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Updated 2008 Tompkins County Community

GREENHOUSE GAS EMISSIONS AND
ENERGY USE INVENTORY

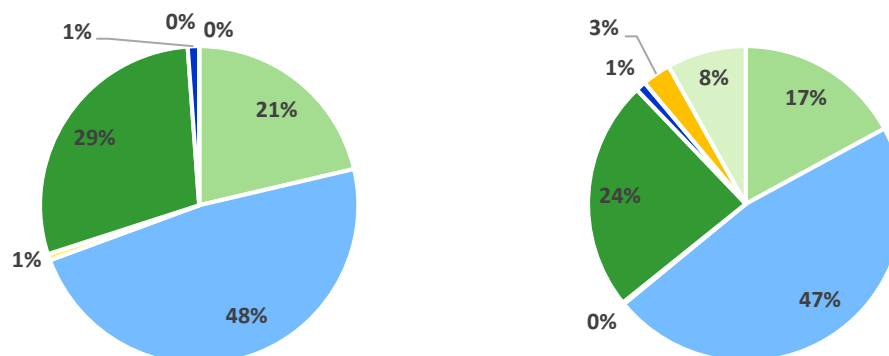
Tompkins County Department of Planning and Sustainability

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Executive Summary: Updated 2008 Tompkins County Community GHG Emissions and Energy Use



Sectors	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Residential	3,112,954	21%	216,718	17%
Commercial and Industrial	7,009,635	48%	596,013	47%
Groton Electric	93,846	1%	2,305	0%
Transportation	4,203,940	29%	299,822	24%
Air Travel	169,361	1%	13,466	1%
Solid Waste	0	0%	37,298	3%
Agricultural Livestock	0	0%	103,208	8%
Total	14,589,736	100%	1,268,830	100%

Greenhouse Gas Emissions. The total GHG emissions in the County in 2008 were estimated to be 1,268,830 metric tons of carbon dioxide equivalent (MTCO_{2e}), with 64% of those emissions from stationary energy use, 36% from transportation related fuels, and the remainder from landfilled municipal and biosolid waste and agricultural livestock.

Electricity. The total electricity consumed by the community in 2008 was estimated to be 1,063,779,000 kWh. About 98% of that electricity was generated in nearly equal amounts using nuclear, hydro, coal, and gas & oil.

Thermal Energy. The total amount of energy consumed for space and water heating in the county in 2008 was estimated to be 6.6 million British Thermal Units (MMBtu). In 2008, natural gas provided nearly half of the thermal energy fuel mix.

Transportation. In 2008, the community consumed an estimated 4,204,000 MMBtus of energy to fuel its transportation needs with an estimated 671,150,000 miles traveled over the course of the year. Gasoline accounted for roughly 85% of fuel used with 29 million gallons, and diesel accounted for 15%.

Next Steps. The results of the Inventory will be used as the baseline for future comparison to determine progress in achieving the County's GHG emissions goals.

Updated 2008 Tompkins County Community GHG Emissions and Energy Use

Introduction

A greenhouse gas emissions inventory provides a quantification of the amount of greenhouse gases (GHG) emitted to the atmosphere during a stated period of time. A greenhouse gas inventory also provides information about the activities that cause emissions and the fuels used to power them. The information is used to track emissions trends, develop strategies and policies, and assess progress.

The Intergovernmental Panel on Climate Change for the United Nations states that six greenhouse gases should be included in an inventory: Carbon Dioxide (CO₂), Nitrous Oxide (N₂O), Methane (CH₄), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF₆). For ease of analysis, all the emissions are converted into an equivalent amount of CO₂ and reported as metric tons of carbon dioxide equivalent (MTCO₂e).

This report quantifies emissions from the entire Tompkins County community including governments, higher education, residents, non-profits, and businesses. Included in this report are results from an updated 2008 Inventory of GHG emissions and energy use. It quantified GHG emissions released within Tompkins County's geographic boundary, plus some emissions that partially occur outside the boundary but are associated with the County, such as those associated with air travel and waste disposal.

