Town of Dryden, New York: Greenhouse Gas Emissions Inventory: A comparison of 2013 and 2018

Compiled by:
Cornell Cooperative Extension of Tompkins County
May 2019

Introduction

The comparison of 2018 greenhouse gas (GHG) emissions in The Town of Dryden, New York, from baseline year 2013, 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 guidance and assistance of the NYS Climate Smart Communities Greenhouse Gas Inventory Guide for Government Operations. This guide was developed to provide detailed guidance on procedures on how to collect the municipal energy usage and emissions data. It also advises on what specific data is needed to calculate the government operations total greenhouse gas emissions. This guide was used in conjunction with the EPA Government Operations GHG calculation tool which provides the specific requirements to calculate total emissions.

This Greenhouse Gas Inventory was prepared as a component of the Town of Dryden's participation in the Climate Smart Communities program of the New York State Department of Environmental Conservation. The inventory was prepared by Osamu Tsuda, Clean Energy Communities Specialist on behalf of the Town of Dryden and under the guidance of Terrance Carroll, Clean Energy Communities coordinator for Tompkins County. Additional assistance was provided by Alice Green from the Town of Dryden who provided the necessary data to complete this inventory.

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 through everyday

activities of all kinds which eventually lead to changing weather patterns and thus 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.

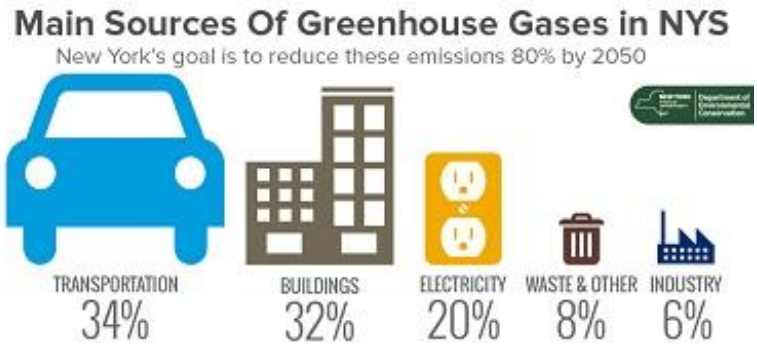

Image source: New York Department of Environmental Conservation
http://www.dec.ny.gov/images/administration_images/ghgsrcsm.jpg

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 in our everyday lives. Residential and commercial activity contributes emissions as well, mostly through heating, cooking, wastewater management, and refrigerant leaks. While greenhouse gasses are most commonly associated with urban areas, agricultural lands, which are primarily located in rural areas also emit GHGs through soil management practices which releases nitrous oxide into the atmosphere. These agricultural 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 however could be mitigated through 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. The chart below from Climate Smart Farming depicts county-specific annual temperature projections.

