Hastings-on-Hudson, NY

2019 Inventory of Community Greenhouse Gas Emissions

Photo Credit: Tim Armacost, 2016

Produced by Hastings-on-Hudson Climate Smart Communities Task Force
With Assistance from ICLEI - Local Governments for Sustainability USA

Village of Hastings-on-Hudson
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Table of Contents

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Executive Summary

The Village of Hastings-on-Hudson 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 Village has multiple opportunities to benefit by acting quickly to reduce community GHG emissions. These benefits include reducing energy and transportation costs for residents and businesses, creating green jobs, improving the health of residents, and making our community a more attractive place to live and locate a business.

To demonstrate its commitment to addressing the growing threat of climate change, in June of 2010 the Village of Hastings-on-Hudson signed up to become a registered Climate Smart Community, and formally adopted the New York State Climate Smart Communities (CSC) pledge. Since making that initial pledge, Hastings-on-Hudson secured Bronze CSC status in February 2020 and, as of September 2020, is one of seven municipalities that has reached Silver CSC status in the State. As of June 2021, Hastings-on-Hudson is also the leading Clean Energy Community (CEC) in New York State. Hastings-on-Hudson is a participating member of ICLEI-Local Governments for Sustainability (USA) and is also a member of the Global Covenant of Mayors for Climate and Energy, We Are Still In (USA), and Climate Mayors (USA).

As part of its ongoing commitment to addressing climate change, the Village now intends to draft a Climate Action Plan (CAP) that sets out Hastings-specific climate related goals and targets for the next ten years. The first step in this process is to perform a GHG inventory for all buildings, vehicles, and operations controlled by the local government. The resulting report, produced in 2020, provides estimates of greenhouse gas emissions from the Village's government operations. This GHG inventory provided a baseline from which the Village can set emissions reduction goals, determine ways in which those goals can be reached, and track progress. To create this inventory, data for the Village's fuel and electricity use was collected and reviewed. The data was generated from electric and natural gas bills for all Village-owned buildings and operations, as well as fuel records for the Village's vehicle fleet. The GHG emissions for local government operations were measured in metric tons of CO2 equivalents (CO2e) and were calculated using emission factors published by the U.S. Environmental Protection Agency (EPA) and ICLEI's ClearPath software platform.

Having identified GHG emissions from government buildings, the next step in our climate action planning process is to conduct a community-wide emissions inventory. This report provides estimates of greenhouse gas emissions resulting from sources and activities in the Village as a whole for 2019.

Key Findings

In 2019, community-wide GHG emissions for Hastings-on-Hudson totaled 64,620 metric tons of CO2 equivalent (MT CO2e). Figure 1 shows the emissions from the community broken down by sector. Transportation and Mobile Sources are the largest contributors in this set accounting for 49% of emissions. The second largest contributor is Commercial Energy with 31% of emissions, followed by Residential Energy with 18% of emissions. Actions to reduce emissions in each of these three sectors will be a key part of the Village's climate action plan. Solid Waste and Water & Wastewater were responsible for the remaining 2% of emissions.

The Inventory Results section of this report provides a detailed profile of emissions sources within Hastings-on-Hudson. This information will be key to guiding local reduction efforts. This data will also provide a baseline from which the Village will be able to compare future performance and demonstrate progress in reducing emissions.

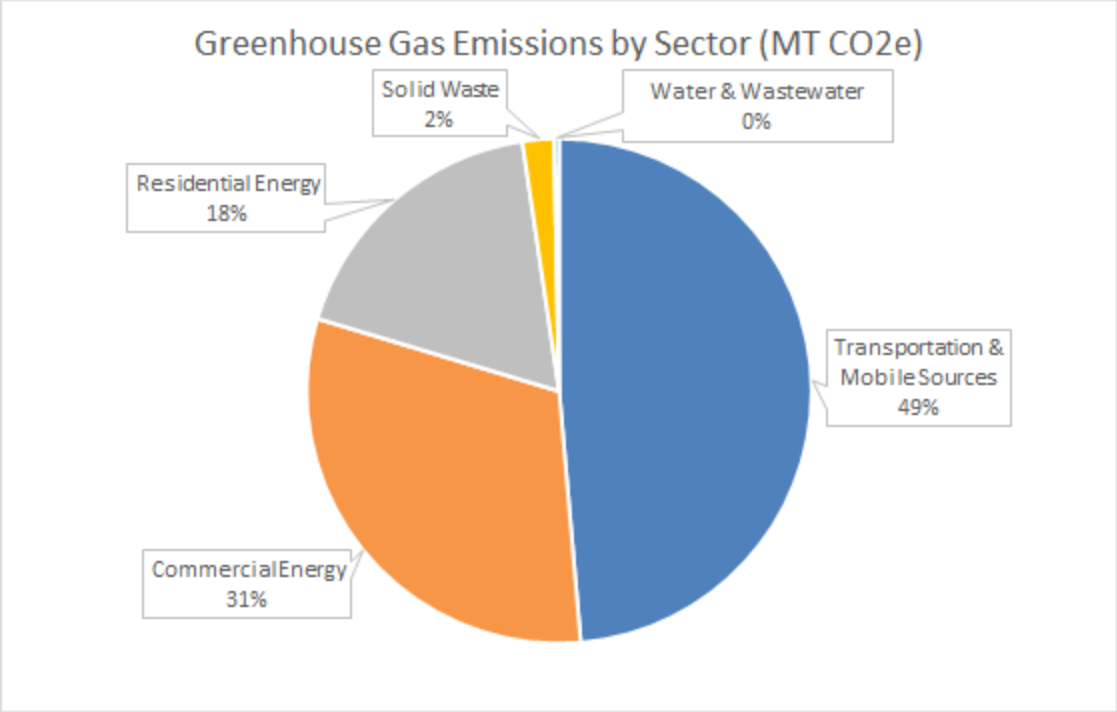

Figure 1: 2019 Hastings-on-Hudson Community Greenhouse Gas Emissions by Sector

Next Steps

Having completed the GHG inventory, our next step will be to set science-based emissions reduction targets, create a formal climate action plan, and specify planned emissions reduction actions.

Climate Change Background

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming evidence shows that human activities are increasing the concentration of greenhouse gases and changing the global climate. The most significant contributor is the burning of fossil fuels for transportation, electricity generation and other purposes, which introduces large amounts of carbon dioxide and other greenhouse gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise.

In the coming years, the Village of Hastings-on-Hudson is likely to be increasingly affected by severe storms and flooding, extreme hot days and heat waves and insect infestation and invasive species**.** Current and expected impacts to Hastings-on-Hudson related to climate change are explained in greater detail below. Other expected impacts in New York State include damage to coastal habitat, property and infrastructure due to sea level rise, declining drinking water quality and quantity, further degradation in air quality, and the disruption of ecosystems, habitats, and agricultural activities.