Since 1998, Tompkins County has tracked community-wide GHG emissions to measure progress towards meeting climate mitigation goals. In 2008, the County Legislature set a goal on behalf of the community to reduce greenhouse gas emissions by at least 20% below 2008 levels by 2020 and 80% below 2008 levels by 2050, setting 2008 as the baseline year.

The Inventory presented in this report are based upon the *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.2, July 2019*. ClearPath Version 2019, an online application for the calculation and tracking of greenhouse gas emissions at the government operations and community scaled, was used to calculate emissions.

The Inventory uses Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report's 100-year Global Warming Potential (GWP) values. The original 2008 Inventory used the IPCC 2nd Assessment Report's 100-year GWP values and has been updated to the 5th Assessment 100-year values. A methodology report outlining data collection and processing for the 2019 Inventory and the Updated 2008 Inventory are included as appendices.

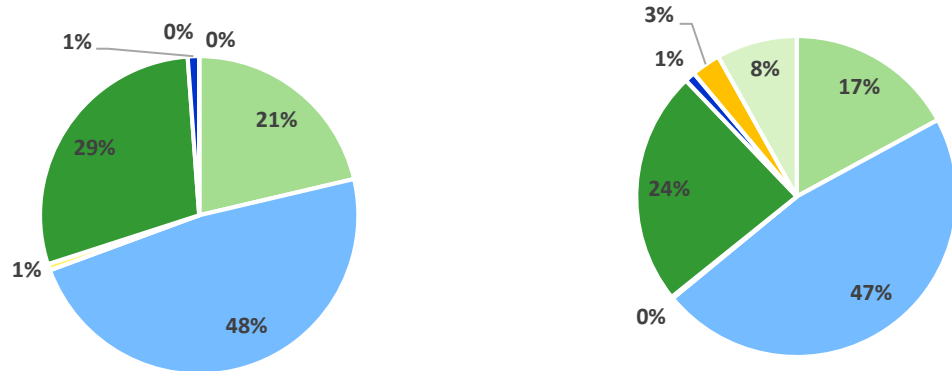
In preparing the Inventory, three aspects of energy use and GHG emissions were quantified, with color themes carried through the document in order to make the distinctions clear.



Knowing the source of emissions helps in effectively planning and implementing emissions reduction actions. An emissions inventory creates a quantitative foundation for a community to take concrete actions to address climate change and sustainability.

Updated 2008 Inventory Results Summary

In 2008, 48% of all energy consumed and 47% of all emissions were from the C&I Sector. Another third of all energy consumed and emissions came from the Transportation Sector. The Residential Sector contributed 21% of all energy consumed and was responsible for 17% of all emissions. Solid Waste and Agricultural Livestock are two sectors which create GHG emissions but do not consume fossil fuel energy. Other sectors tracked in this Inventory include the Village of Groton Electric and Air Travel.



Sectors	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Residential	3,112,954	21%	216,718	17%
Commercial and Industrial	7,009,635	48%	596,013	47%
Groton Electric	93,846	1%	2,305	0%
Transportation	4,203,940	29%	299,822	24%
Air Travel	169,361	1%	13,466	1%
Solid Waste	0	0%	37,298	3%
Agricultural Livestock	0	0%	103,208	8%
Total	14,589,736	100%	1,268,830	100%

