Greenhouse Gas Emissions Inventory of the Village of Baldwinsville

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Local Government Greenhouse Gas Inventory Module created under the Clean Energy Program

Executive Summary

Greenhouse gases are gases such as methane, carbon dioxide, nitrous oxide that amplify the earth's natural 'greenhouse' effect and contribute to global climate change. Communities of all sizes can reduce their carbon footprint by improving energy efficiency and conducting greenhouse gas inventories to identify inefficiencies. The SUNY ESF team conducted a local government operations greenhouse gas inventory of Baldwinsville, NY to assess the municipality's carbon footprint, identify areas for improved energy efficiency, and assist the community in its efforts to achieve Climate Smart Community Certification. This audit functions as a partial update of the 2015 GHG inventory of Baldwinsville.

In 2018, the Village of Baldwinsville released 523.83 MT CO_2e in Scope 1 and 2 emissions. The Village released 161.62 MT CO_2e of stationary combustion emissions, 133.15 MT CO_2e from electricity use, and 229.09 MT CO_2e from mobile combustion. The scope 1 and 2 local government emissions were lower in 2018 compared to 2015, at 523 MTCO_2e compared to 597 in the 2015 report, but that is possible because of variation in weather (heating and cooling degree days), reporting and/or data error or differences. We recommend that the village employ low/no cost energy efficiency measures such as converting incandescent/fluorescent lighting to LED and using best practices identified by the US EPA Energy Star and other reputable sources.

Background and Purpose

Baldwinsville, NY

Baldwinsville, NY is a village in Onondaga County, NY. It is within the Syracuse metropolitan area and is located northwest of the city of Syracuse. The village has an area of 3.24 square miles and has population of 7,378 according to the 2010 U.S. census. Baldwinsville's 2015 Greenhouse Gas Inventory recorded 597 $MTCO_2e$ and projected a 6.9% net increase of GHG by 2025.

Greenhouse Gases and Climate

Greenhouse gases are gases that trap heat in the atmosphere. The 'greenhouse effect' is what facilitates life on earth - life as we know it wouldn't exist without it. However, human industry and other activities produce these gases at abnormally high levels, and are causing a rapid rise in average global temperatures. The most common of the gases are carbon dioxide ($C0_2$), which enters the atmosphere through solid waste, processes such as the manufacture of cement, and the burning of coal, natural, gas and oil, methane (CH_4), which is produced in the production and transport of coal, the decay of organic waste, and agricultural processes, and nitrous oxide (N_20). Nitrous oxide is emitted during agricultural and industrial activities,

combustion of fossil fuels and solid waste, as well as during treatment of wastewater. These are all naturally occurring compounds that are not classical pollutants, but in excess concentrations can have dramatic impacts on the earth's climate.

Climate Smart Community Certification

The Climate Smart Community (CSC) certification from the New York State Department of Environmental Conservation (NYS DEC) is one of 10 high impact actions that municipalities can take towards become designated as a Clean Energy Community (CEC) by the New York State Energy Research and Development Authority (NYSERDA). Municipalities designated as CECs receive benefits such as up to $250,000 in grants to complete additional clean energy projects. Clean Energy Communities and Climate Smart Communities can receive valuable technical assistance and grant opportunities. They also enjoy healthier, greener municipalities that their citizens can feel good about. According to NYSERDA, "The Climate Smart Communities Certification (CSC) program provides local governments with a robust framework to guide their climate action and enables high-performing communities to achieve recognition for their leadership. Designed around the CSC pledge elements, the certification program recognizes communities for their accomplishments." Greenhouse gas inventories are an important part of the Climate Smart Communities Certification process.

Economic Benefits

The DEC's CSC Grant Program provides additional points for Certified Climate Smart Communities that apply for funding, making applications from Certified CSCs more likely to receive funding. In addition, the greenhouse gas inventory is an excellent opportunity to identify inefficiencies in municipal operations and save money by reducing energy use.

