City of Beacon, NY

Inventory of Community and Municipal Operations Greenhouse Gas Emissions

Produced for City of Beacon

By ICLEI - Local Governments for Sustainability USA

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ICLEI Local Governments for Sustainability USA

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ICLEI-Local Governments for Sustainability USA

This report was prepared by Eli Yewdall, Senior Climate Program Officer at ICLEI Local Governments for Sustainability USA. The authors would like to thank City of Beacon staff for providing much of the insight and local information necessary for the completion of this report.

Table of Contents

Executive Summary

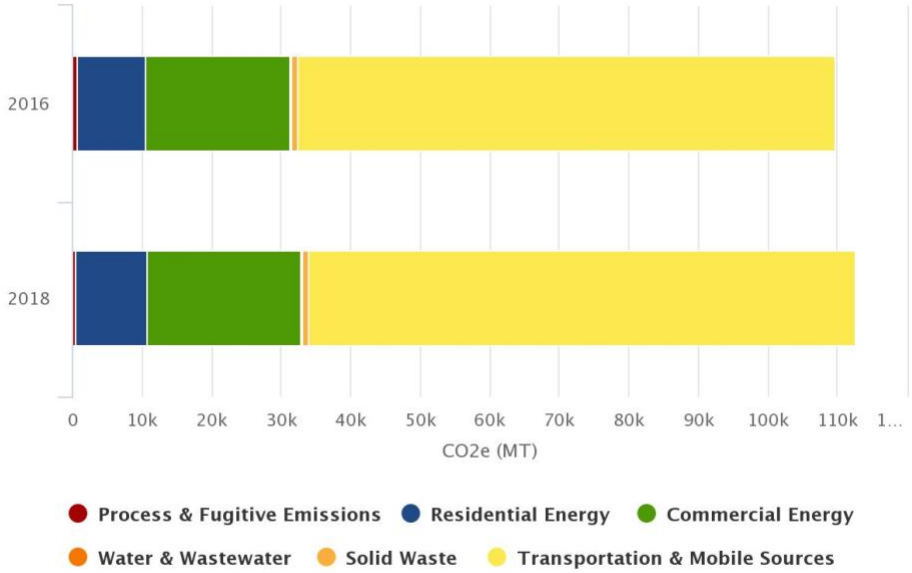
The City of Beacon recognizes that greenhouse gas (GHG) emissions from human activity are catalyzing profound climate change, the consequences of which pose substantial risks to the future health, wellbeing, and prosperity of our community. Furthermore, the City of Beacon has multiple opportunities to benefit by acting quickly to reduce community GHG emissions.

This GHG inventory is part of ongoing sustainability efforts by the City, and an important step towards fulfilling the City's pledge to become an NY Certified Climate Smart Community[1]. The emissions inventory will inform planning for energy savings and emissions reductions, and sets the baseline from which the City can measure progress towards sustainability goals and targets. This report provides estimates of greenhouse gas emissions resulting from community wide activities in City of Beacon as a whole in 2016 and 2018 as well as the separate emissions from City of Beacon government operations. City operations emissions are for 2012 and 2018, as more historic data were available than for community emissions.

Key Findings

Community-wide Beacon GHG emissions for 2016 and 2018 are shown in Figure 1. Transportation was the largest contributor to community emissions, followed by residential and commercial heating fuels.

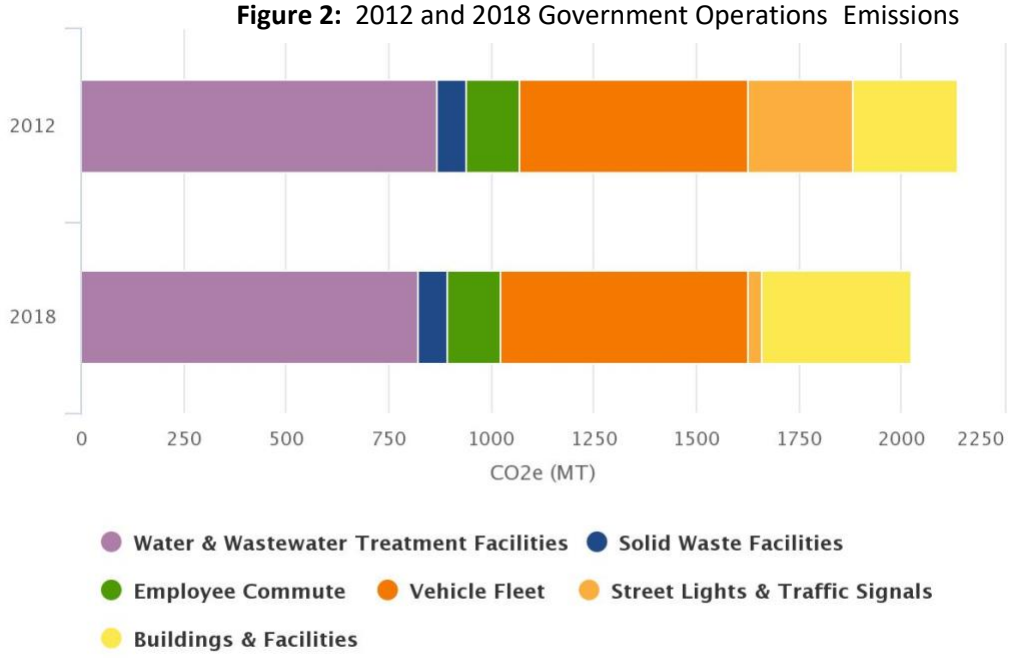
Figure 1: 2016 and 2018 Community Emissions



