GREENHOUSE GAS INVENTORY

Town of Kennebunkport

Prepared by the Southern Maine Planning and Development Commission

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Executive Summary

The Town of Kennebunkport is already experiencing the effects of climate change and is beginning to take steps to address its causes and impacts. Municipal climate action is guided by the Kennebunkport Climate Change Goals and Priorities, approved by the Board of Selectmen in 2020. Kennebunkport has joined a coalition of six towns in coastal York County to create the SMPDC Regional Sustainability and Resilience Program. In 2021, Kennebunkport signed a 20-year contract to buy Maine solar energy credits for municipal electricity use. Kennebunkport is currently undertaking a comprehensive planning process in which climate change and community resilience are guiding themes throughout every plan chapter. Kennebunkport also joined the Community Resilience Partnership in 2022, a program through the State of Maine that assists communities in addressing climate change.

This greenhouse gas (GHG) inventory report establishes a baseline of GHG emissions in the Town of Kennebunkport. It identifies the activities and major sources of emissions, enabling the town to identify areas to focus emission reduction efforts, establish goals and track progress towards those goals, and facilitate decision-making about future policies and strategies.

This report contains two inventories for the Town of Kennebunkport: A *community-wide inventory* and a *municipal inventory*. These inventories were conducted by the Town of Kennebunkport and Southern Maine Planning and Development Commission. The community-wide inventory estimates the GHG emissions due to Kennebunkport's sources and activities, including those of Kennebunkport's residents, workforce, visitors, and economy. It was conducted using the methodology laid out in the SMPDC Greenhouse Gas Inventory Protocol for Southern Maine Cities and Towns. The municipal inventory accounts for the GHG emissions due to the municipal operations of the Town of Kennebunkport, including municipal buildings, vehicles, and employee activities. It was prepared using the Local Government Operations Protocol for the quantification and reporting of greenhouse gas emissions inventories.

Community-wide emissions for Kennebunkport in 2019 are estimated as 48,387 Metric Tons CO_2 equivalent (Metric Tons CO_2e; Figure A). The majority of these emissions (51.2%) come from transportation emissions sources including passenger vehicles, commercial vehicles, and marine vessels. The second largest category is stationary emissions sources (46.1%) including electricity and heating fuel use. Waste emissions from municipal solid waste and wastewater only make up 2.7% of the community-wide inventory.

Municipal emissions for 2018 are estimated as 1,204 MT CO_2e (Figure B). Estimated community-wide emissions are 4018% greater than municipal emissions. The largest sector is the Waste sector (57%), resulting from energy used in wastewater treatment as well as the direct emissions from wastewater and septic tanks. Transportation is the second largest sector (27%), resulting from municipal fleet fuel use and employee commute emissions. Stationary energy use for municipal facilities and lighting accounts for 16% of the municipal GHG inventory.

FIGURE A. KENNEBUNKPORT COMMUNITY-WIDE GHG INVENTORY GROUPED BY SUBSECTOR.

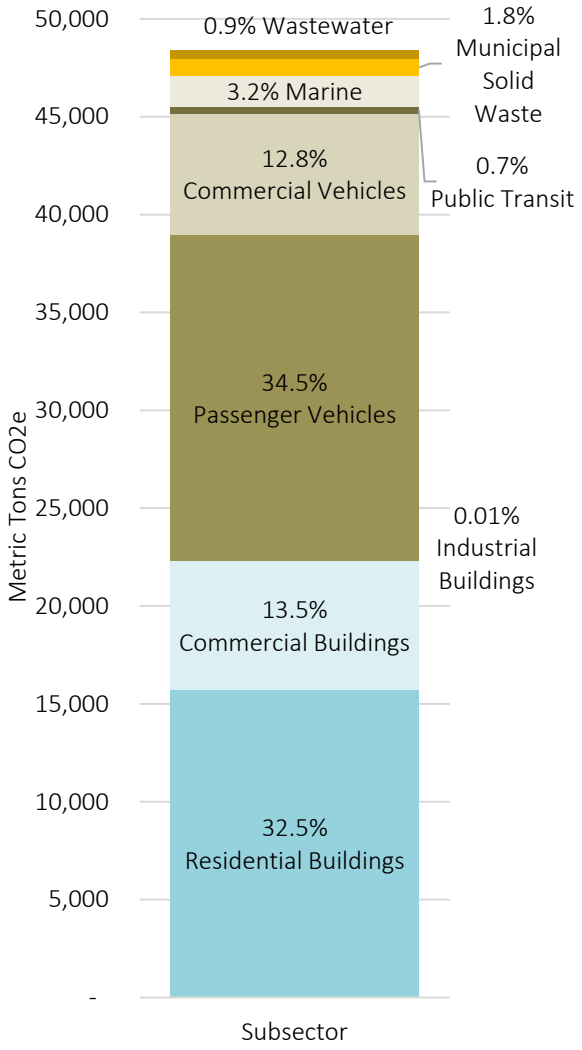
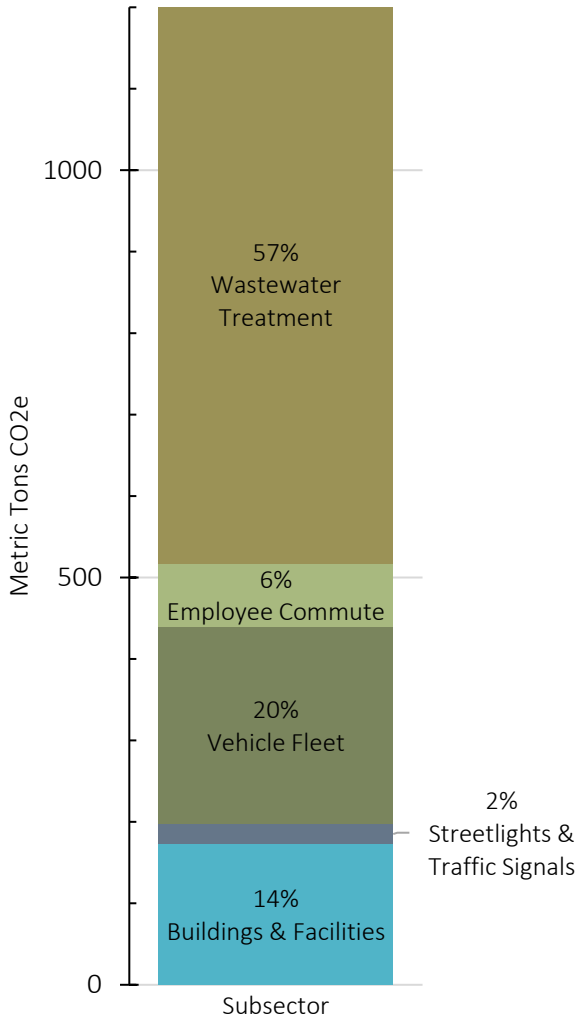


FIGURE B. KENNEBUNKPORT MUNICIPAL GHG INVENTORY GROUPED BY SUBSECTOR.



As Kennebunkport takes the next steps to set GHG reduction targets and develop a climate action plan, these inventories may be used to guide decisions about emissions reduction strategies. Key takeaways from the inventories include:

1. The largest source of community-wide GHG emissions is passenger vehicle fuel use

Passenger vehicle emissions from diesel and gasoline fuel combustion are 34.5% of Kennebunkport community-wide GHG emissions. Kennebunkport could reduce passenger vehicle emissions through encouraging EV adoption and promoting alternative transportation.

2. The second largest source of community-wide GHG emissions is residential heating fuel use, particularly heating oil use

Residential heating emissions from the combustion of home heating fuels account for 21.3% of Kennebunkport community-wide GHG emissions. Kennebunkport could explore strategies for reducing home heating fuel use by encouraging both fuel switching and energy efficiency to reduce heating needs.

3. The energy used by Kennebunkport residents, visitors, and business for transportation and building heating/electricity make up 93.4% of Kennebunkport's GHG inventory

There is no single strategy that will address the majority of Kennebunkport's GHG emissions. However, multiple strategies targeting Kennebunkport's buildings and the vehicles on its roads will have a significant impact. These strategies should consider Kennebunkport's visitors and businesses in addition to its residents.

4. A better understanding of commercial building heating fuel is needed to develop targeted strategies

This inventory provides a rough estimate of Kennebunkport's commercial heating fuel use emissions. However, a better understanding of annual discrete fuel use for building heating and other purposes at commercial buildings would help Kennebunkport develop impactful strategies for commercial building energy use.

5. Community-wide emissions are far greater than municipal emissions

Estimated community-wide emissions are 4018% greater than Kennebunkport's municipal emissions. This is important for Kennebunkport to consider when deciding how to prioritize municipal vs. community-wide emission reduction strategies. In consideration of limited time and financial resources, strategies addressing community-wide emissions might have a larger impact than those addressing municipal emissions.

6. Alternative indicators can be used to identify other strategies to reduce emissions that are not captured in the inventory

These inventories are sector-based inventories, which categorize emissions based on their source. As a result, the inventories exclude many of the lifecycle GHG emissions of the goods and services consumed by Kennebunkport's residents and economy (ex. food, clothing, electronic equipment). It is likely that the GHG emissions impact of Kennebunkport's consumption is even greater than the emission estimates reported here. Therefore, the emissions estimates presented in this report can be considered a lower bound of Kennebunkport's true impact on the generation of GHG emissions within and beyond Kennebunkport. The inventories should not limit emission reduction efforts in areas where there are known to be significant, but difficult to quantify emissions (i.e., food waste, air travel, behavioral change, etc.). Instead, alternative indicators can be used to identify strategies and measure progress on efforts that have an indirect or difficult to quantify impact on emissions.

7. Future GHG inventories can be used to evaluate Kennebunkport's progress on emission reduction efforts.

Once Kennebunkport has created a climate action plan, future community-wide and municipal inventories should be completed 2 years later (i.e., in 2025 if Kennebunkport finalizes a climate action plan in 2023) to help Kennebunkport assess progress toward identified emission reduction goals. Subsequent inventories may be conducted every 5 years to continue to monitor progress on climate action.

The Town of Kennebunkport's GHG inventories can serve as a foundation to develop a climate action plan. The Town of Kennebunkport is already taking steps to reduce municipal emissions and encourage community-wide emission reductions. The Town's contract to purchase solar energy credits for 85% of municipal electricity use will reduce municipal GHG emissions approximately 78 MT CO_2e per year, reducing municipal emissions 6.5% overall and Stationary Energy emissions by 40%. Current efforts to lease electric vehicles for the municipal fleet, to switch streetlighting over to LEDs, and to improve building energy efficiency will all help reduce municipal emissions. Future GHG inventories in two or three years may be used to evaluate Kennebunkport's progress on emissions reductions efforts and toward identified goals.

Introduction

Climate Action in Kennebunkport

As a quaint New England town with abundant natural resources and rich cultural heritage, Kennebunkport strives to foster a sustainable, resilient community for its residents, visitors, and ecosystems. A popular tourist destination, Kennebunkport has a year-round population of 3,596[1] people, with a large influx of visitors and seasonal residents over the summer months. The town consists of several small village areas, including Dock Square, Goose Rocks Beach, and Cape Porpoise, surrounded by wetlands, forest, and sandy beaches.

The Town of Kennebunkport is already experiencing the impacts of climate change, particularly from coastal flooding due to sea level rise and more frequent and more intense coastal storms. Because of these impacts and community concerns about greenhouse gas emissions, Kennebunkport has made substantial progress in laying the foundation to address both the causes and impacts of climate change. In 2019, Kennebunkport joined a coalition of six towns in coastal York County to create the SMPDC Regional Sustainability and Resilience Program. Through this program, Kennebunkport is actively participating in regional climate change assessments to understand how climate change will impact the local economy as well as the built, social, and natural dimensions of the coastal community. In 2021, Kennebunkport signed a 20-year contract to buy Maine solar energy credits for municipal electricity use. Kennebunkport is currently undertaking a comprehensive planning process in which climate change and community resilience are guiding themes throughout every plan chapter. Kennebunkport also joined the Community Resilience Partnership in 2022, a program through the State of Maine that assists communities to reduce carbon emissions, transition to clean energy, and become more resilient to climate change effects.

[1] Source: US Census, ACS 2019 5-Year Estimates.

These and future municipal climate actions are guided by the Kennebunkport Climate Change Goals and Priorities, approved by the Board of Selectmen in 2020. These goals include:

1. Establish GHG emissions inventory, target and plan
2. Ensure community resilience to climate change impacts
3. Actively engage community members in local climate, sustainability, and resilience issues
4. Create and promote a community brand featuring natural resources or cultural characteristics of community
5. Reduce municipal fossil fuel consumption and implement municipal energy efficiency measures
6. Support development of and access to renewable energy
7. Promote and practice environmentally friendly and sustainable landscape approaches
8. Practice sustainable community forest management to increase resources
9. Lead by demonstrating sustainable values and practice
10. Operate a safe, clean and efficient fleet
11. Engage the community in waste reduction and recycling

Why Greenhouse Gas Inventories Matter

The Town of Kennebunkport is already experiencing the impacts of climate change, including warmer air and ocean temperatures, shorter winters, and new pests and diseases.[2] These changes are primarily driven by an increase of carbon dioxide (CO_2) and other greenhouse gases (GHGs) in the atmosphere, largely due to the combustion and use of fossil fuels. These GHGs trap heat in the Earth's atmosphere. They let short-wave sunlight pass through the atmosphere but prevent some of the long-wave radiation emitted from the earth from leaving, thereby warming the atmosphere. As we burn more and more fossil fuels, GHGs continue to build up in the atmosphere, trapping an ever-greater amount of heat.

A greenhouse gas inventory is an account of all the GHG emissions from sources within a community. It is a tool to help communities:

- Understand ongoing activities and major sources of emissions
- Identify areas to focus emission reduction efforts
- Establish goals and track progress towards those goals
- Facilitate decision-making about future policies and strategies

[2] MCC STS. 2020. *Scientific Assessment of Climate Change and Its Effects in Maine*. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). Augusta, Maine. 370 pp. http://climatecouncil.maine.gov/future/sites/maine.gov.future/files/inline-files/GOPIF_STS_REPORT_092320.pdf

An inventory is usually calculated for a specific analysis year. Subsequent inventories every 3-5 years can aid local decision-makers and municipal staff in prioritizing and evaluating emission reduction strategies.

This report contains two inventories for the Town of Kennebunkport: A *community-wide inventory* and a *municipal inventory*. A community-wide GHG inventory estimates the amount of GHG emissions associated with community sources and activities, meaning those of a municipality's residents, workforce, visitors, and economy. A municipal GHG inventory estimates only the emissions occurring because of local government operations, including those from government buildings and facilities, government fleet vehicles, wastewater treatment and potable water treatment facilities, landfill facilities, and other operations. There are benefits and weaknesses to both types of inventories, summarized in Table 1.

Both the municipal and community-wide Kennebunkport GHG inventories presented here are *sector-based* inventories, which categorize emissions based on their source. As a result, the inventory excludes many of the direct and lifecycle GHG emissions of the goods and services consumed by Kennebunkport's residents and economy (such as food, clothing, electronic equipment, etc.). It is likely that the GHG emissions impact of Kennebunkport's consumption is even greater than the emission estimates reported here. Therefore, the emissions estimates presented in this report can be considered a lower bound of Kennebunkport's true impact on the generation of GHG emissions within and beyond Kennebunkport. The inventories can provide guidance to as to where the municipality and community may effectively direct emissions reductions efforts but should not limit emission reduction efforts in areas where there are known to be significant, but difficult to quantify emissions (i.e., food waste, air travel, behavioral change, etc.).

TABLE 1. PROS AND CONS OF COMMUNITY-WIDE AND MUNICIPAL GHG INVENTORIES

	Community-wide GHG inventory	Municipal GHG inventory
Pros	• Comprehensive view of all emissions occurring in the community • Provides insight into regulatory/educational/community emission reduction strategies • Helps set community-wide targets and strategies that can be implemented by the local government, residents, businesses, and region	• Provides clear picture of emissions directly controlled by the local government • Leads to concrete and implementable strategies for reducing municipal emissions • Easier and faster to complete
Cons	• More complex and time consuming to complete • Relies more heavily on modeled data and regional/national averages, as opposed to actual energy use data in the community	• Only a small portion of a community's overall emissions are quantified • Limited impact of resulting emission reduction strategies on community-wide emissions • Doesn't provide insight on regulatory/educational/community emission reduction strategies

What Greenhouse Gases are Included

The primary GHGs included in a GHG inventory are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Each GHG contributes differently to warming in the atmosphere, where some are far more potent than others in the same quantities.[3] Because CH_4 and N_2O absorb far more energy than CO_2 in the atmosphere, global warming potentials (GWP) are needed to account for the warming impact of each gas. A GWP is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of CO_2. To show the total emissions impact, emissions of CH_4 and N_2O are converted to metric tons of CO_2 equivalent (MT CO_2e) using each gas' GWP.

There are many other types of greenhouse gases, including perfluorocarbons, hydrofluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. This protocol does not address these gases because they occur in much smaller quantities and are difficult to estimate for community-wide and municipal sources.

Emission Scopes

GHG emissions are also categorized by scope. Scopes designate the location and control of the emissions. Emission scopes aid communities in understanding emission sources and in inventory reporting and disclosure. They are defined as follows:[4]

Scope 1 emissions are those that physically occur within the boundary of the community or municipality's operations (such as the combustion of fossil fuels for home heating).

