Town of Gardiner

2019 Inventory of Community and Government Operations Greenhouse Gas Emissions

SEPTEMBER 2022

Produced by the Climate Smart Gardiner TASK FORCE
with Assistance from ICLEI Local Governments for Sustainability USA

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Acronyms & Symbols

AFOLU..... Agriculture, Forests & Other Land Use
C..... Celsius
CH4..... Methane
CO2..... Carbon Dioxide
CO2e..... Carbon Dioxide Equivalent
GHG..... Greenhouse Gas
GWh.....Gigawatt Hour
GWP.....Global Warming Potential
ICLEI.....International Council for Local Environmental Initiatives (Now known as ICLEI Local Governments for Sustainability USA).
kWh.....Kilowatt Hour
LED..... Light Emitting Diodes
MMBTU.....Million British Thermal Units
MT.....Metric Ton
MWh..... Megawatt Hour
N2O..... Nitrous Oxide
VMT.....Vehicle Miles Traveled

Executive Summary

The Town of Gardiner 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 was designated a Bronze Certified Climate Smart Community in September 2021. The Climate Smart Communities Program is an official New York State Department of Environmental Conservation initiative designed to enable local governments to adapt to a changing climate by conserving energy, supporting a local green economy, promoting renewable energy, and reducing the community's greenhouse gas emissions. Since 2018 Climate Smart Gardiner has completed a number of actions, including local government greenhouse gas inventories for 2015 through 2018, the adoption of a local government climate action plan in 2019, installation of an electric vehicle charging station, and, along with the Parks and Recreation Committee, planting 670 trees to provide a riparian border along the banks of the Wallkill River.

In May of 2022 the Town of Gardiner adopted an updated Comprehensive Plan that includes a chapter on sustainability measures the Town should consider as it approves new residential and commercial development. It referenced such tools as the Open Space Plan (2007) and a Natural Resources Inventory completed in 2021 that describes the town's important natural assets "including topography, geology and soils, water resources, and habitats, as well as recreational and cultural areas, land uses, and climate conditions and projections. This document also serves to aggregate the numerous local natural resource studies, reports and plans that contribute to a detailed understanding of the unique qualities of the Town."

Since Bronze Certification, and in conjunction with the objectives of the Comprehensive Plan, the Climate Smart Gardiner task force has led the campaign to engage Joule Energy to administer a Community Choice Aggregation plan to bring 100% renewable energy to all eligible residents and small businesses. The task force is also investigating a possible installation of a community solar array at the town's landfill, and the replacement of all the town's streetlights with LED lamps.

This report provides estimates of greenhouse gas emissions resulting from activities in the Gardiner community in 2019, as well as emissions specifically from the town's government operations.

Key Findings

Figure 1 shows communitywide emissions by sector. The largest contributor is Transportation with 59% of emissions. The next largest contributor is Residential Energy (35%). Actions to reduce emissions in these sectors will be a key part of a climate action plan. Commercial Energy, Solid Waste, Wastewater, and Livestock were responsible for the balance of the emissions (less than 7%). Total greenhouse gas emissions were 35,498 metric tons of CO2e.

Figure 2 shows local government operations emissions. The town's highway department vehicle fleet accounts for a vast majority (77%) of these emissions. The next largest contributor is our Administrative Facilities (19%). Actions to reduce emissions from these sectors are a key part of Gardiner's current local government climate action plan. The town's streetlights produce 2% of its emissions while Wastewater Facilities are responsible for the remainder of the local government operations emissions of 166 metric tons.

The Inventory Results sections of this report provide a detailed profile of emissions sources within Gardiner, 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.

The purpose of this data analysis is to obtain insight into what is driving our CO2e emissions. As we develop a climate action plan we will determine what actions can be taken to reduce or eliminate these emissions. While the data presented show the quantity of each emission sector, that in itself is not sufficient to determine what actions to take. We must determine the feasibility of implementing the defined actions. There is no expectation that there will be many actions that are both high impact and easily implemented, but we do expect that we will be able to prioritize actions both by their impact AND ease of implementation, resulting in a set of actions that will enable us to meet our goals. For instance, while street lighting isn't the largest contributor, migrating to LED lighting is relatively easy and will show a measurable impact.

