Prepared by the ***Potsdam Climate Smart Communities Task Force***

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Town of Potsdam

Municipal Operations GHG Inventory

2018 – 2020

Contents

Introduction

On July 11, 2017 the Town of Potsdam passed a resolution recognizing the imminent threat from our changing climate and resolved to better understand and mitigate the Town's contributions to greenhouse gas (GHG) emissions. This resolution was the Town's first step to register as a NYSDEC Climate Smart Community (CSC). The CSC program provides a set of elements to help local governments take action to reduce greenhouse gas emissions and adapt to a changing climate. The Town has also passed a resolution committing to Benchmarking of their three buildings as an action item for the NYSERDA Clean Energy Communities (CEC) program. Benchmarking is the tracking of energy use of a building as a function of time to better understand how energy is used to identify opportunities for improved efficiencies. Reducing energy use saves money and reduces Greenhouse Gas (GHG) emissions. The Town has completed some action items toward earning CEC designation. Becoming a certified CSC would be the Town's 4th action item; along with 1) Benchmarking, 2) LED street light conversion (yet to be submitted), and 3) passing a Unified Solar Permit. Energy Code Enforcement Training for a number of town officials would be needed to earn points in the new CEC program to count as a current action item. A new point system is used to determine grant funding. After completing 4 High Impact Action Items additional funds can be awarded to help a community complete more projects to move toward CEC designation. Details about the CSC program are available at https://climatesmart.ny.gov/, and details about the CEC program can be found at https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/How-It-Works.

The twelve-point pledge elements (PE) defined by the CSC program include requirements to complete an inventory of GHG emissions associated with municipal operations and the community at large. GHG inventories help us understand activities that contribute most to our GHG emissions and provides a basis for developing a climate action plan (CAP). There are four components in ***PE2: Inventory emissions, set goals, and plan for climate action***

- **Government Operations GHG Inventory**
- Community GHG Inventory
- Government Operations Climate Action Plan
- Community Action plan

This report represents the first of these, the Government Operations GHG Inventory. Completing this inventory will increase our eligibility for state funding for actions to support our CSC activities. The inventory is also a foundational step toward effective action. GHG inventories provide the data needed to set realistic goals and track progress toward reducing operating costs, energy use, and emissions.[1] Completing an inventory requires that the municipal activities generating GHG emissions be identified, their annual quantities be determined from municipal records and their overall contribution to GHGs be quantified. The inventory presented here uses standard GHG inventory protocols.

GHG emissions included in an inventory are defined as:

- Scope 1: Direct emissions from municipal activities (e.g., combustion of natural gas (NG) for building heating, combustion of diesel and gasoline in village-owned vehicles, emissions from the wastewater treatment plant)

[1] NYSDEC CSC website PE2: Government Operations GHG Inventory https://climatesmart.ny.gov/actions-certification/actions/#open/action/6 (accessed 12/6/20)

- Scope 2: Indirect emissions associated with the purchase of electricity for use by village activities but generated elsewhere
- Scope 3: Indirect emissions associated with the materials we purchase and associated travel (e.g., commuting)

The town operates a small wastewater package plant that also results in Scope 1 emissions. Data are not available to quantify these fugitive emissions. They will be addressed when prioritizing possible next steps for the town. For convenience to the reader, this report first identifies activities within the Town that generate GHG emissions and then presents results of the assessment. Details of the data sources and GHG emission methodology are integrated into a set of appendices for completeness.

Town Government Activities Contributing to GHG Emissions

The Town of Potsdam owns and operates three buildings: the town hall, town court, and town garage (Figure 1). The Town also has some street lighting, a small water treatment plant, and a small package plant for wastewater. The primary activities included in this assessment consume electricity, natural gas and transportation fuels used in the following activities:

- The Town Hall building at 18 Elm Street includes municipal offices, a meeting room, and a commercial kitchen. Both the meeting room and kitchen are available for use by the community.
- The Highway Superintendent works out of the garage at 19 Madrid Ave with electric and natural gas accounts. The Highway Department also buys diesel and gasoline fuel in bulk. All town maintenance and fleet vehicles fill their fuel tanks from these storage tanks.
- The Town Court is at 35 Market Street. Usage of this building went up when the village eliminated their separate village court. This and the renovation of the building occurred before 2018.
- There is electric use at the small water pump house and wastewater plant serving just a small part of the town in the community of Unionville.

