

# UPDATED **2008** TOMPKINS COUNTY **COMMUNITY**

## GREENHOUSE GAS EMISSIONS AND ENERGY USE INVENTORY

TOMPKINS COUNTY PLANNING DEPARTMENT

SEPTEMBER 2016



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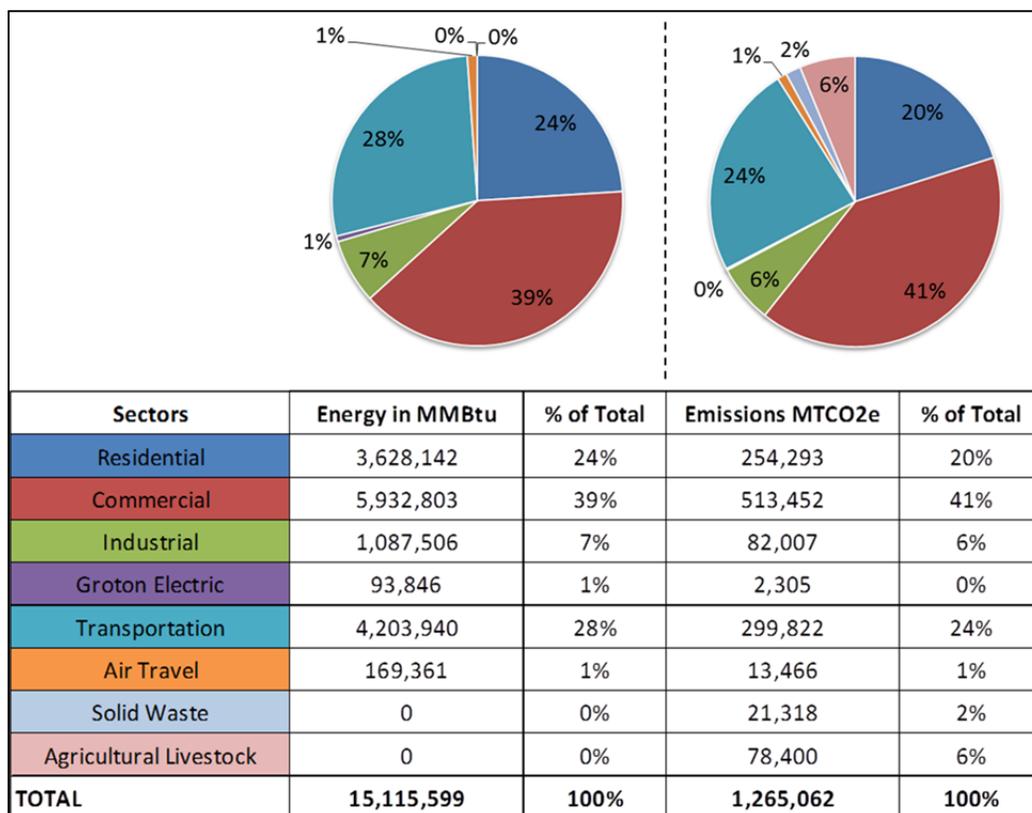
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## **Appendices (see separate document)**

***Detailed Methodology Updated 2008 Community Inventory***

## Executive Summary

### Updated 2008 Tompkins County Community GHG Emissions and Energy Use



**Summary of Updated 2008 GHG Emissions and Energy Consumption by Sector**

**GHG Emissions.** The total greenhouse gas (GHG) emissions in the county in 2008 were estimated to be 1,265,000 metric tons of carbon dioxide equivalent (MTCO<sub>2e</sub><sup>1</sup>), with 92% of those emissions from fossil fuel consumption and the remainder from landfilled solid waste and agricultural livestock.

**Electricity.** The total electricity consumed in the community in 2008 was estimated to be 1,063,779,000 kWh<sup>2</sup>. 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 7,252,000 million British Thermal Units (MMBtu<sup>3</sup>). In 2008, natural gas provided the majority of thermal energy to the community, comprising roughly 59% of the 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 this Inventory will be used as the baseline for future comparison to determine progress in achieving the County's GHG emissions goals.

<sup>1</sup> MTCO<sub>2e</sub> – a measure of the combined ability of emitted GHGs to trap heat

<sup>2</sup> kWh – kilowatt hour – a measure of electricity.

<sup>3</sup> MMBtu – a measure of the energy content in fuel; used as a basis for comparing the energy content of various fuels.

# Updated 2008 Tompkins County Community GHG Emissions and Energy Use Inventory

## Introduction

A greenhouse gas emissions inventory provides an accounting of the amount of greenhouse gases (GHG) emitted to the atmosphere during a specific period of time. A greenhouse gas inventory also provides information about the activities that cause emissions and the fuels used to power them. This information is then 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 (CO<sub>2</sub>), Nitrous Oxide (N<sub>2</sub>O), Methane (CH<sub>4</sub>), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>). For ease of analysis, all the emissions are converted into an equivalent amount of CO<sub>2</sub> and reported as metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e).