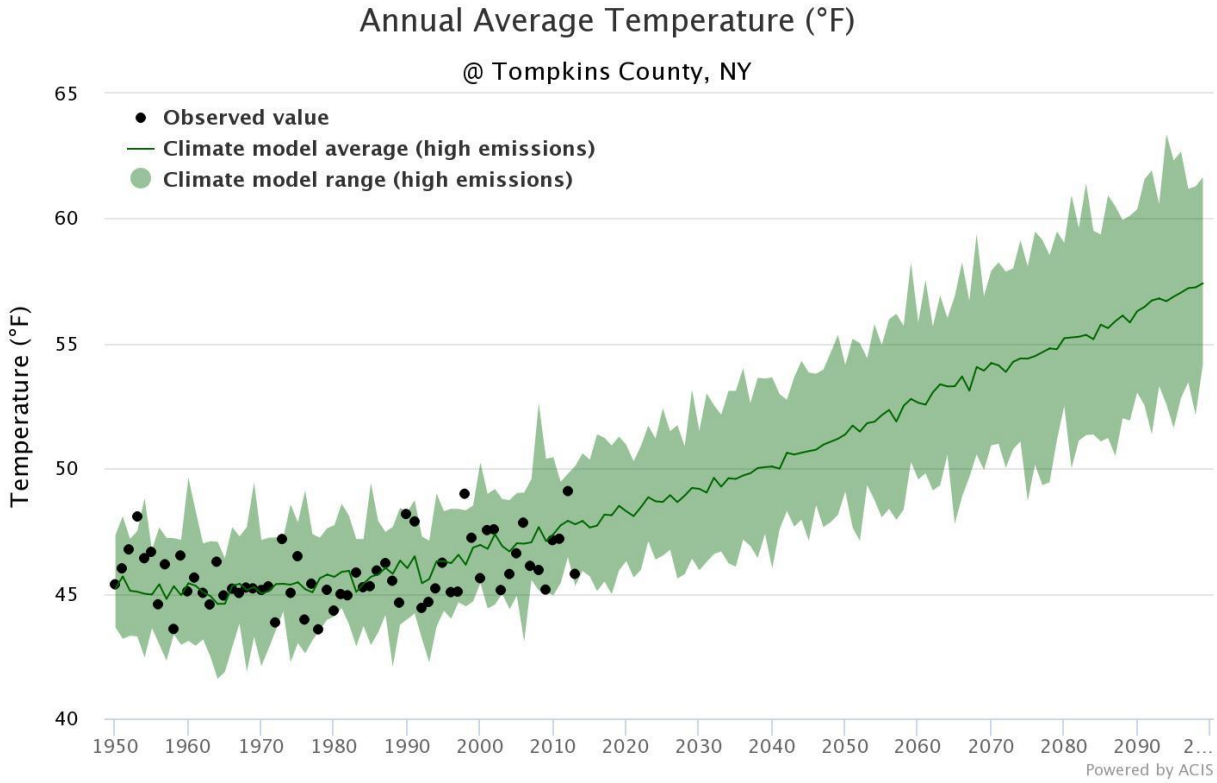

Chart 1 Temperature Projections- Cornell Climate Smart Farming

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). The chart on the following page from Climate Smart Farming depicts county-specific projections. Additionally, 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.

While coastal flooding and sea level rise is a major problem, for most of New York State, inland flooding due to extreme weather poses an even greater threat to communities. According to the DEC, a large portion of Upstate NY will experience increased precipitation. This not only includes rainfall, but snow as well, as the Finger Lakes' regional weather can be significantly influenced by the major lakes (i.e. Lake Ontario). As a result of this increased precipitation, runoff will continue to increase, which

will not only lead to flooding, but potential contamination of existing waterbodies. According to the US EPA, runoff is a major factor to the contamination of large waterbodies, eventually leading to algal bloom, which is a green-colored cyanobacteria that creates a toxic environment to aquatic organisms as well as humans, thus posing a threat to the entire community. This phenomenon is a major issue throughout fresh-water waterbodies in New York State and many findings have shown that while there are many factors that lead to increased algal bloom, increased runoffs which contain contaminants and fertilizers from developed lands and surfaces have significantly contributed to this problem. While this might seem like an indirect link to climate change, it is important to make the connection that all of this can be linked back to greenhouse gas emissions.

