Town of Kent: Municipal Greenhouse Gas Assessment, 2021

Completed by Sharon Nahm, Kate Leventhal, & Nathan Strope

Supervised and edited by Dr. Mary Ann Cunningham & Jennifer Rubbo

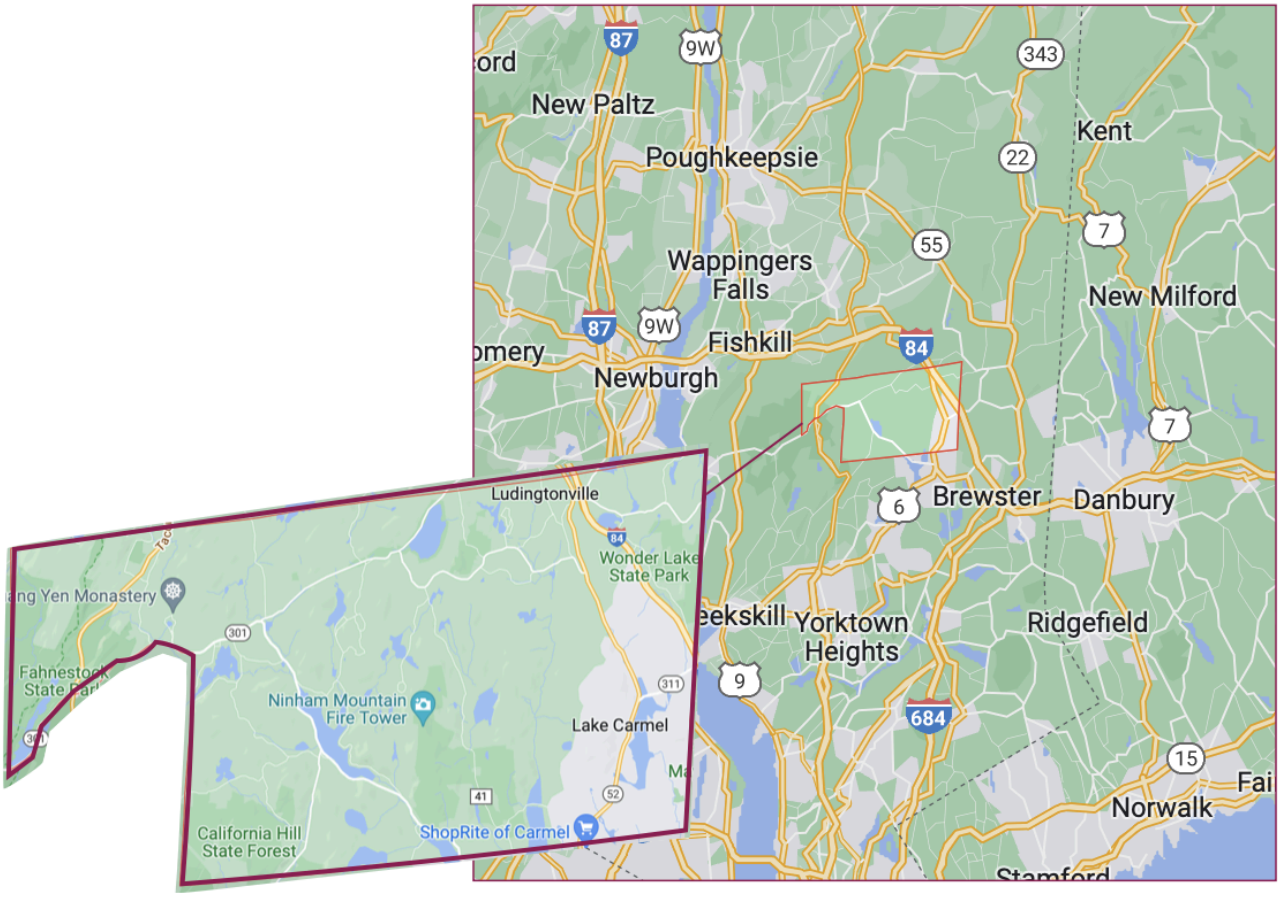

Figure 1. *Map of the Town of Kent.*

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Executive Summary

Recognized as the main catalyst to global warming, greenhouse gas (GHG) emissions resulting from human activity produce dramatic and far-reaching consequences for both humans and the environment. As a result, creating a Greenhouse Gas inventory is an important step in understanding effective action towards reducing climate impacts from human activity. Accounting for energy use and greenhouse gas emissions through a GHG inventory can help a community understand their local impact on the environment. An inventory can also help a community identify cost-effective efficiency opportunities, both large and small.