This report quantifies emissions from the entire Tompkins County community including governments, higher education, residents, non-profits and business. Included in this report are results from a significantly updated 2008 inventory of GHG emissions and energy use. It quantifies GHG emissions released within Tompkins County's geographic boundary (plus some emissions that partially occur outside the boundary, 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. Due to changes in GHG accounting, the 2008 inventory was substantially updated in order to be able to be compared with the 2014 GHG emissions inventory.

The Inventory presented in this report is based upon the *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1, July 2013*<sup>4</sup>. ClearPath version 2014, an online application for the calculation and tracking of greenhouse gas emissions at the government operations and community scales, was used to calculate emissions.

The Original 2008 Inventory used the Intergovernmental Panel on Climate Change (IPCC) 2<sup>nd</sup> Assessment Report's 100 year Global Warming Potential (GWP) values. The Updated 2008 Inventory uses the IPCC 5<sup>th</sup> Assessment Report's 100 year GWP values.

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.



<sup>4</sup> Developed in partnership and adopted by the California Air Resources Board, the California Climate Action Registry, ICLEI-Local Governments for Sustainability, and The Climate Registry.

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.

## 2008 Community GHG Emissions and Energy Use Inventory

### Summary: 2008 Inventory Results

In 2008, 39% of all energy consumed and 41% of all emissions were from the Commercial Sector. Another quarter of all energy consumed and emissions came from the Transportation Sector. The Residential Sector contributed 24% to the overall energy consumption and was responsible for 20% 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 Industrial Sector, the Village of Groton Electric, and Air Travel.