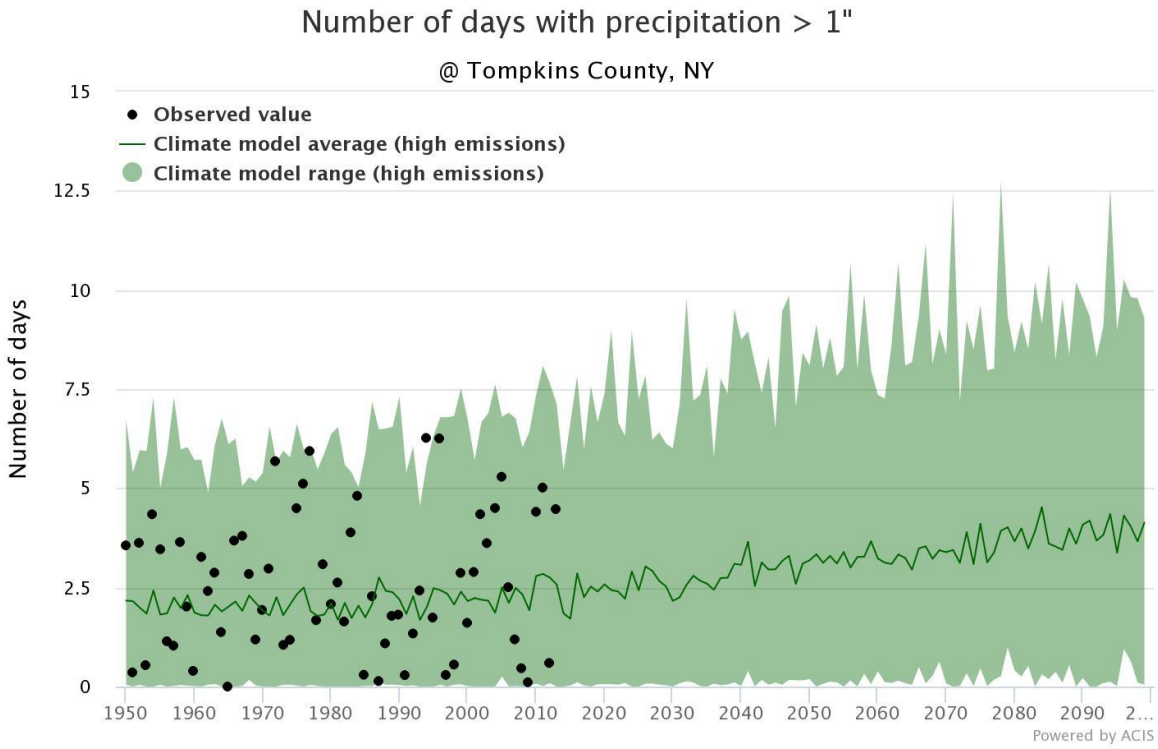

Chart 2Extreme Weather Projections - Cornell Climate Smart Farming

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 emission are affecting our region in order to create strategies to reduce future greenhouse gas emissions and most importantly, protecting ourselves from the changing climate. Modeling 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 Dryden, 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 Dryden 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 consumption logs and the town vehicle inventory. And finally, all other information such as commute survey and water pump information were provided by the town office and department of public works (DPW).

In terms of the categories used for this inventory, the Town Hall is specific to the town hall's energy consumption, HWY/DPW specifically refers to the office, municipal garage, and vehicles, all of which are shared by the highway and department of public works. The Highway department category specifically refers to a radio tower specifically dedicated to highway activities located on Beam Hill, as well as street light energy consumption. As for DPW, the energy consumption specifically refers to the water and wastewater pumps located throughout the municipality. While the data could have been broken down in further detailed categories, due to the data's inconsistency from NYSEG and the combined energy usage between the highway department and DPW, breaking down the data according to specific locations would have created inaccurate representations of existing departmental energy usage.

Stationary Combustion of Fossil Fuels: Natural Consumption in Municipal Buildings

The use of natural gas in municipal facilities has slightly increased in the period between 2013 and 2018. In the town DPW and Highway office and garage, yearly natural gas usage increased from 982 million BTUs to 1005 million BTUs, an approximately 2% increase. As for the gas usage for water pumps, the consumption rose from 9 to 11 million BTUs between 2013 and 2018, around a 22 % increase in consumption. In total, natural gas use in these municipal facilities increased by a modest 2.5%, or a total of 25 million BTUs of natural gas. As for the town hall, because the building is solely operated on geothermal and solar energy, the building does not use any fossil fuels for heating and other operations. In terms of energy consumption for the beam hill road facility, the structure is a wireless communication tower which only consumes electricity (283 Beam Hill Road). A note on units: A BTU, or British Thermal Unit, measures thermal energy, and is a standard measure of natural gas usage.

2013 v. 2018 Municipal Building Fuel and Energy Consumption (million BTU)				
Building	2013 Natural Gas Energy Use	2018 Natural Gas Energy Use	2013 v. 2018 Use Difference	2013 v. 2018 Use Percent Change
Town Hall	0	0	0	0%
Main Highway/ DPW	982	1005	23	2.3%
Highway Dept. Tower	0	0	0	0%
DPW	9	11	2	22%
Total Stationary Combustion Energy Use	**991**	**1016**	**↑25**	↑2.5**%**

The combustion and use of natural gas results in the release of carbon dioxide into the atmosphere. The Town of Dryden's emissions from municipal buildings have been calculated below in metric tons of CO_2 equivalent (MT CO_2E). 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 2013 and 2018, corresponding with the increase in the amount of natural gas used.

2013 v. 2018 GHG Emissions from Natural Gas by Municipal Building (MT CO_2E)				
Building	2013 CO_2 Emissions	2018 CO_2 Emissions	2013 v. 2018 Emission Difference	2013 v. 2018 Emission Percent Change
Town Hall	0	13	0	0%
Main Highway/ DPW	52	53	1	1.9%
Highway Dept. Tower	0	0	0	0%
DPW	<1	1	<1	21%
Total Stationary Combustion Emissions	**53**	**54**	**↑2**	**↑1.9%**

In general, as there is an overall increase in consumption of natural gas, it is important to note that the winter of 2018 was significantly colder than 2013. For example, in 2013 between January and May, the average temperature was approximately 37 F whereas in 2018 the temperature was approximately 35 F. While this might not sound too significant, these lower temperatures likely contributed to the increase in fuel consumption.

