Greenhouse Gas Emssions Inventory for the Government Operations Activities Year 2020
Village of Millerton, New York

June 2022

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List of Acronyms

AR5 - Intergovernmental Panel on Climate Change's Fifth Assessment Report
CAGR – Compound Annual Growth Rate
CH_4 - methane
CO_2 – carbon dioxide
CO_2e - Carbon Dioxide Equivalents
CSC – New York State Climate Smart Communities
EF – GHG Emission Factor
eGRID – US EPA Emissions & Generation Resource Integrated Database
EPA – Environmental Protection Agency
GHG – greenhouse gas
GWP – global warming potential
HFC - hydrofluorocarbon
IMP – Inventory Management Plan
IPCC - Intergovernmental Panel on Climate Change
LPG – liquid petroleum gas (propane)
t – metric tonnes
MSW – municipal solid waste
MWh – Mega Watt hour
N_2O – Nitrous Oxide
NYS – New York State
NYSEG - New York State Electric and Gas Corporation
NYSERDA – New York State Energy Research and Development Authority
PE – Pledge Element
PFC - perfluorocarbon
SF_6 – sulfur hexafluoride
US EPA - United States Environmental Protection Agency
UNFCCC – United Nations Framework Convention on Climate Change

Executive Summary

First Environment, Inc. (First Environment) was retained by the Village of Millerton, New York (the "Village") to prepare a greenhouse gas (GHG) emissions inventory for the government operations activities of year 2020. The GHG inventory was prepared in accordance with the Local Governments for Sustainability (ICLEI)'s Local Government Operations Protocol (LGOP). ICLEI's ClearPath Pro web-based tool provided the platform for data collection, processing, and GHG quantification and reporting.

The GHG inventory assessed emissions of seven greenhouse gases (GHGs):

- carbon dioxide (CO_2),
- methane (CH_4),
- nitrous oxide (N_2O),
- hydrofluorocarbons (HFCs),
- perfluorocarbons (PFCs),
- sulfur hexafluoride (SF_6), and
- Nitrogen tri-fluoride (NF_3).

Conducting the GHG inventory demonstrates the Village's recognition of its relationship to both the local and global environment. It allows the Village to better understand and take responsibility for its activities and their climate impacts. Accordingly, the inventory provides a foundation and starting point for the Village's efforts to reduce greenhouse gas emissions from its activities and demonstrate environmental stewardship. The inventory serves as a reference point to guide the development of policies, programs, and projects as the Village pursues its environmental objectives.

The scope of the inventory included all emissions sources under the Village's operational control. This consisted of the Village's Scope 1 "direct" emissions from stationary and mobile combustion as well as Scope 2 "indirect" emissions from the purchase of electricity. The inventory did not quantify the optional Village Scope 3 emissions except for the required employee commute.

Emissions in the GHG Inventory are reported in Carbon Dioxide Equivalents (CO_2e). CO_2e is used to quantify total emissions because each GHG has a different Global Warming Potential (GWP). Using CO_2e equalizes all GHGs to one standard reference of metric tons of carbon dioxide equivalent. Unless otherwise noted in this report, GHG emissions were converted to CO_2e using Global Warming Potentials (GWPs), a standard conversion factor, from the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5).

TABLE 1: Summary of GHG Inventory

Reporting Protocol	Local Governments for Sustainability (ICLEI)'s Local Government Operations Protocol, v1.1, May 2010
Reporting Tool	ICLEI ClearPath – Government Track - https://clearpath.icleiusa.org
Geographic Boundary	Village of Millerton Municipal Boundary
Organizational Boundary	Operational Control
Operational Boundary	Scope 1, Scope 2, Scope 3 Employee Commute
Inventory Reporting Period	January 1 to December 31, 2020
Base Year	2020

GWP Defaults	IPCC 5th Assessment Report (AR5)

The Village's total Scope 1 GHG emissions for 2020 amounted to 44.75 metric tonnes carbon dioxide equivalents (t CO_2e). These total emissions consist of stationary combustion of fuel oil gas heating and mobile combustion of gasoline and diesel consumption by the Village fleet vehicles. As a point of reference, 44.75 t CO_2e is approximately equivalent to the GHG emissions produced by an average passenger vehicle driven 111,000 miles, according to the US EPA's Greenhouse Gas Equivalencies Calculator.

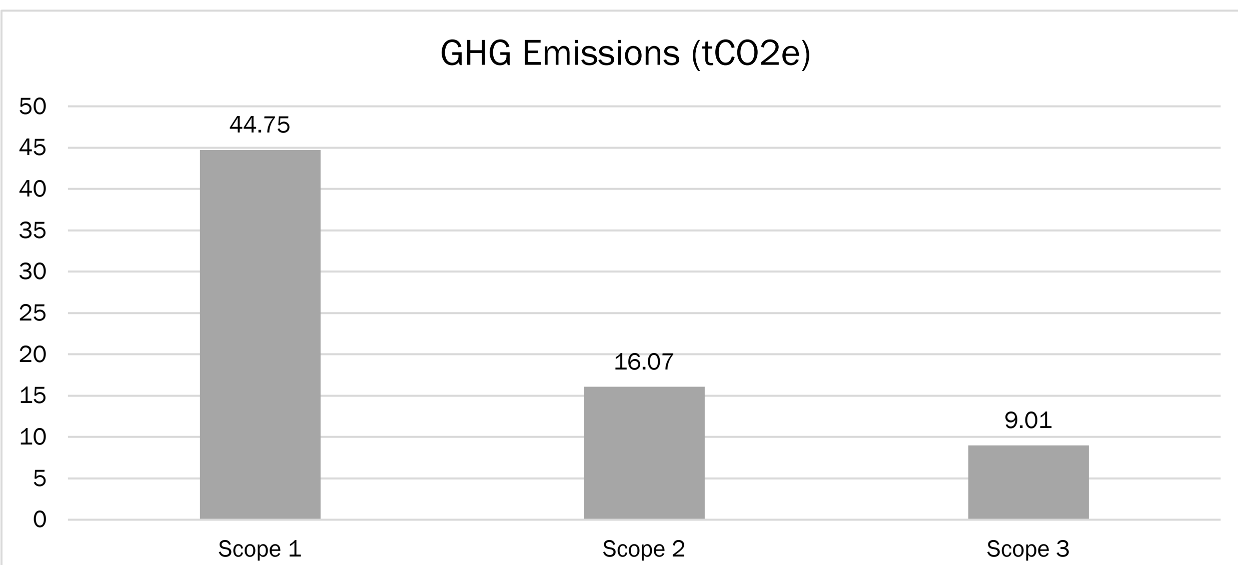
The Village's total Scope 2 GHG emissions for 2020 amounted to 16.07 metric tons carbon dioxide equivalents (t CO_2e). These emissions are associated with electricity usage by the Village and are roughly equivalent to the GHG produced from electricity used by three homes for one year.

The Village's Scope 3 GHG emissions for employee commute for 2020 amounted to 7.64 metric tons carbon dioxide equivalents (t CO_2e).

TABLE 2: Total GHG Emissions by Scope (tCO_2e)

Activity/Source	CO2e
Scope 1	44.75
Scope 2	16.07
Scope 3	9.01
Total	**69.83**

FIGURE 1: Total GHG Emissions by Scope (tCO_2e)



The distribution of emissions by sector is shown in percentage and in tCO_2e in the charts below.

FIGURE 2: Total GHG Emissions by Sector in Percentage

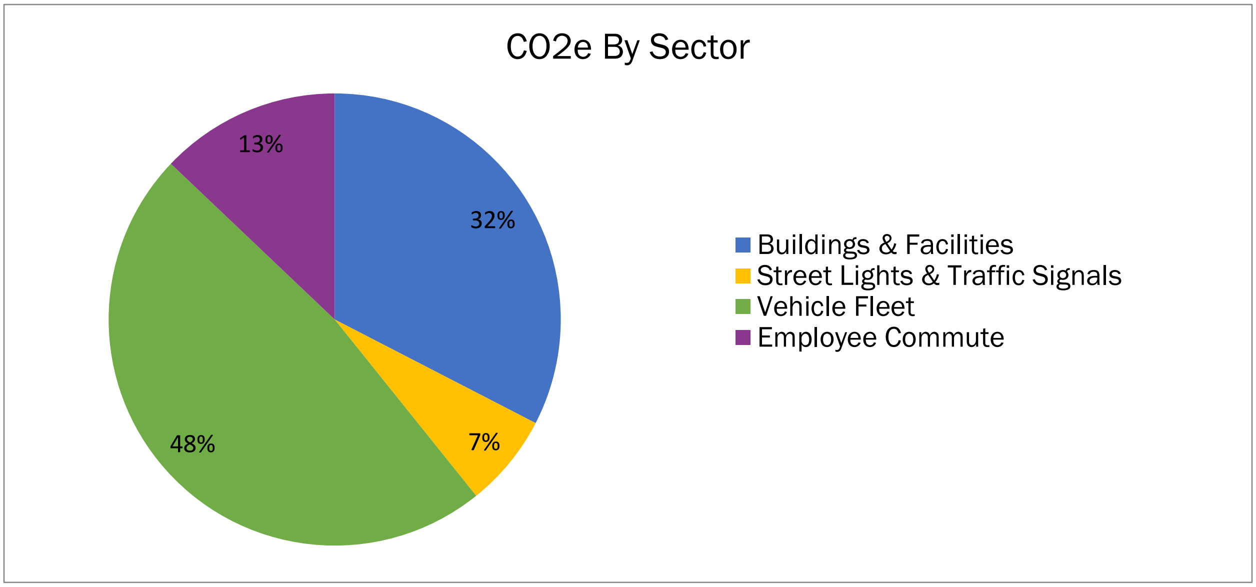
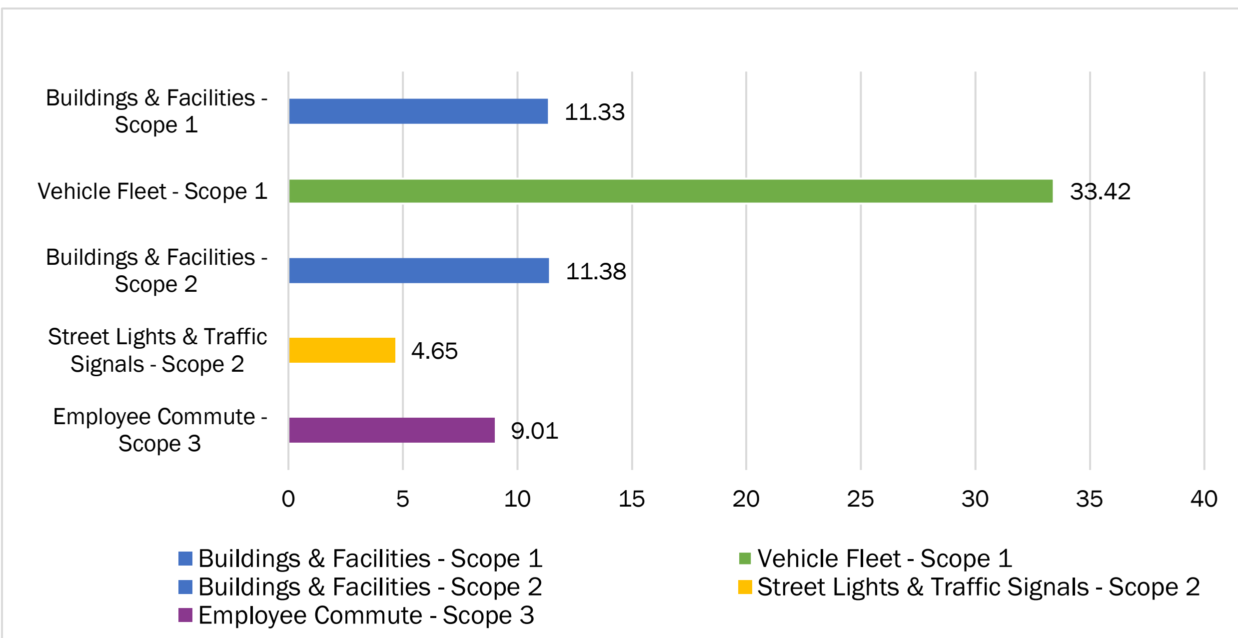