Goals

1. To conduct a scope 1 and 2 Greenhouse Gas (GHG) inventory of the Village of Baldwinsville.
2. Compare the 2018 GHG emissions to the 2015 GHG inventory conducted by the village of Baldwinsville
3. Suggest methods to reduce overall GHG emissions in the Village of Baldwinsville.

Scope

This inventory is a scope 1 and 2 Greenhouse Gas Inventory under the Environmental Protection Agency's Guidelines. Scope 1 emissions are direct emissions from owned or controlled sources within the jurisdictional boundary. Scope 2 emissions are indirect emissions from the generation of purchased electricity. Scope 3 emissions are all other indirect emissions and were not recorded in this inventory. Emission sources that fall under scope 1 and 2 are stationary combustion emissions, mobile combustion emissions, and emissions from electricity.

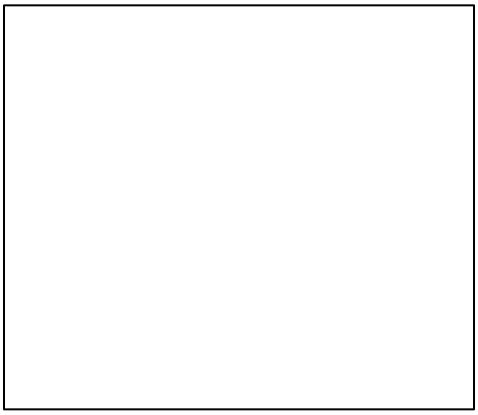
Methods and Reporting

The project team used U.S. Environmental Protection Agencies' Greenhouse Gas Inventory Local Government Operations Module to conduct a scope 1 and 2 local government greenhouse gas inventory.

The project team began by setting up the control sheet and entering basic demographic data such as the population and size. Subsequently, departments were established to track sources of emissions to their respective administrative units in order to delineate responsibility and accountability. We listed 15 departments: water infrastructure, outdoor lighting, community

buildings, public utilities, health, school, offices, other, police vehicle fleet, sewer vehicle fleet gasoline/diesel, water vehicle gasoline/diesel, highway vehicle fleet gasoline/diesel. Due to the nature of the module, which does not allow for the data to be separated by facility type, the "departments" are closer to facility types. For the purpose of clarity, we kept all vehicle emissions separate from facility types. The "other" department includes garages that were not assigned to a specific department. The "school" section includes only the school radios. "Offices" include government and department buildings such as the Police Station and the Department of Public Works.

Baldwinsville Departments as Indicated in the Module



Next, we established our Emissions & Generation Resource Integrated Database (eGRID) Subregion. eGRID is a comprehensive source of data on the environmental characteristics of almost all electric power generated in the United States. Baldwinsville's subregion (NYUP - Upstate New York) determines emission factors for Baldwinsville's electric purchases. For every MegaWatt hour (MWh) of electricity that Baldwinsville consumes, the village produces 294.66 lb CO_2, .021 lb CH_4, and .003 lb N_20. The global warming potential (GWP) of N_20 and CH_4 are scaled to the proportion of CO_2, so a single emissions factor is given in lb CO_2e, or pounds of CO_2 equivalent.

eGRID Subregion Emission Factors as Presented by the EPA Module

		Emission Factors (lb/MWh)			Total EF
	Select eGRID Subregion…	CO_2	CH_4	N_2O	lb CO_2e/MWh
Select your subregion:	NYUP eGRID subregion	294.66	0.021	0.003	296.08

Data provided by the municipality of Baldwinsville was then input into the module in one of three module sections. The first section was stationary combustion emissions, or direct emissions generation from on-site combustion of natural gases in buildings like furnaces or motors. Next was mobile combustion, or all emissions generated by the combustion of fossils fuels from vehicles. Finally, there were electric emissions, or indirect emissions generated from the purchase of electricity through National Grid.

Emissions are reported in $MTCO_2e$, or Metric Tons of CO_2 equivalent. Electricity use is reported in kilowatt hours (kWh). Fuel use is reported in mcf, or thousand cubic feet, and the corresponding energy use of natural gas combustion is reported in MMBtu, or Million British Thermal Units.