1 https://climatesmart.ny.gov/

Emissions from City of Beacon operations for 2012 and 2018 are shown in Figure 2. Energy use in water and wastewater facilities, followed by fleet vehicle fuel use are the largest contributors to city operations emissions. In 2018, City Operations accounted for roughly 2% of the community wide emissions.

Figure 2: 2012 and 2018 Government Operations Emissions



Climate Change Background

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 and changing the global climate. The most significant contributor is the burning of 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.

Climate change is already beginning to impact the people and communities of New York State. New York's ClimAID Report describes what can be expected in New York specifically[2]. Increases in summer and winter temperatures are a primary driver of change throughout the state, and temperatures have already risen about 2.4 degrees Fahrenheit over the past 50 years, with winters even warmer. Heat waves are becoming more frequent and longer-lasting, increasing heat-related illness and death and posing new challenges to heat-stressed electricity infrastructure, air quality, and agriculture (by the end of the century, our growing season could be a month longer) (NYSERDA, 2011). Shifts in year-to-year precipitation patterns that reduce snowpack and increase flooding are among the most acutely felt impacts across the state. For instance, since the late 1950s, the amount of precipitation falling in downpours increased by more than 70%, and although more precipitation is falling during winter, the amount falling as snow has decreased. Moreover, for coastal communities, sea levels have risen more than a foot over the past 100 years and we could see sea levels rising another two or more feet by 2050, increasing the chances of coastal flooding. Our human community is not the only one climate change impacts: Pollinating bees arrive about 19 days earlier than they did during the 1800s and bird and fish populations have shifted their ranges northward, each migration affecting agriculture, hunting and fishing, and recreation.

To respond to the climate emergency, New York State passed the Climate Leadership and Community Protection Act (The Climate Act) in June 2019. Hailed as the most ambitious state climate legislation in the United States, The Climate Act calls for 100 percent carbon-free electricity by 2040 and a net-zero carbon economy by 2050, with 85 percent of reductions coming from reduced GHG emissions and the remaining 15 percent coming from carbon offsets (from projects primarily occurring within the state). Moreover, strong statewide local climate initiatives—the Climate Smart Communities and Clean Energy Communities Programs—offer the potential capacity to address many climate-related risks at the local level.

2 NYSERDA 2014, Responding to Climate Change in New York State (ClimAID): 2014 Supplement - Updated Climate Projections Report

Many communities in the United States have taken responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas 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, money not spent on energy is more likely to be spent 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.

Figure 3: ICLEI Climate Mitigation Milestones

ICLEI Climate Mitigation Program

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas 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. 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 Five Milestones, also shown in Figure 3:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions reduction target;
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 City of Beacon.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the City of Beacon community as a whole and also emissions from government operations of the City of Beacon government. The government operations inventory is a subset of the community inventory (see Figure 4); for example, data on commercial energy use by the community includes energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

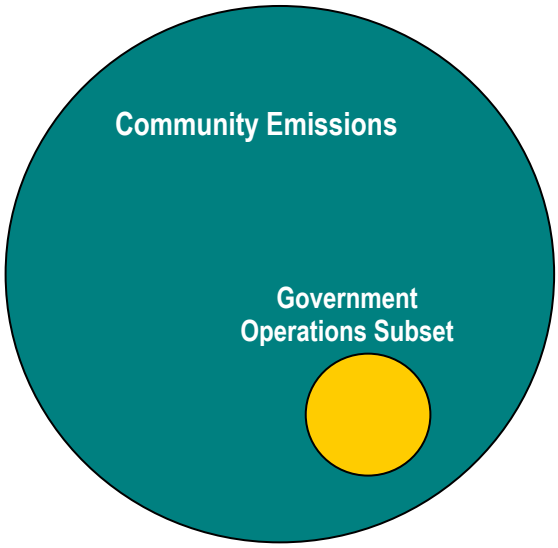


Figure 4: Relationship of Community and Government Operations Inventories

As local governments have continued 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 Community Greenhouse Gas Emissions Protocol (Community Protocol)[3].