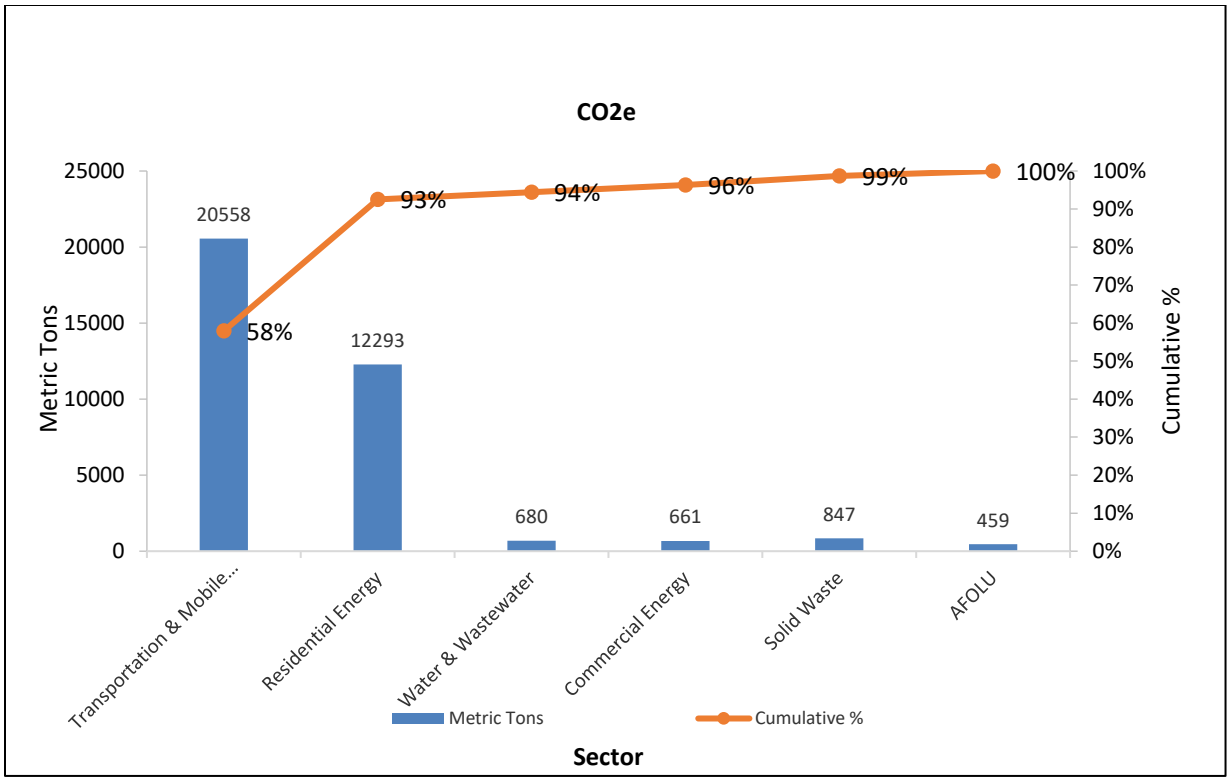


Figure 1: Communitywide Emissions by Sector

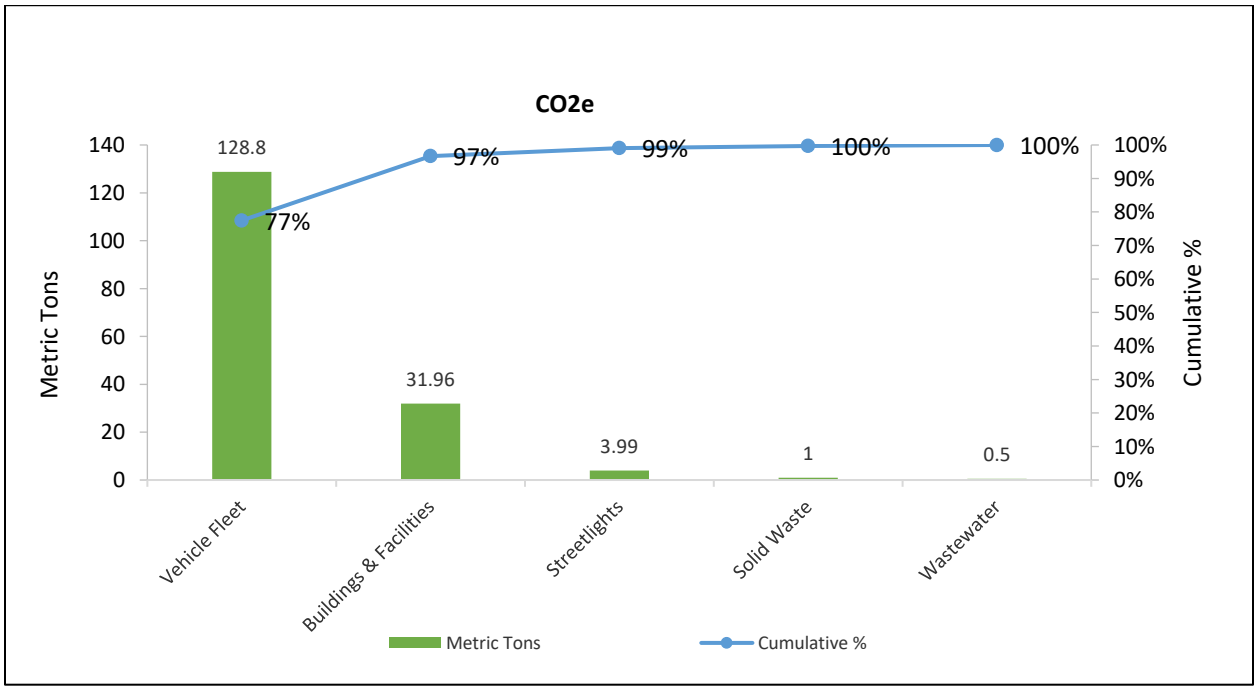


Figure 2: Government Operations Emissions by Sector

Introduction to Climate Change

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases (GHG) 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 emissions.[1] Many regions are already experiencing the consequences of global climate change, and the Hudson Valley 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 2018 National Climate Assessment, the seasonality of the Northeast is central to the region's sense of place and is an important driver of rural economies. Less distinct seasons with milder winter and earlier spring conditions are already altering ecosystems and environments in ways that adversely impact tourism, farming, and forestry. The region's rural industries and livelihoods are at risk from further changes to forests, wildlife, snowpack, and streamflow.[3]

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 spend more 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.

