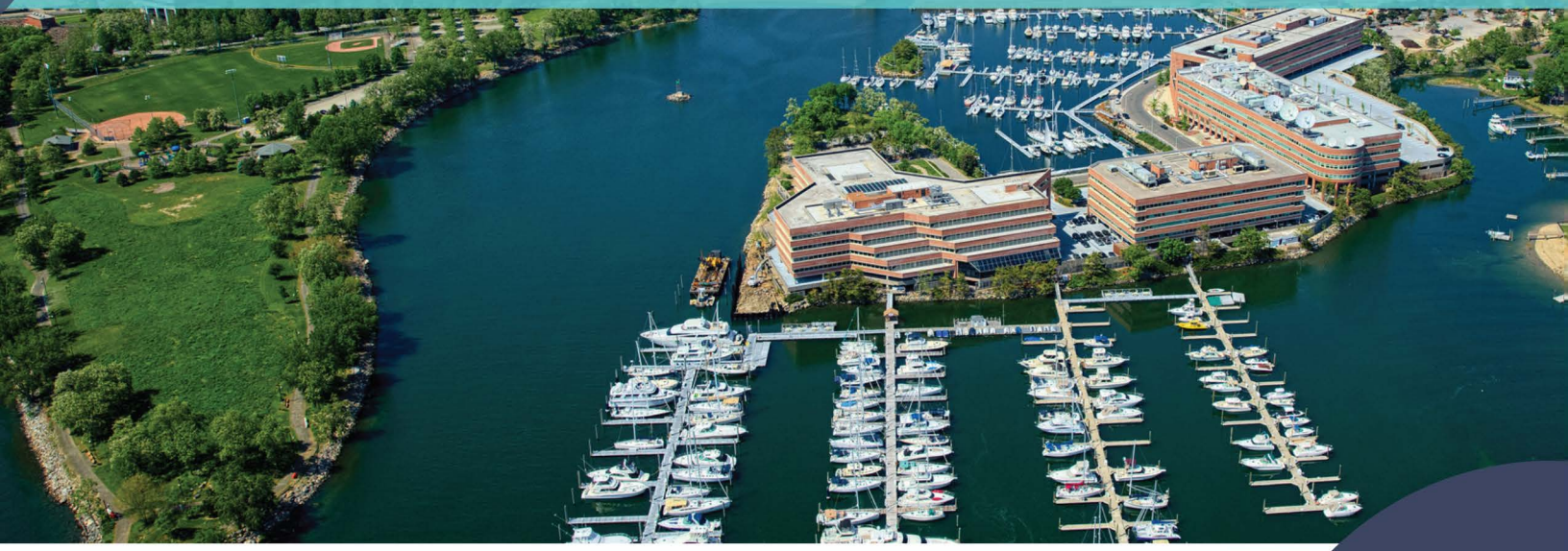
STAMFORD, CONNECTICUT

2021 Inventory of Community and Government Operations Greenhouse Gas Emissions



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City of Stamford
Land Use Bureau

In Partnership With:
ICLEI – Local Governments for Sustainability USA

April 19, 2023

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ICLEI – Local Governments for Sustainability USA
This template was updated by ICLEI USA in 2023.

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Executive Summary

Stamford recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, well-being, and prosperity of our community.

Over the past decade, Stamford has recognized the importance of combating climate change. Numerous initiatives have been and continue to be successfully implemented in various areas, including environmental resiliency, greener development, and decreased dependency on personal automobiles. In a renewed commitment to the environment, Mayor Caroline Simmons created the City's first-ever Climate Council in 2022 with the goal of making Stamford a more resilient and environmentally conscious city.

