Emission Inventory Report

Village of Homer New York

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Chapter I: Introduction

1.1 Climate Change and Greenhouse Gases

Climate Change has been a growing concern for the past few decades across the world. The biggest contributing factor to the climate change is Greenhouse Gases such as carbon dioxide, water vapor, methane and others. Due to increased human activity of burning fossil fuels (such as oil, coal, and natural gas), deforestation, waste disposal, and industrial processes, the level of GHGs has significantly increased in the last century. This in turn lead to GHGs trapping heat and energy in the atmosphere, and this caused the Earth to warm. This global warming has negative effects on human, economic, and environmental health.

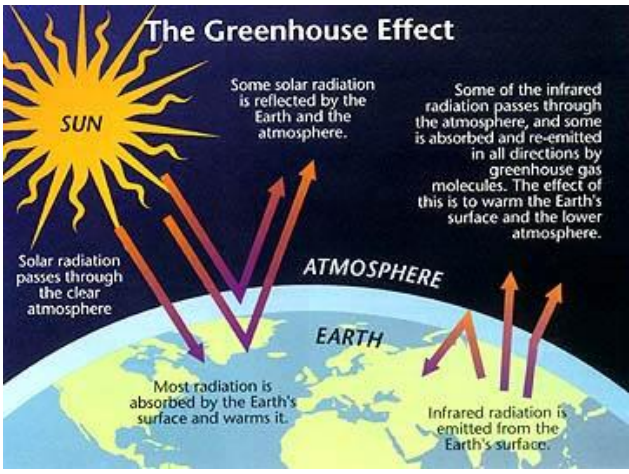


Figure 1: The Greenhouse Effect

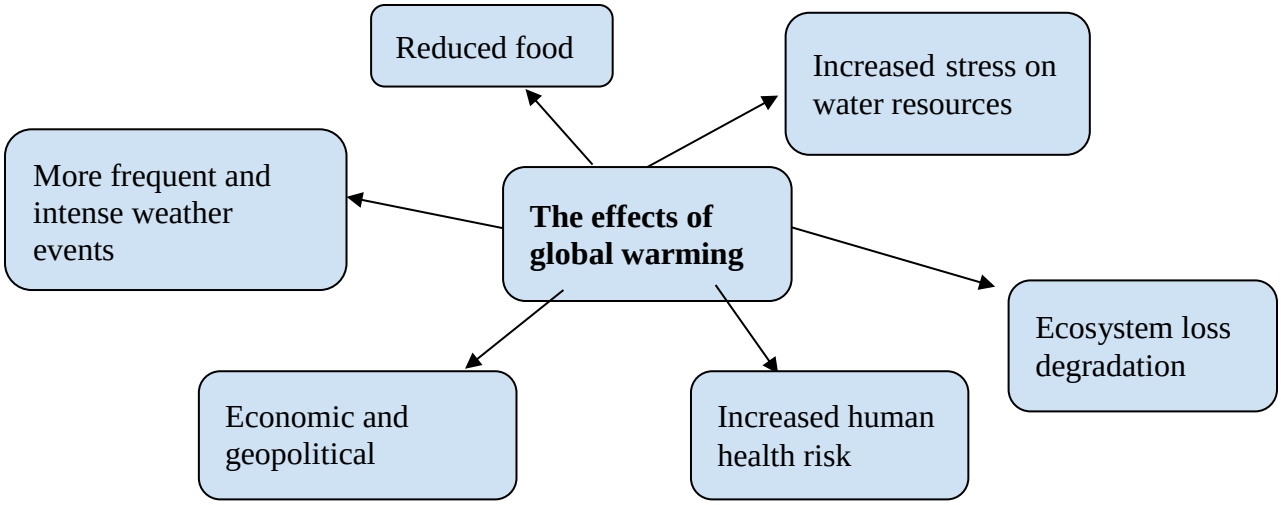


Figure 2: The effects of global warming

1.2 Climate Change in Upstate New York

The annual average temperature in New York State has increased approximately 2.4°F since 1970. It is expected that the average temperature in New York State will be up to 3.0°F warmer by the 2020s and 6.0°F warmer by the 2050s.[1] In many areas of New York, spring now begins a week earlier than it did a few decades ago.