Electricity Consumption in Municipal Buildings

Overall electricity consumption in municipal buildings in the Town of Dryden has decreased between the period between 2013 and 2018. Between 2013 and 2018, while annual electricity uses in the Highway Department (Street Lights and Radio Tower) increased by 23,400 kWh, or 35.3%, the rest of the municipal facilities have managed to decrease energy use. In the same period, electricity uses in the Town Hall decreased by 27,840 kWh or 18.4% , HWY/DPW buildings by 5,555 kWh or 17%, and DPW (water/ wastewater pumps) by 20,016 kWh or 18.8%. In total, municipal buildings in the Town of Dryden consumed 30,011 fewer kilowatt hours of electricity in 2018, compared to 2013. This was a total reduction of 8.4%.

2013 v. 2018 Electrical Consumption by Municipal Building (kWh)				
Building	2013 Electrical Use	2018 Electrical Use	2013 v. 2018 Electrical Use Difference	2013 v. 2018 Electrical Use Percent Change
Town Hall	151,600	123,760	-27,840	-18.4%
HWY/DPW	32,742	27,187	-5,555	-17.0%
Highway	66,342	89,742	23,400	35.3%
DPW	106,156	86,140	-20,016	-18.8%
Total Electrical Consumption	**356,840**	**326,829**	**↓30,011**	**↓8.4%**

The reduction of electrical consumption in this period resulted in a reduction of greenhouse gas emissions from electricity. Between 2013 and 2018, greenhouse gas

emissions from electricity use in the Town Hall decreased by 10.13 metric tons of CO_2 equivalent, or 37.9%. As for the HWY/DPW buildings, yearly electricity consumption was reduced by 2.13 metric tons of CO_2 equivalent between 2013 and 2018, a decrease of 36.9%. Similarly for Public Works (DPW) a decrease of 7.2 metric tons or 40.5%. As noted above, the only department that increased energy consumption was the Highway department (streetlights and radio tower) which increased Co2E emissions by 0.34 metric tons, or a modest 2.9%. In total, electricity uses in municipal buildings produced 30.3% less, or 19.1 fewer metric tons of CO_2 equivalent in 2018, compared to 2013.

2013 v. 2018 GHG Emissions from Electricity by Municipal Building (MT CO_2E)				
Building	2013 CO_2 Emissions	2018 CO_2 Emissions	2013 v. 2018 Emission Difference	2013 v. 2018 Emission Percent Change
Town Hall	26.75	16.62	-10.13	-37.9%
HWY/DPW	5.78	3.65	-2.13	-36.9%
Highway	11.71	12.05	0.34	2.9%
DPW	18.73	11.57	-7.2	-40.5%
Total Electrical Consumption	**62.97**	**43.89**	**↓19.1**	**↓30.3%**

While there is no single answer to the significant decrease in overall electricity consumption between 2013 and 2018, one potential answer might be the installation of LED lights. While LED lighting upgrades have been occurring over a period of time, there were significantly more in 2018 compared to 2013. Other factors to consider are overall technological upgrades between 2013 and 2018. While the change might be insignificant, the cumulative effect could have a larger impact on the electricity consumption.

Mobile Combustion of Fossil Fuels: Municipal Vehicle Fleet Consumption

As of 2018, the mobile fleet in the Town of Dryden consists of 39 vehicles: 18 of which consume diesel, and the rest of which consume gasoline. In 2013, the municipal vehicle fleet in the Town of Dryden used a total of 8219 million British Thermal Units (MMBtu) of energy, from 60,820 gallons of fossil fuel. By 2018, with the addition of new vehicles, fossil fuel use increased by approximately 15%. In 2018, the fleet's fossil fuel consumption increased by 1,246 MMBtu to 9,465 MMbtu. The fleet used 69,809 gallons of fossil fuel.

2013 v. 2018 Vehicle Fossil Fuel Use by Type (MMBtu)			
Year	Gasoline	Diesel	**Total**
2013	924	7295	8219
2018	1676	7788	9465

The increase in fleet size naturally led to an increase in greenhouse gas emissions from fossil fuel use in the fleet. Between 2013 and 2018, carbon dioxide emissions increased by 90 MT CO_2E, from 604 MT CO_2E to 694 MT CO_2E, a 14.9% overall increase in emissions.