- Development Initiatives:
  - Transitioned City buildings, traffic lights, & streetlights to energy-efficient LEDs
  - Added a Sustainability Amendment to Stamford's Master Plan in 2010
  - Required Sustainability Scorecard for large-scale developments
  - LEED Silver requirement for all new city-owned developments
- Environmental Initiatives:
  - The City of Stamford Mayor's Climate Council formed in 2022
  - Banned single-use reusable plastic bags in the city in 2019
  - Street tree planting requirements
  - Ongoing Coastal Flood Resiliency Plan and Citywide Invasive Species Plan
  - Food Scrap Recycling Pilot Program, with plans to expand citywide
  - Completed a GIS-based Downtown tree inventory in 2022, with further plans for creation of a city-wide tree inventory
- Transportation Initiatives:
  - Electric vehicle and bike parking requirements in place
  - Bike and Pedestrian plan completed in 2019
  - Ongoing conversion of traditional street gutters to bioswales

This report provides estimates of GHG emissions resulting from activities in Stamford as a whole in 2021, with GHG emissions from Stamford's government operations as a subset of the community-wide inventory.

Credits and Acknowledgments

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Key Findings: Community-Wide Inventory

Figure 1 shows community-wide emissions by sector. The largest contributors are Residential Energy and Transportation & Mobile Sources, with 31% of emissions each. The next largest contributor is Commercial & Industrial Energy (28%). Actions to reduce emissions in all of these sectors will be a key part of a climate action plan. Solid Waste, Water & Wastewater, and Process & Fugitive Emissions were responsible for the remaining (less than 10%) emissions. In 2021, Stamford's community-wide greenhouse gas emissions totaled 1,064,995 metric tons of carbon dioxide equivalent (Mt CO2e), or, 7.8 Mt CO2e per capita.

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

COMMUNITY EMISSIONS AT A GLANCE

1 **Transportation 31%**

2 **Residential Energy 31%**

3 **Commercial & Industrial Energy 28%**

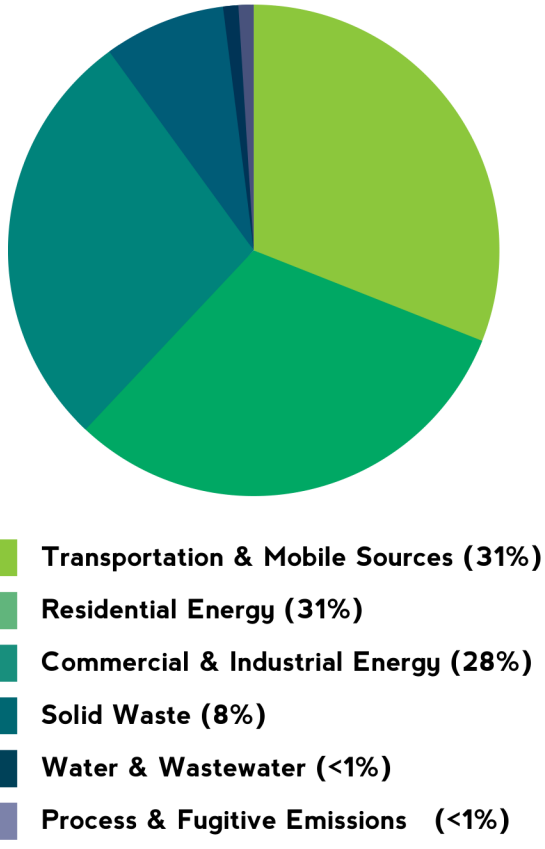


Figure 1: Community-Wide Emissions by Sector

Key Findings: Government Operations Inventory

Figure 2 shows government operations emissions by sector. The largest contributor is Building & Facility Energy with 33% of emissions. The next largest contributors are Employee Commute (29%) and Water & Wastewater (24%). Actions in all of these sectors will be a key part of reducing emissions from government operations. Vehicle Fleet and Streetlights & Traffic Signals were responsible for the remaining (less than 14%) emissions.