Scope 2 emissions are those that result from energy use within the boundary of the community or municipal operations but whose emissions occur outside the boundary (such as grid-supplied electricity).

Scope 3 emissions occur outside of the community or municipal operations boundary but are driven by activities within the community (such as landfilling community waste outside the community).

[3] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

[4] Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories, Greenhouse Gas Protocol, 2014. https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

Community-wide Inventory

Overview

The community-wide inventory estimates the GHG emissions due to Kennebunkport's sources and activities, including those of Kennebunkport's residents, workforce, visitors, and economy. It was estimated using the following inventory boundaries.

Inventory Year: This inventory was calculated for all emissions activities occurring in 2019. In the case where 2019 data was not available, 2017, 2018, or 2020 data were used as a substitute. The coverage year for specific data sources is indicated in the detailed inventory in Appendix A.

Inventory Boundary: The inventory boundary is the geographic extent of Kennebunkport's jurisdictional boundary. All emissions that originated inside Kennebunkport's jurisdictional boundary are included and classified as Scope 1. All emissions that happened outside the jurisdictional boundary as a direct result of community activity within the boundary (i.e., electricity use, landfilling of waste) are also included in the inventory, but classified as either Scope 2 or Scope 3.

Methodology

This inventory was conducted using the methodology laid out in the SMPDC Greenhouse Gas Inventory Protocol for Southern Maine Cities and Towns. This is a standardized and simplified protocol for community-wide GHG inventories. The protocol is based on the 2014 Global Protocol for Community-Scale Greenhouse Gas Inventories. It is also informed by the ICLEI – Local Governments for Sustainability U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, and the Metropolitan Area Planning Council Greenhouse Gas Inventories for Massachusetts Cities and Towns. The ICLEI ClearPath reporting platform was used for emissions calculations and accounting.

Community-wide GHG emissions may be either directly created (e.g., through household heating or vehicle fuel combustion) or indirectly created (e.g., through grid electricity use) by community

members. For the inventory, emission types are divided into different sectors and subsectors. Table 2 shows the sectors and subsectors *included* in the Kennebunkport GHG inventory.

There are several sectors and subsectors of emission sources that were *excluded* from Kennebunkport's community-wide inventory (Table 3). In some cases, it is because these categories are not applicable to the Town of Kennebunkport. In others, it is because data for emissions in those categories are less readily available, are likely inaccurate given current methodologies, and/or have little relevance to municipal climate action planning.

TABLE 2. SECTORS AND SUBSECTORS **INCLUDED** IN THE KENNEBUNKPORT COMMUNITY-WIDE GHG INVENTORY.

SECTOR	SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/END USE
STATIONARY ENERGY	Residential	Energy used in buildings as well as losses from distribution systems	Electricity
		Energy used in buildings	Discrete Fuel and Natural Gas
	Commercial	Energy used in commercial, government, and institutional buildings as well as losses from distribution systems	Electricity
		Energy used in commercial, government, and institutional buildings	Discrete Fuel and Natural Gas
	Industrial	Energy used in manufacturing and industrial facilities as well as losses from distribution systems	Electricity
		Energy used in manufacturing and industrial facilities	Discrete Fuel and Natural Gas
TRANSPORTATION	Passenger Vehicles	Fuel combusted from all passenger vehicle trips that are attributable to the community	Gasoline, Diesel, Electricity
	Commercial Vehicles	Fuel combusted from all commercial vehicle trips that are attributable to the community	Gasoline, Diesel, Electricity
	Public Transit	Fuel combusted due to passenger miles travelled on public transit	Gasoline, Diesel, Electricity
	Marine Vessels	Fuel combusted by boats that are refueled at community harbors	Gasoline, Diesel
WASTE	Municipal Solid Waste - Incineration	GHG emissions resulting from the incineration of all trash generated by residential and commercial activity in the community that is sent to an incineration plant	Incineration Emissions
	Wastewater – Septic	Emissions from wastewater processed in Kennebunkport Septic Systems	Aerobic and Anaerobic Digestion
	Wastewater – Wastewater Treatment Plant	Emissions from wastewater treated at Kennebunkport WWTP	Aerobic and Anaerobic Digestion
	Wastewater- Effluent Discharge	Emissions from wastewater effluent from Kennebunkport WWTP	Aerobic and Anaerobic Digestion

TABLE 3. SECTORS AND SUBSECTORS **EXCLUDED** FROM THE KENNEBUNKPORT COMMUNITY-WIDE GHG INVENTORY.

SECTOR	SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/ END USE	REASON
TRANSPORTATION	Passenger Rail	Fuel combusted due to passenger miles travelled on passenger rail	Gasoline, Diesel, Electricity	Not applicable in Kennebunkport
	Freight Rail	Emissions from the movement of freight on rail lines through a community	Gasoline, Diesel, Electricity	Data availability, not relevant for municipalities
	Off-Road Equipment	Emissions that result from airport equipment, agricultural tractors, chain saws, forklifts, snowmobiles, etc.	Gasoline, Diesel, Electricity	Data availability
	Aviation	Fuel combusted from passenger and commercial air travel	Jet Fuel	Data availability
WASTE	Municipal Solid Waste - Landfilling	Landfill gas emissions resulting from all trash generated by residential and commercial activity in the community and sent to landfill	Landfill Gas	Not applicable in Kennebunkport
	Compost	GHG emissions resulting from the breakdown of all composted material generated by residential, commercial, and schools	Aerobic and Anaerobic Digestion	Data availability, methodology
INDUSTRIAL	Industrial Process Emissions	Process and fugitive emissions from industrial facilities	Combustion and other Chemical Emissions	Data availability
	Product Use	Emissions from the use of products such as refrigerants, foams, or aerosol cans	Combustion and other Chemical Emissions	Data availability
AGRICULTURE, FORESTRY, MARINE	Livestock	Emissions from manure management and enteric fermentation	Enteric fermentation and manure management	Data availability
	Land	Emissions and sequestration of GHGs from land use changes	Soil and Land Management Changes	Data availability, methodology

Collecting the data

Community-wide emissions are calculated for each activity by multiplying activity data (e.g., fuel consumption) by the corresponding emission factors (e.g., tons CO_2 emitted per gallon of fuel combusted). The quality and availability of fuel consumption data varies across sectors and subsectors. This inventory is based on the highest quality data available according to the following hierarchy:

1. Real consumption data for each fuel type or activity, disaggregated by subsector.
2. A representative sample set of real consumption data from surveys.
3. Modeled energy consumption/activity data.
4. Regional or national fuel consumption data scaled down using population or other indicators.

The quality of available data may reduce the confidence in the GHG emissions estimate for some subsectors of emissions. Similarly, the current scientific understanding and/or simplifications that must be made may also reduce confidence in the emissions factors used to convert activity data to emissions estimates (particularly for waste and electricity end uses as well as transmission and distribution losses). To provide a broad measure of these uncertainties, the level of confidence of the data quality in each subsector is indicated as either low, medium, or high according to the guidelines provided in the 2014 Global Protocol for Community-Scale Greenhouse Gas Inventories (Table 4).

TABLE 4. DATA QUALITY DESCRIPTIONS FROM TABLE 5.3 IN 2014 GLOBAL PROTOCOL FOR COMMUNITY-SCALE GREENHOUSE GAS INVENTORIES.

Data Quality	Activity Data	Emission Factor
High	Detailed activity data	Specific emission factors
Medium	Partial or modeled activity data using robust assumptions	More general emission factors
Low	Highly-modeled or uncertain activity data	Default emission factors

Inventory

Summary

Figure 1 summarizes Kennebunkport's 2019 community-wide GHG inventory. Community-wide emissions for 2019 were estimated as 48,387 Metric Tons CO_2 equivalent (Metric Tons CO_2e). The majority of these emissions (51.2%) came from transportation emissions sources including on-road and marine emissions. Stationary emissions were the second largest sector at 46.1% of the total emissions inventory. Waste emissions from municipal solid waste and wastewater only made up 2.7% of the inventory.

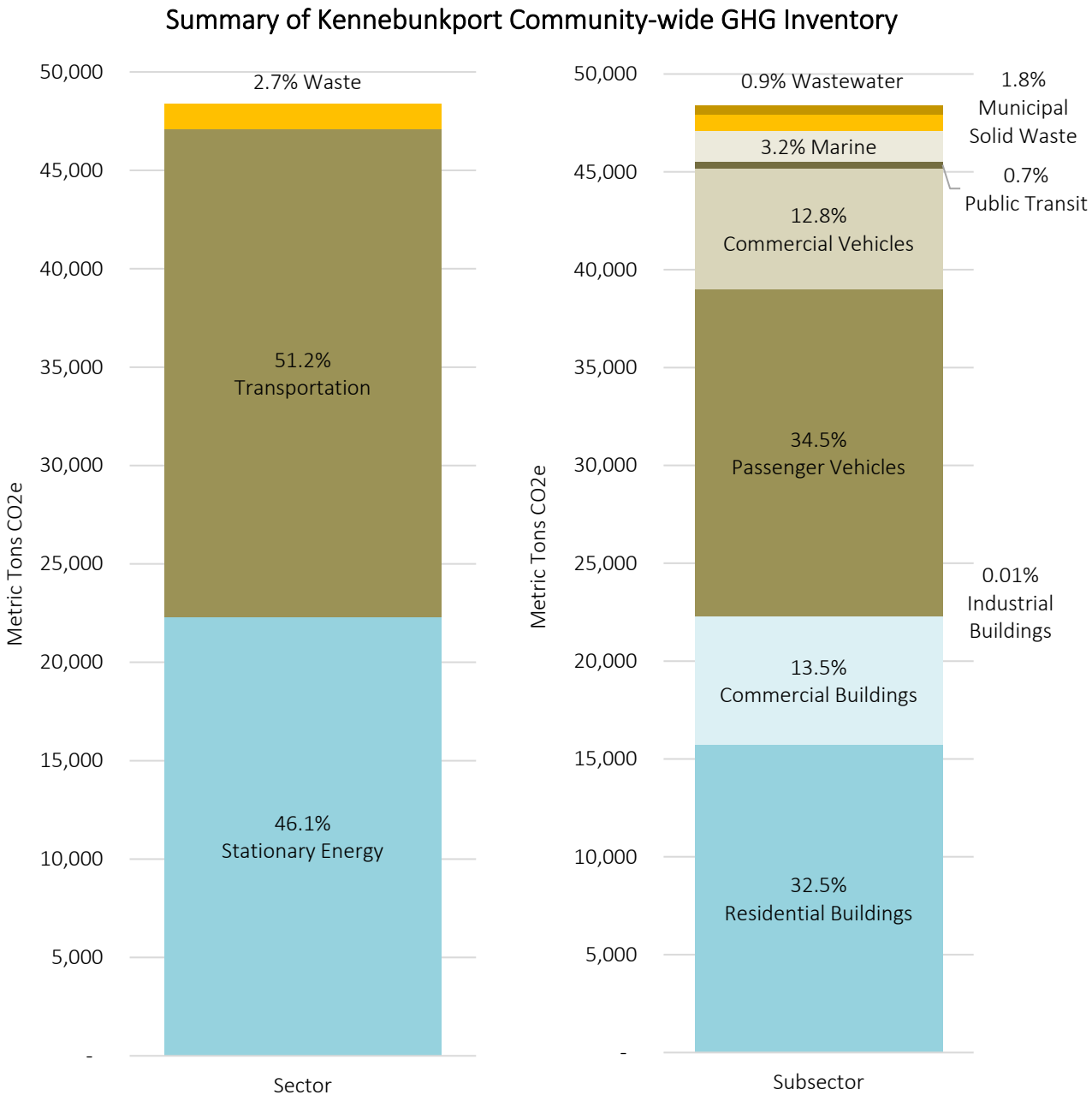


FIGURE 1. KENNEBUNKPORT COMMUNITY-WIDE GHG INVENTORY GROUPED BY SECTOR (LEFT GRAPH) AND SUBSECTOR (RIGHT GRAPH)

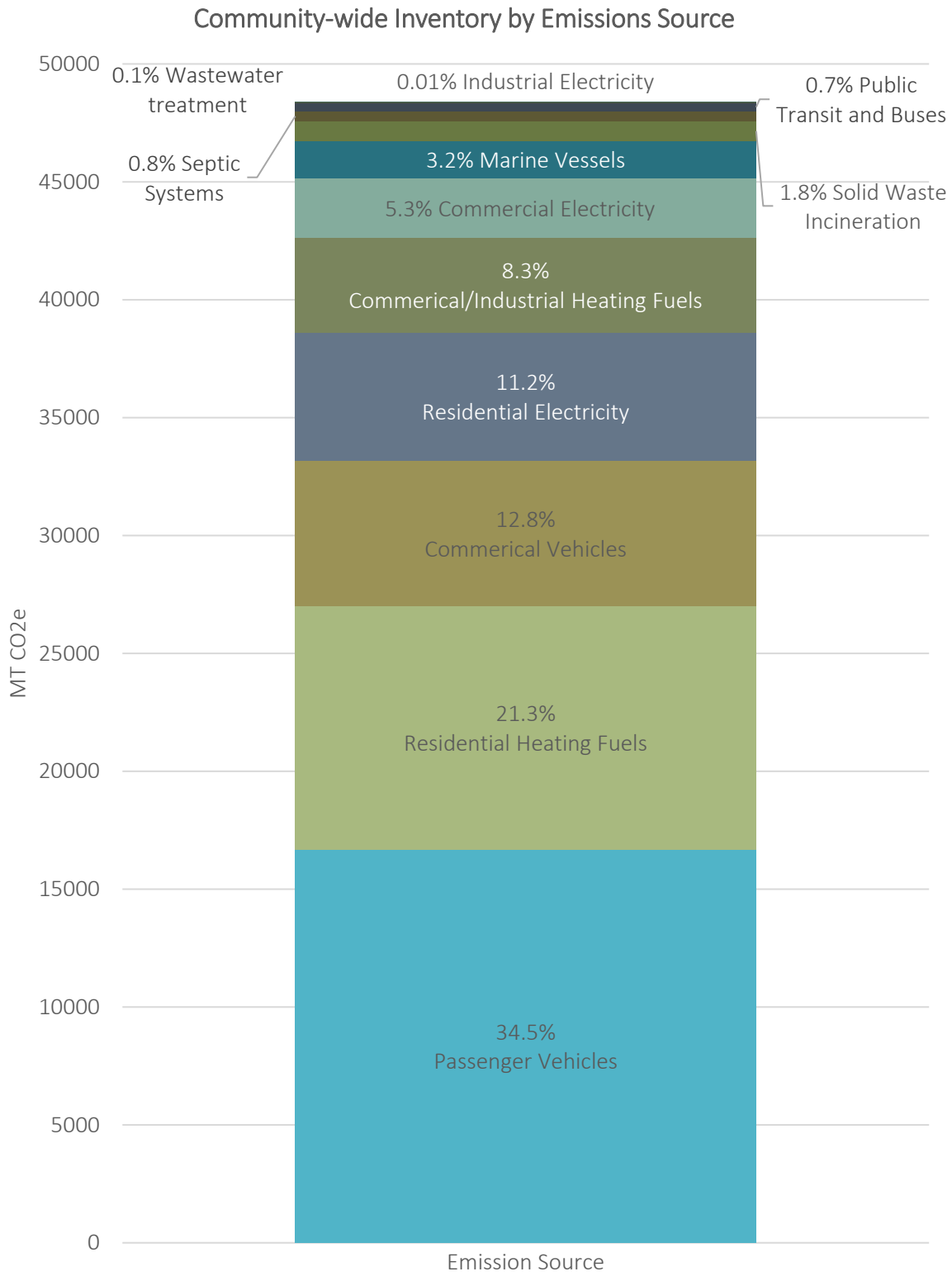


Figure 2. Emissions grouped by end use or emission source.

Figure 2 shows emissions grouped by end use or emission source. Passenger vehicle emissions from diesel and gasoline fuel combustion is the largest source of emissions (34.5%), followed by Residential heating emissions from the combustion of home heating fuels. Together, these two emission sources account for over 55% of the emissions inventory. The next highest emissions sources are commercial vehicle emissions and residential electricity use, 12.8% and 11.2% respectively. These are followed by commercial heating fuel used for building heating (8.3%) and commercial building electricity use (5.3%). Together, these categories represent the energy Kennebunkport residents, visitors, and businesses use for transportation, electricity, and heating, and make up 93.4% of Kennebunkport's community-wide GHG inventory.

When allocated based on year-round resident population, the Kennebunkport Community-wide GHG emissions are estimated as 13.5 MT CO_2e per capita. However, this measure does not necessarily paint a realistic picture of emissions per person. First, many of the emissions from building electricity use, heating fuel use, and transportation are the result of the activities of seasonal residents and tourists who are not included in the year-round resident population. Second, because the community-wide inventory is a *sector-based* inventory, it excludes many of the direct and lifecycle GHG emissions of the goods and services consumed by Kennebunkport's residents and visitors (such as food, clothing, electronic equipment, etc.). Though it is difficult to quantify the true GHG emission impact of each Kennebunkport resident, visitor, or employee, emission reduction strategies should be developed to target each of these populations rather than just residents alone.