Results

The total 2018 scope 1 and 2 municipal emissions for the village of Baldwinsville were 523.86 $MTCO_2e$. The total scope 1 emissions were 390.71 $MTCO_2e$, or 75% of the total scope 1 and 2 emissions. The total scope 2 emissions were 133.15 $MTCO_2e$, or 25% of the total.

Total Scope 1 and 2 Baldwinsville Emissions (MT CO_2e)

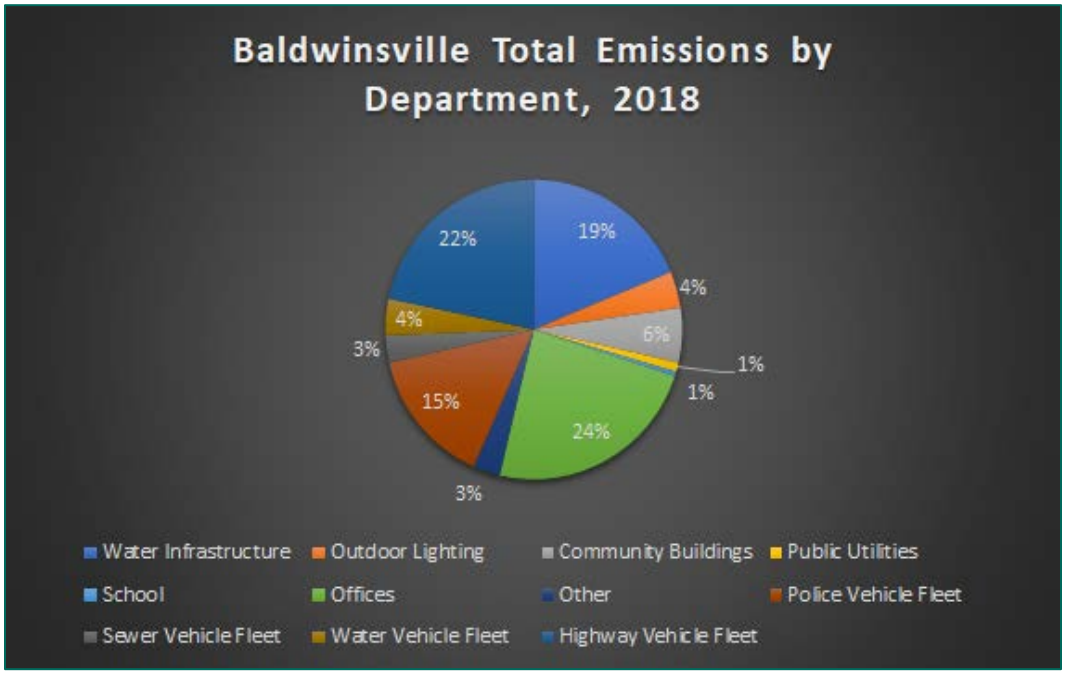
	CO_2	CH_4	N_20	Total MT CO_2e	Percent of Total
Scope 1	390.53	.04	.14	390.71	75%
Scope 2	132.51	.24	.4	133.15	25%
Total Gross Emissions	**523.04**	**.28**	**.54**	**523.86**	**100%**

The largest single source of emissions were offices/government buildings, with 24% of total emissions at 123.26 $MTCO_2e$. The next largest contributor was the highway vehicle fleet, comprising 22% of emissions, or 114 $MTCO_2e$. The water department as a whole, including water infrastructure, water vehicle fleet, and sewer vehicle fleet comprised 26% of total emissions, or 136.92 $MTCO_2e$.