The area of Upstate New York has its own consequences of climate change, which are summarized below:

- **Changing weather and precipitation patterns:** In all NY State, precipitation patterns are changing. Precipitation has increased by 70% since 1958, with instances of floods and droughts increasing.
- **Impacts to lakes and waterbodies:** Increased temperature and acidity of the water can harm fish. Moreover, intensity of flooding leads to pollutants entering waterbodies in the form of runoff from the land, causing the water to become more dangerous for its inhabitants and people who rely on the water use.
- **Agriculture:** Increased temperatures, especially during the summer, could lead to the reduction of corn yields, which is the NY's most important crop. Cows also eat less when too warm, which could affect the amount of milk and beef produced.
- **Air Quality:** Extreme heat patterns might lead to more deaths caused by heat. Air will be more polluted, which leads to more health risks such as asthma.
- **Deforestation and forest fires:** New York could experience a 10-20% increase in the risk of fires. Increased temperatures could also cause tree species to start to migrate north, so sugar maple and paper birch could disappear from New York.[2]

Climate Smart Communities

The New York State department of Environmental Conservation (NYSDEC) Climate Smart Communities program provides local governments with a framework for them to follow, which would guide their climate actions and enable high-performing communities to achieve recognition for their leadership with 4 awards: Certified, Bronze, Silver, and Gold. There are 10 pledge elements which each government has to do, and show results of their actions. These elements are:

1. **Build a climate-smart community.**
2. **Inventory emissions, set goals, and plan for climate action.**
3. **Decrease energy use.**
4. **Shift to clean, renewable energy.**
5. **Use climate-smart materials management.**
6. **Implement climate-smart land use.**
7. **Enhance community resilience to climate change.**
8. **Support a green innovation economy.**
9. **Inform and inspire the public.**
10. **Engage in an evolving process of**

[1] Responding to Climate Change in New York State (ClimAid), 2011.
Website: https://www.nyserda.ny.gov/climaid

[2] "The Nature Conservancy in New York." *The Nature Conservancy*, www.nature.org/en-us/about-us/where-we-work/united-states/new-york/.

1.3 Purpose of the Greenhouse Gas Inventory:

Like many other cities and municipalities in New York State, the Village of Homer has pledged to reduce its greenhouse gas (GHG) emissions in efforts to reduce its carbon footprint and impact on climate change and get certified as a Climate Smart Community. In order to make a change in their emissions, the Village must first understand where its emissions come from, and identify alternative options that would take advantage of clean energy technology. By analyzing emissions from village owned vehicles, buildings, recreation areas, and other facilities, the village will have adequate information and data on where to make changes. With accurate information on its current emissions, Homer can then set a target for reducing its emissions and work towards its goal. Since local governments control their own fleets, municipal buildings, and energy consumption, each greenhouse gas inventory is unique. Making changes on a local level is the most efficient way to see fast results, environmentally and economically.

1.4 Village Profile:

The historic village of Homer is located in northwestern Cortland County. The Village covers an area of approximately 1.9 square miles, and the majority of the area is used for residential purposes. According to the 2010 US Census, the Village has a population of about 3,291 residents, with 1,364 occupied housing units. Of the occupied housing units, 968 units are owner-occupied with an average household size of 2.66 persons, while 330 units are renter-occupied with an average household size of 1.97 persons.

