Town of Amenia

TOWN OF AMENIA est. 1788

2019 Inventory of Government Operations Greenhouse Gas Emissions

AUGUST 2023

Produced by the Town of Amenia Conservation Advisory Council with Assistance from the Hudson Valley Regional Council (HVRC) and ICLEI – Local Governments for Sustainability USA

Credits and Acknowledgements

Vicki Doyle, Council Member

Victoria Perotti, Town Supervisor

Annette Culligan, Secretary to Town Supervisor

Marge Arnold, Bookkeeper

Amenia Highway Department

Michael Peek, Amenia Conservation Advisory Council Chairman

Stacy Mantel, Amenia Conservation Advisory Council Member

Lauren Pacheco, Hannah Kirshbaum and **Helena Hald**, Interns

The Climate Action Planning Institute*

ICLEI-Local Governments for Sustainability USA
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Executive Summary

The Town of Amenia 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.

The Town of Amenia has previously made significant strides in climate action planning. The Town has many parks and preserves and a long history of appreciating and protecting its natural ecosystems. It is designated in New York State as a Clean Energy Community and in 2018 became a registered Climate Smart Community. It has formed a Comprehensive Plan Implementation Committee that has recommended reducing emissions and protecting the Town's open spaces and natural environment. The Comprehensive plan also details efforts being made to monitor its landfill and preserve privately held parcels of forested land.

This Inventory Report provides estimates of greenhouse gas emissions resulting from activities within the Town's government operations.

Key Findings

Figure 1 shows local government operations emissions. The Solid Waste Facilities sector accounts for a vast majority (91%) of these emissions. The next largest contributor is Buildings and Facilities (3.8%), followed by Vehicle Fleet (3.6%). ctions to reduce emissions from these sectors will be a key part of any future climate action plan developed by the Town of Amenia. The remaining sectors -- street lights and traffic signals, water and wastewater facilities, and employee commute -- were responsible for the remainder (less than 1.6%) of local government operations emissions.

