



**2019 TOMPKINS COUNTY
GOVERNMENT OPERATIONS
GREENHOUSE GAS EMISSIONS
AND ENERGY USE INVENTORY**

February 2021

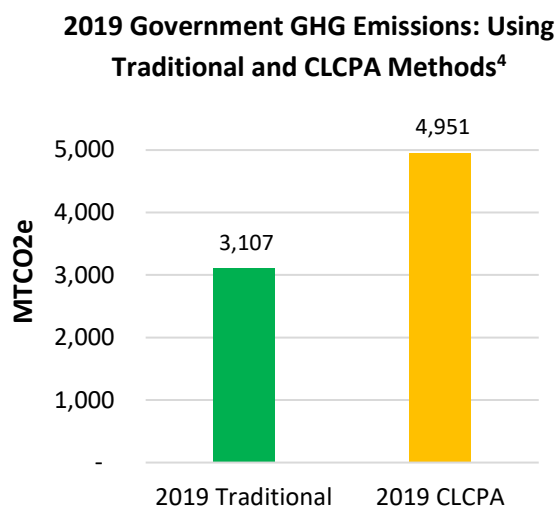
TOMPKINS COUNTY DEPARTMENT OF PLANNING AND SUSTAINABILITY



Executive Summary

This Tompkins County Government Operations Greenhouse Gas Emissions Inventory¹ was developed at a time when greenhouse gas (GHG) accounting methods are poised for changes that have not yet been incorporated into existing protocols and software. As a result, this Inventory tells two distinct stories: Narrative 1 compares the 2019 GHG emissions from County government operations² using two different methods — the traditional GHG accounting method and the new method anticipated to be adopted in New York State as part of implementing the Climate Leadership and Community Protection Act (CLCPA); Narrative 2 explores the details of the 2019 GHG emissions, calculated with the traditional method, to present a snapshot of GHG emissions in 2019 and a comparison of the 2019 emissions to previous inventories.

Narrative 1 – Comparison of GHG emissions accounting methods



The CLCPA became law in January 2020. In addition to setting goals for reducing GHG emissions, it requires that these emissions be calculated with a 20-year time horizon and account for out-of-state methane leakage associated with natural gas extraction. The traditional accounting method uses a 100-year time horizon and in-state emissions of all greenhouse gases. While New York has not yet issued guidance on how to perform the emissions calculations specified in the CLCPA, the climate scientist advising State officials on these calculations shared the anticipated CLCPA methodology with Tompkins County staff³. Using the CLCPA method, the government operations GHG emissions are 1.6 times higher for 2019

than the total emissions calculated using the traditional accounting method.

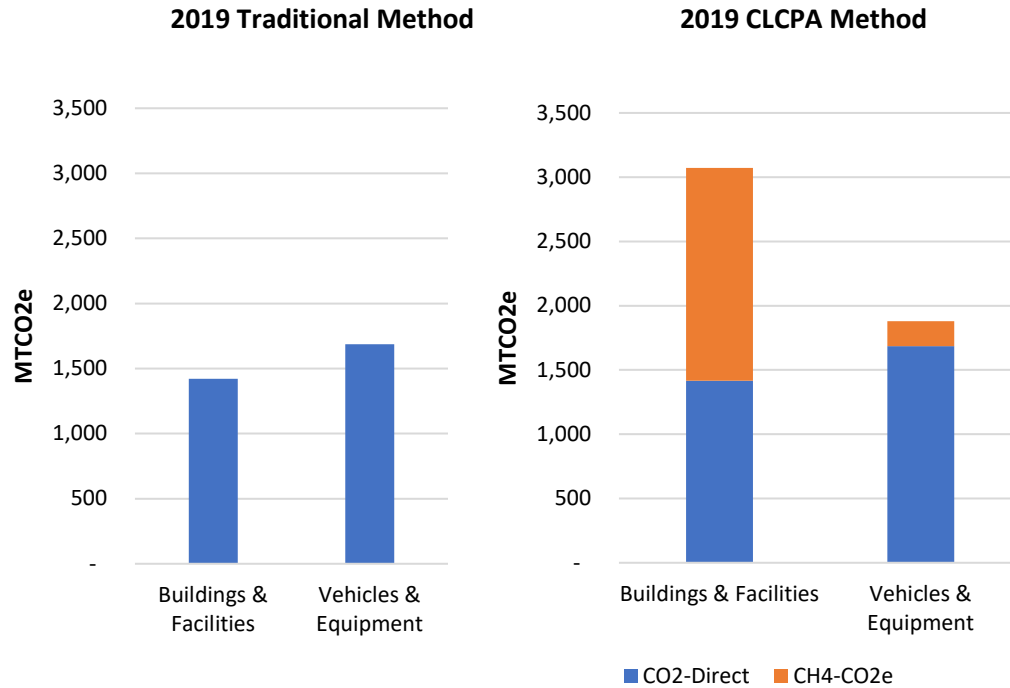
The difference between these two accounting methods can be broken down to show the contribution of methane emissions from Buildings & Facilities and Vehicles & Equipment. The chart, on the left-hand side below, uses the traditional accounting method, and each bar represents all greenhouse gases combined as one emissions number because the methane contribution is too small to see on this scale with a 100-year global warming potential (GWP). Using the anticipated CLCPA method and separating the carbon dioxide and methane contributions of emissions, the chart, on the right-hand side below, shows that calculating emissions with a shorter time horizon, the 20-year GWP, emphasizes the significance of methane in GHG emissions.

¹ A greenhouse gas inventory is a list of emission sources and the associated emissions quantified using standardized methods (US EPA).

² The County government operations include two overarching sectors: (1) Buildings & Facilities, which includes electricity and thermal heating for all County buildings and facilities; and (2) Vehicles & Equipment, which includes both on- and off-road vehicles and equipment powered by predominantly gasoline and diesel.

³ Robert W. Howarth (2020) Methane emissions from fossil fuels: exploring recent changes in greenhouse-gas reporting requirements for the State of New York, *Journal of Integrative Environmental Sciences*, 17:3, 69-81, DOI: 10.1080/1943815X.2020.1789666.

⁴ MTCO₂e – a measure of the combined ability of emitted GHGs to trap heat.



Main takeaways comparing traditional and CLCPA accounting methods

- The GHG emissions using the CLCPA accounting method are 1.6 times the emissions calculated using the traditional method.
- The CLCPA method emphasizes that methane associated with the natural gas used to heat County buildings has a significant impact on climate change.

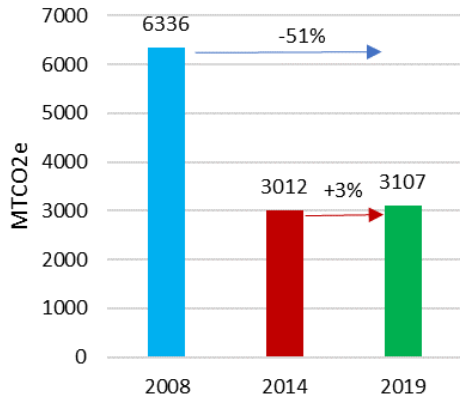
Narrative 2 – Part A: 2019 inventory details with traditional accounting method

Main takeaways for 2019 emissions and energy use using traditional accounting method

- The total 2019 County government GHG emissions were approximately 3,107 metric tons of carbon dioxide equivalent (MTCO₂e) with 54% of emissions from County vehicles and equipment fueled by gasoline, biodiesel, diesel, and ethanol fuels and 46% of emissions from natural gas consumption in County facilities.
- The total electricity consumed by County government operations in 2019 was 6,787,385 kilowatt hours. All the emissions associated with electricity consumption were offset by the County’s purchase of Renewable Energy Certificates, which include electricity produced at a micro-hydro facility in Waterloo, NY, and by the County’s wind energy supplier.
- The total amount of natural gas consumed for County government operations in 2019 was 266,724 therms.
- In 2019, the Vehicles & Equipment Sector consumed 181,606 gallons of fuel (gasoline, diesel and biodiesel), which equates to 23,779 million British thermal units (MMBtu) of energy needed to fuel the vehicles and off-road equipment, such as mowers and forklifts.

