
Photo by: Scott Snell

City of Beacon

Inventory of Greenhouse Gas Emissions from 2021 Government Operations

NOVEMBER 2023

Updated May 2024

Produced by the City of Beacon with Assistance from ICLEI – Local Governments for Sustainability USA and the Hudson Valley Regional Council

Credits and Acknowledgments

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Table of Contents

Executive Summary

The City of Beacon recognizes that greenhouse gas (GHG) emissions from human activity – including from the municipal government's operations – are causing changes to the climate. These changes, in turn, have impacts on our local environment and the health, wellbeing, and prosperity of our community. Rapid reductions in global GHG emissions are necessary to limit these impacts.

It is an urgent goal to collectively transition to operating in ways that do not rely on fossil fuels. Therefore, the City of Beacon has adopted ambitious targets and policies to accelerate how it participates in this transition. Conducting a periodic GHG inventory helps to understand current emissions, then to prioritize actions and check progress over time.

Beacon has become a leader in efforts to reduce GHG emissions as a municipality and a community. The City was among the first to achieve Silver status as a Climate Smart Community for taking substantial steps to mitigate emissions. Beacon has also:

- Set time-bound targets for reducing GHG emissions and zero emission electricity for the entire community
- Established policies which require 100% of municipal electricity usage to utilize renewable energy every year, which we achieve through a combination of locally generated solar power and purchasing Renewable Energy Certificates (RECs)
- Pioneered a free community composting program to reduce incinerated waste
- Adopted a Green Procurement law for all government operations
- Passed legislation[1] which requires the electrification of new residential and commercial buildings.

This report estimates the GHG emissions caused by Beacon's government operations in 2021.[2] The results identify the government sectors that contributed the most and least emissions during the year, the impact of the closed landfill at Dennings Point, and the importance of continuing to measure the impacts of municipal operations.

[1] All-Electric Buildings Law, adopted March 20, 2023: https://beaconny.gov/wp-content/uploads/2023/03/2023-026-Resolutions-Council-1.pdf

[2] This inventory updates conducted previously for Beacon's government operations, covering the years 2012, 2018, and 2019.

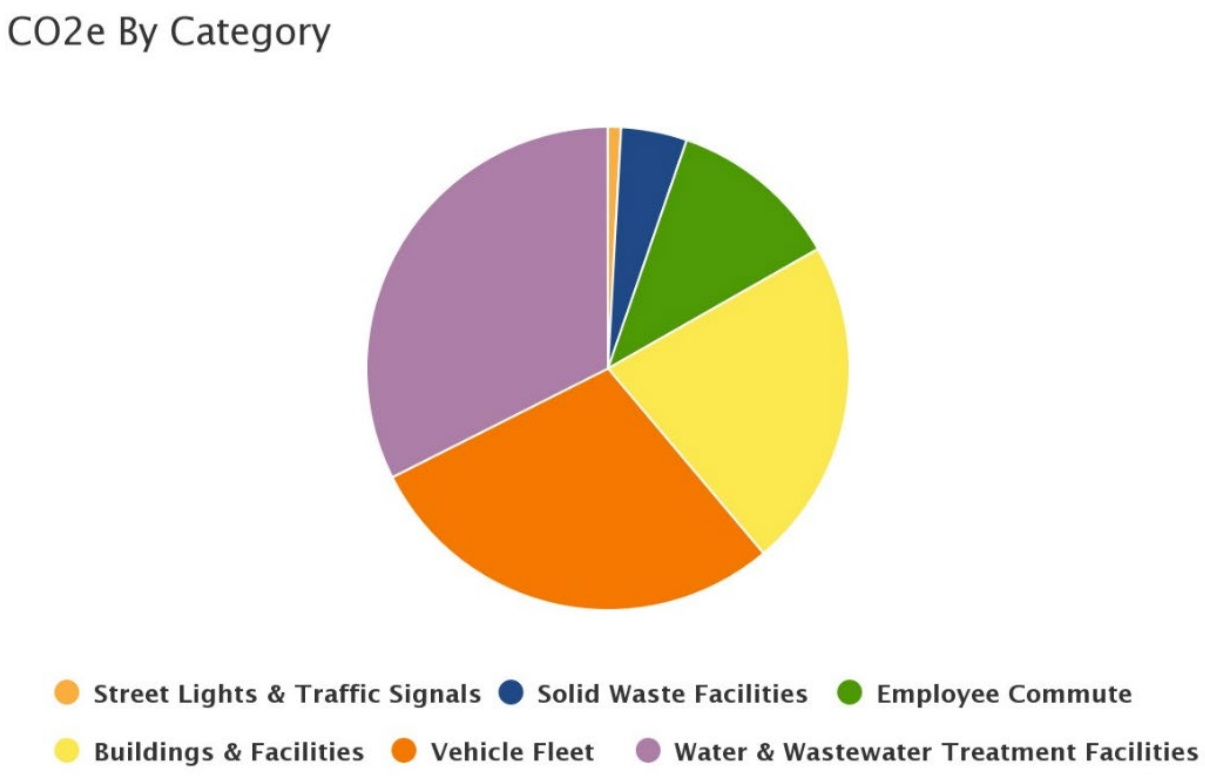
Key Results

The total emissions from the City's operations in 2021 were 1,943 metric tons CO2e (setting aside methane emissions from the landfill). This is equivalent to driving a gasoline-powered passenger vehicle for about 4.9 million miles.[3]

The City's total emissions in 2021 decreased by an estimated 9.8% from 2019.

Thanks to solar energy produced at Dennings Point and used to offset the City's annual electricity consumption, the City's net emissions in 2021 were 1,602 mt CO2e. This is equivalent to driving a gasoline-powered passenger vehicle for about 4 million miles.