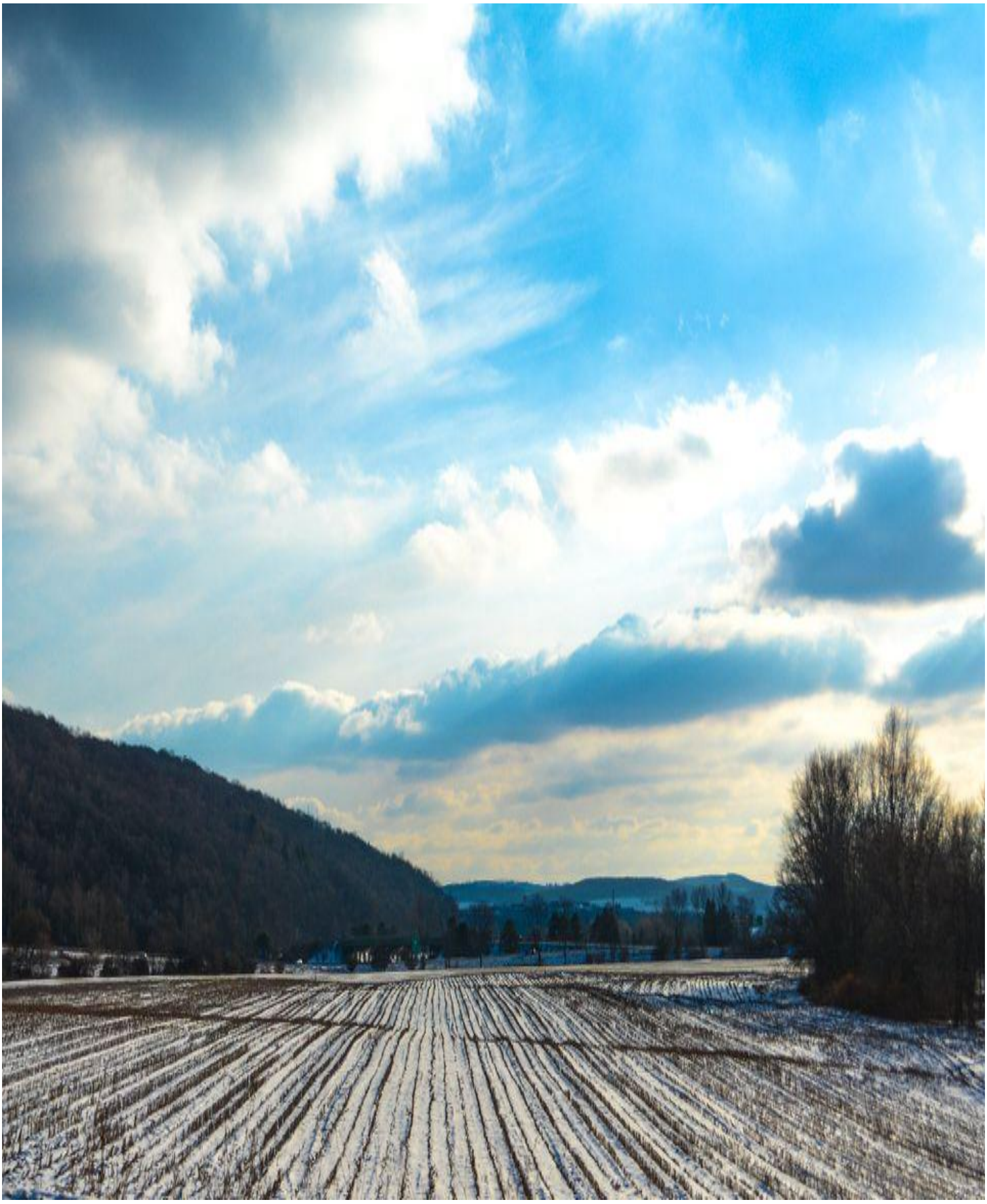
Figure 3: Map of Village of Homer

1.5 Focus Areas

Energy use- This focus concentrates on all energy usage, both electrical and heating, of the government departments.

This focus concentrates on the water use by the government sector.

This focus includes the data of use of transport by several government departments.



2.1 Data Collection and Analysis

For the analysis, the Central New York Regional Planning and Development Board provided the project teach with the Village's energy usage information including 2017 and 2018 Constellation Energy invoices, National Grid information, NYSEG information, and information about Homer's municipal vehicle fuel use. EPA's Local GHG Inventory Tool: Government Operations Module was used to calculate greenhouse gas emissions in metric tons of carbon dioxide equivalent ($MTCO_2e$) based on the energy use data provided. ICLEI-Local Governments for Sustainability's Local Government Operations Protocol (LGOP) and the US Community Operations Protocol were used for reference while analyzing the data and coming up with proposals.

2.2 Inventory Boundary and Organization

The Village of Homer's jurisdictional boundary was used for this GHG inventory. ICLEI's community protocol uses this defined boundary to calculate GHG emissions, and categorizes emissions in two ways: 1) sources and 2) activities.

One of the major differences between the two is that sources only occur within the community boundary, while activities can occur either inside or outside of the community boundary. Two examples of activities are: (1) emissions from a power plant located outside the community to generate electricity consumed inside the community, and (2) emissions from a landfill located outside the community for waste produced inside the community. The distinction between sources and activities is summarized in the definitions below.