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

GOVERNMENT OPERATIONS EMISSIONS AT A GLANCE

1. **Building & Facility Energy** 33%
2. **Employee Commute** 29%
3. **Water & Wastewater** 24%

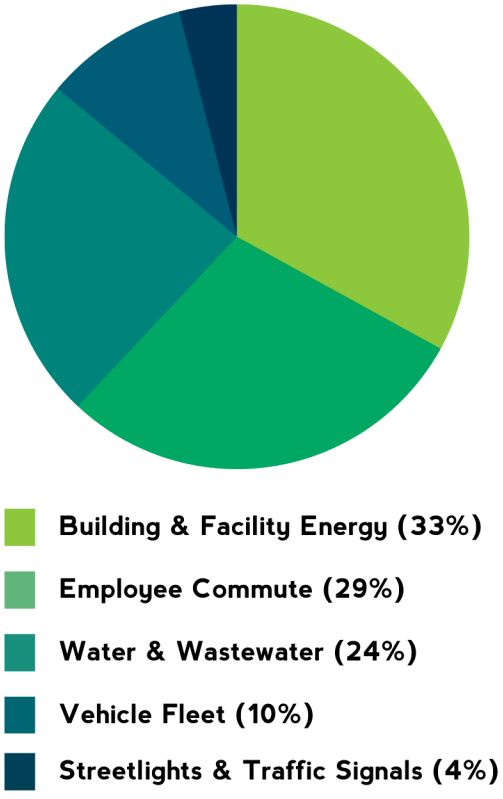


Figure 2: Government Operations Emissions by Sector

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 greenhouse gases 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 Stamford 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 2018 National Climate Assessment, the Northeast U.S. will experience potentially devastating impacts from seasonal changes and hazards occurring at unprecedented magnitudes. The Northeast U.S., including Stamford, is at particular risk for changing seasons, including milder winters and earlier spring conditions, which can impact the region's tourism, farming, and forestry industries. In addition, Stamford's seaside location puts it at additional risk for vulnerability to warming ocean temperatures, sea level rise, and ocean acidification, threatening coastal habitats, ecosystem services, and related economies [2].

Climate scientists expect the Northeast region to experience a greater average temperature than any other area in the contiguous U.S. They anticipate this will happen as quickly as two decades before global average temperatures reach a similar level. Recreation, tourism, and the regional economy centered around autumn foliage, winters in the mountains, and summers at beaches and in the mountains are all expected to be impacted by these changes, which contribute significantly to the region's rich cultural heritage. Additionally, the ocean and coast are sensitive to changing temperatures, sea level rise, storm surges, flooding, and erosion, which pose risks to people, infrastructure, economies, and traditions. Some of the highest sea level rise and ocean warming in the U.S. have already occurred in the Northeast, and climate experts project this will continue throughout the coming decades. These changes also pose hazards to residents, including temperature extremes, poor air quality, coastal flooding, intense precipitation events, and more. These hazards may lead to evacuations, displaced populations, and damaged infrastructure, which will require significant investment and incur high costs. Finally, underserved communities, such as the elderly and low-income populations, will be at increased risk of these hazards resulting in continued and enhanced inequalities.

Many U.S. communities have started to take responsibility for addressing climate change locally. Reducing fossil fuel use in the community can have many benefits besides reducing GHG emissions. More efficient energy use 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.

[2] U.S. Global Change Research Program. 2018. National Climate Assessment – Ch 18: Northeast. Retrieved from https://nca2018.globalchange.gov/chapter/18/.

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 Stamford to identify priority sectors for action while considering climate justice, inclusiveness, local job creation, and other benefits of sustainable development.

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

> The targeted reduction of greenhouse gas (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, Stamford 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.