The Town of Gardiner, as described in the town's proposed Community Preservation Plan, "is a scenic and rural community that possesses natural resources of State and National importance." In addition to attracting an active tourist economy and a vibrant real estate market, the town's forests, meadows, farms, and wetlands actually remove carbon from the atmosphere and filter pollutants from the water and air.

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

Greenhouse Gas Inventory as a Step Toward Carbon Neutrality

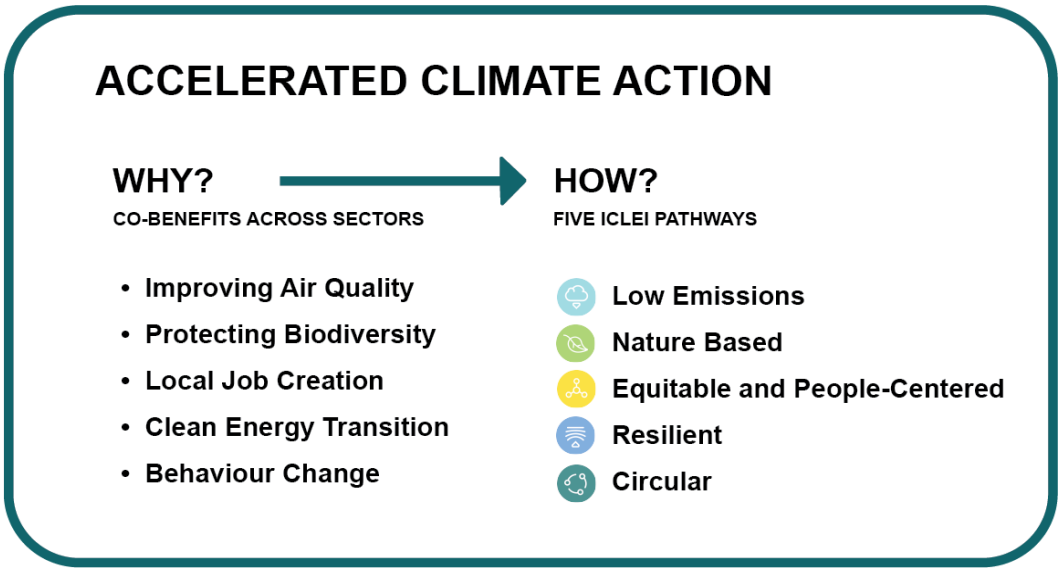
Facing the climate crisis requires the concerted efforts of local governments and their partners, those that are close to the communities directly dealing with the impacts of climate change.

Cities, towns, and counties are on the front lines in determining coherent and inclusive plans that address integrated climate action — climate change adaptation, resilience, and mitigation. Targets and plans need to be reviewed regularly in order to achieve net-zero emissions by 2050 at the latest. Creating a roadmap for climate neutrality requires Gardiner to identify priority sectors for action, while considering climate justice, inclusiveness, local job creation, and other benefits of sustainable development.

To complete this inventory, Gardiner 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, The Town of Gardiner 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. In order to implement effective actions, it is key to get community buy-in through enhanced communication and events like tree planting on Arbor Day and Riverkeeper Sweep of the Wallkill and its tributaries.



ICLEI Climate Mitigation Milestones

In response to the climate emergency, 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 3:

1. Conduct an inventory and forecast of local greenhouse gas emissions
2. Establish a greenhouse gas emissions Science Based Target[5]
3. Develop a climate action plan for achieving the emissions reduction target
4. Implement the climate action plan
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 the Town of Gardiner.

Figure 3: ICLEI Climate Mitigation Milestones

[5] Science-Based Targets are calculated climate goals, in line with the latest climate science, that represent your community's fair share of the ambition necessary to meet the Paris Agreement commitment of keeping warming below 1.5°C. To achieve this goal, the Intergovernmental Panel on Climate Change (IPCC) states that we must reduce global emissions by 50% by 2030 and achieve climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels, and sources and activities generating emissions in the community. This report presents emissions from both the Gardiner community as a whole, and from operations of the Town of Gardiner government. The government operations inventory is mostly a subset of the community inventory, as shown in 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 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). The charts in this report represent emissions in "carbon dioxide equivalent" (CO2e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the IPCC 5th Assessment Report.

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

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

Community Emissions Protocol

Version 1.2 of the U.S. Community Protocol for Accounting and Reporting GHG Emissions[6] was released by ICLEI in 2019, and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

The community inventory in this report includes emissions from the five Basic Emissions-Generating Activities required by the Community Protocol. These activities are:

- Use of electricity by the community
- Use of fuel in residential and commercial stationary combustion equipment
- On-road passenger and freight motor vehicle travel
- Use of energy in wastewater treatment
- Generation of solid waste by the community

The Town of Gardiner has an active farming community. This inventory also includes an estimate of greenhouse gas emissions from livestock.

