Town of Mountain Village Memo: Comparing 2018 and 2019 Municipal GHG Emissions

June 2020

INTRODUCTION

The Town of Mountain Village (Mountain Village/Town) first began preparing greenhouse gas (GHG) emissions inventories for the Town's municipal operations in 2016 with the help of a local non-profit, EcoAction Partners. In 2018, EcoAction Partners created a Mountain Village GHG emissions inventory for the Town's municipal operations. To complete the Town's 2019 GHG inventory, the Town enlisted the help of Lotus Engineering and Sustainability, LLC (Lotus). This memo describes similarities and differences between the 2018 and 2019 inventories.

CALCULATION METHODOLOGY DIFFERENCES

CALCULATION TOOLS

Similarities

For the sectors that were analyzed in both inventories, calculation methodologies were identical; total use multiplied by emission factors to determine metric tons of CO_2 equivalents.

Differences

The EcoAction Partners inventory is a simplified GHG calculation and analysis. The Lotus inventory was completed using the Local Government Operations Protocol (LGOP); an employee commuting survey was also completed. A minor difference between the inventories is that the 2018 inventory does not separate emissions out by specific GHG (i.e., carbon dioxide [CO_2], methane [CH_4], and nitrous oxide [N_2O]) while the 2019 inventory does. EAP uses one standard Environmental Protection Agency (EPA) conversion factor to calculate pounds of carbon dioxide equivalent (CO_2e) in 2018. Lotus uses global warming potentials applied to emissions from CO_2, CH_4, and N_2O emissions added together to calculate total CO_2e in 2019.

EMISSION SOURCES

Similarities and Differences

In the 2018 inventory the following data was collected and used to calculate emissions: electricity consumption in municipal facilities, natural gas consumption in municipal facilities, and gallons of gasoline and diesel fuel consumed by Town fleet vehicles. These sources were also included in the 2019 inventory. The 2019 inventory contains additional data pertaining to business travel and employee commuting, waste and recycling, wastewater treatment, refrigerant use, and paper consumption (Table 1). There are no electric fleet vehicles, no pieces of marina equipment, and no airports owned by the Town, thus those emissions were not calculated in either inventory.

Table 1. Data used in the Municipal GHG Inventory completed in 2018 and in 2019.

Data	2018 Inventory?	2019 Inventory?
Electricity Consumption	Yes	Yes
Natural Gas Consumption	Yes	Yes
Facility Diesel Consumption	No	Yes
Facility Propane Consumption	No	Yes, assumed to be de minimus
Renewable Energy Generation	Yes	Yes
Fuel Use Associated with Water Transport	No	No
Gallons of Gasoline consumed by Municipal Vehicles	Yes	Yes
Gallons of Diesel consumed by Municipal Vehicles	Yes	Yes
Gallons of Ethanol consumed by Municipal Vehicles	No	Yes
Electric Vehicle Miles Traveled	No	No
Mobile Equipment fuel consumed	No	Yes
Marina Fuel Consumed	No	No
Aviation Fuel Consumed	No	No
Employee Commuting	No	Yes
Business Travel	No	Yes
Tons of Waste Landfilled	No	Yes
Tons of Waste Recycled	No	Yes
Tons of Waste Composted	No	No
Amount of Gas Combusted/Flared from Wastewater Treatment	No	No
Nitrogen Discharged from Wastewater Treatment	No	No
Refrigerant Use in Buildings	No	Yes
Refrigerant Use in Vehicle Fleet	No	Yes
Material Purchases (paper, fertilizer, food etc.)	No	Yes, paper only

Calculation Methodologies

Similarities

Sources that were calculated using the same methodology include electricity and natural gas use.

Differences

Different calculations were used for the following sources: vehicle fleet, business travel and employee commuting, waste and recycling, wastewater treatment, refrigerants and material purchases. Emissions from all sectors except the vehicle fleet were new to the 2019 inventory and were calculated based on methodology from the LGOP. Additionally, an employee commute survey was sent out to the Town's municipal employees and this survey collected data on commuting patterns by vehicle type and fuel

type. Emissions from employee commuting were calculated using the emissions factor for each fuel and vehicle type and the data from the employee commute survey.

Vehicle fleet emissions were included in both inventories but calculated differently. In the 2018 inventory, total gallons of unleaded and diesel fuel used in municipal-owned vehicles was calculated. Then, a standard EPA emission factor for both unleaded and diesel fuel was applied to those totals. Those were then added together to determine total municipal fuel use emissions.