This report represents the Town of Kent's municipal greenhouse gas emissions for 2021, and it fulfills a preliminary step in becoming a certified climate smart community (CSC) for the state of New York. The CSC program, operating in alignment with New York State's Climate Act,[1] which aims to reduce economy-wide greenhouse gas emissions 40 percent by 2030 and to cut emissions by 85 percent compared to 1990 levels by 2050, provides planning support and project funding for enrolled CSC[2] communities. This certification, therefore, is a gateway to potential funding to help Kent become a more efficient and sustainable town.

This report represents emissions from local government operations within the boundary of Kent. An accompanying document reports emissions from community uses. Most of the emissions described in this municipal report are from town-owned buildings, facilities, and vehicles and thus fall within the direct control of the local government to address. Others such as the Kent Library are privately-owned municipal buildings that the local government might have some indirect control over. All municipal buildings, facilities, and vehicles are reported and organized under the sectors of buildings and facilities, streetlights, vehicle fleet, and water and sewage facilities following standardized protocols and precedents of other municipal greenhouse gas inventory reports.

Kent's municipal emissions were dominated by vehicle fleet (about 73%), followed by buildings and facilities (24%), water and sewage facilities (2%) and streetlights (1%).

In addressing these emissions, the town has clear advantages that could be built upon. As a starting point, Kent has shown a strong community capacity for innovation, planning, and funding acquisition, and these are an essential foundation for progress. In terms of transportation, electric vehicles are increasingly accessible and save both money and emissions over their lifetime. For heating municipal buildings, using heating oil is expensive and inefficient, and heat pump replacements that utilize electric heating have dramatic cost and energy efficiency

[1] 2019 Climate Leadership and Community Protection Act. https://climate.ny.gov

[2] Climate Smart Communities (CSC) is a New York State program that helps local governments take action to reduce greenhouse gas emissions and adapt to a changing climate. The program offers free technical assistance, grants, and rebates for electric vehicles. https://climatesmart.ny.gov/

advantages. Additionally, although they make up a small percentage of total emissions, municipal street lights and field lights can easily be replaced with LED lights (with the assistance of New York State financial incentive programs) to improve energy efficiency.

This work was carried out in accordance with CSC and ICLEI[3] guidance with funding from a New York State Energy Research & Development Authority (NYSERDA) grant and leadership from members of the Town of Kent Town Board. Funding was also provided by the Vassar College Undergraduate Research Science Institute.[4]

[3] ICLEI-Local Governments for Sustainability is a global network of local and regional governments committed to sustainable urban development. ICLEI provides protocols, frameworks, and guidance for producing greenhouse gas inventories at a community level as well as at a local government level. https://iclei.org

[4]Vassar College Undergraduate Research Science Institute (URSI). https://www.vassar.edu/ursi/projects

Introduction

This report begins with an introduction outlining the rationale for the local government to compile a greenhouse gas inventory and explaining the crucial terminology within the inventory report. Explanations of both boundaries and assumptions are discussed. Details dive into details of analysis, including uncertainties in the data, decisions in methodology, and the limitations of this report more generally are given in the appendix.

The municipal inventory is broken into four sections, representing standard designations of energy use sectors: buildings and facilities, streetlights, vehicle fleet, and water and sewage facilities. Calculating emissions values for these sections relied on firstly acquiring direct consumption data from the local government, then using standard methods of converting consumption to emissions. The formulas used for calculating emissions from each sector were based on ICLEI's *Local Government Operations (LGO) Protocol*[5].