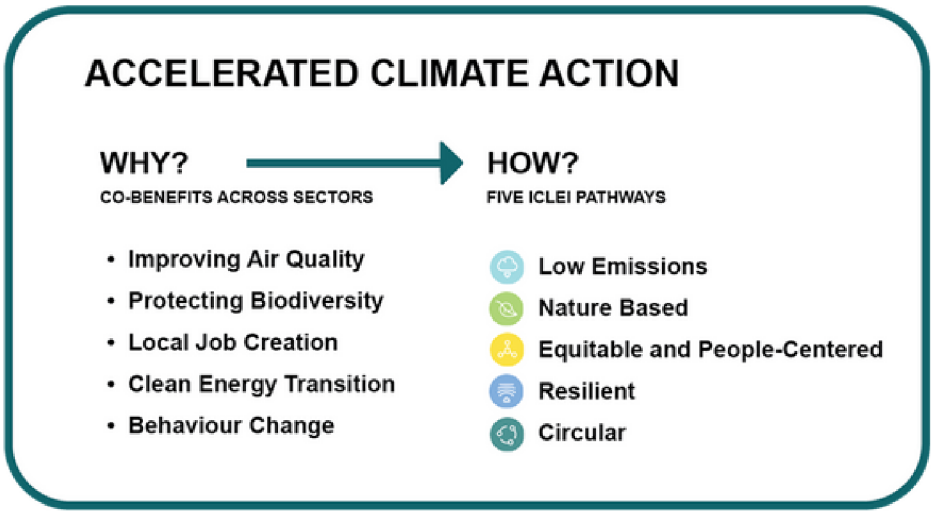


Figure 3: Co-Benefits and ICLEI Pathways to Accelerated Climate Action

ICLEI Climate Mitigation Milestones

In response to the climate emergency, many U.S. communities are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas (GHG) emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing greenhouse gas 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 greenhouse gas 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 [3];
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 greenhouse gas emissions in Stamford.

Figure 4: ICLEI Climate Mitigation Milestones

[3] 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 greenhouse gas (GHG) emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the Stamford community as a whole. The government operations inventory is mostly a subset of the community inventory, as shown in Figure 5. For example, data on commercial energy use by the community include energy consumed by municipal buildings, and community vehicle-miles-traveled (VMT) estimates include miles driven by municipal fleet vehicles.

Figure 5: Relationship of Community and Government Operations Inventories

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 GHG Emissions (Community Protocol) and the Local Government Operations Protocol for Accounting and Reporting GHG Emissions (LGO Protocol), both of which are described below.

Three GHG 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 [4] 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 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
- Industrial processes
- Upstream emissions from natural gas distribution

Local Government Operations (LGO) Protocol

In 2010, ICLEI, the California Air Resources Board (CARB), and the California Climate Action Registry (CCAR) released Version 1.1 of the LGO Protocol [5]. The LGO Protocol serves as the national standard for quantifying and reporting GHG emissions from local government operations. The purpose of the LGO Protocol is to provide the principles, approach, methodology, and procedures needed to develop a local government operations GHG emissions inventory.

The following activities are included in the LGO inventory:

- Energy and natural gas consumption from buildings & facilities and streetlights & traffic signals
- Wastewater treatment processes and energy use
- On-road transportation from employee commute and vehicle fleet

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

[5] ICLEI. 2008. Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/programs/climate/ghg-protocol/ghg-protocol

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas (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 (GHG)

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

Activities within a community include, but are not limited to: heating of homes, driving cars, and throwing away trash. Sources are where the emissions from those activities occur, which may or may not be the same place the activity occurs. When you drive your car, the source is the car's tailpipe. Similarly, when a gas furnace in your home runs, the source is the exhaust vent of the furnace. On the other hand, when you throw away trash the source is at the landfill the trash is sent to. When you flip a switch and use electricity, the source is the power plant where the electricity is generated. Because landfills and power plants are usually located outside the community, careful inclusion of both sources and activities provides a fuller picture of community emissions.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Stamford's GHG emissions inventory utilizes 2021 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 CO2/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 2021 inventory are shown in Table 3 and Figure 6.