In the 2019 inventory, vehicles were classified into five broad categories to match the emission factors provided by the Climate Registry. These categories were: gasoline passenger vehicle, gasoline light duty vehicle, diesel heavy duty vehicles, gasoline-powered equipment, and diesel-powered equipment. Gallons of fuel consumed by vehicle type were summed to calculate total gallons of fuel consumed. This methodology was applied to calculate the gallons of gasoline, diesel and ethanol consumed. To calculate vehicle miles traveled, fuel efficiencies for three vehicle types (excluding equipment) were applied to total gallons of fuel for the designated vehicle types. Fuel emission factors were provided by The Climate Registry and applied to the total gallons consumed and VMT estimates.

EMISSION VALUES COMPARISON

ABSOLUTE EMISSION TOTALS

According to the 2018 inventory, the Town of Mountain Village produced around 13,966,666 lbs of CO_2e, or 6,337 metric tons (mt) CO_2e, in 2018; this value represented a reduction since the original analysis was conducted in 2010, but and increase over the prior four years (Figure 1 and Table 2). The 2019 inventory estimates emissions to be 4,358 mt CO_2e for municipal operations in 2019.

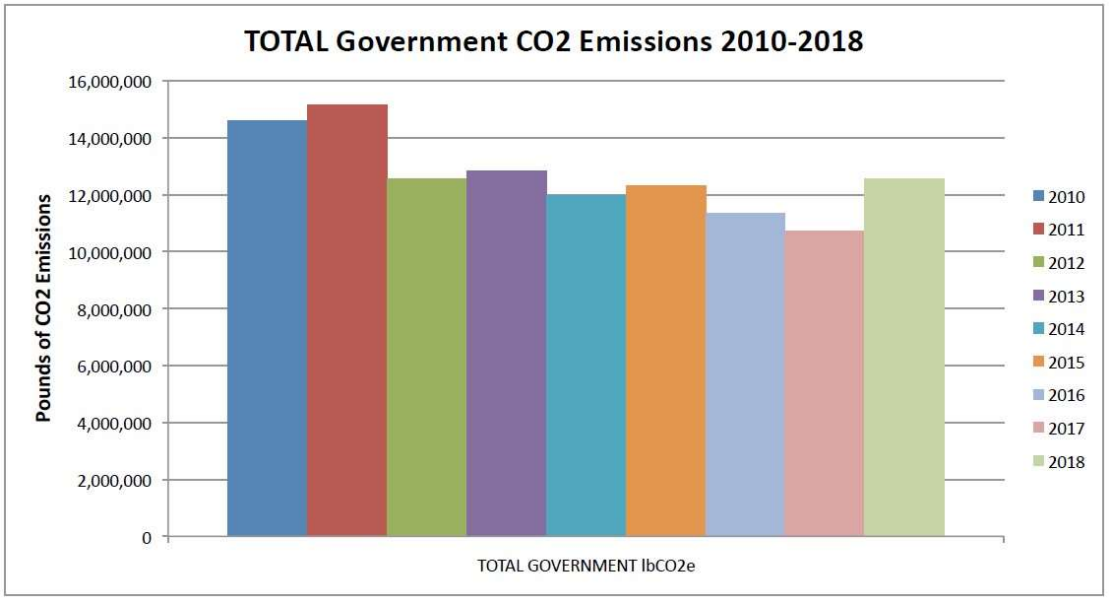

Figure 1: Estimated total government emissions from the 2018 inventory.

Table 2. Emission comparison between the 2018 and 2019 inventories.

Data	2018 Value (mt CO_2e)	2019 Value (mt CO_2e)
Electricity consumption	4,769	2,152
Natural gas consumption	883	1,080
Facility diesel consumption	N/A	4
Renewable energy generation	N/A	(1,411)
Gasoline consumed by municipal vehicles and equipment (includes ethanol)	518	342
Diesel consumed by municipal vehicles and equipment	167	157
Employee Commuting	N/A	152
Employee Business Travel	N/A	0.5
Waste Landfilled	N/A	461
Waste Recycled	N/A	(326)
Waste Composted	N/A	N/A
Refrigerant Use in Buildings	N/A	1
Refrigerant Use in Vehicle Fleet	N/A	N/A
Material Purchases (paper, fertilizer, food etc.)	N/A	9
Total Emissions	**6,337**	**4,358**

While natural gas emissions in 2019 were higher than they were estimated to be in 2018, electricity emissions were much lower; 2019 electricity emissions are less than half the 2018 emissions estimate. Natural gas emissions increased in 2019 most likely due to a colder winter, as the Town saw a 22 percent increase in heating degree days in 2019 compared to 2018[1]. Electricity emissions factors were higher in 2019 than in 2018; however, the 2018 inventory report notes a stark increase in electricity use in 2018 over the prior years, and 2019 electricity use for municipal buildings was reported as less than half of the 2018 use. This reduced electricity use is driven by efficiency gains in municipal buildings, and specifically, in less electricity being used in the Town's snowmelt systems. The Town began to track, monitor, and manage the use of snowmelt systems to a much more thorough degree in 2019; throughout the year the settings on the snowmelt system were adjusted based on seasonality and weather conditions, which significantly reduced wasted energy and emissions.[2]