There is some electricity consumption by street lighting that is provided by the town. These were converted to LED luminaries in Oct '20.

Emissions from these facilities and activities for calendar years 2018 through 2020 are included in this report. The 2018 data are used as a baseline to assess current and future energy reduction activities.

Appendix A includes a detailed list of these activities and the associated electricity and natural gas account numbers. Natural Gas was purchased and delivered by Enbridge/St. Lawrence Gas until that business was purchased by Liberty Utilities in 2019. The

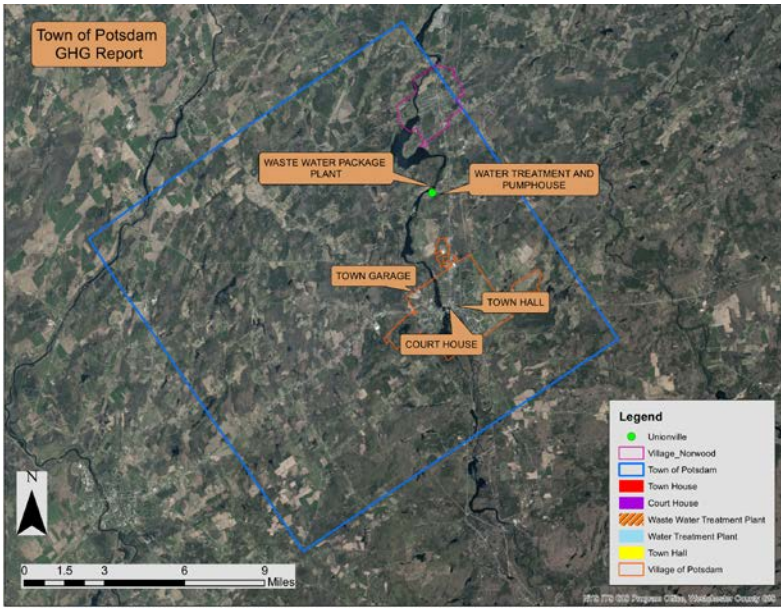


Figure 1. Primary Village of Potsdam Municipal facilities
(map prepared by Ben Goodrich, Clarkson University Civil Engrg student BS CE'22)

account numbers did not change in this transaction. Electricity is purchased from National Grid. For the purposes of this inventory, the electricity generation and associated emissions are estimated by the NY Upstate (NYUP) sub-grid region, which includes all generation resources in the state north of ~Westchester County NY. The use of the regional electricity emissions is a standard practice for GHG inventories.

The NYUP region boasts the lowest average GHG emissions for electricity generation in the entire United States. This region includes a lot of hydropower (34.6%) and nuclear power (31.3%) generation with no GHG emissions (Figure 2). In contrast, the US as a whole generates a majority (63%) of its electricity from fossil fuels. The net result is that electricity generation in the NYUP region results in only 0.115 kg CO_2/kWh generated), which is 73% less than the national average of 0.430 kg/kWh).