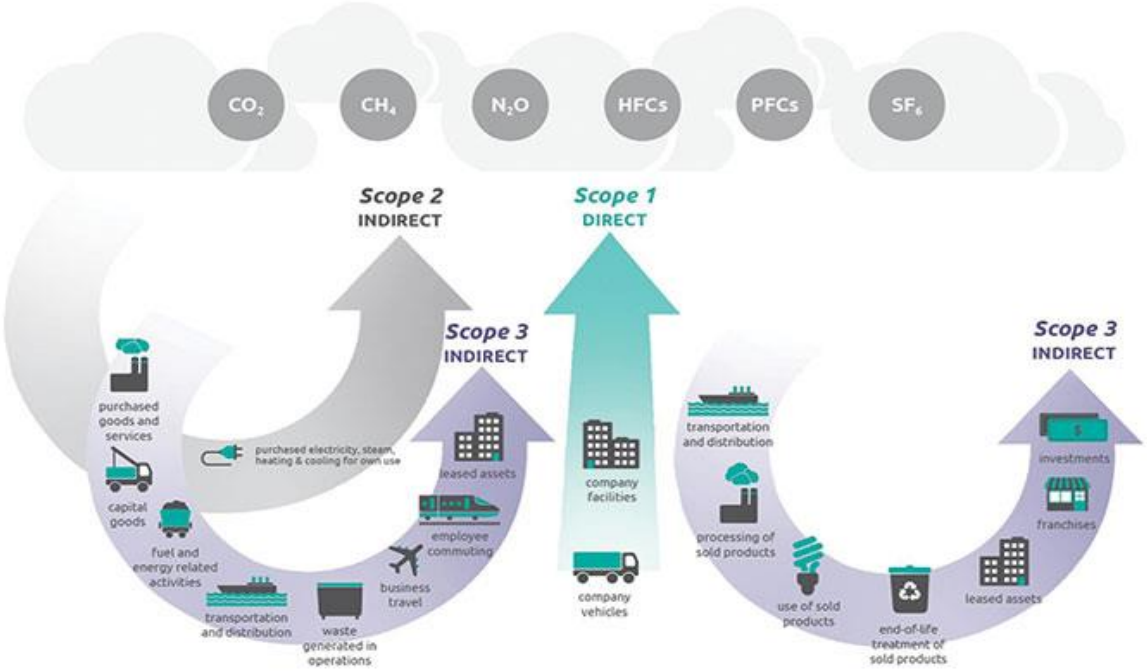


Figure 4: Emission Scopes Distinctions

Sources: Any physical processes inside the jurisdictional boundary of the Village that release GHG emissions into the atmosphere (e.g., combustion of gasoline in transportation; combustion of natural gas in home heating).

Activities: The use of energy, materials, and/or services by members of the Village of Homer community that creates GHG emissions directly or indirectly.
There are 3 scopes of emissions, where emissions in scope 1 are directly emitted within the jurisdictional boundary, and scope 2 and 3 emissions are indirectly emitted. Scope 2 emissions refer to emissions produced outside of the boundary due to energy use within the boundary (i.e. electricity use), whereas scope 3 emissions are produced outside of the boundary due to activities of individuals within the boundary (i.e. emissions from commuting to work from a neighboring community). Local governments typically have more control over scope 1 and 2 emissions, and therefore scope 3 emissions are optional to report in GHG inventories.

2.3 Reporting:

Our analysis showed that GHG emissions in the Village of Homer come from natural gas, electricity, gasoline, and diesel. Looking at GHG emissions by department helps to give a sense of where there is the best opportunity to make adjustments that can help the community reach their goal of becoming a Certified Climate Smart Community.

	In $MTCO_2e$				
Department	**GHG Electricity**	**GHG Natural Gas**	**GHG Gasoline**	**GHG Diesel**	**Total**
Water	179	15.2	9.1	10	213.3
Recreation	10.2	5	6.1	N/A	21.3
Cemetery	0.71	N/A	N/A	5.3	6.01
DPW	13.8	44.4	11.3	52.2	121.7
Police	13.5	11.7	36.5	N/A	61.7
Fire	38.6	42.9	N/A	11.5	93
Total	255.81	119.2	63	79	517.01

Table 1: Government emissions by source

By looking at the data, it is apparent that most of the GHG emissions in Homer are coming from the operation of buildings and facilities, rather than from vehicle use. Electricity and natural gas are sources of emissions within the “building energy use” sector, while gasoline and diesel are sources of emissions within the “transportation” sector. Further, the data shows that the water and public works departments are causing the most GHG emissions. These two departments are the first places that can be looked to make clean energy and energy efficiency upgrades.

Indirect scope 3 emissions have lower potentials to be affected by local policy initiatives, because those activities are coming from outside the boundary of the village. Therefore, for the

purposes of this inventory, the focus was on scope 1 and 2 emissions from the Village of Homer's municipal operations. The mitigation plans focus on municipal improvements and mitigation strategies, including using less electricity and heating in buildings.

Chapter III: Government Operation Emissions

3.1 Government Operations Inventory

The data has been organized by department based on the reporting structure within the municipality. Each department has different staff and resource distribution, so presenting the data separated by department allows the data to be understood and easily used by each department stakeholder.