FIGURE 3: Total GHG Emissions by Sector (tCO_2e)



The results highlight fleet vehicle emissions as the largest source of GHG emissions. The Scope 1 and Scope 2 emissions from buildings and facilities rank as the next two largest sources. Emissions from employee commute rank fourth, followed by electricity consumption by streetlights.

1. Introduction

A GHG emissions inventory identifies an organization's GHG emission sources and quantifies them according to a set of acknowledged conventions using established estimation methodologies.

The Village of Millerton air emission inventory quantifies the release of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other common GHGs, including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and nitrogen tri-fluoride (NF_3), were also considered but no material sources identified. These are the most recognized and common GHGs from human-made sources, as identified in the United Nations Framework Convention on Climate Change Kyoto Protocol (UNFCCC).

The GHG inventory of local government operations (LGO) identifies the amounts of electricity and fuels used in municipal buildings, streetlights, fleets, and other operations controlled by the local government waste and water treatment are not currently conducted within the Village boundary, so GHG emissions from waste and water treatment are not included.

The LGO inventory does not include GHG emissions generated by the Village residents and businesses, including those produced by power generation facilities, if present. The emissions from these sources are accounted for separately and constitute the Community GHG emissions inventory, which are reported under a different Protocol (U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions). The Village of Millerton Community GHG Inventory is not included in the scope of this report. The Town of North East, which surrounds the Village, is also not included in the scope this report. The Town has issued their own GHG inventory report. Both municipalities will be issuing a joint Climate Action Plan (CAP).

2. Overview of the Village of Millerton

The Village of Millerton is located in Dutchess County, New York, approximately 100 miles north of New York City and about 65 miles south of Albany. The Village of Millerton is surrounded by the Town of North East which shares certain municipal functions. Both the Village and the Town participate in New York State's Climate Smart Communities program and will be issuing a joint Climate Action Plan. However, the Village and the Town will be issuing separate GHG inventories for their respective government operations.

According to the United States Census Bureau[1], the Village has a total area of 0.62 square miles, with a population of 903 as of the 2020 census. The surrounding Town of North East is bordered by the Town of Ancramdale to the north, State of Connecticut to the east, Town of Amenia to the south, and the Towns of Pine Plains and Stanford to the west.

The Village was founded on 1851. The Village operations consist of the Highway Department, the Water Department, the Police Department, and Parks and Recreation. The Village government staff is composed of 15 employees (mostly part-time).

The Village building and facilities are listed in the following table. All the buildings and facilities listed are owned and operated by the Village. The utilities include electricity and fuel oil.

TABLE 3: Buildings and Facilities with the Village Operations

Building / Facility
Pump Plant
Water Tower
Village Hall
Main Street Gazebo Outlet
Veterans Park Outlet
Rte 44 & 22 Outlet
Denny Park ("Eddie Collins Park")

In addition to the buildings and facilities listed above, the Village operations also include street lighting.

The Village operates a fleet of vehicles consisting primarily of pickups, heavy trucks, and equipment for the highway department. The fleet uses both diesel and gasoline fuel.

The Village does not currently operate waste disposal facilities or wastewater treatment facilities. The Village does not currently operate any public transportation vehicles, fire department, or waste hauling vehicles.

2.1 Staff Responsible for the GHG Inventory

In 2018, the Town of North East and the Village of Millerton each signed a pledge, along with hundreds of other municipalities around New York State, to develop community-wide climate mitigation strategies and improve sustainability. A Climate Smart Task Force was assembled

[1] https://data.census.gov/cedsci/all?q=north%20east%20ny

and is initiating projects that will build environmental and economic resiliency: Chris Kennan, Town of North East Supervisor; Griffen Cooper, Town of North East Councilman; Matthew Hartzog, Village of Millerton Trustee; Laurie Kerr, Village of Millerton Trustee; Kathy Chow, Task Force Coordinator; Jennifer Dowley, Rhiannon Leo-Jameson, Deborah Maier, Claire Owens, Tom Parrett, Eliot Ramos, Rich Stalzer, Andrew Stayman, Chris Virtuoso and Carrissa Whitehead. This GHG inventory was developed by First Environment through consultation with the Town and Village staff and members of the Town and Village Climate Smart Task Force.

2.2 GHG Inventory Reporting Protocol

The Village of Millerton Government Operations GHG inventory was conducted in accordance with the ICLEI's Local Government Operations Protocol (LGOP), Version 1.1, May 2010. The LGOP was developed through a partnership among the California Air Resources Board (ARB), California Climate Action Registry (CCAR), The Climate Registry, and ICLEI. The LGOP is based on the "Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard" developed by the World Business Council for Sustainable Development and the World Resources Institute (WRI/WBCSD), which provides the standards and guidance for companies and other types of organizations preparing a GHG emissions inventory. The goal was to offer additional guidance to local governments on applying the Greenhouse Gas Protocol within the context of local government operations. The LGOP provides a standardized method and procedures to assist local governments in quantifying and reporting GHG emissions associated with their operations.

2.3 GHG Inventory Reporting Tool

The GHG inventory was prepared using ICLEI's ClearPath Tool, an online platform designed to incorporate all the LGOP requirements for inventory data, including all parameters, factors, and methodologies necessary to perform the GHG emissions quantification. ClearPath suite of tools also includes modules allowing forecasting of emissions scenarios, as well as planning and monitoring of measures aimed at reducing GHG emission over time.

2.4 GHG Inventory Reporting Period – Base Year

This GHG inventory report covers GHG emissions from the Village operations within the boundaries described below during the period of:

- January 1 through December 31, 2020.

This first GHG Inventory provides a full calendar year baseline of data about the energy consumption and resulting GHG emissions from the Village municipal operations. The baseline will be used to establish emissions reductions targets and track progress towards achieving them. Although 2020 was during the Covid pandemic, a review of past years of activity data (energy and fuel consumption) shows little difference. The year 2020 was selected has being representative prior to the implementation of identified climate actions.

2.5 GHG Inventory Boundaries

2.5.1 Geographic Boundary

The geographic scope of the emissions report determines which emissions are accounted for and reported by the Village. The Village operations are conducted within the Village municipal boundary; the Village does not control or operate any facility outside such geographic boundary.

2.5.2 Organizational Boundaries

Organizational boundaries define the limits of a GHG inventory by identifying the activities that are owned and/or controlled by the entity and determining which emission sources should be included in its GHG inventory. As recommended by the LGOP, the GHG emissions contained in this report were consolidated according to the Operational Control approach. The operational control is established for facilities, activities, and sources over which the Village possesses the authority to implement operating policies such as financial, environmental, health, or safety directives. A description of the facilities and sources included in the Village's Operational Control boundary is provided in the following paragraph, further detailed according to the Operational Boundary described in the next paragraph.

2.5.3 Operational Boundaries

Operational boundaries in GHG inventory identifies the specific types of emission sources that the Village, as defined by the inventory's organizational boundaries, includes in its GHG Inventory. A key distinction in setting operational boundaries is whether GHG emissions sources are categorized as direct emissions or indirect emissions.

- Direct emissions (Scope 1): result from emission sources that are owned or operated by the organization.
- Indirect emissions (Scope 2, Scope 3): emissions that are due to an organization's activities but occur from sources owned or controlled by another organization.

