

Town of Ulysses Greenhouse Gas Emissions Inventory: 2012-2016

Compiled by
Cornell Cooperative Extension
of Tompkins County

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Greenhouse Gas Emissions Inventory:

A comparison of 2012 and 2016

Introduction

This comparison of 2016 greenhouse gas (GHG) emissions in Ulysses, New York, from a baseline year of 2012, serves as a preliminary step in creating strategies to reduce GHG emissions. It is important for local government to understand their Town's emission levels and their impacts as it allows them to prioritize actions when creating a local Climate Action Plan to mitigate the effect of these emissions.

This information was compiled per the Local Government Operations Protocol (LGOP), version 1.1. The LGOP is a policy framework that provides guiding methodologies to help local governments calculate and understand the GHG emissions of their operations. The LGOP was developed by the International Council for Local Environmental Initiatives and the Climate Registry in collaboration with the California Climate Action Registry and the California Air Resources Board.

This Greenhouse Gas Inventory was prepared as a component of the Town of Ulysses' participation in the Climate Smart Communities program of the New York State Department of Environmental Conservation. The inventory was prepared by Amelia Visnauskas and Skye Hart, Clean Energy Community interns of Cornell Cooperative Extension on behalf of the Town of Ulysses and under the guidance of Darby Kiley, Planner for the Town of Ulysses, and Terrance Carroll, Clean Energy Communities coordinator at CCE Tompkins.

Communities that have been certified as Climate Smart Communities are committed to reducing GHG emissions and improving climate resilience, which allows them to reduce long-term costs and adapt to a changing climate.

Greenhouse Gas Emission and Energy Use in New York State

Greenhouse gases are gases that trap heat in the Earth's atmosphere when they accumulate in high concentrations. Common greenhouse gases include carbon dioxide, methane, nitrous oxide, and fluorinated gases, which are synthetic gases produced by industrial processes. These gases are released into the atmosphere in a number of ways: everyday activities of all kinds can have a direct impact on greenhouse gas emissions and climate change.

Some gases have a greater impact on the atmosphere than others, but together, these gases combine to "thicken the Earth's blanket" and change climatic conditions. For example, methane gas has a higher warming effect on the atmosphere than carbon dioxide, but dissipates more quickly. Some of these gases, such as water vapor, carbon dioxide, and methane, occur naturally in small percentages, and help the atmosphere retain enough heat to sustain life. This balance is disrupted, however, by greenhouse gas emissions from human activity, which cause the atmosphere to retain more energy from the sun than it normally would. This seemingly small change in the atmosphere's composition has already led to big changes in temperature and weather all over the world.

Main Sources Of Greenhouse Gases in NYS

New York's goal is to reduce these emissions 80% by 2050

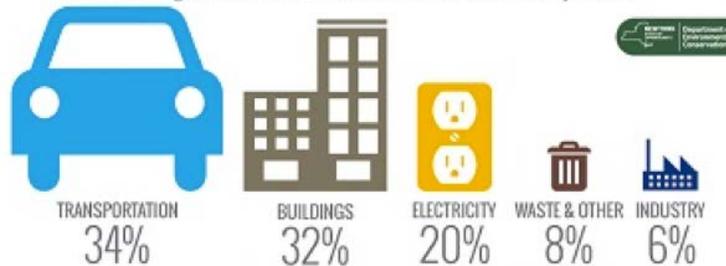


Image source: New York Department of Environmental Conservation
http://www.dec.ny.gov/images/administration_images/ghsrrcsm.jpg

Greenhouse gas emissions in New York State come mostly from transportation (34%). This includes all travel of people and goods by cars, trucks, ships, airplanes, trains, and other vehicles. Greenhouse gases in the state are also largely produced by the industrial sector from the manufacturing processes that create the goods and raw materials that we use every day. Residential and commercial activity contributes as well, mostly resulting from heating, cooking, wastewater management, and refrigerant leaks. GHG emissions in rural areas of New York State also come from soil management of agricultural land that releases nitrous oxide into the atmosphere. These activities include the use of synthetic and organic fertilizers, growing nitrogen-fixing crops, and various irrigation processes. Livestock also contribute to GHG emissions, as their natural digestive processes produce methane. This can be exacerbated or mitigated by proper management of livestock waste.

A variety of research, including New York's Climate Aid report (2011, 2014) and the National Climate Assessment (2014), has shown that impacts of climate change have already begun to occur in New York State. Climate change manifests as changes in temperature, precipitation, sea levels, seasonal changes, and severe weather events. These changes have direct effects on the health of humans, animals and plants in New York State.