Figure 1: Summary of Updated 2008 GHG Emissions and Energy Use

Table 1 provides a summary of energy and emissions for reference. Each sector is further broken down in detail in the associated report sections.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Residential		3,112,954	21%	216,718	17%
Electricity (kWh)	293,815,424	1,002,782		96,405	
<i>NYSEG Meters</i>	293,371,081	1,001,266		33,706	
<i>Renewables - Solar</i>	444,343	1,516		0	
Natural Gas (therms)	17,018,828	1,701,883		90,517	
Fuel Oil (gallons)	2,600,044	358,806		26,715	
Propane (gallons)	543,774	49,483		3,071	
Commercial and Industrial		7,009,635	48%	596,013	47%
Electricity (kWh)	492,615,286	2,523,243		248,027	
<i>NYSEG Meters</i>	492,529,663	1,680,944		161,850	
<i>Cornell Generation</i>	26,700,000	91,104		13,296	
<i>Cornell Elect. Purch</i>	220,100,000	751,195		72,327	
<i>Cornell Elect. Export</i>	0	0		0	
<i>Renewables - Hydro</i>	29,968	10,578		0	
<i>Renewables - Solar</i>	3,100,000	102		0	
Natural Gas (therms)	25,552,696	2,555,269		135,858	
<i>NYSEG Meters</i>	24,341,696	2,434,169		129,417	
<i>Cornell Use</i>	1,211,000	121,100		6,441	
Fuel Oil (gallons)	6,441,541	915,454		68,518	
<i>Commercial, non-Cornell</i>	6,438,341	915,167		68,481	
<i>Cornell Use</i>	3,200	287		37	
Propane (gallons)	603,893	54,960		3,406	
Coal	65,420	960,709		140,204	
Groton Electric (kWh)	27,503,611	93,846	1%	2,305	
Transportation		4,203,940	29%	299,822	24%
Gasoline (gallons)	28,645,469	3,580,900		253,715	
Diesel (gallons)	4,532,044	623,040		46,107	
VMT (miles)	672,759,539				
<i>Passenger Vehicles</i>	521,667,155				
<i>Motorcycles</i>	5,070,884				
<i>Light Trucks (incl. Para-Transit Buses)</i>	112,707,455				
<i>Transit and School Bus</i>	2,800,000				
<i>Medium-Duty Trucks</i>	20,156,762				
<i>Heavy-Duty Trucks</i>	8,747,274				
Air Travel		169,361	1%	13,466	1%
Jet Fuel (gallons)	1,367,012	164,041		13,096	
Aviation Gasoline (gallons)	44,334	5,320		370	
Solid Waste (Landfilled waste, tons)	70,730			37,298	3%
Agricultural Livestock (# Animals)	31,280			108,208	8%
TOTAL	NA	14,589,736	100%	1,268,830	100%

Table 1. Detailed Inventory of Updated 2008 GHG Emissions and Energy Consumption

Analysis by Sector: Updated 2008

Residential Sector

The Residential Sector accounted for 21% of all community GHG emissions. Within this sector, natural gas accounted for more than half of all emissions and electricity made up about 32% of total residential emissions. While fuel oil and propane cumulatively account for 13.1% of emissions, consumption data was scaled down from state-level data utilizing proportions of households with heating fuel oil according to the Census American Community Survey; thus, the consumption data are less accurate than other fuels utilized at the county-level.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Electricity (kWh)	293,815,424	1,002,782	32.2%	96,405	23.9%
<i>NYSEG Meters</i>	293,371,081	1,001,266	32.1%	33,706	23.9%
<i>Renewables - Solar</i>	444,343	1,516	0.1%	0	0%
Natural Gas (therms)	17,018,828	1,701,883	54.7%	90,517	63.4%
Fuel Oil (gallons)	2,600,044	358,806	11.5%	26,715	10.9%
Propane (gallons)	543,774	49,483	1.6%	3,071	1.8%
SUBTOTAL	NA	3,112,954	100.0%	216,718	100.0%

Table 2: Residential Sector Updated 2008 GHG Emissions and Energy Consumption

In addition to energy consumption from fossil fuels, this inventory tracks consumption from renewable energy sources, which accounted for nearly 0.2% of total residential electricity consumption in 2008.

