Ulster County

2018 Inventory of Community-wide Greenhouse Gas Emissions

March 2021

Produced by the Ulster County Department of the Environment
With Assistance from ICLEI - Local Governments for Sustainability USA

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Executive Summary

Ulster County 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. This report provides estimates of GHGs resulting from activities in Ulster County as a whole in 2018, and compares these to the 2010 community GHG inventory, which is used as the baseline to measure against.

Per Executive Order 1-2019, the Ulster County government "shall support ways to decrease energy use, decrease greenhouse gas emissions and increase the use of green power across our community and sets a goal of decreasing community wide greenhouse gas emissions by 80% by 2050 (below 1990 levels) using the regional GHG emissions inventory as a baseline."

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

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. Global climate change influences seasonal patterns and intensifies weather events, threatening the safety, quality of life, and economic prosperity of communities everywhere[1]. Many regions are already experiencing the consequences of global climate change, and Ulster County is no exception.

[1] International Panel on Climate Change. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp. Retrieved from https://www.ipcc.ch/report/ar5/syr/

Climate Hazards

Climate change is already impacting Ulster County and will likely accelerate in the future. According to the National Climate Assessment[2], between 1895 and 2011, temperatures in the Northeast increased by almost 2˚F (0.16˚F per decade), and precipitation increased by approximately five inches, or more than 10% (0.4 inches per decade). Coastal flooding has increased due to a rise in sea level of approximately 1 foot since 1900. The Northeast has experienced a greater recent increase in extreme precipitation than any other region in the United States: between 1958 and 2010 the region saw more than a 70% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events).

Projected Climate Change: As in other areas, the amount of warming in the Northeast will be highly dependent on global emissions of heat-trapping gases. If GHG emissions continue to increase, warming of 4.5ºF to 10ºF is projected by the 2080s; if global GHG emissions were reduced substantially, projected warming still ranges from about 3ºF to 6ºF by the 2080s. Heat waves, heavy downpours, and sea level rise pose growing challenges to many aspects of life in the Northeast.

The New York State Energy Research & Development Authority's (NYSERDA) *ClimAID Report* (2014 Supplement)[3] includes projections for the following climate hazards in Region 2 – Port Jervis, where Ulster County is located:

- Precipitation is projected to increase by approximately -1 to +10 percent by the 2020s; 1 to 14 percent by the 2050s, and 2 to 18 percent by the 2080s. Although the increase in total annual precipitation is projected to be relatively small, larger increases are projected in the frequency, intensity, and duration of extreme precipitation events (defined as events with more than 1, 2, or 4 inches of rainfall) at daily timescales.

- The total number of hot days in New York State is expected to increase as this century progresses. The frequency and duration of heat waves, defined as three or more consecutive days with maximum temperatures at or above 90 ˚F, are also expected to increase.

- Sea level is projected to rise along the New York State coastline and in the tidal Hudson by 3-8 inches by the 2020s, 9-21 inches by the 2050s, and 14-39 inches by the 2080s .The high-end estimate for sea level rise by the 2080s is 58 inches.

[2] *Third National Climate Assessment*. Available at: https://nca2014.globalchange.gov/report.
[3] *ClimAID 2014 Supplement - Updated Climate Projections Report*: Available at: https://www.nyserda.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Environmental-Research-and-Development-Technical-Reports/Response-to-Climate-Change-in-New-York

A key next step in planning for the impacts of climate change in Ulster County will include identifying and assessing local vulnerabilities to these and other potential primary and secondary climate hazards, and developing strategies and tools to address them.

Climate Action Planning

Many communities in the United States have started to take responsibility for addressing climate change at the local level. Reducing fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions. More efficient use of energy decreases utility and transportation costs for residents and businesses. Retrofitting homes and businesses to be more efficient creates local jobs. In addition, money not spent on energy is more likely to be spent at local businesses and will add to the local economy. Reducing fossil fuel use improves air quality and increasing opportunities for walking and bicycling improves residents' health. In 2021, the Ulster County government is launching its Green New Deal initiative and a climate adaptation planning project. These activities will include community stakeholder engagement in a climate action discussion to inform a community climate action plan.