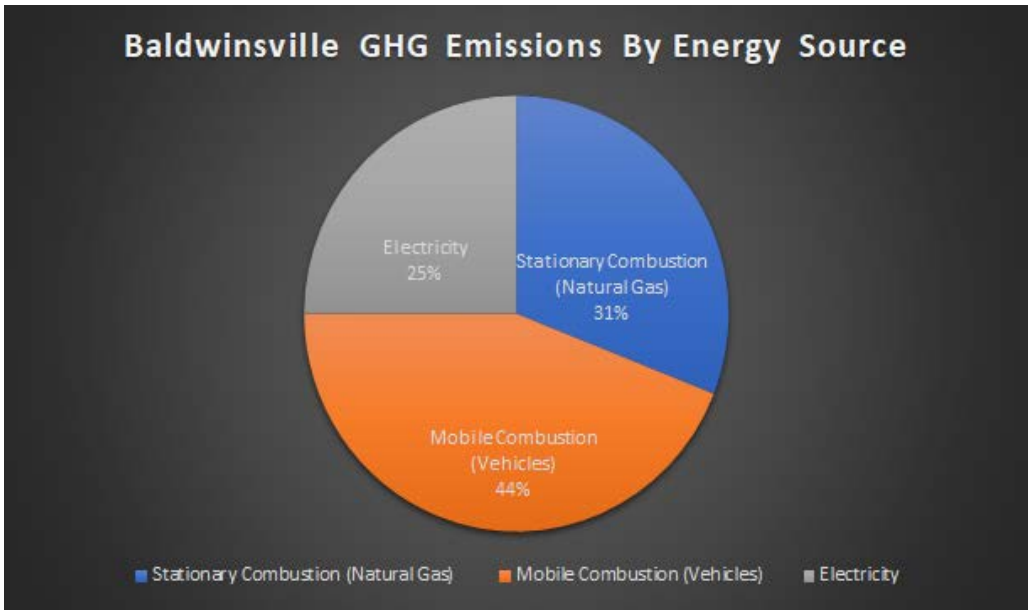
Total Scope 1 and 2 Emissions by Department

Department	Total Emissions (MT CO_2e)	Percent of Total
Water Infrastructure	99.73	19%
Outdoor Lighting	19.1	4%
Community Buildings	29.13	6%
Public Utilities	7.17	1%
School	.52	0%
Offices	123.26	24%
Other	15.87	3%
Police Vehicle Fleet	77.56	15%
Sewer Vehicle Fleet	18.07	3%
Water Vehicle Fleet	19.12	4%
Highway Vehicle Fleet	114.34	22%
Total	523.86	100%

Baldwinsville 2018 Total Scope 1 and 2 Emissions by Department



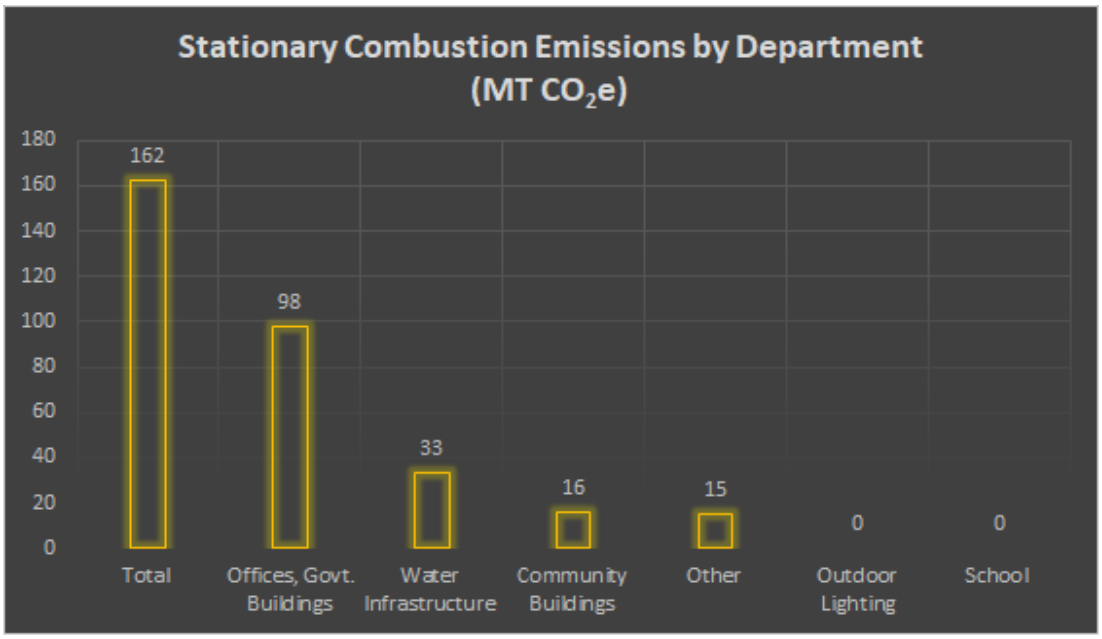
Baldwinsville 2018 Total Scope 1 and 2 Emissions by Energy Source