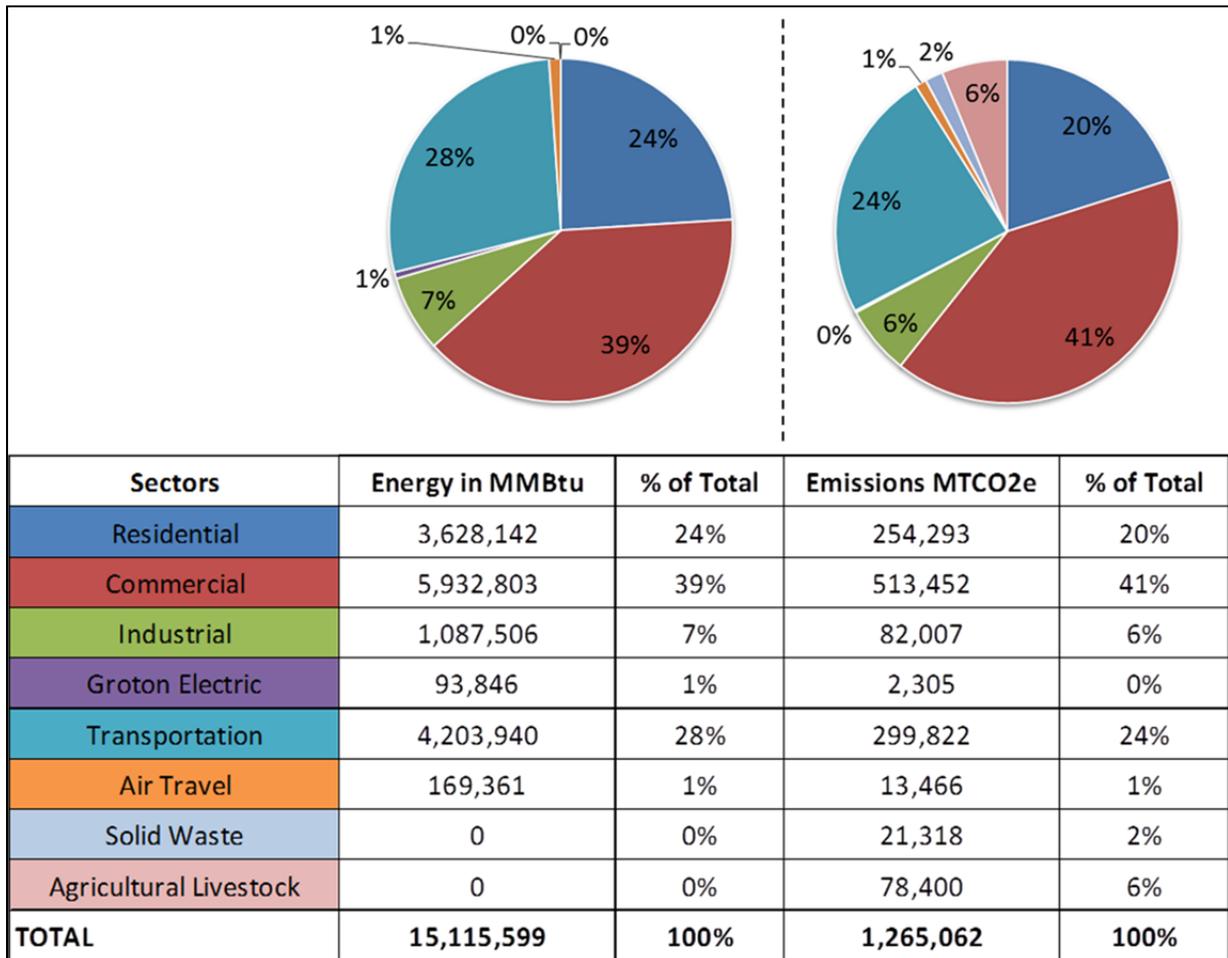


Figure 1: Summary of 2008 GHG Emissions<sup>5</sup> and Energy Consumption<sup>6</sup> by Sector

<sup>5</sup> MTCO2e stands for one million metric tons of carbon dioxide equivalent, a measure of the combined ability of emitted GHGs to trap heat.

<sup>6</sup> MMBtu stands for one million British Thermal Units, a measure of the energy content in fuel. MMBtu is used as a basis for comparing the energy content of various fuels.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
<b>Residential</b>		<b>3,628,142</b>	<b>24%</b>	<b>254,293</b>	<b>20%</b>
Electricity (kWh)	293,815,424	1,002,782		96,405	
<i>NYSEG Meters</i>	293,371,081	1,001,266		96,405	
<i>Renewables - Solar</i>	444,343	1,516		0	
Natural Gas (therms)	17,018,828	1,701,883		90,517	
Fuel Oil (gallons)	5,880,828	811,554		60,425	
Propane (gallons)	1,229,918	111,923		6,946	
<b>Commercial</b>		<b>5,932,803</b>	<b>39%</b>	<b>513,452</b>	<b>41%</b>
Electricity (kWh)	604,267,968	2,062,279		202,062	
<i>NYSEG Meters</i>	354,338,000	1,209,300		116,439	
<i>Cornell Generation</i>	26,700,000	91,104		13,296	
<i>Cornell Elect. Purch</i>	220,100,000	751,195		72,327	
<i>Renewables - Hydro</i>	3,100,000	10,578		0	
<i>Renewables - Solar</i>	29,968	102		0	
Natural Gas (therms)	21,321,612	2,132,161		113,402	
Fuel Oil (gallons)	5,205,396	740,893		55,503	
<i>Commercial, non-Cornell</i>	5,202,196	740,606		55,466	
<i>Cornell Use</i>	3,200	287		37	
Propane (gallons)	403,975	36,762		2,281	
Coal (tons)	65,420	960,709		140,204	
<b>Industrial</b>		<b>1,087,506</b>	<b>7%</b>	<b>82,007</b>	<b>6%</b>
Electricity (kWh)	138,191,663	471,644		45,411	
Natural Gas (therms)	4,231,084	423,108		22,456	
Fuel Oil (gallons)	1,236,145	174,561		13,015	
Propane (gallons)	199,918	18,193		1,125	
<b>Groton Electric (kWh)</b>	<b>27,503,611</b>	<b>93,846</b>	<b>0.6%</b>	<b>2,305</b>	<b>0.2%</b>
<b>Transportation</b>		<b>4,203,940</b>	<b>28%</b>	<b>299,822</b>	<b>24%</b>
Gasoline (gallons)	28,645,469	3,580,900		253,715	
Diesel (gallons)	4,532,055	623,040		46,107	
VMT (miles)	671,149,530				
<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				
<b>Air Travel</b>		<b>169,361</b>	<b>1.1%</b>	<b>13,466</b>	<b>1.1%</b>
Jet Fuel (gallons)	1,367,012	164,041		13,096	
Aviation Gasoline (gallons)	44,334	5,320		370	
<b>Solid Waste (Landfill waste, tons)</b>	<b>70,730</b>			<b>21,318</b>	<b>1.7%</b>
<b>Agricultural Livestock (# Animals)</b>	<b>31,280</b>			<b>78,400</b>	<b>6%</b>
<b>TOTAL</b>	<b>NA</b>	<b>15,115,599</b>	<b>100.0%</b>	<b>1,265,062</b>	<b>100.0%</b>