The majority of the City's emissions come from treating drinking water and wastewater – accounting for (32%) of municipal emissions in 2021. The next largest contributor was the City's fleet of vehicles (29%), followed by municipal buildings and facilities (22%).



[3] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

The inventory report is a major step in creating an evidence-based plan for reducing Beacon's GHG emissions by creating a baseline against which key decision-makers can set emissions reductions targets and measure future progress. Further, it serves to clarify the greatest opportunities for reductions, many of which would simultaneously reduce operating costs and improve workplace quality.

The 2021 GHG Emissions Inventory and the forthcoming Climate Action Plan are part of the City of Beacon's participation in the Dutchess County Climate Action Planning Institute (CAPI).

GHG Inventory as a Step Toward Carbon Neutrality for Beacon

The City of Beacon must determine how to achieve net-zero emissions before 2050[4] as part of a global effort to limit warming to 1.5 degrees Celsius.[5]

Creating such a roadmap requires identifying priority sectors for action, while considering climate justice, inclusiveness, local job creation, and other benefits of sustainable development. This GHG Emissions Inventory provides key information needed to prioritize action.

Since many of the major sources of GHG emissions are directly or indirectly controlled through local policies, local governments have an important role to play in reducing greenhouse gas emissions within their boundaries, as well as influencing regional emissions through partnerships and advocacy.

Through proactive measures built around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities.

[4] The New York State Climate Law is aligned with achieving neutrality sooner than 2050, and the City of Beacon has committed to moving even faster than the State, in recognition of the urgency of limiting warming.
[5] ICLEI 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.

Chapter 1: Inventory Methodology

Baseline year: The City of Beacon previously completed GHG emission inventories for the years of 2012, 2018 and 2019.[6] The present inventory provides an update from these prior reports with data on emissions in 2021, the most recent year for which adequate data is available on the City's energy usage and other emissions information. The 2021 inventory provides a new baseline year to use in developing targets and measuring future progress.

Emissions scopes: Greenhouse gas emissions are measured in three categories, or scopes:

- Scope 1 refers to GHG emitted by local sources, like the use of diesel or gas.
- Scope 2 refers to emissions caused by the energy we purchase, like electricity for municipal buildings and lighting (to the extent that it is not sourced from renewable energy).
- Scope 3 includes emissions from activities further "upstream" such as producing the goods we buy, processing municipal waste, and employees' commute to work.

The City of Beacon's 2021 GHG inventory covers emissions from Scopes 1 and 2, as well as two subsets of Scope 3 emissions: employee commutes and solid waste handling.

Types of greenhouse gas: 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, which are calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the Intergovernmental Panel on Climate Chang0e (IPCC) Fifth Assessment Report *(see Table 1)*.

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

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

[6] Previous inventories: https://beaconny.gov/wp-content/uploads/2020/01/Greenhouse_gas_inventory.pdf

Quantifying emissions: Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies directly measure greenhouse gases as they are emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-based methodologies calculate emissions using activity data (i.e., energy use, other fuel consumption, vehicle miles travelled) and emission factors (i.e., intensity of emissions associated with that activity, as determined by the EPA).

This inventory uses calculation-based methodologies to quantify emissions. Please see the attached appendices for a detailed listing of the activity data used in composing this inventory.

Once activity data has been collected, known emission factors are used to convert such into quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO2/kWh of electricity). To calculate emissions accordingly, the basic equation below is used:

Activity Data x Emission Factor = Emissions

Standardized measurement for local governments: As local governments increasingly take action to combat climate change, it is more important to use a standardized approach to quantify GHG emissions.

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) from ICLEI - Local Governments for Sustainability (ICLEI), which provides authoritative direction for GHG emissions accounting.

The LGO Protocol, the California Air Resources Board (CARB), and the California Climate Action Registry (CCAR) serve as the national standard for quantifying and reporting greenhouse emissions from local government operations.

The inventory was calculated following the Community Protocol and ICLEI's ClearPath software.

IPCC's Fifth Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO2-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 CO2e emissions.

What's new: For the first time, the 2021 inventory includes the following features and updates:

- Estimated methane emissions from closed landfill
- A discussion of follow-up to recommendations from previous inventories
- Updated categories for emissions sectors:
    - E.g., Mase Hook and Ladder is now categorized as a Fire Department facility, rather than being listed as "unidentified," which will help show the emissions impacts of the forthcoming consolidated firehouse project (set to complete in 2024).
    - E.g., Public bathrooms, the Recreation Center, and the University Settlement Camp are now categorized as Parks rather than being listed as "unidentified."
- An updated list of accounts, now including previously missing water pumps, traffic lights and other accounts, and removing accounts that were not in use in 2021, such as Beacon Engine building
- A comparison of emissions sources and totals between 2021 and previous inventories

Data challenges:

- The City received incomplete data regarding electricity accounts from Central Hudson, which resulted in the use of approximations in order to project annual total usage from a few months' worth of data.
- The inventory process highlighted ways that the City could improve fuel and energy record-keeping in order to facilitate future inventories as well as ongoing discrepancies with the City's Central Hudson accounts.
- While some "unidentified" accounts from previous inventoried were able to be categorized more accurately in 2021 than years past, some accounts remain unidentified, pointing to the importance of a clear tracking system for energy usage going forward.
- The inventory does not include tree-planting due to challenges with measuring impacts, but they are important for air quality, rainfall absorption, cooling, and carbon sequestration among other benefits.
- 2019 employee commute survey results were used to approximate 2021 commute impacts, and were scaled using employee headcount growth in the same time period. Resurveying employees about their commuting practices could be part of the next inventory, including questions about willingness to telecommute or use alternate modes of transportation and likelihood of driving an electric vehicle in the coming years.
- New data was unavailable for the volume of solid waste collected from municipal dumpsters. Therefore, the results of the 2019 inventory were carried over for this item. Options for updating the data in the next inventory include: requesting a specific weight audit from the City's waste hauler on municipal solid waste (separately from household waste), or applying household waste averages to City employee headcount.