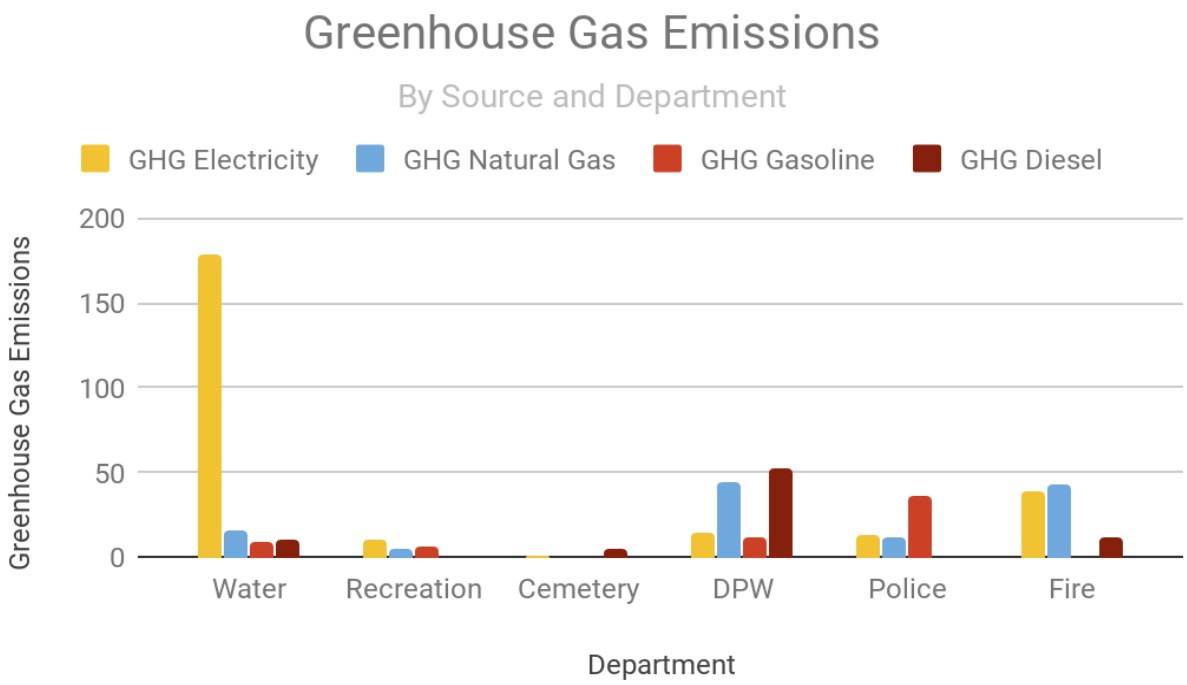


Figure 5: Greenhouse Gas Emissions by department

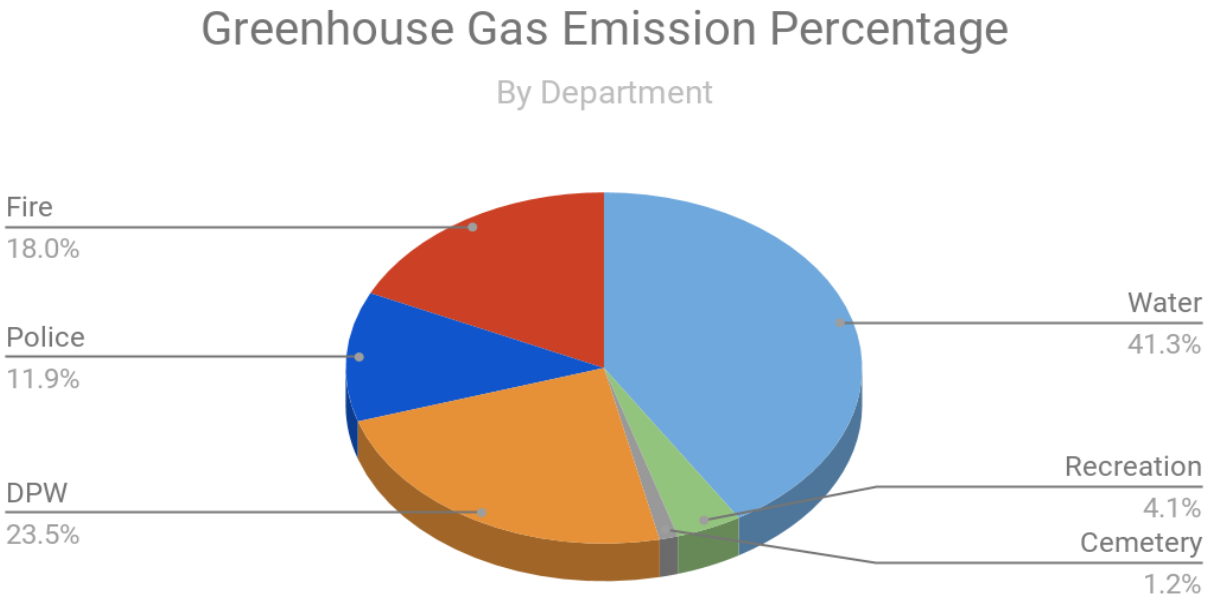


Figure 6: Greenhouse Gas Emissions in percentages

This greenhouse gas emissions inventory shows the emissions from the Village of Homer's public services departments. The inventory also shows the fuel sources causing the emissions. The fuel sources and consumption vary by department. The varying consumption can be explained by the function of each department. Public safety operates a fleet of police and fire vehicles, consuming 4,101.62 gallons of gasoline in 2018. The public safety department is also a large consumer of diesel, at 1,132.94 gallons of diesel. The public safety department contains fire trucks, responding to calls across a 125 square mile district, which are responsible for diesel emissions. The water department uses a large amount of electricity to power water pumps throughout the village. Public works consumed 5,145.03 gallons of diesel in 2018 to fuel their 4 CDL class 8 trucks, used to keep the roads clear of snow and haul asphalt for paving. Public works natural gas consumption can be attributed to heating of their large garage and office building. Public works also consumes a nominal amount of gasoline to fuel two F-250 support trucks and a Ventrac lawn mower used to cut grass.