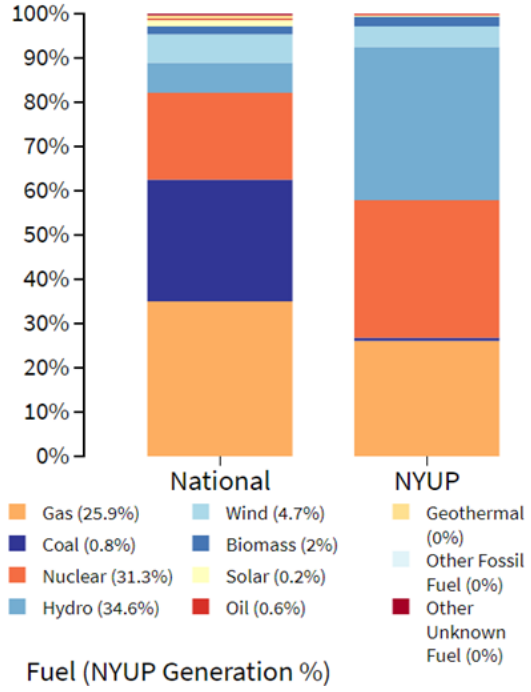


Figure 2. Energy resources used to generate electricity in the NYUP region compared to the national average
https://www.epa.gov/egrid/power-profiler#/NYUP

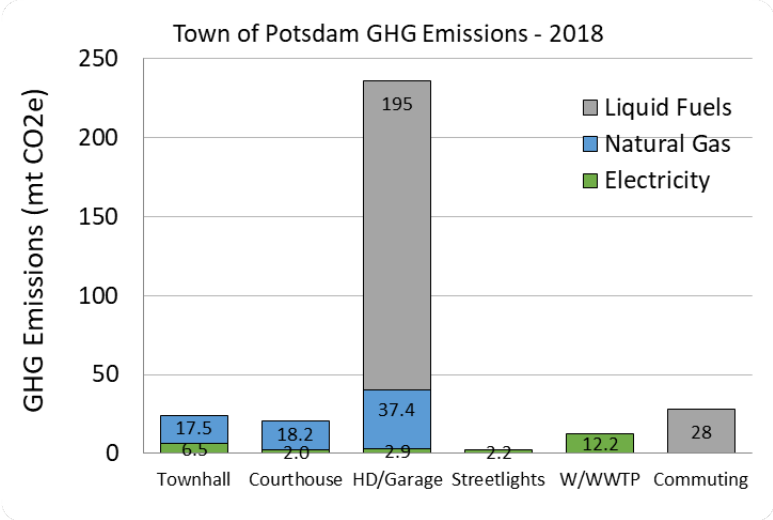
Results

Overview - Baseline GHG Emissions

Greenhouse gas emissions for 2018 were used as a baseline to track the efficacy of future efforts to reduce energy use and GHG emissions. The results are broken into results by the type of emission source (e.g., electricity, natural gas) and type of activity. Figure 3 presents the overall results for the Town of Potsdam municipal GHG emissions. The total emissions are estimated to be 323 metric tons carbon dioxide equivalents (mt CO_2e). The carbon dioxide equivalents are used in GHG inventories to sum contributions from a variety of different greenhouse gases. Carbon dioxide is the primary GHG associated with the Town's operations since so much of the emissions stem from the combustion of fossil fuels. Values for all GHG emissions and all activities are included in Appendix B.

The Highway Department (HD), not surprisingly for a town in the largest NY county in northern NY, is responsible for 73% of the town's GHG emissions with gas and diesel accounting for 83% of the HD footprint. This can be put in perspective realizing that the superintendent has a crew of 12 that maintains 122 miles of roadways with responsibilities that include snow removal and ice control, paving and other maintenance including signage, drainage, and cutting and removal of brush along the right of way.

a)



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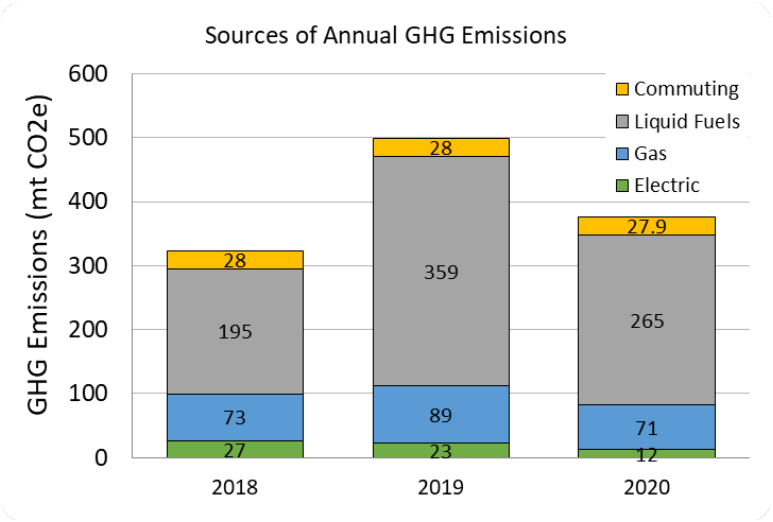

Figure 3. Summary of estimated 2018 GHG emissions for the Town of Potsdam municipal operations: a) breakdown by activity and source and b) breakdown by source across the three years.