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

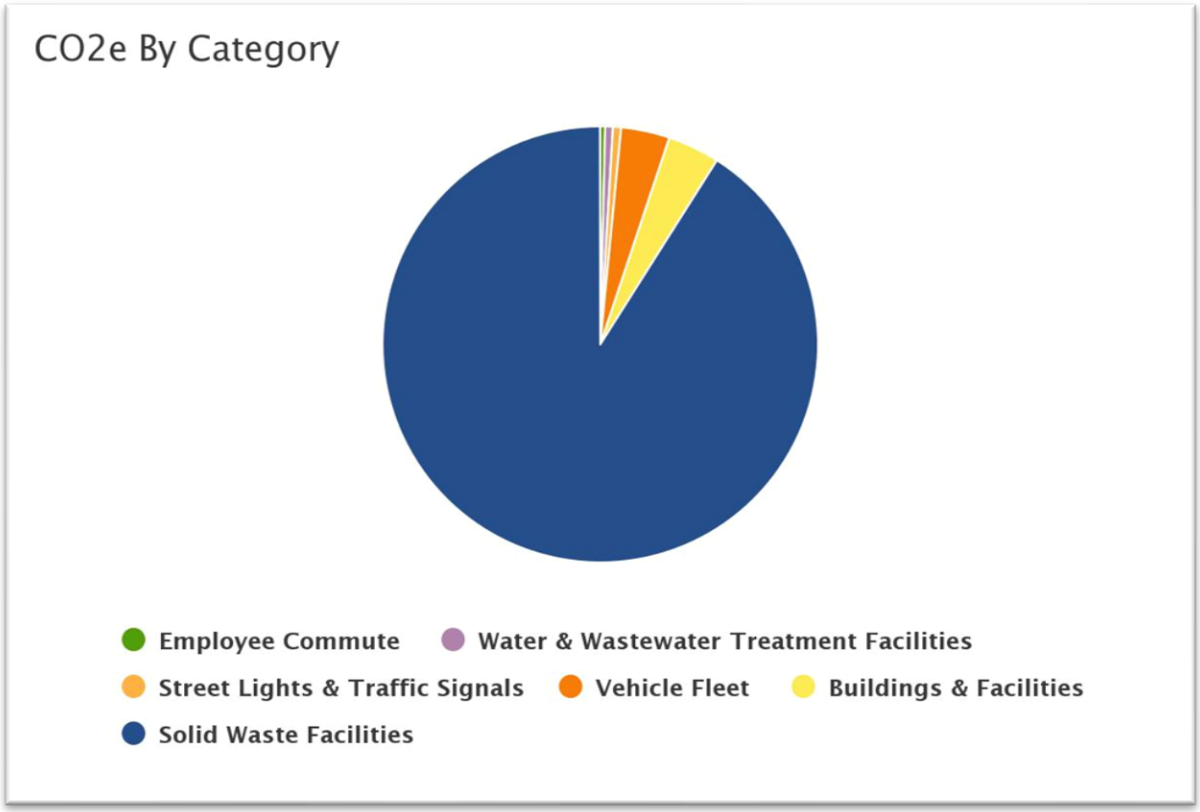


Figure 1: Government Operations Emissions by Sector

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 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, 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 GHG 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 emissions1. Many regions are already experiencing the consequences of global climate change, and the Town of Amenia is no exception.

Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence) Warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (high confidence), but these emissions alone are unlikely to cause global warming of 1.5°C (medium confidence). Climate-related risks for natural and human systems are higher for global warming of 1.5°C than at present, but lower than at 2°C (high confidence). These risks depend on the magnitude and rate of warming, geographic location, levels of development and vulnerability, and on the choices and implementation of adaptation and mitigation options (high confidence)2.

[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.

[2]IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

According to the 2019 National Climate Assessment, the risks that climate change poses to the ecosystems, infrastructures, economies, and health have, and will continue to impact communities across the country. These impacts threaten the critical interconnected systems that our communities rely on, where the failure of one sector (ex: energy, transportation, food production/distribution, national security, etc.) poses an immediate risk to all others. Today's actions such as policy changes can help mitigate or decrease climate related risks in the future.

New York State's Department of Environmental Conservation lists some of the impacts of climate change as sea level rise, increased speed of ocean warming, higher temperatures, and increased precipitation and storms. Across the Northeast and New York, winter temperatures have been rising rapidly, more than any other season. Less snowfall and cover, earlier snowmelt, and increased winter precipitation significantly impact the state's agricultural and economic systems. Extended seasons for disease-carrying species, drier summer soil, and growth of invasive species populations are just a few out of many of these impacts.

Warming ocean temperatures result in sea level rise and impacted productivity of marine and coastal ecosystems. The NYS Department of Environmental Conservation states that not only have marine waters along the northeast experienced a 0.06 F temperature increase per year between 1982 and 2016 but are also predicted to warm more rapidly than most marine waters globally. These changes have and will continue to impact the state's commercial fishing and tourism industries, and economy of various communities.

Many communities in the United States have started to take responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing 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, when residents save on energy costs, they are more likely to be 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.

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.

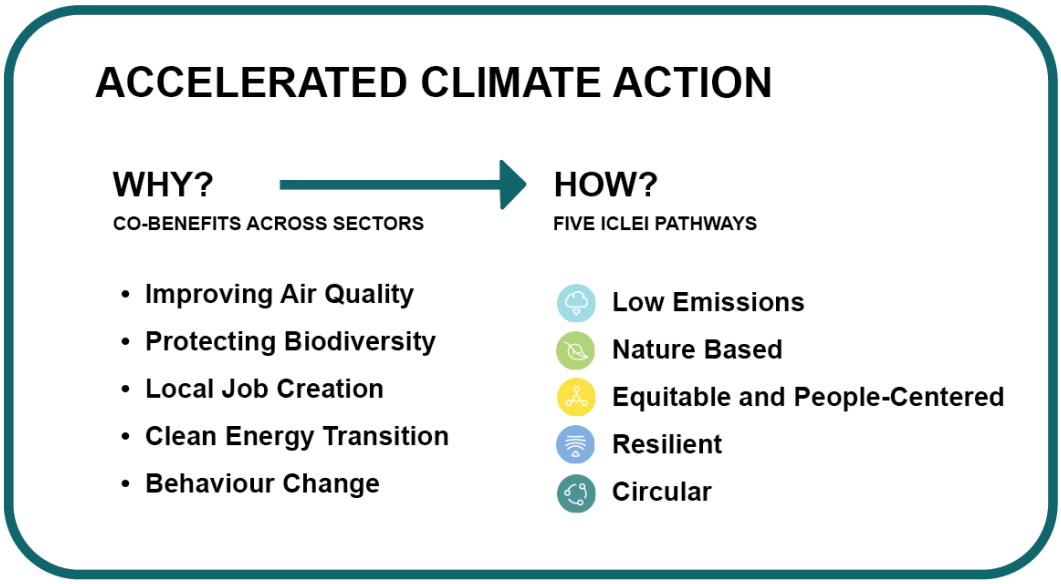
Cities, towns and counties are well placed to define coherent and inclusive plans that address integrated climate action — climate change adaptation, resilience and mitigation. Existing targets and plans need to be reviewed to bring in the necessary level of ambition and outline how to achieve net-zero emissions by 2050 at the latest. Creating a roadmap for climate neutrality requires the Town of Amenia to identify