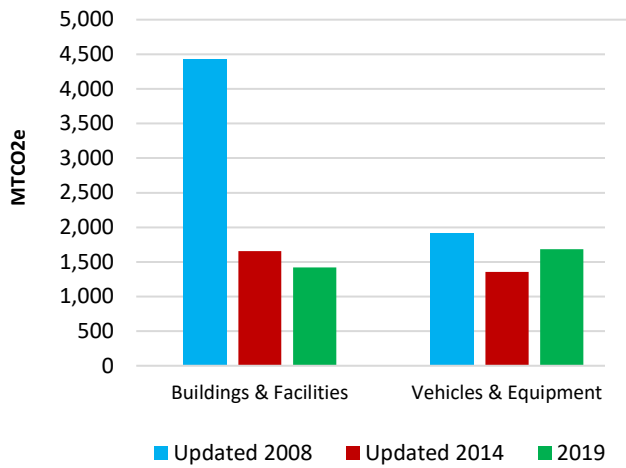
Narrative 2 – Part B: 2008-2019 comparison of emissions and energy use using traditional accounting method

**Government GHG Emissions
2008-2019**

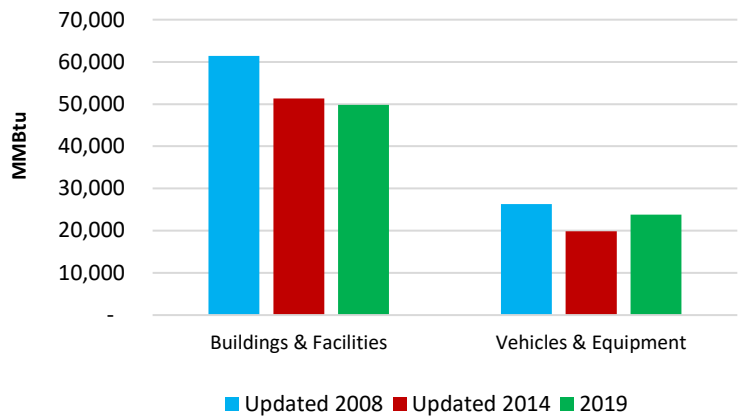


Under the traditional accounting method, Tompkins County reduced the GHG emissions from its government operations by 51% or 3,229 MTCO₂e between the baseline year 2008 and 2019. However, between 2014 and 2019, GHG emissions increased by 3%. The 2019 Tompkins County Energy Strategy calls on the County government, as well as the community, to achieve net-zero emissions⁵ as soon as possible. Although the progress since 2008 is encouraging news and reflects the positive results of the County’s concerted efforts to reduce its emissions, these advances are tempered by the reality that achieving net-zero emissions will require significant changes to the County’s buildings and fleet.

Emissions 2008-2019



Energy Use 2008-2019



⁵ The Energy Strategy defined net-zero to mean that GHG emissions are reduced 100%, to zero, although some emissions can be allowed if balanced by negative emissions achieved through actions such as drawing carbon from the air and tree-planting.

Main takeaways for 2008-2019 comparison of emissions and energy use using traditional account method

- Buildings & Facilities emissions decreased by 68% from 2008 to 2019 with a 14% decrease between 2014 to 2019.
- Vehicles & Equipment emissions decreased 12% from 2008 to 2019 but increased by 25% between 2014-2019.
- Buildings & Facilities energy use decreased by 19% from 2008 to 2019 and had a 3% increase between 2014 to 2019.
- Vehicles & Equipment energy use decreased 10% from 2008 to 2019 but increased by 20% between 2014-2019.

Recent increases in vehicle emissions can be attributed to switching to higher emitting B5 biodiesel as a mechanical necessity for the near term, along with other factors (ex. weather impacts on snow plowing needs, regulatory requirements impacting vehicle use, frequency of service calls covering distant corners of the County). However, conversion of the gasoline-based passenger fleet to electric vehicles (EVs) can yield much progress while electric alternatives to diesel vehicles are under development.

Although weather variations impact energy use and emissions at County facilities, the electrification of buildings currently using natural gas, along with additional energy efficiency improvements, would provide the greatest potential for additional GHG emissions reductions in County buildings and facilities.

The results of this Inventory will inform the County's next steps in reducing GHG emissions from government operations. This Inventory indicates that the greatest potential for GHG emissions reductions in County government operations are to be found in vehicle fleet fuel use and natural gas use in facilities.

Past inventories informed the County's investments to reduce its GHG emissions – examples include the inclusion of a geothermal system to transition the Ithaca Tompkins International Airport Terminal from natural gas as part of its expansion, and acquisition of 23 plug-in EVs in recent years. The information contained in this Inventory, together with investments through the County's Capital Program and other leveraged resources, will help make real the next steps towards achieving net-zero GHG emissions from County government operations.

Contents

Executive Summary.....i

2019 Tompkins County Government Operations1

Comparing Two Greenhouse Gas Emissions Accounting Methods.....3

Findings from the 2019 Inventory4

2008, 2014, and 2019 Inventories: Comparison and Findings9

Next Steps for Reducing Greenhouse Gas Emissions from County Government Operations14

APPENDIX A. 2019 Tompkins County Government Operations GHG Emissions Inventory Facilities Utility Use 15

APPENDIX B. Emissions Without RECs.....17

APPENDIX C. Energy Costs20

(Methodology report for preparation of this inventory is available upon request)

2019 Tompkins County Government Operations

Introduction

A government operations greenhouse gas (GHG) emissions inventory quantifies emissions produced during a specific time period, and periodic updates enable an organization to track changes in emissions and progress towards reduction goals. In August 2019, the Tompkins County Legislature adopted the Tompkins County Energy Strategy, which calls on the County government, as well as the community, to achieve net-zero emissions as soon as possible. To continue to evaluate emissions and energy use trends, Tompkins County developed this 2019 Government Operations GHG Emissions and Energy Use Inventory.

This report summarizes the greenhouse gas emissions produced and the energy used by Tompkins County government operations for the 2019 calendar year, and then compares 2019 to 2008 base-year findings. This Inventory is based upon the *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventory, Version 1.1*.⁶ ClearPath, an online application for the calculation and tracking of greenhouse gas emissions at the government operations and community scales, was used to calculate 2019 emissions. ClearPath is the most widely used software tool for managing local climate mitigation efforts and is available to members of ICLEI- Local Governments for Sustainability, including Tompkins County.

The 2019 Inventory uses the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report's 100-year Global Warming Potential (GWP) values, and the 2008 Inventory was updated in 2014 from the IPCC 2nd Assessment Report values to the 5th Assessment 100-year values to allow direct comparison to the 2014 and 2019 inventories.

The 2019 Inventory also includes emissions calculations based on the new method anticipated to be adopted in New York State as part of implementing the Climate Leadership and Community Protection Act (CLCPA), which requires that emissions be calculated with a 20-year time horizon and account for out-of-state methane leakage associated with natural gas extraction. However, the new method has not yet been incorporated into existing protocols and software, and New York has not issued guidance on how to perform the emissions calculations, the climate scientist advising State officials on these calculations shared the anticipated CLCPA methodology with Tompkins County staff⁷, and results for 2019 are presented below.

Inclusion of RECs in 2019 Findings

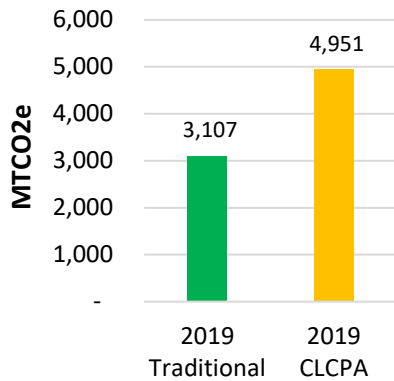
Tompkins County included Renewable Energy Certificates (RECs) in emissions accounting for the 2014 Inventory and for this (2019) Inventory as well. Tradable commodities, RECs are created when energy is harnessed from the wind, sun, water, plants, and other renewable sources. The owner of a REC can claim the environmental attributes, including reduced emissions, associated with the amount of renewable electricity generation that a particular REC represents. Therefore, the entity producing the renewable energy cannot claim the environmental attributes of the energy generated if it does not retain ownership of the RECs for that energy. When referenced throughout this Inventory, the County RECs include these two sources:

⁶ 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.