Photo by: Ed Mendoza

Chapter 2: Inventory Results

The City of Beacon provides several core services, such as water treatment and distribution, wastewater collection and treatment, public works/highway maintenance, park maintenance and recreational activities, police and firefighting, and street lighting and traffic signals. These core services, along with the equipment, facilities, and staff needed to deliver them, are the focus of this inventory.

Total emissions in 2021: The total emissions from the City of Beacon's government operations in 2021 were 3,081 metric tons of carbon dioxide equivalent (CO2e).

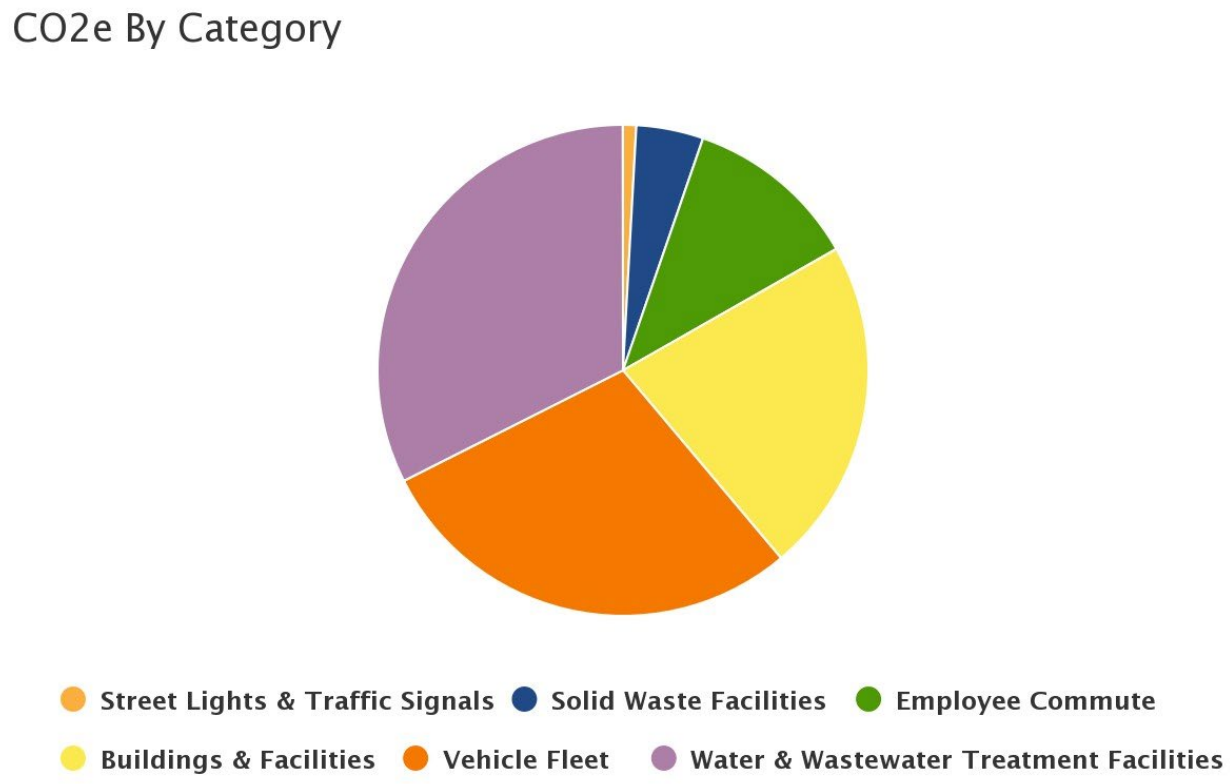
Excluding one source of these emissions – the closed landfill at Dennings Point, which was not included in previous inventories – enables us to compare inventory results to those from previous years, as well as to focus on key areas within current municipal activity.

Without the landfill emissions, the total for 2021 was 1,943 metric tons CO2e. This is equivalent to driving a gasoline-powered passenger vehicle for about 4.9 million miles.[7] The City's total emissions in 2021 were noticeably lower than the 2019 total of 2, 115 metric tons CO2. The decrease in that two-year span was 9.8%.

[7] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

The City of Beacon has a large solar field that generates renewable energy to supply electricity for government operations. In 2021, the solar array produced 3,208,930 kWh, equivalent to 341 mt CO2e[8]. This solar energy was used to offset the use of electricity that the City purchases from other sources. Thus, the City government's total emissions net of solar production were 1,602 mt CO2e (equivalent to driving a gasoline-powered passenger vehicle for about 4 million miles[9]).

Figure 1 below shows City of Beacon's government operations emissions for 2021 by sector.



The difference between emissions from each City of Beacon sector according to the four inventories to date is shown in Table 2 below.

[8] We calculated this by setting the Sunlight Beacon Solar Energy Production to "information only" status and using the difference in total consumption from Buildings/Facilities sector.
[9] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Table 2

Inventory Comparison By Sector

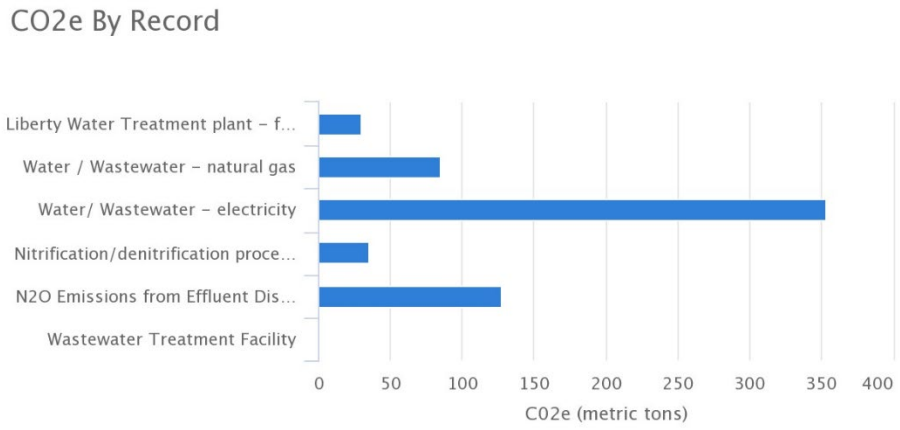
Comparison of CO2e by sector and year over all official inventories