Kent's total municipal emissions, from all sectors analyzed included, were 865 Metric Tons of Carbon Dioxide equivalent $MTCO_2e$. Of these emissions, the majority of the emissions accounted for (73%) can be attributed to the vehicle fleet. Buildings and facilities is the second largest sector, followed by water and sewage facilities, and streetlights (consisting of both the public streetlights and fieldlights within the Town of Kent).

These emissions can also be evaluated in terms of direct combustion within Kent (scope 1), indirect, offsite emissions from outside of Kent (scope 2, largely from purchased electricity), and other upstream emissions (scope 3). Among these, scope 1 is largest, primarily reflecting vehicle fuel use.

In addition to supporting CSC certification, this inventory can be used to guide planning in Kent, including climate action planning. Local climate action plans are an essential component of New York State's plans to reduce overall emissions. In particular, the New York Climate Leadership and Community Protection Act (CLCPA)[6] of 2019 has outlined state-wide goals for renewable energy and conservation, much of it relying on local leadership and local decision-making. As the economic and environmental benefits of planning for energy efficiency and climate protection coincide, following up with a planning process serves as a clear next step. The hope is these findings can be used as a basis for Kent to generate a climate action plan (CAP)[7] which is also a critical step towards certification as a CSC community.

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[5] ICLEI *Local Government Operations (LGO) Protocol*. https://icleiusa.org/resources/local-government-operations-lgo-protocol/

[6] 2019 Climate Leadership and Community Protection Act. https://climate.ny.gov

[7] As defined by NY State's CSC, a climate action plan (CAP) is a strategy document that sets goals and outlines a set of initiatives that reduce greenhouse gas (GHG) emissions. https://climatesmart.ny.gov/actions-certification/actions/?type=1336777436&tx_sjcert_action%5BactionObject%5D=10&tx_sjcert_action%5Baction%5D=getPDF&tx_sjcert_action%5Bcontroller%5D=Action&cHash=e88c3cc9a4fd13bcec4f3a5a25699b62

Table 1: Summary of total municipal emissions by sector and scope, 2021

Sector	Scope 1 ($MTCO_2e$)	Scope 2 ($MTCO_2e$)	Scope 3 ($MTCO_2e$)	Total ($MTCO_2e$)
Buildings and facilities	131	74	-	205
Streetlights	-	9	-	9
Vehicle fleet	635	-	-	635
Water and Sewage Facilities	-	16	-	16
Total	766	99	-	865

Climate Smart Communities

The Climate Smart Communities Program incentivises local governments to increase energy efficiency while reducing GHG emissions, in order to adapt to the current climate landscape. The CSC program, launched by New York State in 2009, encourages municipalities to adopt a pledge that they will commit to climate actions, as a framework for guiding and implementing climate initiatives. The required ten elements of the Climate Smart Communities Pledge are:

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

Climate Change and Greenhouse Gasses

Greenhouse Gasses are gas molecules that absorb infrared radiation emitted from the Earth's surface and then reflect heat back, contributing to global warming. Carbon dioxide, methane, ozone, and chlorofluorocarbons (CFCs) are all important GHG gasses that contribute to global warming and climate change.

Greenhouse Gas Inventory Framework

To generate a greenhouse gas inventory, we used existing frameworks to determine to include and how to break down sources of emissions. As noted in the executive summary, this report was calculated utilizing the framework and guidelines of ICLEI's *Local Government Operations (LGO) Protocol*[8], published in May 2010.

Definitions

Scope 1 Emissions: direct emissions from combustion within the geospatial boundaries of the town, including stationary fuel combustion and vehicle fleet emissions

Biogenic Emissions: CO_2 emissions produced from combusting a variety of biofuels and biomass, such as biodiesel, ethanol, wood, wood waste and landfill gas.

Scope 2 Emissions: indirect emissions at electricity power plants based on the amount of electricity consumed within the boundary, regardless of where the power plants are located.[9]

Scope 3 Emissions: other indirect emissions not included in scope 2 such as emissions from solid waste processes or commuting outside the boundaries of the community. (not included in this report).