Many communities in the United States have taken responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, money saved on energy is more likely to be spent stimulating local businesses and the local economy. Reducing fossil fuel use improves air quality, and increasing opportunities for walking and bicycling improves residents' health.

Evidence of Human-Caused Climate Change

There is overwhelming scientific consensus that the global climate is changing, and that human actions, primarily the burning of fossil fuels, are the main cause of those changes. The Intergovernmental Panel on Climate Change (IPCC) is the scientific body charged with bringing together the work of thousands of climate scientists. The IPCC's Fifth Assessment Report concludes that "warming of the climate system is unequivocal."[1] Furthermore, the 2018 Special Report on 1.5 Degrees C finds that 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.Warming from human-caused emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further

[1] IPCC, 2018: Global Warming of 1.5 degrees C: A Special Report to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland: https://www.ipcc.ch/sr15/.

long-term changes in the climate system, such as sea level rise, with associated impacts, but these emissions alone are unlikely to cause global warming of 1.5°C.

2020 was the hottest year on record for the continental United States.[2] 1976 was the last year with a below average global temperature. The steady uptick in average temperatures is significant and expected to continue if action is not taken to greatly reduce greenhouse gas emissions.

ICLEI Climate Mitigation Program

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing greenhouse gas emissions within their boundaries. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, waste diversion, and more, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts.

ICLEI provides a framework and methodology for local governments to identify and reduce greenhouse gas emissions, organized along Five Milestones:

1. Conduct an inventory and forecast of local greenhouse gas emissions;
2. Establish a greenhouse gas emissions reduction target;
3. Develop a climate action plan for achieving the emissions reduction target;
4. Implement the climate action plan; and,
5. Monitor and report on progress.

This report represents the completion of ICLEI's Climate Mitigation Milestone One for the community as a whole, and provides a foundation for future work to reduce greenhouse gas emissions in Hastings-on-Hudson.

Local Climate Vulnerabilities and Risks

In 2020, the Village of Hastings-on-Hudson conducted a Climate Vulnerability Assessment in which data from 33 climate models were examined using Temperate, a tool made available to the Village by ICLEI. The results were

[2] NASA. "2020 Tied for Warmest Year on Record, NASA Analysis Shows". January 14, 2021: https://www.nasa.gov/press-release/2020-tied-for-warmest-year-on-record-nasa-analysis-shows

presented to the community in May and June 2020 in a series of community engagement workshops. The Village also interviewed the Emergency Management team and conducted a survey of residents to identify the top climate hazards facing the Village. The Temperate tool, the interviews and workshops, and the Climate Vulnerability Assessment Community Survey all indicated that severe storms and flooding, extreme hot days and heat waves, and insect infestation and invasive species are the most pressing hazards for which the Village needs to prepare. Excerpts from the Climate Vulnerability Assessment on the first two types of hazards are provided below.

Severe Storms and Flooding

The relevant precipitation indicators for the severe storms and flooding climate hazards include extreme precipitation events and precipitation threshold. Both indicators show an increasing trend, meaning that Hastings-on-Hudson will experience more severe storms and flooding in the coming decades than it has in the past. These projections should come as no surprise, as historic precipitation data for the northeastern United States show a 71 percent increase in the amount of precipitation falling during very heavy precipitation events from 1958 to 2012 (Figure 2). In addition, historic data for Atlantic hurricanes from 1970 to 2010 show an increase in the total number of hurricanes as well as an increase in the proportion of those hurricanes becoming Category 3 or higher (Figure 3).

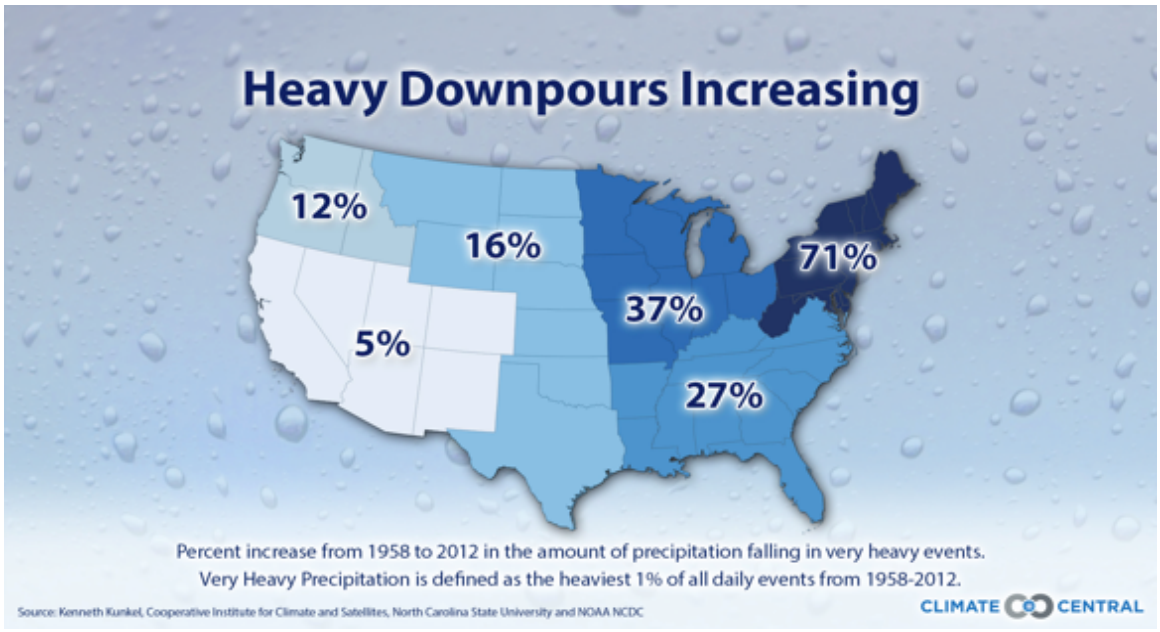

Figure 2. Map of US with geographic regions showing the percent increase in the amount of precipitation falling in very heavy precipitation events from 1958 to 2021. Source: https://statesatrisk.org/new-york/all

