Seneca Polytechnic

Greenhouse Gas Emissions Study Report

August 29, 2023

Table of Contents

Executive Summary

Authorization

This report was prepared at the request of Seneca Polytechnic as per RFP 23-761 as per our proposal dated July 25, 2022.

Purpose

This study establishes the current greenhouse gas emissions as a baseline for future work to better understand and reduce emissions. Where possible, the data is based on the last “normal occupancy” year (2019). However, data from other reporting years was used due to the lack of 2019 information in the following cases:

- Fleet vehicles (2022/2023)
- Diesel (2021)
- Livestock (2022)
- Waste (2020)
- Purchased goods and services (2019/2020)
- Aviation fuel (2022)
- Solar PV (2020)

The report estimates and compares Seneca Polytechnic’s scope 1, 2 and 3 emissions, carbon capture and renewable generation. The emissions are reported in carbon dioxide equivalents (CO_{2e}).

Asset Overview

The following campuses were included in the scope of this study:

- King
- Markham
- Newnham
- Peterborough
- Seneca@York

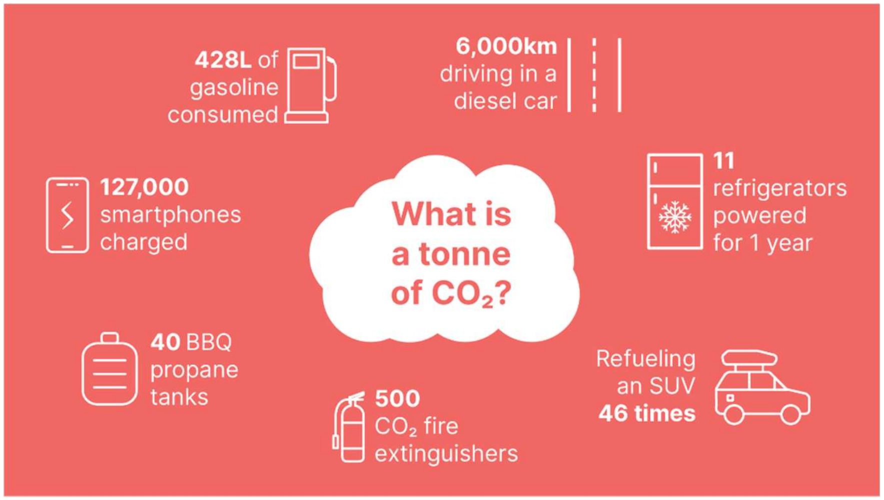

Image source: https://radiclebalance.com/resources/articles/what-is-a-tonne-of-co2

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Key Findings

The following figures illustrate the breakdown of the emissions by source for Seneca Polytechnic as well as the breakdown of total polytechnic emissions by campus.

Expanding the study beyond the emissions within Seneca's control by including scope 3 sources generates a holistic picture of overall emissions.

Seneca Polytechnic Total Scope 1 & 2 Emissions

The table below shows the total estimated scope 1 and 2 greenhouse gas emissions for Seneca Polytechnic including all campuses.

Emission Source	Scope 1 & 2 GHG Emissions (kg-CO_{2e})	Percent of Scope 1 & 2 Emissions
Natural Gas	5,408,491	61.1%
Electricity	873,797	9.9%
District Steam	1,012,460	11.4%
Diesel	35,064	0.4%
Propane	135,283	1.5%
Refrigerants	227,244	2.6%
Fleet Shuttle Busses	393,414	4.4%
Fleet Grounds & Maintenance	42,100	0.5%
Aviation Fuel	750,741	8.5%
Solar Photovoltaics	-24,989	-0.3%
Total Scope 1 & 2 Emissions	8,853,605	100%

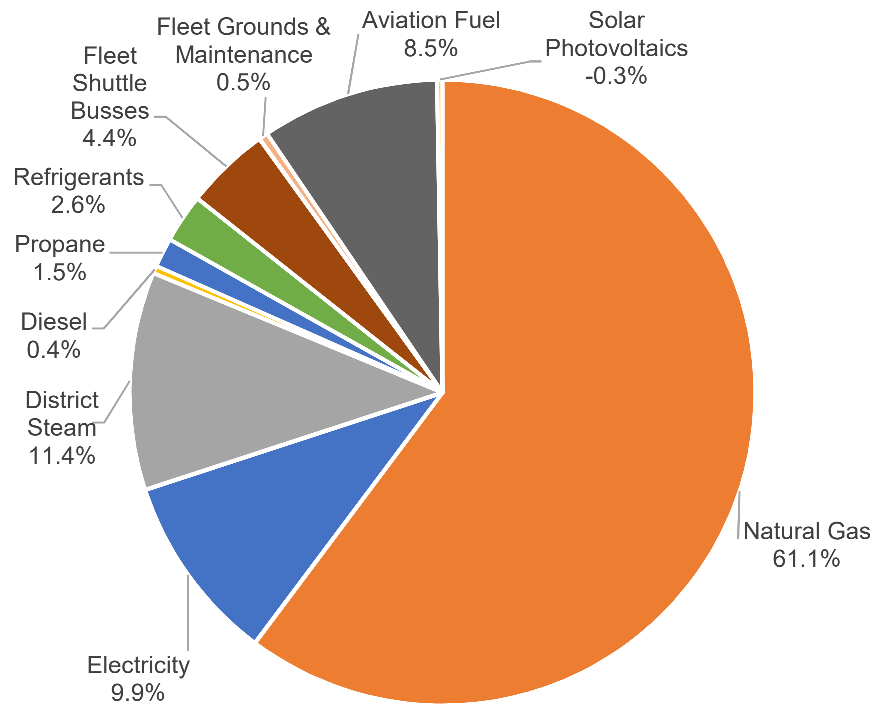


Figure 1: Breakdown of scope 1 and 2 emissions

Seneca Polytechnic Total Scope 1, 2 & 3 Emissions

The table below shows the total estimated greenhouse gas emissions for Seneca Polytechnic including all campuses.