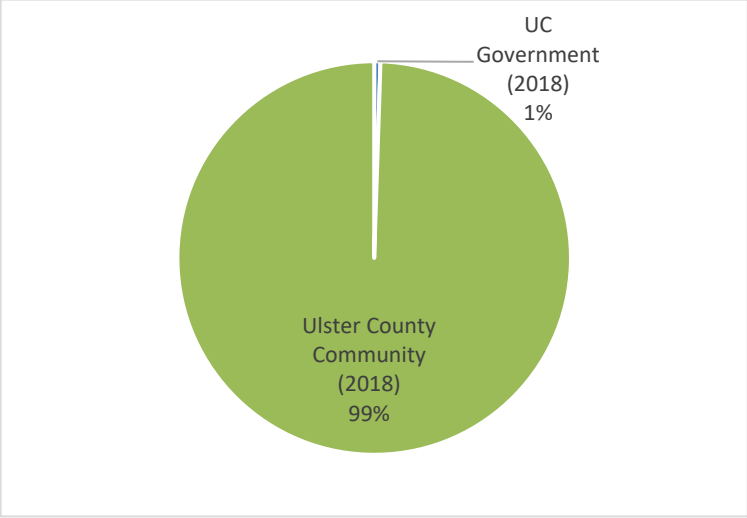
Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the Ulster County community, which includes operations of the Ulster County government. Government operations is mostly a subset of the community inventory, as shown in Figure 1. 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 have continued to join the climate protection movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the approach and methods provided by the *U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions* (Community Protocol) which is described below. As needed, the methodology provided by the *U.S. Community Protocol* has been supplemented by the New York Community and Regional GHG Inventory Guidance, Version 1.0.[4]

Figure 1 Relationship of Community and Government Operations Emissions



[4] Available here: https://climatesmart.ny.gov/fileadmin/csc/documents/GHG_Inventories/ghgguide.pdf

Three greenhouse gases are included in this inventory: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Many of the charts in this report represent emissions in "carbon dioxide equivalent" (CO_2e) values, calculated using the Global Warming Potentials (GWP) for methane and nitrous oxide from the *IPCC 5th Assessment Report*:

Table 1 Global Warming Potential Values (IPCC, 2014)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous Oxide (N_2O)	265

Community Emissions Protocol

Version 1.2 of the U*.S. Community Protocol for Accounting and Reporting GHG Emissions*[5] was released by ICLEI in 2019 and represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities.

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced as a consequence of community "activities".

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

By reporting on both GHG emissions sources and activities, local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory

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

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.

Baseline Year

The inventory process requires the selection of a base year with which to compare current emissions. Ulster County's community GHG inventory utilizes 2010 as its baseline year. The 2010 Mid-Hudson Regional GHG Inventory was the first community wide GHG inventory completed for Ulster County and serves as the best reference point for comparing recent year emission and tracking progress against Ulster County government GHG emissions goals.

2010 Mid-Hudson Regional GHG Inventory

New York State conducted regional GHG emissions inventories for the baseline year 2010, which included emissions for each community in the Mid-Hudson Region[6]. To align the methods used with those used by other regions in New York State, the State convened the NYGHG Working Group to develop a standard New York GHG Protocol (NYGHG Protocol). The Inventory was developed based on the latest methods determined by the NYGHG Working Group at the time, as well as the latest data provided to that group. As inventory protocols were not finalized for all sources, and several data sources requested through the NYGHG Working Group were not available in time for publication, the 2010 Inventory is not directly comparable to new 2018 Inventory completed using ICLEI's ClearPath software. The 2010 Inventory generally used similar data sources, methodology, and calculations for the largest emissions sectors however, as compared to the 2018 Inventory, and therefore will continue to serve as a useful reference point for quantifying and tracking Ulster County community GHGs over time.