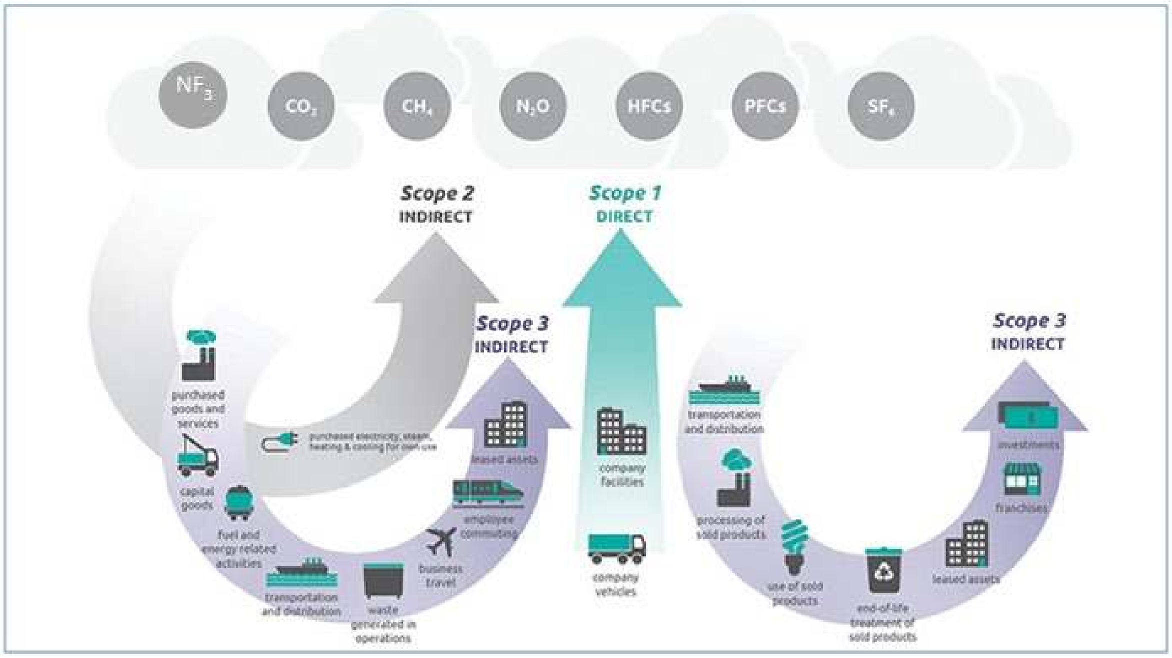
The concept of emission "scopes" expands upon the distinction between direct and indirect emissions, splitting indirect emissions into two separate categories: Scope 2, associated with indirect energy emissions, such as those due to electricity purchased from a utility; Scope 3, capturing all other types of indirect emissions, such as employee commuting, disposal of waste generated, etc. Due to the complexity of determining them, optional Scope 3 emissions are not included in this GHG inventory except as required for employee commute.[2]

In addition, categories of common sources, such as stationary combustion, mobile combustions, etc. create a framework for the organization of the inventory. This framework facilitates the identification of appropriate quantification methodologies for emission sources, collection of data, and reporting of inventory results.

The following diagram provides a summary of the scopes and categories of emissions across the value chain of a reporting entity, as defined in the WRI GHG Protocol.

[2] Scope 3 emissions related to local government employee commuting is required information under the LGOP v1.1 (2010).

FIGURE 4: Overview of GHG Protocol Scopes and Emissions Across the Value Chain



Source: GHG Protocol - Scope 3 Corporate Value Chain Accounting Reporting Standard_041613 (WRI, WBCSD)

The general operational boundaries of the Village GHG inventory are as follows:

Scope 1: Direct GHG emissions from activities that are owned or controlled by the reporting entity.

The Village Scope 1 GHG emission categories include the following:

- stationary combustion, and
- mobile combustion.

Scope 2: Indirect GHG emissions from the generation of purchased or acquired energy, such as electricity, which is consumed by the reporting entity.

The Village Scope 2 GHG emission categories include the following:

- purchased electricity.

Scope 3: All other indirect emissions not covered in Scope 2. Not included in this report except as required for employee commute.

The complete list of emission sources in the Village GHG inventory are listed in the following tables, organized by Scope and Sector.

2.6 Scope 1 - Direct Emissions

The following sources were identified as Scope 1 sources of GHG emissions:

TABLE 4: Scope 1 Emissions Sources

Scope	Source	Emission Category
Scope 1	2009 Case Backhoe	Emissions from Off Road Vehicles
Scope 1	5 Gallon Yellow Ca ID# 20	Emissions from Off Road Vehicles
Scope 1	5 Gallon Red Can ID# 21	Emissions from Off Road Vehicles
Scope 1	2016 Ford F-550	Fleet Vehicle Emissions
Scope 1	Unidentified Gas Used[3]	Fleet Vehicle Emissions
Scope 1	Unidentified Diesel Used[3]	Fleet Vehicle Emissions
Scope 1	2014 Ford F-150 Pick Up Truck	Fleet Vehicle Emissions
Scope 1	2019 Dodge 5500	Fleet Vehicle Emissions
Scope 1	1995 International 4700	Fleet Vehicle Emissions
Scope 1	Pump Plant	Emissions from Stationary Fuel Combustion

2.7 Scope 2 - Energy Indirect Emissions

The following sources were identified as Scope 2 sources of GHG emissions.

TABLE 5: Scope 2 Emissions Sources

Scope	Source	Emission Category
Scope 2	Village of Millerton Street Lights	Emissions from Grid Electricity
Scope 2	Pump Plant	Emissions from Grid Electricity
Scope 2	Water Tower	Emissions from Grid Electricity
Scope 2	Village Hall	Emissions from Grid Electricity
Scope 2	Main Street Gazebo Outlet	Emissions from Grid Electricity
Scope 2	Veterans Park Outlet	Emissions from Grid Electricity
Scope 2	Rte 44 & 22 Outlet	Emissions from Grid Electricity
Scope 2	Denny Park (aka Eddie Collins)	Emissions from Grid Electricity

2.8 Source Exceptions

No sources of HFCs, PFCs, NF_3 or SF_6 were identified in the Village inventory boundary.

2.9 Inventory Data Collection Methodologies

Two primary methodologies were utilized to collect data.

- Data was provided by the Village staff.
- In some cases when data were not available for a particular source, individuals with knowledge of the activities provided an estimate.

The collection methodology for each source is summarized below.

[3] Fuel was pumped from Taylor Oil in small miscellaneous quantities into unspecified vehicles and cans. As of June 2020, tracking is handled via Village fuel depot system.

2.10 Scope 1 Emissions

2.10.1 Stationary Combustion

The Village provided an inventory of the building and facilities owned and or operated by the Village. Each building in the inventory was designated as being under the Village control. Therefore, the related fuel and electricity consumption are included in the inventory.

2.10.1.1 Fuel Oil

The Village staff provided the total No. 2 Fuel Oil consumption for heating in the Village buildings for year 2020 compiled from vendor's invoices, quantified in gallons of fuel. Total fuel oil usage in Village-controlled buildings was calculated and the appropriate emissions quantification methodology from the LGOP was applied to this value.

2.10.2 Mobile Combustion

The Village provided the updated fleet inventory of the vehicles owned and operated by the Village. The fleet includes both on-road and off-road vehicles. The fleet inventory also included data on the vehicle age.

2.10.2.1 Gasoline

The Village staff provided a summary of 2020 gasoline usage in gallons attributable to Village's owned and operated vehicles. The appropriate GHG emissions quantification methodology was then applied.

2.10.2.2 Diesel

The Village staff provided a summary of 2020 diesel usage in gallons attributable to Village's owned and operated vehicles. The appropriate GHG emissions quantification methodology was then applied.

2.11 Scope 2 Emissions

2.11.1 Purchased Electricity

The Village staff provided all the utility invoices for year 2020 electricity consumption by Village buildings and district street lighting. The total electricity consumption was calculated by aggregating the invoices for each electrical service account, prorated as required for the months of January and December. The appropriate GHG emissions quantification methodology was applied to the annual totals for each account.

2.12 Scope 3 Emissions

Employee commute was the only Scope 3 emissions source included.

2.12.1 Employee Commute

The Village staff provided weekly milage for each employee. The appropriate GHG emissions quantification methodology was applied.

3. Emissions Quantification Methodologies

GHG emissions are calculated by applying the appropriate methodologies from:

- ICLEI's Local Government Operations Protocol (LGOP), Version 1.1, May 2010.

In addition, GHG emissions are calculated using emission factors (EF) sourced from:

- US EPA Center for Corporate Climate Leadership - Emission Factors for Greenhouse Gas Inventories – March 9, 2018.
- NYSERDA - Department of Energy and Environmental Analysis – Statewide Electricity Emission Factor - 2014.
- US EPA Emissions & Generation Resource Integrated Database - eGRID2020.
- Fifth Assessment Report of the Intergovernmental Panel on Climate Change - IPCC AR5.

The GHG emissions quantification was performed by ICLEI's ClearPath Pro Tool, which includes the algorithms calculating the emission according to LGOP methods.

The quantification methodology for each source is summarized in the following paragraphs.

3.1 Scope 1 Emissions

3.1.1 Stationary Combustion

3.1.1.1 Fuel Oil

Emissions were calculated according to Equations 6.2 and 6.4 of LGOP by multiplying the total gallons of fuel oil usage by stationary sources by the appropriate CO_2, CH_4, and N_2O emission factors sourced from US EPA emission factors for GHG inventories. The results of these calculations in metric tonnes of CO_2, CH_4, and N_2O emissions were converted to metric tonnes of CO_2e by multiplying for the appropriate IPCC AR5 GWP factor for each GHG.

3.1.2 Mobile Combustion

3.1.2.1 Gasoline

For on-road vehicles, GHG emissions were calculated according to Equation 7.2 of LGOP by multiplying the total gallons of gasoline usage for mobile sources by the appropriate CO_2 emission factor sourced from the US EPA emission factors for GHG inventories. Emissions of CH_4, and N_2O were calculated according to Equations 7.6 and 7.7 of LGOP by multiplying the estimated mileage driven by the vehicles in each fleet category for the appropriate CH_4, and N_2O emission factors sourced from the US EPA emission factors for GHG inventories.

A similar approach was used for non-road vehicles. GHG emissions were calculated according to Equation 7.2 of LGOP by multiplying the total gallons of gasoline usage by mobile sources by appropriate CO_2, CH_4, and N_2O emission factors sourced from the US EPA emission factors for GHG inventories.

The results of these calculations in metric tonnes of CO_2, CH_4, and N_2O emissions were converted to metric tonnes of CO_2e by multiplying for the appropriate IPCC AR5 GWP factor for each GHG.