	Electricity (kWh)	Energy in MMBtu	Emissions MTCO ₂ e
Small-Scale Solar	444,232	1,516	0
% of total sector electricity	0.2%	0.2%	0.0%

Table 3: Residential Sector Updated 2008 Renewables

Commercial and Industrial Sector

NYSEG reported the 2019 data for both the commercial sector and industrial sector energy consumption under a single category. Therefore, in this inventory, these two sectors are aggregated to generate a uniform assessment of these two sectors. Together, the C&I sector accounted for 48% of all GHG emissions. Within this sector, natural gas use accounted for about one third of all emissions.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Electricity (kWh)	492,615,286	2,523,243	36.0%	248,027	41.6%
<i>NYSEG Meters</i>	492,529,663	1,680,944	24.0%	161,850	27.1%
<i>Cornell Generation</i>	26,700,000	91,104	1.3%	13,296	2.2%

<i>Cornell Elect. Purch</i>	220,100,000	751,195	10.7%	72,327	12.1%
<i>Cornell Elect. Export</i>	0	0	0.0%	0	-2.5%
<i>Renewables - Hydro</i>	29,968	10,578	<0.1%	0	0.0%
<i>Renewables - Solar</i>	3,100,000	102	<0.1%	0	0.0%
Natural Gas (therms)	25,552,696	2,555,269	36.4%	135,858	22.8%
<i>NYSEG Meters</i>	24,341,696	2,434,169	34.7%	129,417	21.8%
<i>Cornell Use</i>	1,211,000	121,100	1.8%	6,441	1.0%
Fuel Oil (gallons)	6,441,541	915,454	13.1%	68,518	11.5%
<i>Commercial, non-Cornell</i>	6,438,341	915,167	13.1%	68,481	11.5%
<i>Cornell Use</i>	3,200	287	<0.1%	37	<0.1%
Propane (gallons)	603,893	54,960	0.8%	3,406	0.6%
Coal	65,420	960,709	13.8%	140,204	23.5%
SUBTOTAL	NA	7,009,635	100%	596,013	100.0%

Table 4: Commercial and Industrial Sector Updated 2008 GHG Emissions and Energy Consumption

Renewable energy provided electricity for 0.5% of total C&I electricity consumption in 2008.

	Electricity (kWh)	Energy in MMBtu	Emissions MTCO ₂ e
Small-Scale Solar	29,968	102	0
Hydro	3,100,000	10,578	0
TOTAL	3,129,968	10,680	0
% of total sector electricity	0.5%	0.5%	0.0%

Table 5: Commercial Sector Updated 2008 Renewables

Village of Groton Electric

The Village of Groton's municipal electric utility supplies electricity within the Village's boundaries and accounted for 0.2% of all GHG emissions. The fuel sources for energy purchased by Groton Electric have fully transitioned to renewable energy between 2014 and 2019, with 85% of energy coming from hydropower and 16% from nuclear.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Electricity (kWh)	27,503,611	93,846	100%	2,305	100.0%

Table 6: Village of Groton Electric Updated 2008 GHG Emissions and Energy Consumption

Transportation

Transportation accounted for 24% of all community GHG emissions. Most emissions were from gasoline vehicles (84% of total transportation emissions). Vehicles cumulatively drove approximately 673 million miles in 2008.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Gasoline (gallons)	28,645,469	3,580,900	61.4%	253,715	84.6%

Diesel (gallons)	4,532,044	623,040	14.8%	46,107	15.4%
VMT (miles)	672,759,539				
<i>Passenger Vehicles</i>	521,667,155				
<i>Motorcycles</i>	5,070,884				
<i>Light Trucks (incl. Para-Transit Buses)</i>	112,707,455				
<i>Transit and School Bus</i>	2,800,000				
<i>Medium-Duty Trucks</i>	20,156,762				
<i>Heavy-Duty Trucks</i>	8,747,274				
SUBTOTAL	NA	4,203,940	100.0%	299,822	100.0%

Table 7: Transportation Updated 2008 GHG Emissions and Energy Consumption

Air Travel

Air travel accounted for 1% of all GHG emissions for the community. Nearly all these emissions were due to burning jet fuel, which was the fuel used by commercial carriers operating out of the Ithaca Tompkins Regional Airport.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Jet Fuel (gallons)	1,367,012	164,041	96.9%	13,096	92.3%
Aviation Gasoline (gallons)	44,334	5,320	31.1%	370	1.7%
SUBTOTAL	NA	169,36q	100.0%	13,466	100.0%