Carbon dioxide represents the vast majority (98%) of the community emissions and is produced from burning fossil fuels such as gasoline, diesel, fuel oil, and natural gas. Nitrous oxide accounts for less than 1% of communitywide emissions, primarily from grid electricity (from fuel combusted to create electricity) and gasoline used for passenger vehicles. Methane accounts for about 1% of communitywide emissions, and comes primarily from grid electricity, gasoline used for passenger vehicles, livestock emissions, and solid waste that is sent to a landfill.

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.[7] The LGO Protocol serves as the national standard for quantifying and reporting greenhouse gas 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.

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

[7] 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

The following emission sources are included in the LGO inventory:

- Electrical energy, propane and fuel oil consumption by buildings and facilities
- Electrical energy for the town's street lights
- Gas and diesel emissions from the town's 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." Combustion of fossil fuels to generate electrical energy is a "source" of emissions, using that electricity to power a home or business is an "activity" that results in emissions.

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 results 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 provide an estimate of the total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory would provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional 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. Gardiner's community greenhouse gas emissions inventory utilizes 2019 as its baseline year, because it is the most recent year for which accurate data are available. The Covid 19 pandemic severely disrupted data gathering activities in 2020 and 2021, including the U.S. Census. The Community Greenhouse Gas Inventory for the most part utilizes data for the year 2019. In some cases, data from other years were used as noted and adjusted if necessary to determine an estimated number for 2019.

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.

The activity data show a Town of Gardiner residential consumption of 21,596.72 megawatt hours of grid electricity in 2019. When multiplied by the Emission Factor of 232.305, the total emissions are 5,017,026 lbs of CO2 (2,275.70 Metric Tons).

Communitywide Emissions Inventory Results

The total communitywide emissions for the 2019 inventory are shown in Table 2 and Figure 5.

Table 2: Communitywide Emissions Inventory

Sector	Fuel or source	2019 Usage	Usage unit	[Baseline Year] Emissions ($MTCO_2e$)
Residential energy	Electricity-Central Hudson Gas & Electric	21596.7	MWh	2286
	Distillate Fuel Oil #2	100145.00	MMBtu	7456
	Propane	37893.00	MMBtu	2352
	Wood	19928.00	MMBtu	199
Residential energy total				**12293**
Commercial energy	Electricity	4334	MWh	459
	Distillate Fuel Oil #2	9699	Gallons	100
	Propane	18011	Gallons	102
Commercial energy total				**661**
Industrial energy	Electricity	N/A		
	Natural gas	N/A		
	[Non-utility Fuel]	N/A		
Industrial energy total				
On-road transportation	Gasoline (passenger vehicles)	43256126	Miles	14404
	Diesel (passenger vehicles)	770004	Miles	3317
	Diesel (freight trucks)	1268243	Miles	2027
Transit	Diesel	N/A		
	Gasoline	N/A		
Aviation	Jet A (Jet Kerosene)	N/A		
	Aviation Gasoline	40000	Gallons	83
Off-Road	Diesel	N/A		
	Gasoline	82178	Gallons	727
Waterborne	Diesel	N/A		
	Gasoline	N/A		
Rail	[Fuel Type]	N/A		
Transportation total				**20558**
Solid Waste	Waste Generated	1167	Tons	847
Solid waste total				**847**
Water and wastewater	Water Treatment Energy Usage	N/A		
	Wastewater Treatment Energy Usage	See Electricity		
	Wastewater Treatment			680
	Nitrogen Discharge	N/A		
Water and wastewater total				**680**
AFOLU	Emissions from Livestock	16.377	MT CH4	459
Livestock emissions total				**459**
			Total communitywide emissions	**35,498**

Figure 5 shows the distribution of communitywide emissions by sector. Transportation is the largest contributor, followed by Residential Energy & Commercial Energy.