**Table 1: Detailed Inventory of 2008 GHG Emissions and Energy Consumption**

## Analysis by Sector: 2008

### Residential Sector

The Residential Sector accounted for 20% of all GHG emissions. Within this sector, electricity accounted for 38% of all emissions and natural gas use made up 36% of emissions. Although fuel oil consumption accounted for 24% of emissions in this sector, these data are scaled down from State-level data, so may be less accurate than other fuels utilized at the County-level.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO <sub>2</sub> e	% of Subtotal
Electricity (kWh)	293,815,424	1,002,782	27.6%	96,405	37.9%
<i>NYSEG Meters</i>	293,371,081	1,001,266	27.6%	96,405	37.9%
<i>Renewables - Solar</i>	444,343	1,516	0.0%	0	0.0%
Natural Gas (therms)	17,018,828	1,701,883	46.9%	90,517	35.6%
Fuel Oil (gallons)	5,880,828	811,554	22.4%	60,425	23.8%
Propane (gallons)	1,229,918	111,923	3.1%	6,946	2.7%
<b>SUBTOTAL</b>	<b>NA</b>	<b>3,628,142</b>	<b>100.0%</b>	<b>254,293</b>	<b>100.0%</b>

**Table 2: Residential Sector 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 (and 0.04% of all residential energy consumption) in 2008. Small-scale solar PV (200 kW or less) provided all of the renewable power to the Residential Sector.

### Residential Renewables

	Electricity (kWh)	Energy in MMBtu	Emissions MTCO <sub>2</sub> e
Small-Scale Solar	444,343	1,516	0
% of total sector electricity	0.2%	0.2%	0.0%

**Table 3: Residential Sector 2008 Renewables**

### Commercial Sector

The Commercial Sector accounted for 41% of all GHG emissions. Within this sector, electricity accounted for over a third of all emissions and natural gas use made up 22% of emissions.

Accounting for emissions and energy consumption in the Commercial Sector is complicated by the fact that Cornell University both generates and consumes large quantities of energy due to its 13.9 million sq. ft. of gross building space on the Ithaca campus in 2008 and its energy-intensive laboratory and other research needs. Cornell accounted for 17% of all Commercial Sector emissions from electricity.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO <sub>2</sub> e	% of Subtotal
Electricity (kWh)	604,267,968	2,062,279	34.8%	202,062	39.4%
<i>NYSEG Meters</i>	354,338,000	1,209,300	20.4%	116,439	22.7%
<i>Cornell Generation</i>	26,700,000	91,104	1.5%	13,296	2.6%
<i>Cornell Elect. Purch</i>	220,100,000	751,195	12.7%	72,327	14.1%
<i>Renewables - Hydro</i>	3,100,000	10,578	0.2%	0	0.0%
<i>Renewables - Solar</i>	29,968	102	0.0%	0	0.0%

Natural Gas (therms)	21,321,612	2,132,161	35.9%	113,402	22.1%
Fuel Oil (gallons)	5,205,396	740,893	12.5%	55,503	10.8%
<i>Commercial, non-Cornell</i>	5,202,196	740,606	12.5%	55,466	10.8%
<i>Cornell Use</i>	3,200	287	0.0%	37	0.0%
Propane (gallons)	403,975	36,762	0.6%	2,281	0.4%
Coal (tons)	65,420	960,709	16.2%	140,204	27.3%
<b>SUBTOTAL</b>	<b>NA</b>	<b>5,932,803</b>	<b>100.0%</b>	<b>513,452</b>	<b>100.0%</b>

**Table 4: Commercial Sector 2008 GHG Emissions and Energy Consumption**

Renewable energy provided electricity for 0.5% of total commercial electricity consumption (and 0.002% of all commercial energy consumption) in 2008.

### Commercial Renewables

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

**Table 5: Commercial Sector 2008 Renewables**

### Industrial Sector

The Industrial Sector accounted for 6% of all GHG emissions. Within this sector, electricity accounted for over half of all emissions and natural gas made up over a quarter of emissions. There were no renewable energy sources directly attributed to the Industrial Sector.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO <sub>2</sub> e	% of Subtotal
Electricity (kWh)	138,191,663	471,644	43.4%	45,411	55.4%
Natural Gas (therms)	4,231,084	423,108	38.9%	22,456	27.4%
Fuel Oil (gallons)	1,236,145	174,561	16.1%	13,015	15.9%
Propane (gallons)	199,918	18,193	1.7%	1,125	1.4%
<b>SUBTOTAL</b>	<b>NA</b>	<b>1,087,506</b>	<b>100.0%</b>	<b>82,007</b>	<b>100.0%</b>

**Table 6: Industrial Sector 2008 GHG Emissions and Energy Consumption**

### Village of Groton Electric

The Village of Groton's municipal electric system supplies electricity within the Village's boundaries and accounted for 0.2% of all GHG emissions. The Village has a contract through 2025 to purchase 4,469 KW of hydro power from the New York Power Authority and purchases additional incremental power in cooperation with a group of 35 other municipal systems, called the New York Municipal Power Agency. Emissions calculated in this sector take into account the fact that 86% of this electricity is generated from non-emitting sources, including hydro, nuclear and other renewables.