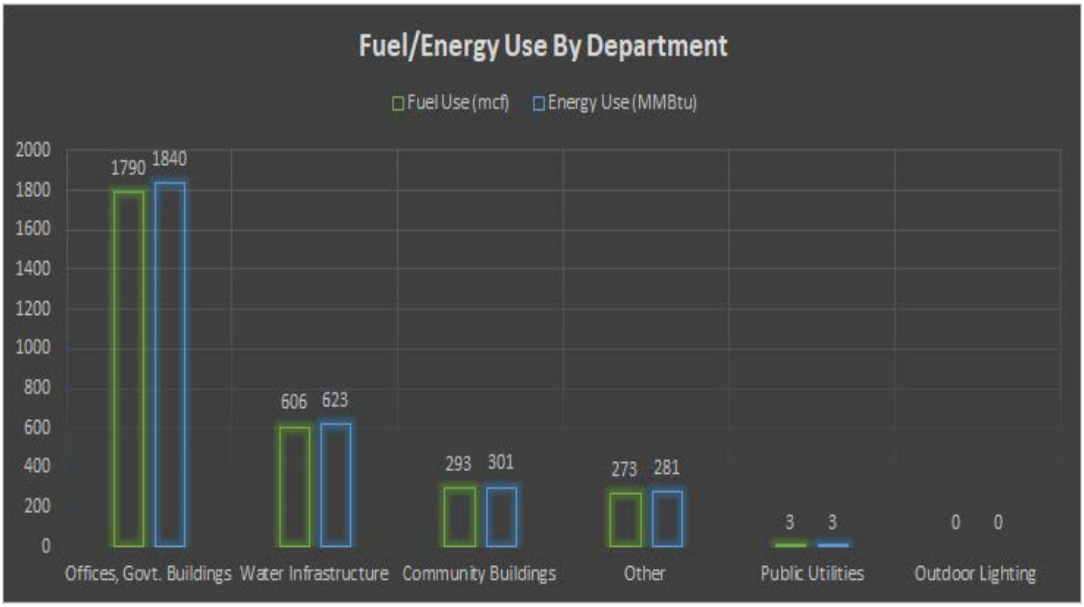
Stationary Combustion Emissions

The municipality of Baldwinsville released 162 Metric Tons of CO_2 from stationary combustion, or its natural gas sector. The largest contributor to these emissions were the village's government and office buildings, including the Police Station, the Department of Public Works, etc. The largest source of emissions, as well as the biggest draw of fuel and energy, was government and office buildings. The department emitted 98 MTCO2e, used 1790 mcf of fuel, and 1840 MMBtu of energy.

