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PE2 Action: Community GHG Inventory

16 Points   🏅 BRONZE PRIORITY   🏅 SILVER PRIORITY

Town of Woodstock
Community GHG Inventory

Early in 2024, Woodstock joined other municipalities in a cohort sponsored by the Mid-Hudson Regional Council to develop a community GHG inventory and Climate Action Plan (CAP) using an updated Mid-Hudson regional GHG inventory. The Community Climate Action Plan, a requirement of the Climate Smart Communities (CSC) program, is a set of initiatives, goals, and targets to reduce community GHG emissions.

As part of developing regional sustainability plans, NYSERDA funded a series of contractors to prepare greenhouse gas inventories for each of New York State's ten economic development regions. The *2010 Mid-Hudson Regional Inventory* estimated GHG emissions for the entire Mid-Hudson region and provided community-level data for each village, town, city, and county in the region for the baseline year 2010.

In 2023, the staff of the Hudson Valley Regional Council (HVRC) updated the original, *Mid-Hudson Regional Greenhouse Gas Emissions Inventory Final Report*, using data from 2020, 2021, and 2022. Funded under the CSC Coordinator Program through the New York State Department of Environmental Conservation (NYSDEC), and with support from Climate Action Associates, the inventory was updated during the 2023 Community GHG cohorts.

The HVRC's update follows the methodology of the *Mid-Hudson 2010 Greenhouse Regional Inventory* and the 2015, *New York Community and Regional GHG Inventory Guidance* document. GHG emissions for all community-wide activities are measured in metric tons of carbon dioxide equivalents (MTCO2e) and were calculated using emissions factors from the US Energy Information Administration (EIA), US Environmental Protection Agency (EPA), and ICF International / NYSERDA GHG Inventory Tool.

The attached Woodstock community greenhouse gas inventory complies with the methodology of the *New York Community and Regional Greenhouse Gas Inventory Guidance*, as updated by the Mid-Hudson Regional Council, and is submitted as eligible for points under the CSC Certification Program.

Table of Contents

Introduction and Narrative

Provides an overview of the Mid-Hudson regional greenhouse gas inventory sources and a summary Woodstock's greenhouse gas emissions and sources. The two largest sectors, transportation and residential, account for 82% of Woodstock's greenhouse gas emissions.

Transportation Sector

Describes in detail the sources of greenhouse emissions from on-road and off-road vehicles in Woodstock. This section also explains the impact on Woodstock of emissions from the NY Thruway.

Residential Sector

Identifies the greenhouse emissions associated with electric and fuel oil consumption in residential housing units.

Summary & Projections

Considers other sources of emissions beyond the transportation and residential sectors, and extends the emission estimates to the year 2030 under the conditions of current trends and expectations. Also lists a variety of existing programs and initiatives that could reduce future greenhouse emissions in Woodstock.

Climate Action Plan

The basic foundation and data for development of a Climate Action Plan for Woodstock is provided in the attached community greenhouse gas inventory.

Respectfully submitted,

Kenneth S. Panza, Secretary

Woodstock Climate Smart Committee

WOODSTOCK, N.Y.
COLONY OF THE ARTS

Overlook Mountain is the southernmost peak of the Catskill Escarpment in the central Catskill Mountains near Woodstock, New York. The centerpiece of the 590-acre Overlook Mountain Wild Forest area of Catskill Park, the mountain is the site of one of the remaining five Catskill Mountain fire towers and the Overlook Mountain House.

(Picture courtesy of Woodstock Land Conservancy)

Mid-Hudson Regional Greenhouse Gas Inventories

In 2012, New York State's Climate Smart Communities and NYSERDA's Cleaner, Greener Communities (CGC) program launched an effort to develop regional GHG inventories for all ten of the State's economic development regions. The New York State Research and Development Authority (NYSERDA) convened the New York GHG Working Group to review GHG protocols and design a consensus approach applicable for New York State. The group included over 70 stakeholders representing CGC planning teams, academic institutions, CSC consultants, state agencies, and regional and municipal officials.

The document, *New York State, Regional, and Community GHG Inventory Guidance*, released September 2015, is the compendium of methods and decisions made by the GHG Working Group. For the most part, the regional GHG Inventories produced under CGC Phase I conformed to these methods.

On December 13, 2012, ICF International released its *Mid-Hudson Regional Greenhouse Gas Emissions Inventory, Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inventory*, which incorporates the methods designated by the New York

GHG Working Group, to develop a comprehensive GHG inventory for the Mid-Hudson Region. The Mid-Hudson Regional Inventory calculates emissions for the entire Mid-Hudson region and provides community-level data for each village, town, city, and county in the region for the baseline year 2010.

Prepared for:
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Prepared by:
ICF International, Sub-consultant to VHB, Inc.
December 13, 2012

Woodstock Community Greenhouse Gas Inventory

In 2021, the Woodstock Climate Smart Task Force created a community-wide, GHG inventory using the documentation and methodology described in the ICF International document. By necessity, the Woodstock community GHG inventory uses the baseline data from 2010.

A community GHG inventory accounts for emissions associated with activities occurring within a community's boundaries, including electricity consumption, transportation, solid waste emissions, etc. The community inventory establishes a baseline GHG inventory that identifies opportunities to reduce emissions. The 2010 Mid-Hudson Regional Inventory provided community-level GHG emissions data by sector for each village, town, city, and county in the Mid-Hudson region.

Mid-Hudson Regional GHG Inventory Update

In 2023, the staff of the Hudson Valley Regional Council (HVRC) updated the original, *Mid-Hudson Regional Greenhouse Gas Emissions Inventory Final Report*, using data from 2020, 2021, and 2022. Funded under the CSC Coordinator Program through the New York State Department of Environmental Conservation (NYSDEC), and with support from Climate Action Associates, the inventory was updated during the 2023 Community GHG Cohorts.

The update follows the methodology of the Mid-Hudson 2010 Greenhouse Regional Inventor*y* and the 2015, New York Community and Regional GHG Inventory Guidance document. GHG emissions for all community-wide activities are measured in metric tons of carbon dioxide equivalents (MTCO2e) and were calculated using emissions factors from the US Energy Information Administration (EIA), US Environmental Protection Agency (EPA), and ICF International / NYSERDA GHG Inventory Tool.

The 2021 Mid-Hudson Regional Inventory updates the 2010 inventory using 2021 data (or the closest year available). Due to the COVID-19 Pandemic and data availability, multiple years of data were used to prepare the 2021 Inventory Update. The reason why a specific

year was chosen is explained in the methods of each sector. In general, direct data sources were updated using new data sets when available, such as from the 2020 Census, Utility Energy Registry (UER), or the US Energy Information Administration (EIA).

Census data was updated with 2020 data. UER data was updated with 2022 information, as it was the most accurate full year of data. Where direct data was not available, the 2010 emissions totals for the region were extrapolated based on external drivers such as population, emissions factors, and fleet fuel economy trends. Some sources were kept the same where there was reasonable justification.

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Woodstock 2021 Community GHG Inventory Update

In 2022 and 2023, the Hudson Valley Regional Council, through the NYSDEC CSC Coordinator Program, hosted a series of cohorts that provided technical assistance to municipalities in the Mid-Hudson Region for developing greenhouse gas emissions inventories and climate action plans.

As part of a 2024 Community GHG Cohort, Woodstock joined 25 other municipalities across the region to develop a community GHG inventory. This cohort consisted of four meetings to understand how the 2010 Inventory was updated, how to check data, a discussion of land use and carbon sequestration, and finally an overview of public outreach and stakeholder engagement.

Kenneth S. Panza, Town of Woodstock, Secretary to the Woodstock Climate Smart Task Force, was a cohort participant and was responsible for revising Woodstock's community GHG inventory using the regional council's updated inventory.

Background

The Town of Woodstock recognizes that greenhouse gas (GHG) emissions from human activity are causing climate change, the consequences of which pose substantial risks to the future health and well-being of our community. To demonstrate its commitment to addressing the growing threat of climate change, on February 11, 2020, the Town of

Woodstock became a registered Climate Smart Community by formally adopting the New York State Climate Smart Communities (CSC) pledge.

The CSC program, administered by the New York State Department of Environmental Conservation (NYSDEC), is a certification program that provides a robust framework to guide the actions local governments can take to reduce GHG emissions and adapt to the effects of climate change. As part of this program, Woodstock developed a Community GHG Inventory that identifies and quantifies the sources of GHG emissions from community GHG sources and establishes a baseline for future emissions' reductions.

Community Profile

The evolution of the Town of Woodstock is intimately tied to its natural resources. From the original Munsee Lenape inhabitants, to the Dutch and English colonizers, to the generations of artists and counter-culture pioneers who have passed through these 67 square miles, the natural beauty and ecological wealth of our town has long been a draw to visitors and residents alike.

Woodstock is located in the eastern escarpment of the Catskill Mountains in the mid-Hudson valley, approximately 100 miles north of New York City. Its topography includes mountain peaks, narrow valleys, and low hills with large areas of the town unsuitable for farming or building. Woodstock is located entirely within the Catskill Park which has over 230,000 acres owned by the State with facilities for camping, hiking, fishing, and hunting, as well as nearby skiing centers. The Catskills have become increasingly popular as a resort destination and Woodstock participates in that trend.
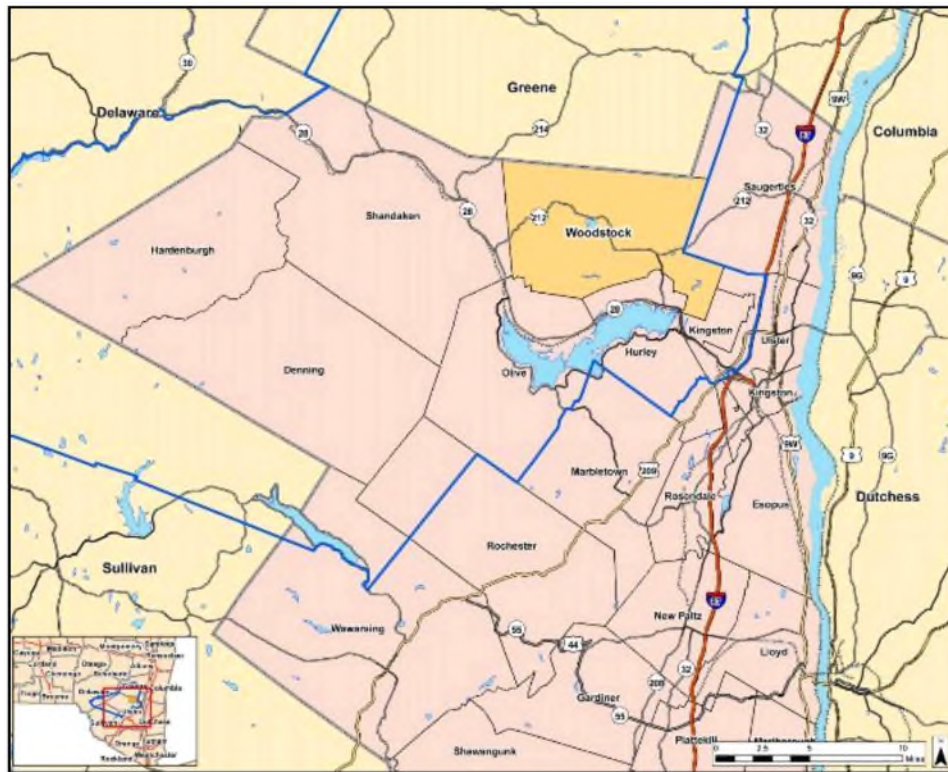
Location Map: Town of Woodstock and surrounding towns in Ulster County

Three major watersheds - the Sawkill, the Beaverkill, and the Little Beaverkill - are located in Woodstock. These contribute to or influence not only the Woodstock's water system but also the water supply systems for Kingston and New York City. Other environmental features include wetlands, floodplains, and forests and wild habitats.

The diversity and extent of the town's natural resources contribute to its scenic appeal and have been identified as a major reason why many residents choose to live in Woodstock. The natural resources also support an environmental resilience that could help the town in an era of increasing climate change.

Often called "the most famous small town in the world," Woodstock is known for its breathtaking scenery, art, music, outdoor recreation, spirituality, and quality of life—all due in large part to the abundance of natural resources that grace this community.