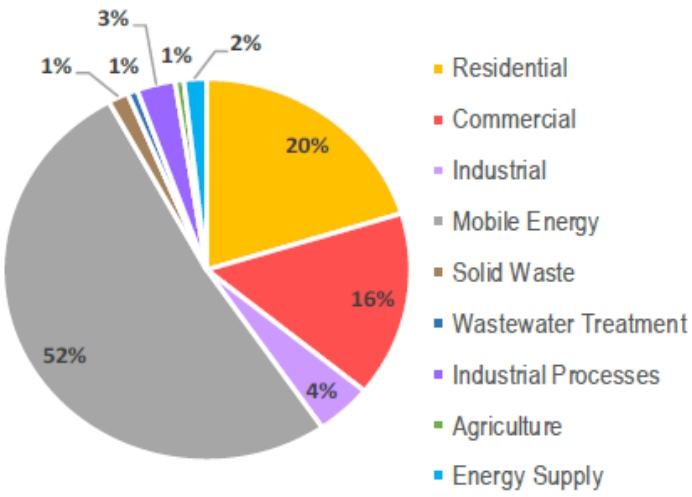
[6] *Mid-Hudson Regional Greenhouse Gas Emissions Inventory Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inventory* (2012). Available at: https://climatesmart.ny.gov/fileadmin/csc/documents/GHG_Inventories/midhudghginventory.pdf

Figure 2 lists Ulster County's emission sectors and shows the GHG emissions associated with each sector, with total community GHG emissions estimated at 2,052,895 MT C02e in 2010. Mobile Energy (transportation) was Ulster County's largest source of GHG emissions, comprising approximately 52 percent of 2010 community emissions, with residential (20%) and commercial (16%) the next largest sources.

Figure 2: Ulster County 2010 Community GHG Inventory

GHG EMISSION SECTORS	$MTCO_2e$*
Residential	451,256
Commercial	349,919
Industrial	100,290
Mobile Energy	1,151,440
Solid Waste	36,203
Wastewater Treatment	17,754
Industrial Processes	67,738
Agriculture	15,645
Energy Supply	39,744
Total Emissions	2,052,894
Population	182,493
Per Capita Emissions	11

*Metric Tons of Carbon Dioxide Equivalent



2018 Ulster County Community GHG Inventory

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used:

Activity Data x Emission Factor = Emissions

Most emissions sources in this inventory are quantified using calculation-based methodologies. Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption

by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. Please see appendices for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. lbs CO_2/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath tool.

2018 Community Emissions Inventory Results

The total communitywide emissions for the 2018 inventory are shown in Table 2 and Figure 3.