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

To complete this inventory, the Town of Amenia 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, Amenia 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.



ICLEI Climate Mitigation Milestones

In response to the climate emergency, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of 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, 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 Five Milestones, also shown in Figure 2:

1. Conduct an LGO inventory and forecast of local government greenhouse gas emissions;
2. Establish a greenhouse gas emissions target;
3. Develop an LGO 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 Amenia.

Figure 1: ICLEI Climate Mitigation Milestones

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 operations of the Town of Amenia government. The government operations inventory is mostly a subset of the community inventory, as shown in Figure 3. 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 2: 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 Greenhouse Gas Emissions (Community Protocol) and the Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions (LGO Protocol), both of which are described below.

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

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

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

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.3 The LGO Protocol serves as the national standard for quantifying and reporting greenhouse 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 greenhouse gas emissions inventory.

The following activities are included in the LGO inventory:

- Energy and natural gas consumption from buildings & facilities
- Wastewater treatment processes
- Operation of solid waste facilities
- On-road transportation from employee commute and vehicle fleet

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 up 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

[3] 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

boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, but that does not have a clear definition for application to community inventories.

Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Amenia's LGO greenhouse gas emissions inventory utilizes 2019 as its baseline year, for which the necessary data are available.

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

Most 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 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 tool.

Government Operations Emissions Inventory Results

Government operations emissions for 2019 are shown in Table 3 and Figure 6.

Table 2: Local Government Operations Inventory

Sector	Fuel or source	2019 Usage	Usage unit	2019 Emissions ($MTCO_2e$)
Buildings & Facilities	Electricity	134,667	kWh	14.3
	Oil	7,471	gallons	76.8
	Propane	537	gallons	3.0
Buildings & Facilities total				**94**
Street Lights & Traffic Signals	Electricity	153,073	kWh	16.2
Street Lights & Traffic Signals total				**16**
Vehicle Fleet	Gasoline	1,197.1	gallons	10.5
	Diesel	7,654.1	gallons	78.2
Vehicle Fleet total				**89**
Employee Commute	Gasoline	1051.8	gallons	9.3
Employee Commute total				**9**
Solid Waste	Waste Generation	276,235	tons	2,242
Solid waste total				**2,242**
Water and wastewater	Pump Electricity	135,339	kWh	14.3
Wastewater and Water total				**14**
TOTAL				**2,464**

Figure 4 shows the distribution of emissions among the four sectors included in the inventory. For comparison, the first figure is inclusive of solid waste, while the second is exclusive of solid waste. Solid Waste represents the majority of emissions, followed by Buildings and Facilities, and Vehicle Fleets. Water and Wastewater Treatment Facilities, Streetlights and Traffic Signals, and Employee Commutes account for a small portion of emissions.