⁷ Robert W. Howarth (2020) Methane emissions from fossil fuels: exploring recent changes in greenhouse-gas reporting requirements for the State of New York, *Journal of Integrative Environmental Sciences*, 17:3, 69-81, DOI: 10.1080/1943815X.2020.1789666.

- In 2012, the County began purchasing Green Energy (Green-e) RECs to offset 100% of the County government's electricity usage. Therefore, the zero emissions attributed to the Green-e RECs purchased by the County are used in this Inventory's calculations.
- In March 2016, the Tompkins County Legislature authorized execution of a 20-year hydroelectric remote net metering agreement between the County and Gravity Renewables, Inc., which renovated a hydroelectric plant in Waterloo, NY. The County pays Gravity Renewables a fee to operate based on a kilowatt hour (kWh) basis and in return receives a credit on its electric bills for the electricity produced. Beginning with the 2019 Inventory, the County also began accounting for RECs generated from the Waterloo micro-hydro facility, which reduces the number of RECs the County may need to purchase to offset 100% of electricity consumption.

Comparing Two Greenhouse Gas Emissions Accounting Methods



The CLCPA became law in January 2020. In addition to setting goals for reducing GHG emissions, it requires that these emissions be calculated with a 20-year time horizon and account for out-of-state methane leakage associated with natural gas extraction. The traditional accounting method uses a 100-year time horizon and in-state emissions of all greenhouse gases. Using the CLCPA method, the government operations GHG emissions⁸ are 1.6 times higher for 2019 than the total emissions calculated using the traditional accounting method.

Figure 1. 2019 Government GHG Emissions: Using Traditional and CLCPA Methods

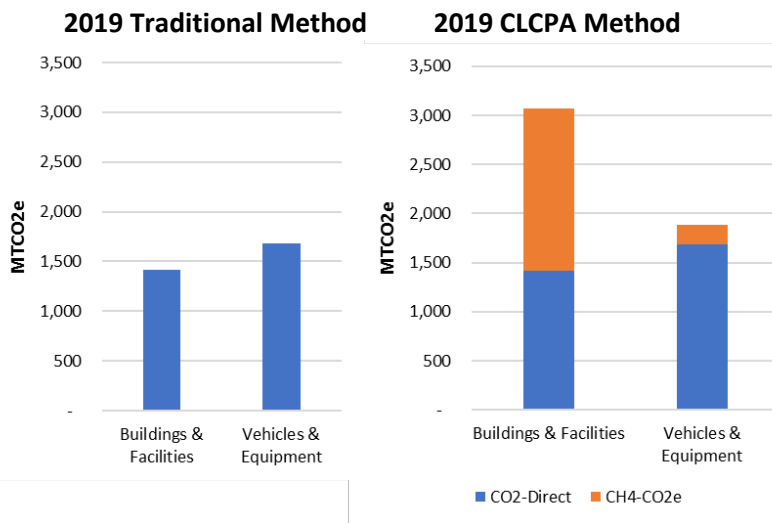


Figure 2. Breakdown of GHG emissions by County operations in 2019 using traditional and CLCPA accounting methods

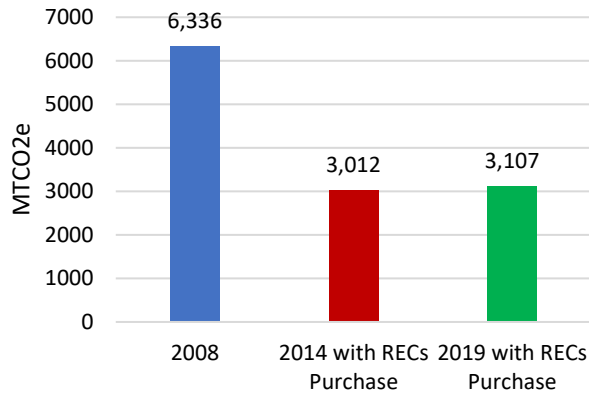
The difference between these two accounting methods can be broken down to show the contribution of methane emissions from Buildings & Facilities and Vehicles & Equipment. The chart on the left-hand side of Figure 2 uses the traditional accounting method, and each bar represents all greenhouse gases combined as one emissions number because the methane contribution is too small to see on this scale with a 100-year GWP. Using the anticipated CLCPA method and separating the carbon dioxide and methane contributions of emissions, the chart on the right-hand of Figure 2 shows that calculating emissions

with a shorter time horizon, the 20-year GWP, emphasizes the significance of methane in GHG emissions. Given that the CLCPA method cannot be accurately applied to previous inventory years, the remainder of this report presents data based on the traditional GHG accounting method. The CLCPA method shows the impacts on overall 2019 GHG emissions calculations and points to the need to rapidly transition County buildings and facilities to efficient electric heating systems.

⁸ MTCO₂e – a measure of the combined ability of emitted GHGs to trap heat.

Findings from the 2019 Inventory

Overview



The total emissions from Tompkins County government operations in 2019 were 3,107 MTCO₂e, which is a 3.1% increase since 2014. This increase can largely be attributed to higher fuel consumption in the Vehicles & Equipment Sector, including a shift in the type of biodiesel⁹ used and snow removal requirements at the Ithaca Tompkins International Airport (Airport). Even with the small increase in emissions reported in year 2019, the County has still achieved a 51% decrease in emissions compared to baseline year 2008, as illustrated in Figure 3.

Figure 3. Total MTCO₂e Emissions

Emissions by Fuel Type and Sector

Unlike 2014, when natural gas was the fuel type with the highest emissions, the combined vehicle fuels for the County fleet, including gasoline, biodiesel, diesel, and ethanol, together represent 54.2% of total emissions (Figure 4). Natural gas usage for heat and hot water contributed 45.7% of the County government’s emissions. Propane used to heat the Highway Satellite Facility contributed 0.07% of emissions. Due to the purchase of Green-e RECs coupled with the RECs produced by the Waterloo micro-hydro facility, electricity accounted for 0% of total emissions in 2019.

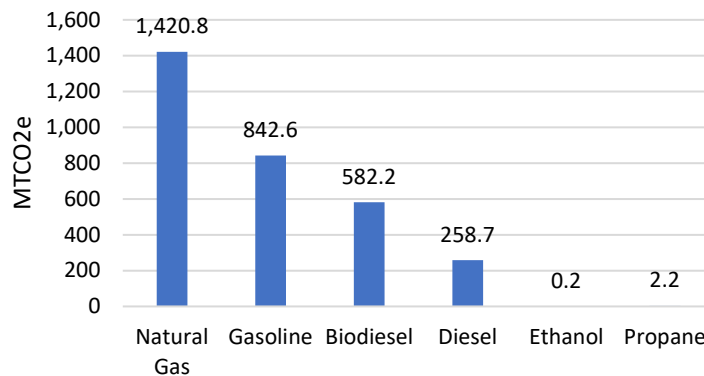


Figure 4. Breakdown of total MTCO₂e emission by fuel type, including RECs

⁹ Biodiesel is a diesel fuel produced from plant oils or animal fats. It is commonly sold blended with diesel derived from petroleum. Common blends include “B2” (2% biodiesel), “B5” (5% biodiesel), “B10” (10% biodiesel), and “B100” (100% biodiesel) (<http://www.bioenergywiki.net/Biodiesel>).

The *Local Government Operations Protocol* (Protocol) uses the following local government sectors to categorize emissions:

- buildings and other facilities, including solid waste and airport facilities
- streetlights and traffic signals
- vehicle fleet (including on-road vehicles and off-road equipment, such as mowers).

While the Airport and Recycling and Solid Waste Center (Solid Waste Facilities) were broken out per the Protocol in 2014, they have been reintegrated with the Buildings & Facilities Sector in 2019 after discussion with ICLEI staff. The Airport and Solid Waste Facilities included here perform managerial functions and are therefore more closely aligned with Buildings & Facilities, as opposed to waste processing, for example.