Emission Source	Total GHG Emissions (kg-CO_{2e})	Percent of Total Emissions
Natural Gas	5,408,491	16.9%
Electricity	873,797	2.7%
District Steam	1,012,460	3.2%
Diesel	35,064	0.1%
Propane	135,283	0.4%
Refrigerants	227,244	0.7%
Fleet Shuttle Busses	393,414	1.2%
Fleet Grounds & Maintenance	42,100	0.1%
Aviation Fuel	750,741	2.4%
Water	4,070	0.01%
On Site Water	-	-
Personal Vehicle Commuting	18,071,287	56.6%
Public Transit Commuting	2,546,664	8.0%
Livestock Enteric Fermentation	40,793	0.1%
Purchased Goods & Services	1,700,112	5.3%
Waste	262,467	0.8%
Maintenance & Refurbishment	487,061	1.5%
Solar Photovoltaics	-24,989	-0.1%
Carbon Sequestration	-53,152	-0.2%
Total Emissions	31,912,908	100%

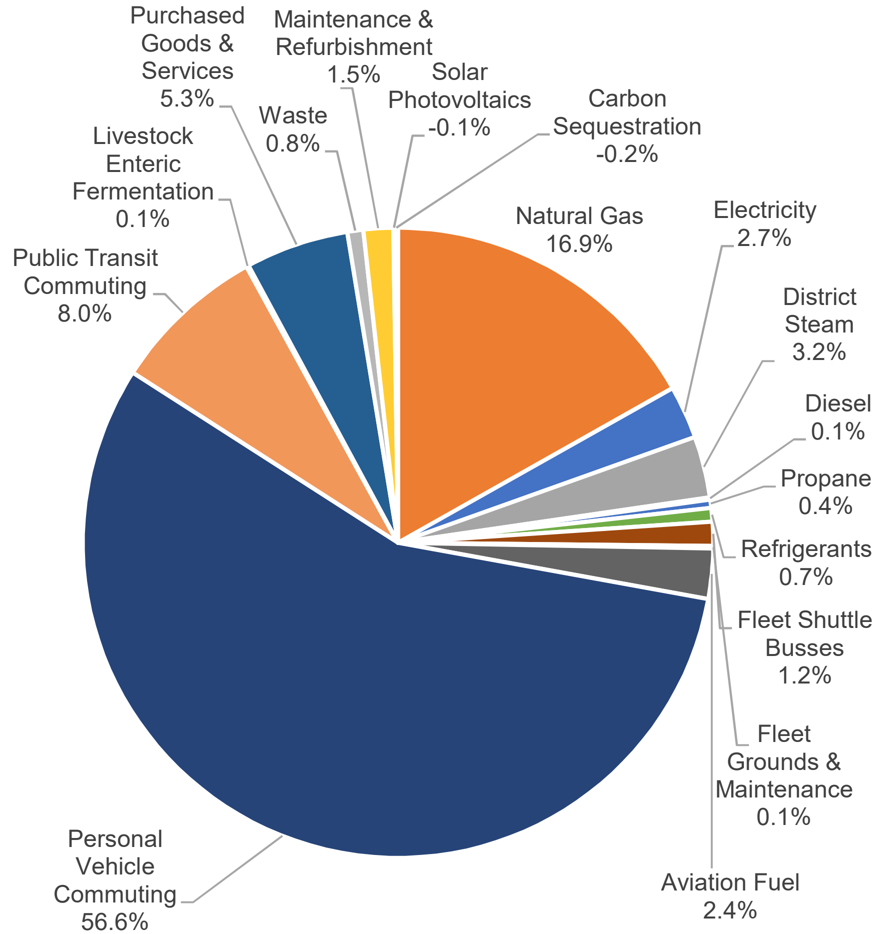


Figure 2: Breakdown of scope 1, 2 and 3 emissions

As expected, the study shows that scope 3 emissions, those emissions from sources not owned or directly controlled by Seneca but are a consequence of the activities of the polytechnic, represent a significant portion of the total emissions.

The following figures show the magnitude of difference between the scope 1 and 2 emissions versus scope 3. The polytechnic's carbon sequestration, inset and offset initiatives are included in the comparison.

The majority of scope 3 emissions where the polytechnic does not have control (e.g. student and employee commuting) are typically quantified using lower quality data sources. The range of data quality for the emissions sources is presented in the Data Quality subsection.

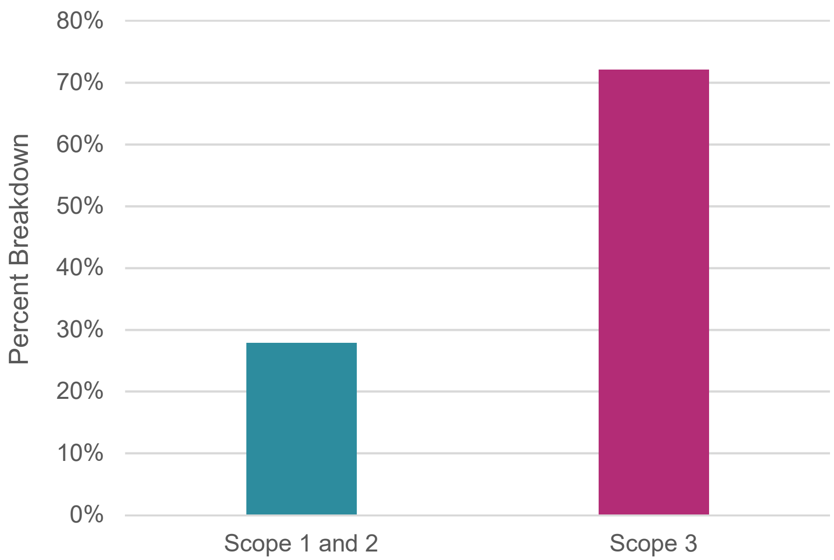


Figure 3: Breakdown of scope 1, 2, and 3 emissions by percentage

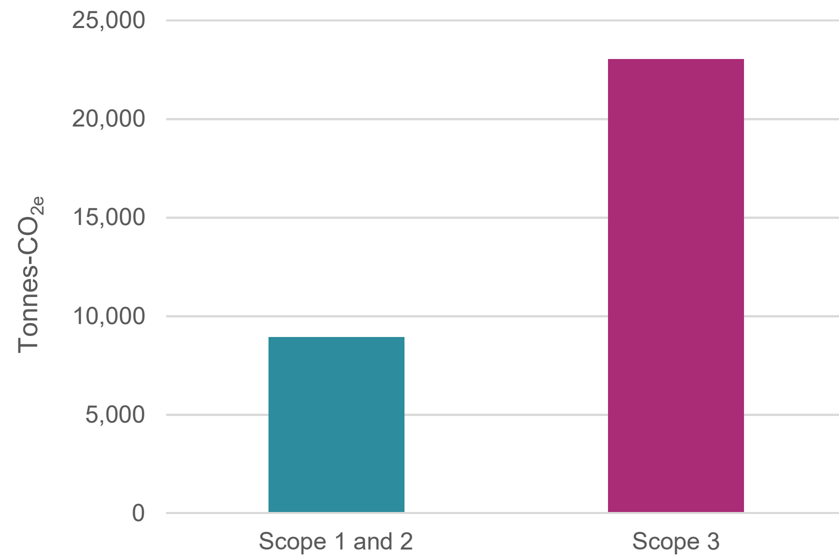


Figure 4: Breakdown of scope 1, 2, and 3 emissions by Tonnes-CO_{2e}

Seneca Polytechnic Emissions by Campus

The following figure illustrates the breakdown of greenhouse gas emissions by each of the five campuses evaluated.