Sector: organizational subdivision of the community: buildings and facilities, streetlights, vehicle fleet, and water and sewage facilities.

Source: fuel or energy source of emissions, for example electricity or fuel oil.

Greenhouse gasses (GHGs): primarily CO_2 but also CH_4, N_2O, and a variety of other trace gasses that contribute to global warming.

Metric tons CO_2 equivalent ($MTCO_2e$): because different GHGs have a different strength of impact on climate warming (also called global warming potential), comparison is easiest when relative impacts are converted to equivalent impacts of CO_2. Most GHG inventories report emissions in terms of CO_2 equivalents.

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[8] ICLEI Local Government Operations (LGO) Protocol. https://icleiusa.org/resources/local-government-operations-lgo-protocol/

[9] *Climate Smart Communities: New York Community and Regional GHG Inventory Guidance,* 2015, pg. 5 https://climatesmart.ny.gov/fileadmin/csc/documents/GHG_Inventories/ghgguide.pdf

Greenhouse Gas Inventory

Buildings and Facilities

The buildings and facilities sector includes direct and indirect emissions from the local government-owned buildings and facilities in the Town of Kent (scope 1 and scope 2).

Municipal buildings and facilities in this sector include: Town Hall, Police Department, Lake Carmel Park District Community Center, Lake Carmel Park District Maintenance Garage, Kent Highway, Old Town Hall, Ryan's Field, Kent Library, Kent Recycling Center, 311 Highway Garage, 301 Highway Garage, Kent Town Hall Generator, Kent Police Generator, Horsepound Road Generator, Marion Way Generator, and Will Way Generator. Streetlights and water and sewage facilities were accounted for in separate sectors following ICLEI protocol.

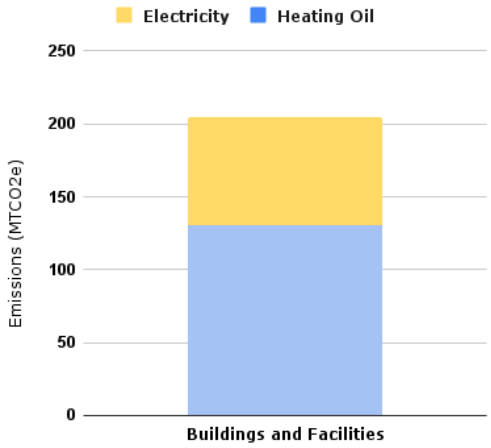

Figure 2 *Summary of Buildings and Facilities Emissions by Fuel Source and Sector, 2021.*

Methods

We measured buildings and facilities sector emissions from two different sources: the indirect source of electricity and the direct source of heating oil.

Electricity emissions for Kent's municipal buildings and facilities were compiled using direct data from NYSEG electricity bills. We added up the total electricity wattage usage from the various buildings and facilities for the year of 2021, then used the US EPA's NPCC Upstate NY (NYUP) eGRID factors (MWh/metric tons) for 2019[10] (the closest year available) to convert electricity consumption (in MWh) to emissions (in metric tons) of carbon dioxide, methane, and

[10] US EPA's NPCC Upstate NY (NYUP) eGRID factors for 2019 were found on the EPA's website: https://www.epa.gov/egrid/download-data .

nitrous oxide. Finally, using the global warming potentials (GWP)[11] of methane and nitrous oxide we converted these emissions to the standard measurement of metric tons of carbon dioxide equivalents (MTCO2e).

To find the heating oil emissions for Kent's municipal buildings and facilities, we used the direct data of receipts from Mirabito Energy Products transactions. We added up the total heating oil usage from the various municipal buildings and facilities and found total heating oil consumption (in MMBtu) which we then converted to emissions (metric tons) of carbon dioxide, methane, and nitrous oxide by using ICLEI's conversion factors for each fuel (MMBtu/metric tons). We then used the global warming potentials (GWP) of methane and nitrous oxide to convert these emissions to the standard measurement of metric tons of carbon dioxide equivalents (MTCO2e).