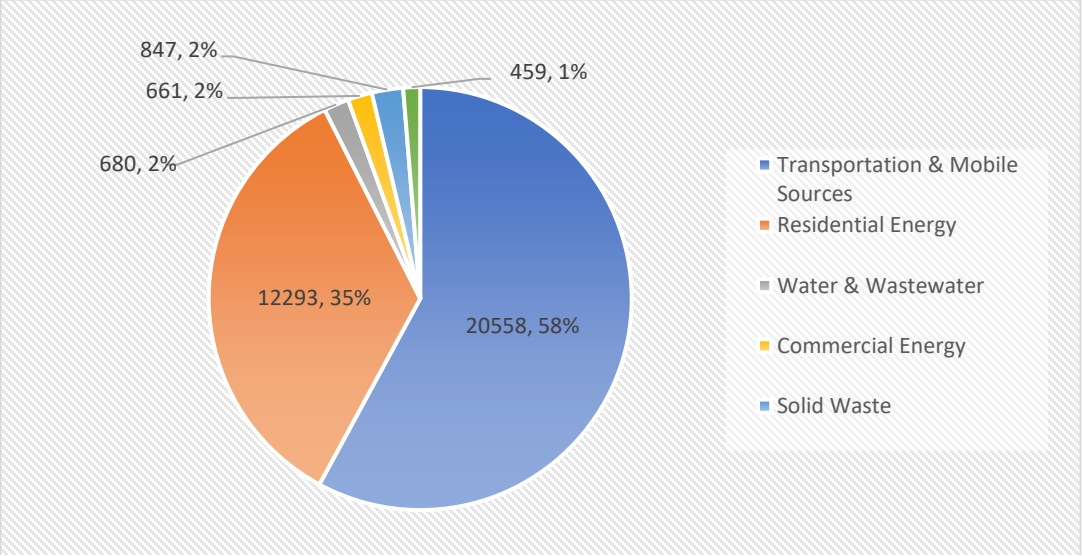


Figure 5: Communitywide Emissions by Sector

Next Steps

The inventory should be used to focus and prioritize actions to reduce emissions. Based on the inventory results, the following recommendations have the greatest potential for emissions reduction:

- Residential Energy Use: Promote environmental and economic benefits of installing heat pumps and solar panels, requiring them for development of new homes and commercial establishments.
- Transportation: Urge local businesses to install EV charging stations.
- Solid Waste: Implement a communitywide food waste composting program.

The number of homes using fuel oil for heat is taken from census records. During the last few years many homeowners in Gardiner have installed electric-powered heat pumps to provide both heating and cooling and use their old heating systems for backup. In 2021 the Gardiner Building Department issued 51 permits for HVAC unit installation. If we assume all of the installations were heat pumps in homes using fuel oil, the town's emission would drop by as much as 250 metric tons.

While the inventory includes the annual communitywide greenhouse gas emissions in compliance with the U.S. Community Protocol, there is another concern the town must consider as future development is contemplated. Our forests, meadows, and wetlands remove carbon from the atmosphere, sequestering emissions, as long as they remain undisturbed. Though it is not included in our formal inventory we have used ICLEI's LEARN Tool (Land Emissions and Removal Navigator) to estimate the amount of carbon removals our current forest canopy provides. The very transition of this resource, through residential, commercial or highway construction or through damage by disease, insects, fires, or storms can add to the town's carbon emissions. Replacing the forests and wetlands with agricultural fields or commercial

and residential development has a huge impact on the carbon sequestration that undisturbed natural resources supply. As we update this inventory the impact of development and climate change on our natural resources should be fully quantified and added as another important component of our communitywide GHG Inventory.

Figure 6 Below shows the current estimated CO2e emissions compared to CO2e removals by our forests.