Community Emissions Protocol

The Community Protocol was released by ICLEI in October 2012, and represents a new 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

[3] http://www.icleiusa.org/tools/ghg-protocol/community-protocol

- Use of energy in potable water and wastewater treatment and distribution
- Generation of solid waste by the community

In addition, the inventory includes wastewater process emissions and fugitive emissions from local natural gas distribution system leakage. Three greenhouse gases are included in this inventory: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Carbon dioxide represents the vast majority of the community emissions and is produced from burning fossil fuels such as coal, gasoline, diesel, and natural gas. Methane accounts for about two percent of community-wide emissions, and comes primarily from waste decomposition in landfills and from local natural gas distribution system leakage, as well as small amounts as a byproduct of fuel combustion. Nitrous oxide is the smallest contributor to the inventory and comes from wastewater treatment process emissions, as well as small amounts as a byproduct of fuel combustion.

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas 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".

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.

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.

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas 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

All emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see Methodology Details section 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).

Community Emissions Inventory Results

The total emissions for the 2016 inventory were calculated at 109,800 metric tons CO2e (Table 1). In 2018, emissions increased 2.5% to 112,600 metric tons.

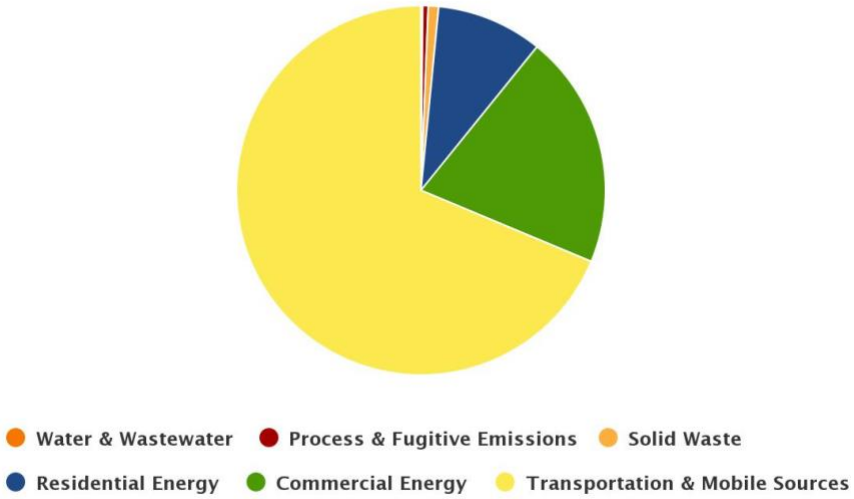
Table 1: 2016 and 2018 Community Inventory

Sector	Fuel or source	2016 Usage	2018 Usage[4]	Usage unit	2016 Emissions ($MTCO_2e$)	2018 Emissions ($MTCO_2e$)
Residential energy	Electricity	27,370,985	28,157,990	kWh	3,676	3,782
	Natural gas	Included in commercial total; separate residential usage not provided.				
	Fuel oil	566,444	555,137	gallons	5,820	5,704
	Propane	50,808	109,039	gallons	287	616
Residential energy total					**9,783**	**10,102**
Commercial energy	Electricity	17,747,840	19,149,160	kWh	2,384	2,572
	Natural gas	3,386,631	3,600,292	ccf	18,517	19,685
Commercial energy total					**20,901**	**22,257**
On-road transportation	Gasoline	118,870,812	121,380,591	vehicle miles	50,079	50,821
	Diesel	12,192,693	12,450,124	vehicle miles	19,010	19,411
Transit use	Diesel	54,766,868	55,365,128	Passenger miles	8,264	8,355
Transportation total					**77,352**	**78,586**
Solid Waste	Waste incinerated	3,311	3,501	tons waste	934	988
Solid waste total					**934**	**934**
Water and wastewater	Electricity and Natural gas[5]				640	640
	Wastewater process	N/A	N/A	N/A	160	160
Water and wastewater total					**160**	**160**
Fugitive	Natural gas leakage	3,386,631	3,600,292	ccf	655	530
Fugitive total					**655**	**530**
Community total emissions					**109,786**	**112,570**

4 Electricity usage for July 2017-June 2018 used for 2018. VMT for 2017 used for 2018.
5 Wastewater energy is for information only, since it is included as part of commercial energy above. This row not added to community totals.