Table 8: Air Travel Updated 2008 GHG Emissions and Energy Consumption

Solid Waste

Solid waste accounted for 3% of total GHG emissions. These emissions were a result of natural decay of solid waste that was generated in the community and disposed of in landfills outside of the county. All landfills used for disposal of municipal solid waste and bio-solids were equipped with methane collection systems, which reduces the GHG emissions associated with the decay of solid waste. In 2019, 62% of all waste was recycled.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Landfilled Waste (tons)	70,730			37,298	100.0%

Table 9: Solid Waste Updated 2008 GHG Emissions

Agricultural Livestock

Agricultural livestock accounted for 8% of all GHG emissions. These emissions were calculated from livestock that had methane emissions factors available from the EPA.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO ₂ e	% of Subtotal
Number of Animals	31,280			93,128	100.0%

Table 10: Agricultural Livestock Updated 2008 GHG Emissions

Power Generation at the Cayuga Power Plant (formerly AES Cayuga)

Although this source of emissions is not included in the emissions accounting protocol and therefore not included in the overall community emissions total, it is tracked as part of the inventory since it has historically been a significant energy facility in the community. In 2008, the Cayuga Power Plant produce 2,178 GWh of electricity and emitted 1,995,805 MTCO₂e.

Analysis by Fuel Source: Updated 2008

All Fuels

Natural gas provided 29% of all the energy needs in the community across all sectors and 20% of all emissions. Gasoline and electricity provided about 24% of the community's energy needs; however, with the heavy reliance on coal in electricity generation, electricity accounted for 30% of the total emissions, while gasoline accounted for 22%.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Natural Gas (therms)	42,571,524	4,257,152	29.1%	226,375	20.1%
Gasoline (gallons)	28,645,469	3,580,900	24.5%	253,715	22.5%
Electricity (kWh) (not incl. hydro or solar)	1,063,778,666	3,630,551	24.9%	346,183	30.7%
Fuel Oil (gallons)	9,041,585	1,274,260	8.7%	95,233	8.4%
Diesel (gallons)	4,532,055	623,040	4.3%	46,107	4.1%
Jet Fuel (gallons)	1,367,012	164,041	1.1%	13,096	1.7%
Propane (gallons)	1,147,667	104,443	0.7%	6,477	0.6%
Aviation Gasoline (gallons)	44,335	5,320	<0.1%	370	<0.1%
Coal	65,420	960,709	6.7%	140,204	12.4%
TOTAL	NA	14,600,406	100.0%	1,127,760	100.0%

Table 11: All Fuels Updated 2008 GHG Emissions and Energy Consumption

Electricity

The C&I sector consumed 69% of the electricity in the community, with Cornell accounting for 23% of total electricity consumption. The residential sector consumed 28% of total electricity energy.

	kWh	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Residential	293,815,424	1,002,782	27.5%	96,405	27.8%
<i>NYSEG Meters</i>	293,371,081	1,001,266	27.4%	96,405	27.8%
<i>Renewables - Solar</i>	444,343	1,516	<0.1%	0	0.0%
Commercial and Industrial	742,459,631	2,533,923	69.4%	247,473	71.5%
<i>NYSEG Meters</i>	481,529,663	1,680,944	46.0%	161,850	46.7%
<i>Cornell Generation</i>	26,700,000	91,104	2.5%	13,296	3.8%
<i>Cornell Elect. Purch</i>	220,100,000	751,195	20.6%	72,327	20.9%
<i>Cornell Elect. Export</i>	0	0	0%	0	0.0%
<i>Renewables - Hydro</i>	29,968	102	<0.1%	0	0.0%
<i>Renewables - Solar</i>	3,100,000	10,578	2.1%	0	0.0%
Groton	27,222,903	93,846	0.3%	0	0.0%
TOTAL	1,063,778,666	3,650,551	100.0%	346,183	100.0%