Stationary Energy

The Stationary Energy sector includes GHG emissions resulting from energy use by buildings and industries. It includes the direct emissions from the combustion of fossil fuels (Scope 1) and the indirect emissions from the consumption of grid-supplied electricity (Scope 2). It also includes the losses from the transmission and distribution systems of grid-supplied electricity and natural gas (Scope 3). Data Sources for Kennebunkport's Stationary Energy sector are presented in Table 5.

Kennebunkport's Stationary Energy emissions are 22,298 MT CO_2e, 46.1% of all community-wide emissions. Overall, the residential subsector (i.e., building heating and cooling) is responsible for 70.61% of Kennebunkport's Stationary Energy emissions. (Figure 3 and Table 6). Residential discrete fuel use for home heating, including heating oil, propane, wood, and natural gas, is the largest source of Stationary Energy emissions. Combined, discrete fuel end uses account for 46.24% of Stationary Energy emissions and 21.3% of all community-wide emissions. Heating oil is the most common residential heating fuel and is the largest emissions source in the Stationary Energy Sector (28.86%). The second largest end use in the stationary sector is residential electricity use (23.19%)

Due to data limitations, commercial and industrial discrete fuel use are combined in Kennebunkport's GHG inventory. Together, commercial/industrial discrete fuel use are the third largest source of emissions in the stationary energy category, accounting for 17.94% of emissions. Because commercial electricity emissions are much larger than industrial electricity emissions, it is likely that most commercial/industrial discrete fuel emissions come from commercial buildings as well.

TABLE 5. STATIONARY ENERGY SUBSECTORS AND DATA SOURCES

SUBSECTOR	EMISSIONS SOURCES	END USE/ENERGY TYPE	SCOPE	DATA SOURCE	DATA QUALITY
RESIDENTIAL	Energy used in buildings as well as losses from distribution systems	Electricity	2 and 3	Real consumption data from Central Maine Power (CMP)	High (use) Low (losses)
	Energy used in buildings	Discrete Fuel and Natural Gas	1	Scaled down fuel consumption data from state datasets	Low
COMMERCIAL	Energy used in commercial, government, and institutional buildings as well as losses from distribution systems	Electricity	2 and 3	Real consumption data from Central Maine Power (CMP)	High (use) Low (losses)
	Energy used in commercial, government, and institutional buildings	Discrete Fuel and Natural Gas	1	Scaled down fuel consumption data from state datasets. Includes industrial discrete fuel use	Low
INDUSTRIAL	Energy used in manufacturing and industrial facilities as well as losses from distribution systems	Electricity	2 and 3	Real consumption data from Central Maine Power (CMP)	High (use) Low (losses)

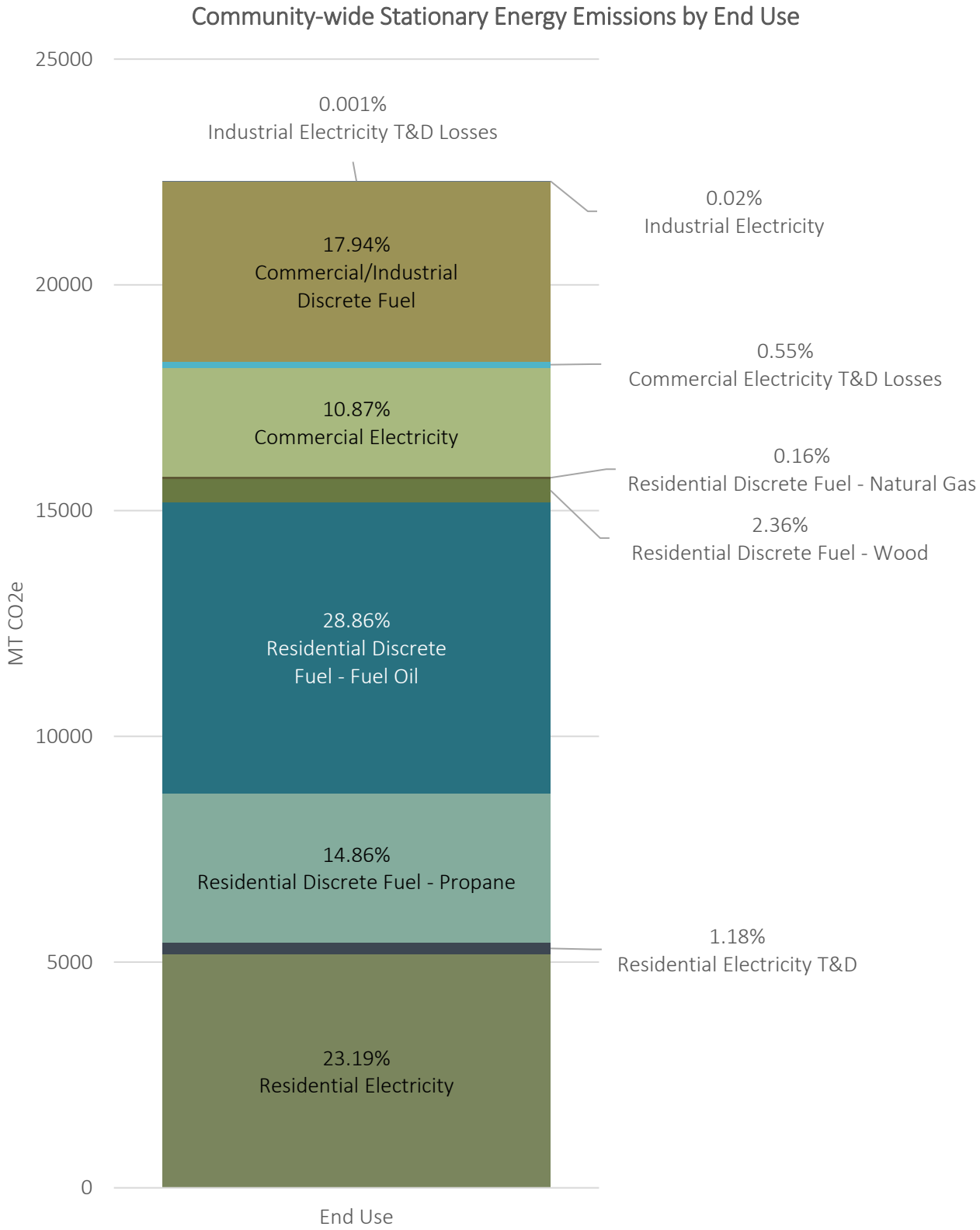


FIGURE 3. SUMMARY OF STATIONARY EMISSIONS FOR KENNEBUNKPORT COMMUNITY-WIDE GHG INVENTORY.

TABLE 6. STATIONARY EMISSIONS BY END USE AND SUBSECTOR.

End Use and subsector	Emissions (MT CO_2e)	Percent of stationary emissions (%)
Residential Electricity	5171	23.19%
Residential Electricity T&D Losses	264	1.18%
Residential Discrete Fuel - Propane	3313	14.86%
Residential Discrete Fuel - Fuel Oil	6435	28.86%
Residential Discrete Fuel - Wood	527	2.36%
Residential Discrete Fuel - Natural Gas	36	0.16%
Commercial Electricity	2424	10.87%
Commercial Electricity T&D Losses	124	0.55%
Commercial/Industrial Discrete Fuel	4001	17.94%
Industrial Electricity	4	0.02%
Industrial Electricity T&D Losses	0.2	0.001%

Data Quality Considerations

While data quality for electricity is high, data quality for discrete fuel use is low. This is because the discrete fuel use estimates are based on statewide energy use data and national survey results. For example. According to the region's natural gas provider Unitil, there are no natural gas customers in Kennebunkport. However, the American Community Survey results used for this analysis estimates that nine Kennebunkport homes use natural gas for their primary heating fuel. Similarly for commercial and industrial buildings, there is no available data on the discrete fuels used in Kennebunkport. Because of this, the analysis assumes that all Kennebunkport commercial/industrial buildings use fuel oil as their primary heating source, whereas in reality some may use propane or other heating sources. Despite the lack of high-quality data, it is clear that discrete fuel use is a significant source of emissions for the Town of Kennebunkport that may be targeted through local emission reduction strategies.

Transportation

The Transportation sector includes emissions from all on-road transportation sources, including passenger vehicles, commercial vehicles, and public transit. It also includes emissions from marine vessels. Due to limited data availability or lack of applicability, it excludes emissions from freight rail, passenger rail, off-road equipment, and aviation. There is currently no quality data source for freight rail or off-road equipment for Maine communities. Passenger rail emissions are not relevant to the Town of Kennebunkport where there is no passenger rail service. Aviation emissions are excluded as well due to lack of data. Data Sources for Kennebunkport's Transportation sector are presented in Table 7 and emissions estimates are presented in Figure 4 and Table 8.

On-road transportation emissions were calculated using modelled vehicle milage data and regional vehicle population data. This methodology is detailed in the report, Estimating On-Road Transportation Emissions in York County, Maine. Under this methodology, the emissions estimate is based on all trips that occur because of people travelling to, from, and within a community. It specifically excludes emissions from vehicles that pass through – but do not stop in – the community. On-road transportation emissions are divided into scope 1 emissions (those miles driven within Kennebunkport's jurisdictional boundary) and scope 3 emissions (those miles driven outside of Kennebunkport's jurisdictional boundary).

Emissions from Transportation sources are estimated as 24,789 $MTCO_2e$, 51.2% of all community-wide emissions. Emissions from passenger vehicles account for most transportation emissions (67.2%). Passenger vehicle emissions from both gasoline and diesel fuel use are the largest single source of emissions in the community-wide inventory, accounting for 34.5% of community-wide emissions. High passenger vehicle emissions are common for most Maine communities. Throughout southern Maine, high community passenger vehicle emissions are due to the high daily travel volumes of passenger vehicles, as well as the dominance of low fuel efficiency SUVs and light-duty trucks in the region's vehicle population. Commercial vehicles were the second largest source of emissions (25.0%). Together emissions from marine gasoline and diesel fuel sold at Kennebunkport's docks and marinas make up 6.3% of transportation emissions. Public transit only accounted for a small fraction (1.5%) of the transportation emissions. Emissions from the public transit subsector likely come from school buses and tour or charter buses, as there are no public bus services in Kennebunkport. The small

number of electric vehicles (EVs) in the regional vehicle population (<1% of vehicles) has a negligible impact on the transportation emissions.

TABLE 7. TRANSPORTATION EMISSIONS SUBSECTORS AND DATA SOURCES.

SECTOR	SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE	SCOPE	DATA SOURCE	DATA QUALITY
TRANSPORTATION	Passenger Vehicles	Fuel combusted from all passenger vehicle trips that are attributable to the municipality	Gasoline, Diesel, Electricity	1 and 3	Modeled energy consumption/activity data based on real activity data	Medium
	Commercial Vehicles	Fuel combusted from all commercial vehicle trips that are attributable to the municipality	Gasoline, Diesel, Electricity	1 and 3	Modeled energy consumption/activity data based on real activity data	Medium
	Public Transit	Fuel combusted due to passenger miles travelled on public transit	Gasoline, Diesel, Electricity	1 and 3	Modeled energy consumption/activity data based on real activity data	Medium
	Marine Vessels	Fuel combusted by boats that are refueled at community docks and marinas	Gasoline, Diesel	1	Fuel sale records from Cape Porpoise and Chicks Marina	High

TABLE 8. TRANSPORTATION EMISSIONS BY SUBSECTOR.

Subsector	Emissions (MT CO_2e)	Percent of transportation emissions (%)
Passenger Vehicles	16693	67.2%
Commercial Vehicles	6185	25.0%
Public Transit	360	1.5%
Marine Diesel	1107	4.5%
Marine Gasoline	445	1.8%

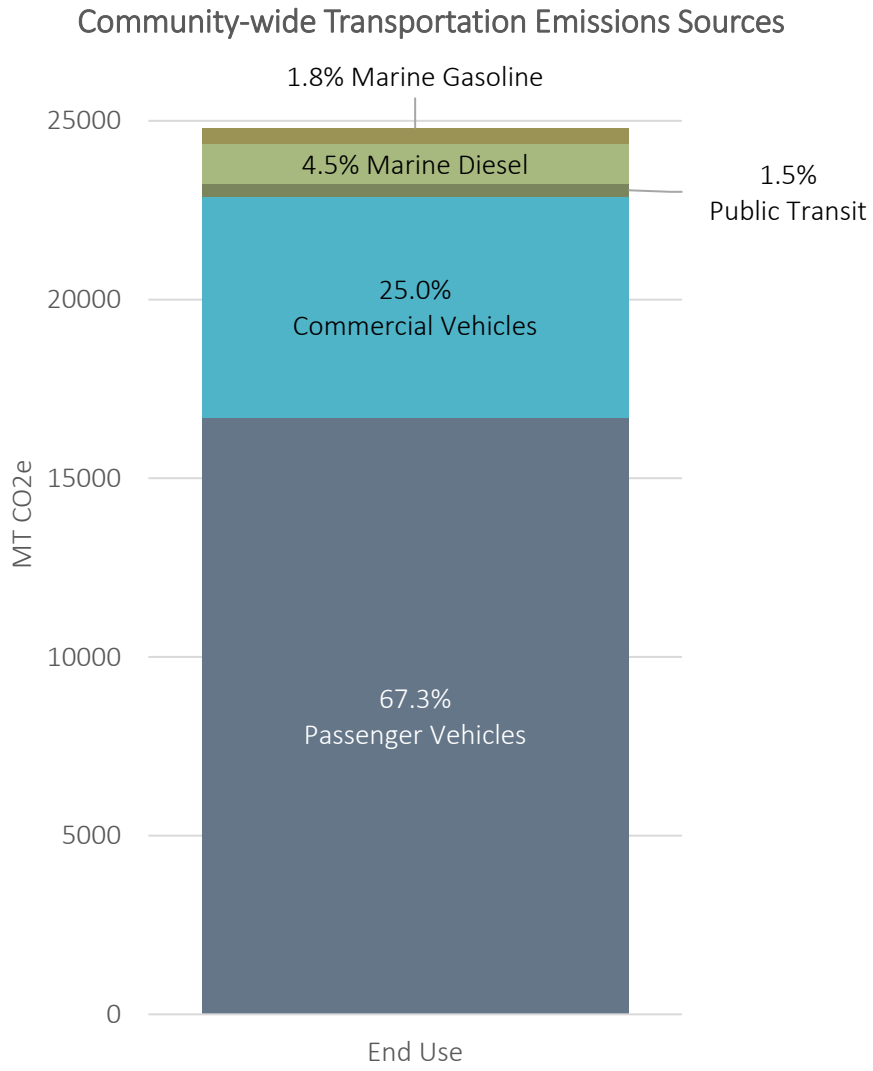


FIGURE 4. SUMMARY OF TRANSPORTATION EMISSIONS FOR KENNEBUNKPORT'S COMMUNITY-WIDE GHG INVENTORY.

Data Quality Considerations

SMPDC's approach to modelling vehicle miles traveled using Streetlight Data allows for a fuller and more accurate measure of on-road transportation emissions assigned to the Town of Kennebunkport. However, without the inclusion of other forms of transportation, the picture of Kennebunkport's transportation emissions remains incomplete. Aviation is likely a significant source of Scope 3 emissions from the air travel of Kennebunkport's residents and visitors. Aviation emissions may be estimated using a community-wide survey question asking about annual air travel by residents. An alternative metric for understanding the impact of aviation emissions could be the average or median number of flights flown by Kennebunkport residents each year. Off-road transportation emissions are also likely relevant but might be harder to ascertain without regional or state-wide data.

Waste

The management of solid waste and wastewater results in GHG emissions through the decay of waste with biologic constituents or the burning of waste. The Waste sector includes all emissions from the disposal and treatment of waste generated within the Town of Kennebunkport, whether treated inside or outside of the municipal boundary. Data sources for Kennebunkport's Waste sector are presented in Table 9. The Town of Kennebunkport disposes of municipal solid waste (MSW) through incineration, composting, and recycling. MSW – Incineration emissions include those from trash generated by residents that is picked up curbside and transferred to the EcoMaine waste-to-energy plant in Portland, Maine. Avoided emissions from composting and recycling excluded from this inventory because they are minimal and difficult to quantify. Wastewater treatment emission sources in Kennebunkport include septic systems, the Kennebunkport Wastewater Treatment Plant, and effluent discharge from the Kennebunkport Wastewater Treatment Plant.

Figure 5 and Table 10 show the emission estimates for the Waste sector. Waste emissions are estimate as 1,300, making up just 2.7% of Kennebunkport's community-wide GHG emissions. Most Waste emissions (66.0%) are from the incineration of municipal solid waste. The second largest waste subsector is septic system emissions (31.1%). Greenhouse gas emissions per septic system far exceed emissions per sewer connection. In Kennebunkport, the emissions per septic system are 0.27 $MTCO_2e$ (resulting from methane production during the break down of waste). In comparison, wastewater emissions per sewer connection are 0.02 MT CO_2e, greater than thirteen times less than for a septic system.

TABLE 9. WASTE EMISSIONS SUBSECTORS AND DATA SOURCES.