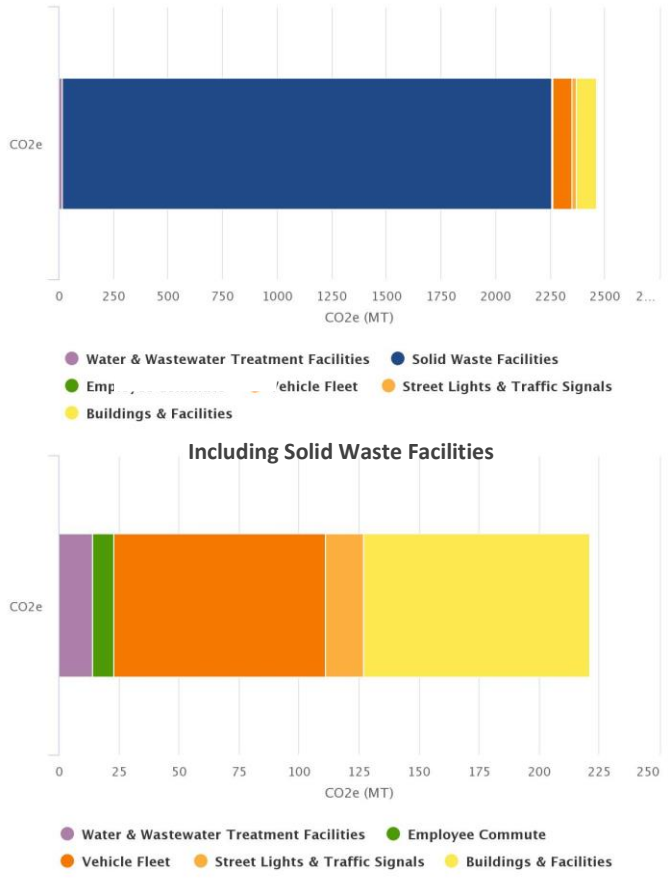
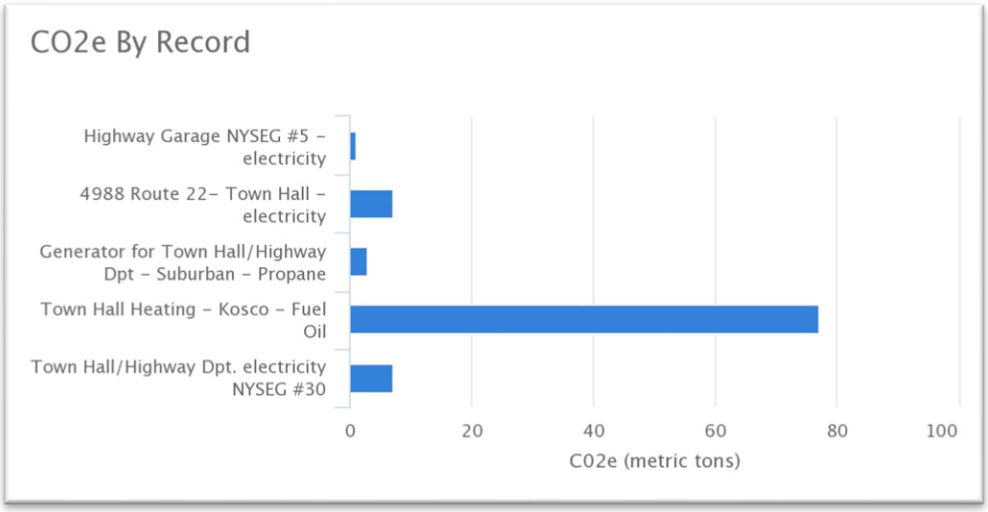


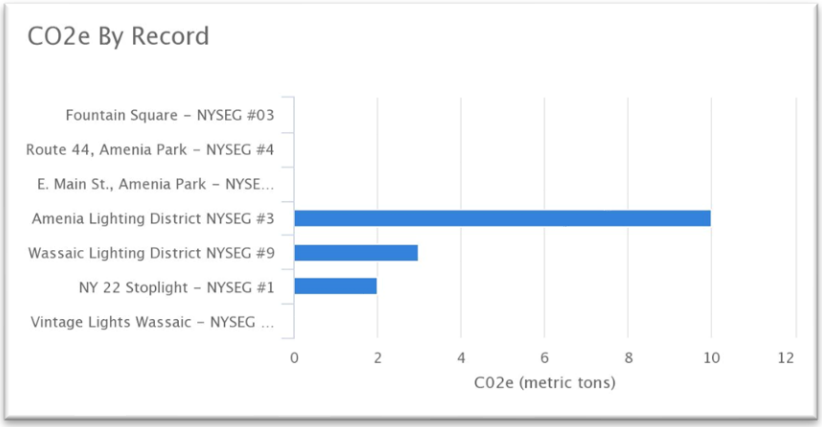
Figure 4: Town of Amenia 2019 GHG Emissions Inventory by Sector