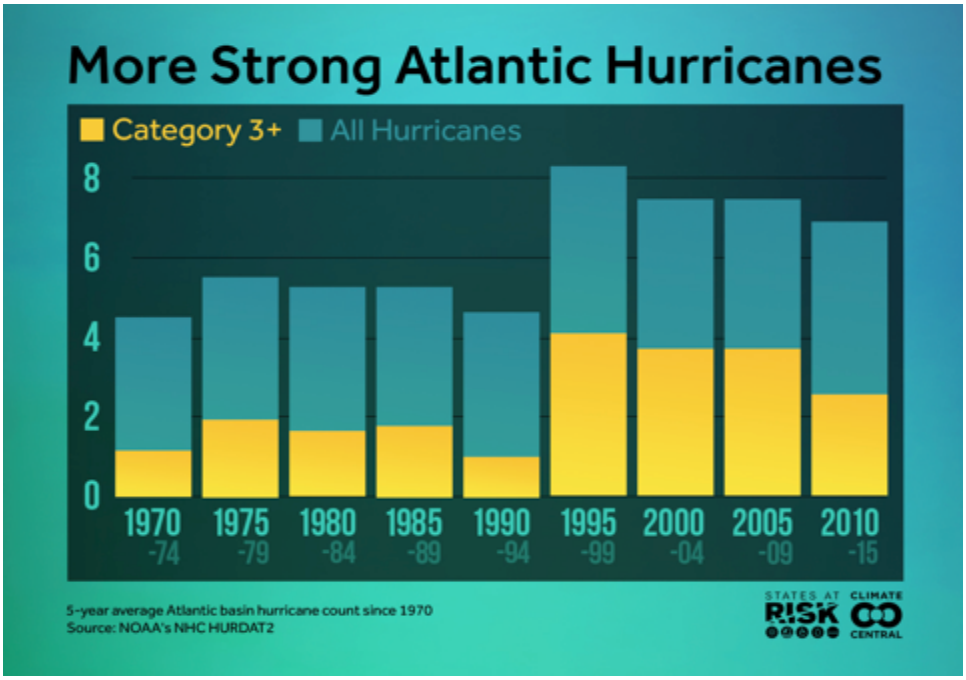

Figure 3. Bar graph showing an increase in the total number of Atlantic hurricanes from 1970 to 2010, as well as an increase in the proportion of those hurricanes becoming Category 3+ hurricanes. Source: https://statesatrisk.org/new-york/all

The number of extreme precipitation events in Hastings-on-Hudson is projected to nearly double by 2100. The Village is projected to experience warmer and more frequent hot days in the coming decades. Higher temperatures in the atmosphere lead to changes in weather patterns and fluctuations in the amount of moisture that is retained in the atmosphere throughout the year. While the total amount of precipitation in Hastings-on-Hudson is anticipated to change only modestly — from an average of 49 inches of annual precipitation today to an average of 54 inches by 2100 — when and how that precipitation falls is likely to change markedly. One change that residents can expect is a doubling of the number of extreme precipitation events in the next 80 years. Extreme precipitation events are defined as any time the average precipitation on a given day is higher than 99 percent of historical precipitation, compared to a historic base range year of 1971. Today, these extreme events of heavy rain or snow occur about twice per year, but that number is anticipated to reach four or more occurrences per year by the end of the century.

A precipitation threshold is defined as the cumulative precipitation amount that generates critical runoffs high enough to cause flooding. Research indicates that peak storm intensity is significantly correlated with a precipitation threshold above which flooding becomes highly probable. This correlation suggests that the projected increases in extreme precipitation events and their intensity will lead to more days where the precipitation exceeds the threshold and causes flooding. The Temperate tool suggests a precipitation threshold of two inches per day for Hastings, and today, the threshold is breached about one day a year. By the end of the century, the precipitation threshold is projected to be exceeded an average 2.5 days per year.

In addition to the precipitation indicators presented by the Temperate tool, other relevant and important indicators for the severe storms and flooding climate hazards are sea-level rise and storm surges. Historic global average sea

level change data from 1880 to 2020 clearly shows a 9-inch increase in sea level, as well as an increase in the rate of sea level rise over time (Figure 4).

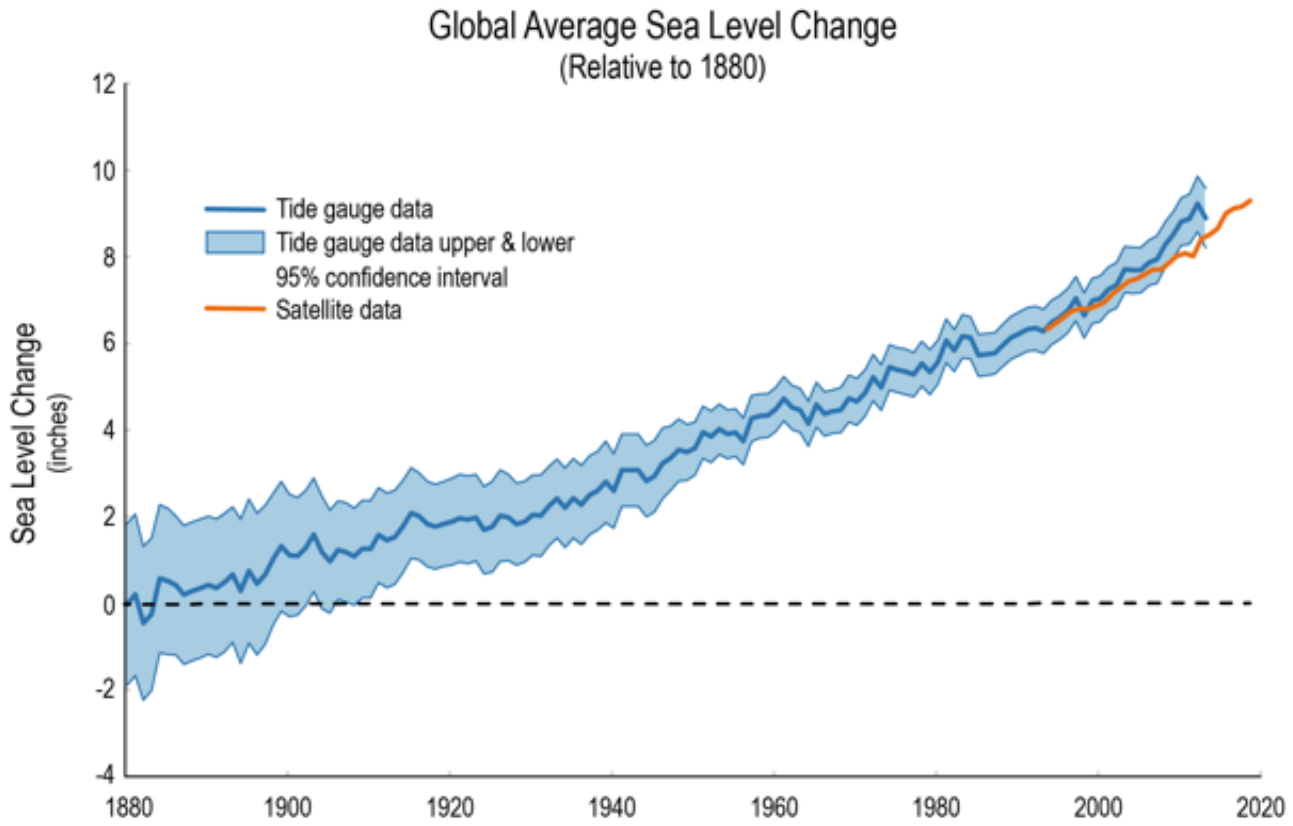

Figure 4. Graph depicting global average sea level change in inches relative to 1880 levels from 1880 to 2020. Source: https://www.globalchange.gov/browse/indicators/global-sea-level-rise#:~:text=Global%20sea%20level%20has%20risen,has%20increased%20in%20recent%20decades

The polar ice caps are melting at a faster rate than scientists predicted, and given its location near the mouth of the Hudson River, Hastings-on-Hudson is located in an area that will be especially susceptible to sea level rise. The Hudson River is tidally influenced all the way to Troy. Rising sea levels push upriver during flood tides and channeled between the Palisades to the west, and the steep topography of the Rivertowns to the east creates a condition ripe for severe flooding when confronted by runoff from increasingly impervious upland areas. The influx of polar ice melt into the Atlantic Ocean caused by global warming is adding to long-standing regional geological subsidence, causing sea level in the northeastern United States to rise 3 to 4 times faster than the global average.