3.1.2.2 Diesel

For on-road vehicles, GHG emissions were calculated according to Equation 7.2 of LGOP by multiplying the total gallons of diesel usage for mobile sources by the appropriate CO_2 emission factor sourced from the US EPA emission factors for GHG inventories. Emissions of CH_4 and N_2O were calculated according to Equations 7.6 and 7.7 of LGOP by multiplying the estimated mileage driven by the vehicles in each fleet category for the appropriate CH_4, and N_2O emission factors sourced from the US EPA emission factors for GHG inventories.

A similar approach was used for non-road vehicles. GHG emissions were calculated according to Equation 7.2 of LGOP by multiplying the total gallons of diesel usage by mobile sources by appropriate CO_2, CH_4, and N_2O emission factors sourced from the US EPA emission factors for GHG inventories.

The results of these calculations in metric tonnes of CO_2, CH_4, and N_2O emissions were converted to metric tonnes of CO_2e by multiplying for the appropriate IPCC AR5 GWP factor for each GHG.

3.2 Scope 2 Emissions

3.2.1 Purchased Electricity

Location-based electricity GHG emissions were calculated according to Equation 6.10 and 6.11 of the LGOP by multiplying the total electricity consumption in MWh by Village-controlled buildings and street lighting for the appropriate CO_2, CH_4, and N_2O electricity emission factors sourced from NYSERDA–NYS CSC. The results of these calculations in metric tonnes of CO_2, CH_4, and N_2O emissions were converted to metric tonnes of CO_2e by multiplying for the appropriate IPCC AR5 GWP factor for each GHG.

An equivalent calculation was performed to quantify “market-based electricity emissions.” Because the Village does not make use of any direct supply of electricity from dedicated sources or of any contractual instruments that would convey specific emissions rates for the purchased electricity, the market-based electricity GHG emissions are equivalent to the location-based electricity GHG emissions.

Electric Power Transmission and Distribution Losses were also calculated, using the transmission and distribution losses factor for NYS from US EPA eGRID2020 databases. Upstate New York has a very low electricity emission intensity (234.5 lb CO_2e/MWh) compared to the US average (822.6 lb e/MWh) due to its high use of renewable energy (e.g., Hydro-electric).

3.3 Scope 3 Emissions

Scope 3 GHG emissions from Village operations were not accounted for and are not included in this Inventory except as required for employee commute. A quantification method similar to the approach used for mobile combustion was applied to calculate emissions from employee commute based on the mileage provided.

3.4 Global Warming Potentials

The Global Warming Potentials, identified in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, were used to convert the GHG emissions associated with Airport activities into carbon dioxide equivalents (CO_2e).

The Global Warming Potentials applied to the Village GHG inventory are the following:

TABLE 6: Global Warming Potentials

Name	Chemical Formula	SAR GWP Value
Carbon Dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265

3.5 Quantification of Emissions

3.5.1 Scope 1 GHG Emissions

The Village Total Scope 1 Emissions were quantified as 44.75 metric tonnes (t) CO_2e. The quantity includes contributions of the following GHGs:

TABLE 4: Scope 1 GHG Emissions

Greenhouse Gas	t GHG	t CO2e
Carbon Dioxide (CO_2)	46.2858622	46.2858622
Methane (CH_4)	0.0016655	0.046634
Nitrous Oxide (N_2O)	0.00011546	0.0305969
Total		46.363093

The distribution of Scope 1 emissions by sector is shown in percentage and in tCO2e in the charts below.

FIGURE 5: Scope 1 Emissions by Sector, in Percentage

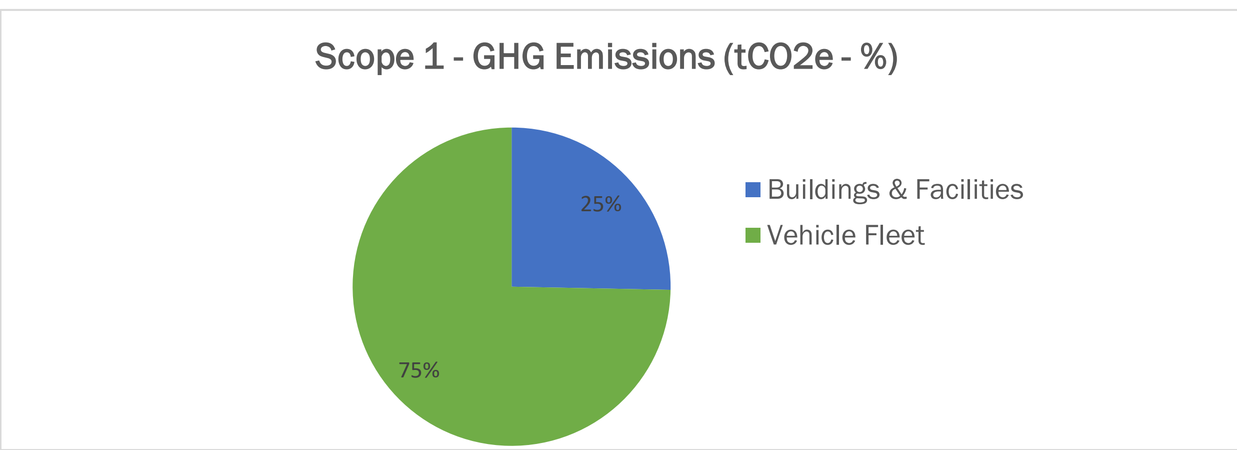
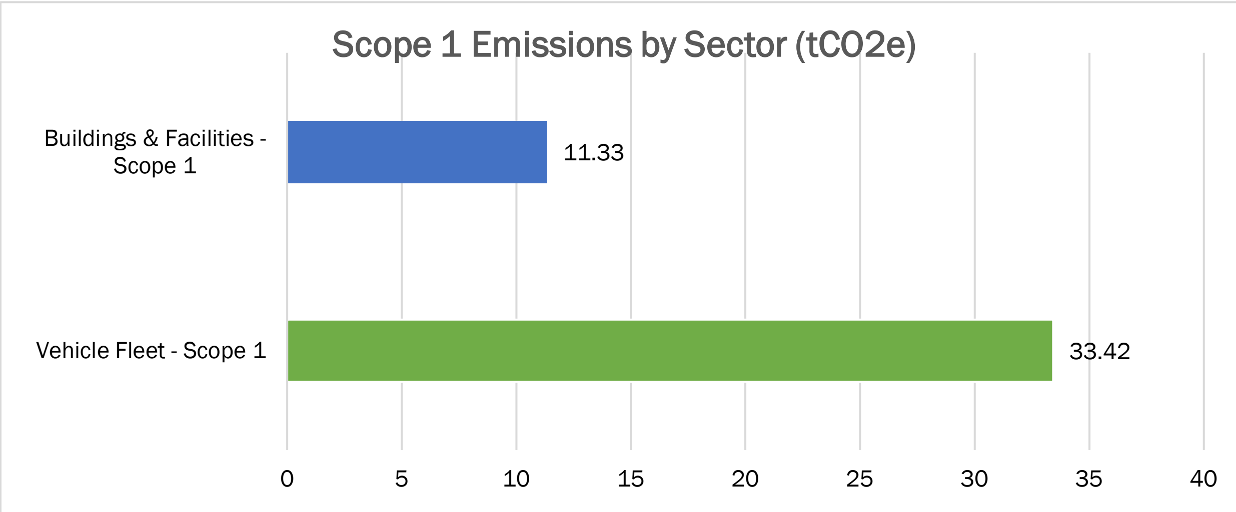


FIGURE 6: Scope 1 Emissions by Sector (tCO_2e)



The results show that emissions from the vehicle fleet amount to nearly three times the number of emissions from buildings and facilities.

The following paragraphs detail the sources of GHG emissions in each sector, identifying the contribution by each fuel.

3.5.1.1 Direct Stationary Combustion Emissions – Building and Facilities

The Village direct stationary combustion emissions were quantified as 11.33 t CO_2e. This stationary combustion quantity comes from fuel oil.

3.5.1.2 Direct Mobile Combustion Emissions – Vehicle Fleet

The Village direct mobile combustion emissions were quantified as 33.42 t CO_2e. This mobile combustion quantity includes contributions from the following fuels:

TABLE 8: Direct Mobile Combustion Emissions by Fuel

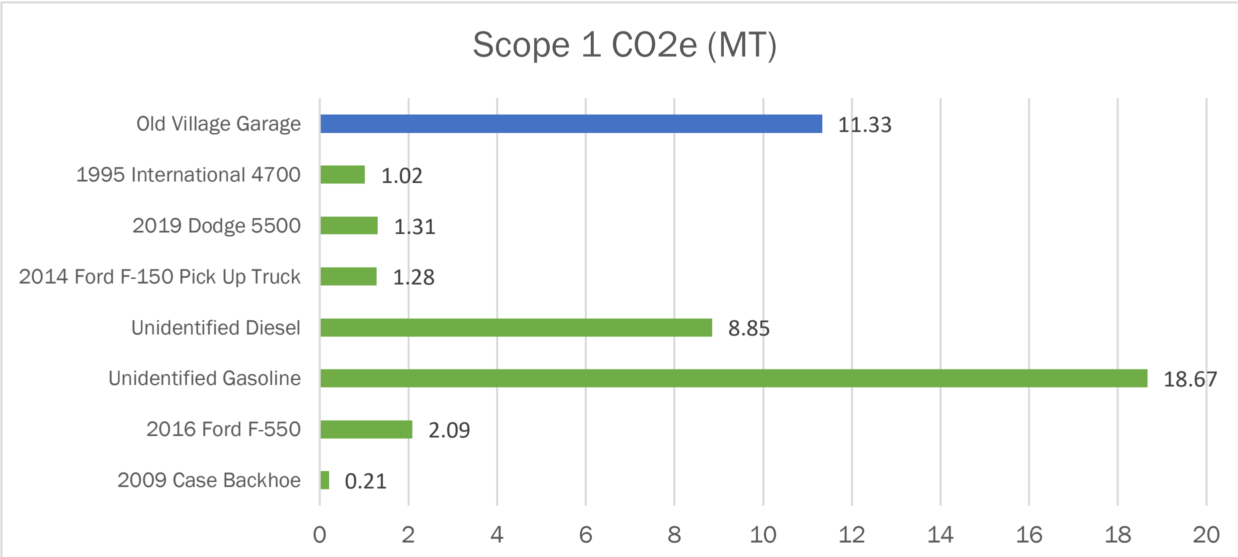
Mobile Combustion Emissions	
Fuel	t CO_2e
Gasoline	20.70
Diesel	14.33
Total	**35.03**

3.5.2 Scope 1 Emissions by Source

The following table and charts show the Scope 1 emissions from each specific source, as identified in the inventory. For each source, the energy usage responsible for the emissions is also reported.