More than fifty years ago town historian Alf Evers began to express concerns about the potential for overbuilding, and he encouraged town leaders to develop land use ordinances. In 1982 Alf was quoted as saying:

> *The reawakening of Americans to the importance of personal contact with the world of nature is an encouraging development, but new ways of relating to nature must become accepted on our crowded earth if areas of natural beauty and usefulness like the Catskills are not to be destroyed.*

This statement rings evermore true today. With changing demographics and pressures for new development, along with the challenges of climate change, protecting our natural resources is increasingly critical.
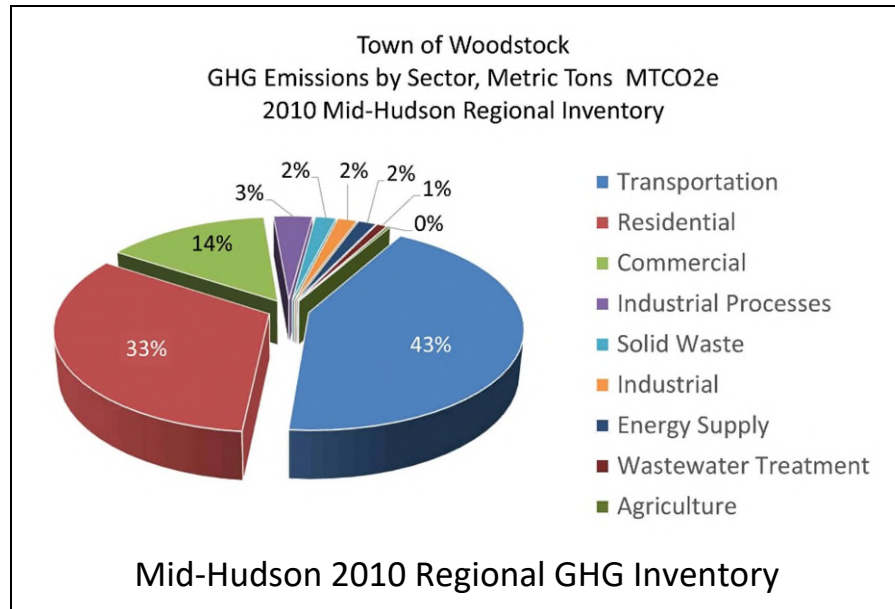
Woodstock's 2021 Community GHG Inventory, Key Findings

Woodstock's community-wide emissions in 2021 totaled 61,259 MTCO2e. The largest emitting sector is transportation, which accounts for 31,809 MTCO2e, 52% of the total community emissions (Table 1). The second greatest contributor to Woodstock's communitywide emissions are the town's residences, which account for 18,529 MTCO2e, 30% of the overall emissions in 2021 (Table 1). When combined, transportation and the town's residences are over 82% of the Woodstock's communitywide emissions.

Sector	2010 MTCO2e		2021 MTCO2e		Change MTCO2e	% Change MTCO2e
Transportation	27,619	43%	31,809	52%	4,190	15%
Residential	20,922	33%	18,529	30%	(2,393)	-11%
Commercial	9,229	14%	5,281	9%	(3,948)	-43%
Industrial Processes	2,184	3%	3,151	5%	967	44%
Solid Waste	1,167	2%	1,705	3%	538	46%
Industrial	1,079	2%	0	0%	(1,079)	-100%
Energy Supply	1,015	2%	443	1%	(572)	-56%
Wastewater Treatment	572	1%	310	1%	(262)	-46%
Agriculture	172	0%	30	0%	(142)	-83%
Total	63,959		61,258			

Table 1: Woodstock Community GHG Emissions by sector for 2010 and 2021

Woodstock 2010 GHG Emissions by Sector

Town of Woodstock
GHG Emissions by Sector, Metric Tons MTCO2e
2010 Mid-Hudson Regional Inventory

Mid-Hudson 2010 Regional GHG Inventory

Woodstock 2021 GHG Emissions by Sector

Town of Woodstock
GHG Emissions by Sector, Metric Tons MTCO2e
2021 Update Mid-Hudson Regional Inventory

2021 update to the Mid-Hudson Regional GHG Inventory
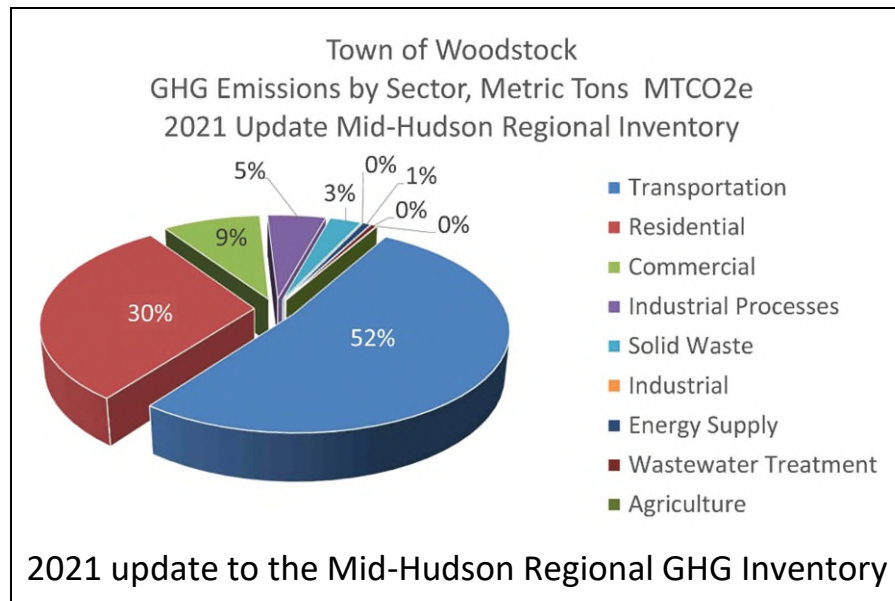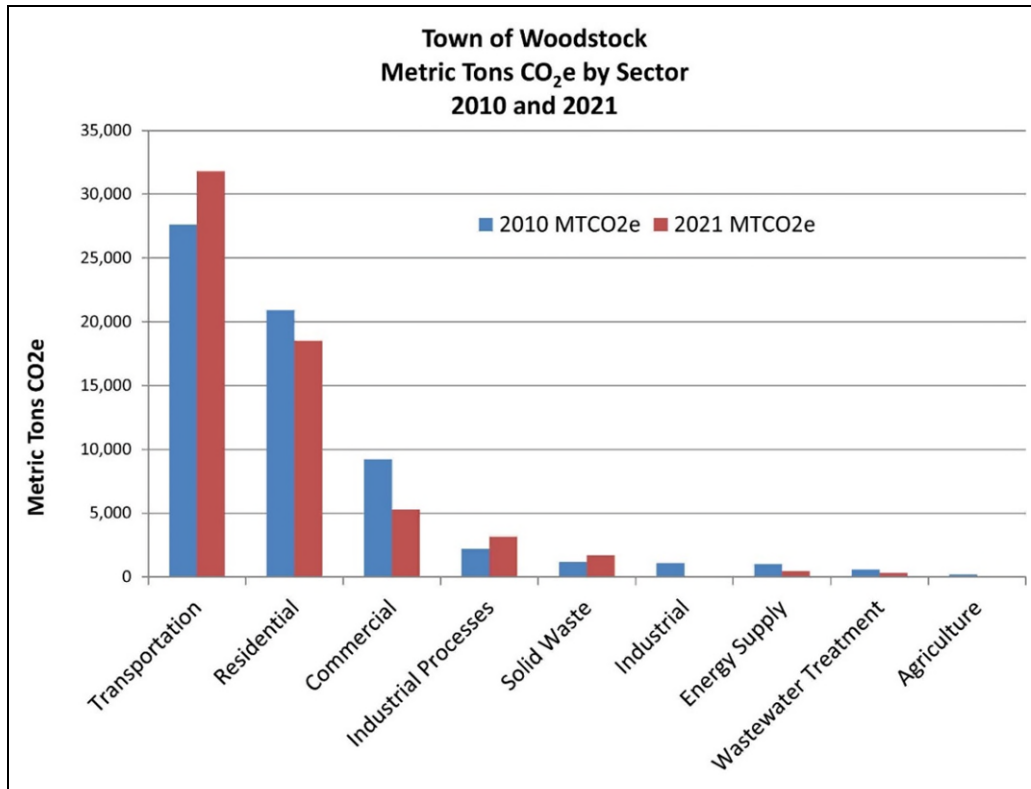
The Town of Woodstock plans to focus on sectors with the highest emissions, transportation and residential building. The next steps are to set an emissions reduction target, and to develop a Community Climate Action Plan that identifies specific quantified strategies that can cumulatively meet that target.

Bar Chart of Woodstock Community GHG Emissions by Sector for 2010 and 2021

References

Woodstock [2010] Baseline Community GHG Inventory, June 2, 2021, Available at https://drive.google.com/file/d/1zVK82p1w5Cb6lRWeWe-5lE_TDBZXErlA/view?usp=sharing

Patapis, Melanie, Climate Smart Coordinator, "Mid-Hudson Regional Greenhouse Gas Emissions Inventory: An Update to the 2010 Regional Inventory," Hudson Valley Regional Council, 2023, Available at https://hudsonvalleyregionalcouncil.org/wp-content/uploads/2024/01/2021-Mid-Hudson-Regional-Inventory-MethodologyV2.pdf

Attachments

Table 29, 2021 HVRC Update, Ulster County, Total Emissions by Municipality and Sector, MTCO2e

Table 29 – Ulster County; Total Emissions by Municipality and Sector, MTCO₂e

Municipality	Type	Stationary Energy Residential	Commercial	Industrial	Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	2021 Total Emissions	2010 Total Emissions	% Change
Denning	Town	1,107	482	0	2,603	134	24	247	5	37	4,640	7,088	-35%
Esopus	Town	23,018	8,677	0	43,262	2,590	471	4,785	82	1,273	84,158	99,889	-16%
Gardiner	Town	13,792	3,917	0	27,815	1,522	277	2,811	343	293	50,770	63,788	-20%
Hardenburgh	Town	678	183	0	1,306	60	11	111	13	20	2,382	2,733	-13%
Hurley	Town	18,498	3,964	0	34,916	1,676	305	3,096	39	279	62,773	71,627	-12%
Kingston	City	46,547	42,540	4,435	116,738	6,529	1,187	12,062	0	6,909	236,947	290,246	-18%
Kingston	Town	2,719	736	0	5,156	253	46	468	24	46	9,448	11,560	-18%
Lloyd	Town	25,873	13,474	0	53,419	3,020	549	5,579	100	2,160	104,174	115,819	-10%
Marbletown	Town	15,800	4,937	0	25,767	1,535	279	2,835	345	333	51,831	65,669	-21%
Marlborough	Town	23,117	10,976	811	45,331	2,363	430	4,366	227	1,038	88,659	99,764	-11%
New Paltz	Town	22,241	21,399	289	49,805	3,908	711	7,220	249	1,875	107,696	116,628	-8%
Olive	Town	9,197	2,973	0	19,603	1,146	208	2,118	39	218	35,502	51,577	-31%
Plattekill	Town	21,030	4,951	0	54,745	2,827	514	5,224	164	316	89,772	103,686	-13%
Rochester	Town	15,489	4,954	0	35,547	1,973	359	3,644	324	389	62,678	85,269	-26%
Rosendale	Town	12,973	4,446	0	32,378	1,568	285	2,898	97	285	54,931	73,596	-25%
Saugerties	Town	52,641	22,734	50,996	104,078	5,164	939	9,541	258	3,907	250,257	267,287	-6%
Shandaken	Town	8,435	3,616	0	13,148	777	141	1,436	21	296	27,871	41,703	-33%
Shawangunk	Town	29,578	12,589	286	53,617	3,679	669	6,797	483	1,497	109,196	119,317	-8%
Ulster	Town	27,388	30,691	5,553	68,482	3,434	624	6,344	181	3,667	146,365	179,266	-18%
Wawarsing	Town	23,775	11,313	0	57,427	3,464	206	6,400	224	824	103,632	122,425	-15%
Woodstock	Town	18,529	5,281	0	31,809	1,705	310	3,151	30	443	61,259	63,958	-4%
Allocated Total		412,425	214,835	62,371	876,954	49,327	8,545	91,131	3,248	26,105	1,744,942	2,052,895	-15%

Note: Totals may not sum due to independent rounding.