According to the U.S. government's 2018 National Climate Assessment, the sea-level rise in the northeastern United States will likely be within the range of 2 to 6 feet by the end of the century. In the worst case scenario, where countries are unable to limit the average global warming to less than 4° F and the ice caps melt at the high-end of projections, sea level could rise upwards of 11 feet in the northeastern United States. The effects of sea level rise on the Hastings-on-Hudson waterfront can be visualized using the Scenic Hudson's Sea Level Rise Mapper (Figure 5).

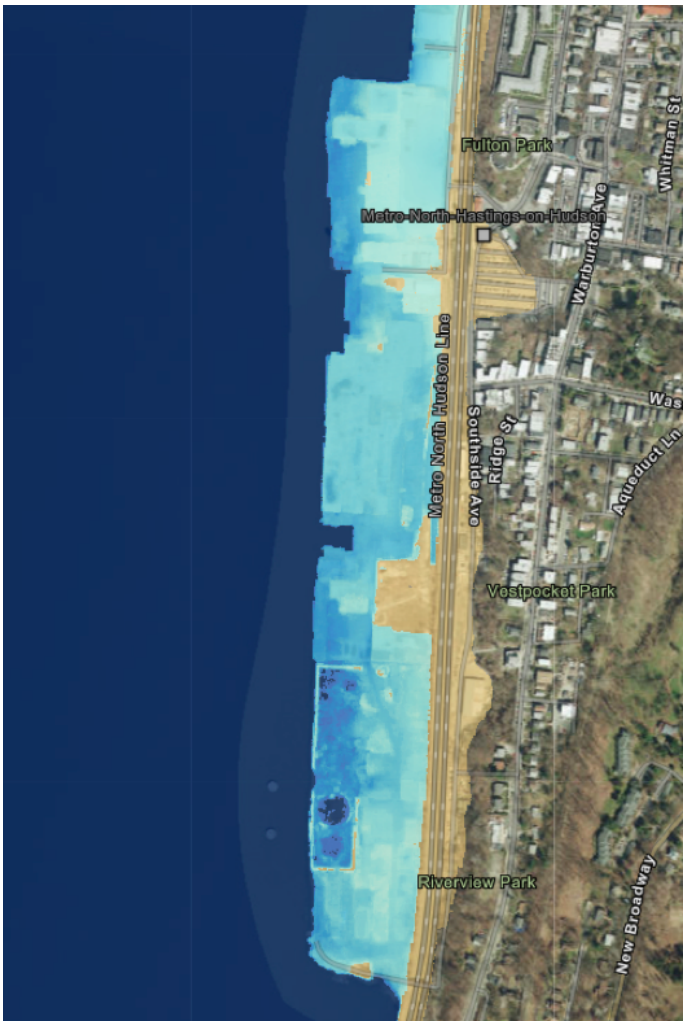

Figure 5. Map of Hastings-on-Hudson Waterfront showing the effect of a six foot rise in sea level.
Source:https://scenichudson.maps.arcgis.com/apps/MapJournal/index.html?appid=3a3d0dc3884c4637ad0a51f4aa912189#

Regarding storm surges, while there is limited data on their historic occurrence in the Hudson River and future predictions of their increase or severity, there is anecdotal evidence that storm surges in the Hudson River will increasingly affect Hastings-on-Hudson in the coming years. Hurricane Sandy in 2012 is the most recent severe storm that caused a significant local storm surge. The storm surge flooded a significant portion of the Hastings Waterfront, as it lies only a few feet above sea level. Storm surges necessarily result from severe storms, and the evidence provided earlier in this section showing an increasing trend in the number of Atlantic hurricanes and the number of Category 3 or higher hurricanes suggests there will also be an increase in storm surges that will affect the Village in the future.

Extreme Hot Days and Heat Waves

The relevant temperature indicators for extreme hot days and heat waves include average high temperature, maximum high temperature, extreme heat events, and heat wave incidents. All four indicators show an increasing

trend through time, meaning that Hastings-on-Hudson is set to suffer more extreme hot days and heat waves in the coming decades than it has historically experienced.

Today, the average high temperature for Hastings-on-Hudson is 64.6° F, while the maximum high temperature is 99.1° F. In the next decade, the average high temperature is predicted to increase 0.7 degrees to 65.3° F, and the maximum high temperature is predicted to increase to 100.0° F. Changes start to become significant by mid-century, with the average high temperature reaching 67.6° F, an increase of 3.0° F from today, and the maximum high temperature reaching 102.7° F, an increase of 3.6° F from today. By century's end, the changes are striking, as the average high temperature will reach 73.1° F, up a total of 8.5° F from today, and the maximum high temperature is predicted to reach 110.1° F, up a total of 11° F from today. Even if countries are successful in achieving the climate goal of limiting average global warming to less than 4° F, by the end of the century, the climate in Hastings-on-Hudson will likely be comparable to current climate conditions in Fort Meyers, Florida. Extreme heat events, defined as when the daily maximum temperature exceeds 99 percent of historic temperature observations with a historic base range year of 1971, will occur on an average of 8.3 days in 2020. There is a slight increase in extreme heat events by 2030, with the count reaching 11.8 days per year of above historic temperatures. By mid-century, the count of extreme heat events will reach 20.6 days per year, and by century's end, Hastings-on-Hudson will experience 61.4 days of extreme heat, or just over 2 months of above historic temperatures per year, a total increase of 53.1 days from today.

Hastings-on-Hudson is projected to experience an average 2.1 more heat waves every year by 2035. Heat waves are defined as the number of times the daily high temperature exceeds 9° F above the historic norm for at least five consecutive days, with a historic base range year of 1971. Today, the Village experiences an average of three heat waves per year. By mid-century, Hastings-on-Hudson will experience 6.5 heat waves per year, and by the end of the century, we will experience almost 15 heat waves per year, an increase of 12 heat wave events from today. The impacts predicted for Hastings-on-Hudson are similar to those predicted for New York State and other locations in the North Eastern United States.