The Scope 1 results displayed in a bar diagram:

FIGURE 8: Total Scope 1 Emission by Source (tCO_2e)



The detailed breakdown above indicates Unidentified Gasoline used as responsible for the largest share of emissions.

3.5.3 Scope 2 GHG Emissions – Purchased Electricity

All Scope 2 emissions reported are from purchased electricity. Total Scope 2 Emissions were quantified as 16.07 metric tonnes t CO_2e, including contributions of the following GHGs:

TABLE 10: Scope 2 GHG Emissions

Greenhouse Gas	t GHG	t CO2e
Carbon Dioxide (CO_2)	16.0022699	16.0022699
Methane (CH_4)	0.00109647	0.03070111
Nitrous Oxide (N_2O)	0.00013706	0.03632051
Total		16.069292

The distribution of Scope 2 emissions by sector is shown in percentage and in tCO_2e in the charts below.

FIGURE 9: Scope 2 Emissions by Sector, in Percentage

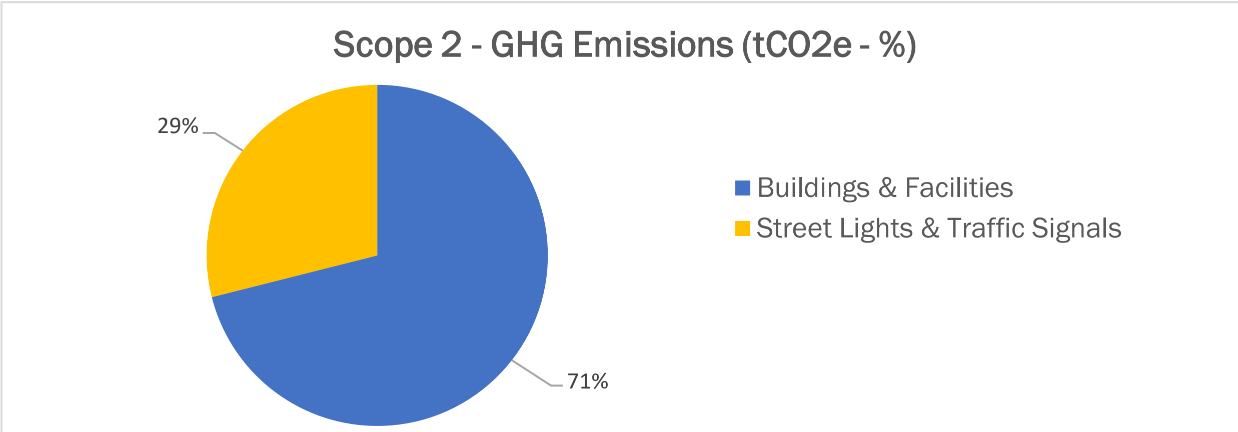
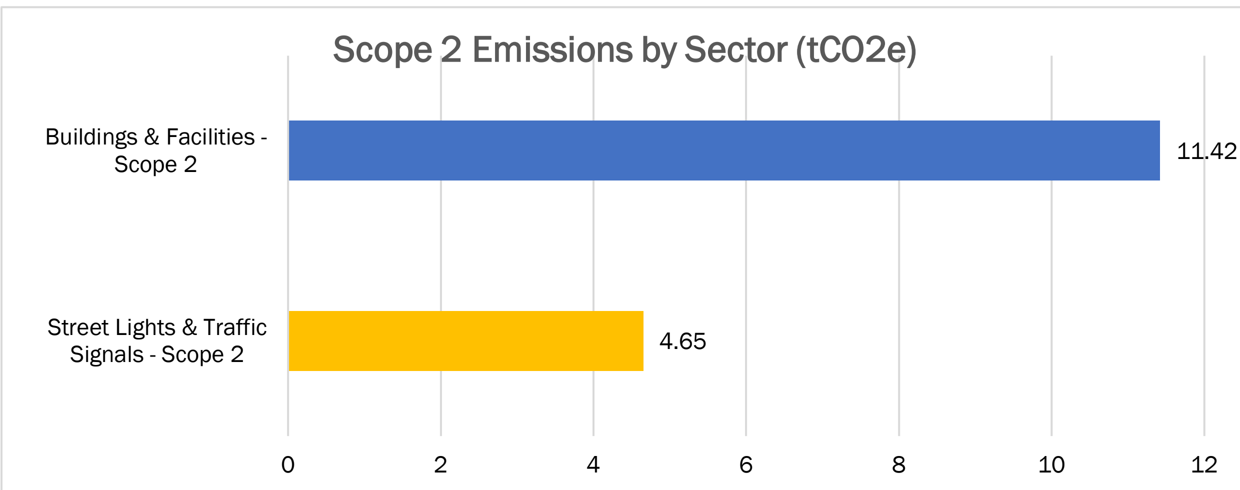


FIGURE 10: Scope 2 Emissions by Sector (t CO_2e)



The results indicate that electricity consumption by buildings and facilities is higher than that by street lights.

3.5.4 Scope 2 Emissions by Source

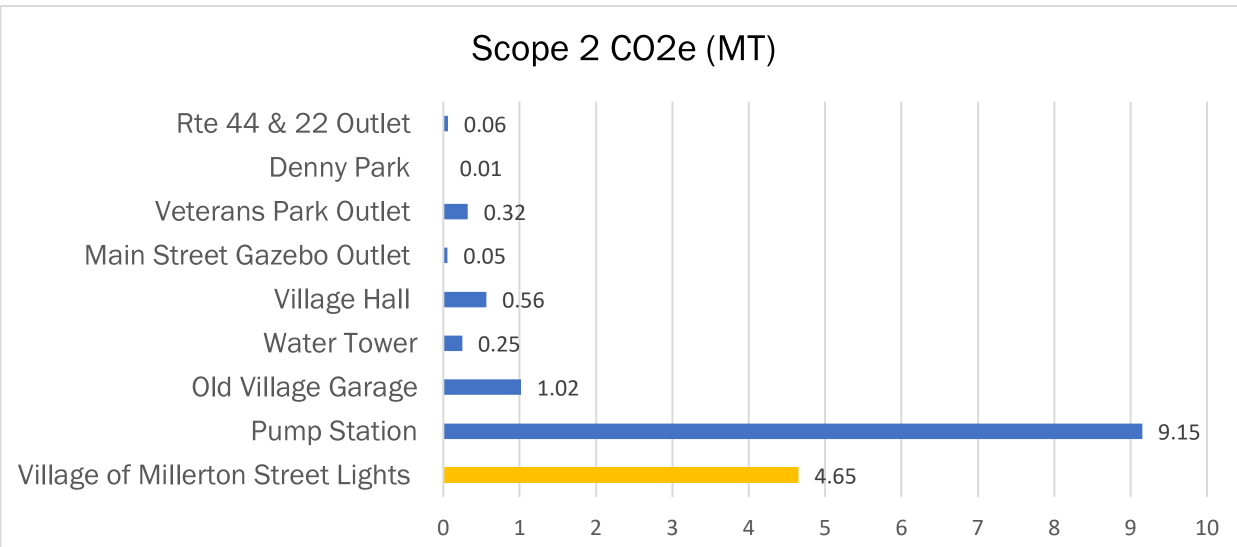
The following table and chart show the Scope 2 emissions from each specific source, as identified in the inventory. For each source, the energy usage responsible for the emissions is also reported, expressed in kWh of electricity used.

TABLE 11: Scope 2 Emissions from Each Specific Source (tCO_2)

Source	Sector	Energy Use (kWh)	GHG Emissions (tCO_2e)
Old Village Garage	Emissions from Grid Electricity	9,560	1.02
Pump Plant	Emissions from Grid Electricity	86,040	9.15
Water Tower	Emissions from Grid Electricity	2,314	0.25
Village Hall	Emissions from Grid Electricity	5,283	0.56
Main Street Gazebo Outlet	Emissions from Grid Electricity	517	0.05
Veterans Park Outlet	Emissions from Grid Electricity	3,016	0.32
Rte 44 & 22 Outlet	Emissions from Grid Electricity	574	0.06
Denny Park	Emissions from Grid Electricity	59	0.01
Village of Millerton Street Lights	Emissions from Grid Electricity	43,718	4.65

The same results displayed in a bar diagram:

FIGURE 7: Scope 2 Emission by Source (tCO_2e)



The results show that the Pump Plant is responsible for the majority of the Scope 2 emissions, followed by street lights. The remaining buildings and facilities produce relatively lower emissions.

3.5.5 Scope 3 GHG Emissions

Total Scope 3 Emissions were not quantified for the GHG Inventory except as required for employee commute. The Village Total Scope 3 Emissions were quantified as 7.64 metric tonnes (t) CO_2e.