Since 1970, the average annual temperature has risen by 2.4°F in New York State. Average winter temperatures have increased by over 4.4°F. Climate change has also resulted in increased precipitation in the winter, and less in the summer. Climate change also includes climactic events beyond global warming, namely an increase in severe weather events, such as superstorms and hurricanes. Between 1958 and 2010, the number of very heavy precipitation events increased by over 70% in the United States. New York's coastal areas have seen a sea level rise of over a foot since 1900. Sea level rise is a result of climate change, which causes warmer temperatures that melt polar caps, glaciers, and land-based ice. Sea level rise is especially imminent in New York State, where the rate of rise (1.2 inches per decade) is nearly twice as high as the global rate (0.7 inches per decade). Climate change has also resulted in variation in seasonal patterns. In New York State, for example, spring begins a week earlier than it once did. The first leaf date in autumn is, correspondingly, over a week late.

Once greenhouse gases are emitted into the atmosphere, they can linger for decades or even centuries, even if emissions are reduced in the future. It is important to understand how greenhouse gas emissions are affecting our region in order to create strategies for reducing future greenhouse gas emissions. Modelling has projected that climate change will continue in New York State. The region will experience more precipitation, more variability in precipitation, and warmer temperatures. By 2020, average precipitation will increase by up to 8%, compared to the 1971-2000 period, and annual average temperatures will increase by 3°F.

Climate change also negatively impacts the availability of clean air, water, and food supplies. Changing environmental conditions in New York State also help insects, such as mosquitoes and ticks, spread infectious diseases such as West Nile virus and Lyme disease. Human health is also affected directly by the changing climate, especially those, like the elderly and children, who are already vulnerable. This can be caused by things such as increased pollen production, ground-level ozone formation, or the presence of other forms of air pollution. All of these factors exacerbate asthma, allergies, and other respiratory conditions.

In summary, greenhouse gas emissions and the climate change that they cause have already begun to affect the health and sustainability of communities in New York State. These negative effects can be partially mitigated, however, by reducing greenhouse gas emissions and the activities that create them. This Greenhouse Gas Inventory for the Town of Ulysses, New York, serves as a first step in taking action to plan for a healthier and more environmentally responsible town that may be enjoyed for generations to come.

Methodology

The calculations in this report were performed using the Climate Smart Communities Local Government Greenhouse Gas Accounting Tool, provided by the New York State Department of Environmental Conservation. The tool is based on the Local Government Operations Protocol, which serves as a national standard for municipal greenhouse gas inventories across the country. Buildings emissions data for the Town of Ulysses was collected from the New York State Electric and Gas Corporation (NYSEG) over a 12-month period. Vehicle emissions data was gathered through municipal gas logs, bills and surveys of Town staff. Solar calculations were based on a running log kept by the town, supplemented by NYSEG data.

Stationary Combustion of Fossil Fuels: Natural Consumption in Municipal Buildings

The use of natural gas in the Town Hall and Town Barn has increased in the period between 2012 and 2016. In the Town Hall, yearly natural gas usage increased from 106 million BTUs to 144 million BTUs, a 35.8% increase. In the Town Barn, natural gas usage increased from 70 million BTUs to 170 million BTUs, an increase of 42.9%. In total, natural gas use in these municipal buildings increased by 79.0%, or a total of 139 million BTUs of natural gas used per year. A note on units: A BTU, or British Thermal Unit, measures thermal energy, and is a standard measure of natural gas usage.

2012 v. 2016 Municipal Building Fuel and Energy Consumption (million BTU)				
Building	2012 Natural Gas Energy Use	2016 Natural Gas Energy Use	2012 v. 2016 Use Difference	2012 v. 2016 Use Percent Change
Town Hall	106	144	↑38	↑35.8%
Town Barn	70	170	↑100	↑42.9%
Total Stationary Combustion Energy Use	176	315	↑139	↑79.0%

The combustion and use of natural gas results in the release of carbon dioxide into the atmosphere. The Town of Ulysses' emissions from municipal buildings have been calculated below in metric tons of CO₂ equivalent (MT CO₂E). This unit converts other greenhouse gases into the amount of CO₂ that would have the same impact on global climate change in order to standardize and measure harmful emissions. The yearly carbon dioxide equivalent emissions of these buildings have increased in the period between 2012 and 2016, corresponding with the increase in the amount of natural gas used.