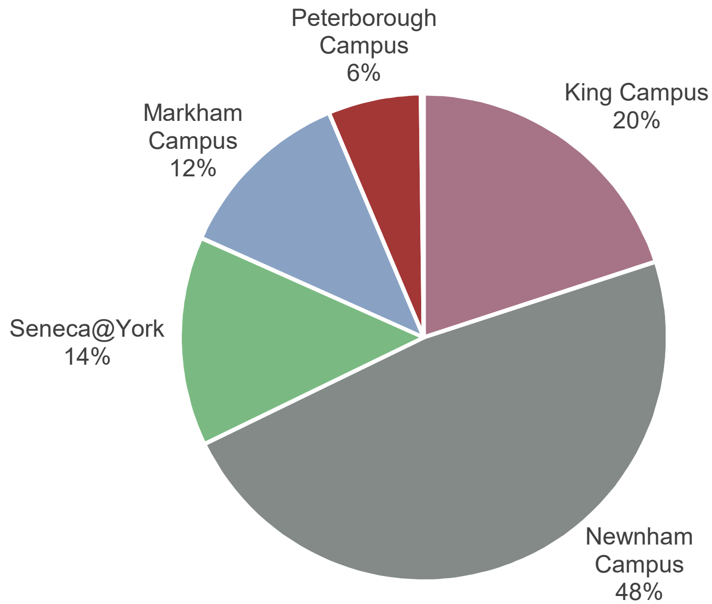
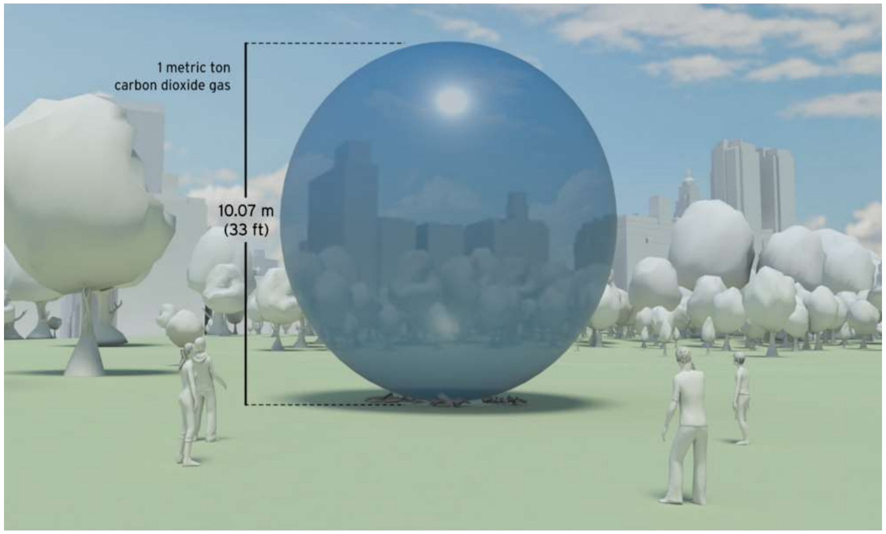


Figure 5: Breakdown of emissions for Seneca Polytechnic by campus

Campus	Total GHG Emissions (Tonnes-CO_{2e})	Percent of Total Emissions	GHG Intensity (kg-CO_{2e}/m^2)
King Campus	6,401	20%	96.4
Newnham Campus	15,329	48%	76.4
Seneca@York	4,450	14%	82.4
Markham Campus	3,833	12%	151.2
Peterborough Campus	1,899	6%	326.2
Seneca Polytechnic	31,913	100%	90.6



Data Quality

This report forms a comprehensive quantification of the scope 1, 2 and 3 greenhouse gas emissions for the polytechnic. Where the scope 1 and 2 emissions that are directly related to the polytechnic are better defined, the scope 3 emissions represent a sizable percentage of the overall emissions.

This study quantified the greenhouse gas emissions resulting from many aspects of the polytechnic operations and it was found that the data quality was lower for the majority of scope 3 emissions where the polytechnic doesn't have control.

Sources of primary data and secondary data can vary in quality. When selecting data sources, the following data quality indicators as provided by the GHG Protocol have been used as a guide[1].

- Technological representativeness: The degree to which the data set reflects the actual technology(ies) used.
- Temporal representativeness: The degree to which the data set reflects the actual time (e.g., year) or age of the activity.
- Geographical representativeness: The degree to which the data set reflects the actual geographic location of the activity (e.g., country or site).
- Completeness: The degree to which the data is statistically representative of the relevant activity. Completeness includes the percentage of locations for which data is available and used out of the total number that relate to a specific activity. Completeness also addresses seasonal and other normal fluctuations in data.
- Reliability: The degree to which the sources, data collection methods and verification procedures used to obtain the data are dependable.

The data quality indicators describe the representativeness of data in terms of technology, time, and geography as well as the quality of data measurements (i.e., completeness and reliability of data).

The data quality for each of the emission estimates was qualitatively evaluated based on the criteria outlined on the following page as provided in the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard[2].

An overview of the data quality for this assessment is provided in the following graph.