Results

Table 2: *Summary of Buildings and Facilities emissions by sector and scope, 2021 (MWh=megawatt-hours/million watt-hours)*

SECTOR	FUEL OR SOURCE	SCOPE	USAGE	EMISSIONS ($MTCO_2e$)
Buildings and Facilities	Electricity	2	694 MWh	74
	Heating Oil	1	12,759 gallons	131
	total			205

Streetlights

The streetlights sector includes the indirect electricity emissions (scope 2) from the 42 streetlights, and the fieldlights (in Ryan's Field) within the town of Kent.

[11] For GWP Potentials for methane and nitrous oxide, see the UN IPCC 2nd Assessment report's 20 year GWPs: https://unfccc.int/process/transparency-and-reporting/greenhouse-gas-data/greenhouse-gas-data-unfccc/global-warming-potentials

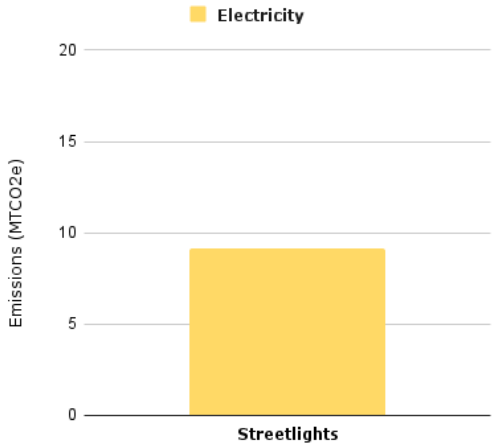

Figure 3 *Summary of Streetlights Emissions by Fuel Source and Sector, 2021.*

Methods

Electricity emissions for Kent's streetlights were compiled using direct data from NYSEG electricity bills. We added up the total electricity wattage usage from streetlights and fieldlights for the year of 2021 and used the same methods detailed above for converting buildings and facilities electricity usage into emissions to convert street light electricity consumption (in MWh) into emissions (of $MTCO_2e$)

Results

Table 3: *Summary of Streetlights emissions by sector and scope, 2021. (MWh=megawatt-hours/million watt-hours)*

SECTOR	FUEL OR SOURCE	SCOPE	USAGE	EMISSIONS ($MTCO_2e$)
Streetlights	Electricity	2	86 MWh	9
	total			9

Vehicle Fleet

The vehicle fleet sector includes the direct emissions (scope 1) emitted from the gasoline, ethanol, and diesel consumed by the 110 vehicles within Kent's municipal vehicle fleet. The fleet consists of trucks, passenger vehicles, and other vehicles that all consume different amounts of fuel, however all of these vehicles received their gasoline or diesel from a single fueling station. This information was used to calculate the municipal vehicle fleet emissions for both the years of 2019 and 2021.

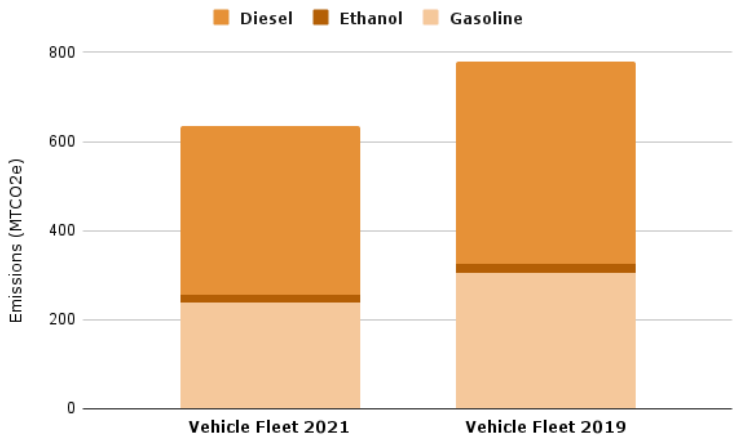

Figure 4 *Summary of Vehicle Fleet Emissions by Fuel Source and Sector, 2021 and 2019*