2012 v. 2016 GHG Emissions from Natural Gas by Municipal Building (MT CO ₂ E)				
Building	2012 CO ₂ Emissions	2016 CO ₂ Emissions	2012 v. 2016 Emission Difference	2012 v. 2016 Emission Percent Change
Town Hall	6	8	↑2	↑33.3%
Town Barn	4	9	↑5	↑125.0%
Total Stationary Combustion Emissions	10	17	↑7	↑70.0%

Electricity Consumption in Municipal Buildings

Electricity consumption in municipal buildings in the Town of Ulysses has decreased considerably in the period between 2012 and 2016. Between 2012 and 2016, annual electricity use in the Town Hall decreased by 11,930 kWh, or 42.6%. In the same period, electricity use in the Town Barn decreased by 16,955 kWh, or 53.4%. In total, municipal buildings in the Town of Ulysses consumed 28,885 fewer kilowatt hours of electricity in 2016, compared to 2012. This was a total reduction of 49.5%. It is important to note that this consumption only includes electricity drawn from the grid and does not include the consumption of power generated by the solar panels that have been installed on municipal buildings. This shift of power consumption, from electricity provided by the New York State Electric and Gas Corporation to the consumption of electricity created by the Town's solar panels. Thus, overall energy consumption and use has not decreased by the amount show in the below table in real terms. Rather, the consumption of the grid has been reduced, and thus the greenhouse gas emissions created by energy production have been reduced to a nominal amount through the use of solar panels.

2012 v. 2016 Electrical Consumption by Municipal Building (kWh)				
Building	2012 Electrical Use	2016 Electrical Use	2012 v. 2016 Electrical Use Difference	2012 v. 2016 Electrical Use Percent Change
Town Hall	20,790	8,860	↓11,930	↓42.6%
Town Barn	36,419	19,464	↓16,955	↓53.4%
Total Electrical Consumption	57,209	28,324	↓28,885	↓49.5%

The reduction of electrical consumption in this period resulted in a reduction of greenhouse gas emissions from electricity. Between 2012 and 2016, greenhouse gas emissions from electricity use in the Town Hall decreased by 2.7 metric tons of CO₂ equivalent, or 46.8%. In the Town Barn, yearly electricity consumption was reduced by 6.5 metric tons of CO₂ equivalent between 2012 and 2016, a decrease of 53.7%. In total, electricity use in municipal buildings produced 6.5 fewer metric tons of CO₂ equivalent in 2016, compared to 2012.

2012 v. 2016 GHG Emissions from Electricity by Municipal Building (MT CO ₂ E)				
Building	2012 CO ₂ Emissions	2016 CO ₂ Emissions	2012 v. 2016 Emission Difference	2012 v. 2016 Emission Percent Change
Town Hall	4.7	2.0	↓2.7	↓46.8%
Town Barn	8.2	4.4	↓3.8	↓53.7%
Total Emissions from Electricity	12.9	6.4	↓6.5	↓49.6%

Part of the Town of Ulysses' significant reduction in the amount of greenhouse gas emissions generated in 2016 versus 2012 is the installation of an array of solar panels. In 2016, these panels produced over 20,000 kWh of electricity, the consumption of which reduces the amount of power that must be drawn from the grid in order to power the Town Hall and Town Barn.

Mobile Combustion of Fossil Fuels: Municipal Vehicle Fleet and Employee Commute Consumption

In 2012, the mobile fleet in the Town of Ulysses consisted of 14 vehicles: three of which consumed gasoline, and the rest of which consumed diesel. In 2012, the municipal vehicle fleet in the Town of Ulysses used a total of 413 million British Thermal Units (MMBtu) of energy, from 3,116 gallons of fossil fuel. By 2016, with two additional vehicles in the fleet, and some older vehicles replaced, fossil fuel use increased. In 2016, the fleet consisted of 16 vehicles, four of which consumed gasoline, and the rest of which consumed diesel. In 2016, the fleet's fossil fuel consumption increased by 47 MMBtu to 460 MMBtu. The fleet used 3,903 gallons of fossil fuel.

2012 v. 2016 Vehicle Fossil Fuel Use by Type (MMBtu)			
Year	Gasoline	Diesel	Total
2012	163	250	413
2016	190	270	460

The increase of fossil fuel use for the municipal vehicle fleet naturally led to an increase in greenhouse gas emissions from fossil fuel use in the fleet. Between 2012 and 2016, carbon dioxide emissions increased from 30 MT CO₂E to 33 MT CO₂E, a growth of 10.0%.