3.6 GHG Inventory Results

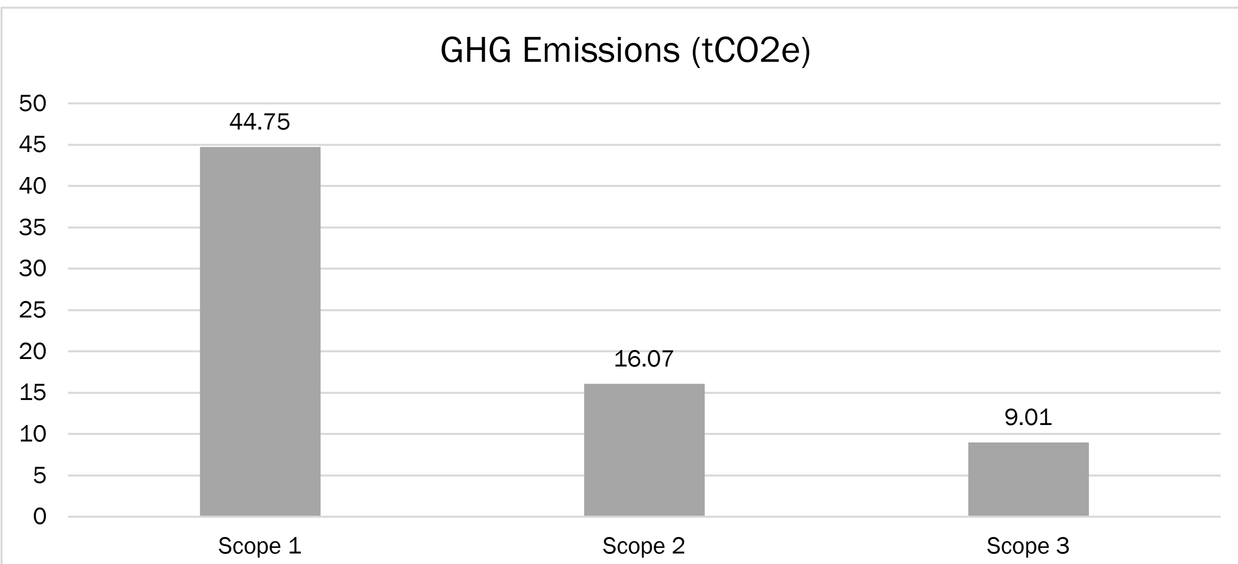
The Village's total Scope 1 GHG emissions for 2020 amounted to 44.75 metric tonnes carbon dioxide equivalents (t CO_2e). These total emissions consist of stationary combustion of fuel oil gas heating and mobile combustion of gasoline and diesel consumption by the Village fleet vehicles. As a point of reference, 44.75 t CO_2e is approximately equivalent to the GHG emissions produced by an average passenger vehicle driven 111,000 miles, according to the US EPA's Greenhouse Gas Equivalencies Calculator.

The Village's total Scope 2 GHG emissions for 2020 amounted to 16.07 metric tons carbon dioxide equivalents (t CO_2e). These emissions are associated with electricity usage by the Village and are roughly equivalent to the GHG produced from electricity used by three homes for one year.

TABLE 12: Total GHG Emissions by Scope (tCO_2e)

Activity/Source	CO2e
Scope 1	44.75
Scope 2	16.07
Scope 3	9.01
Total	**69.83**

FIGURE 12: Total GHG Emissions by Scope (tCO_2e)



The distribution of emissions by sector is shown in percentage and in tCO_2e in the charts below.

FIGURE 13: Total GHG Emissions by Sector in Percentage

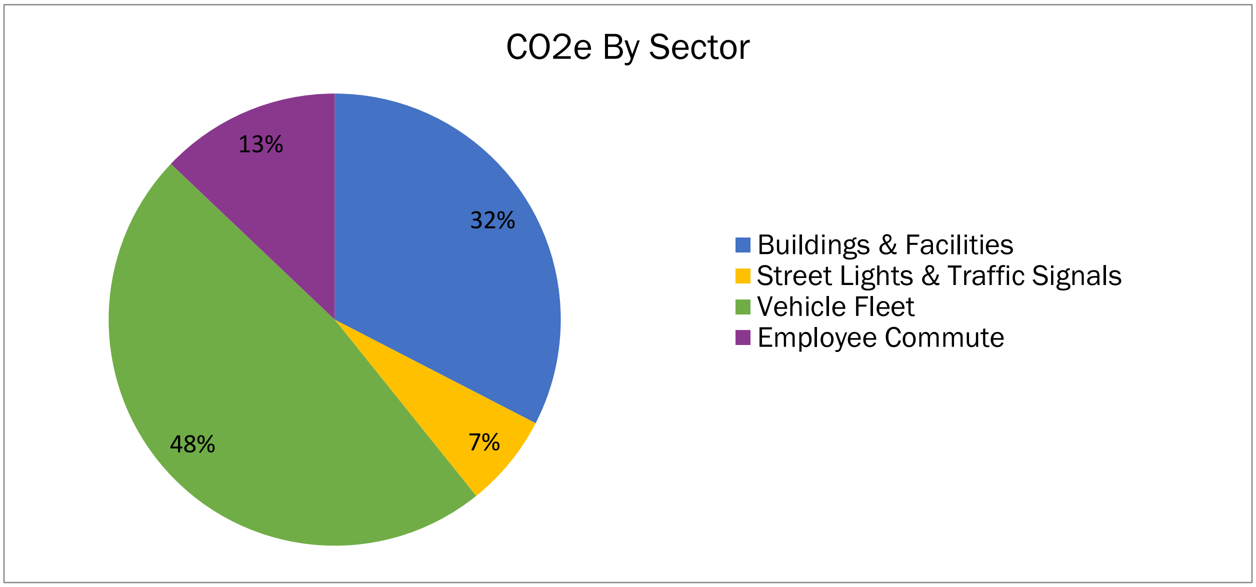
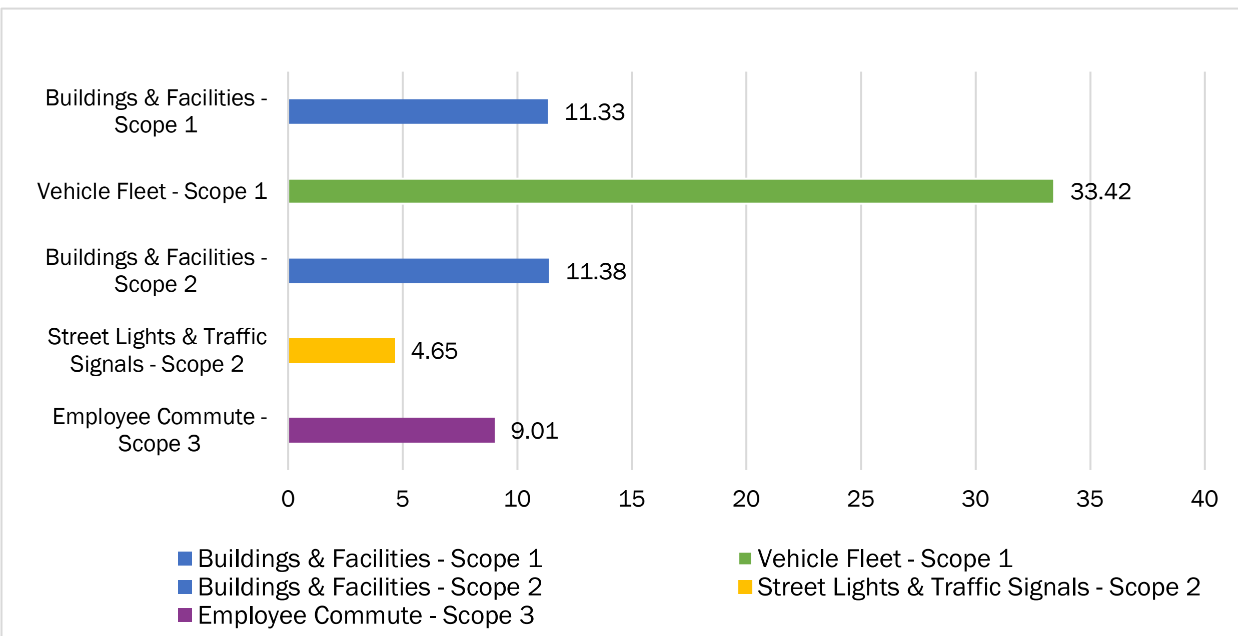


FIGURE 14: Total GHG Emissions by Sector (tCO_2e)



The results highlight fleet vehicle emissions as the largest source of GHG emissions. The Scope 1 and Scope 2 emissions from buildings and facilities rank as the next two largest sources. Emissions from employee commute rank fourth, followed by electricity consumption by streetlights.

4. GHG Inventory Base Year

A GHG inventory base year provides a standardized point of reference against which future inventories can be compared to identify changes, such as reductions, or track progress toward an emission goal or action plan. The Village has selected year 2020 as the GHG inventory base year.

4.1 GHG Inventory Forecast

Once the Base Year has been selected, the next step is to select one or multiple future years by which the Village wishes to reach certain emissions reduction goals. The GHG emissions for that future year are estimated presuming Business As Usual (BAU) growth of emissions from the base year. BAU refers to a scenario where the Village pursues no measures or actions aimed at reducing energy consumption and GHG emissions.

The Village has selected to develop BAU projections of GHG emissions inventory at 1-, 5-, and 10-year intervals from the Base Year. Emissions forecast for each one of these target years will be used as baseline to select appropriate reduction targets and to evaluate the actual results that could be achieved by implementing various reduction measures.

In order to develop the BAU scenario, First Environment evaluated several factors that could affect the GHG emissions independently from any action planned and implemented by the Village. Among the many possible factors, the following were reviewed for analysis and discussion:

- weather data normalization;
- Village of Millerton Demographic Trends;
- energy use in NYS;
- carbon intensity of electric grid in NYS.

4.2 Weather Data Normalization

The Village's location in the Hudson Valley makes its energy and fuel use, as well as its GHG emissions in a given year, dependent upon the weather experienced during that year, both in terms of temperature and precipitation. Besides average temperature, the number of Heating Degree Days (HDD) and Cooling Degree Days (CDD) are useful parameters frequently used to compare energy usage in buildings. HDD is the number of degrees that a day's average temperature is below 65°F, which is the reference temperature below which buildings need to be heated. When the mean daily temperature is above 65°F, HDD is zero. Similarly, CDD data can be used to estimate the energy required for cooling and is defined as the number of degrees that a day's average temperature is above 65°degrees. When the mean daily temperature is lower than 65°F, CDD is zero.

Due to the complexity of modeling the normalization to HDD/CDD and its possible effects on fuels, electricity consumption and therefore GHG emission, no quantitative correction of the 2020 GHG inventory is being performed.

4.3 Village of Millerton Demographic Trends

One factor that could indirectly affect the LGO GHG emissions could be the Village demographic trend in the next decades. While it is unlikely a direct relation, it is reasonable to link the GHG emissions to the demographic trends, assuming for example that a considerable increase in the Village population would lead to an increase in the size of the LGO infrastructure, service fleet, road maintenance and repairs services, Village staff, etc.

Demographic projections specific for the Village of Millerton could not be sourced, so an estimate of actual population trend for the Village were inferred from a combination of Dutchess County population projections and North East historical trend.