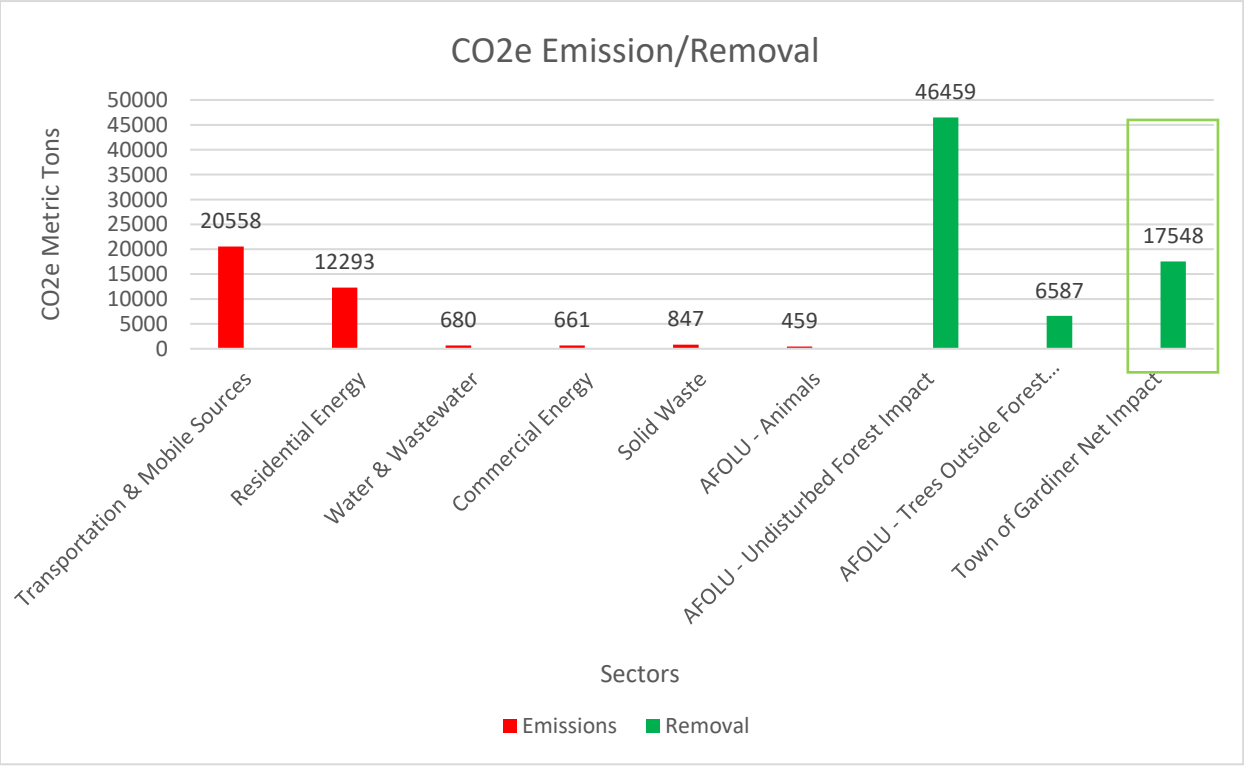


Figure 6: Communitywide Emissions and Removals by Sector

Completion of another GHG inventory in five years is recommended in order to assess progress resulting from any implemented actions. 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 Town of Gardiner, will be helpful to complete a future inventory consistent with this one.

Government Operation Emissions Inventory Results

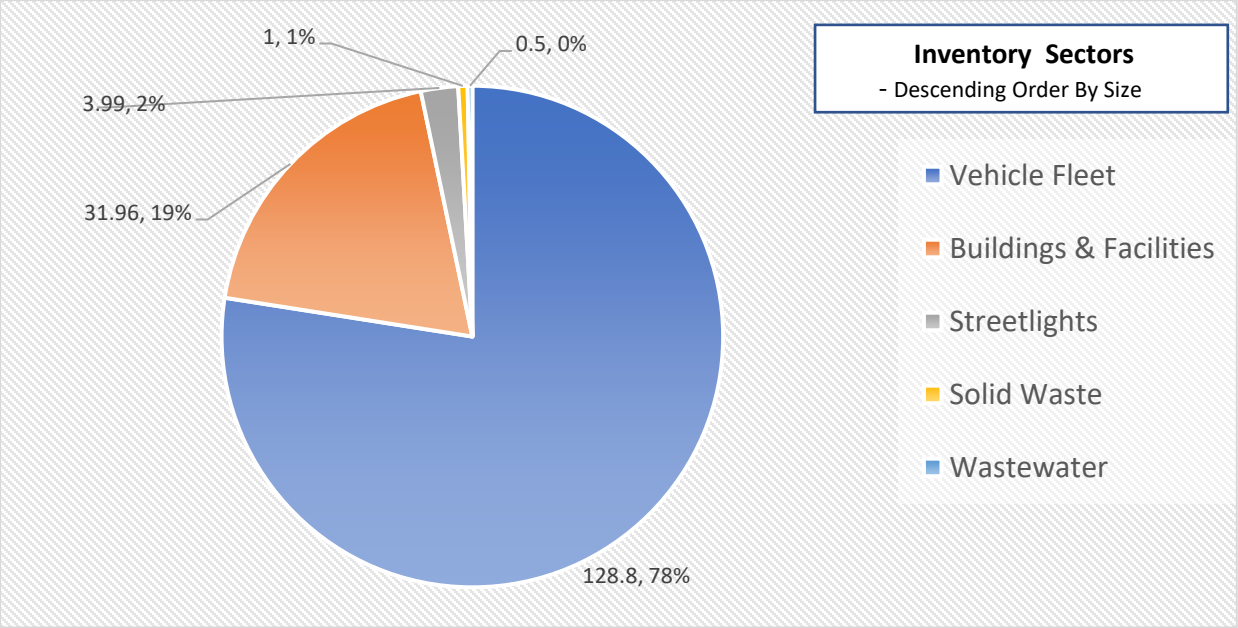
Government operations emissions for 2019 are shown in Table 3 and Figure 7.

Table 3: Local Government Operations Inventory

Sector	Fuel or source	2019 Usage	Usage unit	2019 Emissions ($MTCO_2e$)
Buildings & Facilities	Electricity	67874	kWh	7.2
	Propane/Fuel Oil	3246	Gallons	24.76
Buildings & Facilities Total				**31.96**
Streetlights & Traffic Signals	Electricity	39673	kWh	3.99
Street Lights Total				**3.99**
Vehicle Fleet	Gasoline (off-road)	N/A	Gallons	
	Diesel (off-road)	2081.7	Gallons	21.3
	Gasoline (on-road)	4079	Gallons	35.8
	Diesel (on-road)	6931.3	Gallons	71.7
Vehicle Fleet Total				**128.80**
Employee Commute	Gasoline	N/A		
	Biodiesel/Ethanol	N/A		
	Electric	N/A		
	Hybrid Gasoline	N/A		
	PHEVs	N/A		
Employee Commute Total				
Electric Power Production	Various Fuels for Power Generation	N/A		
Electric Power Production Total				
Solid Waste	Waste Generation	4714	kWh	.50
	Compost	N/A		
Solid waste total				**.50**
Water and wastewater	Sewer System Electricity	7296	kWh	1
	Digester Gas Combusted (used for boiler operations)	N/A		
	Nitrogen Discharge	N/A		
Water and wastewater total				**1**
Process & Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	**N/A**		
Process & Fugitive Emissions total				
Total government emissions				**166.25**

Figure 7 shows the distribution of emissions among the five sectors included in the inventory. Vehicle Fleet represents the majority of emissions, followed by Buildings & Facilities and Streetlights. Wastewater and Solid Waste account for a small portion of emissions.