Sustainability & Climate Change Mitigation Activities in Hastings-on-Hudson

Hastings-on-Hudson has already implemented programs that have or will lead to ancillary benefits in the form of energy conservation and greenhouse gas mitigation. These include the adoption of a Heat Emergency Plan (2020), a Natural Resources Inventory (2020) and a Climate Vulnerability Assessment (2020), each of which identifies existing vulnerabilities and key actions the municipality can take to address climate change. The Village has also adopted a Comprehensive Plan (2011), a Hazard Mitigation Plan (2015), a Complete Streets Policy (2014), a Shade Structures Policy (2020), an Environmentally Preferable Purchasing Policy (2020) and a Low-Embodied Carbon Concrete Policy (2020). In February 2021, the Village dedicated 112 acres of open space as parkland, which brings

the total dedicated parkland to 156 acres, representing about 84% of the open space owned by the Village and more than 8% of the 1,882 acres on which the Village sits.

Hastings-on-Hudson was one of the early adopters of the New York Stretch Energy Code (2020) and Property Assessed Clean Energy (C-PACE) Financing (2020), which together with Uniform Solar Permitting (2017), facilitate the move to clean energy for local residents and businesses. The Village has upgraded the majority of its conventional street lights (90%), traffic lights (75%) and interior lights (52%) with energy efficient LED technology. The Village adopted an Anti-idling Local Law and Resolution (2019), installed an EV charging station (2019), purchased EVs for the municipal fleet (2020 to 2021) and adopted a Green Fleets Policy (2021). Since 2015, the Village has participated in Community Choice Aggregation (CCA), which ensures that a greater percentage of electricity in the Village is coming from renewable sources. The Village adopted a Benchmarking Policy (2016) which requires the annual reporting of energy used in municipal buildings; the reports are made available on the Village website. In addition, the Village has run several community campaigns geared at energy efficiency education and behavior change, including Solarize, HeatSmart, GridRewards™, Community Solar, EnergySmart Homes and a campaign designed to encourage EV procurement by residents in the Village.
The Village also has an active recycling and organic waste reduction program, including a curbside yard waste pick up program, a food scraps drop-off program and a pilot food scraps pick-up program. All of these programs are designed to reduce residential waste.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels and the sources and activities generating emissions in the community. This report presents an inventory of the GHG emissions from the Hastings-on-Hudson community as a whole. An inventory of the emissions from operations of the Village government are presented in the Hastings-on-Hudson Inventory of Government Operations Greenhouse Gas Emissions, published in April 2020. The government operations inventory is a subset of the community-level inventory. 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.

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 ICELI's US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions Protocol (US Community Protocol)[3].

Community Emissions Protocol

The Community Protocol was released by ICLEI in October 2012, and represents a new national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

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"

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

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere.	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. 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. Hastings-on-Hudson's community greenhouse gas emissions inventory uses 2019 as its base year.

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.[4]
- 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*

[4] Hastings-on-Hudson's community inventory includes emissions data provided by the EPA, SUEZ, Westchester County DEF that was gathered through direct measurement.

Almost all of the emissions sources in this inventory are quantified using calculation-based methodologies, except for Solid Waste, which uses the measurement-based methodology. For the 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.

For this inventory, calculations were made using ICLEI's ClearPath software platform. Data was first measured in megawatt hours (MWh) for grid electricity, therms for natural gas, gallons for fuel oil No.2, and vehicle miles travelled (VMT) for on-road transportation. Using the ClearPath tool, this data was multiplied by emission factors published by the EPA in order to convert the energy usage, or other activity data, into quantified emissions. Different emission factors were used based on the fuel type and eGRID subregion, which in this case is the NYCW (NPCC NYC/Westchester) subregion.

The GHG emissions in this inventory are measured in metric tons of CO2 equivalents (CO2e). In order to measure all greenhouse gases, especially non-CO2 gases, in a common term that indicates their relative strength of the greenhouse effect they have in the atmosphere, the ClearPath tool applies multipliers, referred to as Global Warming Potentials (GWP), to all greenhouse gases emitted. This ensures results are presented in consistent and uniform terms. The GWP values used in this inventory are those published in the IPCC's 5th Assessment Report.

Inventory Results

Community Profile

To put emissions inventory data in context, it is helpful to have some basic information about the community such as population and number of households. This information is provided in Table 1.

Table 1. Hastings-on-Hudson Community Indicators

Estimated 2019 Population	**7,921**
Estimated 2019 Households	**3,024**

Community-Wide Activities Frame

Following the Community Protocol, this inventory reports emissions within the community-wide activities frame. This frame includes emissions that result from the use of energy, materials, and services by all members of the community. These emissions may be occurring within or outside of the community boundary. This frame includes the required five Basic Emissions Generating Activities:

1. Use of electricity by the community;
2. Use of fuel in residential and commercial stationary combustion equipment;
3. On-road passenger and freight motor vehicle travel;
4. Use of energy in potable water and wastewater treatment and distribution;
5. Generation of solid waste by the community;

as well as emissions from on-road and rail public transit, and emissions from a digester used in wastewater treatment. When used for comparison across communities, this framework is helpful in illustrating relative urban/suburban efficiencies. Table 2 summarizes the GHG emissions from community-wide sources and activities.

Table 2. Hastings-on-Hudson Community GHG Emissions by Source or Activity

Source or Activity	Activity Data Quantity and Unit	Emissions Factor (CO2 or Biogenic CO2)	Emissions (metric tons CO2e)
Residential Use of Electricity	20,343 MWh	533.8 lbs/MWh	5,120
Residential Stationary Combustion (Natural Gas)	767,712 therms	53.02 kg/MMBtu	4,083
Residential Stationary Combustion (Fuel Oil No.2)	238,014 gallons	73.96 kg/MMBtu	2,446
Commercial Use of Electricity	15,709 kWh	533.8 lbs/MWh	3,954

Commercial Stationary Combustion	3,023,646 therms	53.02 kg/MMBtu	16,082
On-road Motor Vehicle Travel	71,447,864 vehicle miles	4.18 x10-4 MT/mile	29,865
Use of Electricity in Potable Water Treatment and Distribution	188,444 kWh	533.8 lbs/MWh	48
Use of Electricity in Wastewater Treatment	415,110 kWh	533.8 lbs/MWh	116
Generation of Solid Waste	3,917 tons	Direct Entry	1,300
On-road Public Transit (Bus)	135,077 vehicle miles	0.073934 MT/MMBtu	345
Rail Public Transit (MTA)	8,074,810 passenger miles	1.509 x10-4 MT/passenger mile	1,218
Wastewater Digester	700215 scf/day	52.07 kg/MMBtu	44
Total Community-Wide Activity Emissions			**64,620 MT CO2e**

Hastings will focus on these emissions sources and activities in developing a Climate Action Plan. The total community-wide emissions of 64,620 metric tons CO2e will be the baseline for setting emissions reduction targets and for measuring the success of future emissions reductions. In developing emissions reduction policies, it is often useful to look at emissions broken down by sector, as each sector will require a particular set of strategies to reduce emissions. Figure 6 shows Hastings-on-Hudson's community-wide emissions broken down by sector, while the remainder of this section of the report breaks down these emissions in further detail within each sector.