Figure 5 shows sources of 2018 community emissions. On-road transportation was the largest contributor to community emissions, followed by commercial and residential heating fuels.

Figure 5: 2016 Community Emissions



Next Steps

The inventory results 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:

- Reducing per-capita VMT through land use planning and encouraging use of transit, bicycling and walking.
- Promotion of electric vehicles (EVs) to replace gasoline passenger vehicles.
- Energy efficiency for residential and commercial buildings.
- Conversion of building heating to air source or geothermal heat pumps.
- Continued reductions in the electricity emissions factor through added renewable energy.

Completion of another GHG inventory in two to five years is recommended in order 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 tool and a master data Excel file provided to the City of Beacon, will be helpful to complete a future inventory consistent with this one.

Government Operations Inventory Results

Government operations emissions for 2012 and 2018 are shown in Table 2 and Figure 6. Water and wastewater treatment facilities are the largest contributors to government operations emissions, followed by the vehicle fleet.

Table 2: Government Operations Inventory Results

Sector	Fuel or source	2012 Usage	2018 Usage	Usage unit	2012Emissions ($MTCO_2e$)	2018Emissions ($MTCO_2e$)
Buildings	Electricity	753,793	805,667	kWh	140	108
Buildings	Natural gas	21,800	48,209	therms	116	256
Buildings total					**256**	**363**
Street lights & Signals	Electricity	1,360,529	284,386	kWh	253	37
Street light total					**253**	**37**
Vehicle fleet	Gasoline	35,551	36,781	gallons	312	323
Vehicle fleet	Diesel	24,106	27,354	gallons	246	279
Vehicle fleet total					**558**	**602**
Employee commute*	Gasoline	--	13,770	gallons	122	122
	Diesel	--	808	gallons	8	8
Employee commute total					**130**	**130**
Solid waste*	Government generated waste	--	253	tons	71	71
Solid waste total					**71**	**71**
Water & wastewater treatment	Electricity	3,459,553	4,111,311	kWh	647	557
	Natural gas	10,516	18,296	therms	59	102
	Process emissions*			N/A	162	162
Water & wastewater treatment total					**868**	**821**
Government operations total emissions					**2,136**	**2,024**
Sunlight Beacon production**			1,393,937	kWh	--	-187
Emissions net of solar production						**1,837**

*2012 data was not available for employee commute, solid waste, and wastewater process emissions, so these categories were assumed equal to 2018 emissions. **Sunlight Beacon production started July 2018.

Figure 6: 2018 City Operations GHG Emissions by Sector

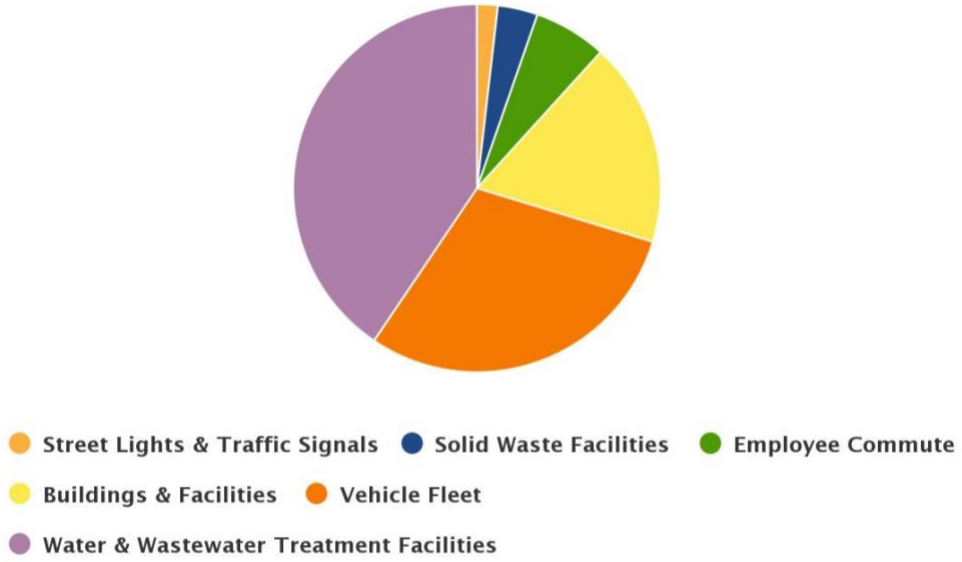


Figure 7 shows electricity usage for the highest usage facilities in 2012 and 2018. The wastewater treatment and water supply facilities dominate electricity usage. This is typical for cities that operate water and wastewater treatment, as many energy intensive processes are needed to safely and effectively treat the water and wastewater. Nevertheless, the water and wastewater facilities should be a high priority for evaluating energy efficiency and onsite renewable energy opportunities. Water supply energy use increased between 2012 and 2018, while usage at the sewage treatment plant decreased slightly. Street lighting energy decreased significantly because of the switch to LED lighting.