The following data is extracted from a study conducted by Cornell University, Program on Applied Demographics[4], providing projection of population growth in New York State from 2010 to 2035. The data is organized by County and the results for Dutchess County are reported in the table below.

TABLE 5: Dutchess County Population Growth Projections 2010 - 2035

Year	2010	2015	2020	2025	2030	2035	2040
Projected Population	297,488	303,374	309,985	316,091	320,734	323,935	326,402
Variation		5,886	6,611	6,106	4,643	3,201	2,467
Variation %		1.98%	2.18%	1.97%	1.47%	1.00%	0.76%
Variation %/year		0.40%	0.44%	0.39%	0.29%	0.20%	0.15%

The demographic projection shows an increase in population in the county at an annual rate of ~0.4% until 2025 then decreasing to 0.2-0.15 percent.

The following US Census information for North East illustrates the population trend from 1970 to 2020, showing population fluctuations but no steady increase or decrease.

TABLE 14: Village of Millerton Population Historical Data 1970 - 2020

Year	1970	1980	1990	2000	2010	2020
Millerton Population	1,042	1,013	884	925	958	903

Source: U.S. Census Bureau

The historical data seems to indicate that Village is not yet following the population growth projected for the County. It is anticipated that the Village may grow its population related to improved infrastructure (e.g., wastewater treatment). However, it does not seem the potential Village's population change will be significant and, as such, the demographic trends are not going to be included in the GHG inventory forecast.

4.4 Energy Consumption in NYS

The U.S. Energy Information Administration (EIA) provides a large amount of information on energy and fuel usage in the U.S., detailed according to numerous parameters such as economic sectors, user categories, and geographic location. Both historic and forecast data is available and the latter was reviewed to extrapolate energy usage change trends that could be useful to project Village energy use and GHG emissions in the future.

[4] https://pad.human.cornell.edu/counties/projections.cfm

In particular, data from the "2021 EIA Energy Outlook[5]" detailing New England region projected energy consumption for 2020 to 2050[6] were reviewed and the CAGR calculated.

The following change rates were identified for use in the Village's GHG 10 year inventory forecast for the period from 2020 to 2031:

TABLE 15: EIA Energy Outlook Consumption for 2017 to 2028

GHG Inventory Sector	Energy Source	Projected Consumption Change Rate (%/year)	Information Source
Buildings and Facilities	Electricity Consumption	-0.03%	EIA Forecast for Residential Commercial Energy Use
Buildings and Facilities	Distillate Fuel Oil - Stationary	-2.87%	EIA Forecast for Residential Commercial Energy Use
Fleet	Gasoline	-1.51%	EIA Forecast for Transportation Energy Use
Fleet	Diesel	-0.78%	EIA Forecast for Transportation Energy Use
Fleet	Construction	-0.78%	EIA Forecast for Transportation Energy Use

It can be observed that in general, the projected consumption trends show a decrease in energy usage in both stationary and mobile sources.

4.5 Carbon Intensity of Electricity Grid in NYS

Besides the data on energy consumption, key factors that will affect the GHG inventory result are the specific emission factors of the various energy sources included in the inventory.

To simplify the approach, we assumed that fuel emission factors would not change in the near future. This is reasonable since fuel emission factors are strictly linked to the chemical composition of fuels and these are not projected to change significantly in the near future.

The electricity grid emission factors are instead steadily decreasing due to increase of renewable energy generation and shift from coal to natural gas for the fossil fuel portion. The steady decrease of nuclear energy in the generation mix on the other hand could lead to a temporary increase in grid emissions before sufficient renewable energy is deployed to replace the lost generation power.

The forecast of the grid emission factor considers the historical trend of the NYSERDA GHG factor for NYS, from 2010 to 2014, published in the CSC guidance for Community GHG inventories[7] and U.S. EPA eGRID emission intensity data for electricity generation in the New York Upstate subregion, from 2010 to 2020[8].

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[5] https://www.eia.gov/outlooks/aeo/
[6] https://www.eia.gov/outlooks/aeo/data/browser/
[7] http://www.dec.ny.gov/docs/administration_pdf/ghgguide.pdf
[8] US EPA eGRID 2014 (Calendar Year 2010) Summary Tables, https://19january2017snapshot.epa.gov/energy/egrid-2014-summary-tables_.html and eGRid 2020 Summary Tables, Summary Data | US EPA.

TABLE 16: NYSERDA New York Average Grid Carbon Intensity

Year	Grid Emission Factor (lbs CO_2e/MWh)	Annual Rate of change (%/year)
2010	826	-6.73%
2011	826	
2012	625	
2013	625	
2014	625	

The CAGR calculated for the short period was -6.73 percent, annual percent rate of decrease. Because of the short timeframe of historical data available and the significant rate decrease, the data was compared to U.S. EPA's eGRID emission intensity data for electricity generation in the New York Upstate subregion, from 2010 to 2020.

TABLE 17: NYS Estimated GHG Emissions from Fuel Combustion – Electricity Generation

Year	GHG Emissions (lbs CO_2e/MWh)	Annual Rate of change (%/year)	Annual Rate applied in forecast
2010	548.37	-5.7%	**-5.7 %**
2020	234.5		

The latest eGRID information show a somewhat lower rate of decarbonization compared to the older NYSERDA information. Nonetheless, this data confirms the steady decrease of GHG emissions from energy generation on a long-time span of historical data. It must be also taken into account that the 2020 eGRID information was used in calculating the inventory's Scope 2 emissions. For consistency, the eGRID compound rate of -5.7 percent/year is deemed more appropriate to reflect the decreasing trend of the electric grid carbon intensity and apply it to forecast the Village's GHG Inventory for the next 10 years.

5.0 GHG Inventory Forecast: Business as Usual

As previously mentioned, a BAU forecast refers to a scenario where the Village pursues no measures or actions aimed at reducing energy consumption and GHG emissions. Two factors were identified that could potentially affect the BAU scenario, and both were included in a detailed analysis: 1) EIA Energy Consumption Trend and 2) Electricity Grid Carbon Intensity Variation.

5.1 BAU – EIA Energy Consumption Trend and Electricity Grid Carbon Intensity Variation

This forecast presumes no significant changes in Village emissions due to weather or population trends. This forecast applies the EIA 2020-2050 energy consumption outlook trends (decreasing) to the various categories of energy and emissions included in the Village's GHG inventory base year. This forecast also applies the expected decrease in carbon intensity of the NYS electricity grid, projected at –5.7 percent/year, thus reducing the electricity grid EF.

While this forecast does not specify any specific reduction implemented by the Village government, the actions are somewhat implied within the EIA projections where the decrease in energy consumption and associated emissions is predicted because of technology advancement, mandated stricter energy efficiency, emissions requirements at Local, State and Federal level, and behavioral changes by end-users in the community. The reduction due to projected consumption change could be significant for all scopes.

This BAU forecast also benefits from the progressive de-carbonization of the NYS grid electricity. Therefore, achieving the reduction targets will be in part facilitated by the measures implemented by the electric utilities at state level. The reduction due to the progressive de-carbonization of the NYS grid electricity will be important for Scope 2 emission, but it will have no effect on Scope 1 and Scope 3 – Employee Commute emissions.

As such, this scenario should be interpreted as a prediction of the results that could be achieved by the Village if it correctly plans and implements measures in line with the expected trend in energy efficiency, renewable energy, and general technology advancement.

TABLE 18: BAU – EIA Energy Consumption Trend, Electricity Grid EF Variation - GHG Emissions 2020 – 2031 (tCO_2e)

Scope	Source	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Scope 1	Buildings - Fuel Oil No. 2	11	11	11	10	10	10	10	9	9	9	8	8
Scope 1	Fleet Vehicle - Gasoline	20	20	19	19	19	18	18	18	18	17	17	17
Scope 1	Fleet Vehicle - Diesel	13	13	13	13	13	13	13	13	12	12	12	12

Scope	Source	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Scope 1	Fleet-Large Utility	0	0	0	0	0	0	0	0	0	0	0	0
Scope 2	Buildings - Electricity Energy	11	11	10	10	9	9	8	8	7	7	6	6
Scope 2	Streetlights - Electricity Energy	5	4	4	4	4	3	3	3	3	3	3	2
Scope 3	Employee Commute	9	9	9	9	8	8	8	8	8	8	8	8

TABLE 19: BAU - EIA Energy Consumption Trend, Electricity Grid EF Variation - GHG Emissions 2020 – 2031 by Scope (tCO_2e)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Total Scope 1 Emissions (tCO2e)	44	44	43	42	42	41	41	40	39	38	37	37
Total Scope 2 Emissions (tCO2e)	16	15	14	14	13	12	11	11	10	10	9	8
Total Scope 3 Emissions (tCO2e)	9	9	9	9	8	8	8	8	8	8	8	8
Total GHG Emissions (tCO2e)	69	68	66	65	63	61	60	59	57	56	54	53

TABLE 20: BAU - EIA Energy Consumption Trend, Electricity Grid EF Factor Variation - GHG Emissions Variation to Base Year 2020 (%)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Scope 1 change to 2020 Baseline (%)	0%	0%	-2%	-5%	-5%	-7%	-7%	-9%	-11%	-14%	-16%	-16%
Scope 2 change to 2020 Baseline (%)	0%	-6%	-13%	-13%	-19%	-25%	-31%	-31%	-38%	-38%	-44%	-50%
Scope 3 change to 2020 Baseline (%)	0%	0%	0%	0%	-11%	-11%	-11%	-11%	-11%	-11%	-11%	-11%
Total GHG Emissions change to 2020 Baseline (%)	0%	-1%	-4%	-6%	-9%	-12%	-13%	-14%	-17%	-19%	-22%	-23%

The results of the forecast are also shown in the charts below:

FIGURE 18: BAU – EIA Energy Consumption Trend, Electricity Grid EF Variation - GHG Emissions 2020 – 2031 (tCO_2e)