Additional general observations can be made about these results (with additional details included in later sections):

- Adding the contribution from the employees' commute makes liquid fuels responsible for a whopping 69% of the Town's total GHG emissions. Both absolute quantity and percentage of total goes up for both 2019 and 2020.
- Natural gas for heating across all facilities contributes the second most to the Town's municipal GHG emissions (22%)
    - HD building: 51% (of emissions from natural gas use)
    - Courthouse: 25%
    - Town hall: 24%

- Electricity use contributes about 8% of the Town's GHG emissions for 2018. Street lighting is listed last as a conversion to LED luminaires was completed Oct '20 and this is now the lowest contributor with no future action contemplated.
    - W/WWTP 43% (of emissions from electricity use)
    - Town hall 25%
    - Garage 11%
    - Courthouse 7.7%
    - Street lighting 8.5%

Fugitive emissions of methane (CH4) and nitrous oxide (N2O) from the wastewater treatment processes could be a significant factor, but is difficult to quantify. The package plant, rated for 50,000 gal/d, is permitted for 42,000 gal/d, and actually treats on average 10,000 gal/d. Only BOD5 is measured (120 mg/L); not COD nor N load. A review of literature, especially a detailed study of different types of treatment facilities in China[2], indicates that both nitrous oxide primarily from the aerobic treatment tank and methane primarily from the landfilled sludge, would both make a greater GHG contribution than the electricity to run the plant. Since the NYUP electricity is greener than most, balanced by the longer retention time for a low load system (which reduces N2O), it is safe to say this contribution is somewhere between the GHG contribution from electricity and that from the natural gas used for space heating. Without more data available, this topic will be left until a brief mention under "Next Steps".

Details: Electricity Use

Electricity use data for all of the meters paid by the Town were documented from 2018 through 2020. Data were obtained from direct downloads from the National Grid portal and review of monthly bills paid by the Town. Figure 4 illustrates that the Town municipal operations consume approximately 196 MWh electric energy in 2018 and closing in on 200 MWh for 2020 (COVID 19 effect?). Additional meter level data are included in Appendix C for 2019 and 2020. The largest user is the wastewater treatment package plant at fairly steady annual usage of almost 93 MWh per year growing to almost 98 MWh for 2020. The decrease in electricity use at the garage is largely due to an LED lighting conversion completed in Oct 2018. The courthouse shows a slight decrease. The Unionville Pump house account shows a significant decrease of almost 18% from 2018 to 2019 that continued to decrease for 2020.

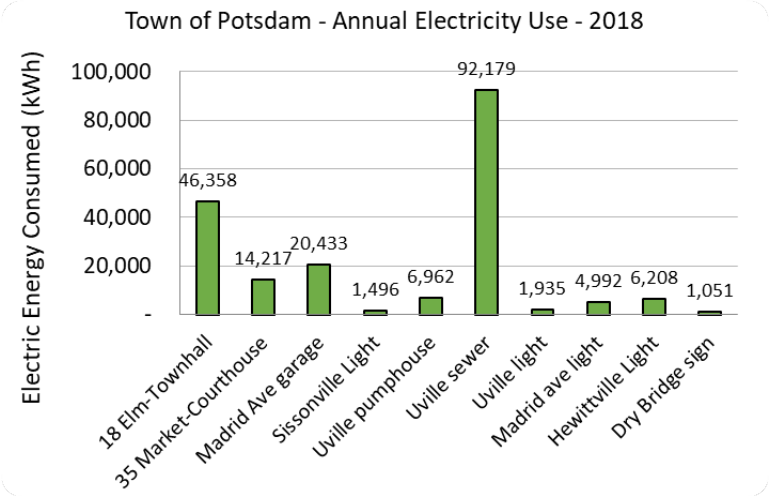

Figure 4. Electricity use associated with Town operations.