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

**Table 7: Village of Groton Electric 2008 GHG Emissions and Energy Consumption**

## Transportation

Transportation accounted for 24% of all GHG emissions. The vast majority of those emissions were from gasoline with the remainder from diesel fuel. Vehicles drove approximately 671 million miles in 2008.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO <sub>2</sub> e	% of Subtotal
Gasoline (gallons)	28,645,469	3,580,900	85.2%	253,715	84.6%
Diesel (gallons)	4,532,055	623,040	14.8%	46,107	15.4%
VMT (miles)	671,149,530				
<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				
<b>SUBTOTAL</b>	<b>NA</b>	<b>4,203,940</b>	<b>100.0%</b>	<b>299,822</b>	<b>100.0%</b>

**Table 8: Transportation 2008 GHG Emissions and Energy Consumption**

## Air Travel

Air Travel accounted for 1.1% of all GHG emissions. Nearly all of those emissions were due to burning jet fuel, which was the fuel used by all of the commercial carriers operating out of the Ithaca Tompkins Regional Airport.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO <sub>2</sub> e	% of Subtotal
Jet Fuel (gallons)	1,367,012	164,041	96.9%	13,096	97.3%
Aviation Gasoline (gallons)	44,334	5,320	3.1%	370	2.7%
<b>SUBTOTAL</b>	<b>NA</b>	<b>169,361</b>	<b>100.0%</b>	<b>13,466</b>	<b>100.0%</b>

**Table 9: Air Travel 2008 GHG Emissions and Energy Consumption**

## Solid Waste

Solid Waste accounted for 1.7% of all GHG emissions. All of these emissions were from the 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 solid waste were equipped with methane collection systems, which reduces the GHG emissions associated with the natural decay of solid waste. In 2008, 62% of all waste was recycled.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO <sub>2</sub> e	% of Subtotal
Landfilled Waste (tons)	70,730			21,318	100.0%

**Table 10: Solid Waste 2008 GHG Emissions**

## Agricultural Livestock

Agricultural Livestock accounted for 6% of all GHG emissions. All of these emissions were from farm animals that had methane emissions factors available from the EPA.

	Unit Measure	Energy in MMBtu	% of Subtotal	Emissions MTCO2e	% of Subtotal
Number of Animals	31,280			78,400	100.0%

**Table 11: Agricultural Livestock 2008 GHG Emissions**

## Power Generation at the AES Cayuga Power Plant (later known as Cayuga Power)

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 is a significant energy facility in the community. In 2008, the Cayuga Power Plant produced 2.178 GWh of electricity and emitted 1,995,805 MTCO2e.

### Analysis by Fuel Source: 2008

#### All Fuels

Natural gas provided 29% of all the energy needs in the community and 20% of all emissions. Gasoline and electricity each provided 23%-24% of the energy needs, however, with the heavy reliance on coal in electricity generation, electricity accounted for 29% of the total emissions, while gasoline accounted for 22%. Renewables provided 0.1% of the energy needs of the community.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
Electricity	1,061,900,521	3,458,353	23.1%	335,461	29.1%
Gasoline	28,645,469	3,580,900	23.9%	253,715	22.0%
Natural Gas	42,571,524	4,257,152	28.5%	226,375	19.6%
Coal	65,420	960,709	6.4%	140,204	12.1%
Fuel Oil	12,322,370	1,727,008	11.5%	128,943	11.2%
Diesel	4,532,055	623,040	4.2%	46,107	4.0%
Jet Fuel	1,367,012	164,041	1.1%	13,096	1.1%
Propane	1,833,811	166,878	1.1%	10,352	0.9%
Aviation Gasoline	44,334	5,320	0.0%	370	0.0%
Hydro	3,100,000	10,578	0.1%	0	0.0%
Solar	474,311	1,618	0.0%	0	0.0%
<b>TOTAL</b>	<b>NA</b>	<b>14,955,597</b>	<b>100.0%</b>	<b>1,154,623</b>	<b>100.0%</b>

**Table 12: All Fuels 2008 GHG Emissions and Energy Consumption**

## Electricity

The Commercial Sector consumed 57% of the electricity in the community, with Cornell accounting for 24% of the total electricity consumption. The Residential Sector consumed 28% of the total electrical energy and the Industrial Sector accounted for 13%.

	kWh	Energy in MMBtu	% of Total	Emissions MTCO2e	% of Total
<b>Residential</b>	<b>293,815,424</b>	<b>1,002,782</b>	<b>27.6%</b>	<b>96,405</b>	<b>27.8%</b>
<i>NYSEG Meters</i>	293,371,081	1,001,266	27.6%	96,405	27.8%
<i>Renewables - Solar</i>	444,343	1,516	0.0%	0	0.0%
<b>Commercial</b>	<b>604,267,968</b>	<b>2,062,279</b>	<b>56.8%</b>	<b>202,062</b>	<b>58.4%</b>
<i>NYSEG Meters</i>	354,338,000	1,209,300	33.3%	116,439	33.6%