Year	Buildings & Facilities	Street Lights & Traffic Signals	Vehicle Fleet	Employee Commute	Solid Waste Facilities	Water & Wastewater Treatment Facilities
2012	256	253	558	130	71	868
2018	364	36	602	130	71	821
2019	466	47	585	147	71	797
2021	429	17	556	222	85	630

Discussion of contributing sectors:

1. Drinking Water/ Wastewater Treatment. The City of Beacon's drinking water and wastewater treatment facilities collectively make up the largest contributor to the 2021 emissions (setting aside the emissions released at the closed landfill at Dennings Point[10]).

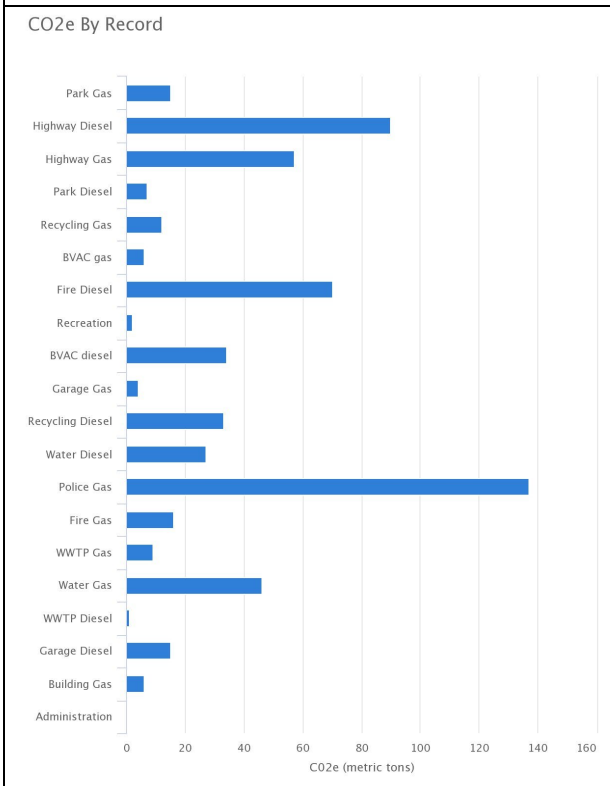
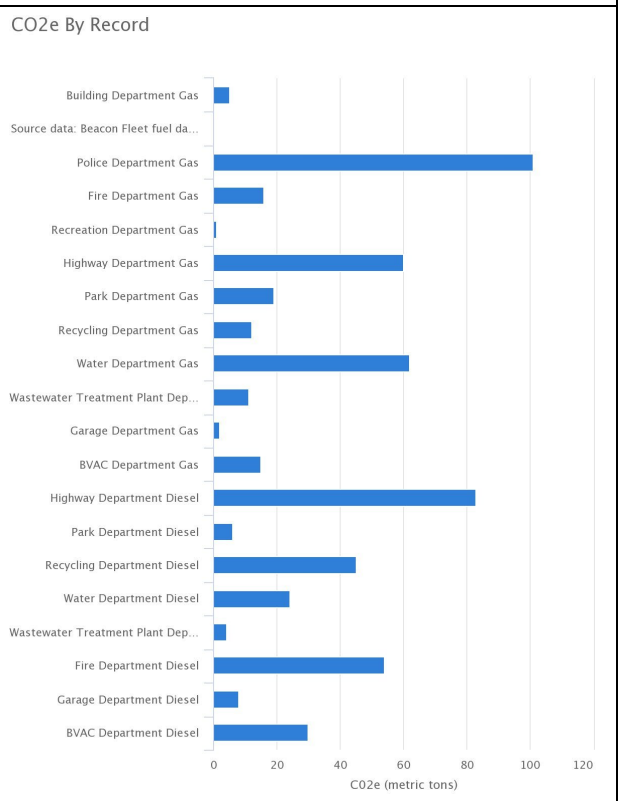
It is typical for this sector to use the highest amount of energy in cities that operate water supply and wastewater treatment facilities because the process to treat water safely and effectively are often energy-intensive.[11] These operations are, therefore, an important area for evaluating energy efficiency and identifying opportunities for the use of renewable energy.



[10] The former landfill at Dennings Point released an estimated 40.64 metric tons of methane in 2021, making it the largest actual contributor to overall emissions from government operations (36.9% in 2021). This source of emissions will continue to fall in the coming years. With landfill our total emissions are: 3,081 CO2eMT and the landfill emissions are 1,138 CO2eMT.

[11] See 2019 GHG inventory report: https://beaconny.gov/wp-content/uploads/2020/06/Government-Operations-Inventory-Report-2019.pdf

2. **Vehicle fleet**. The City's vehicle fleet was the second-largest contributor to emissions in 2021, but a slightly lower total than in 2019 (556 rather than 587), which amounts to a 5% decrease in two years. A significant change in vehicle fleet emissions was seen in the Police Department, where gas was a much lower portion of the fleet's energy sources and overall emissions.

