2015-2018

Greenhouse Gas Emissions Inventory
Local Government Operations

City of Long Beach, NY

1 W. Chester Street

2015-2018

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1. INTRODUCTION

As a barrier island, Long Beach faces an increased risk to the effects of climate change, particularly rising sea levels and more powerful coastal storms. As we move forward, a collective effort must take place locally, as well as globally, to address our role in fueling climate change and to prepare for the effects of a warming world. It's extremely important that we take *proactive* steps toward increasing our resiliency and reducing our carbon footprint, instead of simply being *reactive.*

Conducting a greenhouse gas (GHG) inventory of government operations is an important step toward engaging in a process of climate action. After all, you cannot manage what you do not measure. The information contained in this report will be utilized to develop goals and strategies to reduce Long Beach's GHG footprint, to prepare for a changing climate, and to measure progress on climate action.

1.1 What is a Local Government Operations GHG Inventory?

A local government operations GHG inventory is an accounting, analysis, and baseline report of the GHG emissions resulting from the day-to-day operations of a village, town, city or county. This includes consumption of energy and materials from the operation of government-owned or managed facilities, emissions from vehicle fleets, energy from outdoor lighting, wastewater and water treatment facility processes, decomposition of waste, and other sources.
The inventory can be used as a starting point for developing climate mitigation strategies or a climate action plan and as a benchmark for tracking progress for GHG reductions.

1.2 Why is a Local Government Operations GHG Inventory Important?

The purpose of conducting a local government operations GHG emissions inventory is to gain an understanding of the emission sources, establish a baseline, and identify opportunities to reduce energy use and GHG emissions. A local government operations GHG inventory can lead to the following benefits:

- Improved ability to manage energy use. A GHG inventory helps a local government identify the largest energy users and GHG emissions sources, which will help to target energy efficiency strategies to the areas with the greatest opportunities.
- Leading by example. Local governments can set an example for local businesses, the community, and their peers by developing a GHG inventory and helping others understand the results. The more others understand the benefits of measuring GHG emissions and implementing energy efficiency improvements, they will begin to take similar actions. The

GHG inventory can also be the starting point to open up a dialogue and share best practices with local businesses and other organizations.

- <u>Increased Transparency.</u> Publicly releasing the results of an inventory and explaining the results, helps to increase transparency and accountability of local governments to their taxpayers to operate efficiently and use resources effectively.
- <u>Cost Savings.</u> Energy efficiency improvement opportunities that can arise from a GHG inventory help to save taxpayer dollars. For example, many energy efficiency improvements can pay for themselves within a few years or less, resulting in direct and measurable energy and cost savings.

This inventory was prepared as a component of the City of Long Beach's participation in the Climate Smart Communities (CSC) program. The CSC program is a network of communities across New York State that are committed to reducing GHG emissions and increasing their resilience to a changing climate. The city will utilize the information in this report to develop goals and strategies to reducing its greenhouse gas footprint while also cutting costs and saving taxpayer dollars.

1.3 Background on Climate Change

There are three macro factors that affect global climate. These macro factors dictate how much energy is exchanged between earth and space. When the flow of incoming energy is balanced by an equal flow of heat to space, Earth is in equilibrium and global temperatures are relatively stable. However, anything that increases or decreases the amount of incoming or outgoing energy will disturb Earth's equilibrium – causing global temperatures to rise or fall in response.

<u>The Three Macro-Factors that Affect Global Climate:</u>

- **Solar Radiation reaching Earth:** The rate of energy coming from the sun is relatively constant, however, fluctuations are known to exist as a result of changes in sun spot activity (on a timeline of years to decades), as well as changes in Earth's orbit and the tilt of its axis (on a timeline of tens of thousands to millions of years).

- **Earth's Albedo:** Also known as the reflectivity of the Earth's surface. Bright surfaces, such as polar ice caps, reflect solar energy (heat) back to space; while dark surfaces, such as oceans or dark colored roofs, absorb solar energy.

- **Atmospheric Concentration of Greenhouse Gases:** Greenhouse gases (such as carbon dioxide) trap heat in Earth's atmosphere before it escapes to space. Warmed by sunlight, Earth's land and ocean surfaces radiate thermal infrared energy (heat). Greenhouse gases absorb this heat and release it gradually over time. Higher concentrations of greenhouse gases results in higher average global temperatures, and vice versa.