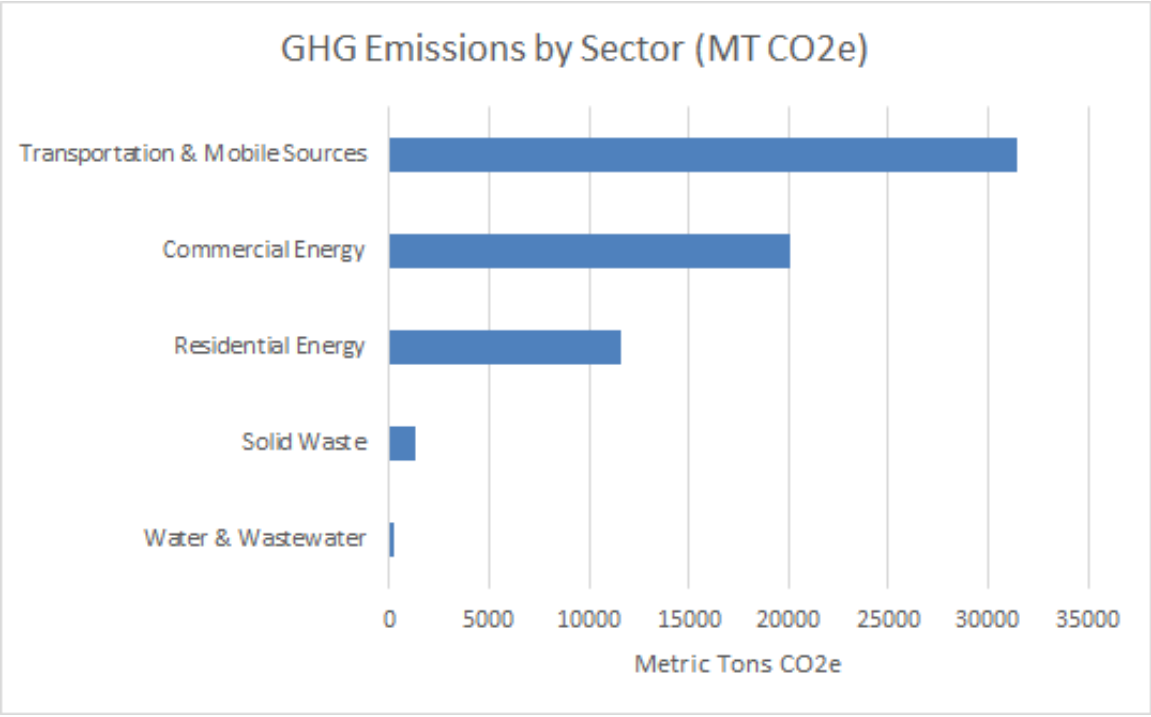

Figure 6. Hastings-on-Hudson Community-Wide GHG Emissions by Sector

Transportation & Mobile Sources

Transportation and Mobile Sources were the largest sector contributing to community-wide GHG emissions, accounting for 31,429 metric tons of carbon dioxide equivalent, or about 49% of total Village emissions. Table 3 and Figure 7 show the breakdown of emissions from transportation and mobile sources. Total vehicle miles traveled (VMT) data was obtained at the scale of Westchester County and supplied by the County Department of Transportation. Paired with county population, these values provided a metric for VMT per person. Hastings-on-Hudson's allotment of VMT is only a portion of the counties. Therefore, using a population-allotment, the reported values for the Village VMT reflect a Village proportion of county-wide per-capita VMT.

It becomes immediately clear that close to all of these emissions come from on-road motor vehicle transportation, with public transit contributing minimally. Transportation and Mobile Sources are made up of emissions from both Activity and Source points within and outside the Village's boundary.

Table 3. Hastings-on-Hudson Transportation & Mobile Source GHG Emissions by Source or Activity

Source or Activity	Emissions (MT CO2e)	Emissions (%)
On-Road Motor Vehicle Travel	29,865	95.0%
Public Transit - Rail	1,218	3.9%
Public Transit - Bus	345	1.1%
Total	**31,428**	

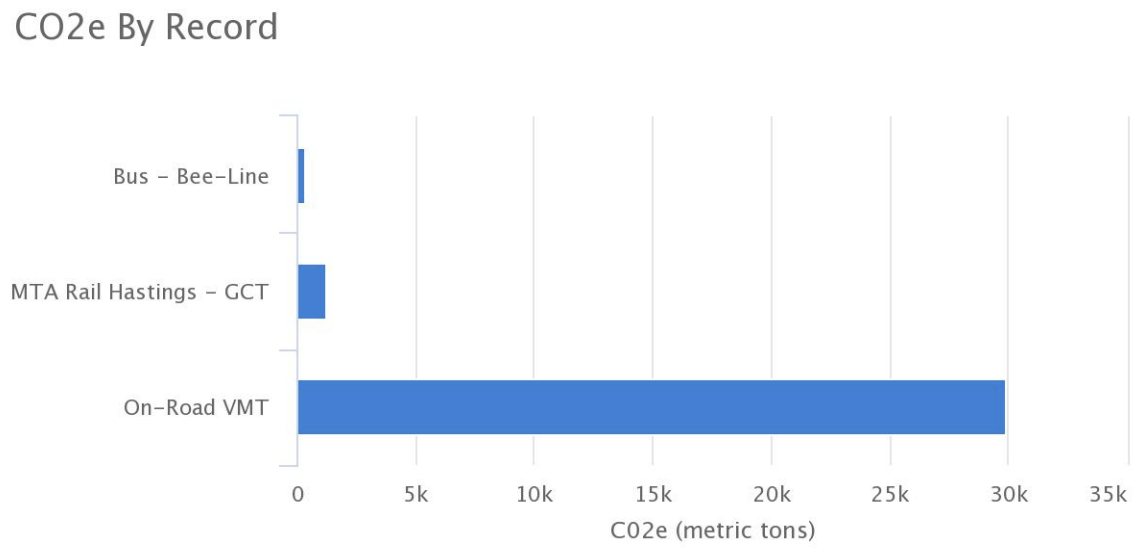

Figure 7. Hastings-on-Hudson Transportation & Mobile Source Emissions by Source or Activity

Commercial Energy Use

Commercial energy consumption was the second largest sector contributing to community-wide GHG emissions, accounting for 20,036 metric tons of carbon dioxide equivalent, or about 31% of total Village emissions. Table 4

and Figure 8 show the breakdown of emissions from commercial energy use, with natural gas accounting for 16,082 MT CO2e, or about 80% of commercial emissions, and electricity from the grid accounting for 3,954 MT CO2e, or about 20% of commercial emissions. Commercial energy use is made up of emissions from both Activity and Source points within and outside Hastings' boundary.