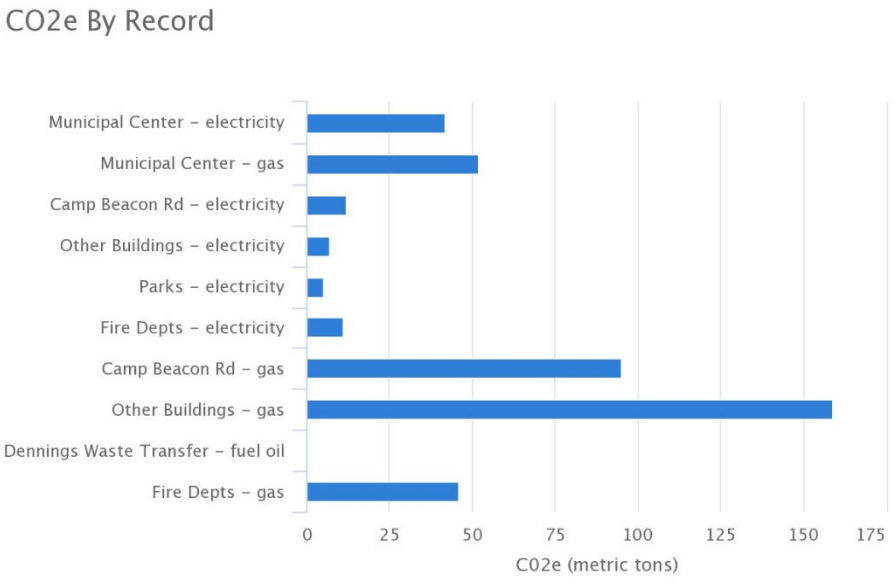
2019	2021
	

The 2019 GHG inventory report identified the vehicle fleet as having great potential for reducing emissions, by replacing fleet vehicles with electric vehicles or more efficient vehicles. This has indeed been a focus for the City's fleet, which has replaced 6 vehicles with battery-electric or hybrid ones since 2021, with a particular focus on the Police Department's vehicles.

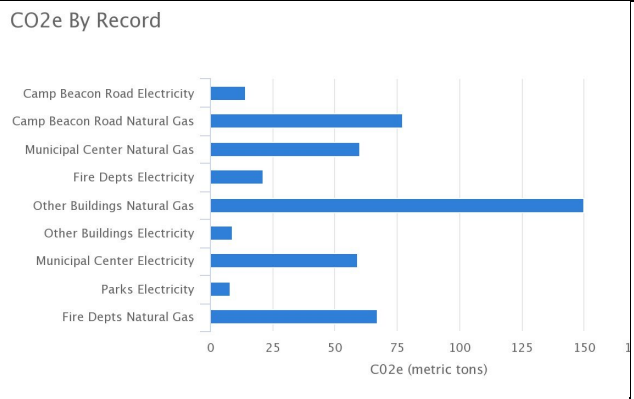
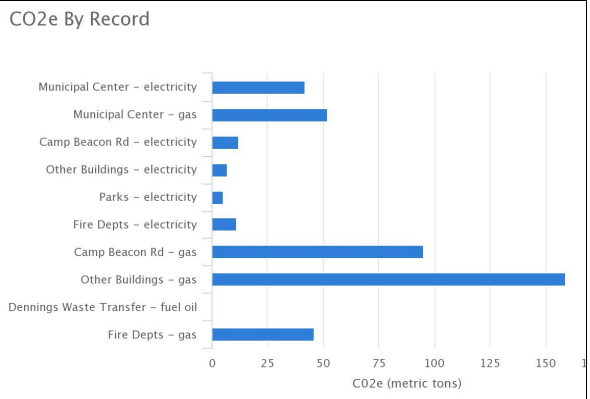
The Department's growing number of "green" vehicles includes two hybrid patrol vehicles, two all-electric unmarked vehicles, and one plug-in hybrid detective car.

The City Council passed a five-year Capital Program in July 2022 which included additional EV and hybrid vehicles for the Police Department in the coming years. The Police Department expects to receive three more hybrid patrol vehicles in 2025. The City's Recreation Department has also moved to the use of a hybrid vehicle, and the City's departments now must consider "green" alternatives for all future vehicle purchases.

3. **Buildings:** Buildings and facilities owned and operated by the City were another significant portion of annual emissions, with gas for many of the buildings collectively making up the bulk of this sector.