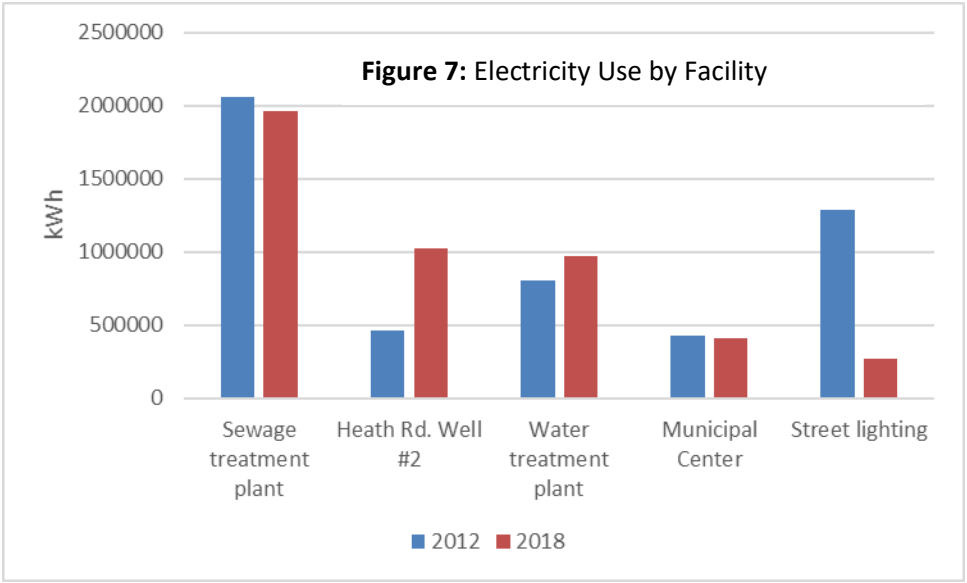
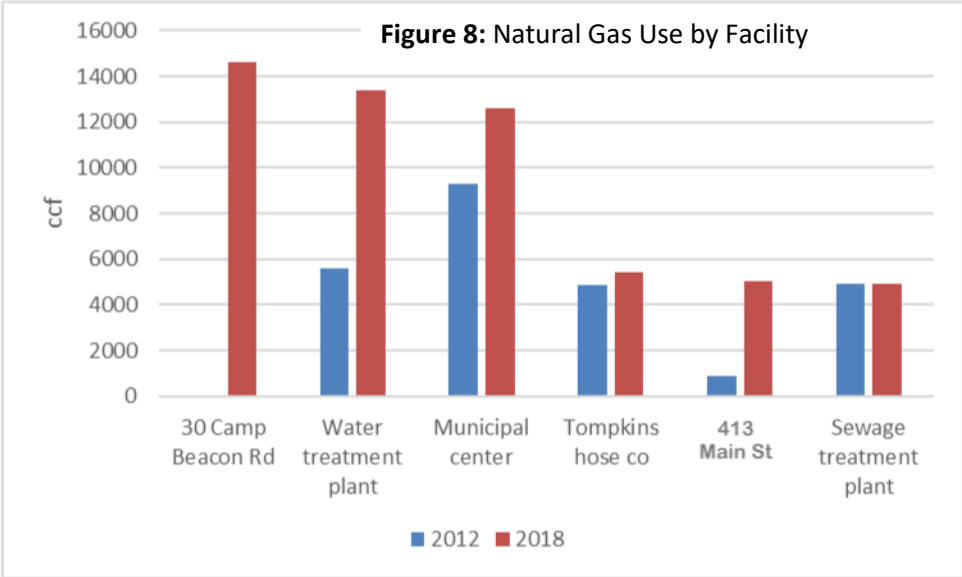


Figure 7: Electricity Use by Facility

Figure 8 shows natural gas use for the highest usage facilities. The highest usage facility in 2018 was 30 Camp Beacon Rd, which was a new facility not present in 2012. Usage increased significantly at the water treatment plant, likely due to new treatment processes. Usage also increased at most other facilities; this is likely driven by colder weather. There were 5,985 heating degree days in 2018, compared to 4,925 heating degree days in 2018.[6] The Memorial Building at 413 Main St was heated with oil through most of 2012, so the 2012 natural gas usage for that building is only for December.