Figure 6: Quality of data used in the study

[1] https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

[2] https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf

Score	Representativeness to the activity in terms of:				
	Technology	Time	Geography	Completeness	Reliability
Very good	Data generated using the same technology	Data with less than 3 years of difference	Data from the same area	Data from all relevant sites over an adequate time period to even out normal fluctuations	Verified[3] data based on measurements[4]
Good	Data generated using a similar but different technology	Data with less than 6 years of difference	Data from a similar area	Data from more than 50 percent of sites for an adequate time period to even out normal fluctuations	Verified data partly based on assumptions or non-verified data based on measurements
Fair	Data generated using a different technology	Data with less than 10 years of difference	Data from a different area	Data from less than 50 percent of sites for an adequate time period to even out normal fluctuations or more than 50 percent of sites but for a shorter time period	Non-verified data partly based on assumptions, or a qualified estimate (e.g. by a sector expert)
Poor	Data where technology is unknown	Data with more than 10 years of difference or the age of the data are unknown	Data from an area that is unknown	Data from less than 50 percent of sites for shorter time period or representativeness is unknown	Non-qualified estimate

Adapted from B.P. Weidema and M.S. Wesnaes, "Data quality management for life cycle inventories – an example of using data quality indicators," Journal of Cleaner Production 4 no. 3-4 (1996): 167-174.

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Introduction

Project Description

Seneca is a comprehensive polytechnic with degree, diploma and graduate certificate programs. Full and part-time programs are offered on campuses in Toronto, York Region, and Peterborough with approximately 25,000 full-time and 70,000 part-time students enrolled. Seneca's size and diversity give students the advantage of partnerships with industry leaders, the latest in hands-on computer technology, a variety of class sizes, and full-time, part-time and continuing education options. Seneca also employs various methods of flexible and accessible teaching – from in-class lectures and online learning to co-op and field placements – in programs related to applied arts, business, financial services and technology.

Seneca Polytechnic invited qualified and experienced consultants to conduct a scope 1, 2 and 3 emissions audit. The study considered greenhouse gas emissions across each of the five Seneca Campuses; Newnham, Seneca@York, Markham, King and Peterborough. The following GHG emission scopes were considered as part of the study:

- Scope 1: covers direct emissions from owned or controlled sources.
- Scope 2: covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company.
- Scope 3: includes all other indirect emissions that occur in a company's value chain.

The greenhouse gas emissions study was conducted to:

- identify GHG emission generating processes and activities at Seneca;
- estimate the greenhouse gas emissions generated by the facilities and activities at Seneca.

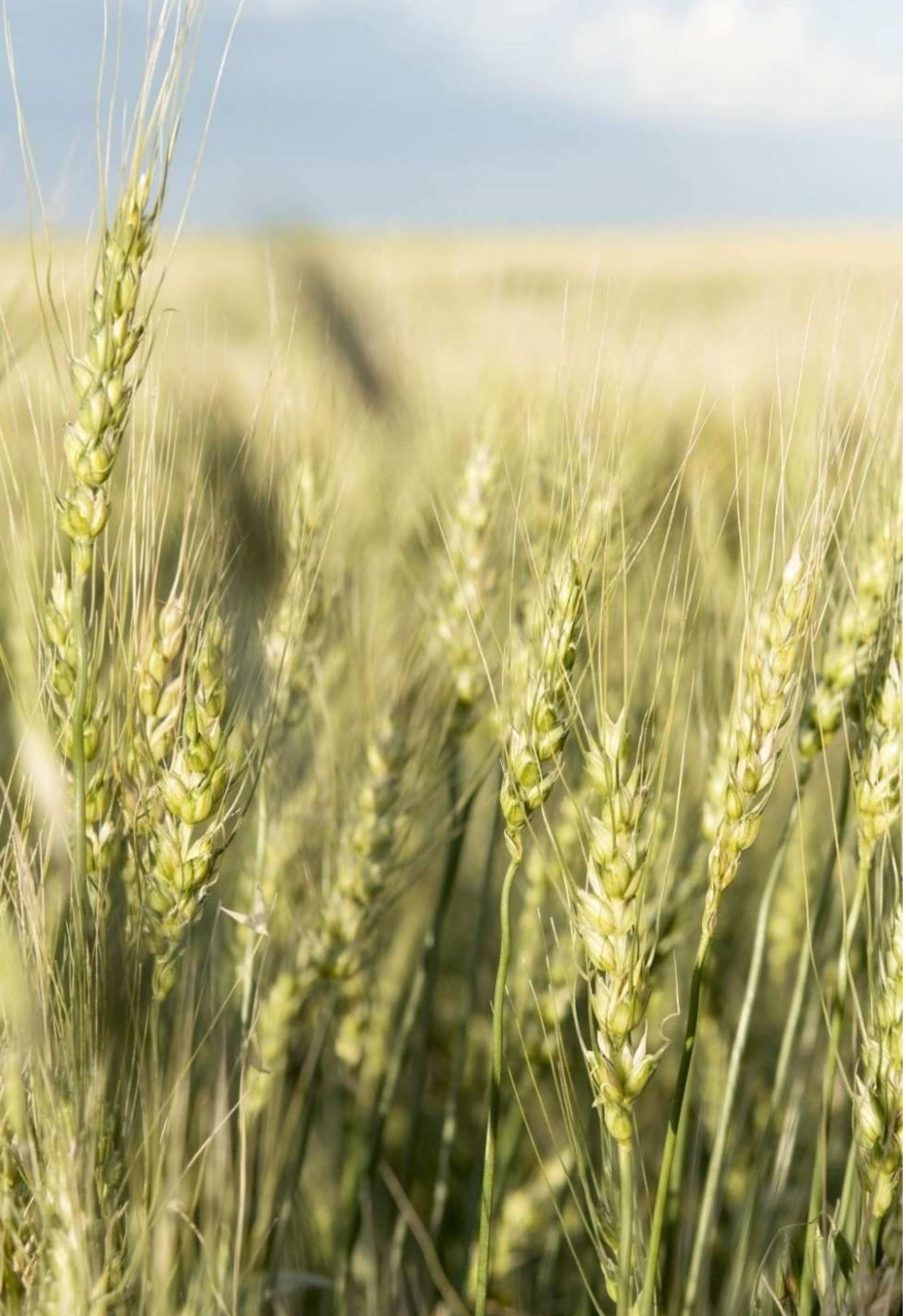
This report provides a baseline summary of the greenhouse gas emissions for Seneca Polytechnic. Where possible, the data is based on the last "normal occupancy" year (2019). However, data from other reporting years was used due to the lack of 2019 information in the following cases:

- Fleet vehicles (2022/2023)
- Diesel (2021)
- Livestock (2022)
- Waste (2020)
- Purchased goods and services (2019/2020)
- Aviation fuel (2022)
- Solar PV (2020)

Project Goal

The goals of this study are:

- Reduced energy demand and reliance on fossil fuels
- Reduced greenhouse gas emissions across all scope levels
- A pathway to net zero across all campuses



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Background

Canadian Commitment to Net Zero by 2050

In 2016, Canada was one of 195 signatories on the Paris Agreement. The Paris Agreement was adopted in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC). One of the main goals of the agreement is to limit global warming to 1.5 degrees Celsius above pre-industrial levels.