SECTOR	SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE	SCOPE	DATA SOURCE	DATA QUALITY
WASTE	MSW - Incineration	Emissions resulting from the incineration of all trash generated by residential activity in the community that is sent to an incineration plant	Incineration Emissions	3	Kennebunkport curbside tonnage and EcoMaine emissions data from EPA	Medium
	Wastewater - Septic	Emissions from wastewater processed in septic systems	Aerobic and Anaerobic Digestion	1	Modeled emissions data based on number of septic systems	Low
	Wastewater - Wastewater Treatment Plant	Emissions from wastewater treated at Kennebunkport WWTP	Aerobic and Anaerobic Digestion	1	Modeled emissions data based on number of sewer connections and population	Low
	Wastewater-Effluent Discharge	Emissions from wastewater effluent from Kennebunkport WWTP	Aerobic and Anaerobic Digestion	1	Modeled emissions data based on number of sewer connections and population	Low

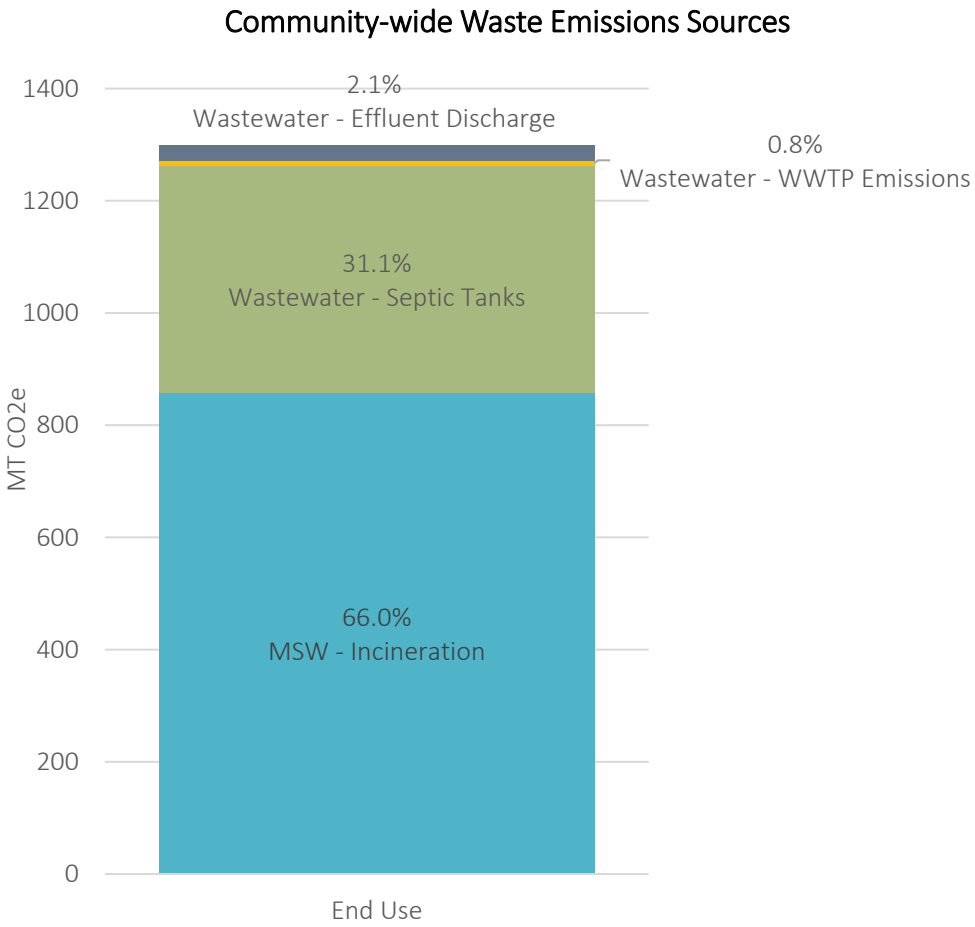


FIGURE 5. SUMMARY OF WASTE EMISSIONS FOR KENNEBUNKPORT'S COMMUNITY-WIDE GHG INVENTORY.

TABLE 10. WASTE EMISSIONS BY SUBSECTOR.

Subsector	Emissions (MT CO_2e)	Percent of Waste emissions (%)
MSW - Incineration	858	66.0%
Wastewater – Septic Tanks	404	31.1%
Wastewater - WWTP	10	0.8%
Wastewater - Effluent Discharge	27	2.1%

Data Quality Considerations

Emissions data from waste tend to be low quality due to both lack of activity data and uncertainty in emissions calculations. Because municipalities are responsible for transfer stations, residential waste options, and wastewater treatment plants, they often have good records of residential MSW and wastewater volumes. However, it is often unclear how much of the commercial and industrial waste streams are captured in municipal MSW. To get a clearer picture of commercial waste volumes, Kennebunkport could survey businesses about their waste volumes and management practices.

Additional Indicators of Climate Action

The process of calculating and inventorying GHG emissions from community-wide activities is a vital step for communities to understand the sources of their emissions and identify priority actions for reducing emissions. But due to the need to sometimes rely on statewide, national, or modelled data for GHG inventories, it can be hard to quantify the specific impact of mitigation efforts on the emissions calculated in the inventory. This is especially true for those efforts that have an indirect impact on emissions, such as activities like educating residents and businesses about renewable energy or community building and environmental justice initiatives. These are critical activities that research has shown are vital to driving down GHG emissions across many sectors.

Additional Indicators of Climate Action are alternative metrics that may be used to develop emissions reduction initiatives and set measurable goals without the need to quantify their impact in MT CO_2e. These additional indicators support Kennebunkport's community-wide inventory and provide a broader picture of climate action within the community.

Stationary Energy

Indicators for stationary energy can help guide community efforts to increase energy efficiency and reduce reliance on fossil fuels in homes and businesses.

Heat pump and weatherization rebates

The number of heat pump and weatherization rebates show how many residents are taking advantage of Efficiency Maine programs to increase energy efficiency and decrease fossil fuel use. Overall, Kennebunkport residents have claimed 186 heat pump rebates and 81 weatherization rebates from 2014-2020. Heat pump rebates have steadily increased since 2016, while weatherization rebates have decreased each year since 2017. The most popular weatherization rebates are those for air sealing and attic insulation followed by basement insulation.

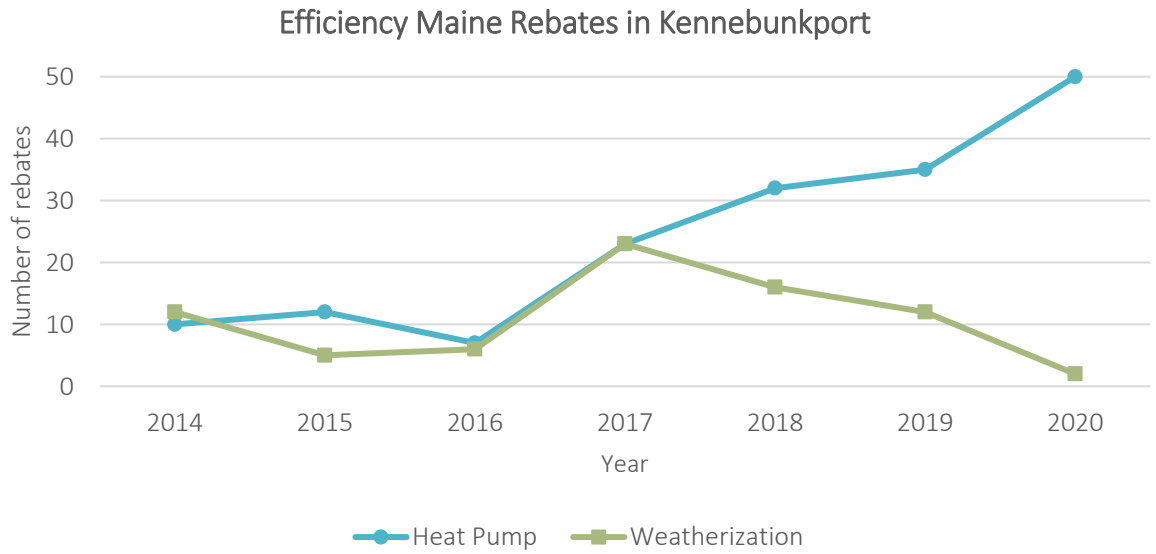


FIGURE 6. NUMBER OF EFFICIENCY MAINE HEAT PUMP AND WEATHERIZATION REBATES CLAIMED BY RESIDENTS OF THE TOWN OF KENNEBUNKPORT.

Electricity use per household

Tracking the electricity use per household can help Kennebunkport set goals for energy efficiency. Average annual household electricity use for the Town of Kennebunkport was 7,427 KWH per year for 2017-2019. This is lower than the U.S. national average of 10,715 KWH per year in 2020, likely due to lower reliance on air conditioning in Kennebunkport compared to the U.S. average. It is higher than the Maine statewide average of 6,840 KWH per year in 2020[5].

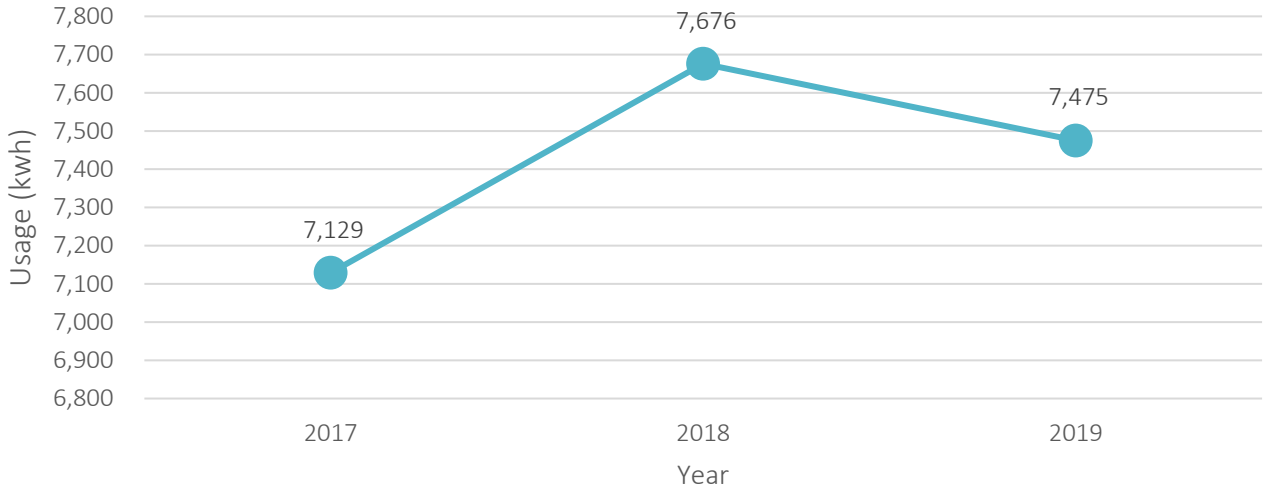


FIGURE 7. AVERAGE ANNUAL HOUSEHOLD ELECTRICITY USAGE FOR THE TOWN OF KENNEBUNKPORT. DATA OBTAINED FROM CENTRAL MAINE POWER.

Household energy burden

Kennebunkport can track the impact of initiatives to support accessible renewable energy and energy efficiency measures by tracking the energy burden (percentage of household income devoted to energy expenditures) of average and low-income households. An energy burden over 10% is considered severe, while an energy burden of 6% to 10% is considered high. Household energy burden data is provided by U.S. Department of Energy's Low-income Energy Affordability (LEAD) Tool. According to the LEAD tool analysis, across all income levels, the energy burden in Kennebunkport is higher than Maine average. Kennebunkport households making less than 80% of the State Median Income (SMI; i.e., less than $46,334, 80% of the 2015-2019 State Median Income of $57,918[6]) face a severe energy burden. In Kennebunkport, approximately 30% of households make less than $46,334 and face a severe average energy burden. Approximately 6.4% of Kennebunkport households fall into the lowest category (0-30% SMI) and face an extreme average energy burden of 44%.

It is difficult to tell whether the extreme energy burden reported by the LEAD tool is an accurate representation of the true energy burden placed on Kennebunkport's residents. The LEAD tool relies on U.S. Census housing data from American Community Survey (ACS) 5-year estimates, which may not

[5] Source: https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf
[6] Source: American Community Survey – 2019: ACS 5-year estimates income in the past 12 months

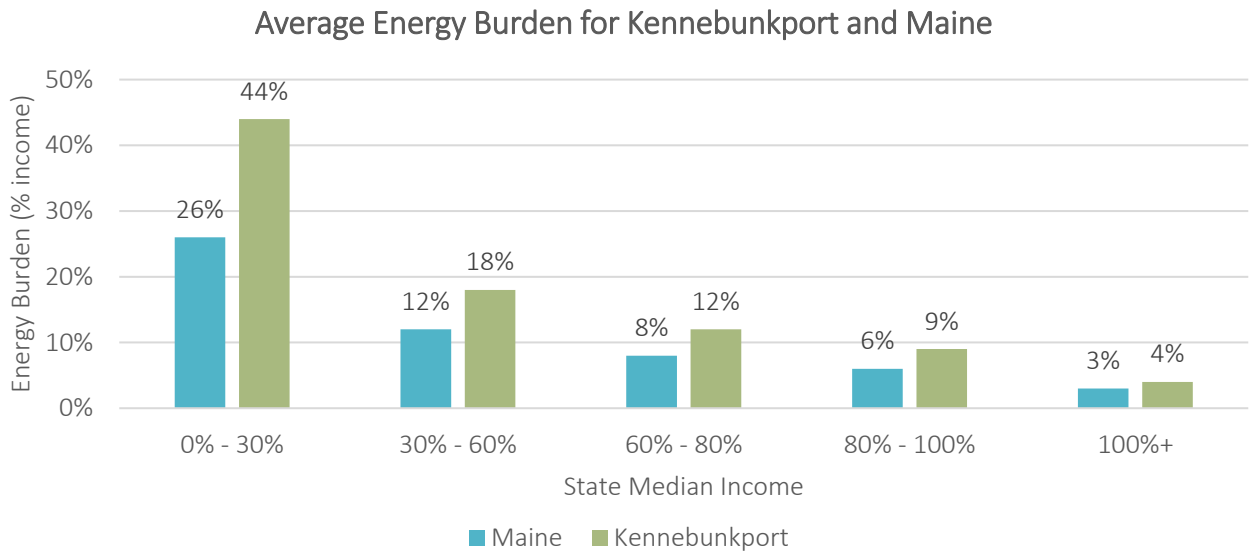


FIGURE 8. AVERAGE ENERGY BURDEN BY INCOME FOR THE STATE OF MAINE AND KENNEBUNKPORT. ENERGY BURDEN IS REPRESENTED BY THE PERCENTAGE OF A HOUSEHOLD'S ANNUAL INCOME THAT IS SPENT ON ENERGY-RELATED EXPENDITURES (HEATING FUEL AND ELECTRICITY). DATA OBTAINED FROM THE U.S. DEPARTMENT OF ENERGY'S LOW-INCOME ENERGY AFFORDABILITY TOOL.

have a high number of responses from a small town such as Kennebunkport. Additionally, Kennebunkport's high number of retirees and seasonal residents might impact how income is reported for a large portion of the population. Nonetheless, this data highlights the financial burdens of energy use and the potential to reduce energy costs and fossil fuel emissions simultaneously, particularly for Kennebunkport's lower income residents.

Transportation

Indicators for transportation can help the community track efforts to increase electric vehicle adoption, walk/bike-ability, and use of public transit.

Number of EVs and hybrids in local vehicle population

The number of electric vehicles (EVs) and hybrids registered in Kennebunkport may be used to track community efforts to increase the number or residents or businesses driving EVs. Different types of EVs and hybrids include:

- **Battery Electric Vehicle (BEV)** - A full all electric vehicle that runs strictly on a battery system that must be charged with a plug.
- **Plug-in Electric Vehicle (PHEV)** - Can be operated with both gasoline and electricity from a battery system that must be charged by plugging it in. Some plug-in models can travel over 70 miles on electricity alone. All plug-in models can operate solely on gasoline when necessary.
- **Hybrid Electric Vehicle (HEV)** - A hybrid car is fueled strictly by gasoline. Electrification technology is used to recapture some energy during braking and store it as electricity which it uses to help power the car at very low speeds and stops. Hybrids are not plugged in.

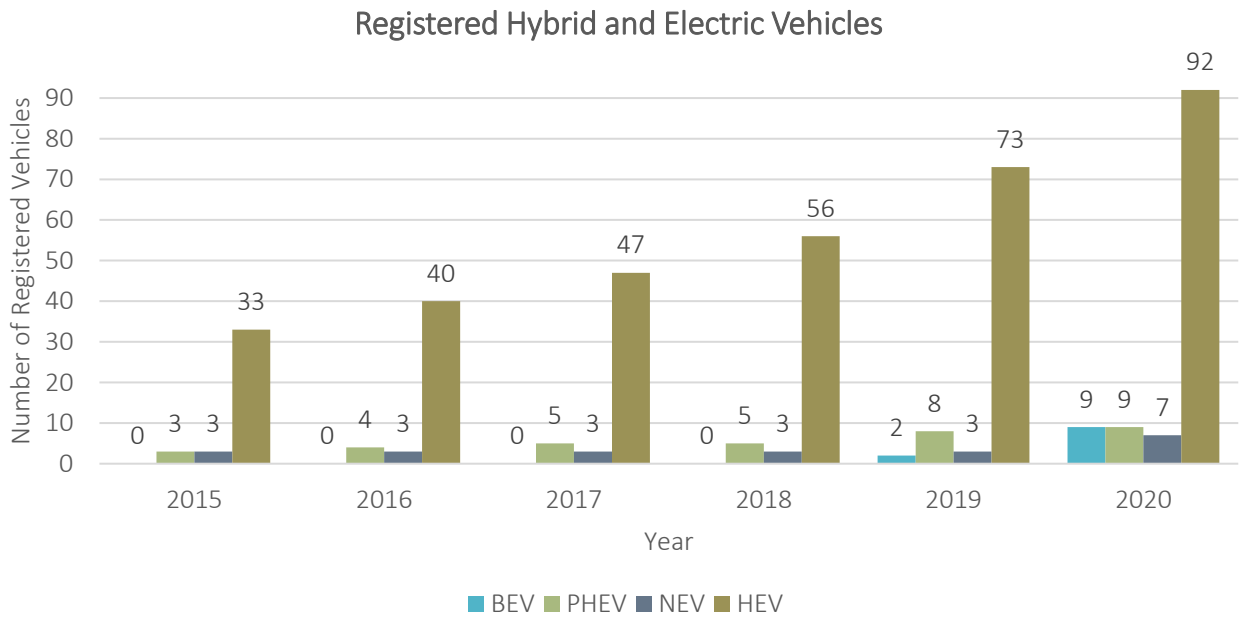


FIGURE 9. NUMBER OF ELECTRIC VEHICLES (EVS) AND PLUG-IN HYBRID ELECTRIC VEHICLES (PHEVS) REGISTERED IN THE TOWN OF KENNEBUNKPORT BY YEAR. DATA OBTAINED FROM THE MDEP VEHICLE POPULATION AND GREENHOUSE GAS DATA PORTAL.