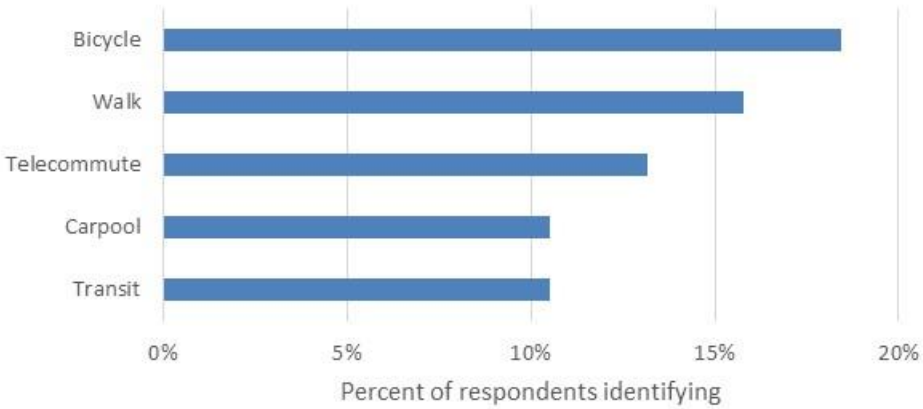
Figure 8: Natural Gas Use by Facility



Employee Commute Survey

A survey of how employees get to work was conducted in order to obtain data needed to calculate employee commute emissions. The survey also asked questions about willingness to consider different transportation options, and what would encourage them to use a different option. Currently, 97% of Beacon employees normally drive

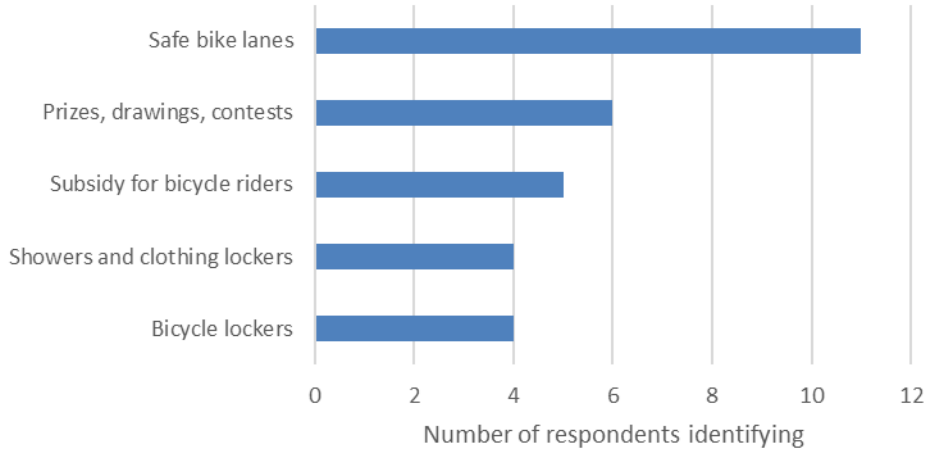
Figure 9: Percent of employees who would consider alternate commute modes



[6] Obtained from https://www.weatherdatadepot.com/ with base temperature of 65F and weather station NYBO.

alone to work. However, many employees are willing to consider different modes, as shown in figure 9. Eighteen percent would consider bicycling, and sixteen percent would consider carpooling. Employees reported that safe bike lanes are the number one thing that would encourage them to bike to work, as shown in Figure 10. Employees who already bike to work, either daily or occasionally, would be a good starting point for additional engagement to identify priorities for improved bike infrastructure. Improved bike infrastructure would support reductions in community-wide transportation emission as well as those from employee commute.

Figure 10: Top five ways to encourage bicycling to work



Government Operations Next Steps

The inventory results 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:

- Continued energy efficiency improvements to water and wastewater facilities, as well as other facilities.
- Where feasible, replacing fleet vehicles with electric vehicles, or with more efficient vehicles.

Annual tracking of energy use in City buildings and facilities, with completion of another complete GHG inventory in two to five years, is recommended in order 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 tool and a master data Excel file provided to the City of Beacon, will be helpful to complete a future inventory consistent with this one.

Methodology Details

Community Inventory Data

Electricity and Natural Gas

Electricity and natural gas usage data were obtained from the NYSERDA energy data portal[7] for the residential and commercial sectors. The portal provides monthly usage by customer type. However, many data points were withheld; information on the portal indicates that data is withheld for privacy reasons when usage of a single customer is more than 15% of the total for a customer class.

2016 data gaps: For electricity, a couple months of commercial data and one month of residential data were withheld. These data gaps were filled in by assuming usage equal to the average of the months before and after the withheld month. For natural gas, more data points were withheld. Total natural gas usage across all customer types was used to minimize the number of missing data points, but data was still only available for six months. Fortunately, months representing winter, spring and summer were available, so missing months were filled in assuming usage equal to a month from the same season.