The Government of Canada developed the 2016 Pan-Canadian Framework on Clean Growth and Climate Change with provinces and territories and in consultation with Indigenous peoples. The framework addresses the goals of the Paris Agreement and outlines greenhouse gas reduction targets to achieve a 30% reduction in greenhouse gas emissions by 2030.

Changes Identified and Projected for Canada

To move forward with a framework towards a 30% reduction and eventual net-zero carbon emissions, several measures have been implemented (or are underway) nationally to assist in achieving these targets. In addition to each province and territory requiring a carbon pricing system, other items such as phasing out coal by 2030, phasing down hydrofluorocarbons, and implementing methane regulations are part of these strategies.

As the targets towards a 30% reduction and net-zero emissions draw closer, more stringent reduction measures and updated standards, such as the National Building Code, can be expected.

Climate Change Impacts and Risks

Many people think of global warming and climate change as synonyms, but scientists prefer to use "climate change" when describing the complex shifts now affecting our planet's weather and climate systems. Climate change encompasses not only rising average temperatures (global warming) but also extreme weather events, rising seas and a range of other impacts.

"Global warming will continue to increase in the near term (2021-2040) mainly due to increased cumulative CO_2 emissions in nearly all considered scenarios and modelled pathways. In the near term, global warming is more likely than not to reach 1.5°C even under the very low GHG emission scenario and likely or very likely to exceed 1.5°C under higher emissions scenarios. In the considered scenarios and modelled pathways, the best estimates of the time when the level of global warming of 1.5°C is reached lie in the near term. Global warming declines back to below 1.5°C by the end of the 21st century in some scenarios and modelled pathways. The assessed climate response to GHG emissions scenarios results in a best estimate of warming for 2081–2100 that spans a range from 1.4°C for a very low GHG emissions scenario (SSP1-1.9) to 2.7°C for an intermediate GHG emissions scenario (SSP2-4.5) and 4.4°C for a very high GHG emissions scenario (SSP5-8.5)"[3].

Things that we depend upon and value – human health, water, energy, transportation, wildlife, ecosystems and agriculture – are experiencing the effects of a changing climate. These can have significant implications for both people and infrastructure on campus.

Some of the direct impacts of climate change on educational institutions include:

- Rising maximum temperatures
- Increase in heavy precipitation (heavy rain and hail)
- Increase in extreme weather and storm events
- Increased risk of forest fires

Beyond the physical impacts, institutions also face financial risks related to the transition to a lower-carbon economy.

3 https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

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Steps to Net Zero

One of the most critical steps on the path to net zero is defining the end goal – what is net zero? In its simplest terms, net zero refers to a state in which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere[4]. To go net zero is to reduce greenhouse gas emissions and/or to ensure that any ongoing emissions are balanced by removals[5]. This means looking at all scope 1, 2 and 3 emissions and determining where emissions can be completely eliminated and where offsets will be required.

Although this report focusses on the measurement of Seneca's emissions to provide a baseline summary, it is important to understand the best practice approach for achieving net zero to inform strategies for advancing GHG emissions reduction going forward.

Net Zero Carbon Defined

There are several net zero definitions to be aware of. It is important to be clear on what net zero means to continue to reduce their emissions towards net zero.

Net zero carbon refers to a facility that, "…produces on-site, or procures, carbon-free renewable energy or high-quality carbon offsets in an amount sufficient to offset the annual carbon emissions

[4] https://netzeroclimate.org/what-is-net-zero/
[5] https://netzeroclimate.org/what-is-net-zero/

associated with building materials and operations".[6] Note that net zero carbon is based on carbon emissions and not on energy consumption.

Step 1. Energy Conservation and Energy Efficiency

There is no silver bullet to get to net zero. The path to net zero is comprised of many small steps, all with the intent to reduce greenhouse gas emissions.

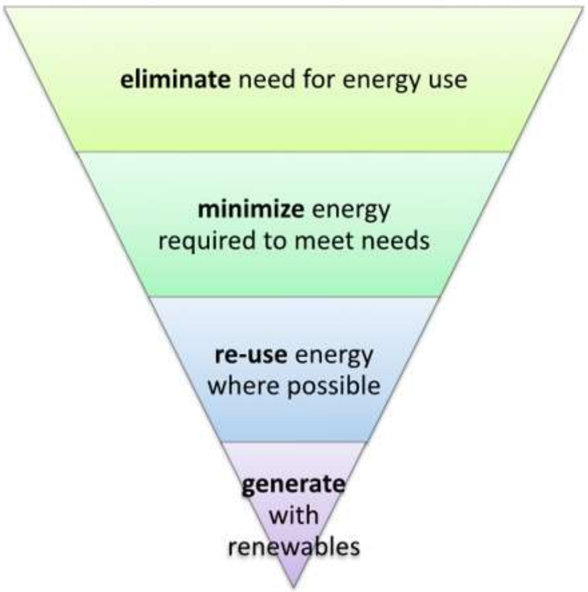
The first step on the path to net zero is energy conservation. Before applying efficiency measures or looking to decarbonize, basic conservation can go a long way to reducing energy consumption and associated emissions. Implementing energy conservation and efficiency measures should be looked at as a layered approach.

- First, focus on eliminating the need for energy;
- Second, focus on improving the efficiency of systems that deliver energy;
- Third, focus on recovering energy before discharging; and
- Finally, supplement with renewable energy generation.

While this approach is buildings-centric, this layered approach can be applied to scope 3 emissions as well.

Step 2. Decarbonization

Once conservation and efficiency measures have been implemented, the next step in the pathway to net zero is decarbonization. Decarbonization refers to transitioning away from fossil-fuel based systems toward systems that have a significantly smaller carbon footprint. Whether this means replacing a standard boiler in a building with an electric heat pump or electrifying fleet vehicles, decarbonization is a critical step in the path to net zero.