- **Neighborhood Electric Vehicle (NEV)** - Are full battery electric car capable of traveling at low speeds generally around 25 miles per hour (mph). NEV's must be plugged in to recharge.

From 2015 to 2019, the number of hybrid vehicles registered in Kennebunkport increased from 33 to 92 vehicles (280%). The number of registered PHEVs increased from three to nine. There were no BEVs registered in Kennebunkport from 2015-2018. In 2019 there were two registered BEVs and in 2020 there were nine registered BEVs. In 2020, EVs and PHEVs made up **less than 1%** of Kennebunkport's registered vehicle population (18 of 4,074 vehicles total). Standard hybrid cars make up 2.3% of Kennebunkport's 2020 vehicle population.

Number of public EV charging stations

Kennebunkport's accessibility to EV drivers may be estimated based on the number of public EV charging stations. There are ten public EV charging locations in Kennebunkport as of March 2022. The town provides a free public charging location at the Fire Administration Building near the North Street public parking lot. All other public charging stations are located at tourist-serving businesses such as hotels and restaurants. While many offer free charging, some locations do require a charging fee.

Average commutes

The average commute of residents and local employees can help to track initiatives to improve workforce/affordable housing as well as remote work initiatives. According to the American Community Survey, the 5-year average commute for Kennebunkport residents in 2019 was 24.9 minutes. This is slightly higher than the Maine average commute of 24.2 minutes and lower than the U.S. average commute of 27.6 minutes. It is a decrease from previous years – the 5-year average commute was 28.9 minutes in 2018, and 30 minutes in both 2017 and 2016.

Waste

Municipal solid waste disposal and wastewater treatment only account for 2.7% of Kennebunkport's emissions. However, reducing, reusing, and recycling waste are vital strategies for reducing or avoiding emissions from the consumption of goods and foods which have impacts beyond Kennebunkport's waste sector of the GHG inventory. Indicators for waste management can help Kennebunkport track efforts to reduce consumption and increase waste diversion.

Percentage of Municipal Solid Waste recycled

Recycling prevents waste from entering the landfill and reduces the production of new materials. The town of Kennebunkport has a long history of offering curbside recycling. However, changes to the recycling market caused Kennebunkport to drop curbside recycling in 2019. Through the work of dedicated staff and volunteer committee members, Kennebunkport negotiated a new recycling contract and began offering curbside recycling to residents in January 2021. According to town records, 13% by weight of curbside waste was recycled in 2021.

Composting programs

Composting is an effective way to eliminate waste, and in particular food waste, from the MSW stream. There is currently no curbside composting service offered in Kennebunkport. The town does manage a home composting educational program called the Lobster Trap Compost Bin Program. The program provides a free backyard composter and kitchen food scraps pail to interested Kennebunkport residents.

Municipal Inventory

Overview

The municipal inventory accounts for the GHG emissions due to the municipal operations of the Town of Kennebunkport, including municipal buildings, vehicles, and employee activities. It was estimated using the following inventory boundaries.

Inventory Year: This inventory was calculated for all emissions activities occurring in 2018. In the case where 2018 data was not available, 2017, 2019, or 2020 data were used as a substitute. The data coverage year for specific data sources are indicated in the detailed inventory in Appendix B.

Inventory Boundary: The boundary of this inventory is Kennebunkport's operational control boundary. This includes any emissions sources that the municipality has full authority over their operating policies. All emissions that occur from sources owned or operated by the municipality are included and classified as Scope 1. All emissions that happen indirectly as a result of municipal activities (i.e., electricity and employee commute) are also included in the inventory but are classified as either Scope 2 or Scope 3. Emissions from non-municipal public buildings (such as the Cape Porpoise Library, Grave Memorial Library, and the Kennebunkport Consolidated School) are excluded from the municipal emissions inventory.

Methodology

This inventory was originally conducted by Sarah Merriam, a summer intern from St. Michaels College, in 2019. The inventory has been updated and expanded upon for this report. It was prepared using the Local Government Operations Protocol for the quantification and reporting of greenhouse gas emissions inventories. Developed in partnership by the California Air Resources Board, California Climate Action Registry, and ICLEI – Local Governments for Sustainability, the protocol provides step-by-step guidance on developing a municipal GHG inventory.

Municipal GHG emissions may be either directly created (e.g., through building heating or vehicle fuel combustion) or indirectly created (e.g., through grid electricity use) by municipal operations. For the municipal inventory, emission types are divided into different sectors and subsectors. Table 11 shows the sectors and subsectors *included* in the Kennebunkport municipal GHG inventory.

There are several subsectors of emission sources that were *excluded* from Kennebunkport's municipal inventory. Kennebunkport does not operate a transit fleet or a school bus fleet, and so these subsectors were excluded. Similarly, Kennebunkport is served by the Kennebunk, Kennebunkport, and Wells Water District, a quasi-municipal district, a political subdivision to provide a single public service over which the Town of Kennebunkport does not have operational control. Because of this, the water treatment subsector is excluded (although it's electricity use is captured in the community-wide inventory). Due to lack of municipally-generated waste data, the waste – municipal solid waste (MSW) subsector is also excluded. Table 12 shows the sectors excluded from Kennebunkport's municipal GHG inventory.

Collecting the data

Municipal emissions were calculated by multiplying activity data (e.g., fuel consumption) by the corresponding emission factors (e.g., tons CO_2 emitted per gallon of fuel combusted) for each activity. This activity data was compiled by UNH fellow Sarah Mariam and municipal staff from vendor invoices and utility data platforms. Similar to the community-wide GHG inventory, confidence of the data quality in each subsector was indicated as either low, medium, or high according to the guidelines provided in the 2014 Global Protocol for Community-Scale Greenhouse Gas Inventories (Table 4).

TABLE 11. SECTORS AND SUBSECTORS INCLUDED IN KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

SECTOR	SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/END USE
STATIONARY ENERGY	Buildings and Facilities	Energy used in town offices, fire stations, police stations, and parks and recreation facilities	Electricity
			Natural Gas
			Discrete Fuel
	Streetlights and Traffic Signals	Energy used in town street lighting and traffic signals	Electricity
TRANSPORTATION	Vehicle Fleet	Fuel combusted by municipally-owned vehicles	Gasoline, Diesel
	Employee Commute	Fuel combusted from vehicles used by municipal employees as they commute to and from work	Gasoline, Diesel
WASTE	Wastewater Treatment	Emissions from wastewater treated at the Kennebunkport WWTP	Aerobic and Anaerobic Digestion
		Emissions from wastewater treated in community septic systems	Aerobic and Anaerobic Digestion
		Energy used in wastewater processing at the WWTP and pump stations	Electricity

TABLE 12. SECTORS EXCLUDED FROM KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

SECTOR	SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/END USE	REASON
STATIONARY ENERGY	Water treatment	Emissions from energy used to treat drinking water	Electricity	Not applicable to Kennebunkport
TRANSPORTATION	Transit Fleet	Fuel combusted in transit vehicles.	Diesel	Not applicable to Kennebunkport
	School Buses	Fuel combusted in school buses	Diesel	Not applicable to Kennebunkport
WASTE AND WASTEWATER	Waste – MSW	Emissions from the incineration of municipal solid waste generated by municipal operations	Incineration Emissions	Data availability

Inventory

Summary

The summary of Kennebunkport's Municipal GHG inventory is presented in Figures 10 and 11. Municipal emissions for 2018 were estimated as 1,204 MT CO_2e. Estimated municipal emissions are comparable to only 2.5% of community-wide emissions. The largest sector is the Waste sector (57%), resulting from the energy used in wastewater treatment as well as the process and fugitive emissions from wastewater and septic tanks. Transportation emissions are the second largest sector at 27% and stationary energy emissions compromise 16% of the estimated emissions. The subsectors responsible for the most emissions are:

1. Wastewater treatment (57%)
2. Vehicle Fleet (20%)
3. Buildings and Facilities (14%)

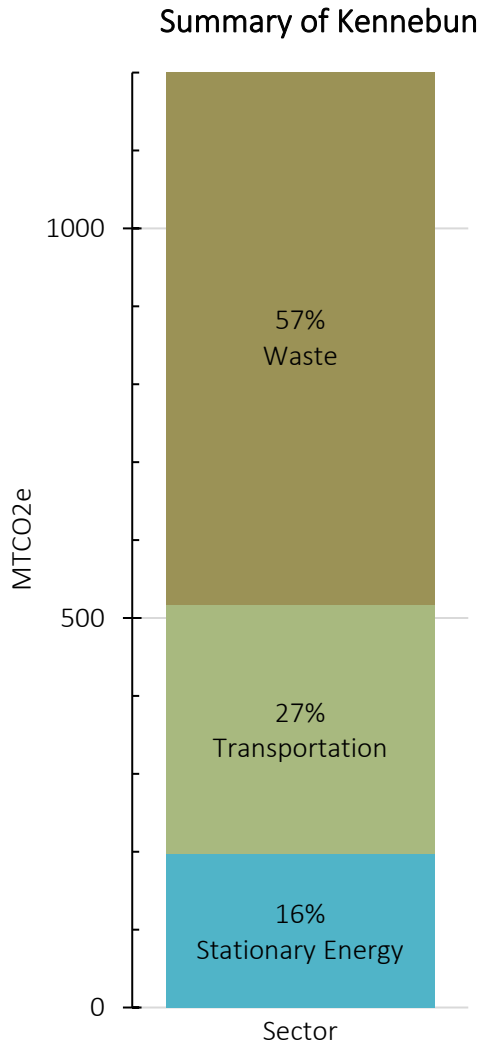


FIGURE 10. KENNEBUNKPORT'S 2018 MUNICIPAL GHG INVENTORY BY SECTOR.

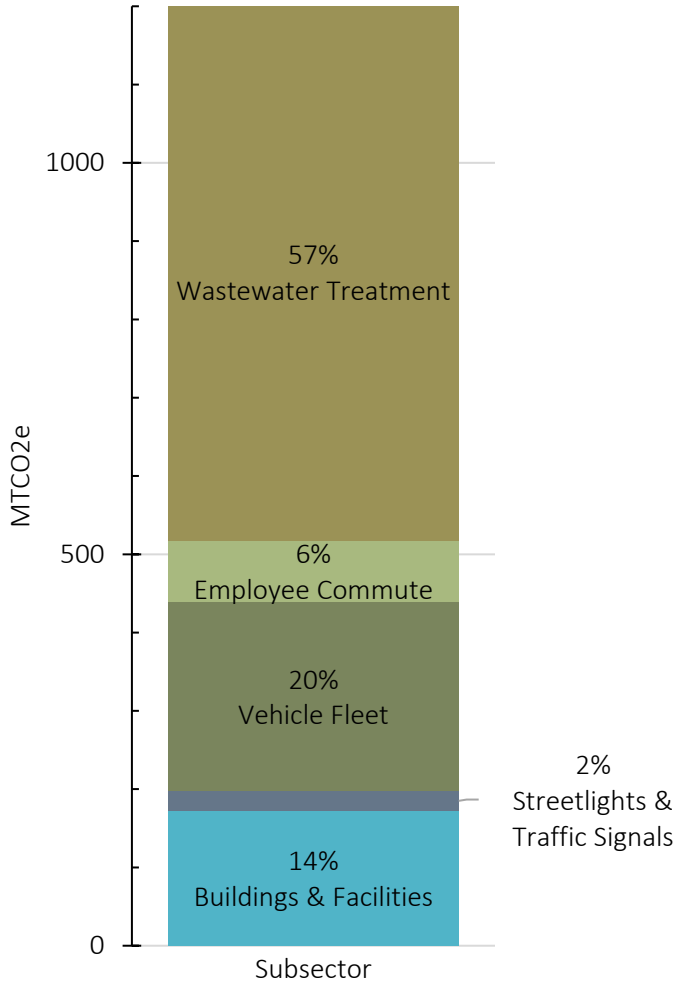


FIGURE 11. KENNEBUNKPORT'S 2018 MUNICIPAL GHG INVENTORY BY SUBSECTOR.

Stationary Energy

The Stationary Energy sector includes GHG emissions resulting from energy use by municipal buildings and facilities as well as streetlights and traffic signals. It includes the direct emissions from the combustion of fossil fuels (Scope 1) and the indirect emissions from the consumption of grid-supplied electricity (Scope 2). The stationary energy subsectors and data sources are presented in Table 13. Table 14 lists the buildings and facilities included in the Kennebunkport municipal GHG inventory. Goose Rocks and Cape Porpoise fire stations are leased by the town and thus excluded from the municipal GHG inventory.

Municipal stationary emissions were estimated as 197 MT CO_2e (Figure 13 and Table 15). Eighty-eight percent of these emissions came from building energy use, including electricity, propane, and heating oil use. Streetlight electricity use compromises 12% of municipal electricity use. Electricity use in buildings is the largest emissions energy type in the stationary sector (35%), followed by propane use (29%).

TABLE 13. SUBSECTORS AND DATA SOURCES FOR MUNICIPAL STATIONARY ENERGY SECTOR.

SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/END USE	SCOPE	DATA SOURCE	DATA QUALITY
BUILDINGS AND FACILITIES	Energy used in town offices, fire stations, police stations, and parks and recreation facilities	Electricity	2	Real consumption data from Central Maine Power (CMP)	High
		Discrete Fuel	1	Real consumption data from vendor invoices	Medium
STREETLIGHTS AND TRAFFIC SIGNALS	Energy used in town street lighting and traffic signals	Electricity	2	Real consumption data from Central Maine Power (CMP)	High

TABLE 14. BUILDINGS/FACILITIES INCLUDED IN KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY AND THEIR ENERGY USES.

Building & Facility location	Description	Fuel Types
Cape Porpoise Pier	Pier, docks and bait shed at the end of Pier Road. Records include electricity used for area lighting as well as general electricity use around the bait shed.	Electricity
Dock Square parking lot	Municipal parking lot serving the Dock Square area. Records include electricity use for area lighting, the Dock Square booth and the Dock Square ticket booth.	Electricity
Government Wharf	Commercial fishing wharf with bait shed. Records include electricity used at and around the bait shed.	Electricity
North Street Parking lot	Municipal parking lot on North Street. Records include electricity used for area lighting.	Electricity
Parks and Recreation	The Parks and Recreation Department has a permanent facility at 20 Recreation Way. It also supports temporary facilities such as an ice rink and a small facility on school street. Records include electricity use at these facilities and propane use for heating the facility at 20 Recreation Way.	Electricity, Propane
Public Safety Building	The public safety building houses the public health department and the police department, including the communications division. Records include electricity used by these departments and propane used for building heating.	Electricity, Propane
Public Works facility	Public Works has a facility located on Beachwood Ave. There are two buildings at the facility, the highway building and the mechanic building. Records include electricity use at the Beachwood Ave. facility as well as propane used for heating the highway building and Mechanics building.	Electricity, Propane
Town Office	The town office is home to a number of different administrative departments such as human resources, code enforcement, and the town manager. Records include electricity use and heating oil.	Electricity, Heating Oil
Solid waste compactor	Compactor operated by the Solid Waste division. Records include electricity use.	Electricity

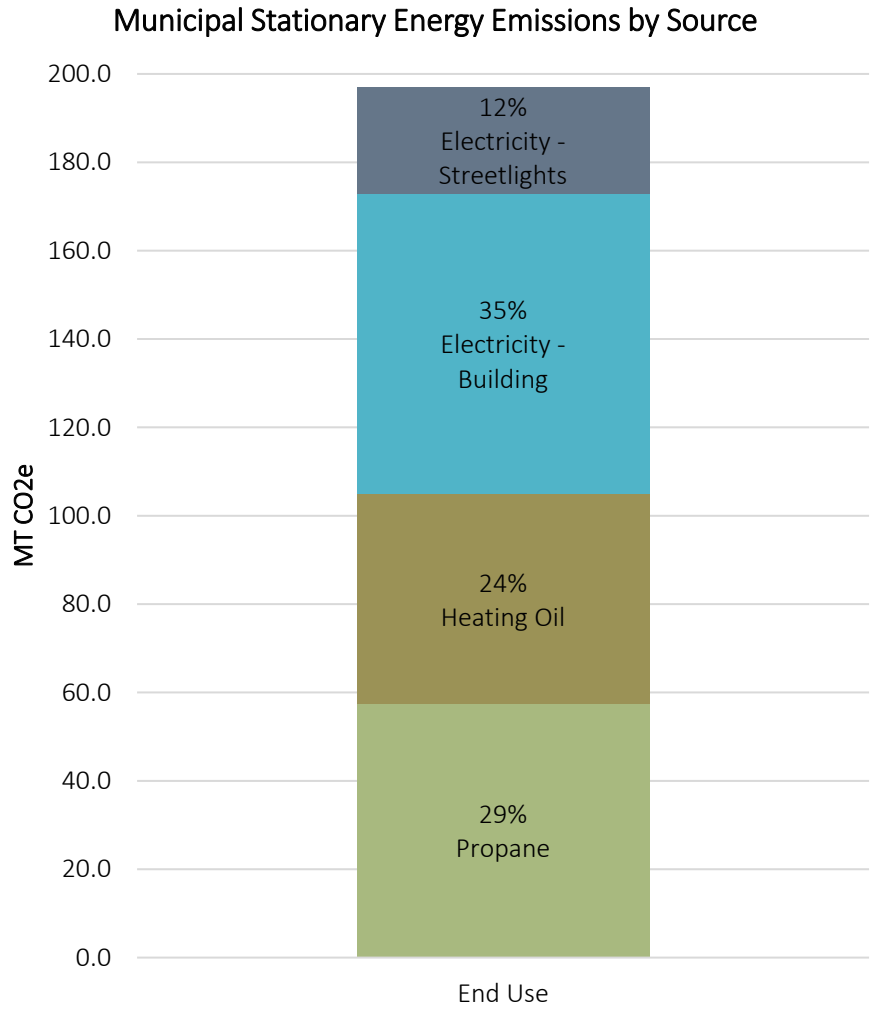


FIGURE 13. STATIONARY ENERGY EMISSIONS BY END USE FOR KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

TABLE 15. KENNEBUNKPORT MUNICIPAL GHG INVENTORY STATIONARY EMISSIONS BY SUBSECTOR AND END USE.