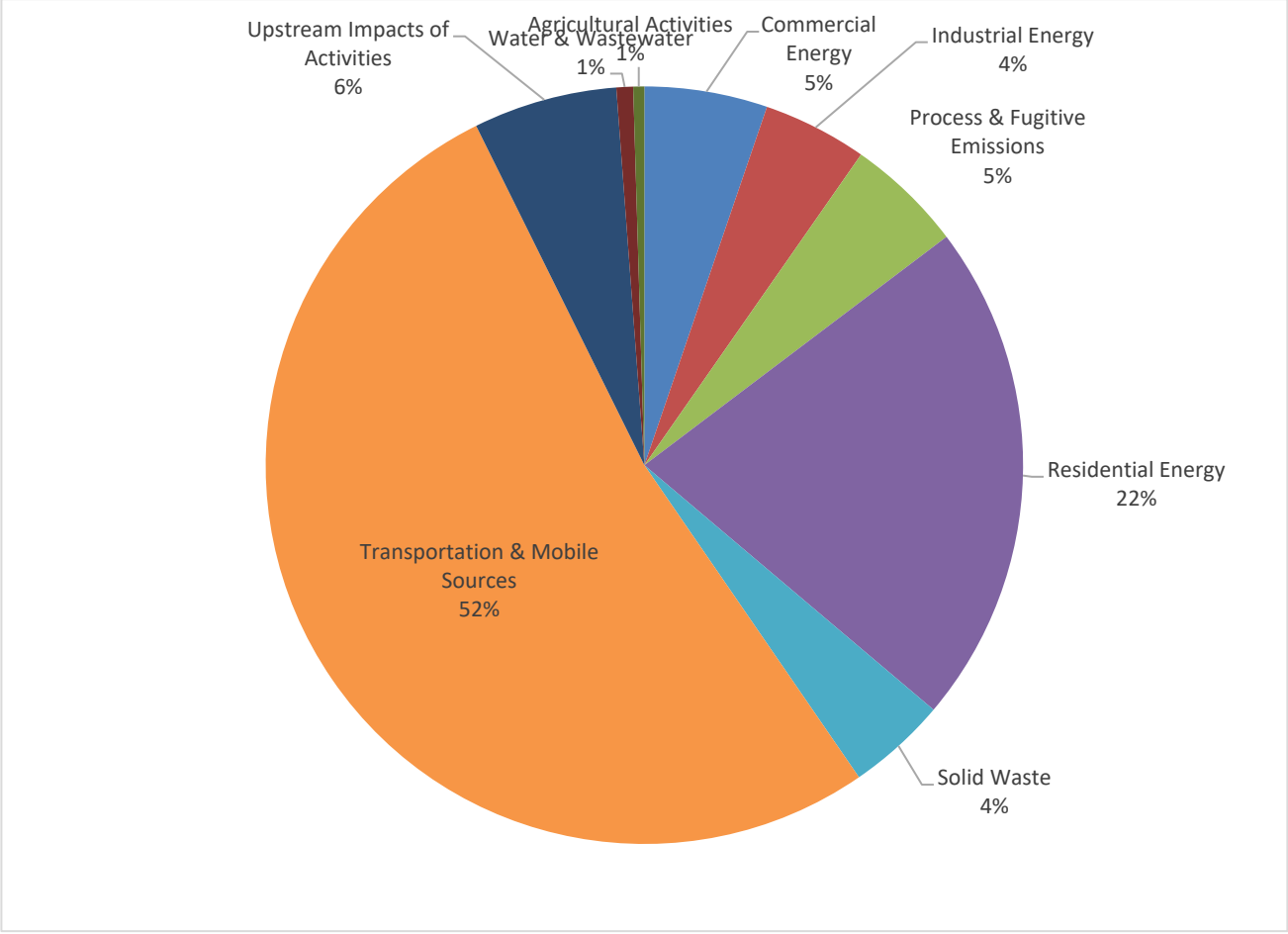
Table 2 Communitywide Emissions Inventory

Sector	Fuel or source	2018 Usage	Usage unit	2018 Emissions ($MTCO_2e$)
Residential energy	Electricity	1,233,888	MWh	142,234
	Natural Gas	1,095,696	MMBtu	58,276
	Propane	429,164	MMBtu	26,633
	Fuel oil (Distillate Oil #2)	2,208,712	MMBtu	164,453
			Residential energy total	**391,596**
Commercial energy	Electricity	269,235	MWh	31,036
	Natural gas	747,003	MMBtu	39,730
	Fuel Oil	1,352,887	Gallons	13,901
	Propane	1,955,033	Gallons	11,041
			Commercial energy total	**95,707**
Industrial energy	Electricity	N/A	N/A	N/A
	Natural gas	N/A	N/A	N/A
			Industrial energy total	**81,102**
On-road transportation	Gasoline	N/A	N/A	839,046
	Diesel	N/A	N/A	112,470
Transit	Gasoline & Diesel	N/A	N/A	1,580
			Transportation total	**953,095**
Solid Waste	MSW (via UCCRA, generated in-county) - Landfill disposal	101,379	Tons	66,219
	MSW (via UCCRA, generated in-county) - Transport to landfill	101,379	Tons	6,784
	MSW (via UCCRA, generated in-county) - Landfilling process emissions	101,379	Tons	1,662.6
	Other MSW (via UCCRA) - Transport to landfill	29,201.21	Tons	1,954
	Biosolids - Landfill disposal	3,680	Tons	2404
	Biosolids - Transport to landfill	3,680	Tons	190
	Biosolids - Landfilling Process Emissions	3,680	Tons	60
			Solid waste total	**77,319**
Upstream impacts of activities	Electricity consumption	1,503.123	MWh	54,227
	Natural gas consumption	921,350	MMBtu	22,587
	Fuel oil consumption	17,358,046	Gallons	35,153
	Propane consumption	429,164	MMBtu	46
			Upstream impacts of activities total	**112,013**
Water and wastewater	Fugitive Emissions from Septic Systems (population based)	106,238		12,908