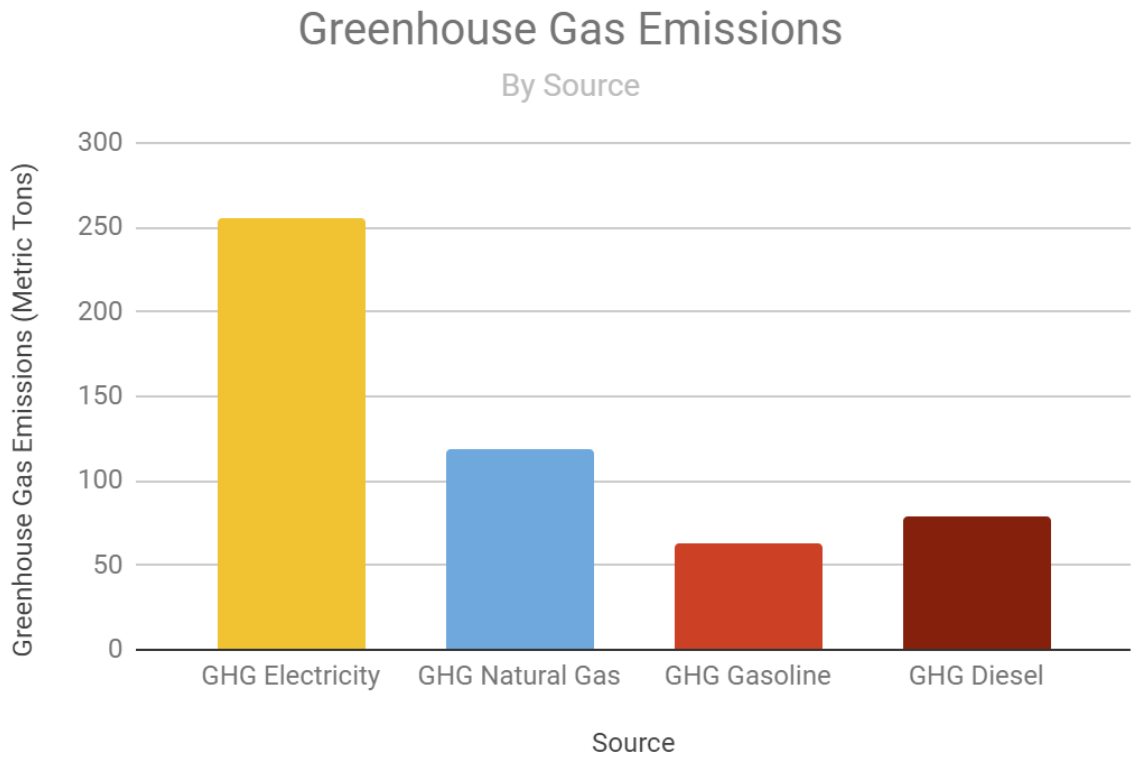
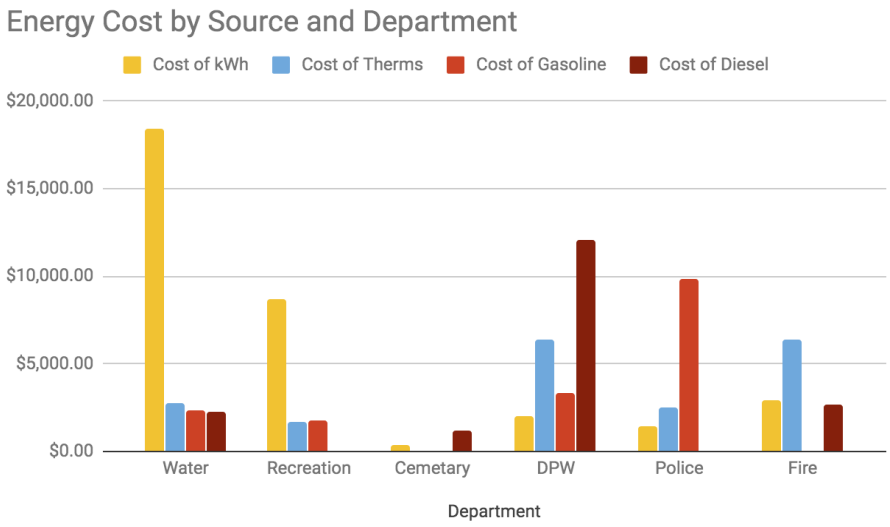
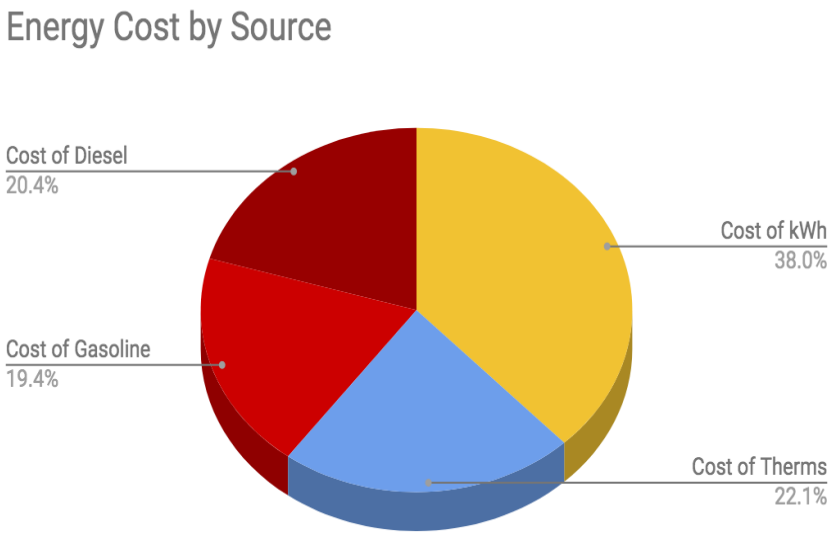