Together, these forces dictate the earth's "energy budget" – in other words, the amount of energy that flows into and out of the Earth's climate.

Of the three macro factors that affect global climate, human activity has most significantly affected the concentration of greenhouse gases in the atmosphere – thus disrupting earth's climate equilibrium.

According to the International Panel on Climate Change (IPCC), human activities are estimated to have caused approximately 1.0°C (1.8°F) of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. If human activities continue unabated, global warming is likely to reach 1.5°C (2.7°F) between 2030 and 2052[i].

1.2 Background on Greenhouse Gases

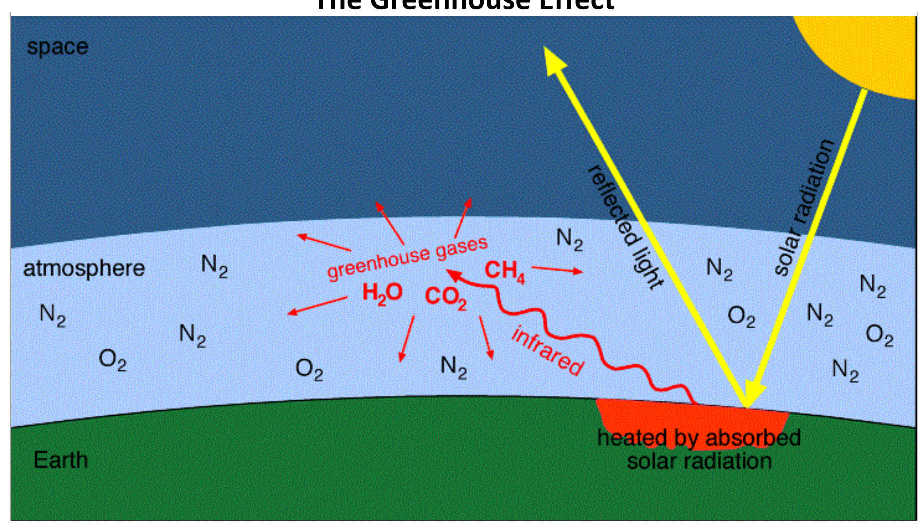
The Greenhouse Effect

Greenhouse gases trap heat in the Earth's atmosphere. Warmed by sunlight, Earth's land and ocean surfaces continuously radiate thermal infrared energy (heat).

Greenhouse gases absorb this heat and release it gradually over time, like bricks in a fireplace after the fire goes out. This is called the "Greenhouse Effect."

Of all of the greenhouse gases, carbon dioxide (CO2) tends to receive the most attention because it is one of the longest lasting molecules in the environment – once emitted, it stays in the atmosphere for decades to thousands of years.