2013 v. 2018 GHG Emissions from Municipal Vehicle Fleet (MT CO_2E)			
2013 CO_2 Emissions	2018 CO_2 Emissions	2013 v. 2018 Emission Difference	2013 v. 2018 Emission Percent Change
604	694	↑90	↑14.9%

Town of Dryden Employee Commute

As the town of Dryden does not keep record of employee commute modes and distances, a survey was independently conducted among employees to get a better sense of how the employees contribute to greenhouse gas emissions. While in general employee commutes are not the most significant factor to consider in government operations, over time the effects can add up and cause a significant increase or decrease depending on the employee's behavior and mode of transit. While there is no previous year's data to compare the survey to, this data can be used to better understand and assess the behavior of the municipal staff and create incentives to reduce the overall carbon footprint of the employees. Additionally, this data can be used as a baseline to cross compare future surveys to understand how the employees commute behavior has changed over time.

As for the survey itself, the basic goal was to better understand the employee's commute characteristics, such as their travel mode and distance. While the survey results were meant to be an accurate representation of all employees, the results are ultimately a representation of only those that participated. The final number of respondents are 19 people, or approximately 60% of all municipal employees.

Per the results, over 90% of the respondents stated that they drive their personal vehicle to work, a total average distance of 10 miles a day. Based on the assumption that the employees work approximately 240 days a year (a five-day work week including vacation), the total emissions from the employee commute is 30 metric tons of CO2e per year, or 3,376 gallons of gasoline burned in one year.

2018 Employee Commute Survey Results			
Percentage that drives their own car to work	Average daily commute distance (miles)	Metric Tons of CO2e	Gallons of gasoline consumed
95%	10.2	29.89	3,376

Town Wastewater and Solid Waste Operations

While the Village of Dryden has its own sewage and wastewater treatment plant, the township contracts with the City of Ithaca and exports its wastewater to the Ithaca Area Wastewater Treatment Facility (IAWWTF). In addition to treating the Town of Dryden's Wastewater, the IAWWTF also treats wastewater from the Town of Ithaca, City of Ithaca, overflow from the Village of Cayuga Heights, and trucked waste from numerous locations including the Cornell University College of Veterinary Medicine. Because the treatment facility is not located within the Town of Dryden and is not operated by the municipality, the emissions from this source will not be included in accordance with the guidelines stated on page 11 of the Climate Smart Communities GHG Inventory Guide of Local Government Operations.

In addition to wastewater, the Town of Dryden contracts with an external waste disposal service and does not have any municipal landfills within the township. Per the same guidelines stated on page 11 in the Climate Smart Communities GHG Inventory Guide for Local Government Operations, emissions around solid waste disposal will be excluded in this inventory.

Summary: GHG Emissions in the Town of Dryden, New York

2013 v. 2018 GHG Emission Source (MT CO_2E)				
Year	Stationary Combustion	Electricity	Mobile Combustion	**Total**
2013	52.54	62.97	604.26	741.59
2018	53.86	43.89	693.58	821.16
% Change in Emissions	**↑2.5%**	**↓30.3%**	**↑14.7%**	**↑10.7%**

In total, the greenhouse gas emissions generated by municipal government in the Town of Dryden seem to have increased by 10.7%. This number should be considered as an estimate (but capturing at least 95% of the town's GHG emissions) since it can be very difficult to capture every source of greenhouse gas emission involved in local government operations. Additionally, it is important to remember that waste disposal and treatment are also factors that are not considered in this inventory, solely because the disposal and treatment facility is not located within the township. And finally, it is important to note that this inventory only estimates emissions created by the town government and does not take into account the greenhouse gas emissions generated by residents and businesses located within the township.

As Dryden is currently on track to implement sustainability measures such as installing new energy efficient technology in municipal buildings and opening new EV charging stations, this will cut the overall MT CO_2E. By the town being proactive and slowly implementing additional sustainability measures over time, the municipality will continue to see an overall decline in overall emissions, not just for municipal operations, but also for the entire community.

Conclusions: Impacts and Further Action

In 2018, the Town of Dryden created 821.16 metric tons of carbon dioxide equivalent. This is approximately equivalent to driving 174 average passenger cars for an entire year. Alternatively, it is 174 average fuel consuming vehicles that travel 11,539 miles each.