Buildings and Facilities



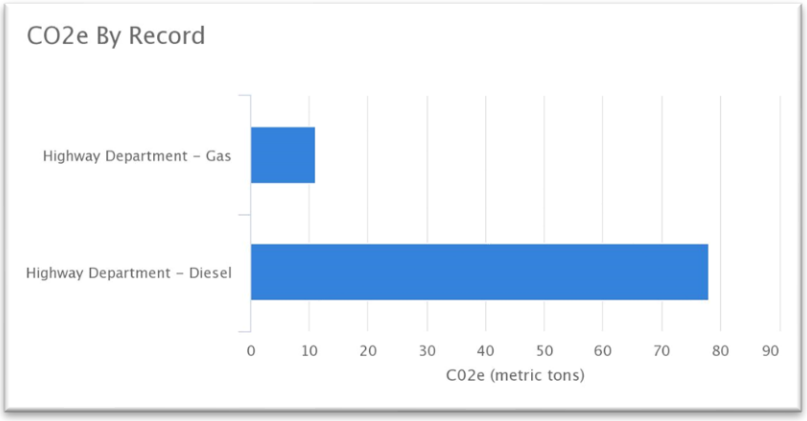
The GHG emissions related to the buildings and facilities in Amenia were calculated from the records of electricity, oil, and natural gas. The heating of the Town Hall far outweighed any other building in terms of emissions, about 77 metric tons of CO2. As the buildings and facilities sector is the second highest source of emissions for Amenia, heating the town hall accounts for a major portion of its total footprint. Focusing on better insulating the town hall would prove very beneficial, as well as possibly investing in a more efficient heating system.

Street Lights and Traffic Signals



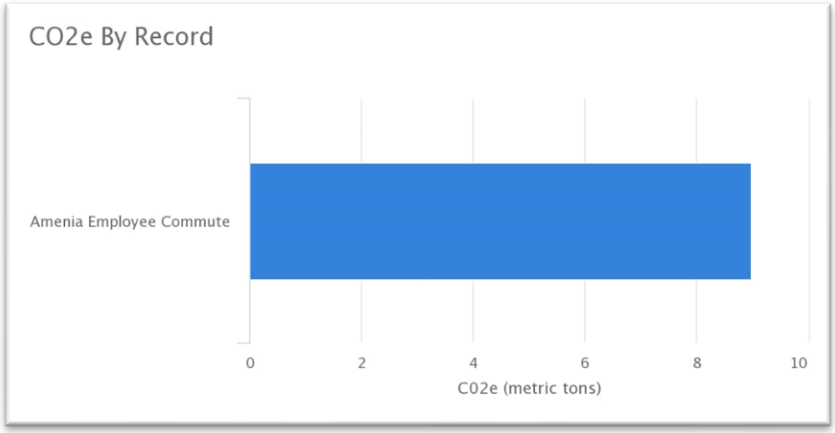
Amenia's street lighting accounts for a very low portion of their total emissions, with a few of their lighting sectors' emissions being negligible.

Vehicle Fleet



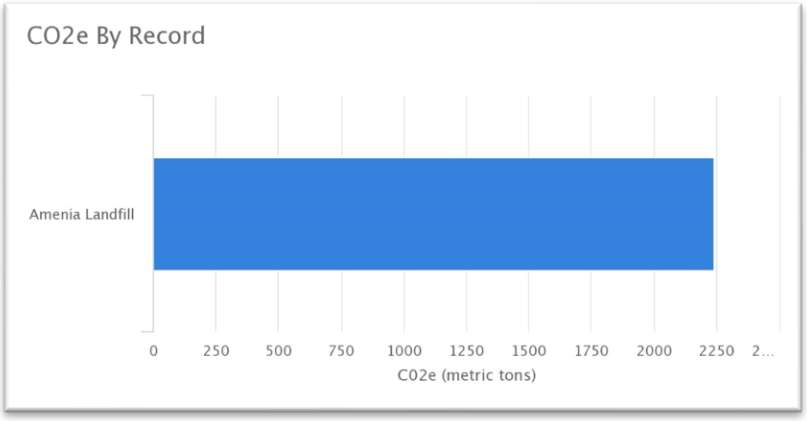
Amenia's vehicle fleet consists of 14 total vehicles, 3 are gas and 11 are diesel. The emissions from the diesel vehicles far outweigh the emissions of the gas vehicles. This could be due to the number of vehicles, as well as the vehicle type. The 3 gasoline vehicles are all pickup trucks, whereas the diesel vehicles are mainly large trucks. As the vehicle fleet accounts for a significant portion of Amenia's emissions, switching to electric vehicles would significantly reduce emissions.

Employee Commute



The employee commute in Amenia was calculated from a survey given to municipal workers. Most employees conveyed that they would not consider switching to electric vehicles (EVs). However, a few employees stated they would consider alternate forms of transportation if there was EV charging available. Other employees mentioned improved sidewalks or pathways might encourage them to walk to work.