<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	20.7%	72,327	20.9%
<i>Renewables - Hydro</i>	3,100,000	10,578	0.3%	0	0.0%
<i>Renewables - Solar</i>	29,968	102	0.0%	0	0.0%
<b>Industrial</b>	<b>138,191,663</b>	<b>471,644</b>	<b>13.0%</b>	<b>45,411</b>	<b>13.1%</b>
<b>Groton</b>	<b>27,503,611</b>	<b>93,846</b>	<b>2.6%</b>	<b>2,305</b>	<b>0.7%</b>
<b>TOTAL</b>	<b>1,063,778,666</b>	<b>3,630,551</b>	<b>100.0%</b>	<b>346,183</b>	<b>100.0%</b>

**Table 13: Electricity: 2008 GHG Emissions and Energy Consumption**

## Thermal Energy

The Commercial Sector consumed 53% of the thermal energy required to heat spaces and provided hot water in the community, followed by the Residential Sector at 38%.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO <sub>2</sub> e	% of Total
<b>Residential</b>		<b>2,765,750</b>	<b>38.1%</b>	<b>171,385</b>	<b>33.0%</b>
<i>Electricity (kWh)</i>	41,134,159	140,390	1.9%	13,497	2.6%
<i>Natural Gas (therms)</i>	17,018,828	1,701,883	23.5%	90,517	17.4%
<i>Fuel Oil (US gallon)</i>	5,880,828	811,554	11.2%	60,425	11.6%
<i>Propane (US gallon)</i>	1,229,918	111,923	1.5%	6,946	1.3%
<b>Commercial</b>		<b>3,870,525</b>	<b>53.4%</b>	<b>311,391</b>	<b>60.0%</b>
<i>Natural Gas (therms)</i>	21,321,612	2,132,161	29.4%	113,402	21.8%
<i>Fuel Oil (US gallon)</i>	5,205,396	740,893	10.2%	55,503	10.7%
Sub-Category: Comm, non-Cornell	5,202,196	740,606	10.2%	55,466	10.7%
Sub-Category: Cornell Use	3,200	287	0.0%	37	0.0%
<i>Propane (US gallon)</i>	403,975	36,762	0.5%	2,281	0.4%
<i>Coal (tons)</i>	65,420	960,709	13.2%	140,204	27.0%
<b>Industrial</b>		<b>615,862</b>	<b>8.5%</b>	<b>36,596</b>	<b>7.0%</b>
<i>Natural Gas (therms)</i>	4,231,084	423,108	5.8%	22,456	4.3%
<i>Fuel Oil (US gallon)</i>	1,236,145	174,561	2.4%	13,015	2.5%
<i>Propane (US gallon)</i>	199,918	18,193	0.3%	1,125	0.2%
<b>TOTAL</b>	<b>NA</b>	<b>7,252,136</b>	<b>100.0%</b>	<b>519,371</b>	<b>100.0%</b>

**Table 14: Thermal Energy: 2008 GHG Emissions and Energy Consumption**

## Transportation Fuels

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

	US Gallon	Energy in MMBtu	% of Total	Emissions MTCO <sub>2</sub> 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%
<b>TOTAL</b>	<b>34,588,870</b>	<b>4,373,301</b>	<b>100.0%</b>	<b>313,288</b>	<b>100.0%</b>

**Table 15: Transportation Fuels: 2008 GHG Emissions and Energy Consumption**

## Further Analysis to Inform the 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 Commercial Sector remains the largest emitter and b) natural gas remains the largest contributor of GHG emissions. As can be seen in the table below, without the contribution of Cornell, transportation jumps to the number 1 spot for both emissions and energy consumption, with Commercial for second. This indicates that transportation is even more crucial to target for community actions to reduce emissions.