Table 4. Hastings-on-Hudson Commercial GHG Emissions by Source or Activity

Source or Activity	Emissions (MT CO2e)	Emissions (%)
Natural Gas	16,082	80.3%
Grid Electricity	3,954	19.7%
Total	**20,036**	

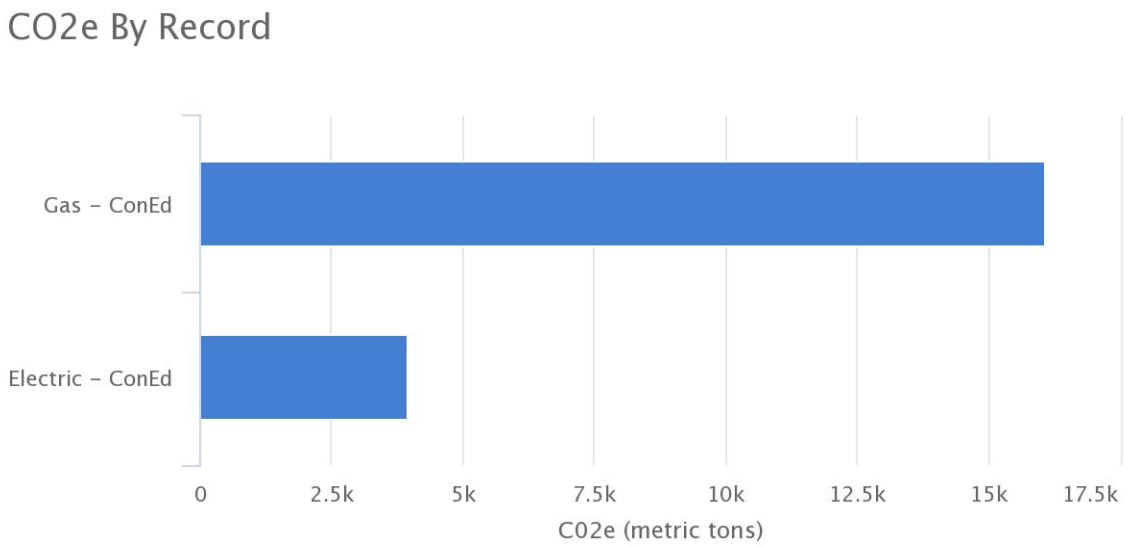

Figure 8. Hastings-on-Hudson Commercial Energy Emissions by Source or Activity

Residential Energy

Residential energy consumption was the third largest sector contributing to community-wide GHG emissions, accounting for 11,649 metric tons of carbon dioxide equivalent, or about 18% of total Village emissions. Table 5 and Figure 9 show the breakdown of emissions from residential energy use, with electricity from the grid accounting for 5,120 MT CO2e, or 44% of residential emissions, natural gas accounting for 4,083 MT CO2e, or 35% of residential emissions, and distillate fuel oil No.2, which is still burned in about 750 households in the Village for heating, accounting for 2,446 MT CO2e, or 21% of residential emissions. Residential energy use is made up of emissions from both Activity and Source points within and outside the Village's boundary.

Table 5. Hastings-on-Hudson Residential GHG Emissions by Source or Activity

Source or Activity	Emissions (MT CO2e)	Emissions (%)
Grid Electricity	5,120	44.0%
Natural Gas	4,083	35.0%
Distillate Fuel Oil No.2	2,446	21.0%
Total	**11,649**	

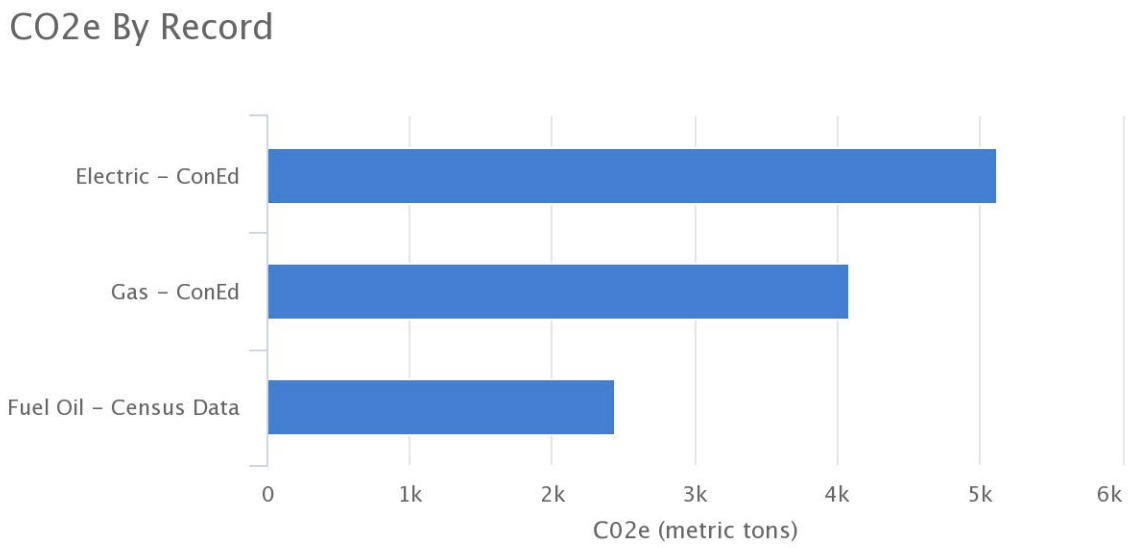

Figure 9. Hastings-on-Hudson Residential Energy Emissions by Fuel Type

A Note on Community Choice Aggregation (CCA)

Since 2016, Hastings-on-Hudson has subscribed to a community-choice aggregation option for purchased electricity. The option supplies the Village with nearly 100 percent renewable electricity. In 2019, the CCA provided 15,096 MWh of renewable electricity to residential and commercial customers in Hastings-on-Hudson. This renewable energy avoided approximately 3,800 metric tons of CO2e. The values shown in Table 5 use the regional average emissions factor for electricity consumption, which is the standard inventory practice. Using an alternate approach that assigns zero emissions to renewable energy procured through the CCA, community emissions from grid electricity are reduced to 1,320 Metric tons.

Solid Waste

The generation of solid waste was the fourth largest sector contributing to community-wide GHG emissions, accounting for 1,299 metric tons of carbon dioxide equivalent, or about 2% of total Village emissions. Table 6 and Figure 10 show the breakdown of emissions from generating solid waste, with solid waste sent to an incinerator facility accounting for 1,270 MT CO2e, or 97.7% of solid waste emissions, yard waste sent to a composting facility accounting for 28 MT CO2e, or 2.1% of solid waste emissions, and food waste sent to a composting facility

accounting for 2 MT CO2e, or 0.1% of solid waste emissions. The generation of solid waste is made up of emissions from both Activity and Source points within and outside the Village's boundary.