Step 3. Green Power Products, Carbon Offsets and Insets

The final step in the path to net zero is to purchase green power products and carbon offsets to offset the campus emissions. There are two main types of emissions offsets to consider:

- Green power products
- Carbon offsets

The procurement of green power products allows campuses to replace power from their local grid with clean, renewable power supplied to the

[6] Zero Carbon Building Standard v2, Canada Green Building Council

grid on their behalf. Green power may be in the form of bundled green power products or renewable energy certificates (REC). Bundled green power products are a subset of renewable energy composed of grid-based electricity produced from renewable sources and involves purchasing environmental attributes directly from our local utility. A REC is a tradable commodity representing proof that a unit of electricity was generated from a renewable source and are sold separately from electricity itself. Note that green power products and RECs are used to reduce emissions from electricity consumption only and should be Green-e Energy certified or EcoLogo certified.

Emissions from fossil fuels are offset using carbon offsets. Carbon offsets, a form of avoided greenhouse gas emissions, are a credit for greenhouse gas emissions reductions that occur somewhere else that can be purchased to compensate to the emission of a project or campus.

“Insetting refers to the financing of climate protection projects along a company’s own value chain that demonstrably reduce or sequester emissions and thereby achieve a positive impact on the communities, landscapes and ecosystems associated with the value chain”[7]. A common example is planting trees. The focus of carbon offsets is on the tonnes of carbon avoided/removed, while the focus of carbon insets is creating carbon emissions reduction capacity.

[7]https://www.myclimate.org/information/faq/faq-detail/what-is-carbon-insetting/

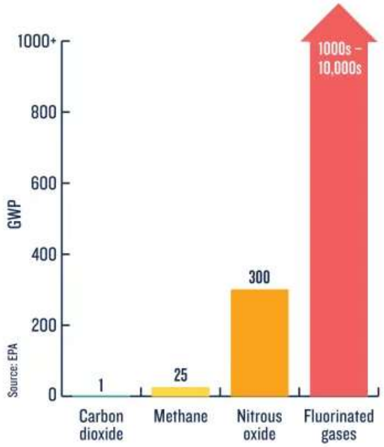
Measuring Greenhouse Gas Emissions

The GHGs considered in the analysis are those covered by the internationally recognized Greenhouse Gas Protocol. Gases are converted to CO_2 equivalents to calculate the emissions for the campus. The gasses included in the CO_{2e} emissions are carbon dioxide, nitrogen trifluoride, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

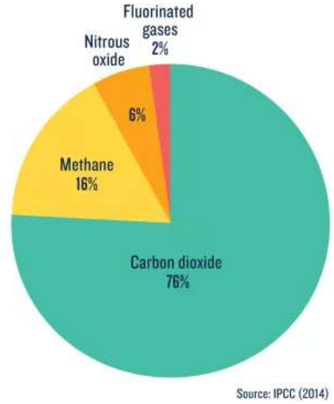
Each of the GHGs has a unique atmospheric lifetime and heat-trapping potential. The global warming potential (GWP) metric examines each GHG's ability to trap heat in the atmosphere compared to carbon dioxide. The first figure on the following page demonstrates how GHGs warm our planet[8].

Greenhouse gas emissions are divided into three scopes, as outlined in the second figure on the following page.

[8] https://www.goodenergiesalliance.ie/key-topics/climate-crisis/greenhouse-effect/



The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.



How much each human-caused greenhouse gas contributes to total emissions around the globe.

Scope 1: Direct

Emissions from sources that are owned or controlled by the institution

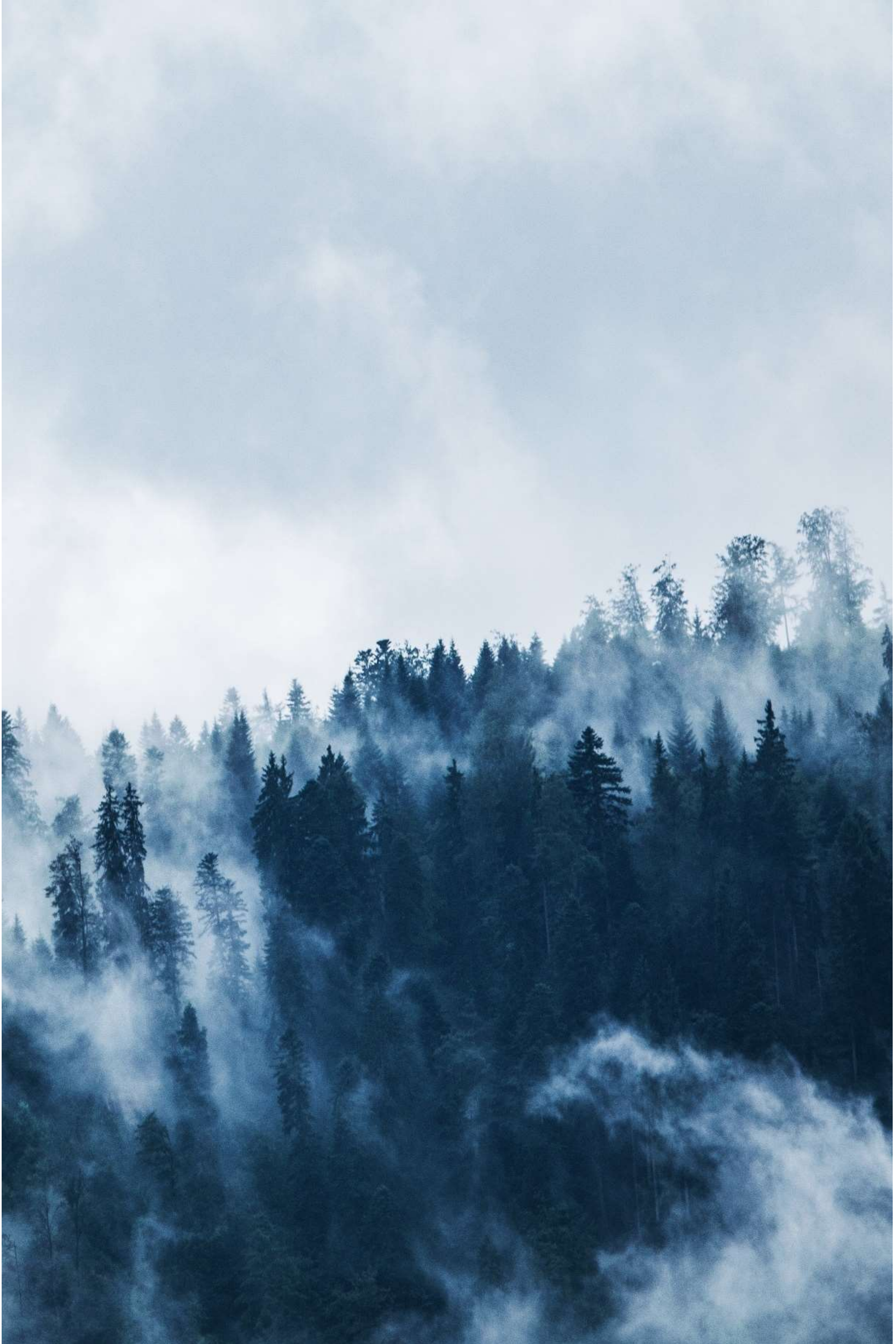
Scope 2: Indirect

Emissions generated in the production of electricity, heat or steam consumed by the Institution

Scope 3: Indirect

Emissions from sources not owned or directly controlled by the institution but that are a consequence of the activities of the institution.