2018 data gaps: Total natural gas usage was available for all months in 2018. Electricity usage was available for January through June but not for July through Dec, so data from July 2017 through June 2018 was used; data was available for all months in this period.

Electricity emissions factors were obtained from EPA's eGRID[8], and are shown in Table 3.

Table 3: Electricity Emissions Factors

Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)
2012	408.8	15.59	3.83
2016*	294.7	21	3

*2016 is the most recent data available from eGRID, and was used for both 2016 and 2018.

Fuel oil and Propane

Residential fuel oil and propane use were estimated based on EIA usage data[9] for New York State. The number of households using each fuel in Beacon and in New York State was obtained from American Community Survey (ACS) data.[10] Commercial fuel oil and propane use were not estimated.

7 https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/Community-Energy-Use-Data
8 https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid
9 https://www.eia.gov/state/seds/sep_use/notes/use_print.pdf Table CT4
10 https://factfinder.census.gov/

On Road Passenger and Commercial Transportation

Vehicle miles travelled (VMT) for the community were provided by the Duchess County Transportation Department for 2016 and 2017. Data specific to the City of Beacon was not available, so countywide VMT was scaled to Beacon based on population. The data provided was annual average daily VMT, and was converted to annual VMT by multiplying by 365. This is an in-boundary VMT estimate. 2018 data was not available, so 2017 data was used as a proxy.

To calculate emissions, the VMT needs to be allocated to different vehicle and fuel types. This was done using data from the EPA State Inventory Tool,[11] which provides statewide VMT by vehicle type and fuel. This data was used to calculate the percent of VMT for each vehicle type and fuel, which are shown in Table 5. These percentages were applied to the total Beacon VMT above.

Table 5: New York State VMT by Fuel and Vehicle Type

Fuel	% of VMT	
Gasoline	90.7	
Diesel	9.3	
Vehicle type	**% of Gasoline VMT**	**% of Diesel VMT**
Passenger car	75.8	3.5
Light truck	22.0	8.4
Heavy truck	1.5	88.1
Motorcycle	0.7	0

Next it is necessary to apply average miles per gallon and emissions factors for CH_4 and N_2O to each vehicle type. The factors used are shown in Table 6.

Table 6: MPG and Emissions Factors by Vehicle Type[12]

Fuel	Vehicle type	MPG	CH_4 g/mile	N_2O g/mile
Gasoline	Passenger car	23.86	0.0187	0.011
Gasoline	Light truck	17.34	0.0201	0.017
Gasoline	Heavy truck	5.36	0.0333	0.0134
Gasoline	Motorcycle	23.86	0.0187	0.011
Diesel	Passenger car	17.34	0.005	0.001
Diesel	Light truck	23.86	0.001	0.0015
Diesel	Heavy truck	6.02	0.0051	0.0048

11 https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

12 These are standard defaults provided by ICLEI USA for many GHG inventories, and are derived from the following sources: Table 2.8 Motor Vehicle Mileage Fuel Consumption and Fuel Economy 1949-2010, https://www.eia.gov/totalenergy/data/annual/showtext.php?t=ptb0208; Freight Existing Trucks Fuel Efficiency Heavy Motor Gasoline Reference AEO2015, https://www.eia.gov/opendata/qb.php?category=1373322&sdid=AEO.2015.REF2015.EFI_NA_FGHT_RADS_MGS_NA_NA_MPG.A; Freight Existing Trucks Fuel Efficiency Heavy Diesel Phase 2 AEO2016, https://www.eia.gov/opendata/qb.php?sdid=AEO.2016.PHASEII.EFI_NA_FGHT_RADS_DSL_NA_NA_MPG.A; Table 4-23M: Average Fuel Efficiency of U.S. Light Duty Vehicles, Bureau of Transportation Statistics (2015).

Passenger Rail

Beacon is served by MTA Metro North commuter rail on the Hudson Line. Metro Railroad North provided data on average weekday and weekend passenger boardings at the Beacon station. The data did not specify the destination station, so it was assumed that all passengers' destination was Grand Central Station, NYC, a distance of 59 miles by rail. This resulted in 54,766,868 rail passenger miles in 2016 and 55,365,128 passenger miles in 2018 allocated to Beacon. The MTA sustainability report[13] gives an emissions factor of 0.0001509 **$MTCO_2e$** /passenger mile, which was multiplied by the miles above to give passenger rail emissions.

Wastewater

Wastewater is treated by the City of Beacon. For more detail on wastewater treatment energy, see the government inventory methodology details on p. 21.