The resulting changes in emissions from the use of electricity and natural gas are likely driven primarily by weather variations between the two years, as well as by greater energy efficiency in regard to the use of electricity in municipal buildings. As seen in Table 3, which shows the average daily temperature and the number of heating degree days[3] and cooling degree days for each month in 2018 and 2019,

[1] See https://www.weatherdatadepot.com/degree-day-comparison.
[2] Details on the Town's efficiency efforts were provided by Brad Wilson with the Town of Mountain Village's Facility Maintenance, PDF on file.
[3] 'Degree days' help to determine the heating requirements of a building based on the change in outdoor temperature. Heating degree day (HDD) is the number of degrees by which the average daily temperatures is lower than a balance point temperature (in this case, 60 degrees Fahrenheit), and cooling degree days (CDD) is the number of degrees by which the average daily temperatures is higher than the balance point temperature. Degree

temperatures in 2019 were, on average, colder in the winter and cooler in the summer. This would necessitate greater use of natural gas to heat buildings in the winter in 2019 as compared to 2018; this would also presumably lead to a reduced need for building cooling systems to be operational in the summer of 2019 as compared to the summer of 2018.

Table 3: Average daily temperature and number of degree days, 2018 and 2019.

Month	Heating Degree Days		Cooling Degree Days		Average Temperature	
	2018	2019	2018	2019	2018	2019
January	900	1072	0	0	30	25
February	895	992	0	0	28	24
March	805	871	0	0	34	31
April	518	592	0	0	42	40
May	236	662	0	0	52	38
June	11	232	85	7	62	52
July	0	29	149	25	64	59
August	10	24	111	16	63	59
September	94	113	19	19	57	54
October	543	704	0	0	42	37
November	846	838	0	0	31	32
December	1,073	1,163	0	0	25	22
Total	**5,931**	**7,361**	**364**	**67**	**-**	**-**

Emission Contributions

In 2018, the leading sources of emissions were:

- Electricity consumption (75%); and
- Natural gas consumption (14%)

In 2019, the leading sources of emissions were:

- Electricity consumption (50%);
- Natural gas consumption (25%);
- Solid waste (11%);
- Gasoline fuel use (including fleet vehicles, equipment, and employee commuting, 9%); and

days reflect changes in climate and are used as a proxy for the energy demand for heating or cooling buildings. Degree day and temperature data is from www.weatherdatadepot.com using the zip code 81435.

- Diesel fuel use (including fleet vehicles, equipment, and employee commuting; 6%).

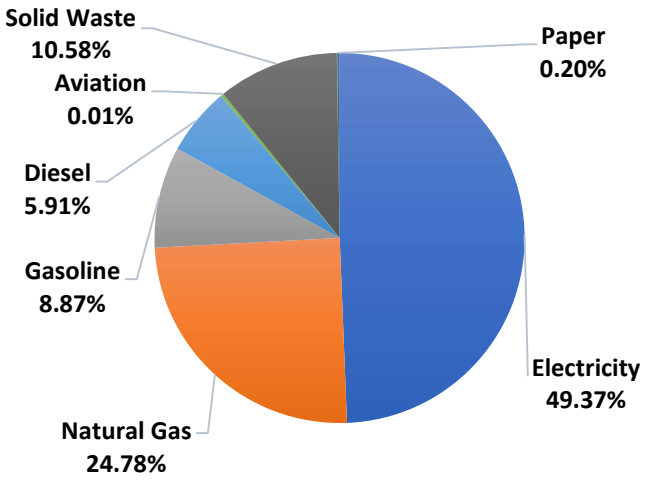

Figure 2: Estimated emissions by source for government operations, 2019.

The additional sources of emissions that were analyzed in 2019 naturally resulted in a significant change to the share of emissions that comes from each source as compared to 2018. Reduced electricity consumption and higher natural gas consumption in 2019 also drove the change in contributions from each of these sources between 2018 and 2019.

CONCLUSION

Emissions in Mountain Village are estimated to be significantly lower in 2019 than they were in 2018; this is largely driven by lower electricity use in 2019 as compared to 2018. Additionally, inventories for 2018 and 2019 were completed with different methodologies and data sources. As Mountain Village continues to track municipal emissions moving forward, utilizing a consistent methodology and data collection process will ensure that future inventories are comparable in such a way that trends in activity data and emissions can be better identified.