Table 3: Community-Wide Emissions Inventory

Sector	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (Mt CO2e)
Residential Energy	Electricity	497,056,774	kWh	120,162
	Natural Gas	2,220,832	MMBtu	118,118
	Propane	312,199	MMBtu	19,375
	Distillate Fuel Oil	978,053	MMBtu	72,822
Residential Energy Total				330,477
Commercial & Industrial Energy	Electricity	746,232,557	kWh	180,399
	Natural Gas	2,296,470	MMBtu	122,141
Commercial & Industrial Energy Total				302,540
Transportation & Mobile Sources	Gasoline	589,381,885	VMT	243,092
	Diesel	61,041,090	VMT	88,744
	Public Transit	410,450	Gallons	3,608
Transportation & Mobile Sources Total				335,444
Solid Waste	Waste Sent to Landfill	69,034	Tons	82,293
	Compost	61,066	Tons	3,038
Solid Waste Total				85,331
Water & Wastewater	Septic Systems			2,285
	N2O			369
	Methanol			712
Water & Wastewater Total				3,366
Process & Fugitive	Natural Gas Distribution	4,517,302	MMBtu	7,837
Process & Fugitive Total				7,837
Total Community-Wide Emissions				1,064,995

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

Figure 6 shows the distribution of community-wide emissions by sector. Transportation & Mobile Sources and Residential Energy are the largest contributors, followed by Commercial & Industrial Energy.

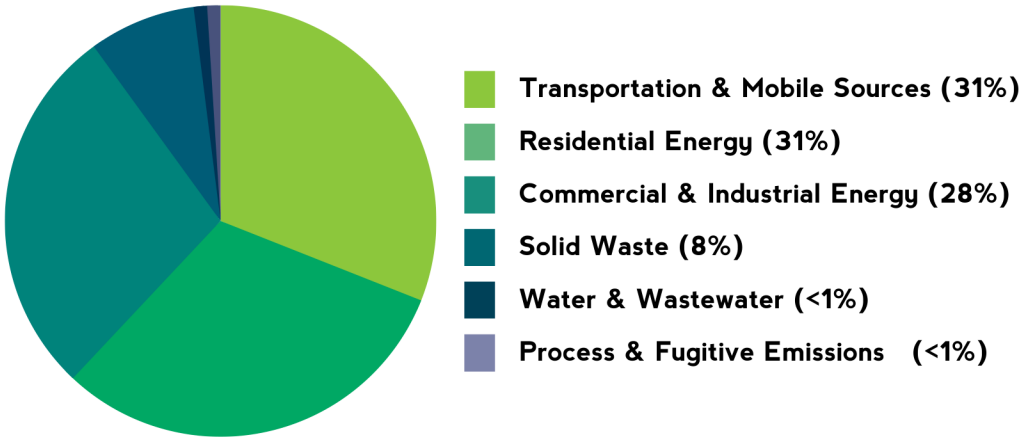


Figure 6: Community-Wide Emissions by Sector

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 and land use policies to incentivize public transit usage, walking, and biking, and the implementation of nature-based solutions
  - Work with communities to expand public transportation options
- Community electricity use
  - Increase distributed solar
- Community stationary fuels use
  - Electrify buildings- Convert gas-powered heating/cooling and kitchen appliances (e.g., water heaters) to electric powered
- 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 Stamford, will be helpful to complete a future inventory consistent with this one.

Government Operations Emissions Inventory 2021 Results

The total government operations emissions for the 2021 inventory are shown below in Table 4 and Figure 7.

Table 4: Government Operations Emissions Inventory 2021

Sector	Fuel or Source	2021 Usage	Usage Unit	2021 Emissions (Mt CO2e)
Buildings & Facilities	Electricity	28,271,649	kWh	6,974
	Natural Gas	664,839	Therms	3,536
Buildings & Facilities Total				10,510
Streetlights & Traffic Signals	Electricity	4,403,536	kWh	1,086
Street Lights & Traffic Signals Total				1,086
Vehicle Fleet	Gasoline	91,101	Gallons	800
	Diesel	228,557	Gallons	2,334
Vehicle Fleet Total				3,133
Water and Wastewater Treatment Facilties	Electricity	12,396,495	kWh	3,058
	Natural Gas	612,099	Therms	3,256
	N2O			416
	Methanol			713
Water and Wastewater Treatment Facilities Total				9,142
Employee Commute	Gasoline	21,954,447	VMT	8,915
	Diesel	54,076	VMT	84
	Electric	321,960	VMT	27
	Transit Bus	9,678	VMT	0.56
	Transit Commuter Rail	651,418	VMT	115
Employee Commute Travel Total				7,442
Total Government Operations Emissions				31,313

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

Figure 7 shows the distribution of Government Operations emissions by sector. Building & Facility Energy is the largest contributor, followed by Employee Commute and Water & Wastewater.