Subsector and End Use	Emissions (MT CO_2e)	Percent of Stationary Energy Emissions
Electricity - Streetlights	24.2	12%
Electricity – Building/facility	68.1	35%
Propane – Building/facility	57.4	29%
Heating Oil – Building/facility	47.4	24%

Figure 14 and Table 16 show municipal stationary energy emissions grouped by facility locations, including both building and area lighting. Winter Harbor Fire Station is the largest source of Stationary Energy emissions (18.20%) followed by the Public Works Facility (15.48%) and the Wildes District Fire Station (15.09%). Together, the two fire stations account for a third of municipal Stationary Energy emissions.

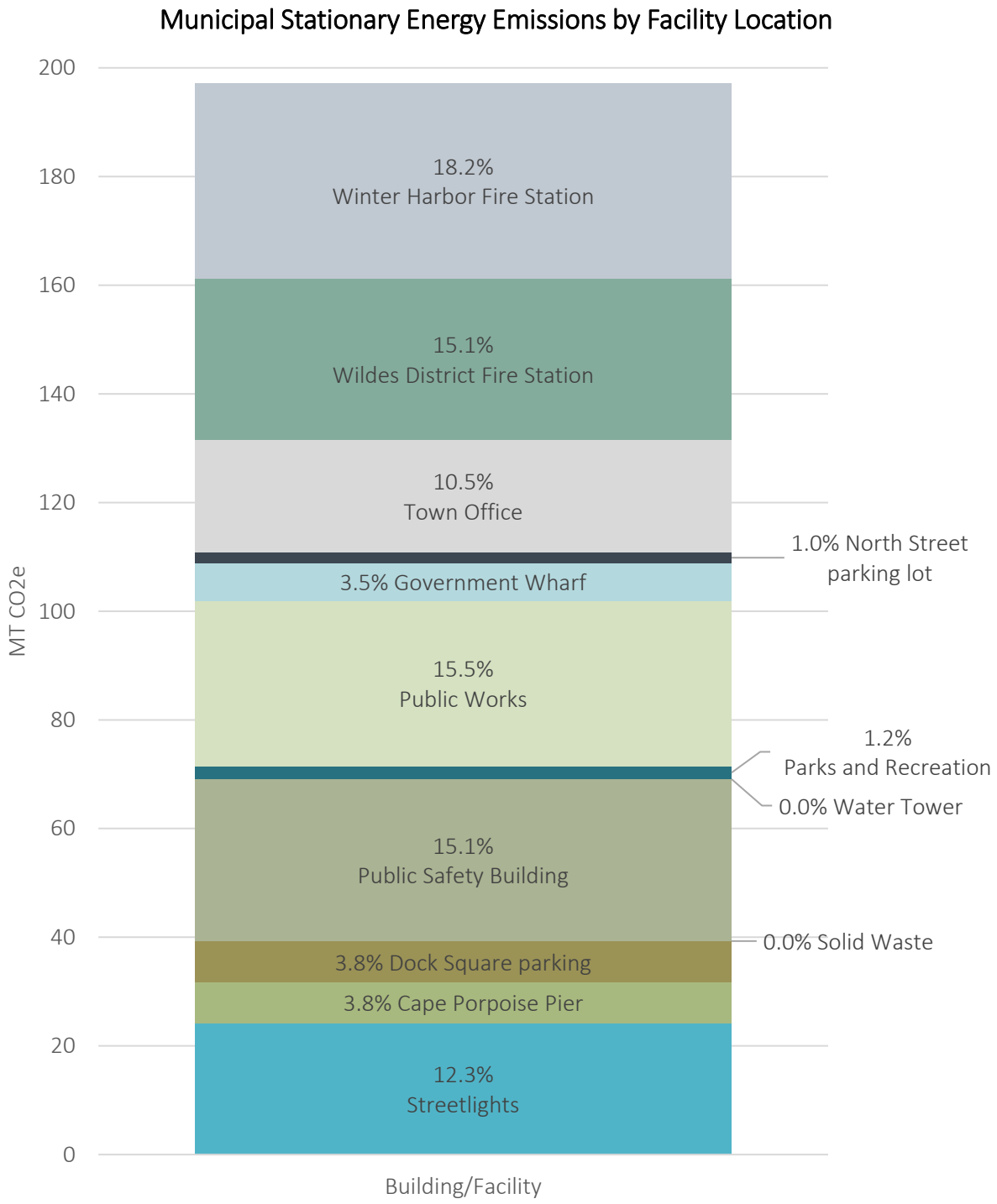


FIGURE 14. KENNEBUNKPORT MUNICIPAL GHG INVENTORY STATIONARY ENERGY EMISSIONS GROUPED BY FACILITY LOCATION.

TABLE 16. KENNEBUNKPORT MUNICIPAL GHG INVENTORY STATIONARY EMISSIONS GROUPED BY FACILITY LOCATION.

Facility	Emissions (MT CO_2e)	Percent of Stationary Energy Emissions
Winter Harbor Fire Station	35.9	18.20%
Public Works	30.5	15.48%
Wildes District Fire Station	29.7	15.09%
Public Safety Building	29.7	15.08%
Streetlights	24.2	12.27%
Town Office	20.7	10.50%
Dock Square parking	7.5	3.82%
Cape Porpoise Pier	7.5	3.82%
Government Wharf	7.0	3.53%
Parks and Recreation	2.3	1.16%
North Street parking lot	1.9	0.96%
Solid Waste	0.1	0.04%
Water Tower	0.1	0.04%

Data Quality Considerations

For all end uses in the stationary energy sector, activity data came from real consumption records. In the case of electricity, these records were provided by their respective utilities who keep extensive online data records. As a result, these are complete and high-quality data sources. For the different types of discrete fuel used for heating Kennebunkport's municipal buildings, activity data was obtained from past invoices from several vendors. Because there is a reasonable likelihood that some invoices were misplaced or accidentally excluded from inventory, discrete fuel use estimates are considered medium quality and likely slightly under-represent actual discrete fuel use.

Transportation

The transportation sector includes all the emissions from fuel combusted in the local vehicle fleet, such as passenger vehicles, light, medium, and heavy-duty trucks, and any other vehicles. Because Kennebunkport does not operate a school bus fleet, emissions from school buses were not included. Vehicle fleet emissions estimates were based on the record of fuel used Kennebunkport departments. Transportation subsectors and data sources are presented in Table 17. The Transportation sector also includes emissions from vehicle travel as municipal employees commute to and from Kennebunkport, which are classified as Scope 3.

Municipal transportation emissions were estimated as 320 MT CO_2e (Figure 15 and Table 18). The majority of transportation emissions (76%) come from the vehicle fleet, with gasoline and diesel emissions being almost equal. Employee commuting makes up 24% of municipal transportation emissions. Employee commute – diesel made up less than 2% of municipal transportation emissions.

Figure 16 and Table 19 show municipal transportation emissions by department and fuel type. The department with the greatest fuel use and transportation emissions is Public Works. Public Works diesel and gasoline emissions together make up 40% of Kennebunkport's municipal transportation emissions. The police department has the second highest transportation emissions, accounting for 21% of municipal transportation emissions.

TABLE 17. TRANSPORTATION SUBSECTORS AND DATA SOURCES FOR KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/END USE	SCOPE	DATA SOURCE	DATA QUALITY
VEHICLE FLEET	Fuel combusted by municipally-owned vehicles	Gasoline, Diesel	1	Real consumption data from vendor invoices	High
EMPLOYEE COMMUTE	Fuel combusted as employees commute to Kennebunkport	Gasoline, Diesel	3	Survey and estimated average and national fuel consumption data	Low

TABLE 18. TRANSPORTATION EMISSIONS BY SUBSECTOR AND END USE FOR KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

Subsector and end use	Emissions (MT CO_2e)	Percent of Transportation Emissions
Employee Commute Gasoline	72	22.6%
Employee Commute Diesel	5	1.6%
Vehicle Fleet Gasoline	121	37.7%
Vehicle Fleet Diesel	122	38.1%

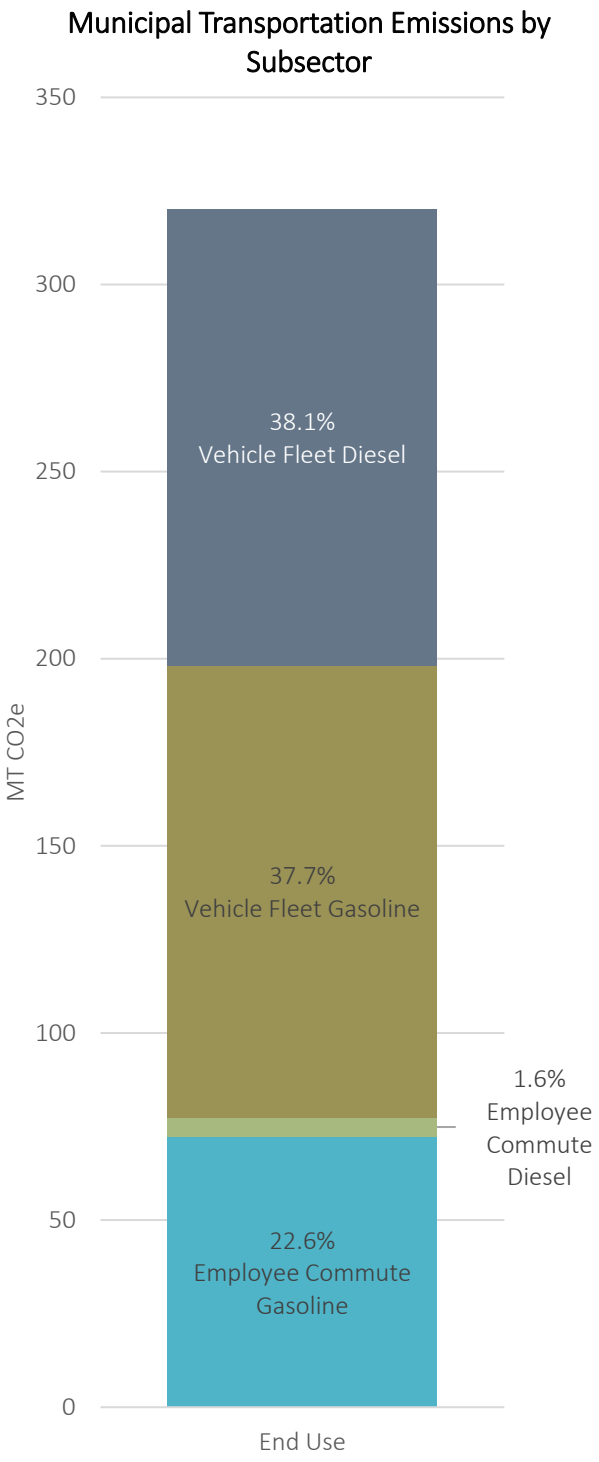


FIGURE 15. KENNEBUNKPORT MUNICIPAL TRANSPORTATION EMISSIONS BY SUBSECTOR AND END USE.

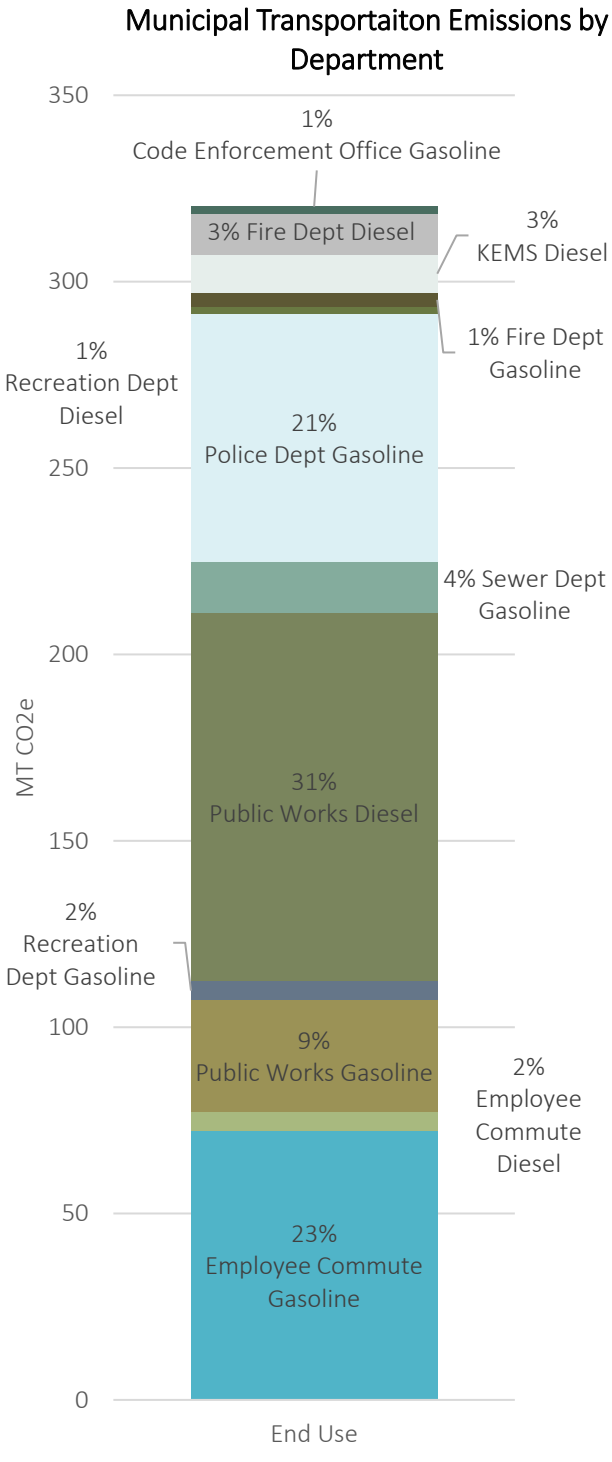


FIGURE 16. KENNEBUNKPORT MUNICIPAL TRANSPORTATION EMISSIONS BY DEPARTMENT AND END USE.

TABLE 19. TRANSPORTATION EMISSIONS BY DEPARTMENT AND FUEL TYPE FOR KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

Subsector and end use	Emissions (MT CO_2e)	Percent of Transportation Emissions
Employee Commute Gasoline	72.32	23%
Employee Commute Diesel	5.11	2%
Public Works Gasoline	29.91	9%
Public Works Diesel	98.99	31%
Sewer Dept Gasoline	13.48	4%
Police Dept Gasoline	66.67	21%
Recreation Dept Gasoline	4.92	2%
Recreation Dept Diesel	1.85	1%
Fire Dept Gasoline	3.73	1%
Fire Dept Diesel	10.82	3%
KEMS Diesel	10.29	3%
Code Enforcement Office Gasoline	2.03	1%

Data Quality Considerations

Fuel consumption for the vehicle fleet subsector come from real consumption data from vendor invoices and are therefore high in quality. Estimates of emissions for the employee commute subsector are low quality. Employee commute fuel use was estimated by UNH sustainability fellow Sarah Merriam in summer 2019. However, there is no record of the methodology for how the employee commute fuel use was estimated. Based on Table 4 in Sarah Marriam's report, it appears that the employee commute emissions may have been estimated using a survey. In the future, a more accurate estimate of employee commute could be made using a survey of employee commuting behaviors.