2012 v. 2016 GHG Emissions from Municipal Vehicle Fleet (MT CO ₂ E)			
2012 CO ₂ Emissions	2016 CO ₂ Emissions	2012 v. 2016 Emission Difference	2012 v. 2016 Emission Percent Change
30	33	↑3	↑10.0%

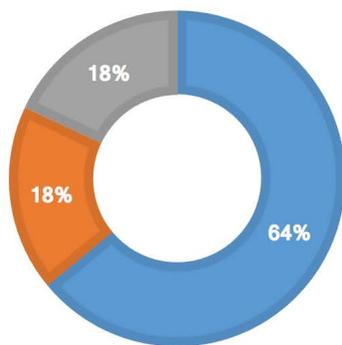
Town of Ulysses Employee Commute Modes

A survey of town employees was conducted in 2016 to assess the GHG emissions generated from commutes to and from the Town Hall and Town Barn. The average one-way commute length was 3.6 miles. This resulted in a total of 4.91 MT CO₂E of GHG emissions in 2016 from employee commutes. This data was not collected prior to 2016, so the 2016 data cannot be compared to 2012 data. However, the 2016 data can now serve as a baseline for future studies.

CO ₂ Emissions by Department (MT CO)	
Town Hall	3.12
Town Barn	1.78
Total	4.91

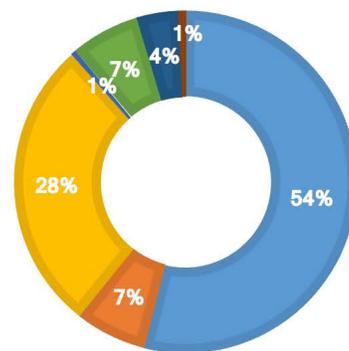
The 2016 Employee Commute Survey also collected data on how Town employees get to work every day. Most employees used single occupancy vehicles (cars, trucks, etc.), though some chose to walk or use public transportation. This suggests that employees in the Town of Ulysses rely on single occupancy vehicles slightly more for their commutes than the statewide average. This is partially because of the rural nature of the Town, which can make it more difficult for employees to walk, bike, or take public transportation to work than in more suburban or urban areas of New York.

Town of Ulysses: Mode of Employee Commute (2012)



- Single Occupancy Vehicle
- Transit
- Walk

New York State: Average Mode of Employee Commute



- Single Occupancy Vehicle
- Carpool
- Motorcycle
- Transit
- Bike
- Walk
- Work at home
- Other

New York State data is from the American Community Survey, of the U.S. Census Bureau.

Greenhouse gas emissions created by the Town might be reduced in future through changes in employee commute patterns. Despite the short commute distance of most employees, selecting modes of transit with lower, or zero, greenhouse gas emissions (such as walking, biking, using transit, or carpooling) would have a significant impact on the amount of CO₂ emissions that the Town of Ulysses produces.

Increased use of alternative fuel vehicles would lead to significant CO₂ emissions as well and are an attractive option in rural areas when biking, walking, or public transit commutes are not an option. The Town of Ulysses has already installed an electric vehicle charging station in order to make the use of electrical vehicles more attractive to employees and residents. Electric vehicles are much more efficient than those powered by gasoline, as they convert 59–62% of their stored energy to power at the wheels, while gas vehicles use only about 17%–21% of the energy stored in the gasoline that they burn. As all-electrical vehicles do not burn fossil fuels, they also do not produce the tail-pipe emissions that gas vehicles do.

2012 v. 2016 GHG Emission Source (MT CO ₂ E)					
Year	Stationary Combustion	Electricity	Mobile Combustion	Employee Commutes	Total
2012	9	13	30	N/A	52
2016	17	6	33	5	56
% Change in Emissions	↑188.8%	↓46.2%	↑10%	N/A	↑7.7%