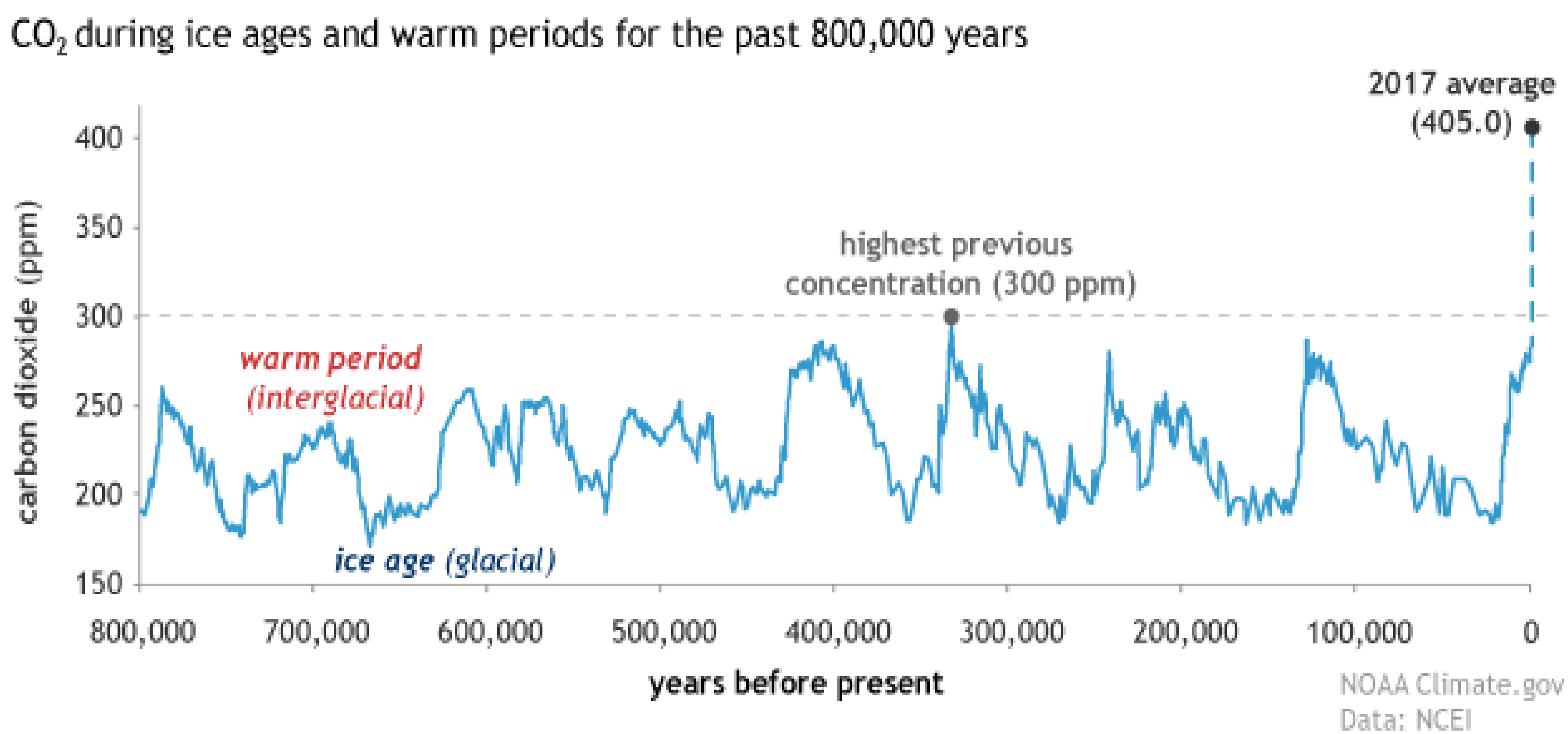
The Greenhouse Effect



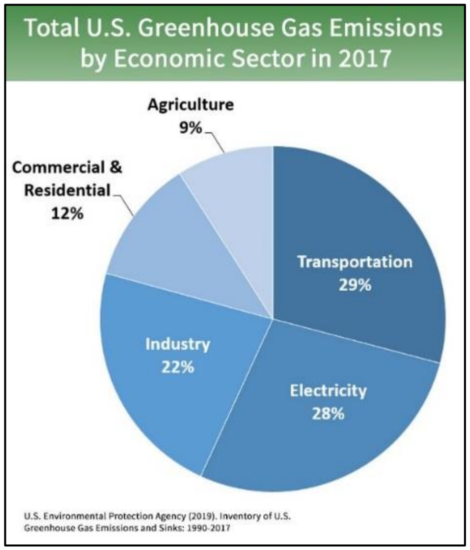
Increases in carbon dioxide are responsible for approximately one-third of the total energy imbalance that is causing Earth's temperature to rise[ii].

Prior to the industrial revolution in the 19th century, the average concentration of carbon dioxide in the atmosphere was 280 parts per million (ppm). Comparatively, the average carbon dioxide concentration for the month of May 2019 was 414.8 ppm[iii].

Reliable records exist that show atmospheric carbon dioxide concentrations going back hundreds of thousands of years:



Emission Sources



The largest source of anthropogenic greenhouse gas emissions in the United States comes from burning fossil fuels for transportation, electricity, heat, and industry. Fossil fuels, such as oil and coal, contain carbon that was pulled out of the atmosphere by plants millions of years ago. By burning these fuels, we are returning that carbon to the atmosphere in just a few decades. In the last two decades, the rate of increase of carbon dioxide in the atmosphere has been roughly 100 times faster than previous natural increases[iv]

To mitigate the worst effects of global warming, it is essential that we rapidly "decarbonize" these sectors.

Carbon Dioxide Equivalencies

There are many different greenhouse gases, most notably: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases. Each has unique characteristics – some hold more heat than others, and each has a particular lifespan in the atmosphere. For example, methane traps more heat per molecule than carbon dioxide, however, it breaks down quicker – one methane molecule lasts about 12.4 years on average, whereas carbon dioxide can remain in the atmosphere for many hundreds of years.