Table 30 – Ulster County; Total Emissions by Municipality and Sector, MTCO₂e, continued

Municipality	Type	Stationary Energy Residential	Commercial	Industrial	Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	2021 Total Emissions	2010 Total Emissions	% Change
Village emissions, included in town totals													
Ellenville	Village	7,201	4,517	0	18,722	1,130	206	2,088	4	448	34,315	39,760	-14%
New Paltz	Village	7,215	11,819	0	19,732	1,987	361	3,670	0	1,108	45,892	44,912	2%
Saugerties	Village	19,622	11,375	1,474	22,004	1,058	192	1,954	0	2,621	60,300	51,898	16%

Note: Totals may not sum due to independent rounding.

Transportation Sector

Town of Woodstock
GHG Emissions by Sector, Metric Tons MTCO2e
2021 Update Mid-Hudson Regional Inventory

Legend:
- Transportation — 52%
- Residential — 30%
- Commercial — 9%
- Industrial Processes — 5%
- Solid Waste — 3%
- Industrial — 1%
- Energy Supply — 0%
- Wastewater Treatment — 0%
- Agriculture — 0%

Mid-Hudson Regional Council GHG Emissions Update

During 2012, New York Climate Smart Communities and NYSERDA's Cleaner, Greener Communities (CGC) program formulated regional GHG inventories for the state's economic development regions. On December 13, 2012, ICF International released its *Mid-Hudson Regional Greenhouse Gas Emissions Inventory, Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inventory,* a comprehensive GHG inventory for the Mid-Hudson Region. The Mid-Hudson Regional Inventory estimates emissions for the entire Mid-Hudson region and provides community-level data for each village, town, city, and county in the region for the baseline year of 2010.

In 2023, the staff of the Hudson Valley Regional Council (HVRC), with the assistance of Climate Action Associates, LLC, updated the original, *Mid-Hudson Regional Greenhouse Gas Emissions Inventory Final Report*, using data from 2020, 2021, and 2022. Early in 2024, Woodstock joined other municipalities in a cohort sponsored by the Mid-Hudson Regional Council to develop a municipal community GHG inventory and Climate Action Plan (CAP) using the 2021 updated regional GHG inventory.

Transportation Sector

This document describes the sources of emissions for the transportation sector, sets emission reduction targets, and provides the basis for a Community Climate Action Plan with specific quantified strategies to achieve these targets. Woodstock's community-wide emissions in 2021 totaled 61,259 MTCO2e. The largest emitting sector is transportation, which accounts for 31,809 MTCO2e, 52% of the total community emissions.

Emissions for the transportation sector include on-road vehicles; passenger and freight rail, aviation, marine transportation; and off-road vehicles. Aviation emissions are estimated, but are not included in the regional total because they are an optional source under the NYGHG Protocol.

The inventory is organized by source and by "Scope." Scope refers to the degree of control that the regional community has over the emission source. Although the Scope framework was first developed for corporate-level GHG inventories, a similar principle is applied here. The basic definition of the Scopes for communitywide emissions is as follows:

- **Scope 1:** All direct emissions that occur physically within a boundary, such as those emitted by burning natural gas or fuel oil in homes, schools, and businesses.

- **Scope 2:** Indirect emissions from utility energy generation plants based on the amount of electricity (or other utilities such as hot water or steam) consumed withing the boundary, regardless of where the plants are located.

- **Scope 3:** All other indirect, upstream, or lifecycle emissions attributed to community activity regardless of where they occur.

On-Road Vehicle Emissions

Fuel used by on-road vehicles create emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The amount of CO_2 emitted by vehicles depends on the amount of fuel consumed, whereas CH_4 and N_2O emissions vary depending on the emissions control technologies used by the vehicles.

The Regional Inventories used three components to estimate on-road emissions:

- Types of vehicles on the road ("Vehicle Mix")
- Distance traveled by on-road vehicles ("VMT," vehicle miles traveled)
- Fuel consumption per vehicle type ("Fuel Economy")

Vehicle Mix

Data on the on-road vehicle mix for each functional class of road (e.g., rural interstate, urban freeways and expressways) were obtained for each New York State Department of Transportation (NYSDOT) region from NYSDOT's Environmental Science Bureau dataset. The breakdown of vehicle types for each functional class of road was translated to Highway Performance Monitoring System (HPMS) vehicle categories by the NYGHG Working Group in 2010. This was not changed in the 2021 Inventory Update.

Distance – Vehicle Miles Traveled (VMT)

Data on vehicle miles traveled (VMT) was obtained from NYSDOT modeled data for all counties. County-level VMT data was available by functional class of roadway for 2019 through a Freedom of Information Law (FOIL) Request to the NYSDOT.

Fuel Economy

State- or regional-level data on the fuel economy of the Mid-Hudson Region's vehicle fleet were not available. As a proxy, national average fuel economy values by vehicle class were used based on the Federal Highway Administration's Highway Statistics 2019 series.

Fuel Consumption

Fuel consumption in the Mid-Hudson Region was estimated by determining the distance traveled by different vehicle types and the amount of fuel consumed by each type of vehicle (fuel economy). First, data on total annual distance (VMT) traveled by vehicles within each county was allocated to vehicle types using the NSYDOT dataset on the breakdown of vehicles on NY roads (vehicle mix) by functional class of road. For each vehicle type and functional class, VMT data were multiplied by the average fuel economy of each vehicle type to determine total annual fuel consumption for each vehicle type.

Emissions

The estimates of gasoline and diesel fuel consumption were then multiplied by the CO_2 emission factor for each fuel.[1] The NYGHG Protocol assumes that 10% of gasoline sold in New York is comprised of ethanol. CO_2 emissions from ethanol are biogenic and are not included in this inventory.

Methane and nitrous oxide make up less than 2% of on-road transportation emissions and are dependent on vehicle emissions control technologies. For the 2010 Mid-Hudson Region GHG inventory, per the guidelines of the NYGHG Protocol, non-CO_2 emissions from vehicles were estimated by multiplying CO_2 emissions by the ratio of CH_4 and N_2O emissions from transportation per million tons (MT) of CO_2 emissions (MTCO2e /MTCO2). This ratio, obtained from the EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010,* is 0.000994 MTCO2e of CH_4 per MTCO2 and 0.01367 MTCO2e of N_2O per MTCO2 of on-road transportation emissions.

Municipal-Level Allocation

Using the results of the procedure described above, the 2010 Inventory team allocated the region's emissions to individual towns, cities, and villages based on the available data; the same was done for 2021 update. For the transportation sector, on-road motor vehicle activity and off-road vehicle activity has been allocated to the town level. Emissions for rail, marine, and air travel subsectors have not been similarly allocated. On-road emissions in Mid-Hudson Region were allocated to municipalities based on the number of occupied housing units (households) in cities, towns, and villages adjusted based on commuting preferences.

Based on these methodologies, the 2021 Update of the Mid-Hudson Regional GHG Inventories allocated transportation emissions to Ulster County municipalities.

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[1] 8,887 grams of CO_2 for gasoline

Woodstock On-Road Vehicle Emissions

Although the above described methodologies are compelling, they are not operational for a municipality. Few municipalities have access to the data sets required or the skills necessary to complete the prescribed calculations. Woodstock lacks these skills.

Instead, Woodstock will estimate on-vehicle emissions based on number of vehicles registered in Woodstock and EPA's figures for fuel economy and yearly milage traveled for a typical gasoline vehicle.

It should be noted that this is a first pass at estimating these numbers, and as the cohort proceeds, it is expected that better data will become available. It's expected that the Ulster County DMV will provide more accurate vehicle information.

On-Road Vehicles

Lacking actual vehicle registration statistics from the Ulster County DMV, a first level estimate of the number of on-road vehicles in Woodstock is based on state level statistics for vehicles per 1,000 population.[2] New York State, because of New York City, has the lowest vehicle per capita of all the states. New York is listed at 539 vehicles per 1,000 persons. The next highest is New Jersey at 655 vehicles per 1,000 persons. I considered the New York State per capita too low for Woodstock, and instead established 630 vehicles per 1,000 persons for Woodstock.

Using the 2020 U.S. Census population of 6,287 for Woodstock and 630 vehicles per 1,000 persons, it is estimated that the number of on-road vehicles for 2020 in Woodstock was 3,961. This number is a placeholder until data from the Ulster County DMV can be obtained.

On-Road Vehicle Emissions

Estimates for fuel economy and miles traveled for a typical gasoline vehicle are obtained from the EPA.[3] A typical passenger vehicle emits about 4.6 metric tons of CO_2 per year, assuming the average gasoline vehicle on the road today has a fuel economy of about 22.2 miles per gallon and drives around 11,500 miles per year. Every gallon of gasoline burned creates 8,887 grams of CO_2.

The total, on-road fuel used in Woodstock is then calculated using the estimated number of vehicles, each driven 11,500 miles/year and with fuel economy of 22.2 miles/gallon.

The EPA includes emissions from ethanol, but New York considers ethanol as biogenic and is not included in the Mid-Hudson Regional GHG Inventory. Most gasoline sold in the U.S. is a mixture of gasoline and up to 10% ethanol (often referred to as E10). While fuel economy when using an ethanol blend will be slightly lower than gasoline without ethanol, the CO_2 tailpipe emissions per mile will be similar. This is because ethanol has less carbon per gallon than gasoline.

Before calculating on-road vehicle emissions for Woodstock, the ethanol content is removed by reducing the amount of fuel used by 10%. Metric tons of CO_2 is then calculated using the

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[2] Wikipedia, "List of U.S. states by vehicles per capita," Accessed Jan. 31, 2024, Available at https://en.wikipedia.org/wiki/List_of_U.S._states_by_vehicles_per_capita

[3] Environmental Protection Agency, "Greenhouse Gas Emissions from a Typical Passenger Vehicle," Accessed Jan. 31, 2024, Available at https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle

CO2 emission factor for gasoline of 8,887 grams of CO2 per gallon. (8.887×10^{-3} metric tons/gallon)

For the 2010 Mid-Hudson Region GHG inventory, per the guidelines of the NYGHG Protocol, non-CO2 emissions from vehicles were estimated by multiplying CO2 emissions by the ratio of CH4 and N2O emissions from transportation per million tons (MT) of CO2 emissions (MTCO2e /MTCO2). This ratio, obtained from the EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010, is 0.000994 MTCO2e of CH4 per MTCO2 and 0.01367 MTCO2e of N2O per MTCO2 of on-road transportation emissions.

On-Road Vehicle Types

In addition to gasoline vehicles, Woodstock will include hybrid, plug-in hybrid, and battery electric vehicles in its Climate Action Plan. In 2020, the assumption, by personal observation, is that 1% of on-road vehicles are all battery electric vehicles (Tesla, Leaf, etc.), and that 5% of all vehicles are hybrid or plug-in hybrid (Prius, etc.). These assumptions are subject to correction by actual data from the Ulster County DMV.

On-Road Vehicle Emission Projections

Woodstock emissions for the three types of vehicles were projected, year by year, from 2020 to 2030. A table of the 2030 targets is provided.

Population

The Woodstock comprehensive plan identified a need for affordable housing, and now, a major revision of the zoning law allowing for multifamily dwellings is under consideration. If adopted and successful in encouraging more housing, it's expected Woodstock's population will increase.

Demographics & Basic Assumptions

	2020	2030
Population	6287	6787
Vehicles/1000	630	630
Total Vehicles	3961	4276
EPA Fuel Economy	22.2	29.7
EV Percent	1.0%	6.0%
Hybrid Percent	5.0%	20.0%

Total Vehicles

The total number of vehicles in Woodstock is related to its population growth. The vehicles/1000 persons is a placeholder until better data can be obtained, but it does allow for projecting to 2030, the total number of vehicles in Woodstock.

Fuel Economy

Over time, the EPA average fuel economy for gasoline vehicles will improve as new vehicles replace older one. The assumption is that by 2030, the average fleet fuel economy for gasoline vehicles will be 30 miles/gallon. This is about the fuel economy of the highest rated vehicles this year. For hybrid vehicles, fuel economy is assumed to be 25% better than the EPA average.

Based on a comparison of a hybrid Toyota Sienna minivan and a Honda Odyssey, the hybrid achieved 25% better fuel economy.[4]

> "After 40,000 miles, the Sienna lost a bit of the pep in its step, posting a 7.7-second 60-mph time, but that's still quicker than minivans were 15 years ago. And no van from then could average 29 mpg over 40,000 miles. Our long-term 2018 Honda Odyssey returned 23 mpg. The Sienna betters that by 25 percent."