	Process N20 Emissions (population based)	71,335		76
			Water and wastewater total	**12,983**
Agricultural Activities	Livestock (enteric fermentation)			6,000
	Livestock (manure treatment & handling)			2,000
	Agricultural Soils (fertilizers & plant residues)**fertilizer use data not available*			610
			Agricultural Activities total	**8,610**
Fugitive	Natural gas leakage (T&D losses)	N/A	N/A	19,475
	ODS	N/A	N/A	66,521
	Sulfur Hexaflouride	N/A	N/A	5,251
			Fugitive total	**91,247**
			Total communitywide emissions	**1,823,672**

Figure 3 shows the distribution of communitywide emissions by sector. Transportation & Mobile Sources is the largest contributor, followed by residential energy and upstream impacts of activities.

Figure 3: 2018 Community GHG Emissions distribution by Sector



Forests – Emissions & Removals

Nature based GHG accounting associated with land use and land use change is not required in the *U.S. Community Protocol* reporting framework, however it is important to consider in community GHG accounting. Land

management practices can result in significant GHG emissions or removals (sequestration), as can land use change over time.

The US Community Protocol's Land Emissions and Removals Navigator (LEARN) tool[7] was used to calculate GHG emissions and removals from forests in Ulster County and to generate the *Summary Report GHG Inventory for Forests and Trees Outside Forests, 2004 to 2013 Ulster County, New York* (Appendix C). The land cover change data is from the National Land Cover Database, 2004 and 2013, and although there are significant uncertainties in the estimates included in the report, the overall importance of forests and other land uses and land management practices in GHG accounting is a known entity.

Key Report Findings:

- Over the period 2004 to 2013, emissions from forests and trees were 104,963 MT CO2e per year.
- Over the period 2004 to 2013, **the Net GHG balance of forests and trees was -1,478,214 MT CO2e per year**.
- Roughly 81% of Ulster County's total land base of 300,591 hectares (742,776 acres) is forest. Many areas outside of forests are also covered by trees, including an average of nearly 23.6 percent tree canopy on lands outside of forest areas
- Over the same period, annual CO2 removals from forests and trees were -1,583,176 t CO2e per year. (Carbon removals are represented by negative values.)
- Total GHG emissions for Ulster County across all sectors could be reduced if additional forests/trees were added to its land base, and/or if losses of trees were reduced further.

Ulster County's forests function as a net carbon sink, sequestering an estimated 1,478,214 MT CO2e annually. This represents a theoretical offset of about 81% against the County's 1,823,672 MT C02e annual community GHG emissions.

Ulster County's 2008 Open Space Plan[8] identified 236,499 (32%) of the County's total acreage of 742,769 as protected open space. This protected open space includes other land uses, in addition to forests, and will continue to sequester a significant amount of carbon in perpetuity, while the portion of open space which is not protected may be threatened by future land use change. In considering this, the potential for GHG emissions sequestration, in concert with other key considerations, could be used as part of the criteria for identifying and planning for the "Priority Conservation Areas" and "Priority Growth Areas" outlined in the Open Space Plan. Maps

[7] Available at: https://icleiusa.org/learn/.
[8] Available at: https://ulstercountyny.gov/planning/open-space-plan, from *Final Mapbook* Map 1: Protected Open Space.

identifying GHG sequestration potential could also potentially be included in the next planned update to the Natural Resources Inventory, which the Open Space Plan is built upon.