Institution	**Upstream Activities**	**Upstream Activities**	**Upstream & Downstream Activities**	**Downstream Activities**
Facilities (on-site electricity and combustion equipment)	Purchased electricity, steam, heating and cooling for own use	Purchased goods, services and capital goods	Leased assets	Institution Investments
Fleet vehicles		Fuel- and energy related activities	Transportation and distribution	Processing of sold products
		Business travel		End-of-life treatment of sold products
		Staff & student commuting		Franchises
		Waste generated in operations		



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Methodology

Boundaries

Organizational Boundaries

Defining the organizational boundary is a key step in completing your GHG inventory. In this step you determine which operations are included in the organizational boundary and how emissions from each operation are consolidated. There are three options for defining the organizational boundary; these are as follows:

- Equity Share: Account for GHG emissions from operations according to your share of equity in the operation.
- Financial Control: Account for 100% of the GHG emissions over which you have financial control. Emissions from operations in which you own an interest but do not have financial control are not included.
- Operational Control: Account for 100% of the GHG emissions over which you have operational control. Emissions from operations in which you own an interest but do not have operational control are not included.

The approach selected can affect which activities are categorized as direct emissions (i.e. scope 1 emissions) and indirect emissions (i.e. scope 2 and 3 emissions). Those activities that are excluded from scope 1 or scope 2 inventories based on the boundary approach used should be reviewed for their relevance when accounting for scope 3 emissions.

Whichever approach is selected should be used consistently across the scope 1, 2 and 3 emission inventories.

For the purposes of this report we will be using the Operational Control boundary approach. As such, emissions from any asset the polytechnic controls are included in its direct emissions (scope 1). This includes buildings, fleet vehicles and aircrafts. In addition, emissions from the generation of purchased electricity that is consumed in its owned and controlled equipment or operations are included as scope 2 emissions. Emissions from assets the polytechnic wholly or partially owns but does not control (e.g., investments, solid waste, commuting, etc.) are included in the scope 3 inventory.

Minimum Boundaries of Scope 3 Categories

Minimum boundaries have been identified in the GHG Protocol for each scope 3 category. The purpose of the minimum boundaries is to provide standardization of the category boundaries and guidance on the activities to be accounted for.

Food services, paper products and electronics items will be included in the scope 3 category of purchased goods and service. For this category the minimum boundary includes all upstream (cradle-to-gate) emissions of the purchased products and services. This boundary is used to capture the GHG emissions of products wherever they occur in the life cycle, from raw material extraction through purchase by the reporting company in the inventory.

Waste generation (gate-to-grave) is included in the scope 3 category of waste generated in operations. The minimum boundary in this case includes the scope 1 and scope 2 emissions of waste management companies that occur during disposal or treatment. For these categories, the major emissions related to the scope 3 category result from scope 1 and scope 2 activities of the provider.

For student and employee commuting the minimum boundary includes the scope 1 and scope 2 emissions of the student/employee. For this category, the major emissions related to the scope 3 category result from scope 1 and scope 2 activities of the fuel consumed in the vehicle.

Quantification Methods

The two main methods for quantifying emissions are direct measurement and calculation. For this report the calculation method is used to estimate emissions. The following two types of data are used to calculate emissions:

- Activity Data: A quantitative measure of an activity that results in GHG emissions. Examples of activity data include kilowatt-hours of electricity consumed, liters of fuel consumed, kilograms of waste generated, etc.
- Emission Factors: An emission factor is a factor that converts activity data into GHG emissions data. Examples of emission factors may include kg-CO_{2e} emitted per liter of fuel consumed, kg-CH_4 emitted per tonne of waste generated, etc.

Data Quality

Sources of data can vary broadly in quality. When selecting data sources, the following data quality indicators should be used as a guide to obtain the highest quality data available for a given emissions activity:

- Technological representativeness: The degree to which the data set reflects the actual technology(ies) used.
- Temporal representativeness: The degree to which the data set reflects the actual time period or age of the activity.
- Geographical representativeness: The degree to which the data set reflects the actual geographic location of the activity (e.g., country or site).
- Completeness: The degree to which the data is statistically representative of the relevant activity.

For the purposes of this report, available data that is most representative in terms of technology, time and geography; most complete; and most reliable has been selected. A qualitative scoring approach has been used to asses and rate the data used for the calculations based on the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (see Executive Summary for table).

Seneca Polytechnic Controlled Emissions (Scope 1 & 2)

Facility Direct and Indirect Emissions

Data Source

The polytechnic maintains records of natural gas, electricity, and steam consumption in MS Excel spreadsheets. Data from 2019 for each campus was used for this analysis.

Emission factors used in the calculations are presented in the following table.

Utility	Emission Factor	Reference
Natural Gas	1.921 kg-CO_{2e}/m^3	Environment and Climate Change Canada[9]
Electricity	0.029 kg-CO_{2e}/kWh	2022 Canada National Inventory Report[10]
District Steam	0.084 kg-CO_{2e}/MJ (88.54 kg-CO_{2e}/Mbtu[a])	Energy Star Portfolio Manager[11]

[a] One MBtu is equivalent to one million BTUs

The steam emission factor is notably higher than the natural gas and electricity factors. This is because district steam is generated by a non-condensing heating process with a maximum thermal efficiency of 80%. Additionally, steam networks typically have high distribution losses. As such, the emissions from the district steam system at Seneca@York accounts for a significant portion of the scope 1 and 2 emissions.