Carbon dioxide (CO2) tends to receive the most attention and is the most important of Earth's long-lived greenhouse gases because it is more abundant and it stays in the atmosphere for much longer than other greenhouse gases

Since different greenhouse gases have different lifespans and heat absorbing abilities, they are often converted to a common unit – referred to as their carbon dioxide equivalent (CO2e). Every greenhouse gas has a carbon dioxide equivalent which signifies the amount of carbon dioxide which would have the equivalent global warming impact of that particular greenhouse gas. By converting different gases to carbon dioxide equivalencies, it allows a bundle of greenhouse gases to be expressed as a single number.

For example, methane has a Global Warming Potential (GWP) of 86 over a 20 year time frame. Global Warming Potential (GWP) describes the heat absorbing ability of a particular greenhouse gas over a specific time period in the atmosphere. It is used in calculating carbon dioxide equivalencies and allows for comparisons of different gases with different lifespans and heat absorbing abilities. So a GWP_{20} of 86 means that one molecule of methane traps 86 times more heat than one molecule of carbon dioxide over

20 years. Since methane breaks down quicker in the atmosphere compared to carbon dioxide, it's GWP drops from 86 to 34 over a 100 year time frame (it has a GWP_{100} of 34), meaning it traps 34 times more heat than carbon dioxide over 100 years.

Major Greenhouse Gases and their Characteristics[v]

Greenhouse Gas	How it's Produced	Average Lifetime in the Atmosphere	Global Warming Potential (GWP) (CO_2 Equivalent)	
			20 Years	100 Years
Carbon dioxide (CO_2)	Emitted primarily through the burning of fossil fuels (oil, natural gas, coal), solid waste, trees, and wood products. Changes in land use also play a role. Deforestation and soil degradation add carbon dioxide to the atmosphere, while forest regrowth takes it out of the atmosphere.	Decades to thousands years[vi]	1	1
Methane (CH_4)	Emitted during the production and transport of oil, natural gas, and coal. Methane emissions also result from livestock and agricultural practices and from the anaerobic decay of organic waste in landfills.	12.4 years	86	34
Nitrous oxide (N_2O)	Emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.	121 years	268	298
Fluorinated gases	Often found in refrigerators, air-conditioners, and aerosols – these are a group of gases that contain fluorine, including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, among other chemicals. These gases are emitted from a variety of industrial processes and commercial and household uses and do not occur naturally. They are sometimes used as substitutes for banned ozone-depleting substances such as chlorofluorocarbons (CFCs).	A few weeks to thousands of years	Varies (the highest is sulfur hexfluoride at 16,300)	Varies (the highest is sulfur hexfluoride at 23,500)

2. PROJECT BACKGROUND AND METHODOLOGY

2.1 Establishing the Baseline Year

The first step in creating a GHG inventory is establishing a baseline year. The baseline year is the first full calendar year in which emissions data is tracked and progress moving forward is measured against.

For this report, 2015 was chosen as the baseline year.

2.2 Understanding "Scopes"

This inventory accounts for Scope 1, Scope 2, and Scope 3 emission sources from local government operations. This is a way of categorizing emissions sources:

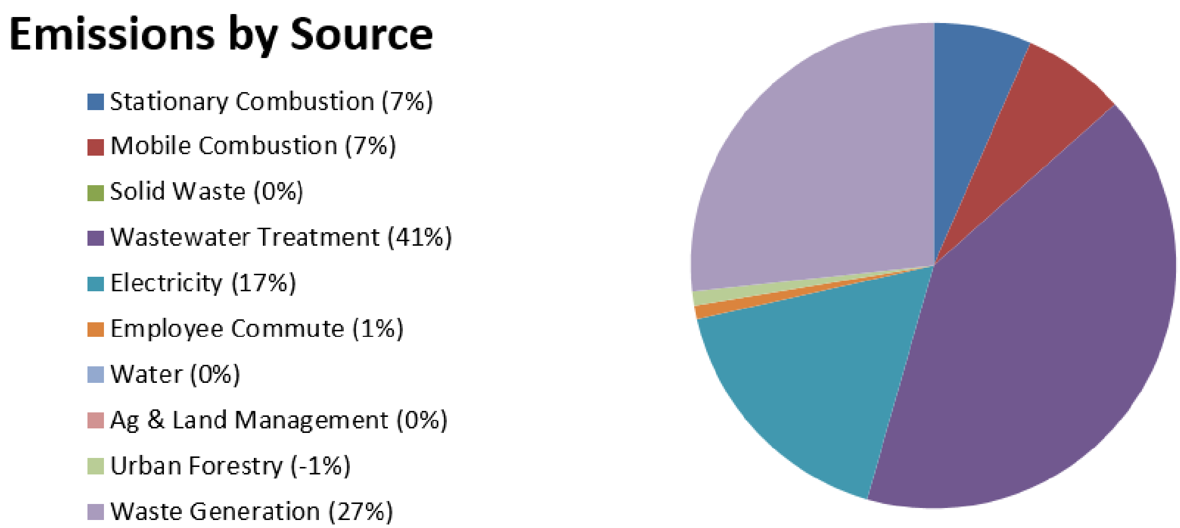
- **Scope 1** covers direct GHG emissions sources owned or controlled by the City of Long Beach.
- **Scope 2** covers indirect GHG emissions from the generation of purchased electricity.
- **Scope 3** covers indirect GHG emissions not owned or directly controlled by the city but related to government activities.