For all electricity use, the overall emission factor for the NYUP sub grid was used as a direct multiplier from these electric energy consumption values to GHG emissions (0.115 mt CO2e/MWh generated) with acknowledgement of the 4.88% loss of electric energy through the transmission from generator to user.

$$GHG\ Emissions\ \frac{mt\ CO2e}{year} = Elec\ Energy\ \frac{MWh\ delivered}{year}\ x\ 0.115\ \frac{mt\ CO2e}{MWh\ generated}\ x\ \frac{1}{(1-0.0488)}\ \frac{MWh\ generated}{MWh\ delivered}$$

Overall, 4 of the Town's 10 electric meters contribute almost 90% of the total electricity consumption (and therefor same percentages for GHG emissions):

WWTP	43-49%	Acct # 48676-08100
Town hall	25-26.5%	21240-47009
Madrid Ave Garage.	11-8.8%	73037-95107
Town Court	7.7-6.3%	97102-07103

Among the various electric meters associated with the Town operations, the largest users pay both for the electric energy consumed as well as a demand charge (and a whole bunch of fees). Demand charges are based on the highest power consumption (kW) in any one 15 minute period during the billing period. The wastewater treatment plant, Town hall and the town garage have demand meters due to their use of electricity that exceeds 2,000 kWh for at least one month out of the previous year. The WWTP and Town hall both substantially exceed this limit so will stay as demand meters. The garage on the other hand has high variability through the season, and assumed through the day. Even with recent electricity efficiency measures, they still have three months in the winter that are just over the 2,000 kWh/mo limit (up to 2,240 kWh/mo). The usage would need to drop below 2,000 kWh for 12 consecutive months to switch to a non-demand account. To illustrate the significance of how a load is metered, consider the last bill included for 2020 with stated usage of 1553 kWh for a 31-day period with a peak demand of 10.3 kW. The overall bill was $248, including $136 as the demand charge. The effective price per kWh for a non-demand account for this same period was $0.143/kWh. If the garage was behind a non-demand meter the bill would have been around $222. Maybe this 10% savings isn't large enough to raise this to a higher priority, but should be revisited if the town considers a solar PV installation at the garage because the value of the solar electricity generated will depend on how it is metered. The building use pattern should also be revisited to again check if any resistive space heaters are being used, or any other avenues for reductions can be found. In any case, energy efficiency measures and operational changes can reduce both the energy use and demand charges.

Details: Natural Gas Use

Each of the town buildings has a natural gas meter. This fuel is used for space heating and domestic hot water. The largest user is the garage (built 1935), which uses as much natural gas as the other two buildings combined (Figure 5). This should come as no surprise considering the building is mainly for parking the large trucks/snow plows with the corresponding bay doors. The seasonal variations of all these buildings is known from a prior benchmarked effort using EPA Portfolio Manager. Improvements to the building envelope have been made over this period, as well as installation of radiative gas heaters, so the reduction from 4.9 to 3.4 $kgCO_2e/ft^2$ from 2018 to 2020 is thought to be sustainable and not just due to weather variations between heating seasons. The Energy Use index (EUI) for this building compares favorably to other similar use buildings in the EPA Portfolio manager database.

The next largest consumer is the town hall. This is a relatively energy efficient building built in 2012. The trend has been for greater energy use by this building over the last few years, possibly associated with greater use. This is not clear as use patterns have surely been disrupted by the pandemic. The building still has a GHG footprint in 2020 at 3.3 $kgCO_2e/ft^2$ with a greater percentage due to an electric air conditioning load in the summer.