Waste

The waste sector includes all the emissions from the treatment of waste occurring within the municipal operational control boundary. The subsector and data sources included in the Waste sector are presented in Table 20. The sector includes emissions from electricity used in the Kennebunkport Wastewater Treatment Plant (WWTP) and the pump stations in the sewer system. It also includes the emissions from aerobic and anaerobic digestion both during treatment in the WWTP and from effluent discharge. Additionally, it includes the emissions from septic tanks within the Town of Kennebunkport. While the municipality does not maintain these septic systems, it does have regulatory control over the tanks and the sewer system. The waste sector does not include emissions estimates for municipal solid waste (MSW). Kennebunkport does not operate a landfill or waste treatment facilities. While Kennebunkport's municipal operations do generate MSW, there currently is no data available about the amount of waste generated within municipal buildings and facilities.

Municipal waste emissions were estimated as 686 MT CO_2e (Figure 17 and Table 21). Septic tank emissions were the largest source of waste emissions (59%). This relatively high estimate of emissions from septic systems is due to the much higher per capita emissions of methane from septic systems

(0.12150 MT CO_2e per capita) than the per capita emissions of nitrous oxide from wastewater treatment plants (0.0049008 $MTCO_2e$ per capita) and the large number of septic systems in Kennebunkport. Electricity use at the pump stations and the WWTP together made up 28% of waste emissions.

TABLE 16. WASTE SUBSECTORS AND DATA SOURCE FOR KENNEBUNKPORT'S MUNICIPAL GHG INVENTORY.

SUBSECTOR	EMISSIONS SOURCES	ENERGY TYPE/END USE	SCOPE	DATA SOURCE	DATA QUALITY
WASTE	Wastewater Treatment	Emissions from wastewater treated at Kennebunkport WWTP	Aerobic and Anaerobic Digestion	Modeled emissions data based on number of sewer connections and population	Low
		Emissions from wastewater treated in community septic systems	Aerobic and Anaerobic Digestion	Modeled emissions data based on number of septic systems	Low
		Energy used in wastewater processing at the WWTP and pump stations	Electricity	Real consumption data from Central Maine Power (CMP)	High

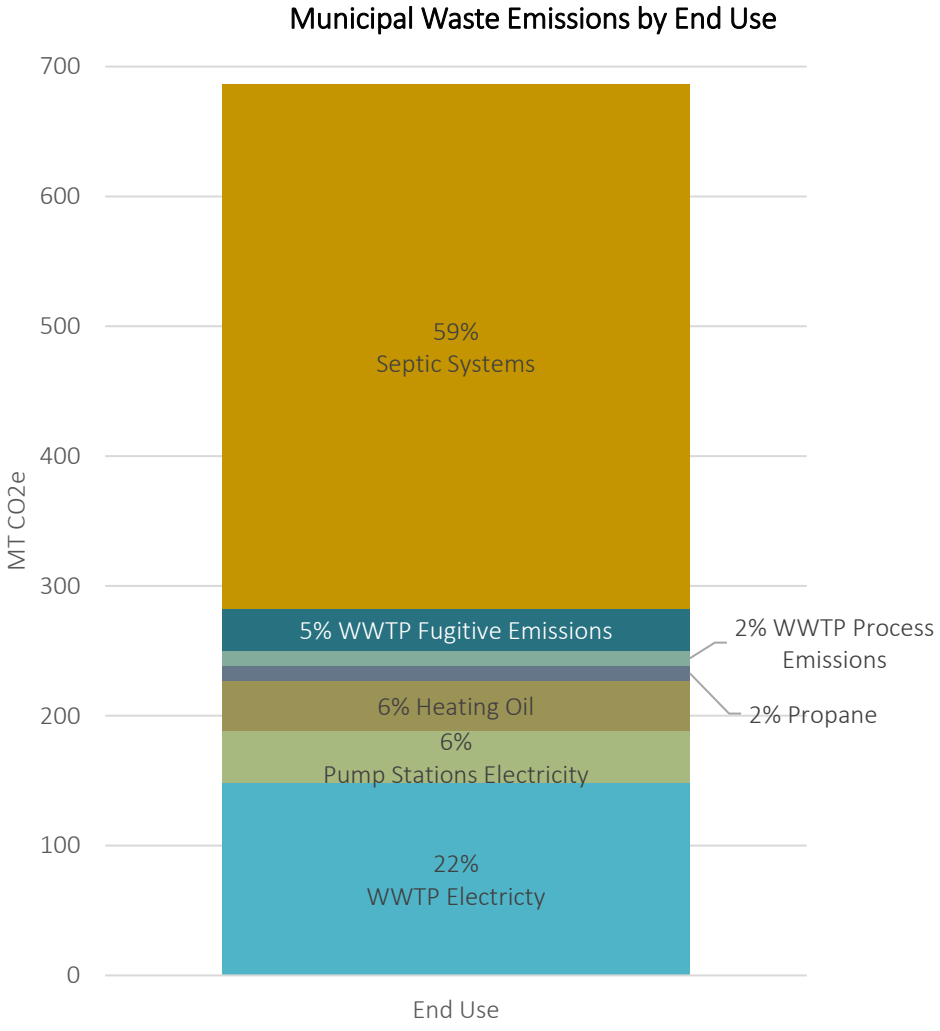


FIGURE 17. KENNEBUNKPORT MUNICIPAL WASTE EMISSIONS BY END USE.

TABLE 17. KENNEBUNKPORT MUNICIPAL GHG INVENTORY WASTE EMISSIONS BY END USE.

End use	Emissions (MT CO_2e)	Percent of Waste Emissions
WWTP Electricity	148	22%
Pump Station Electricity	40	6%
Heating Oil	39	6%
Propane	11	2%
Septic Systems	404	59%
WWTP Process Emissions	12	2%
WWTP Fugitive Emissions	32	5%

Data Quality Considerations

The waste sector is the sector with the lowest quality data and highest uncertainty. While electricity data for the pump stations and WWTP are high quality, emissions data from aerobic/anaerobic digestion are low quality due to both lack of activity data and uncertainty in emissions calculations that are very process specific. In particular it is difficult to determine the impact of Kennebunkport's large seasonal population changes on wastewater treatment emissions. Thus, the relatively high septic emissions (33% of the total municipal GHG inventory estimate) should be considered to have high uncertainty.

This inventory does not include estimates for emissions from municipally-generated or MSW. Town-wide Kennebunkport MSW is transported to the EcoMaine Waste-to-energy plant in Portland. These town-wide MSW emissions are included in the community-wide GHG inventory. Municipal activities likely generate enough MSW to result in non-negligible MSW emissions from waste incineration at EcoMaine. For future municipal GHG inventories, Kennebunkport could measure/estimate the tonnage of municipally-generated MSW for inclusion in the waste sector. For now, the exclusion of the MSW subsector should not prohibit the development of waste management strategies to help the Town of Kennebunkport reduce consumption and increase waste diversion.

Conclusion

The Town of Kennebunkport's first GHG inventory report summarizes the ongoing activities and the major sources of emissions in the community and in municipal operations. Community-wide emissions were estimated as 48,387 MT CO_2e, equivalent to 10,426 passenger cars driven for one year or 112,026 barrels of oil consumed.[7] Municipal emissions were estimated as 1,204 MT CO_2e, equivalent to just 259 passenger cars driven for one year. The Town of Kennebunkport is already taking steps to reduce municipal emissions and encourage community-wide emission reductions. The Town's contract to purchase solar energy credits for 85% of municipal electricity use will reduce municipal GHG emissions approximately 78 MT CO_2e per year, reducing municipal emissions 6.5% overall and Stationary Energy emissions by 40%. Current efforts to lease electric vehicles for the municipal fleet, to switch streetlighting over to LEDs, and to improve building energy efficiency will all help reduce municipal emissions.

As Kennebunkport takes the next steps to set GHG reduction targets and develop a climate action plan, these inventories may be used to guide decisions about emissions reduction strategies. The following is a summary of key takeaways and considerations:

[7] US Environmental Protection Agency, Greenhouse Gas Equivalencies Calculator. https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

1. The largest source of community-wide GHG emissions is passenger vehicle fuel use

Passenger vehicle emissions from diesel and gasoline fuel combustion are 35% of Kennebunkport community-wide GHG emissions. Kennebunkport could reduce passenger vehicle emissions through the adoption of electric vehicles by Kennebunkport's residents, visitors, and businesses. SMPDC's Municipal EV Toolkit provides many resources and strategies for encouraging and supporting EV adoption. Transportation emissions may also be reduced by encouraging alternative forms of transportation such as walking, biking, and ridesharing.

2. The second largest source of community-wide GHG emissions is residential heating fuel use, particularly heating oil use

Residential heating emissions from the combustion of home heating fuels account for 21.3% of Kennebunkport community-wide GHG emissions. Kennebunkport could explore strategies for reducing home heating fuel use by encouraging both fuel switching (i.e., installing heat pumps to reduce heating oil use) and energy efficiency to reduce heating needs (i.e., home weatherization, energy efficient appliances).

3. The energy used by Kennebunkport residents, visitors, and business for transportation and building heating/electricity make up 93.4% of Kennebunkport's GHG inventory

There is no single strategy that will address the majority of Kennebunkport's GHG emissions. However, strategies targeting Kennebunkport's buildings and the vehicles on its roads will have a significant impact. These strategies should consider the energy use of not just Kennebunkport's residents, but its businesses and visitors as well.

4. A better understanding of commercial building heating fuel is needed to develop targeted strategies

This inventory provides a rough estimate of Kennebunkport's commercial heating fuel use emissions. However, a better understanding of annual discrete fuel use for building heating and other purposes at commercial buildings would help Kennebunkport develop impactful strategies for the climate action plan. This data could be gathered through a survey or through a review of town assessor's data.

5. Community-wide emissions are far greater than municipal emissions

Kennebunkport's estimated community-wide emissions are 4018% greater than municipal emissions. This is important for Kennebunkport to consider when deciding how to prioritize municipal vs. community-wide emission reduction strategies. In consideration of limited time and financial resources, strategies addressing community-wide emissions might have a larger impact than those addressing municipal emissions. However, it is generally easier to implement municipal-only strategies, and so strategies to target the largest sources of municipal emissions (municipal fleet, wastewater treatment plant electricity use, heating fuel use in municipal buildings) could still be considered a priority.

6. Alternative indicators can be used to identify other strategies to reduce emissions that are not captured in the inventory

Because it is difficult to quantify the specific impact of many mitigation efforts (especially activities like education, community building, and environmental justice initiatives), alternative indicators may be used to develop emission reduction initiatives and set measurable goals without the need to quantify their impact in MT CO_2e. Areas to consider for additional alternative indicators and associated strategies include:

- Roof top/behind the meter solar installations (using data from code enforcement)
- Private EV charging stations (using data from code enforcement)
- Business waste management practices (using a survey of businesses)
- Number and attendance of public engagement events on climate or energy topics (through event tracking)

7. Future GHG inventories can be used to evaluate Kennebunkport's progress on emission reduction efforts.

Once Kennebunkport has created a climate action plan, future community-wide and municipal inventories should be completed 2 years later (i.e., in 2025 if Kennebunkport finalizes a climate action plan in 2023). These inventories will help Kennebunkport assess progress toward identified emission reduction goals as well as evaluate and prioritize specific strategies. Subsequent inventories may be conducted every 5 years to continue to monitor progress on climate action. Appendix C includes a list of recommendations to improve the quality of a future GHG inventory.

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Appendix A – Community-wide GHG inventory data table

ClearPath Inventory Record	ClearPath Calculator Used	ClearPath Category	Record time period	Sector	Subsector	End use	Scope	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Data Quality	Notes
Kport - Residential - Electricity - 2019	Emissions from Grid Electricity	Residential Energy	CY 2019	Stationary Energy	Residential	Electricity	Scope 2	5120.44	0.806	1.05E-01	5170.78	High	Utility supplied data from CMP for 2019 residential electricity use. See file "Kennebunkport_usage_08320.xlsx" in SMPDC's Sustainability and Resilience Program's GHG Inventory resources.
Kport - Residential - Electricity LOSSES - 2019	Emissions from Electric Power Transmission and Distribution Losses	Upstream Impacts of Activities	CY 2019	Stationary Energy	Residential	Electricity	Scope 3	261.14	0.041	5.34E-03	263.71	Low	Utility supplied data from CMP for 2019 residential electricity use. See file "Kennebunkport_usage_08320.xlsx" in SMPDC's Sustainability and Resilience Program's GHG Inventory resources. Grid Gross Loss Factor from EPA EGRID for Eastern region (https://www.epa.gov/egrid/egrid-questions-and-answers#egrid5aa).
Kport - Residential - Discrete Fuel - Bottled tank or LP gas - 2019	Emissions from Stationary Fuel Combustion	Residential Energy	CY 2019	Stationary Energy	Residential	Discrete Fuel Use	Scope 1	3282.52	0.567	5.67E-02	3313.39	Low	Estimated using EIA Table C5. Residential Sector Energy Consumption Estimates, 2019 and ACS home heating fuel estimates for the 2019 5-year average for Maine and the Town of Kennebunkport. Data calculation in file "Kennebunkport Residential Discrete fuel use 2019.xlsx".
Kport - Residential - Discrete Fuel - Fuel Oil kerosene etc. - 2019	Emissions from Stationary Fuel Combustion	Residential Energy	CY 2019	Stationary Energy	Residential	Discrete Fuel Use	Scope 1	6391.85	0.939	6.26E-02	6434.74	Low	Estimated using EIA Table C5. Residential Sector Energy Consumption Estimates, 2019 and ACS home heating fuel estimates for the 2019 5-year average for Maine and the Town of Kennebunkport. Data calculation in file "Kennebunkport Residential Discrete fuel use 2019.xlsx".
Kport - Residential - Discrete Fuel - Wood - 2019	Emissions from Stationary Fuel Combustion	Residential Energy	CY 2019	Stationary Energy	Residential	Discrete Fuel Use	Scope 1	0.00	16.711	2.22E-01	526.758	Low	Estimated using EIA Table C5. Residential Sector Energy Consumption Estimates, 2019 and ACS home heating fuel estimates for the 2019 5-year average for Maine and the Town of Kennebunkport. Data calculation in file "Kennebunkport Residential Discrete fuel use 2019.xlsx".
Kport - Residential - Discrete Fuel - Utility Gas - 2019	Emissions from Stationary Fuel Combustion	Residential Energy	CY 2019	Stationary Energy	Residential	Discrete Fuel Use	Scope 1	36.27	0.003	6.84E-05	36.380	Low	Estimated using EIA Table C5. Residential Sector Energy Consumption Estimates, 2019 and ACS home heating fuel estimates for the 2019 5-year average for Maine and the Town of Kennebunkport. Data calculation in file "Kennebunkport Residential Discrete fuel use 2019.xlsx". Note that according to Unitil, there appears to be no natural gas service in Kennebunkport. Keeping this estimate due to potential inaccuracies in jurisdictional boundaries or other natural gas suppliers.
Kport - Commercial - Electricity - 2019	Emissions from Grid Electricity	Commercial Energy	CY 2019	Stationary Energy	Commercial	Electricity	Scope 2	2400.19	0.378	4.91E-02	2423.783	High	Utility supplied data from CMP for 2019 commercial electricity use. See file "Kennebunkport_usage_08320.xlsx" in SMPDC's Sustainability and Resilience Program's GHG Inventory resources.