Source and Scope	Greenhouse Gases Included
Scope 1	
Stationary Fossil Fuel Combustion *(i.e. natural gas heating)*	CO_2, CH_4, N_2O
Mobile Fossil Fuel Combustion *(i.e. gasoline, diesel, etc.)*	CO_2, CH_4, N_2O
Wastewater Treatment	CH_4, N_2O
Scope 2	
Electricity Use	CO_2, CH_4, N_2O
Scope 3	
Employee Commute	CO_2
Agriculture & Land Management	N_2O
Urban Forestry	CO_2 (sequestered)
Waste Generation	CH_4

3. RESULTS

Results are outlined below for each calendar year covered under the report. The program utilized to build this inventory was the EPA's Local Greenhouse Gas Inventory Tool: Government Operations Module (LGGIT), which is guided by the Local Government Operations Protocol (LGOP) version 1.1.

2015 Emissions



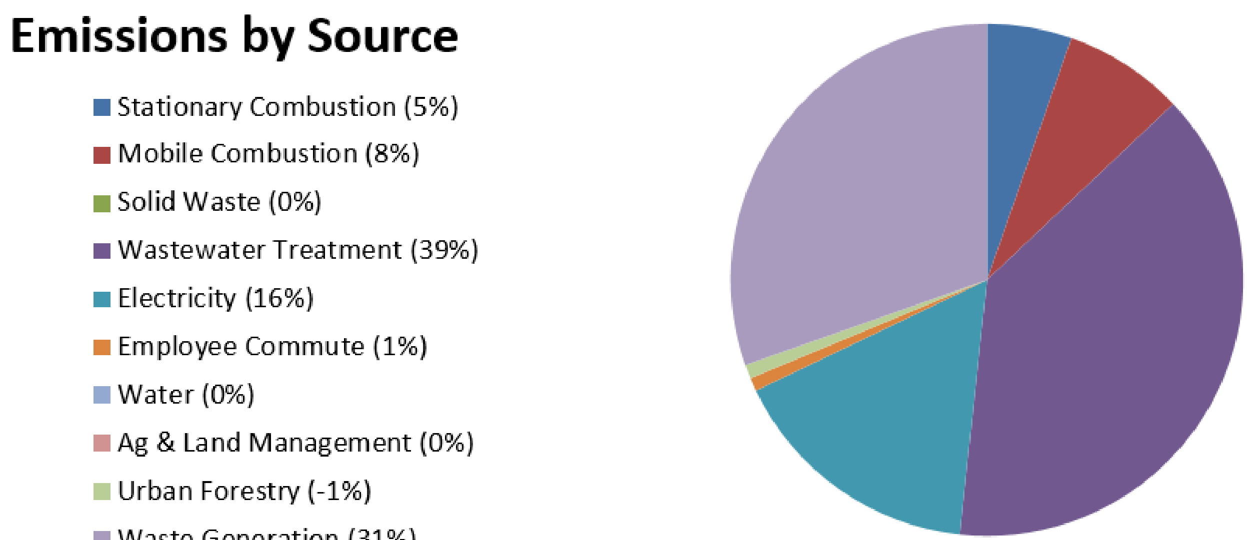
Emissions by Source (MT CO_2e)					
Source	**CO_2**	**CH_4**	**N_2O**	**Total**	**Percent of Total**
Stationary Combustion	1,852.52	0.17	0.00	1,852.69	7%
Mobile Combustion	1,951.94	-	-	1,951.94	7%
Solid Waste	-	-	-	-	0%