Stationary Combustion Emissions by Department



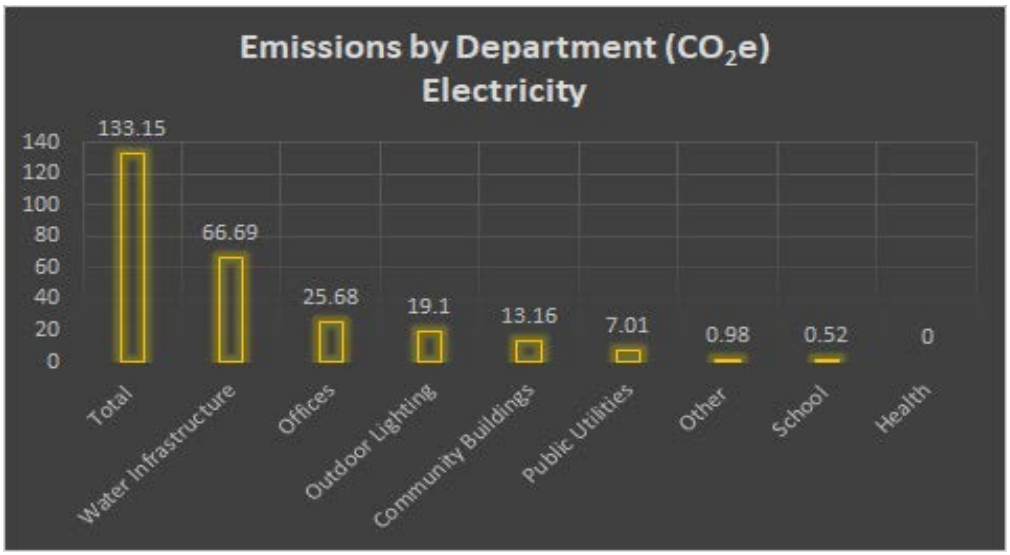
Stationary Combustion Fuel/Energy Use by Department

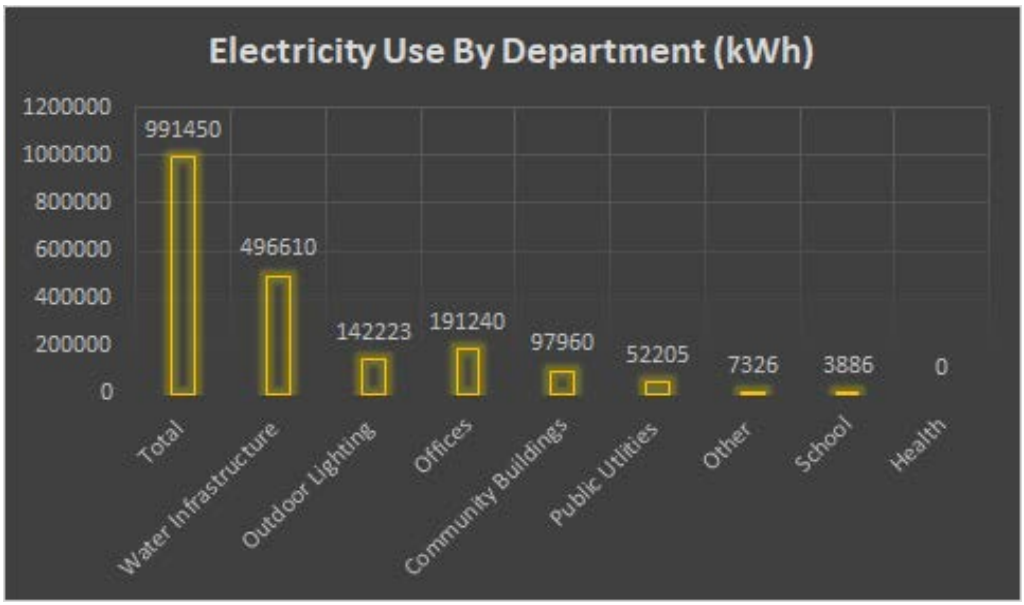


Electricity Emissions

The village produced 133.15 $MTCO_2e$ from purchase of electricity from National Grid. The largest portion of electricity use was water infrastructure, which emitted 66.69 $MTCO_2e$. The village consumed 991, 950 kWh of electricity in the year 2018.