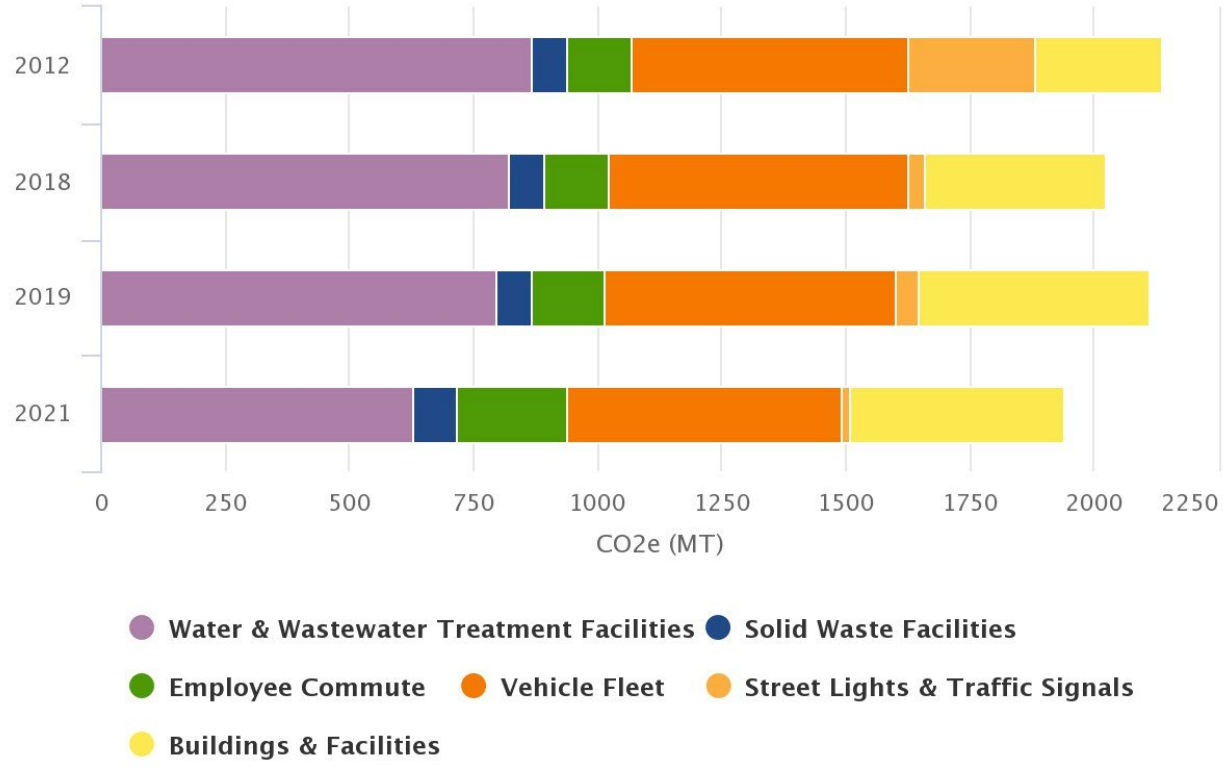


The portion of annual emissions from buildings and facilities has been rising over time overall, but fell between 2019 and 2021, despite the addition of some previously uncategorized accounts to this sector. The changes from each type of building can be seen below.

2019	2021
	

4. **Commute:** Fuel for City employee commutes – including by train – is a relatively small portion of government emissions.
5. **Solid waste** (minus landfill): Apart from methane continually being emitted from the closed landfill at Dennings Point, solid waste services are a small portion of government emissions. This is because Beacon's trash is picked-up and hauled to Poughkeepsie to be burned in the incinerator, effectively "outsourcing" solid waste emissions and associated impacts.
6. **Lighting** – Street lighting and traffic signals were a small portion of annual emissions. This is partly thanks to the switch to LED lighting in all streetlights that took place in 2015-2016.[12]

In sum, apart from the closed landfill, the majority of the City's emissions come from treating drinking water and wastewater – accounting for (32%) of municipal emissions in 2021. The next largest contributor was the City's fleet of vehicles (29%), followed by municipal buildings and facilities (22%). Actions to reduce emissions from these sectors will be a key part of the City's future climate action plan.



[12] See 2012-2018 GHG inventory for Government Operations and Entire Community: https://beaconny.gov/wp-content/uploads/2020/01/Greenhouse_gas_inventory.pdf

Table 3 below shows the volume of emissions in metric tons of carbon dioxide equivalent (CO2) for each sector and its percentage of total emissions for 2021.

Sector	Fuel or source	2021 usage	Usage unit	2021 emissions[13] (MTCO2e)	Percentage of total 2021 emissions
Buildings	Electricity	728,767	kWh	77	
Buildings	Natural gas	69,565.56	Therms	352	
Buildings total				429	22%
Street lights	Electricity	142,360	kWh	15	
Traffic signals	Electricity	18,245	kWh	2	
Lighting total				17	1%
Vehicle fleet	Gasoline	34,637.47	Gallons	304	
Vehicle fleet	Diesel	24,751.48	Gallons	254	
Vehicle fleet total				558	29%
Employee commute	Gasoline	23,965	Gallons	212	
Employee commute	Diesel	1,104.5	Gallons	11	
Employee commute total				223	12%
Solid waste – Transfer station	Electricity	8,125	kWh	1	
Solid waste – Transfer station	Natural gas	2,583	Therms	14	
Combusted waste from city facilities	Tons	253	Tons	71	
Solid waste	*Closed landfill*	*N/A*	*Metric tons*	*1,138*	
Solid waste total				86	4%
Water & wastewater treatment	Electricity	3,323,464	kWh	353	
Water & wastewater treatment	Natural gas	15,952	Therms	85	
Liberty – Water – Fuel oil	Oil	2,962	gallons	30	
Process emissions – nitrification/denitrification	*N/A*	*N/A*	*N/A*	35	
N2O emissions from effluent discharge	Daily N load	167.8	Kg	127	
Water/WWTF total				630	32%
Total 2021 emissions				1,943	100%
Sunlight Beacon production		3,208,930	kWh	341	
Emissions net of solar production				1,602	

[13] Numbers may not total due to rounding

Table 4 below shows only the total emissions by sector.