Figure 7: Local Government Operations Emissions by Sector



Next Steps

The local government operations emissions inventory points to a need for:

- Building energy audits
- Purchase of electric and/or hybrid fleet vehicles
- Consideration of heat pump installation in the Town Hall offices and Highway Garage

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 Local Government Climate Action Plan with a more robust climate action plan that identifies specific quantified strategies that can cumulatively meet that target.

The Intergovernmental Panel on Climate Change (IPCC) states that to meet the Paris Agreement commitment of keeping warming below 1.5°C we must reduce global emissions by 50% by 2030 and reach climate neutrality by 2050. Equitably reducing global emissions by 50% requires that high-emitting, wealthy nations reduce their emissions by more than 50%. More than ever, it is imperative that countries, regions, and local governments set targets that are ambitious enough to slash carbon emissions between now and mid-century.

Science-based targets are calculated climate goals, in line with the latest climate science, that represent a community's fair share of the global ambition necessary to meet the Paris Agreement commitment. To achieve a science-based target, community education, involvement, and partnerships will be instrumental. New York State passed the Climate Leadership and Community Protection Act (CLCPA) in 2019. The law mandates that the State reduce its greenhouse gas emissions by 40% below 1990 levels by 2030. Since this inventory reflects emission levels for 2019, and, assuming that global emissions, as well as local greenhouse gas emissions, have increased since 1990, the goals we set for 2030 should exceed 40% of 2019 levels. The CLCPA also mandates that by 2030 70% of electricity generation for the New York State grid must be powered by renewable energy. Achieving this milestone alone will greatly reduce the town's reliance on fossil fuels to power up our homes, offices, and streetlights and, coupled with the transition to heat pumps to cool and heat our homes and businesses, should bring us a long way toward meeting our goal. There is also the strong possibility that the community could eliminate 95% of its electrical energy emissions through adoption of 100% renewable electricity through community choice aggregation and opt-out community solar well before 2030.

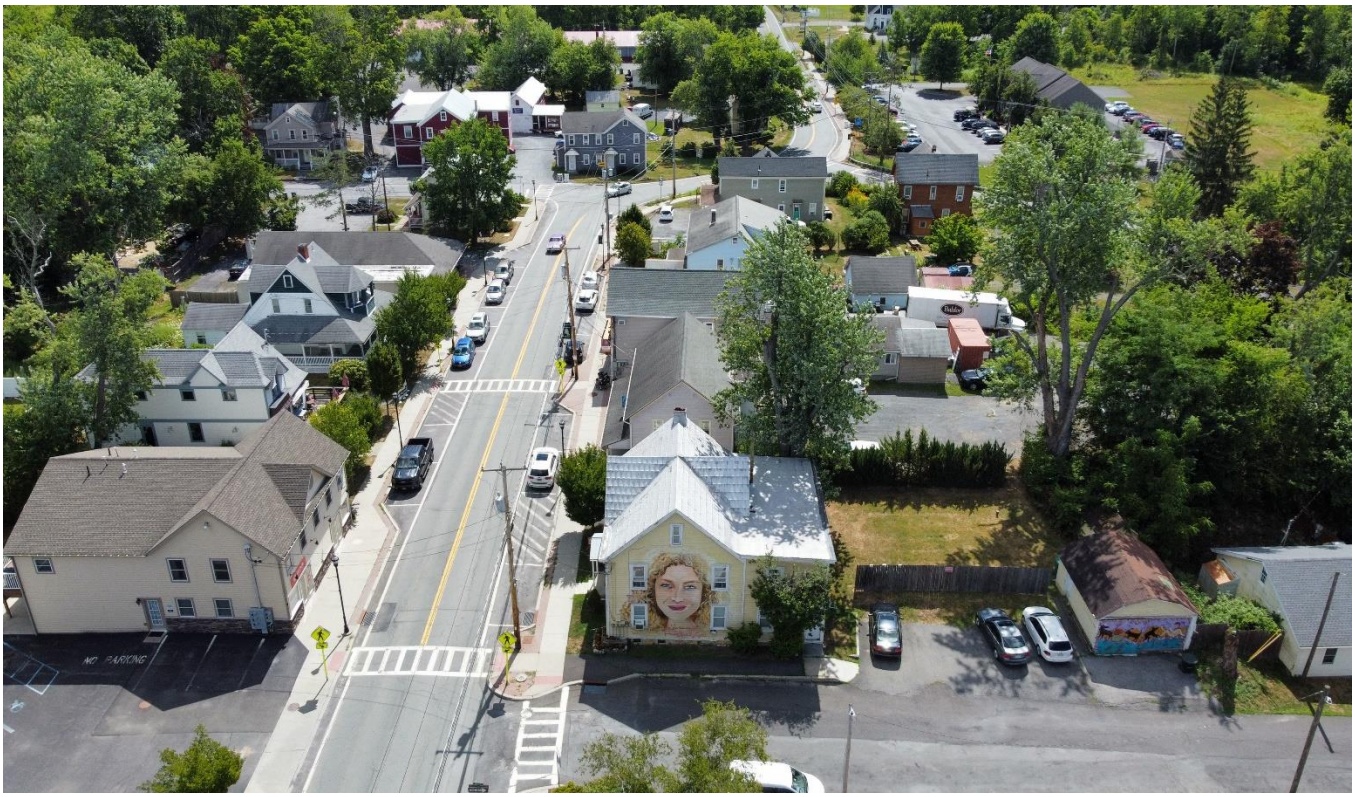
Communitywide transportation patterns will be particularly important to focus on. There are actions that the residents of Gardiner and the town's Highway Department can take to reduce vehicle greenhouse gas emissions. Migrating from gasoline and diesel-powered vehicles to electric vehicles can help to reduce the largest single category of greenhouse gas emissions. The impact of this action will accelerate as more electric vehicles are driven, not only by residents, but also by visitors and those just passing through the town. While only a small percentage of vehicles sold are electric vehicles, that number will continue to grow (In Gardiner, of the 3,521 vehicles registered as of 2021, 35 of them are all-electric).