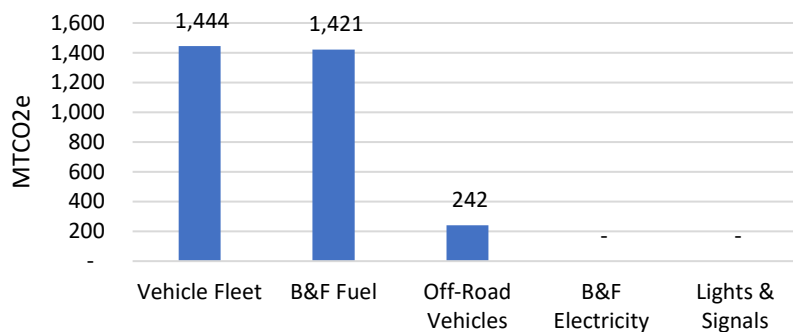


Figure 5. Breakdown of total MTCO_{2e} emission by sector, including RECs

Vehicle Fleet

On-Road Vehicles

The on-road County vehicle fleet, the largest source of emissions in 2019, used 20,427 MMBtu of energy and generated 1,444 MTCO_{2e}, representing 46.5% of County government emissions.

Off-Road Vehicles

The off-road vehicles and equipment, including forklifts, loaders, and mowers, are used by the Airport and the Highway Department, and consumed 3,352 MMBtu of energy and generated 242 MTCO_{2e} in 2019, representing an additional 7.8% of County government emissions.

Buildings and Facilities

County buildings and facilities, including the Airport and the Solid Waste Facilities, used 49,774 MMBtu of energy in 2019, including natural gas, propane, and electricity. However, this value corresponds to only 1,421 MTCO_{2e} of associated emissions from the Buildings & Facilities Sector in 2019 after factoring in the RECs. Although the total RECs significantly reduced the electricity portion of this sector’s emissions, at 45.7% of its total GHG emissions, the Buildings & Facilities Sector is still County government’s second-largest emitter.

Streetlights and Traffic Signals

The Highway Department operates five traffic signals and one set of streetlights. These lights and signals used 99.6 MMBtu of energy and generated 0 MTCO_{2e} in 2019 due to the purchase of RECs.

Energy Use

In 2019 Tompkins County government operations used a total of 73,653 MMBtu, representing the actual energy required by County facilities, vehicles, and equipment for their operation in 2019. After accounting for RECs, this total reduces to 50,587 MMBtu, which is the value used to calculate County government emissions.

Electricity

County government operations used 6,787,385 kWh of electricity in 2019. The Airport, Tompkins County Public Library, and the Human Services Building were the three largest energy consumers within the Buildings & Facilities Sector (Figure 6), and they used 1,238,593 kWh, 1,020,400 kWh, and 822,076 kWh of electricity, respectively. In 2019, the Airport completed an expansion project that increased the size of the terminal by over 50%. Installation of energy efficiency measures included improved building envelope, LED lighting improvements, lighting controls, daylight harvesting, roller shades, a solar canopy-covered parking facility, and a geothermal heating and cooling system. Electricity consumption is expected to increase as the facility uses less natural gas.

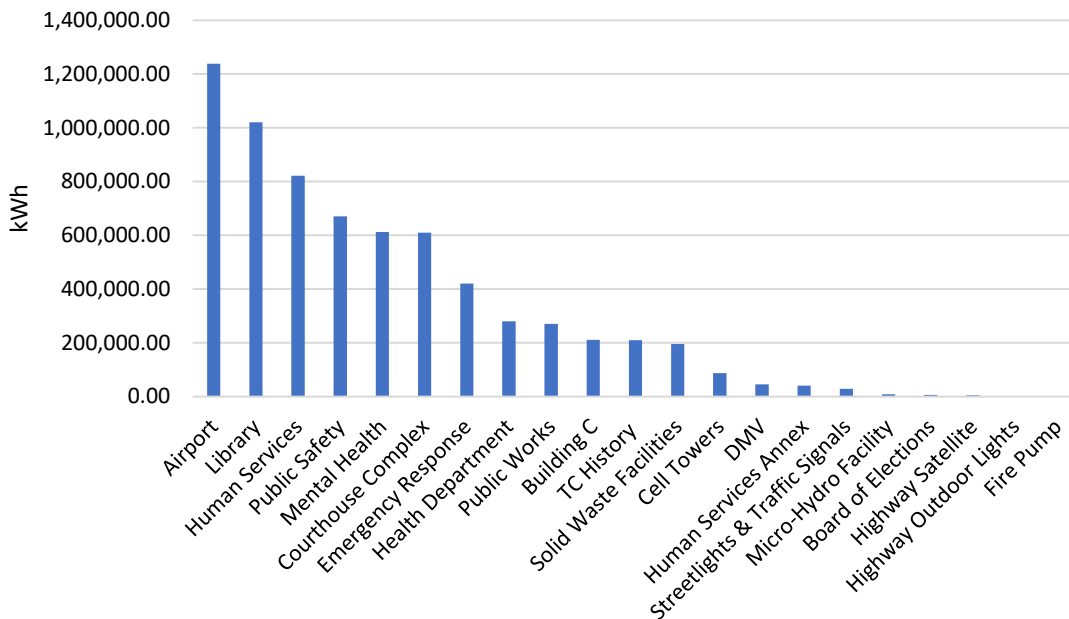


Figure 6. Electricity use by County facilities in 2019

Buildings & Facilities Sector electricity use includes electricity delivered by the grid, as well as any solar electricity generated and used on site by photovoltaic (PV) panels installed on County facilities for which the County does not retain the RECs. Figure 7 indicates the total solar generation for 2019 for the facilities whose PV panels were in operation at the end of the year.

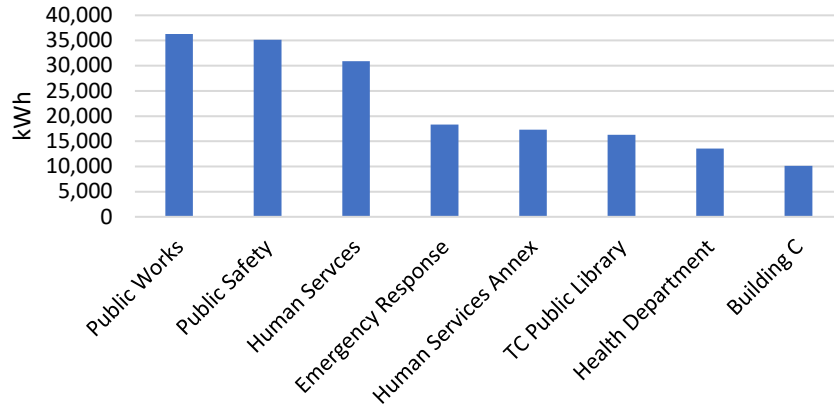


Figure 7. Solar electricity generated at County facilities in 2019

Natural Gas

The total natural gas used for County government operations in 2019 was 266,724 therms. The Airport, Human Services Building, and Courthouse Complex were the three largest consumers of natural gas (Figure 8). They used 47,011 therms, 33,163 therms, and 31,245 therms of natural gas, respectively.

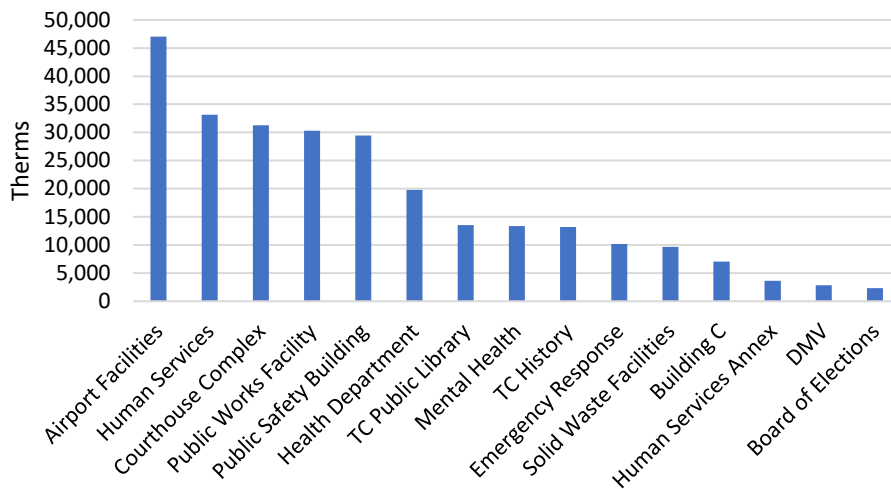


Figure 8. Natural gas use of the facilities

Propane

The Highway Satellite Facility used 396.6 gallons of propane to run a heater in 2019.