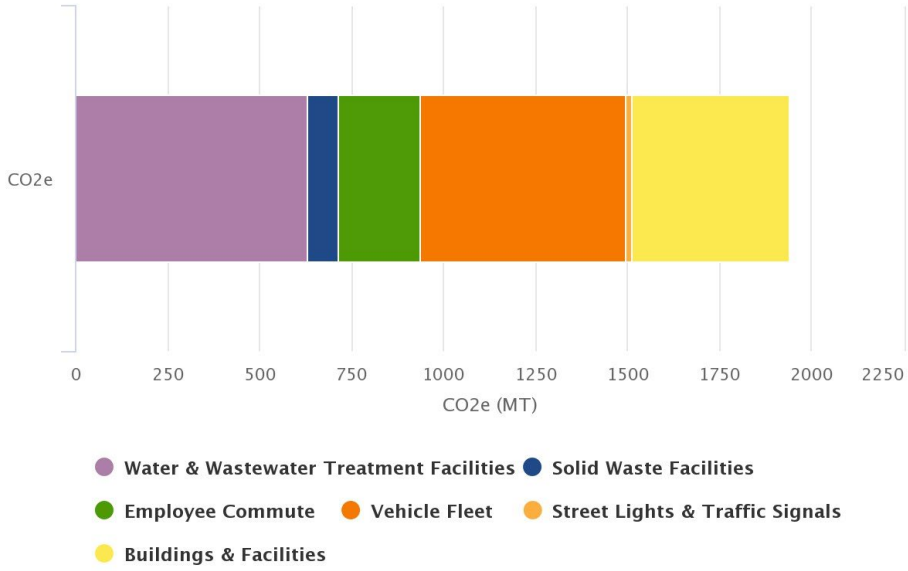
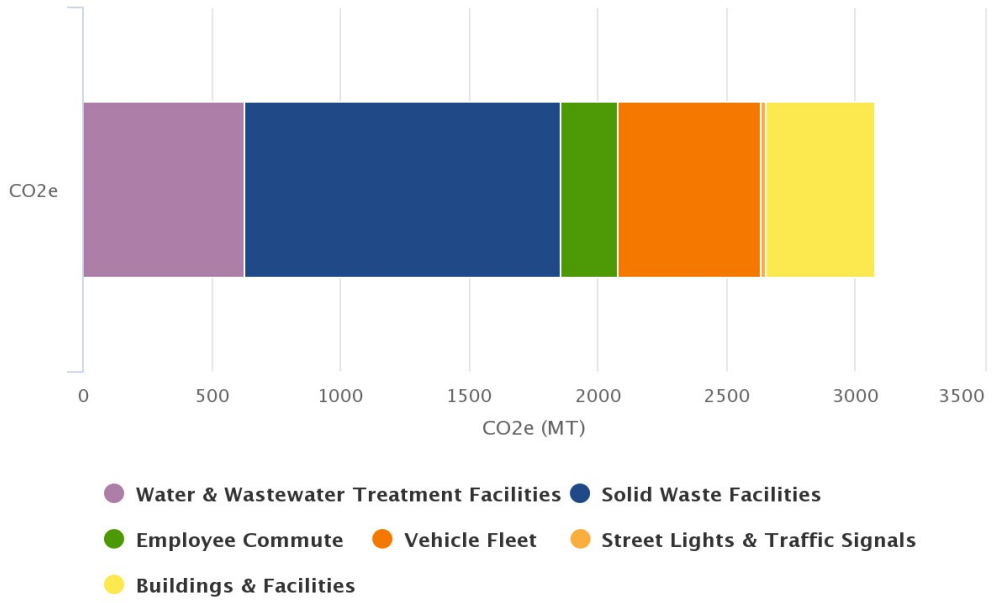
Sector	GHG emissions in metric tons CO2e	GHG emissions (% of total)
Water & wastewater treatment	630	32%
Vehicle fleet	558	29%
Buildings & facilities	429	22%
Employee commute	223	12%
Solid Waste	86	4%
Streetlights & traffic lights	17	1%
Government Operations TOTAL EMISSIONS	**1,943**	**100%**
Sunlight Beacon solar production	**-341**	**-17.9%**
EMISSIONS NET of solar production	**1,602**	

Impact of Closed Landfill:

The former landfill at Dennings Point in Beacon (currently the site of the Sunlight Beacon solar array) continually emits methane as the material beneath the soil decomposes. Estimated using the U.S. Environmental Protection Agency's (EPA) Landfill Gas Emissions Model (LandGEM) tool[14], annual emissions of methane, while naturally declining each year since the landfill was closed in 1968, were still a sizeable contribution to the City's total GHG emissions in 2021.

Methane from the closed landfill – or "brownfield" – comprised the largest segment of municipal emissions, accounting for 61.2% of 2021 total emissions for facilities owned or operated by the City of Beacon. Including the emissions from the landfill brings the total for the solid waste category from 86 to 1,224 CO2eMT for 2021.

[14] LandGem 3.03 2020. US EPA. https://www.epa.gov/catc/clean-air-technology-center-products#software. Accessed July 15. 2023.

Emissions by sector, without landfill	
Emissions by sector, with landfill	

The Local Government Operations Protocol recommends that municipalities consider taking action to reduce methane emissions from a closed landfill. For the City of Beacon, this would entail evaluating options for measurement and mitigation and seeking grant funding to implement the selection option(s), as needed.

Conclusion

This report identifies the largest energy users and sources of GHG emissions. The totality of the data collected and analyzed will enable the City to set realistic goals and track progress toward reducing operating costs, energy use, and emissions. It will also allow Beacon to select actions that will offer the best return on investment – both economically and environmentally – and should be included in future climate action planning. Through such actions, the City of Beacon can achieve environmental, economic, and social benefits beyond reducing emissions, such as reducing operating costs, improving the quality of life, and fostering long-term economic vitality.

This inventory marks the completion of the first of five climate mitigation milestones recommended by ICLEI. The next steps are to:

- Forecast emissions based on the same activities and practices
- Set an emissions-reduction target
- Identify specific quantified strategies that can cumulatively meet that target

These steps will be presented with a climate action plan for Beacon's government operations.

The City of Beacon will continue to track key energy use and emissions indicators on an ongoing basis. Regularly monitoring GHG emissions will allow the City government to operate more efficiently and to use taxpayer resources to better effect. It is best practice for communities to update their inventories on a regular basis, especially as plans are implemented to ensure measurement and verification of impacts. Completing regular inventories also allows for "rolling averages" which will provide insight into sustained changes and can further help reduce the chance of an anomalous year being incorrectly interpreted.

Among several current initiatives to further reduce greenhouse gas emissions, the City of Beacon is:

- Constructing an all-electric firehouse with geothermal heating and cooling that will both eliminate the use of gas for daily needs while lowering energy demand overall through energy efficiency
- Installing a solar array at the Highway Garage, which will provide renewable energy sources for more of the City government's electricity needs
- Purchasing offsite solar power to reach 100% renewable energy for municipal electricity needs each year
- Including EV and hybrid vehicle purchases for vehicle fleet in capital plans
- Conducting a fleet analysis to chart further fleet transition and EV infrastructure in Beacon

We look forward to analyzing the impacts of these planned actions towards our climate goals and identifying additional priorities through the upcoming Climate Action Plan.