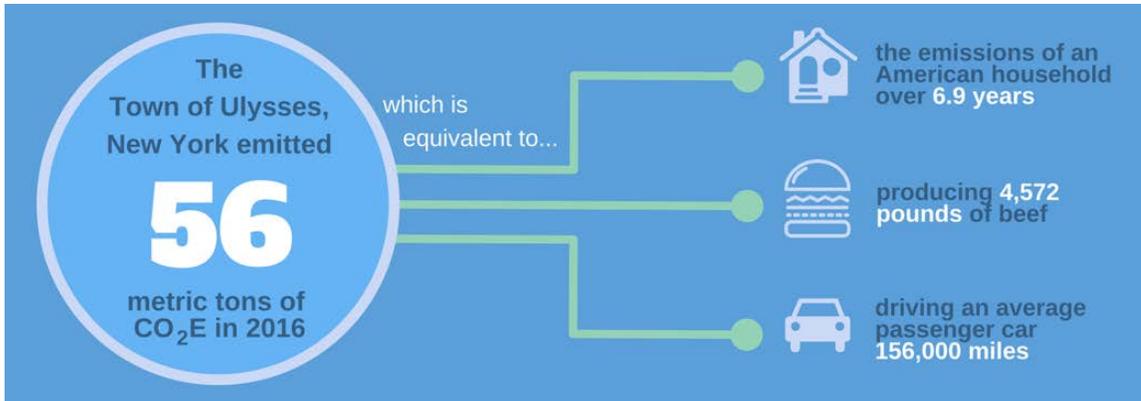
2016 Employee commutes were not calculated into total emissions, for the sake of comparison.

In total, the greenhouse gas emissions generated by municipal government in the Town of Ulysses seem to have increased by 7.7%. This number should be considered as an estimate, however, since not every source of greenhouse gas emissions involved in Town government operations was considered in this inventory, as not all of this data was available. Some of the emissions sources excluded include electric streetlights and employee commutes in 2012. Furthermore, government-based source emissions not connected to energy, such as waste, were also excluded from this analysis. It is also important to note that this inventory only estimates emissions created by Town government and does not take into account the greenhouse gas emissions generated by residents and businesses in Ulysses.

If the Town of Ulysses were to continue business-as-usual, it will emit 250 MT CO₂E and consume 3,603 MMBtu of energy by 2020. This continued growth of greenhouse gas emissions can, however, be mitigated through proactive planning and sustainable actions on the part of the Town of Ulysses and its employees.

Conclusions: Impacts and Further Action

In 2016, the Town of Ulysses created 56 metric tons of carbon dioxide equivalent. This is approximately equivalent to 156,000 miles driving in an average passenger car. That's near the average life expectancy of many gasoline cars!



The Town of Ulysses has taken a number of concrete steps to help reduce their greenhouse gas emissions since 2012. These have included shifting almost entirely to solar power in the Town Hall, beginning to switch to more efficient light fixtures on the interior and exterior of buildings, and considering more efficient vehicle options.

Further reductions in emissions could come from updates to heating and cooling systems in Town buildings, such as installing ductless air pumps and a more efficient ventilation system. Replacing or improving insulation in the Town Hall and Town Barn will reduce heat loss in the winter and improve overall energy efficiency. This would also eliminate the need for space heaters in working areas, which are very costly in terms of electricity use. Energy use from lighting can be reduced by using LED bulbs throughout Town of Ulysses facilities and installing motion sensors for all outdoor lighting and in indoor spaces that are not in constant use.

There are also a variety of energy-conscious actions that Town of Ulysses employees can take to reduce their contribution to greenhouse gas emissions. Opting for alternative modes of transportation, such as carpooling, or biking or walking in warmer months not only drastically reduces automobile emissions but can also have benefits for personal health and wellbeing. Turning off and unplugging computers and other electronics, such as microwaves, coffee makers, printers, etc. when not in use reduces electricity consumption as well, as these things consume electricity even when they are not in use.

Though waste was not taken into consideration in this inventory, smart recycling practices in the Town Hall and Town Barn can lead to significant reductions on the Town's carbon footprint. If the average American household were to divert half of its garbage to recycling, they would save 2,400

pounds of CO₂ per year. In fact, for every 10% of waste reduction, 1,200 pounds of CO₂e are avoided.

The Town of Ulysses has already begun the process of increasing its reliance on renewable energy sources, in the way of solar power. These sustainability efforts could be furthered by incorporating all-electric vehicles into the Town fleet to replace older, less efficient gas vehicles.

For Questions Regarding this Greenhouse Gas Inventory
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Sources and Further Information

United States Environmental Protection Agency: Greenhouse Gas Overview
<https://www.epa.gov/ghgemissions/overview-greenhouse-gases>

New York State Department of Environmental Conservation: Impacts of Climate Change in New York
<http://www.dec.ny.gov/energy/94702.html>

New York State Department of Environmental Conservation: Mitigation of Climate Change
<http://www.dec.ny.gov/energy/99223.html>

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<http://www.dec.ny.gov/energy/68917.html>

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<https://www.fueleconomy.gov/feg/evtech.shtml>

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<http://css.umich.edu/factsheets/carbon-footprint-factsheet>