Potable Water

Water is treated by the City of Beacon. For more detail on wastewater treatment energy, see the government inventory methodology details on p. 21.

Solid Waste

Royal Carting provided data on residential solid waste collected from Beacon in 2016 and 2018. Beacon's solid waste is combusted at the Duchess County Resource Recovery Facility. Total emissions and total waste tonnage collected from the facility for 2017 were used to calculate emissions per ton of waste, which was then multiplied by the waste collected from Beacon on each year.

Fugitive Emissions

Emissions from natural gas leakage for Central Hudson were obtained from the EPA Facility Level Information on Greenhouse gasses Tool (FLIGHT)[14]. These emissions were allocated to Beacon using the portion of total natural gas sold by Central Hudson. Beacon natural gas use represented 2.2% of total residential, commercial and industrial gas supplied by Central Hudson in 2016 and 2.1% in 2018.

Inventory Calculations

The 2017 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. The 5th IPCC Climate Assessment was used for global warming potential (GWP) values to convert methane and nitrous

13 https://new.mta.info/document/10436

14 https://ghgdata.epa.gov/ghgp/main.do

oxide to CO_2 equivalent units. ClearPath's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final CO_2e emissions.

Government Operations Inventory Data

Buildings and Facilities

Central Hudson provided a report of electricity and natural gas usage by facility for 2018. This data was not available as far back as 2012, so electricity and natural gas usage for 2012 was manually copied from scanned utility bills. Electricity emissions factors from eGRID were used as shown in Table 3.

Street Lights and Traffic Signals

Electricity usage for street lights and traffic signals was collected as described above for buildings and facilities. Electricity emissions factors from eGRID were used as shown in Table 3.

Vehicle Fleet

Total gallons of diesel and gasoline fuel by department used in city vehicles for 2012 and 2018 were collected from city records. Emissions were calculated using per gallon emissions factors from Table G.1 of the LGO Protocol.

Employee Commute

A survey of how employees get to work was conducted in November 2019. 39 employees out of a total of 100 responded to the survey, a participation rate of 39%. Survey respondents reported their one-way commute distance, the number of days/year they worked, and the fuel type and miles per gallon (MPG) of their vehicle. In addition, they reported if they used carpooling, transit, bicycling or walking to get to work. This data was used to calculate the annual commute VMT and gallons of fuel for each responding employee. Two of the respondents indicated they bicycle to work every day, while the remaining respondents drive alone to work every day.

From these numbers, average MPG was calculated for gasoline and for diesel vehicles. The VMT from respondents was then multiplied by 100/39, to estimate VMT for all employees. The average MPG numbers were used along with the VMT for each fuel type to calculate emissions. These values are shown in Table 7.

Table 7: Employee Commute VMT and MPG

Fuel	Employee commute VMT	Average MPG
Gasoline	317,101	23.03
Diesel	12,564	15.56

Water and Wastewater Treatment Facilities

Natural gas and electricity usage data were collected as described above for buildings and facilities. Electricity emissions factors were used as shown in Table 3.

N_2O emissions from effluent discharge were calculated based on data provided by Water and Sewer Department. The department indicated an N load discharge of 370 lbs/day; emissions were calculated from this using factors and equations in the Local Government Operations Protocol.[15]

In addition, nitrification/denitrification process emissions from the wastewater treatment facility were calculated based on a population of 15,000 served by the facility[16] and default emissions factors from the Local Government Operations Protocol.[17]

15 https://www.theclimateregistry.org/tools-resources/reporting-protocols/local-goverment-operations-protocol/
16 The department indicated that a small population outside the City of Beacon is served by the facility, but the exact population outside the city that is served is not known.
17 https://www.theclimateregistry.org/tools-resources/reporting-protocols/local-goverment-operations-protocol/

Conclusion

A greenhouse gas inventory is an excellent baseline from which to measure your progress. ICLEI's ClearPath tool allows your community to use the inventory results to conduct a business-as-usual scenario, set targets for reductions, and analyze opportunities to reduce GHG emissions.

Local governments can act directly in areas for which they have judicial authority, operational control or ownership and through advocacy to regional, state, and national bodies with these levels of authority.

Some of these strategies are highlighted on pages 12 and 16 of this report, including:

- Encourage bicycling, walking and transit use by City employees and the public.
- Promotion of electric vehicles (EVs) to replace gasoline passenger vehicles.
- Energy efficiency for both City facilities and residential and commercial buildings.
- Conversion of heating to heat pumps for both City facilities and residential and commercial buildings.

Local actions in each of these areas can make a significant contribution to reducing GHG emissions, and to maintaining cost-effective local government services and a high quality of life for Beacon residents.