The courthouse, built in 1924, was recently renovated. It barely has the lowest GHG footprint of the three buildings, but also shows an increasing trend with the 2020 value of 2.9 $kgCO_2e/ft^2$, almost completely from the natural gas use. This is consistent with a building lightly used, but still needing to be heated in the winter.

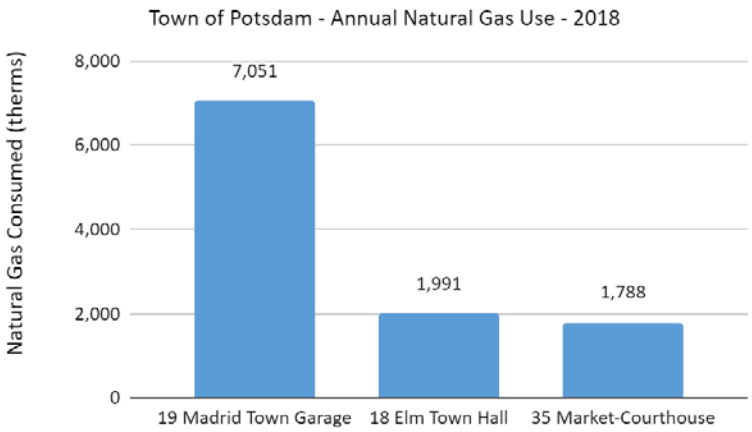

Figure 5: Natural gas use in 2018 baseline year

Details: Gasoline and Diesel Fuel Use

The Highway Department (HD) maintains large storage tanks for gasoline and diesel fuel for refueling of all town-owned vehicles. The great variability between years, especially with the diesel, could just be the timing of large bulk purchases around the change in year.

Just as liquid fuels dominate the town's overall GHG emissions, diesel dominates gasoline as the main contributor both because of its greater volume (almost 80% or total gallons of fuel) and the greater emission factor for diesel fuel (0.0102 metric tons CO2e/gallon) than gasoline (0.00878 metric tons CO2e/gallon). This results in the diesel fuel use contributing 67% of the total Town GHG emissions on average for the three years.

Details: Commuting emissions

A survey of commuting habits among town employees was conducted in 2020 and assumed to represent other years. Employees were asked to identify the length of their daily commute, typical fuel economy for their type of vehicle (e.g., 25-30 MPG (e.g., Subaru Legacy/Outback, Ford Focus FWD)), and comment on their commuting habits. It was assumed that all employees work 47 weeks per year (235 workdays per year). 28 employees responded to the survey. The extremes are a 50 mile round trip commute and a single employee that does not drive to work. The other 12 employees at the garage all drive low fuel economy vehicles.

Results show an average consumption of 145 gallons of gasoline for yearly commuting, leading to a total of 3,182 gallons. The average fuel economy (20.5 MPG) is lower than the national average, but consistent with those 12 individuals driving trucks, or the equivalent, to the garage. The average daily commute was 10.1 miles round trip.

Next Steps

This initial report is identifies the energy use and emissions for operations within the Town of Potsdam. It clearly defines the primary activities that lead to GHG emissions and can be used to identify additional studies to further identify the specific equipment, building structure issues or operations that cause high energy use within specific buildings and activities. This identification and prioritization of additional data collection will allow the town to make informed decisions that can save money and reduce GHG.

Examples of further exploration include:

- Review of the source of electricity supply and consideration of purchasing a higher percentage that is renewable electricity.
- Heat loss analysis and evaluation of additional building envelop improvements at the Town HD building.
- Identifying where a switch from natural gas to electric heat pumps for space heating might be beneficial.
- Evaluation of current practices and potential new policies for engine idling to heat the cabs of trucks; for example, can idling minimized by storing them in the garage?
- Potential replacement of the bucket truck, which is assumed to require the diesel engine to lift, with one that has a rechargeable battery to operate the bucket.
- Development of a vehicle replacement policy that emphasizes fuel economy and a transition, where appropriate, to electric vehicles (EVs).
- Installation of EV charging stations for employees, fleet vehicles and visitors.
- Energy efficiency and fugitive emissions analysis and improvements at the WWTP.