Table 12: Electricity - Updated 2008 GHG Emissions and Energy Consumption

Thermal Energy

The C&I sector consumed 66% of the thermal energy required to heat spaces and provide hot water in the community, and the residential sector consumed 34% of the community's thermal energy needs.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO ₂ e	% of Total
Residential		2,250,562	34.0%	133,800	27.8%
<i>Electricity (kWh)</i>	41,134,159	140,390	2.1%	13,497	2.8%
<i>Natural Gas (therms)</i>	17,018,828	1,701,883	25.7%	90,517	18.8%
<i>Fuel Oil (US gallon)</i>	2,600,044	358,806	5.4%	26,715	5.5%
<i>Propane (US gallon)</i>	543,774	49,483	0.7%	3,071	0.6%
Commercial and Industrial		4,372,251	66.1%	347,986	72.2%
<i>Natural Gas (therms)</i>	25,552,696	2,555,269	38.6%	135,858	28.1%
Sub-Category: NYSEG Meters	24,341,696	2,434,169	36.7%	129,417	26.9%
Sub-Category: Cornell Use	1,211,000	121,100	1.9%	6,441	1.3%
<i>Fuel Oil (US gallon)</i>	6,441,541	801,318	12.1%	68,518	14.2%
Sub-Category: Comm, non-Cornell	6,438,341	801,031	12.1%	68,481	14.2%
Sub-Category: Cornell Use	3,200	287	>0.1%	37	<0.1%
<i>Propane (US gallon)</i>	603,893	54,955	0.8%	3,406	0.7%
<i>Coal (tons)</i>	65,420	960,709	14.5	140,204	29.1
TOTAL	NA	6,622,812	100.0%	481,786	100.0%

Table 13: Thermal Energy – Updated 2008 GHG Emissions and Energy Consumption

Transportation Fuels

Gasoline accounted for 82% of transportation related energy consumption in 2008 and accounted for 81% of transportation fuels emissions.

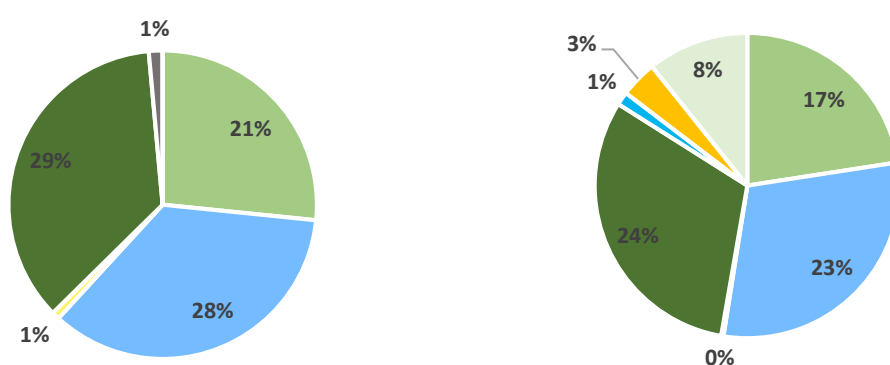
	US Gallon	Energy in MMBtu	% of Total	Emissions MTCO ₂ e	% of Total
Gasoline	28,645,469	3,580,900	81.9%	253,715	81.0%
Diesel	4,532,055	623,040	14.2%	46,107	14.7%
Jet Fuel	1,367,012	164,041	3.8%	13,096	4.2%
Aviation Gasoline	44,334	5,320	<0.1%	370	<0.1%
TOTAL	27,606,581	4,517,188	100.0%	323,305	100.0%

Table 14: Transportation Fuels – Updated 2008 GHG Emissions and Energy Consumption

Further Analysis to Inform the Updated 2008 Inventory

Removing Cornell University Data

In order to better understand 2008 GHG emissions and energy consumption, it is helpful to remove Cornell University from the data to determine whether (a) the C&I sector still contributes more than one third of the Community's emissions and (b) natural gas remains the largest contributor of GHG emissions. As seen below, with Cornell Central Energy Plant's (CEP) electricity generation and consumption removed from the analysis, emissions associated with gasoline consumption and the C&I sector are equal in their contribution to the Community's emissions. Nonetheless, natural gas is second to gasoline in its contribution to the Community's emissions.