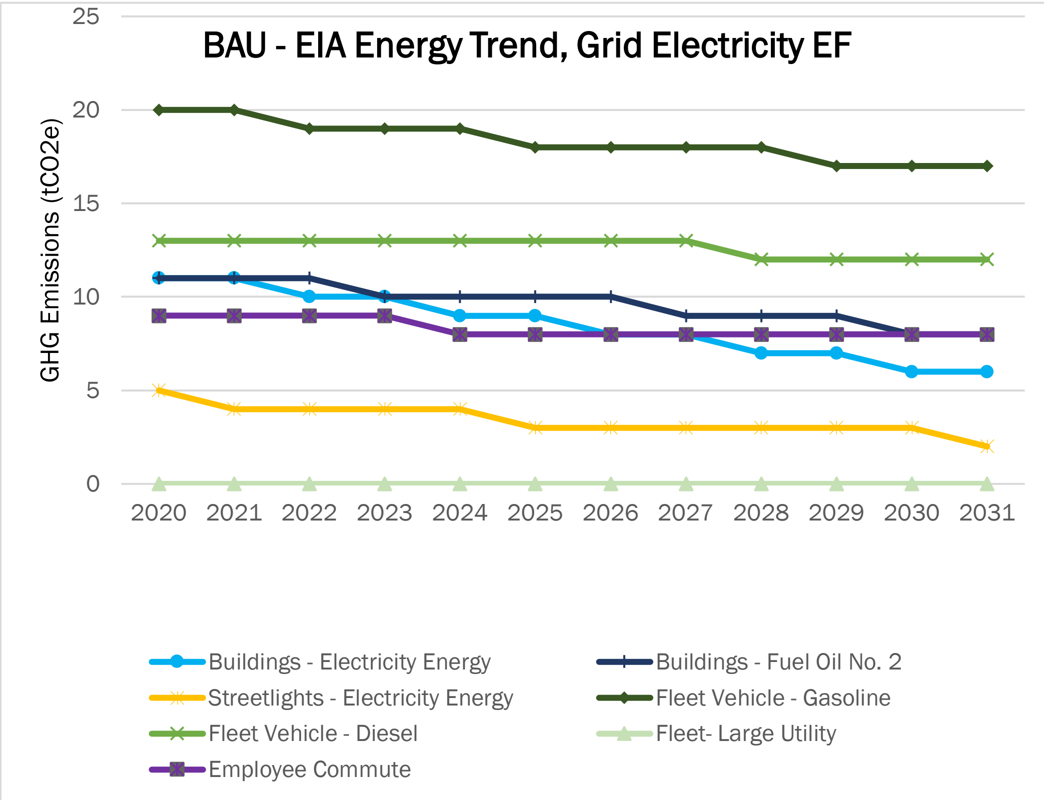


FIGURE 19: BAU - EIA Energy Consumption Trend, Electricity Grid EF Variation - GHG Emissions 2020 – 2031 by Scope (tCO_2e)

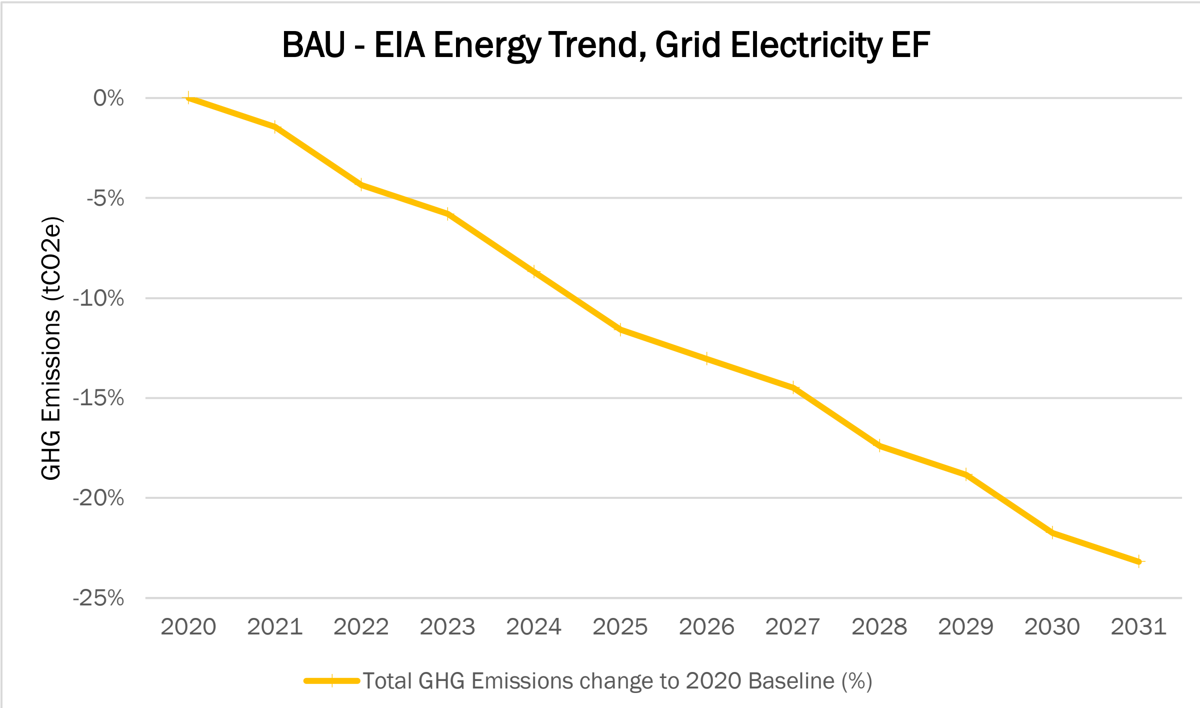
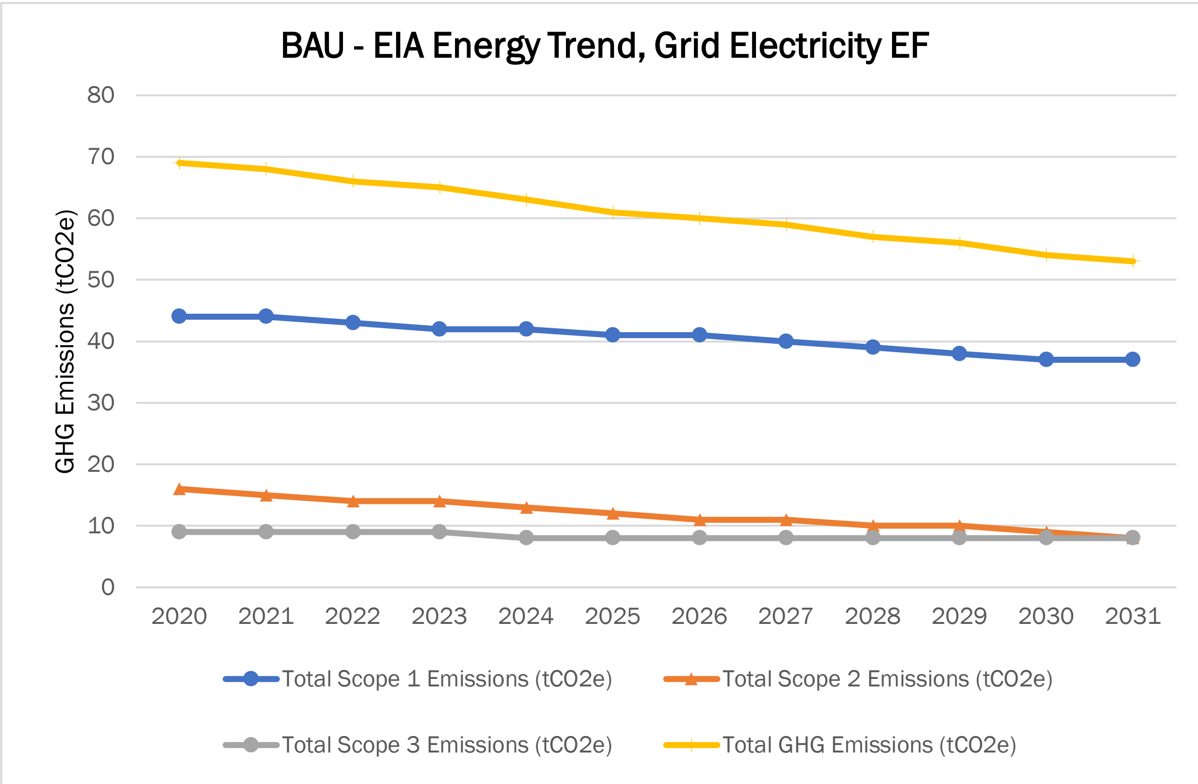


FIGURE 20: BAU - EIA Energy Consumption Trend, Electricity Grid EF Factor Variation - GHG Emissions Variation to Base Year 2020 (%)



The results show that total GHG emissions are expected to be reduced by 23 percent by 2031, as shown by Figure 20. The decrease is almost entirely due to reductions of Scope 1 and Scope 2 emissions (stationary and mobile combustion and electricity). These reductions can be attributed to energy consumption trends and decreased electricity grid emission intensity. There is a minor reduction in Scope 3 emissions (employee commute) as well.

The results presented in this report will be used as a basis for accessing and prioritizing the proposed climate actions presented in the forthcoming joint Town of North East and Village of Millerton's Climate Action Plan. The projected climate action emission reductions will be used to assess progress to meet the Village's emission reduction targets.

6. Uncertainty Assessment and Quality Assurance

With regard to a GHG Inventory, quality refers to the general accuracy and consistency between an organization's actual emissions and quantified emissions. The difference between actual and quantified emissions results from uncertainty and error introduced by activities such as data collection, data management, calculations, and reporting. Inventory quality is impacted as data progresses from individual sources to the final report.

The inventory contains reporting uncertainty resulting from the potential for errors to be introduced in certain activities. Overall uncertainties are as follows:

- Not all data were received from primary sources (i.e., invoices) and backup data were not provided for the information recorded. Thus, errors present in the initial data will be transferred to errors in the emission calculations.
- Default emission factors, though used as a best practice, may present a level of uncertainty from the actual emissions.

7. Verification of this Report

This report, the information it contains, and the data it is based upon have not been verified by an external third party.

8. Acknowledgement

This project was funded in part by the Climate Smart Community Grant Program, Title 15 of the Environmental Protection Fund through the New York State Department of Environmental Conservation.