Vehicle Type

By 2030, battery electric vehicles are projected to be 6% of the total vehicles in Woodstock, and hybrids and plug-in hybrids are projected at 20% by 2030. The remainder, about 75%, will continue to be gasoline vehicles, but with better gas milage.

Town of Woodstock, Ulster County
Mid-Hudson Regional GHG Emissions Inventory
2021 Update to the 2010 Regional Inventory
Demographics & Basic Assumptions

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Population	6287	6337	6387	6437	6487	6537	6587	6637	6687	6737	6787
Vehicles/1000	630	630	630	630	630	630	630	630	630	630	630
Total Vehicles	3961	3992	4024	4055	4087	4118	4150	4181	4213	4244	4276
EPA Fuel Economy	22.2	23.0	23.7	24.5	25.2	26.0	26.7	27.5	28.2	29.0	29.7
EV Percent	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%
Hybrid Percent	5.0%	6.5%	8.0%	9.5%	11.0%	12.5%	14.0%	15.5%	17.0%	18.5%	20.0%

On-Road Vehicle Emission Calculations

The charts below show on-road vehicle emissions for internal combustion (ICE), hybrid, and electric vehicles (EV) from 2020 to 2030. Most of the line items are described above, but some could use additional explanation.

The number of vehicles, EPA fuel economy, and miles driven are basic assumptions. For ICE vehicles, fuel (gallons) consumed is derived using the estimated improvements in EPA fuel economy. Hybrid vehicles assume a fuel economy 25% greater than the EPA fuel economy.

To remove ethanol from the calculations, the total amount of fuel consumed is reduced by 10% to determine the amount of gasoline consumed. The CO_2 emissions from gasoline are computed, then uplifted to account for methane and nitrous oxide emissions to derive MTCO2e. Electric vehicles have no tailpipe emissions.

The MTCO2e emissions from the three vehicle types are summed to provide total MRCO2e from on-road vehicles in Woodstock.

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[4] K.C. Colwell and Caleb Miller, "Our 2021 Toyota Sienna Departs on a High Note," Car and Driver, July 18, 2022, Available at https://www.caranddriver.com/reviews/a37852579/2021-toyota-sienna-reliability-maintenance/

Town of Woodstock, Ulster County
Mid-Hudson Regional GHG Emissions Inventory
2021 Update to the 2010 Regional Inventory
Transportation Segment
On-Road Vehicle Emissions (Page 1 of 2)

		2020	2021	2022	2023	2024	2025
ICE	Vehicles	3,723	3,672	3,622	3,569	3,514	3,459
	Percent	94%	92%	90%	88%	86%	84%
	EPA Fuel Economy	22.2	23.0	23.7	24.5	25.2	26.0
	Miles Driven	11,500	11,500	11,500	11,500	11,500	11,500
	Fuel (gallons)	1,928,483	1,840,155	1,757,418	1,678,817	1,603,524	1,533,028
	Gasoline (gallons)	1,735,634	1,656,140	1,581,677	1,510,935	1,443,172	1,379,725
	MTCO2	15,425	14,718	14,056	13,428	12,825	12,262
	MTCO2e	15,651	14,934	14,262	13,625	13,014	12,441
Hybrid	Vehicles	198	260	322	385	450	515
	Percent	5%	7%	8%	10%	11%	13%
	EPA Fuel Economy	22.2	23.0	23.7	24.5	25.2	26.0
	Fuel Economy	27.8	28.7	29.6	30.6	31.5	32.4
	Miles Driven	11,500	11,500	11,500	11,500	11,500	11,500
	Fuel (gallons)	82,054	104,227	124,996	144,867	164,286	182,582
	Gasoline (gallons)	73,849	93,804	112,496	130,380	147,857	164,324
	MTCO2	656	834	1,000	1,159	1,314	1,460
	MTCO2e	666	846	1,014	1,176	1,333	1,482
EV	Vehicles	40	60	80	101	123	144
	Percent	1%	2%	2%	3%	3%	4%
	Miles Driven	11,500	11,500	11,500	11,500	11,500	11,500
On-Road Totals	MTCO2e	16,317	15,780	15,277	14,800	14,347	13,923

Variances

The Regional Council's 2021 update shows transportation section emissions for Woodstock at 31,809 MTCO2e. Woodstock's calculations for on-road vehicle emissions for 2021 show 15,780 MTCO2e, a substantial difference. As discussed, estimates for the number of vehicles registered in Woodstock are probably incorrect, but cannot account for the huge variance with the Regional Council's GHG estimates.

One large source of on-road emissions not accounted for in Woodstock's calculations is the NY Thruway. The Mid-Hudson Regional GHG Emissions methodology allocates the emissions from the Thruway in Ulster County proportionally to all the municipalities in Ulster County.

From the viewpoint of the Regional GHG Emissions methodology, emissions from the Thruway would be considered Scope 1 emissions, but from the viewpoint of the municipalities, Thruway emissions should be considered Scope 3 emissions.

To normalize on-road vehicle emissions using vehicle counts and type with the Regional Councils' transportation sector emissions for Woodstock, the estimated NY Thruway emissions need to be treated as Scope 3 emissions.

2030 On-Road Emissions Projections

The chart below, a continuation of the chart on the previous page, shows year 2030 projections for Woodstock's on-road vehicle emissions.

Town of Woodstock, Ulster County
Mid-Hudson Regional GHG Emissions Inventory
2021 Update to the 2010 Regional Inventory
Transportation Segment
On-Road Vehicle Emissions (Page 2 of 2)

		2026	2027	2028	2029	2030
ICE	Vehicles	3,403	3,345	3,286	3,226	3,164
	Percent	82%	80%	78%	76%	74%
	EPA Fuel Economy	26.7	27.5	28.2	29.0	29.7
	Miles Driven	11,500	11,500	11,500	11,500	11,500
	Fuel (gallons)	1,465,630	1,401,496	1,339,958	1,281,608	1,225,044
	Gasoline (gallons)	1,319,067	1,261,346	1,205,962	1,153,448	1,102,540
	MTCO2	11,723	11,210	10,717	10,251	9,798
	MTCO2e	11,894	11,374	10,875	10,401	9,942
Hybrid	Vehicles	581	648	716	785	855
	Percent	14%	16%	17%	19%	20%
	EPA Fuel Economy	26.7	27.5	28.2	29.0	29.7
	Fuel Economy	33.4	34.3	35.3	36.2	37.1
	Miles Driven	11,500	11,500	11,500	11,500	11,500
	Fuel (gallons)	200,195	217,180	233,589	249,465	264,848
	Gasoline (gallons)	180,175	195,462	210,230	224,518	238,364
	MTCO2	1,601	1,737	1,868	1,995	2,118
	MTCO2e	1,625	1,763	1,896	2,025	2,149
EV	Vehicles	166	188	211	233	257
	Percent	4%	5%	5%	6%	6%
	Miles Driven	11,500	11,500	11,500	11,500	11,500
On-Road Totals	MTCO2e	13,519	13,137	12,770	12,426	12,091

Between 2021 and 2030, vehicle emissions will have dropped from 15,780 to 12,091 MTCO2e, a drop of 23%. In spite of an increase in population and number of vehicles in Woodstock, a combination of more electric vehicles and hybrid vehicles, and improving fuel economy for ICE vehicles, resulted in a decrease in total GHG emissions from on-road vehicles.

Off-Road Vehicle Emissions

The off-road classification includes vehicles such as ATVs, golf carts, and snowmobiles; tractors and other agriculture equipment; construction and mining equipment; and lawn and garden equipment.

Table 13 – 2007 Off-Road Emissions by Equipment Type (MTCO$_2$e)

Equipment Type	Total MTCO$_2$e
Recreational Equipment	54,919
Construction and Mining Equipment	298,738
Industrial Equipment	133,235
Lawn and Garden Equipment (Res)	64,307
Lawn and Garden Equipment (Com)	123,886
Agricultural Equipment	20,784
Commercial Equipment	135,464
Logging Equipment	1,420
Airport Equipment	1,344
Railroad Equipment	216
Total	**834,313**

Note: Totals may not sum due to independent rounding.

Lawn mowing contributes to air pollution. According to the U.S. Environmental Protection Agency (EPA), one hour operating a new gasoline lawn mower emits the same amount of volatile organic compounds and nitrogen oxide driving a new car 45 miles. Garden equipment engines produce up to 5% of the nation's air pollution. Gasoline-powered lawn and garden equipment emit air pollutants such as carbon dioxide, carbon monoxide, hydrocarbons, volatile organic compounds, nitrogen oxides and particulate matter.

Some of these air pollutants contribute to the formation of ground-level ozone and haze. While ozone occurs naturally in the upper atmosphere and shields the earth from harmful radiation, ozone at ground level is a harmful pollutant.

Off-Road Emissions

The 2007 (proxy for 2010) off-road emissions in the Mid-Hudson Region were approximately 843,313 MTCO2e. Off-road emissions estimates are shown in Table 12 and Table 13.[5]

Off-road vehicle usage and emissions data for each of the seven counties in the Mid-Hudson Region in 2007 was obtained using EPA's NONROAD Emissions Model. The model input values were adjusted by NYS DEC. Among other emission types, the NONROAD model estimates carbon dioxide emissions. The emissions from all off-road vehicles, excluding those in the pleasure craft classification, in each county were summed, and converted to MTCO2e from short tons. To avoid double counting, the emission of vehicles in the pleasure craft classification is accounted in the marine emission source and is not included in the off-road emission source.

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[5] Melanie Patapis, Climate Smart Coordinator, "Mid-Hudson Regional Greenhouse Gas Emissions Inventory: An Update to the 2010 Regional Inventory", Hudson Valley Regional Council, 2023, pages 36, 37

Table 12 – 2007 Off-Road Emissions by County (MTCO₂e)

County	Total MTCO2e
Dutchess	113,231
Orange	117,542
Putnam	36,752
Rockland	102,364
Sullivan	48,117
Ulster	63,346
Westchester	352,960
Mid-Hudson Region Total	**834,313**

Note: Totals may not sum due to independent rounding.

Woodstock Off-Road Emissions

The emission quantities provided in the Mid-Hudson Region GHG Update are estimates for 2010. For each equipment type, the emissions were adjusted for Woodstock based on the change in Ulster County's population between 2010 and 2020.

Projections to 2030 for off-road emissions are based on the assumed change in Woodstock's population by 2030, as shown in the previous "Demographics & Basic Assumptions" table.
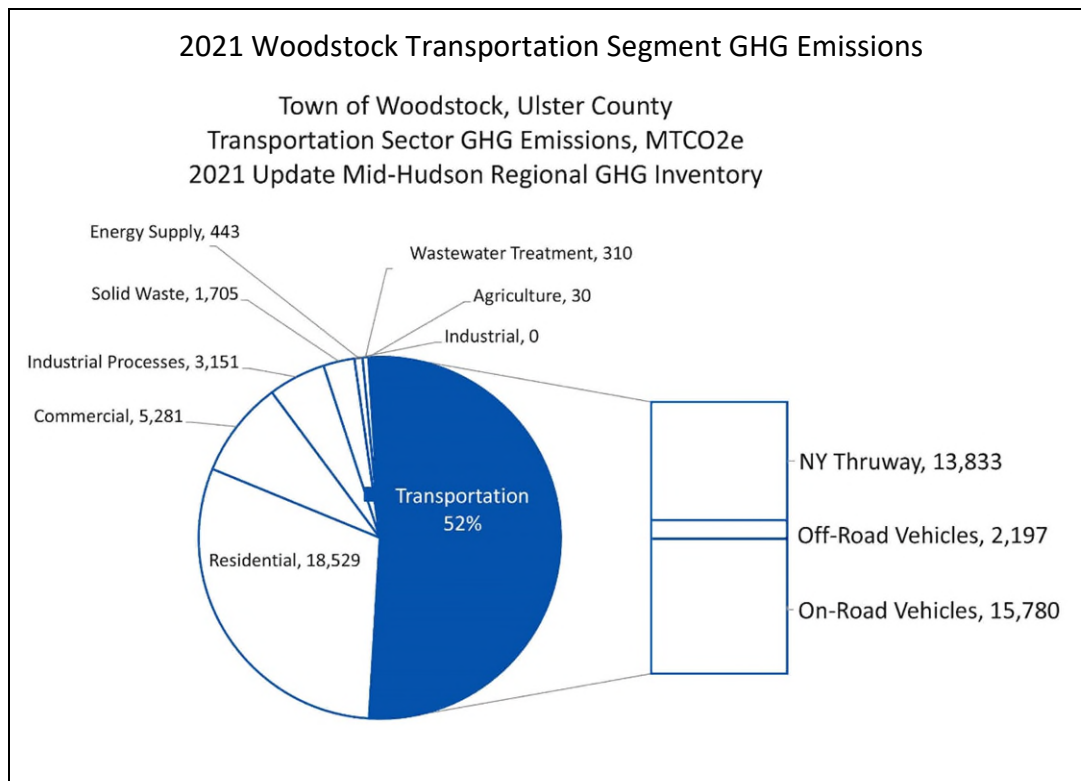
Town of Woodstock, Ulster County
Mid-Hudson Regional GHG Emissions Inventory
2021 Update to the 2010 Regional Inventory
Transportation Segment
Off-Road Vehicle Emissions