In 2019 fuel oil heating accounted for more greenhouse gas emissions than any other residential or commercial energy source followed by propane gas. Household and commercial energy-use audits, combined with the necessary insulation improvements, will increase the community's energy efficiency.

Switching to electrically powered heat pumps in homes and offices currently using oil or propane will eliminate dependence on these fossil fuels going forward. As household appliances age and break down, replacing gas stoves, cooktops, dryers, and water heaters with high-efficiency electrical appliances will also help to reduce emissions, while improving indoor air quality.

Through these efforts and others, the Town of Gardiner can achieve environmental, economic, and social benefits beyond reducing emissions.

The 2021 Comprehensive Plan priority recommendations include a formalized process to "create connections among and between municipal and volunteer bodies to encourage growth and identify targeted regulatory needs to support desired outcomes." This inventory and its updates should be included in the annual review.



Appendix: Methodology Details

Energy

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

Table 4: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Residential, commercial, and industrial electricity consumption	Central Hudson Utility Energy Registry 2019	
Residential, commercial, and industrial natural gas consumption	N/A	
Residential Propane Consumption	U.S. Census, U.S. E.I.A. 2019, EPA Emissions Factors	
Residential Fuel Oil Consumption	U.S. Census, U.S. E.I.A., EPA Emissions Factors	
Residential Wood Consumption	U.S. Census, U.S. E.I.A., EPA Emissions Factors	
Local Government Operations		
Electricity consumption	Central Hudson Invoices	
Propane & Fuel Oil consumption	Supplier Invoices	

Table 5: Emissions Factors for Electricity Consumption

Year	CO_2 (lbs/MWh)	CH_4 (lbs/GWh)	N_2O (lbs/GWh)
2019	232.305	17	2

Transportation

Table 6: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Vehicle miles travelled	UC Transportation Council	
Transit ridership	N/A	
Local Government Operations		
Government vehicle fleet	Monthly Fueling Records and Annual Recording of Odometer Readings	
Employee commute	N/A	

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 7: MPG and Emissions Factors by Vehicle Type

Fuel	Vehicle type	MPG	CH_4 g/mile	N_2O g/mile
Gasoline	Passenger car	24.37713	.0183	.0083
Gasoline	Light truck	17.86788	.0193	.0148
Gasoline	Heavy truck	5.371632	.0785	.0633
Gasoline	Motorcycle	24.37713	.0183	.0083
Diesel	Passenger car	24.37713	.0005	.001
Diesel	Light truck	17.86788	.001	.0015
Diesel	Heavy truck	6.392468	.0051	.0048

Wastewater

Table 8: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide & Local Government Operations		
Nitrogen Discharge	N/A	

Digester Gas Combustion/Flaring		
Energy used in wastewater facilities	See Electricity	

Solid Waste

Table 9: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Landfill	Ulster County Resource Recovery Agency & Gardiner Transfer Station report	Determined amount of annual solid waste per household based on permit holders and tons of solid waste handled by Gardiner Transfer Station. Included emissions from transportation to and from Seneca Meadows Landfill.
Local Government Operations N/A		

Fugitive Emissions

Table 10: Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
CO4 from septic systems	Based on population	MT=CH4/daily kg BOD5(Biological Demand Testing). CO4 emissions factor =0.048213
Local Government Operations N/A		

Inventory Calculations

The 2019 inventory was calculated following the US Community Protocol and ICLEI's ClearPath software. As discussed in Inventory Methodology, the IPCC 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.

Data Links

Town of Gardiner ClearPath 2019 Communitywide GHG Emission Inventory Data:
Town of Gardiner 2019 GHG Inventorynventory_detail (4).xlsx

Town of Gardiner ICLEI 2019 Communitywide GHG Emission Workbook:
https://onedrive.live.com/edit.aspx?resid=7A7A693839EA43FC!175&ithint=file%2cxlsx&authkey=!AkXx_7KVdiE1zMo

Town of Gardiner ClearPath 2019 Local Government Operations GHG Emission Inventory Data:
Town of Gardiner 2019 LG Inventory_detail.xlsx

Town of Gardiner Tree Canopy Emissions/Removals Data

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