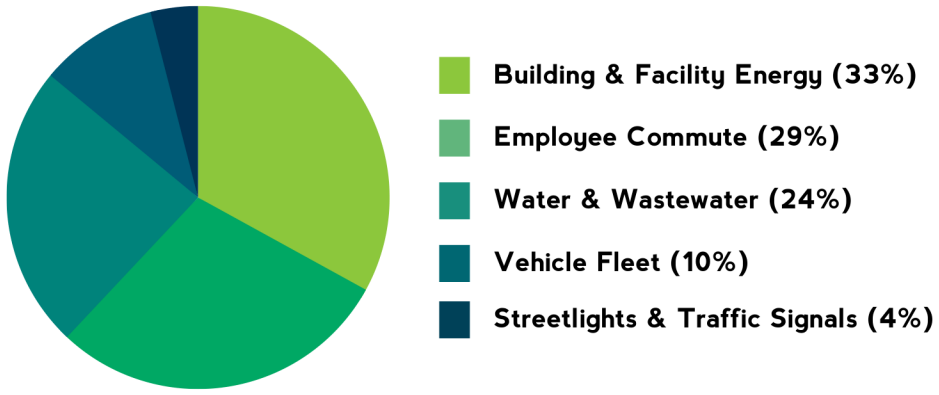


Figure 7: 2021 Local Government Operations Emissions by Sector

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:

- Buildings & Facilities
  - Convert existing buildings from natural gas to electricity
- Vehicle Fleet
  - Purchase and convert internal combustion engine vehicles to electric vehicles or hybrid
- Employee Commute
  - Implement telework policy
  - Incentivize other modes of transportation (e.g., provide employees with public transit passes)
- Water & Wastewater
  - Convert existing buildings and processes from natural gas to electricity, where possible
  - Increase efficiency of treatment processes

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 the City of Stamford, 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 Community Plan 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.

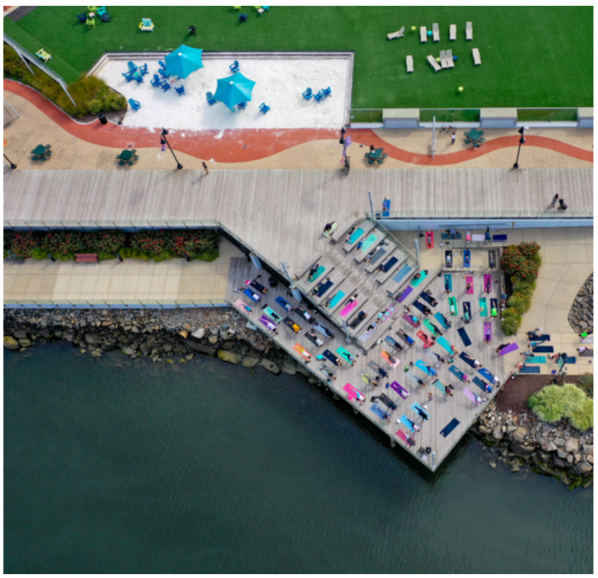
Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent a community's fair share of the global ambition necessary to meet the Paris Agreement commitment. Community education, involvement, and partnerships will be instrumental to achieve a science-based target.

To support the bold climate action of Stamford, ICLEI has calculated the city's 2030 Science-Based Targets [11]:

- **Per-Capita SBT: 62.9%** **(2.9 Mt CO2e per capita)**
- **Absolute SBT: 62.1%**

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, Stamford 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, industrial, and commercial energy as well as transportation patterns will be particularly important to focus on. Through these efforts and others, Stamford can achieve environmental, economic, and social benefits beyond reducing emissions.