		2010 Census MTCO2e			2020 Census MTCO2e	
		Mid-Hudson Regional	Ulster County	Woodstock	Ulster County	Woodstock
Off-Road Emissions	Recreation Equipment	54,919	4,170	134	4,149	143
	Construction & Mining	298,738	22,682	730	22,571	780
	Industrial Equipment	133,235	10,116	326	10,067	348
	Lawn & Garden (Residential)	64,307	4,883	157	4,859	168
	Lawn & Garden (Commercial)	123,886	9,406	303	9,360	324
	Agricultural Equipment	20,784	1,578	51	1,570	54
	Commercial Equipment	135,464	10,285	331	10,235	354
	Logging Equipment	1,420	108	3	107	4
	Airport Equipment	1,344	102	3	102	4
	Railroad Eqiopment	216	16	1	16	1
	Sum of Off-Road Emissions	**834,313**	**63,346**	**2,040**	**63,037**	**2,179**

Total Emissions, Transportation Sector

Town of Woodstock, Ulster County
Mid-Hudson Regional GHG Emissions Inventory
2021 Update to the 2010 Regional Inventory
Transportation Segment, Total Emissions by Source

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
NY Thruway	14,300	13,833	13,395	12,984	12,597	12,233	11,890	11,565	11,257	10,966	10,689
Off-Road Vehicles	2,179	2,197	2,214	2,231	2,249	2,266	2,283	2,301	2,318	2,335	2,353
On-Road Vehicles	16,317	15,780	15,277	14,800	14,347	13,923	13,519	13,137	12,770	12,426	12,091
Total Emissions	32,796	31,809	30,886	30,016	29,193	28,423	27,692	27,002	26,346	25,727	25,133

2021 Woodstock Transportation Segment GHG Emissions

Town of Woodstock, Ulster County
Transportation Sector GHG Emissions, MTCO2e
2021 Update Mid-Hudson Regional GHG Inventory

Energy Supply, 443
Wastewater Treatment, 310
Solid Waste, 1,705
Agriculture, 30
Industrial, 0
Industrial Processes, 3,151
Commercial, 5,281
Transportation 52%
Residential, 18,529
NY Thruway, 13,833
Off-Road Vehicles, 2,197
On-Road Vehicles, 15,780

The update to the "Mid-Hudson Regional Greenhouse Gas Emissions Inventory" showed Woodstock's, 2021 transportation sector, with emissions of 31,809 MTCO2e.

As described in previous sections, on-road vehicles accounted for 15,780 MTCO2e and off-road equipment and vehicles accounted for 2,197 MTCO2e of emissions in 2021. The reminder, attributed to traffic on the NY Thruway, were classified as Scope 3 emissions.

Assuming vehicles that travel the NY Thruway would enjoy the same overall improvements in EPA fuel economy as ICE on-road vehicles, emissions emanating from the NY Thruway were projected to 2030.

Transportation Sector Conclusions

A number of factors will reduce the GHG emissions in Woodstock's transportation sector by the year 2030. There will be continuing improvement in the average vehicle fuel economy through the replacement of older vehicles by newer, more efficient ones. Fuel economy for newly manufactured vehicles is expected to continue improving.

EPA average fuel economy for passenger vehicles is currently 22.2 miles/gallon, and its assumed to increase to 30 miles/gallon by 2030. Currently, vehicles with fuel economy of over 30 miles/gallon are available, and by 2030, many of the older, low milage vehicles will by replace higher milage ones.

Adoption of hybrid vehicles will significantly reduce on-road GHG emissions by 2030 by offering performance equivalent to internal combustion engine vehicles, but with 25% less fuel consumption. The adoption of all battery electric vehicles also contributes to the reduction of GHG emissions during the period to 2030.

Town of Woodstock, Ulster County
Changes in GHG Emissions, MTCO2e
Transportation Segment

	2021 GHG Update MTCO2e	2030 Projection MTCO2e	% Change
On-Road Emissions	15,780	12,091	(23%)
Off-Road Emissions	2,197	2,353	7%
NY Thruway Emissions	13,833	10,689	(23%)
Total Transportation Sector	31,809	25,133	(21%)

Off-road emissions are the only vehicles and equipment not showing a reduction in emissions during this period. Within the context of this analysis, the off-road emissions may seem low, but compared to Woodstock governmental emissions, it's signification. Woodstock governmental emission for 2021 are about 515 MTCO2e; off-road emission for Woodstock in same year are four times Woodstock's governmental emissions. Who would have known that mowing lawns was such a threat to the planet?
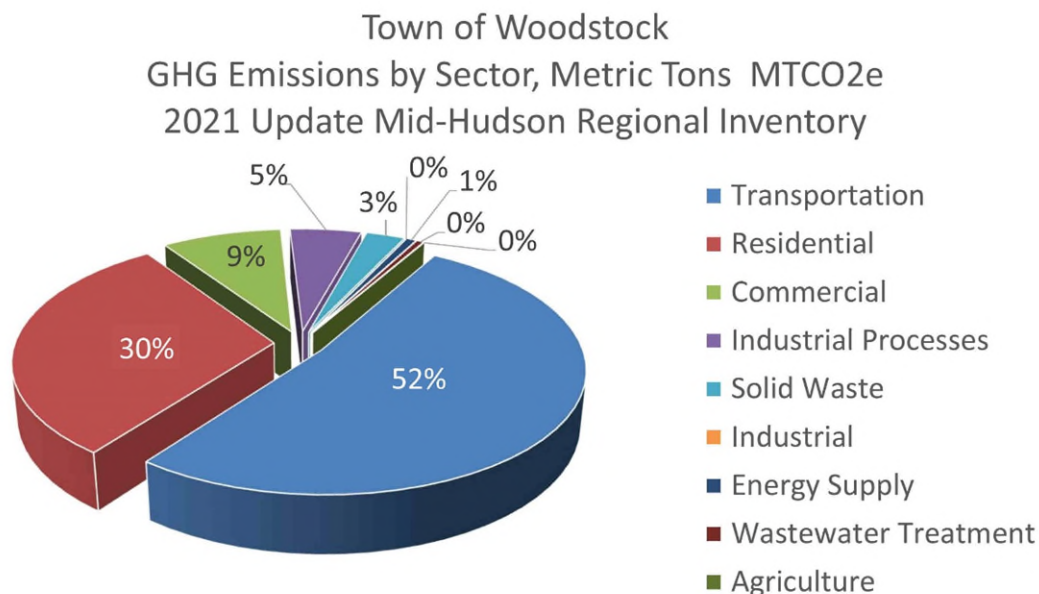
Residential Sector

Town of Woodstock
GHG Emissions by Sector, Metric Tons MTCO2e
2021 Update Mid-Hudson Regional Inventory

Legend:
- Transportation
- Residential
- Commercial
- Industrial Processes
- Solid Waste
- Industrial
- Energy Supply
- Wastewater Treatment
- Agriculture

Mid-Hudson Regional Council GHG Emissions Update

During 2012, New York Climate Smart Communities and NYSERDA's Cleaner, Greener Communities (CGC) program formulated regional GHG inventories for the state's economic development regions. On December 13, 2012, ICF International released its *Mid-Hudson Regional Greenhouse Gas Emissions Inventory, Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inventory,* a comprehensive GHG inventory for the Mid-Hudson Region. The Mid-Hudson Regional Inventory estimates emissions for the entire Mid-Hudson region and provides community-level data for each village, town, city, and county in the region for the baseline year of 2010.

In 2023, the staff of the Hudson Valley Regional Council (HVRC), with the assistance of Climate Action Associates, LLC, updated the original, *Mid-Hudson Regional Greenhouse Gas Emissions Inventory Final Report*, using data from 2020, 2021, and 2022. Early in 2024, Woodstock joined other municipalities in a cohort sponsored by the Mid-Hudson Regional Council to develop a municipal community GHG inventory and Climate Action Plan (CAP) using the 2021 updated regional GHG inventory.

Residential Sector

In the Mid-Hudson Region, the analysis indicates that the Region's total emissions across all sectors in 2021 were approximately 24.32 million MTCO2e. The single largest source of GHG emissions is energy consumption from transportation, which is responsible for 46% of regional emissions, or 11.3 million MTCO2e. The second largest contributor is residential stationary energy combustion from home heating and lighting, which is responsible for 21% of emissions, or 5.1 million MTCO2e.

This document describes the sources of emissions for the residential sector, sets emission reduction targets, and provides the basis for a Community Climate Action Plan with specific quantified strategies to achieve these targets. Woodstock's community-wide emissions in 2021 totaled 61,259 MTCO2e. The town's residences, the second largest source, accounted for 18,529 MTCO2e, 30% of the overall emissions.

Emissions for the residential sector include emissions from heating and electric usage.

The inventory is organized by source and by "Scope." Scope refers to the degree of control that the regional community has over the emission source. Although the Scope framework was first developed for corporate-level GHG inventories, a similar principle is applied here. The basic definition of the Scopes for communitywide emissions is as follows:

- **Scope 1:** All direct emissions that occur physically within a boundary, such as those emitted by burning natural gas or fuel oil in homes, schools, and businesses.

- **Scope 2:** Indirect emissions from utility energy generation plants based on the amount of electricity (or other utilities such as hot water or steam) consumed withing the boundary, regardless of where the plants are located.

- **Scope 3:** All other indirect, upstream, or lifecycle emissions attributed to community activity regardless of where they occur.

Residential Housing Units

The first step for estimating GHG emissions from residential housing is to determine the existing housing inventory in Woodstock. There are two sources of data for identifying the number of residential housing units in Woodstock: Ulster County Parcel Data and the U.S. Census American Community Survey (ACS).

The Ulster County Tax Parcel file contains a listing for every property in Ulster County, and part of this identification is a classification about its use. New York State developed property class codes to provide a statewide uniform classification system for assessment administration. Assessors assign a code to each property on an assessment roll.[1] There are nine categories of property class codes, one of which, code 200, identifies residential properties, defined as "Property used for human habitation. Other living accommodations such as hotels, motels, and apartments are in the Commercial category - 400."

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[1] New York State, Department of Taxation and Finance, "Property type classification codes", Available at
https://www.tax.ny.gov/research/property/assess/manuals/prclas.htm

Below is a listing of parcel counts by residential site codes from the Ulster County Tax Parcel files. The counts for 2021 and 2023 were extracted directly from the parcel files for those years. The counts for 2022 are a rounded average of the 2021 and 2023 values.

Housing units is the number of residential units available on the parcel. It should be noted that this listing does not include apartments buildings, which under the New York State uniform classification system, are considered commercial properties, not residential. (A listing of apartments is provided as an appendix.)