Figure 7: Greenhouse Gas Emissions by Source

3.2 Energy Costs

In 2018, total energy costs in Village of Homer was $88,974.44. As is apparent from the graph, the department which spent the most money was the Water Department, which spent about $20,000, and most of its costs were to pay for electricity. The DPW also spent about the same amount of money, most of which was spent for the cost of diesel and natural gas. The public works department, which consists of fire department and police station together spend more than any other department.
The graph below shows energy cost by source. Electric costs represent the largest cost to the Village, followed by natural gas, diesel, and finally gasoline.





3.3 Building Emission Data 2017 to 2018

	2017		2018	
Department	**GHG Electricit**	**GHG Natural**	**GHG Electricit**	**GHG Natural**
Public Safety	45	22,1	47,6	27,2
Water	181	5,4	166	5,8
Public Works	11,7	29,4	12,4	29,5
Recreation	11,9	1,5	8,7	1,4
Cemetary	0,71	0	0,6	0
Total	250,31	58,4	235,3	63,9

Table 2: Government emissions by source in MCO2 in 2017 and 2018

Analyzing the data from 2017 and 2018, it is possible to see what direction the government operations emissions are heading. Some sectors have seen a decrease in emissions, including the water department, which used 8.2% less electricity in 2018 than in 2017. Other departments have used about the same amount of electricity and therefore emitted the same amount of CO_2 into the atmosphere. Public Safety, however, used more natural gas in 2018 than 2017 which has contributed to greater total emissions.

Overall, governmental operations emissions from electricity in 2018 decreased by 15 metric tons from 250 metric tons in 2017 to 235 metric tons in 2018. However GHG emissions from heating increased by 5 metric tons in 2018 compared to 2017. As a whole, the government has already made some changes that have contributed to less GHG emissions.