Wastewater Treatment	-	11,226.69	363.68	11,590.38	41%
Electricity	4,786.08	13.02	19.94	4,819.04	17%
Employee Commute	255.06	-	-	255.06	1%
Water	-	-	-	-	0%
Ag & Land Management	-	-	-	-	0%
Urban Forestry	(263.77)	-	-	(263.77)	-1%
Waste Generation	-	7,556.09	-	7,556.09	27%
Total (Gross Emissions)	8,845.60	18,795.98	383.63	**28,025.20**	100%
Total (Net Emissions)	8,581.83	18,795.98	383.63	**27,761.44**	

Total Long Beach NY Emissions (MT CO2e)

	CO_2	**CH_4**	**N_2O**	**Total MT CO_2e**	**Percent of Total**
Scope 1	3,804.46	11,226.87	363.69	15,395.02	55%
Scope 2	4,786.08	13.02	19.94	4,819.04	17%
Scope 3	(8.71)	7,556.09	-	7,547.38	27%
Total Gross Emissions	8,845.60	18,795.98	383.63	**28,025.20**	99%
Total Net Emissions	8,581.83	18,795.98	383.63	**27,761.44**	99%

2016 Emissions

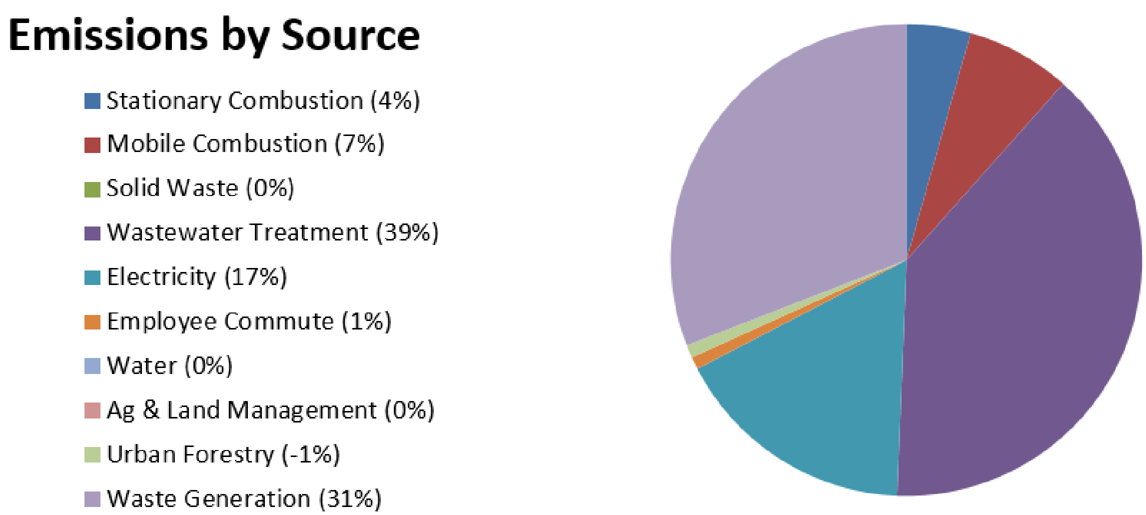


Emissions by Source (MT CO_2e)					
Source	CO_2	CH_4	N_2O	Total	Percent of Total
Stationary Combustion	1,601.80	0.15	0.00	1,601.96	5%
Mobile Combustion	2,278.25	-	-	2,278.25	8%
Solid Waste	-	-	-	-	0%
Wastewater Treatment	-	11,237.36	364.03	11,601.39	39%
Electricity	4,814.02	12.87	19.48	4,846.37	16%
Employee Commute	250.39	-	-	250.39	1%
Water	-	-	-	-	0%
Ag & Land Management	-	-	-	-	0%
Urban Forestry	(263.77)	-	-	(263.77)	-1%

Waste Generation	-	9,101.45	-	9,101.45	31%
Total (Gross Emissions)	8,944.46	20,351.83	383.51	**29,679.81**	100%
Total (Net Emissions)	8,680.69	20,351.83	383.51	**29,416.04**	