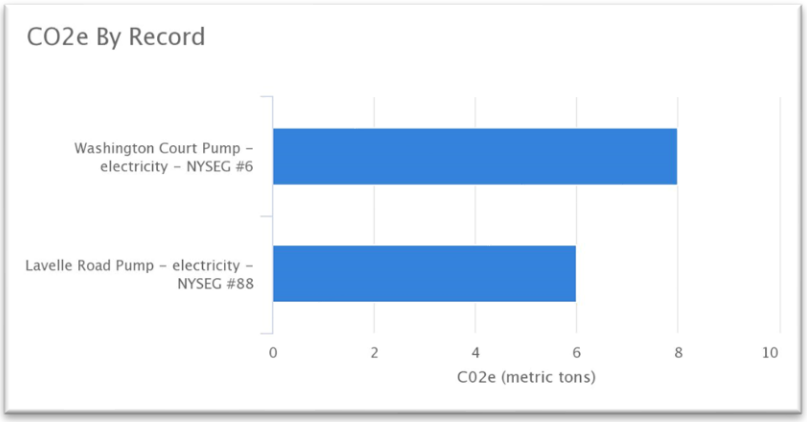
Solid Waste Facilities



Despite no longer being in operation, the Amenia Town Landfill accounts for the majority of Amenia's emissions. The Town of Amenia landfill serviced the whole town from 1940 until its closing in 1976, and throughout this time, the landfill received both municipal and corporate waste. An Illegal drum disposal area was identified in 1998, and thus the USEPA performed an emergency removal. The landfill was originally listed as a Class 2 site in the state, meaning it contains hazardous waste that represents a significant threat to public health or the environment. Cleanup of the site began in 2012. In July 2018, the Town of Amenia landfill was reclassified as a Class 4 site, as following the cleanup of the site, it no longer posed significant risks.

To estimate the amount of methane vented by Amenia's capped landfill, this inventory used the Landfill Gas Emissions Model (LandGEM) Version 3.03 provided by the US Environmental Protection Agency. The model uses estimates of waste deposition rates based on the town population during the period when the landfill was estimated to be in operation. Appendix: Landfill Data details the data used and the model output.

Water and Wastewater Treatment Facilities



Wastewater treatment is outsourced from Amenia due to the Town's relatively small size. There are only two pumps located in Town. The emissions from these pumps were calculated using the electrical meter records, however they account for a very small portion of The Town's total emissions.

Next Steps

The local government operations emissions inventory points to a need for further analysis of ways to reduce GHG emissions from the largest emission sectors: solid waste, buildings and facilities, and vehicle fleet. Possible next steps include expanding the use of demand reduction response for larger municipal buildings, exploring opportunities to transition buildings to cleaner energy sources, and continuing to electrify the vehicle fleet as existing vehicles are replaced.

Possible next steps might include exploring more energy efficient HVAC infrastructure in municipal buildings, as well as opportunities to transition municipal buildings to cleaner energy sources. Other ideas worth exploring include how to further reduce energy demand in larger municipal buildings, fleet electrification, and switching out remaining non LED bulbs to more efficient lighting. An increase number of improved sidewalks might make it more likely for townspeople to walk or bike, thus eliminating the need for a car. Lastly, while it's a challenging issue, capturing and treating landfill gases, might be a viable solution for the Town. Further exploration is needed.

The Town of Amenia is participating in the Hudson Valley Regional Council's (HVRC) Climate Action Planning Institute (CAPI), a facilitated working group of nine Dutchess municipalities developing individual government operations greenhouse gas inventories and climate action plans. As part of CAPI, the Town is taking a collaborative approach to climate action planning, learning from its neighbors and subject matter experts. The next step will be to create a Climate Action Plan.

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 Comprehensive Plan Implementation 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. To achieve a science-based target, community education, involvement, and partnerships will be instrumental.

In addition, the Town of Amenia 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 buildings and facilities, municipal fleet, and the municipal landfill will be particularly important to focus on. Through these efforts and others, the Town of Amenia can achieve environmental, economic, and social benefits beyond reducing emissions.

Appendix: Methodology Details

Energy

The following tables show each activity, related data sources, and notes on data gaps.