Electricity Emissions by Department

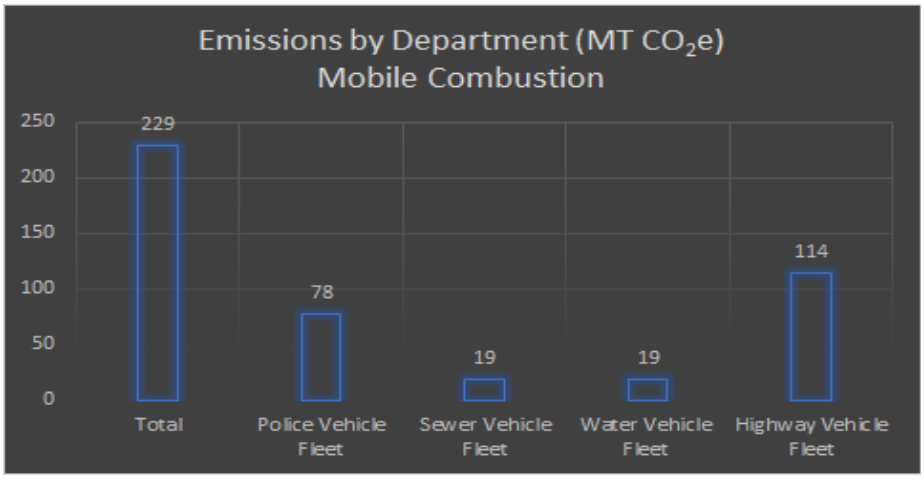




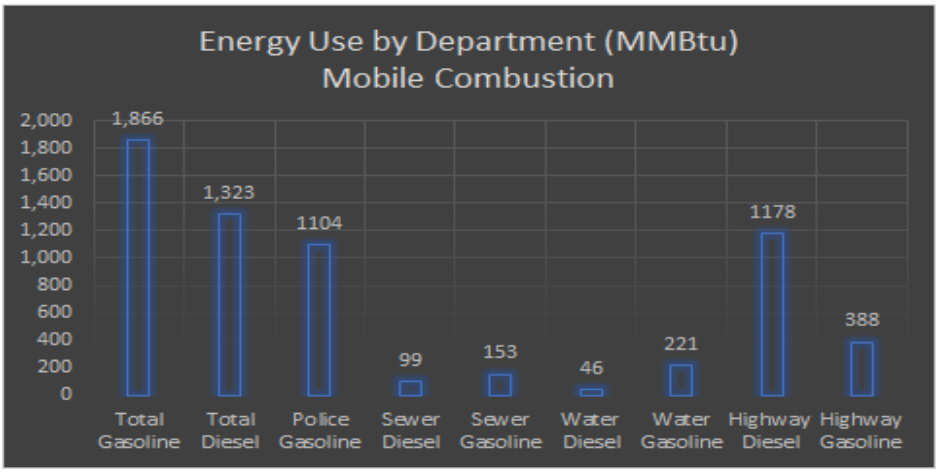
Mobile Combustion Emissions

The vehicle fleet of Baldwinsville emitted 229 $MTCO_2e$ from mobile combustion. The largest portion of these emissions was the highway vehicle fleet, which emitted 114 $MTCO_2e$. The vehicle fleet consumed 1,866 MMBtu of energy.

Mobile Combustion Emission by Department, 2018



Mobile Combustion Energy Use by Department



Discussion

Comparison to 2015 Greenhouse Gas Inventory

In the year 2015, scope 1 and 2 government emissions totaled 597 MTCO2e. Scope 1 emissions were 54% of the emissions or 323 $MTCO_2e$, with scope 2 at 46%, or 274, $MTCO_2e$. The vehicle fleet emitted 168 $MTCO_2e$, comprising 28% of total municipal emissions. The reported estimated 2025 emissions at 640 $MTCO_2e$ due to population growth, projecting an average increase of 3.3 $MTCO_2e$ per year. Following this projection, expected emissions for the year 2018 were 591.9 $MTCO_2e$.

The 2018 Inventory, however calculated total scope 1 and 2 emissions of 523.86, which was 116.14 $MTCO_2e$ less than the 2018 projection, and 73.14 less than the 2015 inventory. It is important to note that this reduction could be caused by differences in the different modules used, emission factors, discrepancies in entry, variation in weather (heating and cooling degree

days), etc., but the data suggests that the local government has reduced its carbon footprint 73.144 $MTCO_2e$.