Table 6. Hastings-on-Hudson Solid Waste GHG Emissions by Source or Activity

Source or Activity	Emissions (MT CO2e)	Emissions (%)
Solid Waste	1,270	97.7%
Yard Waste	28	2.1%
Food Waste	2	0.1%
Total	**1,299**	

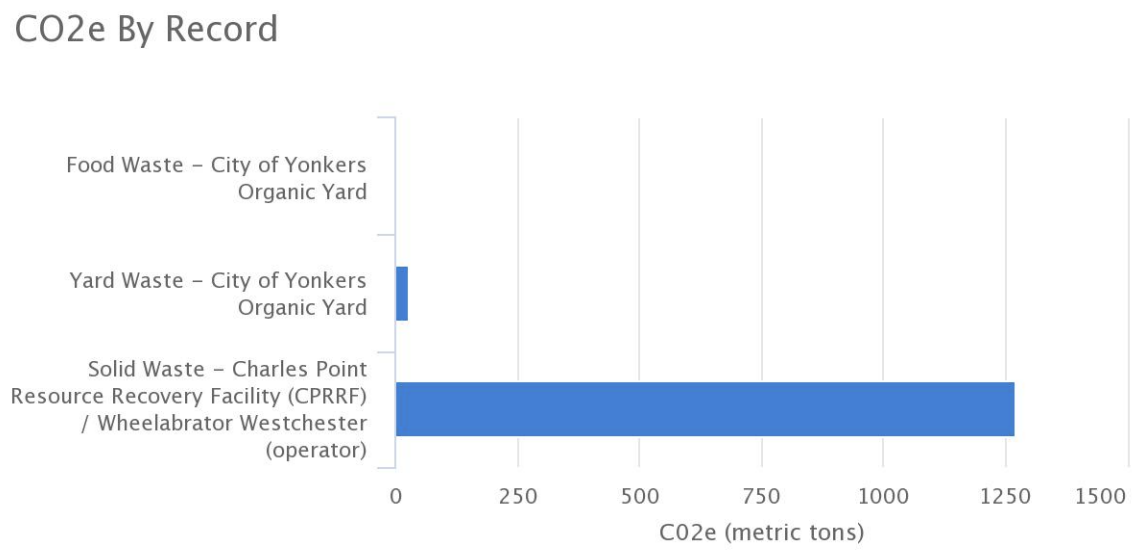

Figure 10. Hastings-on-Hudson Solid Waste Emissions by Waste Type

Potable Water and Wastewater

Potable water and wastewater combined are the fifth largest sector contributing to community-wide GHG emissions, accounting for 208 metric tons of carbon dioxide equivalent, or about 0.3% of total Village emissions. Table 7 and Figure 11 show the breakdown of emissions from potable water and wastewater, with electricity used in the treatment and distribution of potable water accounting for 48 MT CO2e, or 23% of water associated emissions, electricity used the treatment of wastewater accounting for 116 MT CO2e, or 56% of water associated emissions, and emissions released from a wastewater digester (includes biogenic CO2) accounting for 44 MT CO2e, or 21% of water associated emissions. The distribution and treatment of potable water, combined with the treatment of wastewater are made up of emissions only from Activities within and outside the Village's boundary.

Table 7. Hastings-on-Hudson Water & Wastewater GHG Emissions by Source or Activity

Source or Activity	Emissions (MT CO2e)	Emissions (%)
Potable Water	48	23%
Wastewater	116	56%
Digester Emissions	44	21%
Total	**208**	

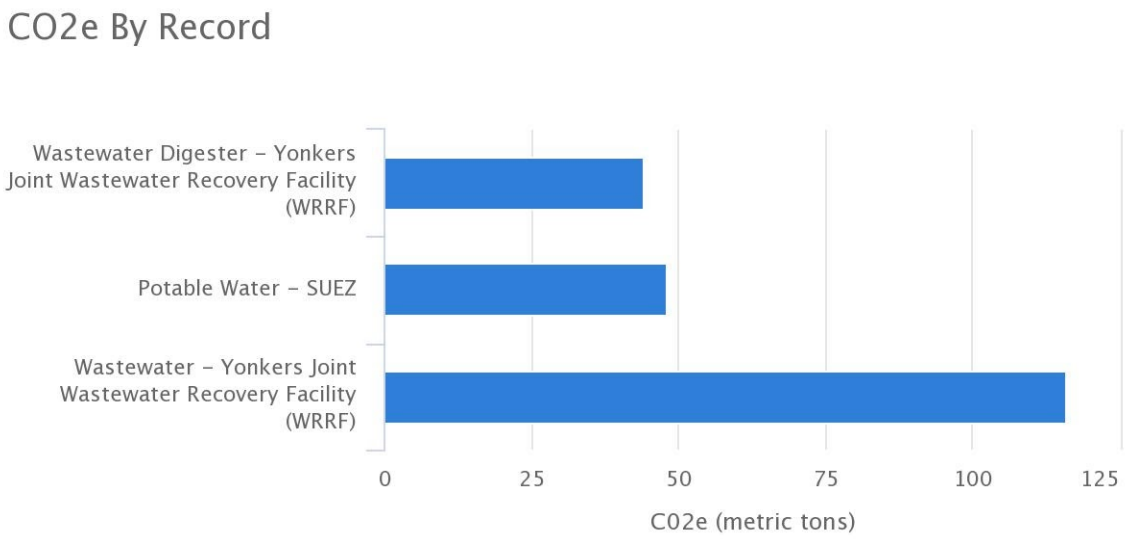

Figure 13. Hastings-on-Hudson Water & Wastewater Emissions by Source

Conclusion

This inventory, together with the previously completed government operations inventory, marks completion of Milestone One of the Five Milestones for Climate Mitigation. The next steps are to set an emissions reduction target, and to develop a climate action plan that identifies specific quantified strategies that can cumulatively meet that target. In addition, Hastings-on-Hudson should continue to track key energy use and emissions indicators on an on-going basis. As per ICLEI's recommendation, Hastings plans on replicating this community-wide GHG inventory at least once every five years to measure emissions reduction progress.

Emissions reduction strategies to consider for the climate action plan include energy efficiency, renewable energy, vehicle fuel efficiency, alternative transportation, vehicle trip reduction, land use and transit planning, and waste reduction among others. This inventory shows that Transportation and Mobile Sources (48% of emissions) and Commercial Energy (31% of emissions) will be particularly important to focus on. Through these efforts and others the Board of Trustees of Hastings-on-Hudson can achieve additional benefits beyond reducing emissions, including saving money and improving Hastings-on-Hudson's economic vitality and its quality of life.