Residential Site Codes
Ulster County Tax Parcels

Site Code	Site Code Text	Description
210	1 Family Res	One family year-round residence
215	1 Family Res w/Apt	One family year-round residence with accessory apartment
220	2 Family Res	Two family year-round residence
230	3 Family Res	Three family year-round residence
240	Rural Res	Rural residence with 10 or more acres
250	Estate	A residential property of not less than 5 acres with a luxurious residence and auxiliary buildings.
260	Seasonal Res	Dwelling units generally used for seasonal occupancy; not constructed for year-round
280	Res Multiple	Multi-Purpose/Multi-Structure
283	Res w/Comuse	Residence with incidental commercial use

Woodstock Housing Units
Woodstock Tax Parcels
Residential Units, Site Code 200s

		2021 Count	2021 Housing Units	2022 Count	2022 Housing Units	2023 Count	2023 Housing Units
	210, 1 Family Res	2984	2984	3001	3001	3017	3017
Multi-Family	215, 1 Family Res w/ Apt	52	104	55	110	57	114
	220, 2 Family Res	35	70	34	68	34	68
	230, 3 Family Res	4	12	5	15	5	15
	Sum of Multi-Family Σ	91	186	94	193	96	197
Other	240, Rural Res	239	239	239	239	238	238
	250, Estate	12	12	11	11	10	10
	260, Seasonal Rental	47	47	54	54	61	61
	280, Res Multiple Use	81	81	78	78	75	75
	283, Res w/Comm Use	2	2	2	2	2	2
	Sum of Other Σ	381	381	384	384	386	386
	Sum of Residential Σ	3456	3551	3479	3578	3499	3600
	Average Housing Units in Multi-Family	2.0		2.1		2.1	

The American Community Survey (ACS) is an ongoing survey by the U.S. Census that provides information on a yearly basis about the nation and its people. Through the ACS, data about jobs and occupations, educational attainment, veterans, whether people own or rent their homes is collected.

The Ulster County Housing Action Plan, released in 2021, outlines proactive policies that county and municipal governments can enact to provide housing solutions that respond to community need and create a diverse range of housing opportunities.[2]

The Plan reveals the impacts of ever-increasing housing costs and carefully examines the data and trends associated with housing. The Plan is intended to provide a base for the conversation with stakeholders in the County – elected officials, business leaders, the healthcare, education, and environmental communities – to come together to examine how what and where to build.

A snapshot for each Ulster County community, including Woodstock, was released that document some the demographic and housing needs. Much of the data in the snapshot is sourced from the 2018 American Community Survey.[3]

Town of Woodstock
2020 Housing Snapshot

Housing Characteristics

		Number	Percent of Total
	Total Housing Units	4,175	-
	Occupied Housing Units	2,808	67%
	Vacant Housing Units*	1,367	33%
Type	Renter Occupied Housing Units	627	22%
	Owner Occupied Housing Units	2,181	78%
Year Built	Built Prior to 1940	1,223	29%
	Built 1940 to 1959	771	18%
	Built 1960 to 1979	1,198	29%
	Built 1980 to 1999	541	13%
	Built 2000 or Later	442	11%

Source: 2018 American Community Survey (US Census Bureau)
*Includes vacant units that are for sale, for rent, and for seasonal / recreational use

Differences

There's a significant difference between the number of residential units identified in the Ulster County Parcel file and the housing units 2018 American Community Survey (ACS). One explanation is that ACS counts apartments as residential units while the Ulster County Tax Parcel Data classifies apartments as commercial properties. The parcel data shows Woodstock has 23 parcels as apartments.

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[2] Ulster County Housing Action Plan, 2021
[3] Town of Woodstock, 2020 Snapshot

Also, there are expected statistical variances in large scale surveys which are evident when the survey results are applied to smaller units. Every year, the U.S. Census Bureau contacts over 3.5 million households across the country to participate in the American Community Survey. Unlike the 10-year census, this survey continues all year, every year, and randomly sample addresses in every state, the District of Columbia, and Puerto Rico. But when the results are applied to small units, such as Woodstock or Ulster County, there are statistical variances from the actual. These variances are to be expected.

The ACS data shows that about a third of Woodstock's housing units are vacant. [4] **The ACS defines vacant as:**

American Community Survey - Vacant Units

Housing Unit. A housing unit is a house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with other persons in the structure and which have direct access from the outside of the building or through a common hall.

Occupied Housing Units. A housing unit is occupied if a person or group of persons is living in it at the time of the interview.

Vacant Housing Units. A housing unit is vacant if no one is living in it at the time of the interview. A vacant unit may be one which is entirely occupied by persons who have their usual residence elsewhere.

Year-round Vacant Units. Year-round units are those intended for occupancy at any time of the year, even though they may not be in use the year round.

Units also Considered Vacant

Vacant units for rent. This group consists of vacant units offered for rent and those offered both for rent and sale.

Vacant units for sale only. This group is limited to units for sale only;

Vacant units rented or sold. This group consists of year-round vacant units which have been rented or sold but the new renters or owners have not moved in as of the day of interview.

Vacant units held off the market. Included in this category are units held for occasional use, temporarily occupied by persons with usual residence elsewhere, and vacant for other reasons.

Considering the large number of second homes, STRs, and seasonal rentals in Woodstock, classifying a third of Woodstock's housing units as vacant is not unreasonable.

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[4] American Community Survey, Definitions, Available at https://www.census.gov/housing/hvs/definitions.pdf

Woodstock 2021 Residential Emissions

During 2023, the Hudson Valley Regional Council (HVRC) updated the original 2010 Mid-Hudson Regional Inventory, developed by ICF for NYSERDA, using the same methodology and with data from 2020, 2021, and 2022. The 2021 Updated Mid-Hudson Regional Inventory provides estimates of emissions for the Mid-Hudson region and community-level data for each village, town, city, and county in the region.

There are two major sources of emissions for the residential sector: emissions from heating and emissions from electric usage. In many cases, the methodologies used in the Mid-Hudson GHG inventory are beyond the capability of municipalities, and in those instances, Woodstock used other sources. The methodology used in the residential sector was especially challenging.

HVRC Mid-Hudson 2021 GHG Inventory Update
1.2 Electricity – Scope 2
Data & Methods

Scope 2 emissions from electricity consumption were calculated using a combination of reported usage from utilities and, where utility data are unavailable, consumption estimates. Central Hudson Gas & Electric, ConEdison, NYSEG, and Orange & Rockland Utilities data was obtained from the Utility Energy Registry (UER). The 2021 Inventory Update obtained data from the platform's back-end website, where utility data is directly uploaded and check before being published to the main UER webpage. To access this data, contact UER managers through the "Feedback" tab of the website.

The data covers all municipalities (cities, towns, and villages) in the region fully, therefore utility-reported usage was used. Some municipalities are in the service area of two utilities and the usage from both utilities is accounted for in their total consumption. Data was missing from April in all Central Hudson communities, due to a reporting error. In this case, April data was calculated using an average of the data from March and May.

The reported usage for that area (in MWh) serves as the full electricity data for that town or village. Where Commercial and Industrial data was not available, the UER data provided Residential and Non-Residential (Commercial + Industrial) sectors, the statewide breakdown in electricity consumption was used (80% commercial, 20% industrial).

Woodstock Data & Methods
Electrical Consumption
Residential GHG Inventory

Woodstock's primary source for estimating residential electrical usage was Joule Assets, Inc., 2022 Annual Report to the Public Service Commission.[5]

Joule Assets is Community Choice Aggregation (CCA) administrator for local governments that have decided to procure energy from an ESCO for eligible energy customers in the community.

Included in Joule Assets' annual report is a table listing all the communities served, the number of qualified utility accounts in each community, and a total electrical load for that community. This table provides electrical usage for over 100,000 residential and small commercial utility customers, and from that table, an average electrical usage is calculated.

The average yearly kWh usage per account for over 100,000 customers is 6,332 kWh. This result is used as Woodstock's base electrical usage for residential housing units.

Municipality	Number of accounts served at beginning of reporting period	Total Load kWh	Average Yearly kWh per account
Town of Clarkstown	15,306	140,257,234	9,164
Town of Orangetown	7,818	70,242,256	8,985
Village of Haverstraw	1,600	10,179,308	6,362
Village of Nyack	1,801	11,274,123	6,260
Village of South Nyack	671	3,533,031	5,265
Village of Upper Nyack	484	4,615,239	9,536
City of Rochester	34,824	218,792,501	6,283
Town of Geneva	446	3,401,356	7,626
Village of Brockport	1,183	8,307,609	7,022
Village of Lima	426	3,596,627	8,443
City of Canandaigua**	2,723	9,557,016	3,510
Town of Brighton**	9,009	31,791,788	3,529
Village of Victor**	846	2,996,759	3,542
City of Beacon	2,602	13,189,782	5,069
City of Poughkeepsie	8,596	34,859,065	4,055
Town of Clinton	1,152	7,522,997	6,530
Town of New Paltz	1,598	10,844,512	6,786
Town of Marbletown	1,760	10,228,422	5,812
Town of Philipstown	2,200	17,532,147	7,969
Town of Redhook	1,363	8,032,904	5,894
Town of Saugerties	3,944	18,517,008	4,695
Village of Cold Spring	831	3,760,392	4,525
Village of New Paltz	1,223	5,381,270	4,400
TOTAL	**102,406**	**648,413,346**	**6,332**

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[5] Joule Assets, "2022 Joule Assets Community Choice Aggregation Annual Report", April 14, 2023, Available at https://www.joulecommunitypower.com/s/Joule-CCA-Annual-Report-2022.pdf

Electrical GHG Emissions

GHG emissions for the town's 2021 electrical usage are determined using emission factors from eGRID2019 for the Upper New York Sub-region.

The eGRID report provide GHG emissions for grid generated electricity that represent the average emissions rate of electric generators supplying power to the grid in the region.

eGRID Emissions by Version

	CO2e lbs/MWh	CO2 lbs/MWh	Methane lbs/GWh	Nitrous Oxide lbs/GWH
eGRID2019	233.0	232.3	17.0	2.0
eGRID2018	253.9	253.1	18.0	2.0
eGRID2016	295.9	294.7	21.0	3.0
eGRID2014 V2	367.6	365.7	30.7	4.1
eGRID2014	379.2	377.2	32.3	4.4
eGRID2012	410.31	408.80	15.59	3.83
eGRID2010	548.37	545.79	16.30	7.24
eGRID2009	500.35	497.92	15.94	6.77

HVRC Mid-Hudson 2021 GHG Inventory Update
1.3 Fuels – Scope 1
Data & Methods

For all Scope 1 stationary fuels other than natural gas, the primary data sources for residential stationary combustion include the US Census Bureau Housing Unit data for 2020, the American Community Survey (ACS) 5-year housing characteristic estimate for 2020, and the Energy Information Administration's (EIA) New York State Energy Data System (SEDS) 2021 residential fuel consumption data, Table CT4.

In the 2010 Mid-Hudson Regional Inventory, guidance was provided by the 2010 NYGHG Working Group to develop a weighted estimate based on the occupancy of single-family detached (SFD), single-family attached (SFA), or multi-family (MF) dwellings, energy use per housing unit by different types of dwellings, the average Heating Degree Days (HDD) for each region in the state, and the use of household heating fuels by household count. Residential stationary combustion emissions are estimated by first estimating fuel consumption, and then multiplying estimated fuel consumption by fuel-specific emission factors.

Heating fuel counts were based only on occupied units.

Occupied housing units were adjusted to account for the difference in energy use per housing unit by dwelling type, as determined in the 2010 Mid-Hudson Regional Inventory by the NYGHG Working Group: a SFD uses 108 MMBTU per year, while a SFA uses 89 MMBTU per year, and a MF uses 54 MMBTU per year.

Woodstock Data & Methods
Heating Fuels
Residential GHG Inventory

Woodstock generally followed the above methodology to estimate residential emissions, but with some major exceptions.
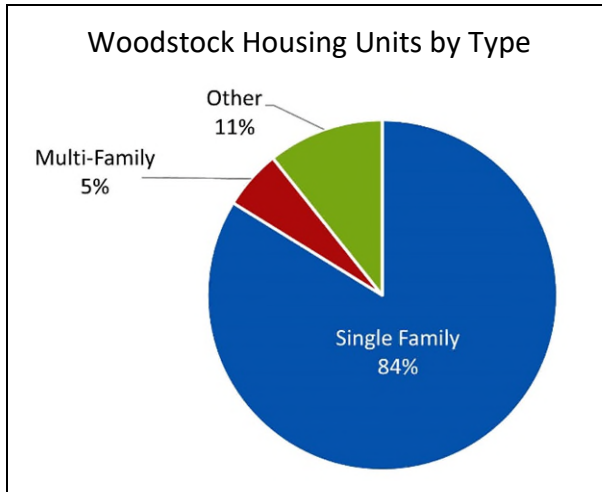
The SFA housing type, Single Family Attached, defined as "a single family residence that is built to the edge of the lot line next to another similar single family residence on the edge of its lot, such that the two buildings are touching along an exterior wall," was not considered.

The above methodology only considers heating fuel usage for occupied housing units. This is an unreasonable assumption in Woodstock where a third of the housing units are vacant. Vacant does not mean unheated, although fuel use would be lower than for full time occupied housing units.