Vehicle Fuel

The total on and off-road vehicle and equipment fuel used for County government operations in 2019 was 181,606 gallons. Figure 9 presents the annual vehicle fuel use by each department in descending order. Though the fuel use by Assessment, Emergency Response, Mental Health, Weights and Measures, County Clerk, Planning and Sustainability, and Information Technology Services are accounted for, the usage values were not

significant enough to include in Figure 9. The Sheriff’s Office, Airport, and Highway and Facilities Departments were the four largest consumers of fuel.

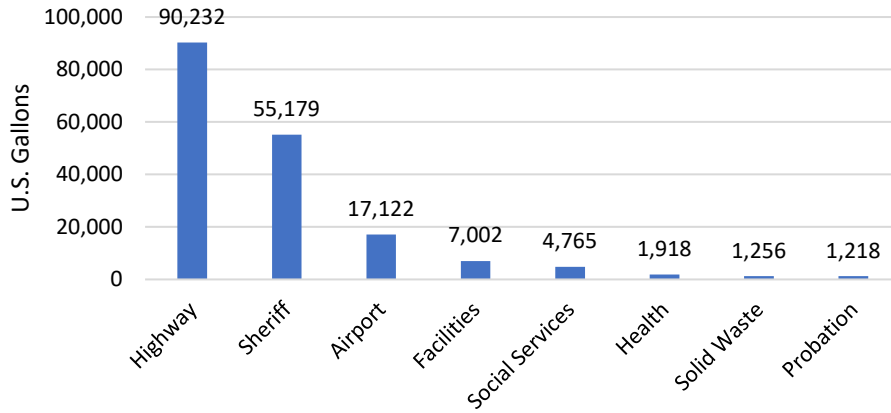


Figure 9. Annual vehicle fuel use of the departments

Gasoline was the primary fuel for the Sheriff’s Office, while the Highway Department relied primarily on biodiesel (Figure 10). The Highway Department also consumed 2,770 gallons of kerosene and 8,846 gallons of sulfur #2 diesel fuel in 2019. Given that sulfur #2 is categorized as a diesel fuel and kerosene was mixed in with diesel when it was purchased by the Highway Department, these fuel types were ultimately rolled into a single “diesel” fuel entry for the purposes of this GHG Inventory. Note that the Highway Department uses kerosene for a pressure washer to wash trucks. The pressure washer burns kerosene to produce heat for hot water.

Electricity was also used as a fuel for an increasing number of plug-in EVs in the County fleet. In this Inventory, energy use and emissions of these vehicles was included in the Buildings & Facilities number. However, the County’s RECs purchase offset electricity emissions associated with these vehicles.

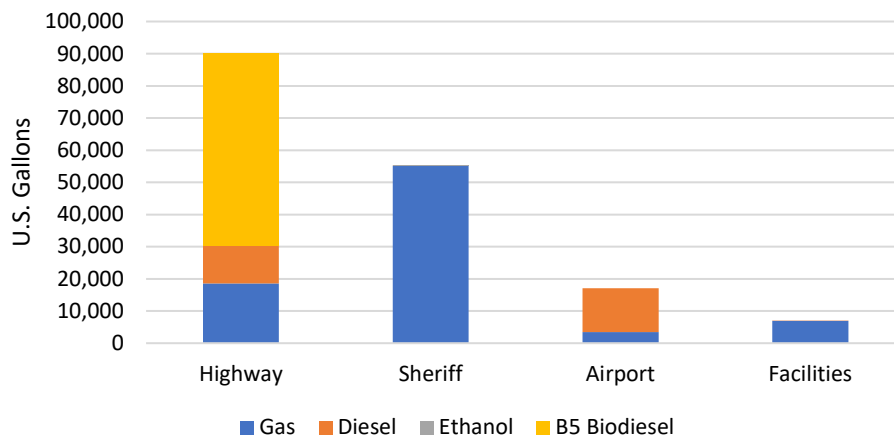


Figure 10. Breakdown of annual vehicle fuel use by fuel type among the largest users

2008, 2014, and 2019 Inventories: Comparison and Findings

Between 2008 and 2014, County government emissions decreased by 52.5%. However, between 2014 and 2019, there was an increase of 3.1%. The following changes since 2008 have been critical in reducing emissions:

Transforming the Electric Grid

According to the U.S. Environmental Protection Agency's Emissions & Generation Resource Integrated Database for 2018, CO₂ emissions factor of electricity generation in the New York Upstate Sub-region declined from 720.8 lbs/MWh in 2008 to 253.9 lbs/MWh in 2018 due to the shift of fuel use from coal to natural gas and renewable energy. This significant change in grid emissions intensity reduces emissions for users of the electricity, including County government.

Renewable Energy Credits (RECs)

RECs Purchased

Green-e RECs: In November 2012, Tompkins County began purchasing Green-e Energy Certified Renewable Energy Credits (Green-e RECs) from wind energy to offset 100% of the County's electricity usage. These Green-e RECs reduced the County's 2019 electricity-related emissions; however, they do not represent actual reductions in energy use by County government.

Micro-hydro: In 2016, Tompkins County entered into a 20-year agreement with Gravity Renewables to be the off-taker of RECs generated at the hydropower plant in Waterloo, NY.

RECs Generated but not Retained

In 2011, Tompkins County entered into a 15-year lease agreement with Solar Liberty to install solar panels on the following seven County government buildings: Building C, Emergency Response Center, Health Department, Human Services Annex, Human Services Building, Public Safety Building, and the Public Works Building. All panels were producing electricity in 2019. Under the terms of the agreement, Solar Liberty retains ownership of the RECs generated by these panels and can sell them to other parties wishing to reduce their emissions. Therefore, although the solar panels on County government buildings generate these RECs, Tompkins County does not own the panels nor retain ownership of these RECs and they do not reduce the County government's emissions.

RECs Generated and Retained

One County building, the Tompkins County Public Library, has solar panels installed that are owned by Tompkins County. The panels were installed by SunPower in 2000, and the County retains the RECs from the electricity they generate. As a result, these RECs do reduce the County government's emissions. Between 2014 and 2019 the Library's solar PV electricity production dropped from more than 80,000 kWh of electricity in 2014 to just over 16,000 kWh in 2019. The generation over the past five years has been quite variable with some days showing zero generation, which may be related to snow cover, but the monitoring system should be investigated for reliability.

Energy Performance Contract

Tompkins County and Johnson Controls, Inc. entered into an Energy Performance Contract (EPC) in December 2005. The contract guarantees that Tompkins County will realize \$4,154,367 of energy cost avoidance between February 2007 and January 2022. Although most improvements to County buildings occurred before 2008, an additional EPC was executed in January 2013 for the purpose of upgrading energy equipment and systems within the Public Safety Building. The energy improvement measures installed as part of this project included exterior lighting upgrades, boiler replacement, heat pump replacement, and window and roof replacements.

Greening the County Fleet

In 2009, the Tompkins County Legislature adopted a green fleet policy for the County, which requires each department to reduce its fleet emissions by 2% annually to reach the County's emissions reduction goals. By 2020, 15 hybrid vehicles and 23 EVs had been added to the County fleet, and car sharing between several County departments had increased.

Departments have replaced fleet vehicles with newer models providing greater fuel efficiency. In particular, EVs have taken the place of a number of internal combustion engine vehicles, further reducing the County government's emissions.

In 2018 the County successfully secured Clean Energy Communities grant funding through NYSERDA to further improve the County fleet through information gathering and assisting departments with the acquisition of EVs and installation of charging stations in order to accelerate the conversion to plug-in electric vehicles.

Changing Vehicle Fuels

In 2009, the Highway Department began transitioning its diesel vehicles, which account for more than three-quarters of its fleet, to B10 and B20 biodiesel. Biodiesel emits less carbon dioxide equivalents than conventional diesel, and this change accounted for 59.4% of the reduced vehicle fleet emissions between 2008 and 2014. Unfortunately, the B10 and B20 biodiesels were problematic for the truck mechanical systems, especially in winter. As a result, since 2017 the Highway Department has instead been using B5 biodiesel, which resolved the mechanical issues but has higher emissions.