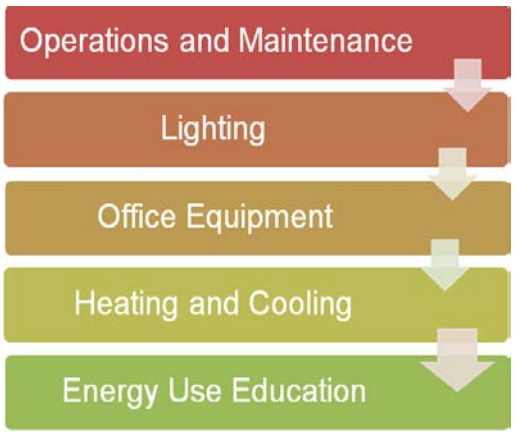
The vehicle fleet, however, has increased its emissions since 2015. This is the section where the most liberties were taken with data entry. Therefore, this discrepancy might be caused by the lack of vehicle specific fuel use data. Nevertheless, the 2018 vehicle fleet data was calculated to be 229.09 $MTCO_2e$, or 44% total emissions, compared to 168 $MTCO_2e$ in 2015. This is markedly higher.

Recommendations

1. Assess fuel use greenhouse gas emissions of the vehicle fleet on a vehicle-by-vehicle basis. This is especially critical because of the reported increase in emissions from 2015 to 2018. This means inputting each vehicle independently with its unique fuel use data. This will allow future planners to address vehicle inefficiencies and opportunities more thoroughly.
2. Conduct a full-scale scope 1, 2, and 3 inventory of both municipal operations and community emissions. This wholistic look will give planners a better picture of Baldwinsville's environmental impact.
3. An excellent first step in environmental action is optimizing efficiency of existing operations - the cleanest energy is the energy that is never used. We recommend following the Energy Star: Guidelines for Small Businesses and their Guides for Local Governments. These primarily address 'low hanging fruit': low/no cost measures that drastically improve efficiency. Through maintenance of existing equipment, improved lighting efficiency, and energy use education, municipalities can make significant reductions to their carbon

4. Example of a low-cost efficiency improvement measure:
    a. Switching from incandescent to LED light bulbs is an incredibly effective switch to make. Both Light Emitting Diode (LED) and Compact Fluorescent Light (CFL) bulbs use over 70% less energy than traditional bulbs, but in terms of long term savings, LEDs are the most practical choice. LED bulbs are more expensive than incandescent light bulbs or Compact Fluorescent Lights, but a single LED bulb lasts upward of 30,000 hours compared to 10,000-20,000 of CFL and 2,000 hours of incandescent (Department of Energy). For older municipal buildings, this will likely require retrofitting of lighting fixtures to adapt them to LED, and there are a variety of different approaches for municipalities to consider. The US Department of Energy has a fact sheet on LED retrofitting that is useful for those making sense of the options, which we will have in the 'recommended sources' section below.
    b. Other low-cost improvements are motion sensors for lights to reduce wasted energy from lights left on, and retrofitting newer diesel vehicles to run on natural gas.

Categories of Low/No-Cost Energy Efficiency Improvements, According to ENERGY STAR



Conclusion

Climate change is a major threat that looms over future generations. Municipalities and people at all scales must do their part to reduce our global carbon footprint and protect the land for our children. With issues as embedded in society as climate change, leadership is critical. The Village of Baldwinsville has displayed excellent initiative and leadership by pursuing Climate Smart Community Certification and performing 2015 and 2018 greenhouse gas inventories. By addressing the most glaring sources of inefficiency first, and then gaining traction to tackle more difficult emission sources, Baldwinsville can serve as a guide for other, similar communities to do the same and add momentum to a growing movement.

Recommended Sources

Low/No Cost Business Practice Improvements

Energy Star Low and No Cost Energy Efficiency Measures. https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/stamp-out-energy-waste#Heating-cooling

LED Lighting and Retrofitting

Guide to LED Lighting. US Department of Energy. https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/led-lighting

LED Retrofit Kits, TLEDs, and Lighting Controls: An Application Guide. US Department of Energy Office of Energy Efficiency and Renewable Energy. https://www.energy.gov/eere/femp/ downloads/led-retrofit-kits-tleds-and-lighting-controls-application-guid

Stouch Lighting: Everything You Need To Know About LED Retrofits. https://www.stouchlighting.com/blog/everything-about-led-lighting-retrofits

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