Sectors	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Residential	3,112,954	21%	216,718	17%
Commercial and Industrial	4,118,931	28%	287,588	23%
Groton Electric	93,846	1%	2,305	0%
Transportation	4,302,940	29%	299,822	24%
Air Travel	169,361	1%	13,466	1%
Solid Waste	0	0%	37,298	3%
Agricultural Livestock	0	0%	960,405	8%
Total	11,699,032	100%	960,405	100%

Figure 2: Summary without Cornell of Updated 2008 GHG Emissions and Energy Consumption

Commercial & Industrial Sector without Cornell

With Cornell data removed, natural gas replaces coal and becomes the second largest source of GHG emissions after electricity.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Electricity (kWh)	354,367,960	1,209,402	29.4%	116,439	40.5%
NYSEG Meters	354,338,000	1,209,300	29.4%	116,439	40.5%
Renewables - Solar	29,968	102	0.0%	0	0.0%
Natural Gas (therms)	21,321,612	2,132,161	51.8%	113,402	39.4%

Fuel Oil (gallons)	5,202,196	740,606	18.0%	55,466	19.3%
Propane (gallons)	403,975	36,762	0.9%	2,281	0.8%
TOTAL	NA	4,118,931	100.0%	287,588	100.0%

Table 15: C&I Sector without Cornell Updated 2008 GHG Emissions and Energy Consumption

All Fuels without Cornell

After removing Cornell's dedicated natural gas line, gasoline accounted for the largest share of the Community's energy emissions, following second by natural gas.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO ₂ e	% of Total
Gasoline (gallons)	28,645,469	3,580,900	29.7%	253,715	29.4%
Natural Gas (therms)	35,242,599	1,778,635	14.7%	187,443	21.7%
Electricity (kWh) (Not including solar)	813,404,355	4,257,152	35.3%	260,560	30.2%
Fuel Oil (gallons)	9,038,385	1,273,973	10.6%	95,196	11.0%
Diesel (gallons)	4,532,055	623,040	5.2%	46,107	5.3%
Jet Fuel (gallons)	1,367,012	164,041	1.4%	13,096	1.5%
Propane (gallons)	1,147,667	104,443	0.9%	6,477	0.7%
Aviation Gasoline (gallons)	44,344	5,320	<0.1%	370	<0.1%
Solar (kWh)	474,311	1,618	<0.0%	0	0.0%
TOTAL	NA	12,059,122	100.0%	862,964	100.0%

Table 16: All Fuels without Cornell Updated 2008 GHG Emissions and Energy Consumption

Weather Conditions in 2008

In 2008, there were 6,975 Heating Degree Days (HDD) where the average temperature was below 65° Fahrenheit, the temperature below which buildings are considered to need to be heated. There were 387 Cooling Degree Days (CDD) where the average temperature is above 65° Fahrenheit and people start to use air conditioning to cool their buildings. During the past 45 years (1970-2015), there were an average of 7,091 Heating Degree Days and 432 Cooling Degree Days. This indicates that 2008 was cooler in the summer and warmer in the winter than average. Therefore, one would expect that less electricity would be needed in 2008 compared to the past 45 years for air conditioning (although air conditioning was less prevalent in the past), and less natural gas and other thermal fuels for space heating

	HDD (Higher number = colder winter)	CDD (Higher number = hotter summer)
2008	6,975	387
Average 1970-2015	7,091	432

Table 17: Historical Heating and Cooling Degree Days

Summary of GHG Inventory Comparisons

1998-2019 Inventories Comparison

In 2010, the County Planning Department released the “Tompkins County Community Greenhouse Gas Emissions Report, 1998-2008” in which it presented the results of the 2008 GHG Emissions Inventory (the “Original 2008 Inventory”), as well as looked back to the initial 1998 GHG emissions inventory and compared results. While it is no longer possible to compare the 1998 Inventory with the subsequent updates to the 2008 Inventory due to substantial changes in methodology and accuracy, it is helpful to see that the community had achieved reductions of 6.9% in GHG emissions during that 10 year time period. That Original 2008 Inventory compared to the 1998 Inventory yielded the following results.