Breakdown of Total Emissions by Sector and Fuel Type

As previously discussed, the purchase of Green-e RECs in 2014 and 2019 substantially reduced emissions from electricity consumed by County buildings and facilities. Additionally, in 2019, the RECs produced by the County's Waterloo micro-hydro facility further reduced the Buildings & Facilities and Streetlights & Traffic Signals electricity emissions down to zero. Fuel use by the Buildings & Facilities Sector also saw a modest emissions decrease, which may be in part due to reduced fuel usage given a warmer winter season.

However, the data show an increase in vehicle fleet emissions from 2014 to 2019, though still a decrease from 2008. Similarly, off-road vehicle emissions increased from 2014 to 2019 (off-road vehicles were not tracked separately in 2008). The increase in on-road and off-road vehicle emissions is largely attributed to the roughly 30,000-gallon increase in fuel use across all County government fleet vehicles. There is some uncertainty in the number of gallons consumed by the vehicle fleet versus off-road vehicles for the Highway Department in 2019,

but a notable increase in gasoline, B5 biodiesel, and kerosene consumption indicates that overall fuel use did increase across the County fleet between 2014 and 2019.

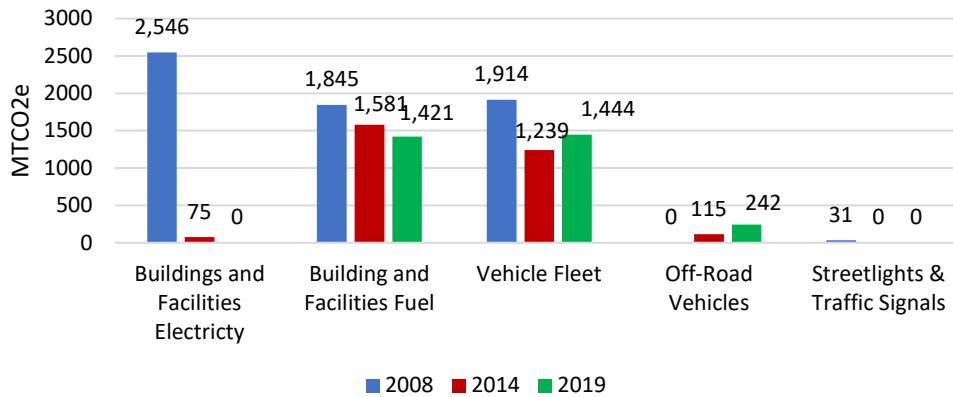


Figure 11. Comparison of emissions by sector

Figure 12 provides the breakdown of the total emissions in 2008, 2014, and 2019 by fuel type. There was a significant 90% drop in emissions from the use of diesel fuel between 2008 and 2014, though a substantial uptick in 2019 kerosene usage in particular saw the emissions attributed to diesel fuel increase 200% from 2014 levels. Tompkins County began switching some of its vehicle and equipment from diesel to biodiesel in 2009. In 2014, 23,547 gallons of B10 biodiesel and 28,522 gallons of B20 biodiesel were purchased, representing a reduction of approximately 67 MTCO₂e emissions over the equivalent amount of ultra-low sulfur diesel fuel. In 2019, the total 52,069 gallons of 2014 B10 and B20 biodiesel usage was almost completely replaced with 60,000 gallons of B5 biodiesel usage, leading to the overall 131 MTCO₂e increase in emissions associated with biodiesel. Between 2014 and 2019, the Highway Satellite Facility switched from heating with waste oil to propane, increasing its propane usage from 100 gallons in 2014 to almost 400 gallons in 2019.

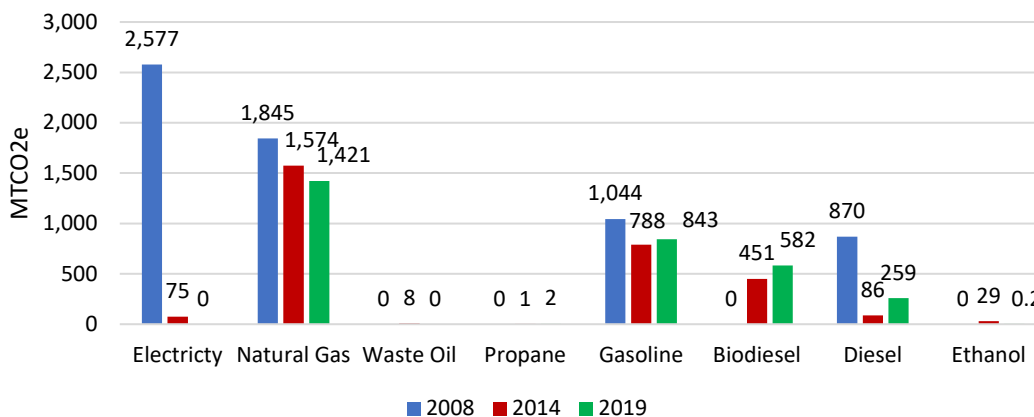


Figure 12. Comparison of emissions by fuel type

Breakdown of Energy Use by Facility

Although the purchase of Green-e RECs now coupled with the RECs from the Waterloo micro-hydro facility reduces emissions from facilities' electricity use, it does not equate to a reduction in actual energy use. Figure 13 provides the breakdown of energy use (MMBtu) by County facility, including electricity consumption as well as any natural gas consumption.

A number of buildings and facilities exhibited an increase in energy use from 2014 to 2019, including the Library and Public Safety, Human Services, and Emergency Response Buildings. In addition, the 2019 Inventory included energy usage from buildings and facilities that were not part of the County facilities in 2014, including two cell towers, the Waterloo micro-hydro facility, EV charging stations at the Health Department, and the Tompkins Center for History and Culture building. The addition of these buildings and facilities, coupled with the decrease in solar production from the Library's rooftop PV array and increased energy use from the buildings and facilities noted above, led to an overall increase in energy consumption.

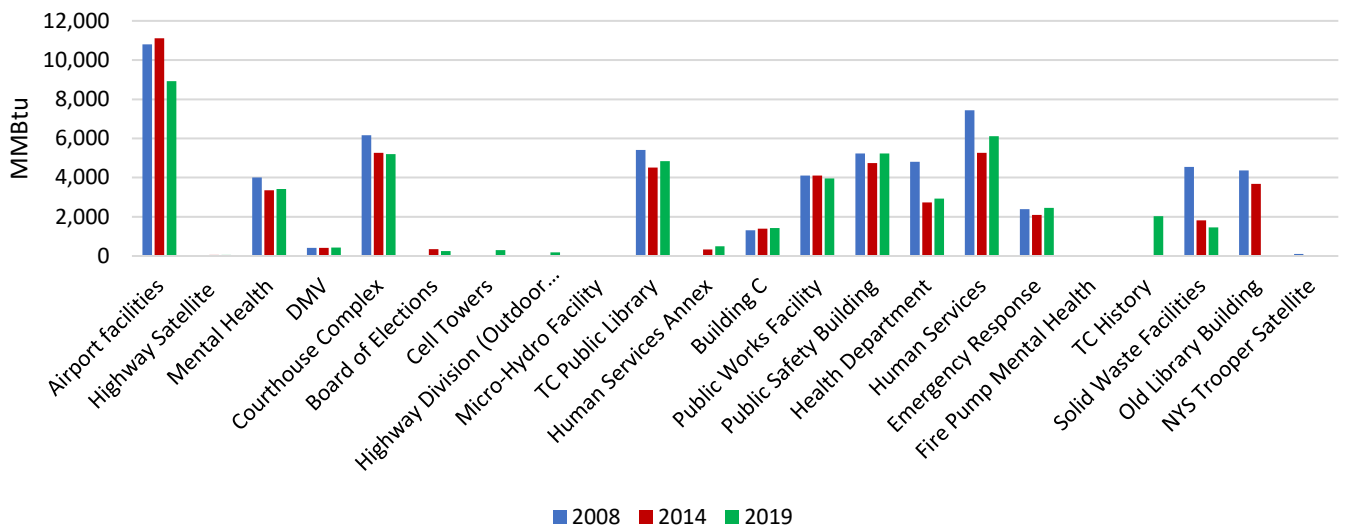


Figure 13. Comparison of energy use by facility

Breakdown of Emissions from Vehicle Fuel Use by Department

Figure 14 provides the breakdown of the total emissions in 2008, 2014, and 2019 from vehicle fuel use by department. Additional information about changes within specific departments that affected vehicle fuel use between 2014 and 2019 may be found in Appendix D. The Highway Department, Sheriff's Office, Airport, and Facilities Building each saw an increase in fuel usage from 2014 to 2019.