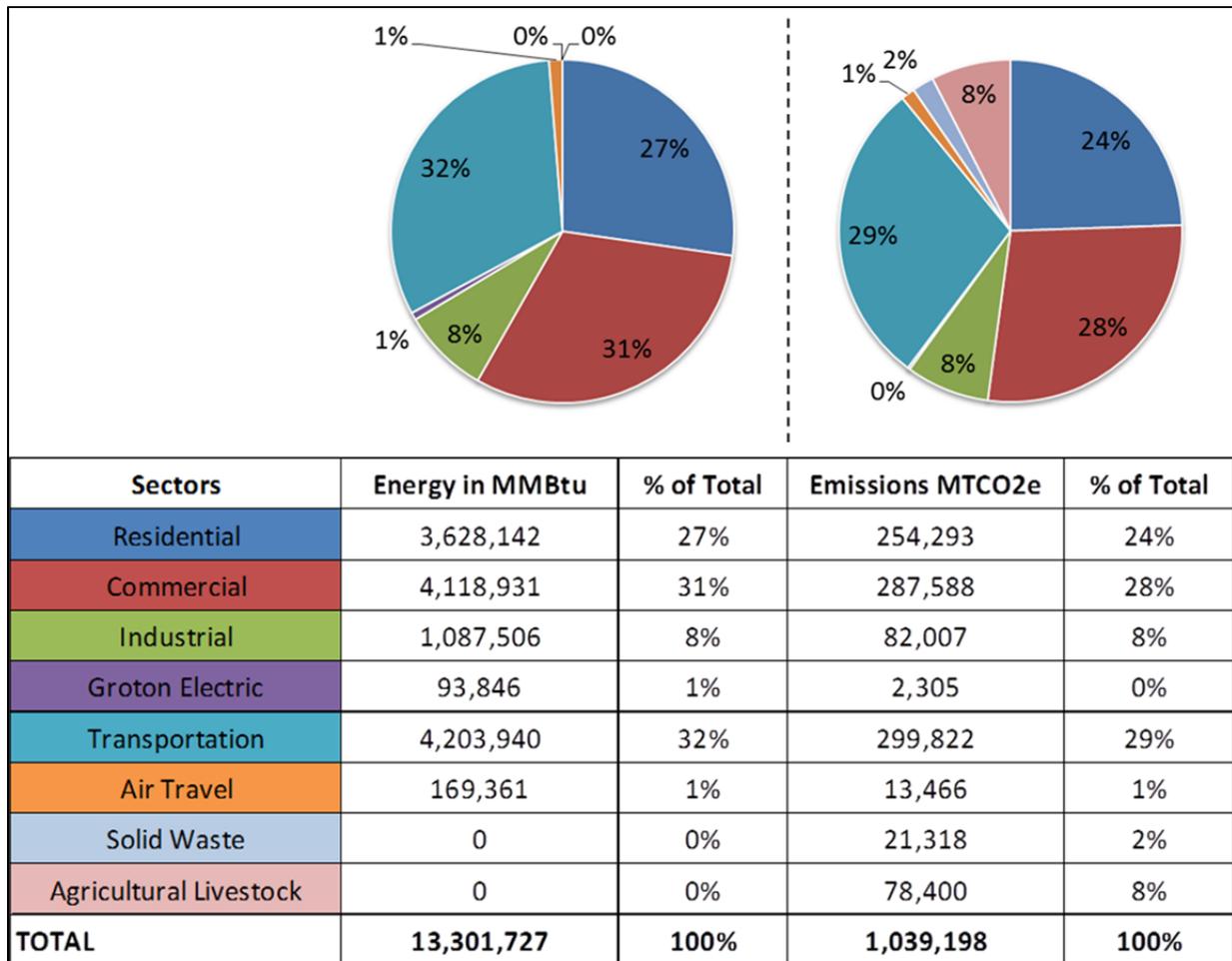


Figure 2: Summary without Cornell of 2008 GHG Emissions and Energy Consumption

Under the Commercial Sector, without the contribution of Cornell, natural gas replaces coal and becomes the second largest source of GHG emissions after electricity.

### Commercial Sector without Cornell

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO <sub>2</sub> e	% of Total
Electricity (kWh)	354,367,968	1,209,402	29.4%	116,439	40.5%
<i>NYSEG Meters</i>	354,338,000	1,209,300	29.4%	116,439	40.5%
<i>Renewables - Solar</i>	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%
<b>SUBTOTAL</b>	<b>NA</b>	<b>4,118,931</b>	<b>100.0%</b>	<b>287,588</b>	<b>100.0%</b>

**Table 16: Commercial Sector without Cornell 2008 GHG Emissions and Energy Consumption**

### All Fuels without Cornell

After removing Cornell from the equation, electricity still accounted for the most emissions of any of the fuel sources, with gasoline second. This is consistent with the findings above that transportation is a crucial target for community actions to reduce emissions.

	Unit Measure	Energy in MMBtu	% of Total	Emissions MTCO <sub>2</sub> e	% of Total
Gasoline	28,645,469	3,580,900	26.9%	253,715	27.0%
Electricity	813,404,355	2,776,056	20.9%	260,560	27.7%
Natural Gas	42,571,524	4,257,152	32.0%	226,375	24.1%
Fuel Oil	12,319,170	1,726,721	13.0%	128,906	13.7%
Diesel	4,532,055	623,040	4.7%	46,107	4.9%
Jet Fuel	1,367,012	164,041	1.2%	13,096	1.4%
Propane	1,833,811	166,878	1.3%	10,352	1.1%
Aviation Gasoline	44,334	5,320	0.0%	370	0.0%
Solar	474,311	1,618	0.0%	0	0.0%
<b>TOTAL</b>	<b>NA</b>	<b>13,301,727</b>	<b>100.0%</b>	<b>939,480</b>	<b>100.0%</b>