Methods

Vehicle fleet emissions were found by using the total gallons consumed of both diesel and gasoline provided by receipts from the single fueling station used by the municipal vehicle fleet. To find the ethanol usage (in gallons), we used a standard equation of calculating 10% of the total fuel usage. After finding the total consumption (in gallons) of gasoline, ethanol, and diesel, we converted consumption to emissions (metric tons) of carbon dioxide, methane, and nitrous oxide by using ICLEI's conversion factors for each fuel (gallons/metric tons). We then used the global warming potentials (GWP) of methane and nitrous oxide to convert these emissions to the standard measurement of metric tons of carbon dioxide equivalents ($MTCO_2e$).

Results

The vehicle fleet emissions for both the year of 2019 and 2021 were calculated, and the total emissions from this sector were found to have decreased by 145 $MTCO_2e$ from 2019 to 2021. Despite this decrease in total emissions within the two-year time span, vehicle fleet emissions made up the significant majority (73%) of emissions in the municipal sector for the year of 2021.

Table 4: *Summary of Vehicle Fleet emissions by sector and scope, 2021*

SECTOR	FUEL OR SOURCE	SCOPE	USAGE	EMISSIONS ($MTCO_2e$)
Vehicle Fleet	Gasoline	1	27,088 gallons	240
	Ethanol	Biogenic	3,010 gallons	17
	Diesel	1	37,001 gallons	378
	total			635

Table 5: Summary of Vehicle Fleet emissions by sector and scope, 2019

SECTOR	FUEL OR SOURCE	SCOPE	USAGE	EMISSIONS ($MTCO_2e$)
Vehicle Fleet	Gasoline	1	34,432 gallons	304
	Ethanol	1	3,826 gallons	22
	Diesel	Biogenic	44,322 gallons	453
	total			779

Water and Sewage Facilities

The water and sewage facilities sector includes the indirect electricity emissions (scope 2) from the water districts and sewer districts within the town of Kent.

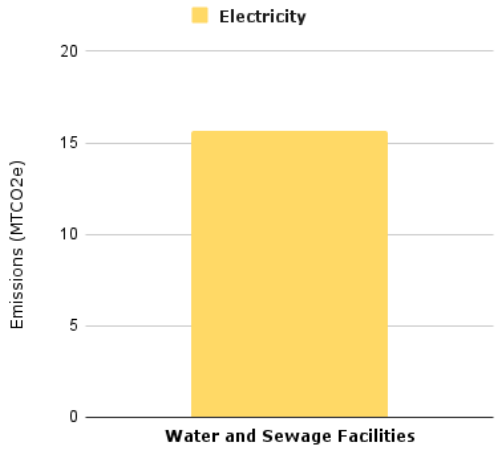

***Figure 5** Summary of Water and Sewage Facilities Emissions by Fuel Source and Sector, 2021*

Methods

Electricity emissions for Kent's water and sewage facilities were compiled using direct data from NYSEG electricity bills. We added up the total electricity wattage usage from the water and sewer districts for the year of 2021 and used the same methods detailed above for converting buildings and facilities and street light electricity usage into emissions to convert water and sewage facilities electricity consumption (in MWh) into emissions (of $MTCO_2e$)

Results

Table 6: *Summary of Streetlights emissions by sector and scope, 2021 (MWh=megawatt-hours/million watt-hours)*

SECTOR	FUEL OR SOURCE	SCOPE	USAGE	EMISSIONS ($MTCO_2e$)
Water and Sewage Facilities	Electricity	2	148 MWh	16
	total			16

Conclusion

This report serves as Kent's inventory of local government-wide greenhouse gas emissions, which is a requirement for participating in New York State's Climate Smart Community program.

This inventory and report can help the town of Kent develop a Climate Action Plan: a set of steps and recommendations that the local government of Kent can take to reduce their emissions, maximize carbon sequestration, and set targets to reach carbon neutrality.