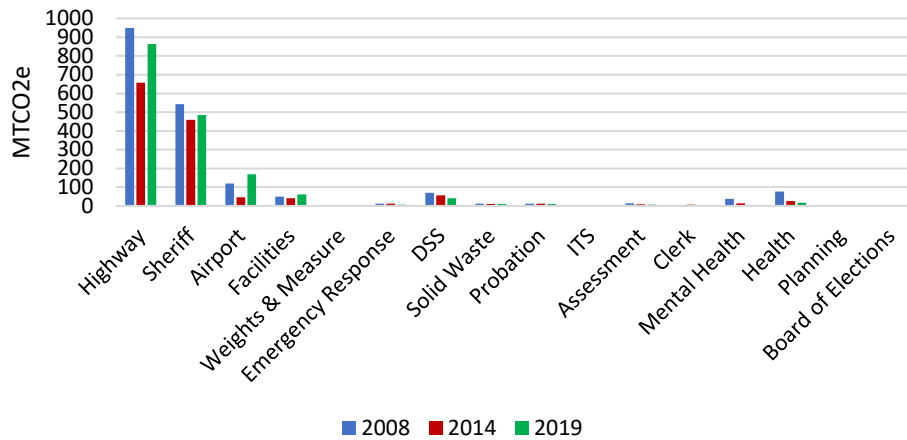


Figure 14. Comparison of emissions from vehicle fuel use by department

Weather Conditions

In 2019, there were 7,201 Heating Degree Days (HDD) where the average temperature was below 65° Fahrenheit, the temperature below which buildings are considered to need to be heated (Table 1). There were 384 Cooling Degree Days (CDD) where the average temperature is above 65° Fahrenheit and air conditioning is more likely to be used to cool buildings. These data indicate that 2014 was cooler in the summer and colder in the winter than the conditions experienced in Tompkins County in 2019. Therefore, one would expect that more electricity would be needed in 2019 compared to 2014 for air conditioning, while less natural gas and other thermal fuels were needed in 2019 for space heating.

Year	HDD	CDD
2008	6975	387
2009	7031	272
2010	6641	622
2011	6615	526
2012	6202	543
2013	7106	479
2014	7403	342
2015	6954	445
2016	6703	555
2017	6791	346
2018	7167	528
2019	7201	384

Table 1. Heating and Cooling Degree Days, 2008-2019

Next Steps for Reducing Greenhouse Gas Emissions from County Government Operations

The detailed results of this Government Operations Inventory should be used to implement the Energy Strategy of 2019, which looks to achieving net-zero emissions as soon as reasonably possible. In addition to County actions to electrify the County's heating and cooling systems and replace vehicles with electric vehicles, it will be important to support the electric grid's transition to renewable energy and to support the New York State Climate Leadership and Community Protection Act's aggressive goals to expand renewable energy with a 2040 target of 100% zero-emissions electricity.

APPENDIX A. 2019 Tompkins County Government Operations GHG Emissions Inventory Facilities Utility Use

Department		MTCO ₂ e	MTCO ₂ e (%)	Energy (MMBtu)	Energy (%)
Airport Facilities	Electricity	143		4227	
	Natural Gas	250		4701	
Subtotal Airport Facilities		393	17.8%	8928	18%
Highway Satellite	Electricity	1		19	
	Natural Gas	0		0	
	Propane	2		36	
Subtotal Highway Satellite		3	0.1%	56	0.1%
Mental Health	Electricity	71		2089	
	Natural Gas	71		1337	
Subtotal Mental Health		142	6.4%	3426	6.9%
DMV	Electricity	5		154	
	Natural Gas	15		285	
Subtotal DMV		20	0.9%	439	0.9%
Courthouse Complex	Electricity	70		2081	
	Natural Gas	166		3125	
Subtotal Courthouse Complex		236	10.7%	5205	10.5%
Board of Elections	Electricity	1		23	
	Natural Gas	12		233	
Subtotal Board of Elections		13	0.6%	256	0.5%
Cell Towers	Electricity	10		299	
	Natural Gas	0		0	
Subtotal Cell Towers		10	0.5%	299	0.6%
Micro-Hydro Facility	Electricity	1		29	
	Natural Gas	0		0	
Subtotal Micro-Hydro Facility		1	0.0%	29	0.1%
TC Public Library	Electricity	118		3483	
	Natural Gas	72		1351	
Subtotal TC Public Library		189	8.6%	4834	9.8%
Human Services Annex	Electricity	5		140	

	Natural Gas	19		364	
Subtotal Human Services Annex		24	1.1%	504	1.0%
Building C	Electricity	24		721	
	Natural Gas	38		707	
Subtotal Building C		62	2.8%	1428	2.9%
Public Works Facility	Electricity	31		925	
	Natural Gas	161		3030	
Subtotal Public Works Facility		192	8.7%	3955	8.0%
Public Safety Building	Electricity	77		2287	
	Natural Gas	157		2944	
Subtotal Public Safety Building		234	10.6%	5231	10.6%
Health Department	Electricity	32		957	
	Natural Gas	105		1977	
Subtotal Health Department		137	6.2%	2934	5.9%
Human Services Building	Electricity	95		2806	
	Natural Gas	176		3316	
Subtotal Human Services		271	12.3%	6122	12.4%
Emergency Response	Electricity	48		1435	
	Natural Gas	54		1016	
Subtotal Emergency Response		103	4.7%	2452	5.0%
TC History	Electricity	24		717	
	Natural Gas	70		1322	
Subtotal TC History		94	4.3%	2038	4.1%
Solid Waste Facilities	Electricity	23		667	
	Natural Gas	51		788	
Subtotal Solid Waste Facilities		74	3.4%	1455	2.9%
Streetlights & Traffic Signals	Electricity	3		100	
	Natural Gas	0		0	
Subtotal Streetlights & Traffic Signals		3	0.2%	100	0.2%
Total		2203	100%	49460	100%

APPENDIX B. Emissions Without RECs

Results: 2019 Government GHG Emissions Inventory and Energy Flow Without RECs

Tompkins County has been purchasing Green-e Energy Certified Renewable Energy Credits (Green-e RECs) to offset the County’s electricity usage since November 2012. Additionally, in 2019 the County government also captured the renewable energy credits (RECs) produced by the Waterloo micro-hydro facility. Purchased RECs allow the purchaser, as opposed to the generation source, to claim the environmental attributes for the renewable electricity consumed. Although Tompkins County can claim the renewable energy use for the RECs it purchases for its government operations, it is important to consider the County government’s emissions without the RECs to gain a clearer understanding of total emissions if the County were not able to take credit for renewable energy generated by other parties. The information below provides a second version of the Inventory calculations without the emissions reductions attributed to the purchase of RECs.

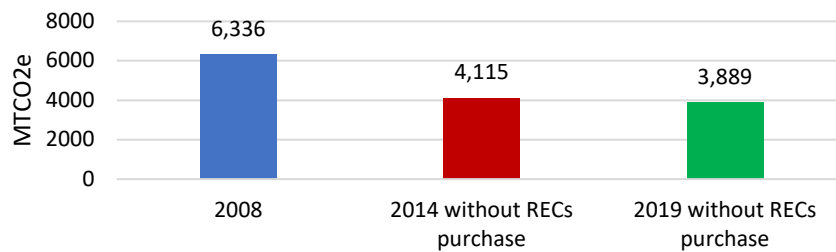


Figure 15. Total MTCO_{2e} emissions in 2008, 2014, and 2019 without RECs purchase

The total metric tons of carbon dioxide equivalent (MTCO_{2e}) emissions from Tompkins County government operations in 2019 were 3,889 MTCO_{2e} when RECs are excluded. In 2008, County government operations emitted 6,336 MTCO_{2e}, and in 2014 the total MTCO_{2e} was 4,115 without RECs. Tompkins County government emissions decreased by 35% between 2008 and 2014, while emissions decreased 5.5% between 2014 and 2019 when emissions reductions from purchased RECs are excluded.