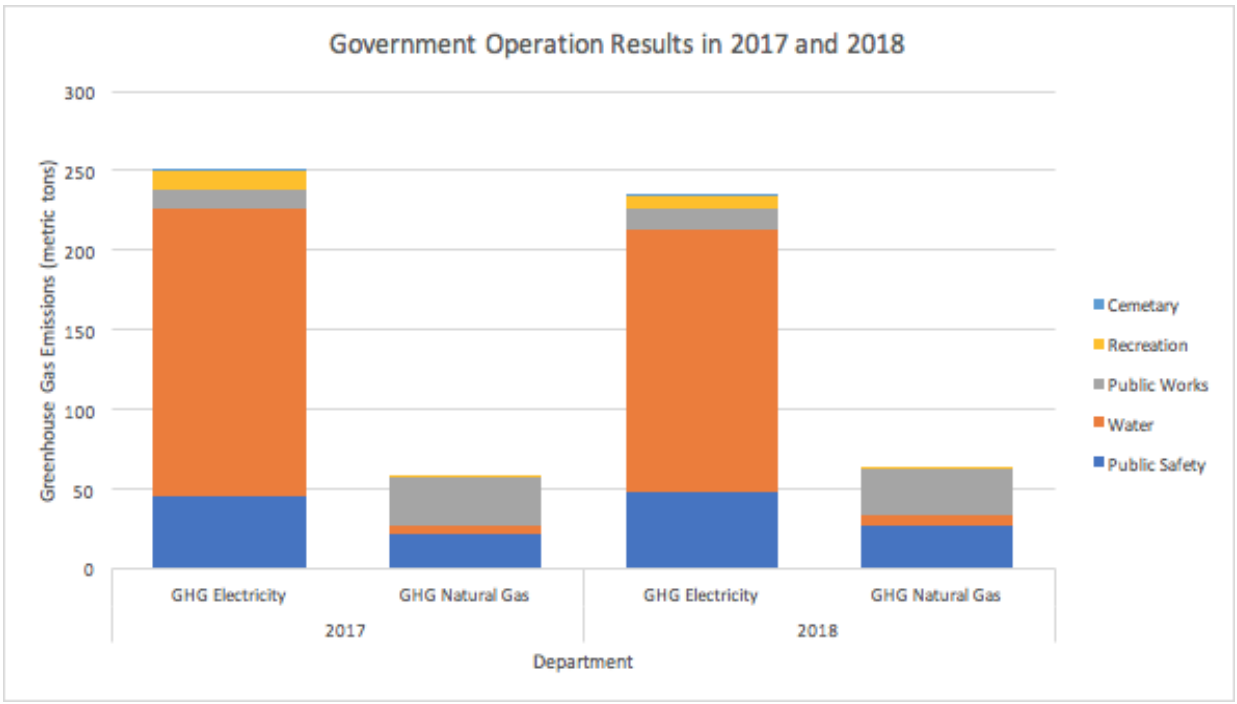


Figure 10: Government GHG emissions in MCO2 in 2017 and 2018

Chapter IV: Discussion

4.1 Analysis

Different emission scopes were important in this report, as they can be addressed with different means and tools. The local government has less control over scope 3 emissions and therefore should prioritize scope 1 and 2 emissions in the short term. The mitigation plans suggested in this report focus on municipal improvements and mitigation strategies, including using less electricity and heating buildings.

This greenhouse gas inventory of government operation emissions is the first step to reducing emissions. Further steps are to develop a reduction goal and create a climate action plan.

This inventory only conducted an analysis of government operation emissions. Community-wide activities and their emissions should be calculated in further research. For now, this study has shown that the largest emitter from Homer government operations is the water department, followed by the public safety department. 72.5% of the total GHG emissions came from the "building energy use" sector, while 27.5% came from the "transportation" sector. Notably, the public safety department used 20% more natural gas in 2018 than in 2017, which should be taken into consideration while creating a climate action plan.

This study is the first one to be conducted in the Village of Homer, and future studies should be done which would improve the plan and actions that the local government should consider taking moving forward. Institutionalizing data collection is also important in order to broaden the boundaries of the inventory, streamline further studies, and provide more comprehensive sets.

4.2 Recommended Upgrades

This study recommends three distinct upgrades for the Village of Homer to reduce their energy usage. The first recommendation is to utilize solar energy through a Power Purchase Agreement or PPA. The Power Purchase Agreement model was chosen for a number of reasons: the Village's annual electricity consumption does not vary much, allowing them to avoid overage, or 'lack of use' charges. Furthermore, a PPA does not require upfront capital from the Village, saving costs and reducing risk. A PPA for the amount of power that the Village of Homer would need would still continue to cost around $0.14 per kilowatt hour, the rate currently paid, or likely could be provided at a lower cost.

Another suggestion is to convert the large diesel trucks used by the department of public works and one water department truck to compressed natural gas (CNG). This type of conversion typically costs 15 to 20% of a vehicle's MSRP. No fire equipment was included in this suggestion due to the difficulty as well as the comparative low usage. To convert the Village's 2018 Freightliner dump (water department), 2014 freightliner 108SD dump, 2016 Freightliner vac, and 2012 international 7500, would cost about $80,920 according to our calculations. A fueling station with low demand system, which compresses as it fuels taking about 15 minutes per fueling, was estimated to cost $67,000. The upgrades would reduce each vehicle's annual emissions by about 31%. Torque value would also be reduced by 30%; however, for the Village

this should not be considered a hindrance, as the posted speed limit would still be easily obtained in a quick manner with the reduced torque, even when fully loaded.

The last recommendation is to purchase a Class A electric vehicle to replace the 2000 Volvo WG42. The electric vehicle costs $146,568 and when fitted with a 15-1/2 foot aluminum dump box to reduce weight, as well as plow upfits, paint and added wiring, the cost was estimated to be $177,000. The vehicle has a 124 mile full load range as well as a 167 mile half load range, and takes three hours to charge. A charging station would cost about $8,000. When combined with a power purchase agreement for solar electricity, this recommendation could result in zero carbon emissions.

The village also expressed an interest in transitioning to a village-operated rubbish removal. The village is advised to look into the city of Chicago’s use of the BYD Company’s electric garbage truck.

Chapter V: Conclusion

As a Climate Smart Community, the Village of Homer has partnered with state and regional agencies to combat climate change and pledge to reduce greenhouse gas emissions. The first milestone for meeting climate mitigation goals, according to ICLEI-Local Governments for Sustainability, is to conduct a baseline emissions inventory and forecast. This study was the first attempt to comprehensively quantify these emissions for the Village's government operation emissions. It will provide a first benchmark for planning purposes with the goal of setting an emissions reduction target and developing a Climate Action Plan.

Emissions for the Village of Homer in the 2018 baseline year totaled 517.01 MTCO2e for all activity covered in this inventory. The majority of government emissions came from scope 1 sources that are easiest to influence through planning initiatives, and therefore can take steps to reduce their energy use and GHG emissions to serve as an example to the community. The local government can also provide information and assistance to community members to encourage them to take related actions.