Total Long Beach NY Emissions (MT CO2e)					
	CO_2	**CH_4**	**N_2O**	**Total MT CO_2e**	**Percent of Total**
Scope 1	3,880.05	11,237.52	364.03	15,481.60	52%
Scope 2	4,814.02	12.87	19.48	4,846.37	16%
Scope 3	(13.38)	9,101.45	-	9,088.07	31%
Total Gross Emissions	8,944.46	20,351.83	383.51	**29,679.81**	99%
Total Net Emissions	8,680.69	20,351.83	383.51	**29,416.04**	99%

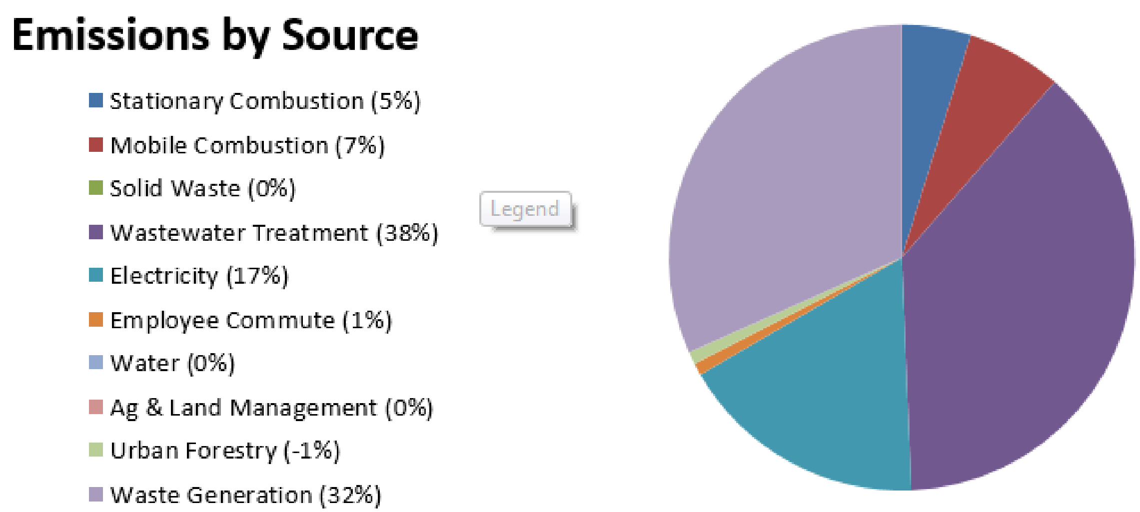
2017 Emissions



Emissions by Source (MT CO_2e)					
Source	**CO_2**	**CH_4**	**N_2O**	**Total**	**Percent of Total**
Stationary Combustion	1,308.57	0.12	0.00	1,308.69	4%
Mobile Combustion	2,134.25	-	-	2,134.25	7%
Solid Waste	-	-	-	-	0%
Wastewater Treatment	-	11,253.37	364.55	11,617.92	39%
Electricity	4,950.06	13.23	20.03	4,983.32	17%
Employee Commute	253.50	-	-	253.50	1%
Water	-	-	-	-	0%
Ag & Land Management	-	-	-	-	0%
Urban Forestry	(263.77)	-	-	(263.77)	-1%
Waste Generation	-	9,188.92	-	9,188.92	31%
Total (Gross Emissions)	8,646.37	20,455.65	384.58	**29,486.60**	100%
Total (Net Emissions)	8,382.60	20,455.65	384.58	**29,222.83**	

Total Long Beach NY Emissions (MT CO2e)					
	CO_2	**CH_4**	**N_2O**	**Total MT CO_2e**	**Percent of Total**
Scope 1	3,442.81	11,253.49	364.55	15,060.86	51%
Scope 2	4,950.06	13.23	20.03	4,983.32	17%
Scope 3	(10.27)	9,188.92	-	9,178.65	31%
Total Gross Emissions	8,646.37	20,455.65	384.58	**29,486.60**	99%
Total Net Emissions	8,382.60	20,455.65	384.58	**29,222.83**	99%