**Table 17: All Fuels without Cornell 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.

	<b>HDD</b> Higher number = colder winter	<b>CDD</b> Higher number = hotter summer
<b>2008</b>	6,975	387
<b>Average 1970-2015</b>	7,091	432

**Table 18: Historical Heating and Cooling Degree Days**

## Applying Latest Climate Science on Shale Gas to Updated 2008 Results

Studies conducted by local internationally-renowned experts, including Dr. Bob Howarth and Dr. Tony Ingraffea, have informed this section of the Inventory, with Dr. Howarth providing appropriate figures to include in these calculations. Dr. Howarth advises that traditional extraction methods, such as those likely used to supply the natural gas consumed in 2008 in Tompkins County, experience a 3.8% leakage rate. Therefore, a leakage factor of 3.8% was applied to methane consumed in 2008.

In addition to the leakage of methane due to shale gas development, transmission and distribution, is the consideration of the appropriate timescale for GWP of methane. Methane is an extremely impactful GHG in the short-term, with a greenhouse warming effect of >100-fold more than carbon dioxide. Given the current state of the Earth’s climate, the Earth is predicted to warm by 1.5° C above the preindustrial baseline within the next 15 years and by 2° C within the next 35 years<sup>7</sup> giving new urgency to the role of methane in the short-term. Standard GHG accounting principles used elsewhere in this report call for the use of the 100-year GWP for greenhouse gases, which is appropriate for the other GHGs. However this special analysis applies the 20-year GWP for methane of 86 to all methane emissions in both 2008 and 2014.

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

**Table 19: 2008 Emissions at 3.8% Methane Leakage and 20-Year GWP of 86**

## Summary of 1998-2008 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 Updated 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.

	<b>1998</b>	<b>Original 2008</b>	<b>Original 2008 adjusted to compare to 1998</b>
<b>MTCO<sub>2</sub>e</b>	1,109,892	1,172,918	1,033,072

<sup>7</sup> Howarth R. Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy. *Energy and Emission Control Technologies*. 2015:3 45-54.

<b>Modifications to 2008 to Make Comparable to 1998</b>			Subtracted 139,846 MTCO <sub>2</sub> e because Cornell Power Generation was not included in 1998
<b>Percent Change</b>	n/a	n/a	-6.9%

**Table 19: Past GHG Emissions Totals – Not Comparable to 2014 or Updated 2008 Inventories**

Since 2008 was selected as the baseline year for the County’s GHG emission reduction goals, it was necessary to significantly update the 2008 Emissions Inventory to make it comparable to future inventories and make it compliant with the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1, July 2013. The full list of changes made to the Original 2008 Inventory is presented in the appendix: Detailed Methodology Updated 2008 Community Inventory.

Since many community efforts have used the Original 2008 Inventory results to plan programs, below is a table comparing the Original 2008 Inventory with the Updated 2008 Inventory. Only the Updated Inventory should be used in the future, as it was significantly corrected and improved from the original.

MTCO <sub>2</sub> e	Original 2008 Community Emissions		Updated 2008 Community Emissions	
	Total Emissions	Percent of Total	Total Emissions	Percent of Total
	Overall Total = 1,172,918 MTCO <sub>2</sub> e		Overall Total = 1,273,042 MTCO <sub>2</sub> e (including 13,466 MTCO <sub>2</sub> e from aviation travel but not listed below)	
<b>Residential</b>	233,469	19.9	254,293	20.0
<b>Commercial</b>	232,081	19.8	287,588 (does not include Cornell CEP)	22.6
<b>Industrial</b>	74,265	6.3	82,007	6.4
<b>Transportation</b>	407,469	34.7	299,822	23.6
<b>Waste</b>	41,792	3.6	29,298	2.3
<b>Agriculture</b>	43,996	3.8	78,400	6.2
<b>Local Power Generation (Cornell CEP and Groton Electric)</b>	139,846	11.9	228,169	17.9
<i>Energy Source</i>				
<b>Electricity</b>	256,203	21.8	258,255 (does not include Cornell CEP or Groton Electric)	20.3
<b>Natural Gas</b>	226,427	19.3	226,375	17.8
<b>Fuel Oil</b>	22,837	1.9	128,906	10.1
<b>Propane</b>	34,348	2.9	10,352	0.8
<b>Gasoline</b>	337,866	28.8	253,715	19.9
<b>Diesel</b>	69,603	5.9	46,107	3.6
<b>Methane (Ag +Waste)</b>	85,788	7.3	107,698	8.5
<b>Local Power Generation (Cornell CEP and Groton Electric)</b>	<b>139,846</b>	<b>11.9</b>	<b>228,169</b>	<b>17.9</b>

**Table 20: Comparison of Original 2008 and Updated 2008 GHG Emissions**