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

Appendix: Methodology Details

Energy

Table 5: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Residential Fuel Oil Consumption	U.S. Energy Information Administration	State energy consumption data from 2020 used because 2021 data is not yet available.
Residential Propane Consumption	U.S. Energy Information Administration	State energy consumption data from 2020 used because 2021 data is not yet available.
Residential, Commercial, and Industrial Electricity Consumption	Eversource	No data gaps or assumptions identified.
Residential, Commercial, and Industrial Natural Gas Consumption	Eversource	No data gaps or assumptions identified.
Local Government Operations		
Natural Gas and Electricity Consumption	Municipal Records	No data gaps or assumptions identified.

Table 6: NPCC New England (NEWE) eGRID (2021) Emissions Factors for Electricity

Year	CO2 (lbs./MWh)	CH4 (lbs./GWh)	N2O (lbs./GWh)	
2021	539.4	72	9	No data gaps or assumptions identified.

Transportation

Table 7: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
On-Road Gasoline and Diesel Consumption	Google Environmental Insights Explorer	No data gaps or assumptions identified.
Public Transit	CT Transit	No data gaps or assumptions identified.

Table 7: Transportation Data Sources Continued

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Government Vehicle Fleet	Government Records	VMT and vehicle class data unavailable.
Employee Commute	Survey	For employees that did not provide total vacation and sick time, assumed 10 days off, and for teachers, assumed 63 days off based on the school calendar. For employees that did not report fuel economy, used averages from the rest of the responses and national averages for EVs.

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 8: MPG and Emissions Factors by Vehicle Type

Fuel	Vehicle Type	MPG	CH4 (g/mile)	N2O (g/mile)
Gasoline	Passenger car	25.30	0.0069	0.0069
Gasoline	Light truck	18.20	0.012	0.0087
Gasoline	Heavy truck	5.38	0.072	0.061
Gasoline	Motorcycle	44	0.0084	0.0069
Diesel	Passenger car	25.30	0.00050	0.0010
Diesel	Light truck	18.20	0.0010	0.0015
Diesel	Heavy truck	6.56	0.0051	0.0048

Wastewater

Table 9: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-Wide Operations		
Methanol	SWPCA	Population served reported as a range, used the median.
N2O	SWPCA	Population served reported as a range, used the median.
Septic Systems	Census Bureau	Population served reported as a range, used the median of this and then the found the difference between the population served by SWPCA and the census population of Stamford to determine the total population using septic systems.
Local Government Operations		
Methanol	SWPCA	Population served reported as a range, used the median.
N2O	SWPCA	Population served reported as a range, used the median.
Electricity Consumption	SWPCA	No data gaps or assumptions identified.
Natural Gas Consumption	SWPCA	No data gaps or assumptions identified.

Solid Waste

Table 10: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Waste Generation and Composting	City of Stamford	No data gaps or assumptions identified.

Fugitive Emissions

Table 11: Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Community-wide		
Fugitive Emissions from Natural Gas Consumption	**Eversource**	**No data gaps or assumptions identified.**

Inventory Calculations

The 2021 inventory was calculated following the U.S. Community Protocol and ICLEI's ClearPath 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 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.

Data Gap Recommendations

The following recommendations may help address data gaps in future inventories:

- Government Vehicle Fleet: Create a list of all vehicles owned by the government (including on- and off-road vehicles) which includes vehicle class and vehicle miles traveled each year.
- Employee Commute: Work with the human resources department to obtain information on the number of days off that various types of employees or departments have each year. Add a question about fuel economy that is specific to electric vehicles.
- Wastewater: Request SWPCA to provide an exact number of people served.
- General: Micro-level data (e.g., energy usage from single-family versus multi-family buildings) may be useful when considering emissions reduction actions. However, various factors should be taken into account when considering the use of micro-level data such as data reliability, staff capacity, and whether the data will remain comparable to prior years or other community and government operations inventories.