The results of this study indicate that the largest percentage of municipal emissions resulted from the town's vehicle fleet, with the town employing 110 vehicles that run on gasoline and diesel. Kent's local government may look to prioritize targeting transportation emissions reduction in their Climate Action Plan, through converting their vehicle fleet from gasoline and diesel engines to electric.

Although a greenhouse gas inventory may indicate which sectors produce relatively greater and fewer emissions, this should not inform the community to disregard certain emissions and focus on certain emissions. A good Climate Action Plan should address as many sectors, scopes and sources of emissions within the community as possible.

This 2021 Municipal greenhouse gas inventory serves as the benchmark for measurable emission reductions progress within the town of Kent. Future inventories may use this existing framework to identify successes and sources of improvement in Climate Action Plans.

Appendix

I. Uncertainties

Although the municipal inventory relied on direct consumption data, uncertainties arose from the estimations taken in converting consumption to emissions. In the following sections, the specific assumptions, uncertainties and limitations associated with each municipal sector are outlined.

Buildings and Facilities

For electricity, the utility-specific greenhouse gas emission factor for NYSEG electricity was unavailable and as a result this was substituted with the less accurate, regional emission factor: the US EPA's NPCC Upstate NY (NYUP) eGRID factors for 2019 (most recent). In future calculations, the NYSEG-specific electricity emission factor (if available) should be used both to achieve greater accuracy and to understand the specific emissions from Kent produced from NYSEG's electricity mix.

For heating oil, the Mirabito Energy Products transactions lacked specificity on the type of fuel type used, thus our calculations assumed that kerosene, the most common heating oil type in New York State, was used by Kent's municipal buildings and facilities. Consequently, our calculations used the kerosene emission factor when converting heating oil consumption (gallons) into emissions ($MTCO_2e$). It is unlikely that a different heating oil would make a significant calculation difference, however in future calculations, the specific fuel type should be used to produce the most accurate emission calculation.

Streetlights

As with the electricity consumed by buildings and facilities, for electricity, the utility-specific greenhouse gas emission factor for NYSEG electricity used by streetlights was unavailable and as a result this was substituted with the less accurate, regional emission factor: the US EPA's NPCC Upstate NY (NYUP) eGRID factors for 2019 (most recent). In future calculations, the NYSEG-specific electricity emission factor (if available) should be used both to achieve greater accuracy and to understand the specific emissions from Kent produced from NYSEG's electricity mix.

Vehicle Fleet

The potential source of error for this calculation is the use of *one* emission factor for both CH_4 and N_2O in diesel emissions. Different diesel vehicles actually in fact have slightly different emission levels of these gasses and thus different emissions factors. However, this source of error

is small, because the total impact of CH_4 and N_2O is less than 1% of the net $MTCO_2e$ emissions from vehicles regardless of type.

The limitation of this assessment is that it does not include employees of the Town of Kent who use personal vehicles for commuting to and from work. Another report which included this value sent a survey to employees of the Town to understand average mileage commuting and type of vehicle to estimate emissions. This report found these emissions to be about 12% of total vehicle fleet emissions (Colgate Report).[12]

Water and Sewer Facilities

As with the electricity consumed by buildings, facilities, and streetlights, for electricity, the utility-specific greenhouse gas emission factor for NYSEG electricity used by water and sewer facilities was unavailable and as a result this was substituted with the less accurate, regional emission factor: the US EPA's NPCC Upstate NY (NYUP) eGRID factors for 2019 (most recent). In future calculations, the NYSEG-specific electricity emission factor (if available) should be used both to achieve greater accuracy and to understand the specific emissions from Kent produced from NYSEG's electricity mix.

Furthermore, the heating oil usage data for water and sewage facilities was not included due to lack of availability of this data. In future inventories, this sector should include the emissions from both electricity (scope 1) and heating oil (scope 2).

[12] Colgate University, *The Town of Hamilton, NY 2019 Municipal Greenhouse Gas Inventory*. https://www.townofhamiltonny.gov/sites/g/files/vyhlif5581/f/uploads/toh_2017_municipal_ghg_inventory_-_csc_final_report_0.pdf