Housing Type	MMBTU
Single Family	108
Multi-Family	54
Vacant	41
Other	108

Estimated energy use, express in MMBTUs,[6] were assigned to occupied housing units in the 2010 Mid-Hudson Regional Inventory by the NYGHG Working Group and adjusted to account for the difference in energy use per housing unit type. Woodstock adjusted these assignments by adding vacant housing units at 41 MMBTU. The table to the right lists the energy use in MMBTU for housing types considered by Woodstock.

Housing Types

Woodstock Housing Units by Type

Data from the 2023 Ulster County Parcel File shows Woodstock with 3,600 housing units, (site codes in the 200s), with single family residences accounting for 84% of the housing units.

According to the ACS data provided by Ulster County, one-third of all Woodstock's housing units are classified as vacant.

One objective of Woodstock's proposed zoning law changes is to increase the inventory of multi-family homes.

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[6] MMBTU is the abbreviation for one million British thermal units. It is the common unit used to measure heating content and the value of a fuel.

Calculation of Residential GHG Emissions

Using the above data, it becomes possible, although not easy, to calculate residential GHG emissions for Woodstock. The first step is to determine total residential MMBTU using the above constants. Second, calculate MMBTU for residential electric usage and subtract electrical MMBTUs from the total residential MMBTUs. The result is the MMBTU used for heating. Finally, all MMBTU rates are converted to MMCO2e, the GHG emissions.

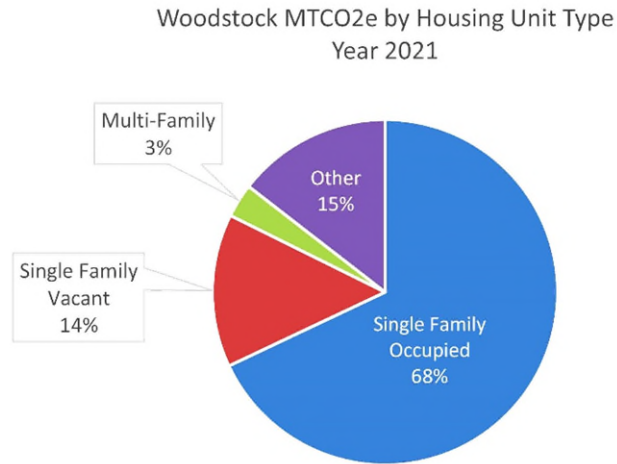**Woodstock Residential GHG Emissions by Housing Type**
for the Year 2021

Year:'2021' Residential MTCO2e

|		Single Family Occupied	Single Family Vacant	Multi-Family	Other	Total
	Sum of Housing Units	1,812	1,172	186	381	3,551
	MMBTU / Housing Unit	108	41	54	108	
	Housing Units MMBTU Total	195,714	47,854	10,044	41,148	
Electric Usage	Yearly Base kWh / Housing Unit	6,332	6,332	6,332	6,332	
	Yearly Base MWh Total	11,475	7,420	1,178	2,412	22,485
	MMBTU / MWh	3.412142	3.412142	3.412142	3.412142	
	Electric MMBTU Total	39,153	25,318	4,019	8,232	
Heating Fuel	Heating Fuel MMBTU Total	156,561	22,536	6,025	32,916	
	Gallons Heating Fuel / MMBTU	7.1429	7.1429	7.1429	7.1429	
	Gallons Heating Fuel Total	1,118,301	160,971	43,038	235,117	1,557,428
	Gallons Heat Fuel/Housing Unit	617	137	231	617	
CO2	Lbs. CO2 / Heating MMBTU	163.45	163.45	163.45	163.45	
	Lbs. CO2 per MWh	233.1	233.1	233.1	233.1	
	Heating Fuel MTCO2e	11,599	1,670	446	2,439	16,154
	Electric MTCO2e	1,212	784	124	255	2,376
	Total Residential MTCO2e	12,811	2,454	571	2,694	18,529

Woodstock Residential Emissions MTCO2e

The analysis shows that Woodstock's residential sector uses over 22,000 MWh of electricity and about 1.5 million gallons of heating fuel oil. Fuel oil used for heating accounts for 87% of the emissions in the residential section, while electricity represents only 13% of emissions.

Mid-Hudson 2021 Update GHG Inventory
Total Residential GHG Emissions, 18,529 MMTCO2e
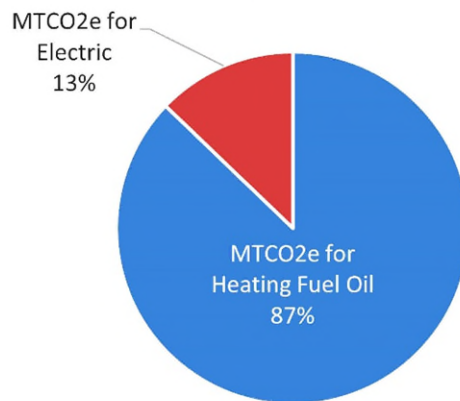
Mid-Hudson 2021 Update GHG Inventory
Total Residential GHG Emissions, 18,529 MMTCO2e

Woodstock 2030 Do-Nothing Projection

The Do-Nothing projection is based on current trends continuing without any action by the town to alter the results. Although major changes in the zoning law are contemplated, there is no consensus about the outcome. This projection assumes current trends continue.

Below is a chart created from the Ulster County Tax Parcel data showing the number of residential buildings, site code 200s, built each year during the past thirty years. Although there have been ups-and-down, the trend line has been steady between 12 to 14 units a year.
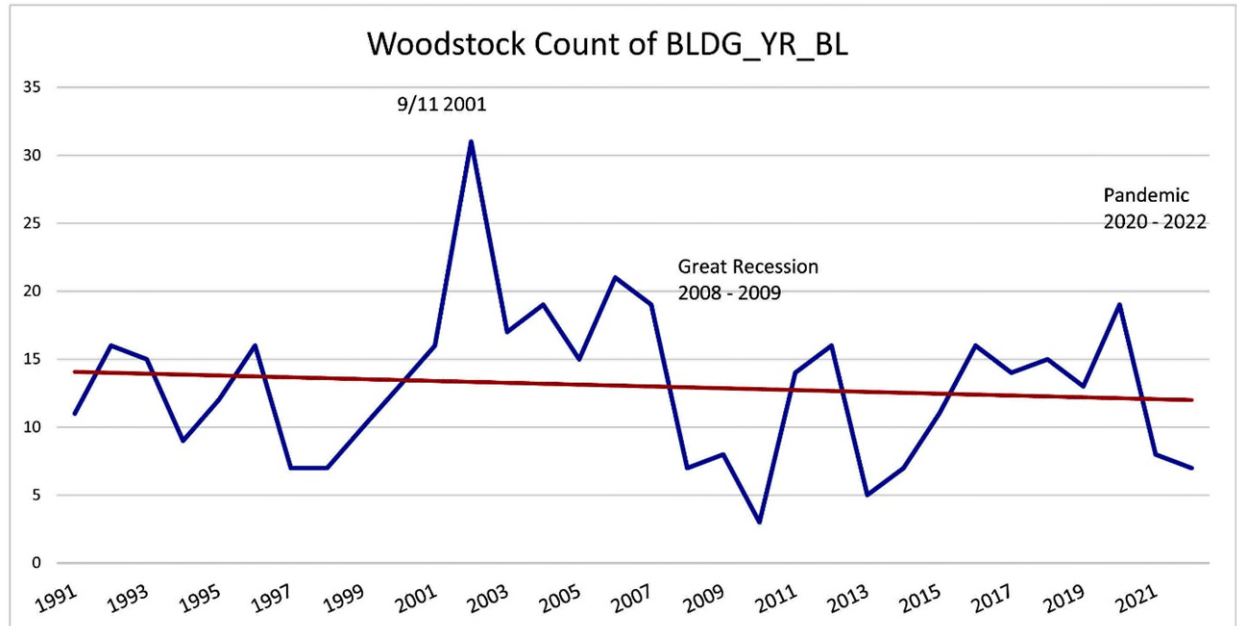
Note: 2022 data is incomplete

Workforce Issues

In the period between December 2019 to December 2021, the S&P 500 index returned, in real terms adjusted for inflation, over 35%. In the same period, the real return on housing was close to 20%. According to a Federal Reserve Bank of St. Louis study, there were 3.27 million "excess retirees" as of December 2022. The booming asset returns in 2020-2021 help explain the significant increases in wealth of those 65 and older and the large number of drop-outs from the workforce of those near retirement.[7]

Woodstock is an attractive location for second home owners and retirees, and under current circumstances, it's expected to remain attractive to the over 65 crowd. According to the January 2024 employment report, there are 828,000 fewer workers over 65 than in February 2020.

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[7] Miguel Faria e Castro and Samuel Jordan-Wood, "Pandemic Labor Force Participation and Net Worth Fluctuations," Federal Reserve Bank of St. Louis Review, First Quarter 2024, pp. 40-58. https://doi.org/10.20955/r.106.40-58

Do-Nothing Assumptions

- About 14 new, single-family residences are built each year.

- One new, multi-family residence is added each year, although this could just be an accessory apartment. The average number of family units increases from 2.1 to 3.0 housing units per residence by 2030.

- At least one-third of Woodstock's residential units will continue to be classified as vacant, i.e. second homes, STR rentals, and seasonal rentals.

- Energy use will continue as presented by the Mid-Hudson Valley GHG Inventory Update.

- The do-nothing projection makes no assumptions about solar additions, EV charging stations, or the use of heat pumps.

- No attempt has been made to include the effects of the proposed changes to the zoning law.

Woodstock Residential GHG Emissions by Housing Type
Do-Nothing Projection
for the Year 2030

Year:'2030' Residential MTCO2e

		Single Family Occupied	Single Family Vacant	Multi-Family	Other	Total
	Sum of Housing Units	1,866	1,249	283	386	3,784
	MMBTU / Housing Unit	108	41	54	108	
	Housing Units MMBTU Total	201,558	50,994	15,282	41,688	
Electric Usage	Yearly Base kWh / Housing Unit	6,332	6,332	6,332	6,332	
	Yearly Base MWh Total	11,817	7,907	1,792	2,444	23,960
	MMBTU / MWh	3.412142	3.412142	3.412142	3.412142	
	Electric MMBTU Total	40,322	26,979	6,114	8,340	
Heating Fuel	Heating Fuel MMBTU Total	161,236	24,015	9,168	33,348	
	Gallons Heating Fuel / MMBTU	7.1429	7.1429	7.1429	7.1429	
	Gallons Heating Fuel Total	1,151,693	171,533	65,483	238,203	1,626,912
	Gallons Heat Fuel/Housing Unit	617	137	231	617	
CO2	Lbs. CO2 / Heating MMBTU	163.45	163.45	163.45	163.45	
	Lbs. CO2 per MWh	233.1	233.1	233.1	233.1	
	Heating Fuel MTCO2e	11,945	1,779	679	2,471	16,874
	Electric MTCO2e	1,249	835	189	258	2,532
	Total Residential MTCO2e	13,194	2,615	869	2,729	19,406

Appendix – Woodstock Apartments

Woodstock Housing Units
2023 Woodstock Parcels, Code 411
Apartments

| Site Code	ADDRNO	ADDRNAME	OWNER_NAME
411	18	Broadview Rd	Bullard, Thomas Hugh
411	1	Leslie Way	Woodstock Commons Housing
411	18	Maple Ln	McGehee, Sharon A
411	72	Meads Mt Rd	Two Hundred Fourteen
411	51	Millstream Rd	Brookside Getaway LLC
411	40	Orchard Ln	Hampton Bay Investors LLC
411	6-10	Orchard Ln	Tree Oasis LLC
411	5-9	Rock City Rd	Scarborough, David
411	4228	Route 212	SIRR LLC
411	207-214	Simmons Ct	Laurelside Two LLC
411	5	Sled Hl	Three-Five Sled Hill LLC
411	2	Striebel Rd	Graham , Jeffrey C
411	6	Studio Ln	Simon, Robert
411	20	Tannery Brook Rd	Twenty Tannery Brook Rd
411	114	Tinker St	One Hundred Fourteen LLC
411	117	Tinker St	Muth, John
411	120	Tinker St	Henderson, Kerry J
411	137	Tinker St	Tensen, Timothy
411	94	West Hurley Rd	Avery, Marcia F: Trust
411	96	West Hurley Rd	Laurelside Three LLC
411	4	White Birch Ln	Stengel, Gregory T Esq
411	3-10	Woodstock Estates Dr	Woodstock Estates Drive, LLC
411	12-22	Woodstock Meadows Ln	Two Hundred Twelve