2018 Emissions

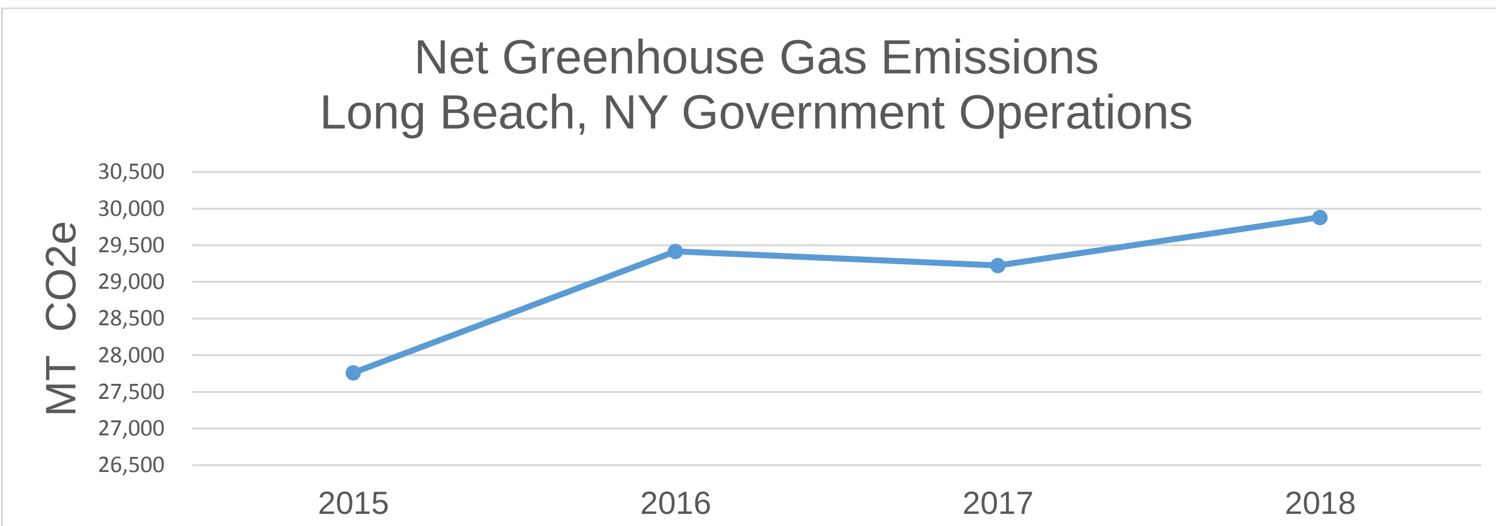


Emissions by Source (MT CO_2e)					
Source	**CO_2**	**CH_4**	**N_2O**	**Total**	**Percent of Total**
Stationary Combustion	1,455.91	0.14	0.00	1,456.05	5%
Mobile Combustion	2,010.28	-	-	2,010.28	7%
Solid Waste	-	-	-	-	0%
Wastewater Treatment	-	11,181.35	362.22	11,543.56	38%
Electricity	5,215.49	13.94	21.10	5,250.54	17%
Employee Commute	255.83	-	-	255.83	1%
Water	-	-	-	-	0%
Ag & Land Management	-	-	-	-	0%
Urban Forestry	(263.77)	-	-	(263.77)	-1%
Waste Generation	-	9,629.26	-	9,629.26	32%
Total (Gross Emissions)	8,937.52	20,824.69	383.32	**30,145.53**	100%

Total (Net Emissions)	8,673.75	20,824.69	383.32	**29,881.76**	

Total Long Beach NY Emissions (MT CO2e)					
	CO_2	CH_4	N_2O	Total MT CO_2e	Percent of Total
Scope 1	3,466.20	11,181.49	362.22	15,009.90	50%
Scope 2	5,215.49	13.94	21.10	5,250.54	17%
Scope 3	(7.94)	9,629.26	-	9,621.32	32%
Total Gross Emissions	8,937.52	20,824.69	383.32	**30,145.53**	99%
Total Net Emissions	8,673.75	20,824.69	383.32	**29,881.76**	99%

Emissions Summary: 2015-2018



[i] https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/

[ii] https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide

[iii] https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/

[iv] https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/

[v] Sources: IPCC Report Fifth Assessment Report Page 714 and IPCC 4th Assessment Report Page 212

[vi] Carbon dioxide's lifetime cannot be represented with a single value because the gas is not destroyed over time, but instead moves among different parts of the ocean–atmosphere–land system. Some of the excess carbon dioxide is absorbed quickly (for example, by the ocean surface), but some will remain in the atmosphere for thousands of years, due in part to the very slow process by which carbon is transferred to ocean sediments.