Consumption-based GHG Inventory

A consumption-based GHG inventory offers an alternative approach to accounting for community scale GHG emissions and is different than a traditional production-based inventory which accounts only for GHG emissions that are produced within the geographic boundary of the community being measured. Although the production-based inventory outlined above in this report is the standard approach used for GHG emissions accounting and is compliant with the *U.S. Community Protocol,* the Protocol also includes *Appendix I: Consumption-Based Emissions (2013)* for accounting of consumption-based emissions. Berkeley's *CoolClimate Data*[9] for Ulster County were used for this consumption-based inventory, as recommended in the Protocol's *Appendix I: Consumption-Based Emissions.*

The consumption-based inventory (Table 3) estimates that Ulster County's annual GHG emissions are 3,142,002 MT C02e, which is about 58% higher than the production-based total of 1,823,672. This discrepancy reiterates the potential significance of accounting for all of the GHG emissions associated with the goods and services consumed within a community.

Table 3

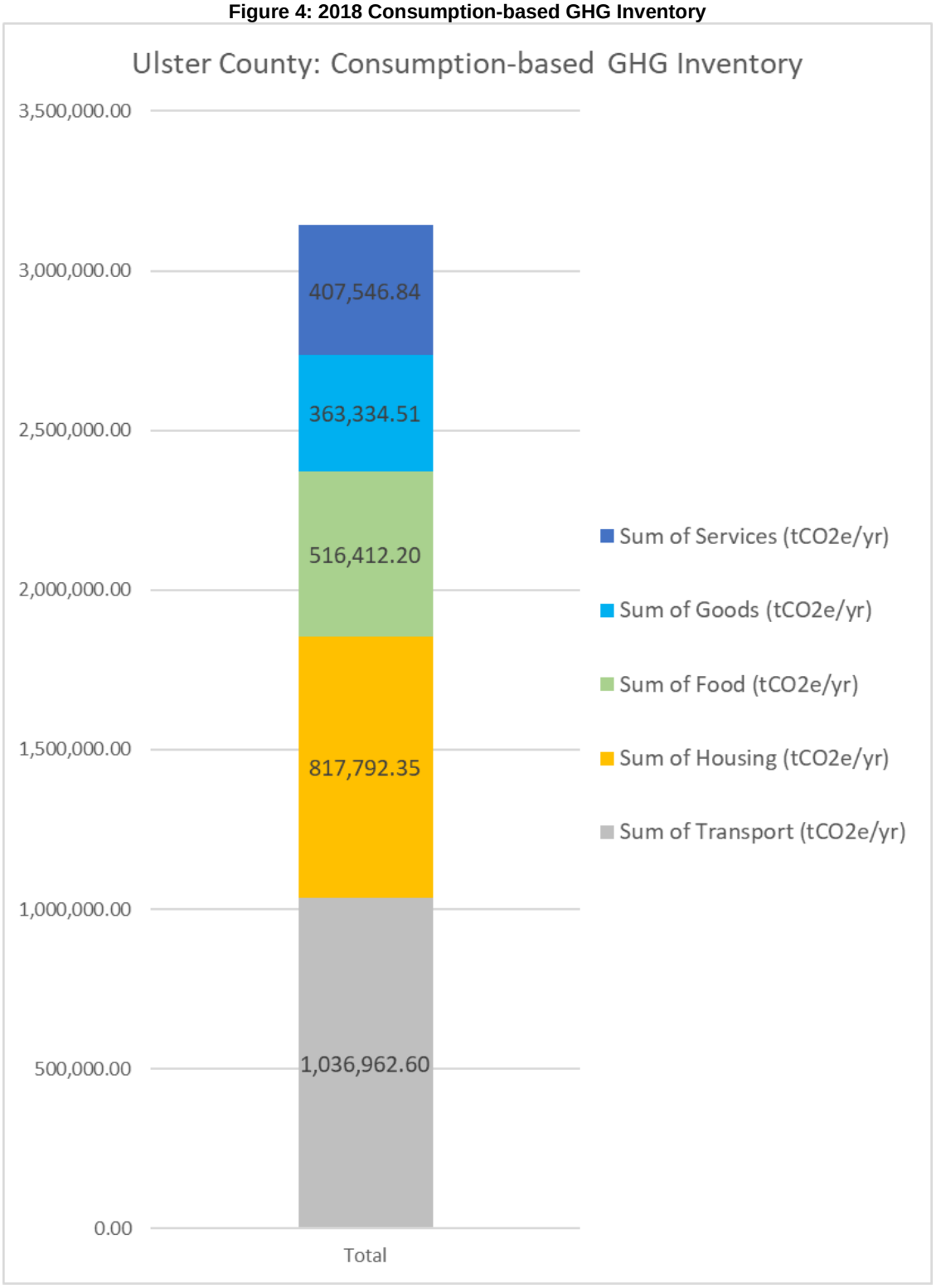
GHG Emissions Sector	Annual Household Emissions (%)	Annual Household Emissions (MT C02e)	Ulster County Total Emissions (MT C02e)
Transport	33%	14.96	1,036,947.31
Housing	26%	11.80	817,780.29
Food	16%	7.45	516,404.59
Services	13%	5.88	407,540.83
Goods	12%	5.24	363,329.15
Total		**45.33**	**3,142,002.17**