As shown in Figures 16 and 17, without the Green-e RECs, electricity moves between gasoline and biodiesel in 2019 to become the third-highest emitting fuel type, and Buildings & Facilities becomes the third-highest sector for electricity emissions.

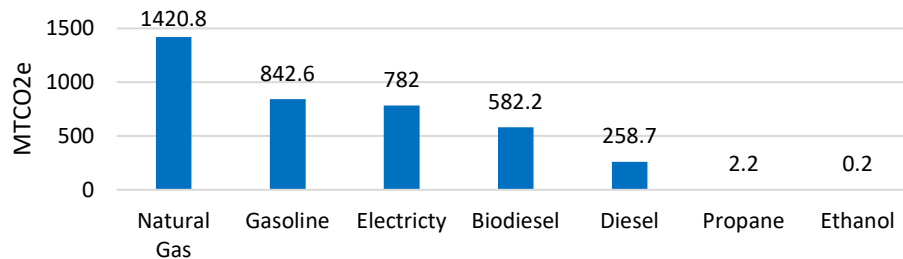


Figure 16. Breakdown of total CO_{2e} emission by fuel type without accounting for RECs purchase

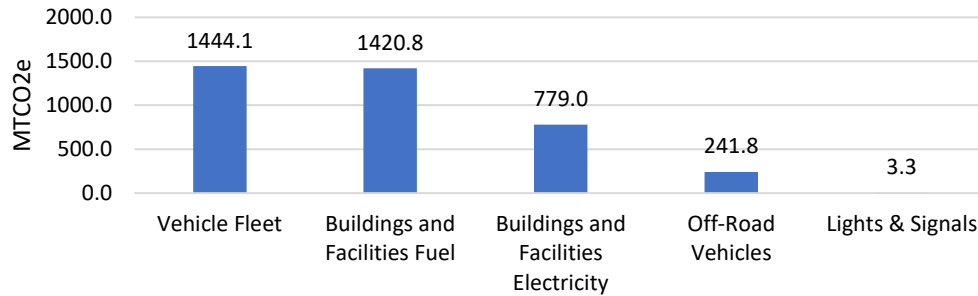


Figure 17. Breakdown of total emission by sector without accounting for RECs purchase

Buildings and Facilities

Buildings and facilities operated by the County used 49,774 million British Thermal Units (MMBtu) of energy and generated 2,203 MTCO₂e in 2019. Producing 56.6% of all emissions, the Buildings & Facilities Sector continues to be the largest emitter of greenhouse gases as it has been in the four previous County government emissions inventories.

Vehicle Fleet

The County vehicle fleet was the second-largest source of emissions, as it has been in previous inventories. The fleet used 20,043 MMBtu of energy and generated 1,444.1 MTCO₂e, representing 37.1% of County government emissions.

Off-Road Vehicles

The County’s off-road vehicles include pick-up trucks, dump trucks, firetrucks, and equipment such as forklifts, loaders, and mowers at both the Airport and Highway Department. These facilities used 3,352 MMBtu of energy and generated 241.8 MTCO₂e in 2019, representing 6.2% of County government emissions.

Streetlights and Traffic Signals

The County’s streetlights and traffic signals, which include five traffic signals and one set of streetlights, used 99.6 MMBtu of energy and generated 3.3 MTCO₂e in 2019, representing .8% of County government emissions.

Comparison of Emissions and Energy Use 2008-2019 Without RECs

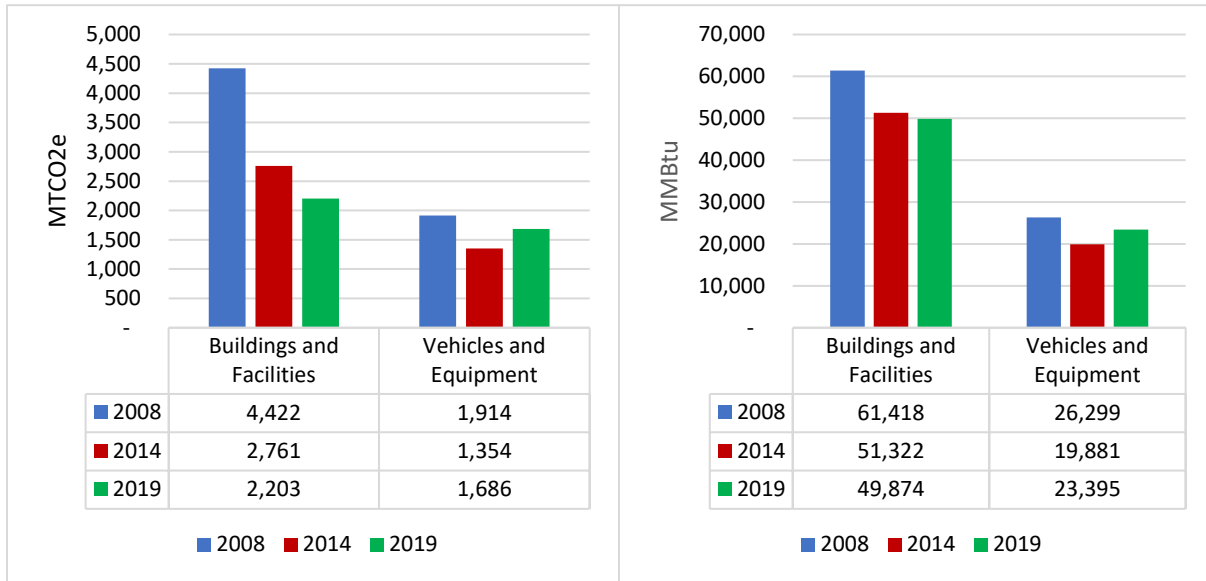


Figure 18. 2008-2019 GHG Emissions and Energy Use without RECs purchase

The County government has two overarching sectors: (1) Buildings & Facilities, which includes electricity and thermal heating for all County buildings and facilities, including the Airport and Solid Waste facilities, and; (2) Vehicles & Equipment, which includes both on- and off-road vehicles and equipment powered by vehicle fuels. Without the emissions reduction benefits of the RECs, the increase in conventionally generated electricity results in a closer correlation between energy use and emissions.

APPENDIX C. Energy Costs

The energy required for Tompkins County government operations in 2019 cost \$1,182,578, with the purchase of RECs (Green-e and hydroelectric) included. Tompkins County spent \$552,094, or 31.8% less than it did on energy costs in 2008, and \$275,900, or 18.9% less than in 2014. (Figure 20).

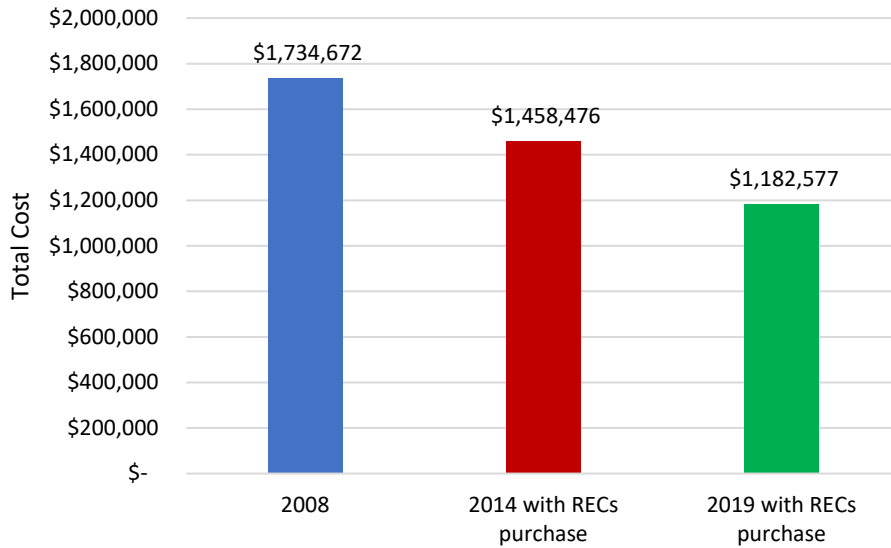


Figure 19. Total costs for energy consumed in 2008, 2014, and 2019

Energy costs were greatest for the vehicle fleet at \$410,078, or 34.7% of total energy costs. The remaining 65.3% of 2019 County energy expenditures were incurred to purchase natural gas for use by County buildings and facilities and RECs to offset electricity consumption.