Appendix: Methodology Details

This appendix provides information on the activity data and emissions factors used to compose the inventory. Tables indicate which activity was, the data sources, notes on data gaps or other challenges, and the specific factors used in calculating energy intensity.

I. Inventory Calculations Overview

The 2021 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. The IPCC 5th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO2 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 CO2e emissions.

II. Buildings and Facilities

Table 5: Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Electricity consumption	Central Hudson provided a report of electricity usage by facility for 2021.	The data from Central Hudson was not complete (usage data was not available for every month on all accounts), so we used the usage of the closest month to populate each gap.
Natural gas consumption	Central Hudson provided a report of natural gas usage by facility for 2021.	The data from Central Hudson was not complete (usage data was not available for every month on all accounts), so we used the usage of the closest month to populate each gap.

The emissions factors are based on the Upstate NY eGRID profile for 2021 and global warming potential established by the IPCC's 5th assessment (100-year values).

Table 6: Emissions Factors (Electricity Consumption)
NPCC Upstate NY (NYUP) eGRID 2021

Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)
2021	233.1	15	2

III.Streetlights and Traffic Signals

Table 7: Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Electricity consumption	Central Hudson provided a report of electricity usage by facility for 2021. We also used a sample bill from Central Hudson and the LED lighting calculator.	The data from Central Hudson not complete (usage data was not available for every month on all accounts), so we used the usage of the closest month to populate each gap.

For Table 6, you should use this one: "2021 US National Defaults (updated 2023)". I've updated this table below so you should be able to cut and paste it into the report.

Table 8: Emissions Factors (Electricity Consumption)
NPCC Upstate NY (NYUP) eGRID 2021

Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)
2021	233.1	15	2

IV. Water and Wastewater Treatment

Table 9: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Nitrogen Discharge	City depts provided data. N2O emissions were calculated using factors and equations in the Local Government Operations Protocol.	We used 2019 data for daily nitrogen as we could not obtain 2021 data.
Digester Gas Combustion/Flaring		
Energy used in wastewater 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 6.	
Nitrification/denitrification process emissions from the wastewater treatment facility	Calculated based on a population of 15,000 served by the facility. Calculated using default emissions factors from the Local Government Operations Protocol.	

V. Transportation – Vehicle Fleet & Employee Commute

Table 10: Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Government vehicle fleet	Fuel usage record from City administration	Total gallons of diesel and gasoline fuel by department used in city vehicles in 2021 were collected from city records. Emissions were calculated using per gallon emissions factors from Table G.1 of the LGO Protocol.
Employee commute	Data from 2019 Beacon Inventory; 2021 employee headcount from City administration	We scaled up data from the 2019 inventory – which had a response rate of 39% - to the current number of City employees. Although we were not able to re-survey employees, we are not aware of factors that would have changed commuting practices substantially between 2019 and 2021. The survey results address: 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. 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. To scale up results from 2019 to the 2021 employee headcount, we raised the gas VMT and the diesel VMT by 60% each – as the employee headcount rose from 100 to 160.

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 11.

Table 11: MPG and Emissions Factors by Vehicle Type: 2021 US National Defaults (updated 2023) (Dutchess and Westchester Counties)

Fuel	Vehicle type	MPG	CH_4 g/mile	N_2O g/mile
Gasoline	Passenger car	25.3	0.0084	0.0069
Gasoline	Light truck	18.2	0.0117	0.0087
Gasoline	Heavy truck	5.383557	0.0719	0.0611
Gasoline	Motorcycle	44	0.0084	0.0069
Diesel	Passenger car	25.3	0.0005	0.001
Diesel	Light truck	18.2	0.001	0.0015
Diesel	Heavy truck	6.561615	0.0051	0.0048

VI. Solid Waste

Table 12: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Electricity consumption at Transfer Station	Central Hudson provided a report of electricity usage by facility for 2021.	The data from Central Hudson was not complete (usage data was not available for every month on all accounts), so we used the usage of the closest month to populate each gap.
Natural gas consumption at Transfer Station	Central Hudson provided a report of natural gas usage by facility for 2021.	The data from Central Hudson was not complete (usage data was not available for every month on all accounts), so we used the usage of the closest month to populate each gap.
Combustion of waste generated at municipal facilities	Royal Carting provided estimated tonnage of waste collected from City facilities, based on dumpster collection schedule and volumes	Calculated assumed a density of 89 lbs/cubic yard. Emissions allocated from total emissions for Dutchess County RRF.
Closed landfill	Annual methane emissions were calculated using the U.S. Environmental Protection Agency's (EPA) Landfill Gas Emissions Model (LandGEM) tool[15], based on an estimate of number of years in operation	LandGEM calculations are based on yearly waste acceptance rates. This data was not available in City of Beacon records. Yearly waste acceptance rates were estimated using 3 lbs. of waste per person per day. DEC data shows the landfill accepted municipal waste, but that is not all it accepted. If an average person produces 4.5 lbs of waste per day today, that was reduced to account for the other uses of the landfill, including coal ash, which does not produce methane emissions

[15] LandGem 3.03 2020. US EPA. https://www.epa.gov/catc/clean-air-technology-center-products#software. Accessed July 15. 2023.

		Average population for the town was calculated based on extrapolation of historical US Census data as reported in 10-year intervals: 11933 (1930 census) 12572 (1940 census) +14012 (1950 census) +13922 (1960 census) / 4 = 13109.75 average population during the estimated time the landfill was open. 3 Yearly Waste Acceptance Rate = 3 lb/person x 13109.75 x 365 days/yr x 1Mg/2204.62 lb.