The consumption-based inventory accounts for GHG emissions that occur as a result of the food, goods, and services consumed by community residents, and includes household transportation and heating. This approach accounts for GHG emissions at the point of consumption, attributing all GHG emissions occurring in the course of production and distribution of goods and services – this includes upstream impacts – to the final consumers of those goods and services. This can present a more actionable approach to community GHG emissions accounting

[9] Available for download at: https://coolclimate.org/data. Data are from the following paper: Christopher M. Jones and Daniel M. Kammen, *Spatial Distribution of U.S. Household Carbon Footprints Reveals Suburbanization Undermines Greenhouse Gas Benefits of Urban Population Density*. Environ. Sci. Technol., 2013, dx.doi.org/10.1021/es4034364.

and can help community residents plan for changes to their household's consumption habits in order to reduce their individual carbon footprints.

Figure 4: 2018 Consumption-based GHG Inventory



Conclusion

This inventory serves as an update to the 2010 Mid-Hudson Regional GHG inventory with improved methodology due to the application of ICLEI's *U.S. Community Protocol* for Accounting and Reporting GHG Emissions. The County will continue to track key energy use and emissions indicators on an on-going, annual basis to update and improve this inventory while increasing compliance with the accounting and reporting methods detailed in the U.S. Community Protocol. As additional sources of community emissions data are developed, the County will implement adjustments to its 2010 baseline year inventory.

The next step is to develop a climate action plan that identifies specific, quantified strategies that can cumulatively meet Ulster County's community GHG reduction target as well as supporting the State's Climate Act (CLCPA) goals.

Appendices: Detailed Reports and data from ICLEI ClearPath

Inventory Calculations

The 2018 inventory was calculated following the *US Community Protocol* and ICLEI's ClearPath software. As discussed in Inventory Methodology, the *IPCC 5th Assessment* was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO_2 equivalent units. ClearPath's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final CO_2e emissions.

Appendix A

The detailed inventory report dataset from ICLEI's ClearPath software is attached as an excel file (APPENDIX A).

Appendix B

The emissions factors and activity dataset from ICLEI's ClearPath software is attached as an excel file (APPENDIX B).

Appendix C

Summary Report GHG Inventory for Forests and Trees Outside Forests, 2004 to 2013 - Ulster County, New York (APPENDIX C).