	1998	Original 2008	Original 2008 adjusted to compare to 1998
MTCO₂e	1,109,892	1,172,918	1,033,072
Modifications to 2008 to Make Comparable to 1998			Subtracted 139,846 MTCO ₂ e because Cornell Power Generation was not included in 1998
Percent Change	n/a	n/a	-6.9%

Table 18: Past GHG Emissions Totals – Not Comparable to 2014 or Updated 2008 Inventories

This report builds upon the updates made in 2014 to provide a more accurate analysis utilizing new solid waste models along with new EPA and Census data. Since many community efforts have used the Original 2008 Inventory results to plan programs, below is a table comparing the updated 2008 Inventory from 2014 and the 2008 Inventory with 2019 updates. Only the final updated Inventory should be used in the future, as it improves upon the Residential, Solid Waste, and Agricultural Sectors.

MTCO ₂ e	Original 2008 Community Emissions		Updated 2008 Community Emissions (2014)		Updated 2008 Community Emissions (2019)	
	Total Emissions	Percent of Total	Total Emissions	Percent of Total	Total Emissions	Percent of Total
	Overall Total = 1,117,918 MTCO ₂ e		Overall Total = 1,273,043 MTCO ₂ e (including 13,466 MTCO ₂ e from aviation travel but not listed)		Overall Total = 1,268,266 MTCO ₂ e (including 13,466 MTCO ₂ e from aviation travel and 140,204 MTCO ₂ e from coal, but not listed below)	
Residential	233,469	19.9	254,293	20.2	216,718	17.3
Commercial and Industrial	306,346	26.1	369,595 (does not include Cornell CEP)	29.3	363,154 (does not include Cornell CEP)	29.4
Transportation	407,469	34.7	299,822	23.8	299,822	23.9
Waste	41,792	3.6	29,298	2.3	37,298	3.0
Agriculture	43,996	3.8	78,400	6.2	103,208	8.2
Local Power Generation (Cornell CEP and Groton Electric)	139,846	11.9	228,169	18.1	234,610	18.2

<i>Total Sector</i>	<i>1,172,918</i>	<i>100%</i>	<i>1,259,577</i>	<i>100%</i>	<i>1,254,810</i>	<i>100%</i>
<i>Energy Source</i>						
Electricity	256,203	21.8	258,255 (does not include Cornell CEP or Groton Electric)	20.5	346,183	31.1
Natural Gas	226,427	19.3	226,375	18.0	226,375	20.3
Fuel Oil	22,837	1.9	128,906	10.2	95,233	8.5
Propane	34,348	2.9	10,352	0.8	6,477	0.5
Gasoline	337,866	28.8	253,715	20.1	253,715	22.8
Diesel	69,603	5.9	46,107	3.6	46,107	4.1
Methane (Ag +Waste)	85,788	7.3	107,698	8.5	140,506	12.6
<i>Total Fuel Type</i>	<i>1,033,072</i>		<i>1,259,577</i>		<i>1,114,596</i>	<i>100%</i>

Table 19: Comparison of Original 2008, Updated 2008 (2014), and Updated 2008 (2019) GHG Emissions

Overview of Natural Gas Impacts

Standard GHG accounting principles used elsewhere in this report call for the use of the 100-year GWP, which is appropriate for the other GHGs. Methane is an extremely impactful GHG in the short-term, with a greenhouse warming effect of >100-fold more than carbon dioxide. The following analysis applies the 20-year GWP for methane of 86 as well as a leakage rate of 3.8% (for conventional natural gas extraction) to all methane emissions.

	2008 New Accounting 5th IPCC 20-yr GWP for Methane with 3.8% Leakage
MTCO ₂ e from Leaked Methane	338,673
Total Community MTCO ₂ e w/o Leakage	1,265,062
Total Community MTCO ₂ e with Leakage	1,603,735
Percent Change comparing with 3.8% Leakage to without	27% increase in emissions

Table 20: 2008 Emissions at 3.8% Methane Leakage and 20-Year GWP of 86