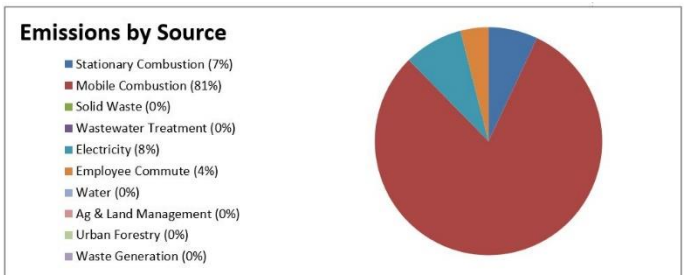

Figure 1 2013 Emissions

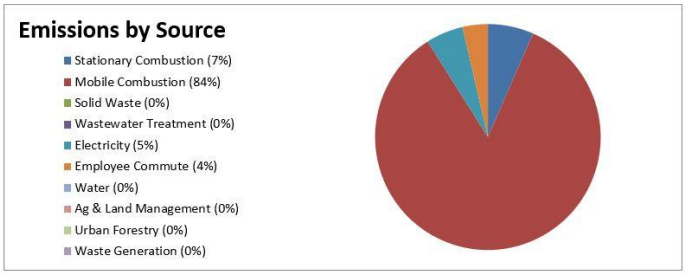

Figure 2 2018 Emissions

The Town of Dryden has taken several concrete steps to help reduce their greenhouse gas emissions. These actions have included installing a geothermal heating system within the town hall, solar on two municipal buildings, upgrading the existing fleet to more fuel efficient vehicles as well as upgrading internal and external lighting to LEDs.

Further reductions in emissions could come from upgrades to heating and cooling systems throughout all municipal buildings, such as installing air source heat pumps or geothermal in the Highway and DPW office. Another action that could significantly reduce overall emissions is upgrading the existing fleet to electric and or hybrid vehicles, which could cut the mobile emissions by at least half. As depicted in the above pie graph, the vehicle emissions accounts for over 80% of the municipal operational emissions, and any reduction in fleet emissions would drastically decrease overall GHG emissions. Because the town has developed a fleet inventory, that information could be used as a baseline to assess how the town can move forward to make their fleet more efficient over time. While there are many ways to reduce energy consumption/ emissions, one other significant action the town could take is to change building operation hours to reduce overall energy usage. While most buildings are open during the day to take advantage of the natural light, there are times when the buildings can change operations according to the season to better utilize the sunlight and warmer weather.

There are also a variety of energy-conscious actions that municipal 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 solid waste was not taken into consideration in this inventory, smart recycling practices throughout the town can drastically reduce the overall carbon footprint. If the average American household were to divert half of its garbage to recycling, they would save 2,400 pounds of CO_2 per year. In fact, for every 10% of waste reduction, 1,200 pounds of CO_2e are avoided.

In terms of wastewater, which is also excluded in this inventory, while the town does not have its own sewage treatment plant, considering how to reduce municipal wastewater can be another significant factor which decreases the overall emissions. Fortunately, the Town of Dryden has been able to install low-water consuming fixtures throughout the town hall. And while this is only one building out of many, this can be a good steppingstone to promote water efficiency fixtures throughout the township.

As mentioned above, the Town of Dryden has already begun the process of increasing its use of renewable and energy-efficient technology such as geothermal heating, solar panels, and internal/ external LED lights. Further actions such as expanding solar technology use throughout all municipal buildings and replacing the current fleet with all electric or hybrid vehicles are just some of the efforts that the town can implement and see a major decrease in overall greenhouse gas emissions in government operations.

For Questions Regarding this Greenhouse Gas Inventory

Please Contact:
Dryden Town Office
93 East Main Street,
Dryden, NY 13053
(607) 844-8888
DeputyClerk@dryden.ny.us

Terrance Carroll (tc629@cornell.edu) OR Osamu Tsuda (ojt3@cornell.edu)
Cornell Cooperative Extension of Tompkins County

Sources and Further Information

Energy Star: LED Lighting and Energy Savings
https://www.energystar.gov/homepage?s=footer

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

New York State Department of Environmental Conservation: Observed and Projected Climate Change in New York State
https://www.dec.ny.gov/docs/administration_pdf/climbkgncrra.pdf

New York State Department of Environmental Conservation: Climate Change and Health
http://www.dec.ny.gov/energy/68917.html

U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
https://www.fueleconomy.gov/feg/evtech.shtml

US Environmental Protection Agency: Harmful Algal Blooms
https://www.epa.gov/nutrientpollution/harmful-algal-blooms

University of Michigan Center for Sustainable Systems
http://css.umich.edu/factsheets/carbon-footprint-factsheet