Table 3: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Electricity consumption	Town Clerk	Electrical meters located at municipal buildings are correctly measuring the electrical output.
Natural gas consumption	Town Clerk	Natural gas is assumed to only being used at the Town Hall and Highway Department.
Fuel oil consumption	Town Clerk	Fuel oil is assumed to only be used to heat the Town Hall.

Table 4: Emissions Factors for Electricity Consumption

Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)
2019	232.31	17.0	2.0

Transportation

Table 5: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Government vehicle fleet	Town Clerk	Emissions calculated by the gallons of diesel and gasoline used in the government vehicles.
Employee commute	Employee Surveys	The miles commuted per person were estimated from which town they live in.

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 6.

Table 6: MPG and Emissions Factors by Vehicle Type
2019 US National Defaults (updated 2021)

Fuel	Vehicle type	MPG	CH4 g/mile	N2O g/mile
Gasoline	Passenger car	24.1	0.0183	0.0083
Gasoline	Light truck	17.6	0.0193	0.0148
Gasoline	Heavy truck	5.371652	0.0785	0.0633
Gasoline	Motorcycle	24.1	0.0183	0.0083
Diesel	Passenger car	24.1	0.0005	0.001
Diesel	Light truck	17.6	0.001	0.0015
Diesel	Heavy truck	6.392468	0.0051	0.0048

Potable Water

Table 7: Potable Water Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Washington Court Pump	Town Clerk	There is no waste water treatment plant in Amenia. These are assumed to be the only two water pumps for the town.
Lavelle Road Pump	Town Clerk	

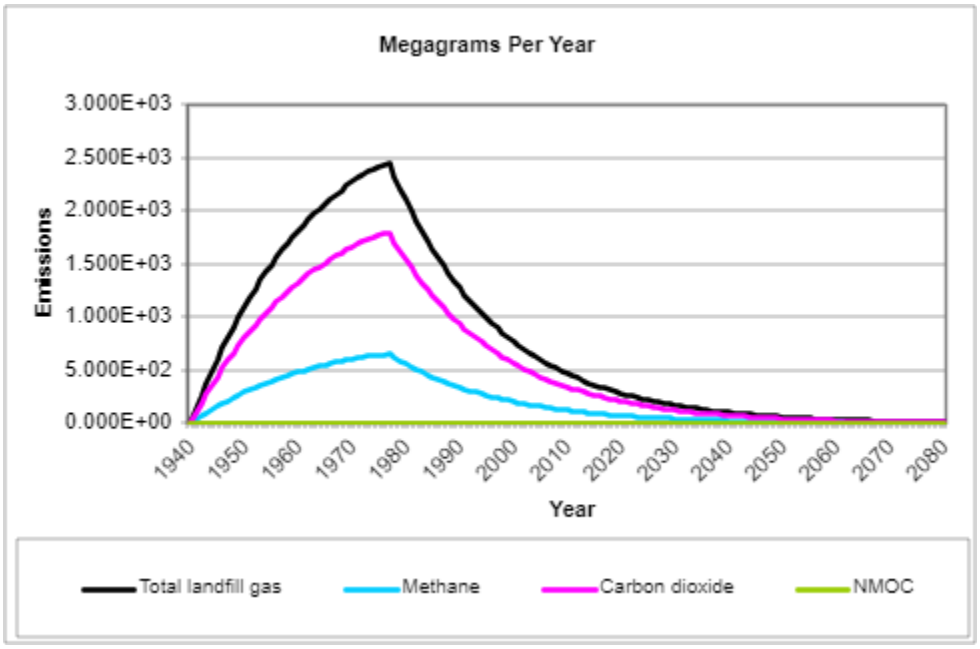
Solid Waste

Table 8: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Local Government Operations		
Amenia Landfill CO2	EPA LandGEM tool	The Amenia Landfill was open from 1940-1976. The accepted waste generated per person per day based on average value. Population estimates were based on census data. The total waste was estimated using this number and the years the landfill was in operation.

Landfill Data

The LandGem calculations were done using the population of the Town of Amenia each year from the opening to the closing date of the landfill. The population data was from the US Census Data, as given dates. The waste acceptance rate for the calculations was 5.5 pounds per person per day. This amount includes both residential and commercial waste. While the CO2e emission peaked its closure year in 1976, the landfill will continue to emit greenhouse gases for many more years, as indicated in the following graph, created using the EPA's LandGEM tool:



Inventory Calculations

The 2019 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. As discussed in Inventory Methodology, the IPCC [Intergovernmental Panel on Climate Change] 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.