2030 Do-Nothing Case
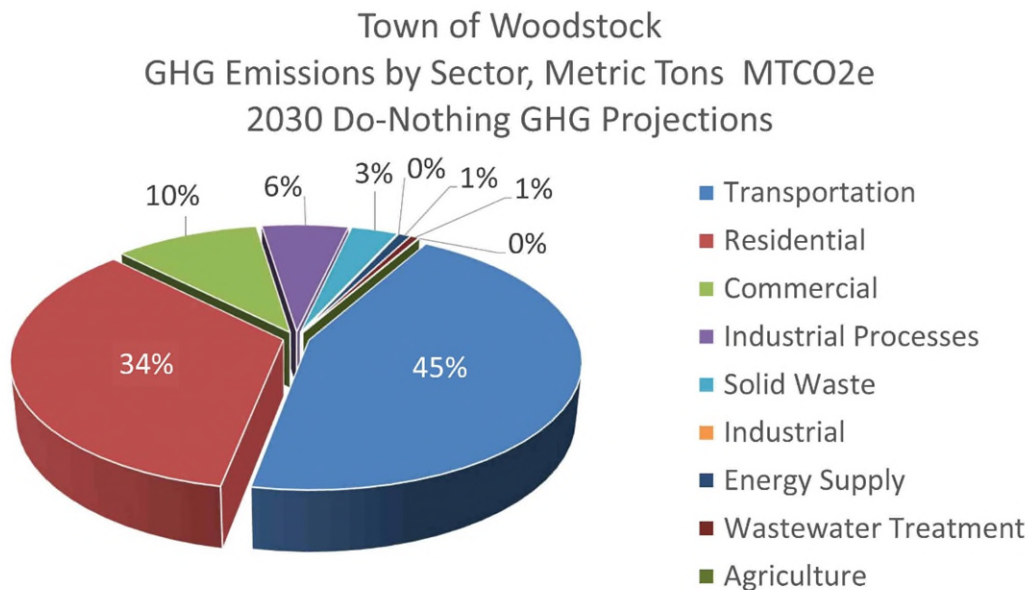
The Do-Nothing Case doesn't mean doing nothing, but rather it is a projection of existing trends to 2030. There are programs and changes that the town could adopt that might change the projections, but the Do-Nothing Case considers only what is already in place.

The transportation and residential sectors remain Woodstock's largest sources of GHG emissions in 2030, but the transportation sector will have shrunk from the 52% of Woodstock's emission to 45%, while the residential sector emissions will have grown from 30% to 34% of Woodstock's total. Overall, Woodstock's 2030 GHG emissions are projected at 56,234 compared to 2021's emission of 61,258, a drop of 8%.

In 2021, combined, transportation and the town's residences are responsible for 82% of the Woodstock's community wide emissions. In 2030, transportation and residential emissions combined are 79% of Woodstock's community emissions.

No attempt was made to analyze the other sectors of Woodstock's emissions, but the emissions in these sectors were increased, year-over-year, in proportion to the increases in population.

Town of Woodstock
Metric Tons CO2e by Sector
2010, 2021, 2030
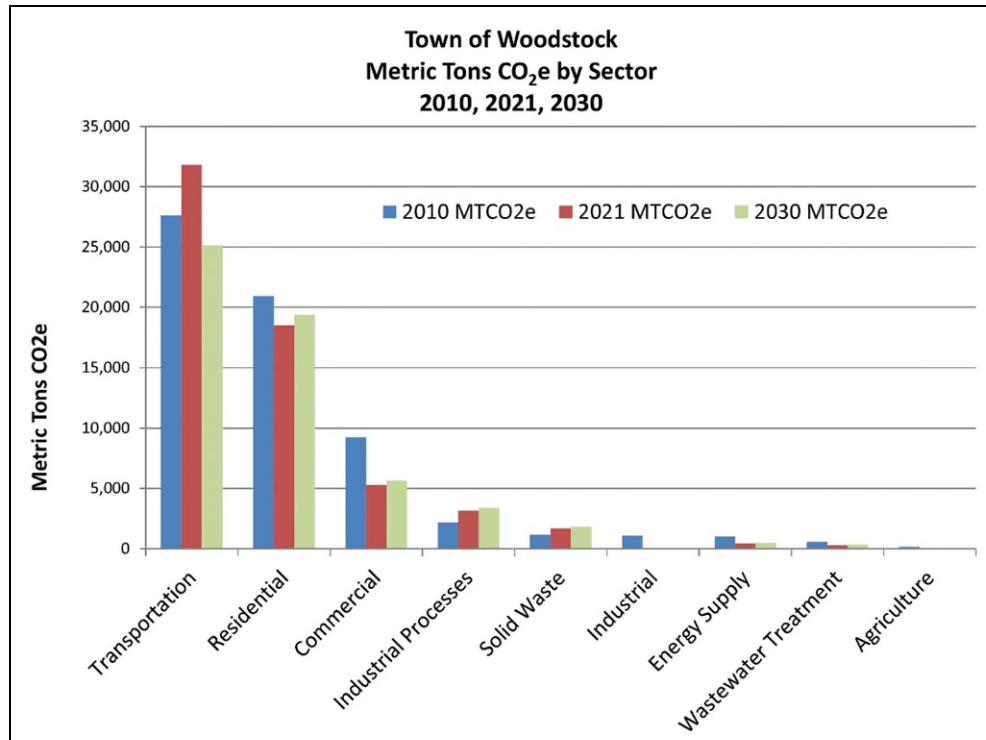
Transportation Sector
Existing Programs and Initiatives

Existing programs at the state and national levels to increase fuel economy and introduce hybrid and electric vehicles will have substantial impact on emissions from transportation. It's not expected any action undertaken by the town would change this trajectory.

Off-road vehicles, especially lawn and garden equipment, present an opportunity for action by the town. The high levels of emissions produced by 2-cycle and 4-cycle garden equipment could be reduced with the introduction of electric garden equipment and reduced lawn mowing.

Off-Road Vehicles – Pollinator Pathway

Woodstock NY Pollinator Pathway, a project of Woodstock Land Conservancy, Catskill Center, Woodstock NY Transition, Woodstock Environmental Commission, and community member partners, has a goal is to build a "pathway" of closely connected pollinator-friendly habitats, neighborhood by neighborhood. Included in the Pathway's education program is instruction on best practices for mowing and lawn maintenance, and the introduction of electric powered gardening equipment is a natural addition to the pathway program.

Residential Sector
Existing Programs and Initiatives

Fossil fuel heating accounts for 87% of the GHG emissions from the residential sector. There are two programs that address these emissions; one involving heat pumps and the other related to the New York stretch code.

Heat Pumps – New Yorkers for Clean Power

New Yorkers for Clean Power (NYCP), a statewide collaborative campaign that through education, advocacy and organizing, engages the public, local governments, and businesses to advance a range of energy solutions. NYCP focus areas include energy efficiency and heat pumps.

New Yorkers for Clean Power offers a variety of programs to promote energy efficiency and the application of heat pumps, which could be incorporated into a Woodstock focused promotion to reduce residential GHG emissions.

NYStretch-2020 – Ulster County Housing Initiative

The Ulster County Housing Smart Communities Initiative (Housing Smart Communities) is a certification and capacity-building program that provides guidance, technical support, and incentives for local municipalities to address their housing and affordability challenges.

One of the Housing Smart Actions identified is the adoption of a building energy code, a regulatory tool that establishes energy efficiency standards related to building construction and design that will reduce energy consumption and GHG emissions associated with one-to-four family homes.

New York State has provided an update to its voluntary addition its building code, NYStretch-2020, which can be adopted by local jurisdictions to further increase energy efficiency and reduce GHG emissions associated with new development projects.

Behind the Meter PV Solar

Statistics for net metered solar panels in Woodstock based on Central Hudson's October 2022 solar interconnection queue:

Individual Sites	Solar Capacity	Average Size
245	2,034 KW	8.3 KW

This installed solar capacity, at a capacity factor of 13%, generated about 2.3 MWh. The total Woodstock residential electrical usage in 2021 was about 22,485 MWh.

Community Thermal initiative
Existing Programs and Initiatives

In May 2023, NYSERDA approved a $100,000 contract for a Community Heat Pump Pilot Program for Woodstock. This is a "Category A" project, rewarded under NYSERDA PON 4614, where a feasibility study will be conducted to understand the heating and cooling needs of potential sites that could connect to a thermal energy network.

According to NYSERDA PON 4614, "A community-style heat pump system will use a network of pipes to share heating water among a cluster of buildings, where the cluster of buildings will use that heating water to produce comfort space heating of occupied spaces. The heating water could be centrally-produced as hot water via electric-driven heat pumps and used in the buildings via radiators for hydronic heating, or could be ambient-temperature water serving as a thermal source enabling electric-driven heat pumps located in each building. The heating water could also be used for production of domestic hot water, and a chilled water piping network could also be included to serve the comfort space cooling needs of the cluster of buildings."

Woodstock's application was a joint effort of the Woodstock Environmental Commission, Transition Woodstock, and CHA Consulting Inc. to investigate the feasibility of low carbon energy in a community-style heat pump, 5th generation configuration. The scoping study will focus on the central corridor through the town including portions of Mill Hill Road, Tinker Street, Rock City Road and Route 375. The selected route consists of residential and commercial zoned districts with 170 buildings of diverse types including houses, restaurants, apartments, retail stores, a school, and community buildings.

Composting
Existing Programs and Initiatives

The Woodstock Environmental Commission (WEC) submitted a grant application to the DEC's "Municipal Funding for Food Scraps Recycling Initiatives" program in October 2023. The goal of this funding is to assist municipalities in starting or expanding municipal food scraps recycling programs. To ensure equitable access and development of food scraps recycling opportunities for all New Yorkers, this year's opportunity will prioritize the first half of available funds for eligible projects serving Environmental Justice and Disadvantaged communities.

Woodstock Community GHG Emissions by Sector, 2021-2030

GHG Emissions by Sector, MTCO2e

2030 Community GHG

		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Woodstock Community GHG Emissions	Transportation	31,809	30,886	30,016	29,193	28,423	27,692	27,002	26,346	25,727	25,133
	Residential	18,529	18,648	18,751	18,844	18,938	19,031	19,124	19,218	19,313	19,406
	Commercial	5,281	5,323	5,364	5,406	5,448	5,489	5,531	5,573	5,614	5,656
	Industrial Processes	3,151	3,176	3,201	3,226	3,250	3,275	3,300	3,325	3,350	3,375
	Solid Waste	1,705	1,718	1,732	1,745	1,759	1,772	1,786	1,799	1,813	1,826
	Industrial	0	0	0	0	0	0	0	0	0	0
	Energy Supply	443	446	450	453	457	460	464	467	471	474
	Wastewater Treatment	310	312	315	317	320	322	325	327	330	332
	Agriculture	30	30	30	31	31	31	31	32	32	32
	Sum of Woodstock Σ	61,258	60,540	59,859	59,216	58,625	58,074	57,563	57,087	56,649	56,234

GHG Emission Changes
2010, 2021, 2030 Projected

Sector	2010 MTCO2e	2021 MTCO2e	2021 Sector %	2010-2021 Change	2010-2021 % Change	2030 MTCO2e	2030 Sector %	2021-2030 Change	2021-2030 % Change
Transportation	27,619	31,809	52%	4,190	15%	25,133	45%	(6676)	-21%
Residential	20,922	18,529	30%	(2,393)	-11%	19,406	35%	877	5%
Commercial	9,229	5,281	9%	(3,948)	-43%	5,656	10%	375	7%
Industrial Processes	2,184	3,151	5%	967	44%	3,375	6%	224	7%
Solid Waste	1,167	1,705	3%	538	46%	1,826	3%	121	7%
Industrial	1,079	0	0%	(1,079)	-100%	0	0%	0	0%
Energy Supply	1,015	443	1%	(572)	-56%	474	1%	31	7%
Wastewater Treatment	572	310	1%	(262)	-46%	332	1%	22	7%
Agriculture	172	30	0%	(142)	-83%	32	0%	2	7%
Total	63,959	61,258		(2,701)	-4%	56,234		(5024)	-8%