Kport - Commercial - Electricity LOSSES - 2019	Emissions from Electric Power Transmission and Distribution Losses	Upstream Impacts of Activities	CY 2019	Stationary Energy	Commercial	Electricity	Scope 3	122.41	0.019	2.50E-03	123.61	Low	Utility supplied data from CMP for 2019 commercial electricity use. See file "Kennebunkport_usage_08320.xlsx" in SMPDC's Sustainability and Resilience Program's GHG Inventory resources. Grid Gross Loss Factor from EPA EGRID for Eastern region (https://www.epa.gov/egrid/egrid-questions-and-answers#egrid5aa).
Kport - Commercial - Discrete Fuel - 2019	Emissions from Stationary Fuel Combustion	Commercial Energy	CY 2019	Stationary Energy	Commercial	Discrete Fuel Use	Scope 1	3974.54	0.584	3.89E-02	4001.211	Low	Calculated discrete fuel use for commercial and industrial users in Kennebunkport for 2019. Assumed all C/I customers heat with fuel oil, which does not accurately account for buildings using propane for heating or cooking. Data and calculation in spreadsheet "commercial fuel use 2019 FINAL Kennebunkport.xlsx"
Kport - Industrial - Electricity - 2019	Emissions from Grid Electricity	Industrial Energy	CY 2019	Stationary Energy	Industrial	Electricity	Scope 2	3.63	0.001	7.42E-05	3.66	High	Utility supplied data from CMP for 2019 industrial electricity use. See file "Kennebunkport_usage_08320.xlsx" in SMPDC's Sustainability and Resilience Program's GHG Inventory resources.
Kport - Industrial - Electricity LOSSES - 2019	Emissions from Electric Power Transmission and Distribution Losses	Upstream Impacts of Activities	CY 2019	Stationary Energy	Industrial	Electricity	Scope 3	0.18	0.000	3.78E-06	0.19	Low	Utility supplied data from CMP for 2019 industrial electricity use. See file "Kennebunkport_usage_08320.xlsx" in SMPDC's Sustainability and Resilience Program's GHG Inventory resources. Grid Gross Loss Factor from EPA EGRID for Eastern region (https://www.epa.gov/egrid/egrid-questions-and-answers#egrid5aa).
Kport - Transportation - Passenger Vehicles - 2019	On Road Transportation	Transportation & Mobile Sources	CY 2019	Transportation	Passenger Vehicles	Gasoline and Diesel	Scope 1 and 3	16635.22	0.710	1.42E-01	16692.730	Medium	Calculated using SMPDC's On-road transportation emissions methodology for Kennebunkport OD 2019 VMT. Data and calculations in the spreadsheet "Kennebunkport ORT emissions calculator 2019.xlsx"
Kport - Transportation - Commercial Vehicles - 2019	On Road Transportation	Transportation & Mobile Sources	CY 2019	Transportation	Commercial Vehicles	Gasoline and Diesel	Scope 1 and 3	6164.63	0.252	5.04E-02	6185.036	Medium	Calculated using SMPDC's On-road transportation emissions methodology for Kennebunkport OD 2019 VMT. Data and calculations in the spreadsheet "Kennebunkport ORT emissions calculator 2019.xlsx"
Kport - Transportation - Public Transit - 2019	Emissions from Public Transit	Transportation & Mobile Sources	CY 2019	Transportation	Public Transit	Gasoline and Diesel	Scope 1 and 3	358.38	0.015	2.90E-03	359.557	Medium	Calculated using SMPDC's On-road transportation emissions methodology for Kennebunkport OD 2019 VMT. Data and calculations in the spreadsheet "Kennebunkport ORT emissions calculator 2019.xlsx". Emissions from Public transit are based upon VMT for all Bus types. This includes school buses.
KPort - Transportation - Marine Diesel - 2019	Water Transportation	Transportation & Mobile Sources	CY 2019	Transportation	Marine	Diesel	Scope 1	1097.51	0.080	2.79E-02	1107.147	High	Diesel fuel consumption provided by Chick's Marina and Cape Porpoise Pier to municipal staff. Data in the file "Marine fuel usage 2019.xlsx"
KPort - Transportation - Marine Gasoline - 2019	Water Transportation	Transportation & Mobile Sources	CY 2019	Transportation	Marine	Gasoline	Scope 1	441.188	0.032	1.11E-02	445.018	High	Data provided by Chick's Marina and Cape Porpoise Pier to municipal staff. Data in the file "Marine fuel usage 2019.xlsx"
Kport - MSW - Incineration - 2019	Combustion of Solid Waste Generated by the Community	Solid Waste	FY 2019	Waste	MSW	Incineration Emissions	Scope 3	812.43	0.723	9.50E-02	857.844	Medium	Calculated using data from EcoMaine and local waste disposal data from municipal staff. Emissions calculated in the file "Kennebunkport MSW Emissions calc.xlsx"

Kport - Wastewater - Septic Systems - 2019	Fugitive Emissions from Septic Systems	Water & Wastewater	CY 2021	Waste	Wastewater	Aerobic and Anaerobic Digestion	Scope 1	14.434	0.00	404.147	Low	According to Community Planner Eli Rubin, Kennebunkport has approx. 1512 septic systems. Average household size is 2.24 people (based on 2020 census data). Make the assumption that all septic systems are for residential dwellings (although there are likely commercial septics as well). Therefore approx. 3,326.4 people served by septic systems annually.
Kport - Wastewater - N20 from WWTP - 2019	Process N2O Emissions from Wastewater Treatment	Water & Wastewater	CY 2021	Waste	Wastewater	Aerobic and Anaerobic Digestion	Scope 1	0.00	3.90E-02	10.342	Low	Updated methodology from Sarah Mariam's 2019 estimate. Changed industrial commercial discharge multiplier to 1 (no known industrial or significant commercial discharge). Based on 2489 sewer connections (sewer dept. communications) and an average household size of 2.24 people, assume population served is 5,575 people. This is larger than the population of Kennebunkport but makes sense given the number of visitors, hotels, and seasonal population.
Kport - Wastewater - Process N20 from effluent discharge - 2019	Process N2O from Effluent Discharge to Rivers and Estuaries	Water &Wastewater	CY 2021	Waste	Wastewater	Aerobic and Anaerobic Digestion	Scope 1	0.00	1.03E-01	27.322	Low	Updated methodology from Sarah Mariam's 2019 estimate. Changed industrial commercial discharge multiplier to 1 (no known industrial or significant commercial discharge). Based on 2489 sewer connections (sewer dept. communications) and an average household size of 2.24 people, assume population served is 5,575 people. This is larger than the population of Kennebunkport but makes sense given the number of visitors, hotels, and seasonal population.

Appendix B – Municipal GHG Inventory Data Table

ClearPath Inventory Record	ClearPath Calculator Used	ClearPath Category	Record time period	Sector	Subsector	End use	Scope	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Data Quality	Notes
Streetlights - Utilities - Electricity - 2018	Emissions from Grid Electricity	Streetlights & Traffic Signals	CY 2018	Stationary Energy	Streetlights & Traffic Signals	Electricity	Scope 2	23.946	0.004	0.001	24.181	High	Electricity use by Kennebunkport streetlights. Streetlights are in the process of being upgraded to LED fixtures.
Cape Porpoise Pier Area Lights - Utilities - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	0.087	0.000	0.000	0.088	High	Electricity used for area lighting at Cape Porpoise Pier. Data from CMP billing.
Dock Square parking lot Area Lighting - Utilities - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	3.095	0.000	0.000	3.125	High	Electricity used for area lighting at the Dock Square parking lot. Data from CMP billing.
Cape Porpoise Pier - Harbormaster - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	7.372	0.001	0.000	7.445	High	Electricity use at the Cape Porpoise Pier. Does not include area lighting. Data from CMP billing.
trash compactor - Solid Waste - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	0.083	0.000	0.000	0.084	High	Electricity use for the trash compactor operated by the solid waste dept. Data from CMP billing.
Public Safety Building - Police Communications and Public Health - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	14.813	0.002	0.000	14.959	High	Sum of two accounts for public safety building, Police/Communications (60135 kwh) and Public Health (2389 kwh). Data from CMP billing.
Water Tower - Utilities - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	0.083	0.000	0.000	0.084	High	Electricity use at town Water Tower. Data from CMP billing.
Parks and Rec facility - Recreation Dept - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	0.355	0.000	0.000	0.358	High	Electricity use at the Recreation Dept facility at 25 Recreation Way. Data from CMP billing.
Beachwood Ave Facility - Public Works - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	17.494	0.003	0.000	17.666	High	Electricity use at the public works facility at Beachwood Ave, which includes a number of structures including a mechanics building and highway building. Data from CMP billing.
Dock Square parking lot - Public Works - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	4.369	0.001	0.000	4.412	High	Electricity use from two accounts, Dock Square Booth (777 kwh) and Dock Square Ticket Booth (17666 kwh). data from CMP billing.
Government Wharf - Harbormaster - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	6.895	0.001	0.000	6.963	High	Electricity use at Government wharf from two accounts, one of which represents the majority of usage (29102 kwh) and the other which appears to be a legacy account (only 2 kwh in the year). Data from CMP billing.
North Street Utilities - Utilities - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	1.871	0.000	0.000	1.890	High	Electricity usage at an unknown utility account, potentially for the North Street Parking lot. Data from CMP billing.

Recreation temporary facilities - Recreation Dept - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	0.107	0.000	0.000	0.108	High	Electricity usage from two Rec Dept. temporary facilities, the ice rink (439 kwh) and a small school street facility (11 kwh). Data from CMP billing.
Town Office - Administrative Depts - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	6.974	0.001	0.000	7.042	High	Electricity used at the town office, which is home to a number of different administrative departments such as human resources, code enforcement, town manager, etc. Data from CMP billing.
Wildes District Fire Station - Fire Dept - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	1.743	0.000	0.000	1.761	High	Electricity use at the Wildes District Fire Station. Data from CMP billing.
Winter Harbor Fire Station - Fire Dept - Electricity - 2018	Emissions from Grid Electricity	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Electricity	Scope 2	2.091	0.000	0.000	2.111	High	Electricity used at the Winter Harbor Fire Station. Data from CMP billing.
Wildes District Fire Station - Fire Dept - Propane - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	27.440	0.005	0.000	27.986	Medium	Use is estimated from vendor invoices for CY 2018
Mechanic Building - Public Works - Propane - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	9.228	0.002	0.000	9.411	Medium	Mechanic building is located in public works facility at 105 Beechwood Ave. Use is estimated from Vendor invoices for CY 2018.
Town Office - Administrative Depts - Heating Oil - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	13.455	0.002	0.000	13.658	Medium	Also sometimes referred to as "Admin Building" in records. Based on invoices from Vendors for CY 2018.
Winter Harbor Fire Station - Fire Dept - Heating Oil - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	33.272	0.005	0.000	33.774	Medium	Use is estimated from vendor invoices for CY 2018
Highway Building - Public Works - Propane - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	3.371	0.001	0.000	3.439	Medium	The highway building is located at the public works facility at 105 Beechwood Avenue. Estimated use comes from vendor invoices for CY 2018.
Recreation Building - Recreation Dept - Propane - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	1.779	0.000	0.000	1.814	Medium	For Recreation Dept. Building at 20 Recreation Way. Based on vendor invoices for 2018.
Public Safety Building - Police Communications and Public Health - Propane - 2018	Emissions from Stationary Fuel Combustion	Buildings & Facilities	CY 2018	Stationary Energy	Buildings & Facilities	Discrete Fuel Use	Scope 1	14.633	0.003	0.000	14.769	Medium	For Police Dept. building, also referred to as the "Communications Building" or "Public Safety" building. Usage estimated from vendor invoices for CY 2018.
Public Works - Gasoline - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Gasoline	Scope 1	29.910	0.000	0.000	29.910	Medium	Gasoline fuel used in Public Works vehicles for CY 2018.
Recreation Dept - Gasoline - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Gasoline	Scope 1	4.922	0.000	0.000	4.922	High	Gasoline fuel used in Recreation Dept. vehicles for CY 2018.
Public Works - Diesel - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Diesel	Scope 1	98.987	0.000	0.000	98.987	High	Diesel fuel used by Public Works Dept. vehicles in Cy 2018

Sewer Dept - Gasoline - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Gasoline	Scope 1	13.483	0.000	0.000	13.483	High	Gasoline fuel used in Sewer Dept. vehicles for CY 2018.
Police Department - Gasoline - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Gasoline	Scope 1	66.674	0.000	0.000	66.674	High	Gasoline used by police dept vehicles for CY 2018
Recreation Dept - Diesel - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Diesel	Scope 1	1.852	0.000	0.000	1.852	High	Diesel fuel used in Recreation Dept. vehicles for CY 2018
Fire Dept - Gasoline - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Gasoline	Scope 1	3.726	0.000	0.000	3.726	High	Gasoline used in Fire Dept vehicles for CY 2018.
KEMS - Diesel - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Diesel	Scope 3	10.290	0.000	0.000	10.290	High	Diesel fuel consumed by Kennebunkport Emergency Management Service, a private ambulance service operated out of the Cape Porpoise Fire Company's station at 172 Main Street. Because it is an outsourced service, considered scope 3 emissions.
Fire Dept - Diesel - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Diesel	Scope 1	10.823	0.000	0.000	10.823	High	Diesel fuel used by Fire Dept vehicles in CY 2018
Code Enforcement Office - Gasoline - 2018	Fleet Vehicle Emissions	Vehicle Fleet	CY 2018	Transportation	Vehicle Fleet	Gasoline	Scope 1	2.032	0.000	0.000	2.032	High	Gasoline fuel used by the Code Enforcement Dept vehicles in CY 2018.
Employee Commute - Gasoline - 2018	Employee Commute	Employee Commute	CY 2018	Transportation	Employee Commute	Gasoline	Scope 3	71.462	0.003	0.002	72.144	low	Employee commute fuel use was estimated by UNH Sustainability Fellow Sarah Merriam in summer 2019. No current record of how the employee commute fuel use was estimated. Looks like it could have been a survey based on the data shared in Table 4 of her final report.
Employee Commute - Diesel - 2018	Employee Commute	Employee Commute	CY 2018	Transportation	Employee Commute	Diesel	Scope 3	5.104	0.000	0.000	5.108	Low	Employee commute fuel use was estimated by UNH Sustainability Fellow Sarah Merriam in summer 2019. No current record of how the employee commute fuel use was estimated. Looks like it could have been a survey based on the data shared in Table 4 of her final report.
Sewer Dept - WWTP - Electricity - 2018	Emissions from Grid Electricity	Water & Wastewater Treatment Facilities	CY 2018	Waste	Wastewater Treatment	Electricity	Scope 2	146.699	0.023	0.003	148.140	High	Electricity usage at the Kennebunkport Wastewater Treatment Plant (WWTP). Data from CMP billing.
Sewer Dept - Pump Stations - Electricity - 2018	Emissions from Grid Electricity	Water & Wastewater Treatment Facilities	CY 2018	Waste	Wastewater Treatment	Electricity	Scope 2	39.771	0.006	0.001	40.162	High	Electricity use at pump stations for sewer system. 17 pump stations in total. Data from CMP billing.
Sewer Dept - WWTP - Oil - 2018	Emissions from Stationary Fuel Combustion	Water & Wastewater Treatment Facilities	CY 2018	Waste	Wastewater Treatment	Discrete Fuel Use	Scope 1	38.673	0.006	0.000	38.910	Medium	Heating oil use for space heating at the WWTP at 25 Recreation Way. Usage estimate from vendor invoices for CY 2018.
Sewer Dept - WWTP - Propane - 2018	Emissions from Stationary Fuel Combustion	Water & Wastewater Treatment Facilities	CY 2018	Waste	Wastewater Treatment	Discrete Fuel Use	Scope 1	10.885	0.002	0.000	10.987	Medium	Propane use for space heating at the WWTP at 25 Recreation Way. Usage estimate from vendor invoices for CY 2018.

Sewer Dept - Septic Systems - Fugitive emissions	Fugitive Emissions from Septic Systems	Water & Wastewater Treatment Facilities	CY 2021	Waste	Wastewater Treatment	Anerobic & Aerobic Digestion	Scope 1	0.000	14.434	0.000	404.150	Low	According to Eli Rubin, Kennebunkport has approx. 1512 septic systems. Average household size is 2.20 people. Assume all septic systems are for residential dwellings. Therefore approx. 3,326.4 people served by septic systems.
Sewer Dept - WWTP - Process N20 from treatment with Nitrification/Denitrification	Process N2O Emissions from Wastewater Treatment	Water & Wastewater Treatment Facilities	CY 2021	Waste	Wastewater Treatment	Anerobic & Aerobic Digestion	Scope 1	0.000	0.000	0.039	12.098	low	Updated methodology from Sarah Mariam's 2019 estimate. Changed industrial commercial discharge multiplier to 1 (no known industrial discharge). Based on 2489 sewer connections (sewer dept. communications) and an average household size of 2.24 people, assume population served is 5,575 people. This is larger than the population of Kennebunkport but makes sense given the number of visitors, hotels, and seasonal population.
Sewer Dept - WWTP - Process N20 from effluent discharge	Process N2O from Effluent Discharge to Rivers and Estuaries	Water & Wastewater Treatment Facilities	CY 2021	Waste	Wastewater Treatment	Anerobic & Aerobic Digestion	Scope 1	0.000	0.000	0.103	31.961	low	Updated methodology from Sarah Mariam's 2019 estimate. Changed industrial commercial discharge multiplier to 1 (no known industrial discharge). Based on 2489 sewer connections (sewer dept. communications) and an average household size of 2.24 people, assume population served is 5,575 people. This is larger than the population of Kennebunkport but makes sense given the number of visitors, hotels, and seasonal population.

Appendix C – Recommendations to improve the GHG inventories

Future GHG inventories in two or three years may be used to evaluate Kennebunkport's progress on emissions reductions efforts and toward identified goals. The following is a list of recommendations to improve the quality of a future GHG inventory:

Community-wide GHG inventory

- Survey residents to get a better estimate of annual discrete fuel use for home heating and other purposes (Stationary Energy – Residential Discrete Fuel Use).
- Survey businesses to get a better estimate of annual discrete fuel use for building heating and other purposes (Stationary Energy – Commercial and Industrial Discrete Fuel Use).
- Survey residents to get an estimate of annual air travel (Transportation – Aviation).
- Survey businesses about their waste volumes and management practices to improve estimates of MSW.
- Consider using ICLEI LEARN tool or other method to estimate emissions and sequestration of GHG from land use changes (Agriculture, Forestry, Marine – Land).
- Collect data on more *Additional Indicators of Climate Action*, including:
    - Number of solar panels installed (potentially using data from code enforcement)
    - Hours of use of public EV charging stations (using data from EV charging station providers)
    - Number of private EV charging stations (using data from code enforcement)
    - Number of residents composting at home (using a survey)
    - Reuse economy statistics (using data from re-use businesses)
    - Business waste management practices (using a survey of businesses)

Municipal GHG inventory

- Streamline and standardize invoicing and record keeping of municipal discrete fuel and transportation fuel use to improve data accuracy.
- Conduct a survey of municipal employee commuting behavior to improve the estimate of employee commute emissions and add in employee business travel emissions.
- Begin to collect data on municipally-generated MSW to be able to estimate Waste MSW emissions.