Data Quality

The data quality is considered very good, with the annual consumption of the three utilities sourced from utility bills.

Diesel Fuel Emissions

Data Source

Records of diesel consumption were provided by Seneca for 2021 and 2022 for Markham and Seneca@York campuses. Data for 2022 was provided for Newnham. Data for 2020 and 2021 was provided for King campus. No data was available for Peterborough campuses. Data from 2021 was used for this analysis where available.

An emission factor of 2.681kg-CO_2/L was used based on Environment and Climate Change Canada data for diesel fuel[12]. The amount of CO_2 equivalents from methane and nitrous oxide emissions were negligible because of their low quantity in diesel fuel and low emission factors.

Data Quality

The diesel fuel consumption data quality is fair. Diesel consumption was sourced from purchase bills; however, the actual amount consumed is not available. In addition, for at least one campus (King) the diesel information provided included a mix of diesel used for the generators and the grounds equipment; however, the split could not be determined.

Propane Emissions

Data Source

Records of propane consumption were provided by Seneca from 2018 onwards. Data from 2019 was used for this analysis.

An emission factor of 1.515 kg-CO_2/L fuel was used based on Environment and Climate Change Canada data for propane – all other uses[13]. The amount of CO_2 equivalents from methane and nitrous oxide emissions were considered negligible because of their low quantity in propane and low emission factors.

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[9] https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en
[10] https://unfccc.int/documents/461919 Part 3, Table A13-7
[11] https://portfoliomanager.energystar.gov/pdf/reference/Emissions.pdf
[12] https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en
[13] https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en

Data Quality

The propane fuel consumption data quality is considered fair. Propane consumption was sourced from purchase bills; however, the actual amount consumed is not available.

Refrigerant Emissions

Data Source

Refrigerant leakage is one of the largest sources of greenhouse gas emissions in air-conditioned buildings. Refrigerant data from 2019 for each campus was used for this analysis. This data included the type of refrigerant in each of Seneca's cooling units and their associated total cooling capacities. In some cases, the amount of refrigerant in the unit was also provided. Where the amount was unavailable, assumptions were made based on equipment cooling capacity and refrigerant type to calculate the approximate amount of refrigerant in the unit. A leakage rate of 3% was assumed, representing the median leakage rate for rooftop air conditioning equipment as reported by the Integral Group[14].

The CO_{2e} emissions for the refrigerant types used on the campus are based on their global warming potentials as defined in the following table.

Refrigerant	Global Warming Potential	Reference
R-134A	1,300 kg-CO_{2e}/kg	Intergovernmental Panel on Climate Change[15]
R-22	1,760 kg-CO_{2e}/kg	Intergovernmental Panel on Climate Change[16]
R-410A	2,088 kg-CO_{2e}/kg	Integral Group[17]
R-123	79 kg-CO_{2e}/kg	UNEP[18]
R-404A	3,922 kg-CO_{2e}/kg	Australian Government Department of Climate Change, Energy, the Environment and Water[19]
R-407C	1,774 kg-CO_{2e}/kg	Australian Government Department of Climate Change, Energy, the Environment and Water[20]

Data Quality

This data is considered fair. The type of refrigerant in the units and capacity of the units have been provided by Seneca. However, the refrigerant leakage quantification is based entirely on industry averages. It would be ideal to track refrigerant leakage to more accurately represent Seneca's refrigerant leakage emissions.

[14] https://www.integralgroup.com/news/refrigerants-environmental-impacts/
[15] https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf
[16] https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf
[17] https://www.integralgroup.com/news/refrigerants-environmental-impacts/
[18] https://wedocs.unep.org/bitstream/handle/20.500.11822/28246/7789GWPRef_EN.pdf
[19] https://www.dcceew.gov.au/environment/protection/ozone/rac/global-warming-potential-values-hfc-refrigerants
[20] https://www.dcceew.gov.au/environment/protection/ozone/rac/global-warming-potential-values-hfc-refrigerants

Fleet Emissions – Shuttle Bus

Data Source

Average commute method and rates from a 2018 survey at Seneca was used for this study. The diesel emission factor of 2.681 kg-CO_2/L is based on Environment and Climate Change Canada data and fuel consumption of 0.45 L/km based on NRCan data[21]. The amount of CO_2 equivalents from methane and nitrous oxide emissions were negligible because of their low emission factors for diesel vehicles.

Data Quality

The data quality is considered good, with total distance travelled by shuttle bus from commuter survey. Due to lack of data for 2018 and 2019, the fleet emissions estimate is based on 2020-21 values. While it is reasonable that the fuel consumption would be similar to that of 2018-19, the extent of similarity is unconfirmed.

Fleet Emissions – Grounds & Maintenance Equipment

Data Source

Records of propane consumption were provided by Seneca from 2018 onwards. Data from 2019 was used for this analysis.

The fuel types provided included diesel, biodiesel and unleaded gasoline. Emission factors for these fuel types are presented in the following table.

Utility	Emission Factor	Reference
Diesel	2.681 kg-CO_2/L	Environment and Climate Change Canada[22]
Biodiesel	2.472 kg-CO_2/L	Environment and Climate Change Canada [23]
Gasoline	2.307 kg-CO_2/L	Environment and Climate Change Canada [24]

The amount of CO_2 equivalents from methane and nitrous oxide emissions were negligible because of their low emission factors for diesel vehicles.

Data Source

The fuel consumption data quality is considered fair. Fuel consumption was sourced from purchase bills; however, the actual amount consumed is not available.

[21]https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en https://www.nrcan.gc.ca/sites/nrcan/files/oee/pdf/transportation/fuel-efficient-technologies/2021%20Fuel%20Consumption%20Guide(1).pdf

[22] https://publications.gc.ca/collections/collection_2021/eccc/En81-28-2020-eng.pdf

[23] https://publications.gc.ca/collections/collection_2021/eccc/En81-28-2020-eng.pdf

[24] https://publications.gc.ca/collections/collection_2021/eccc/En81-28-2020-eng.pdf

Aviation Fuel Emissions

Data Source

The polytechnic maintains records of aviation fuel (World Fuel) consumption in a MS Excel spreadsheet. Data from 2022 was used for this analysis. An emission factor of 2.3254 kg-CO_2/L for aviation gasoline (AvGas) was used based on Environment and Climate Change Canada data[25].

Data Quality

The data quality is considered fair. Fuel consumption was sourced from purchase bills; however, the actual amount consumed is not available.

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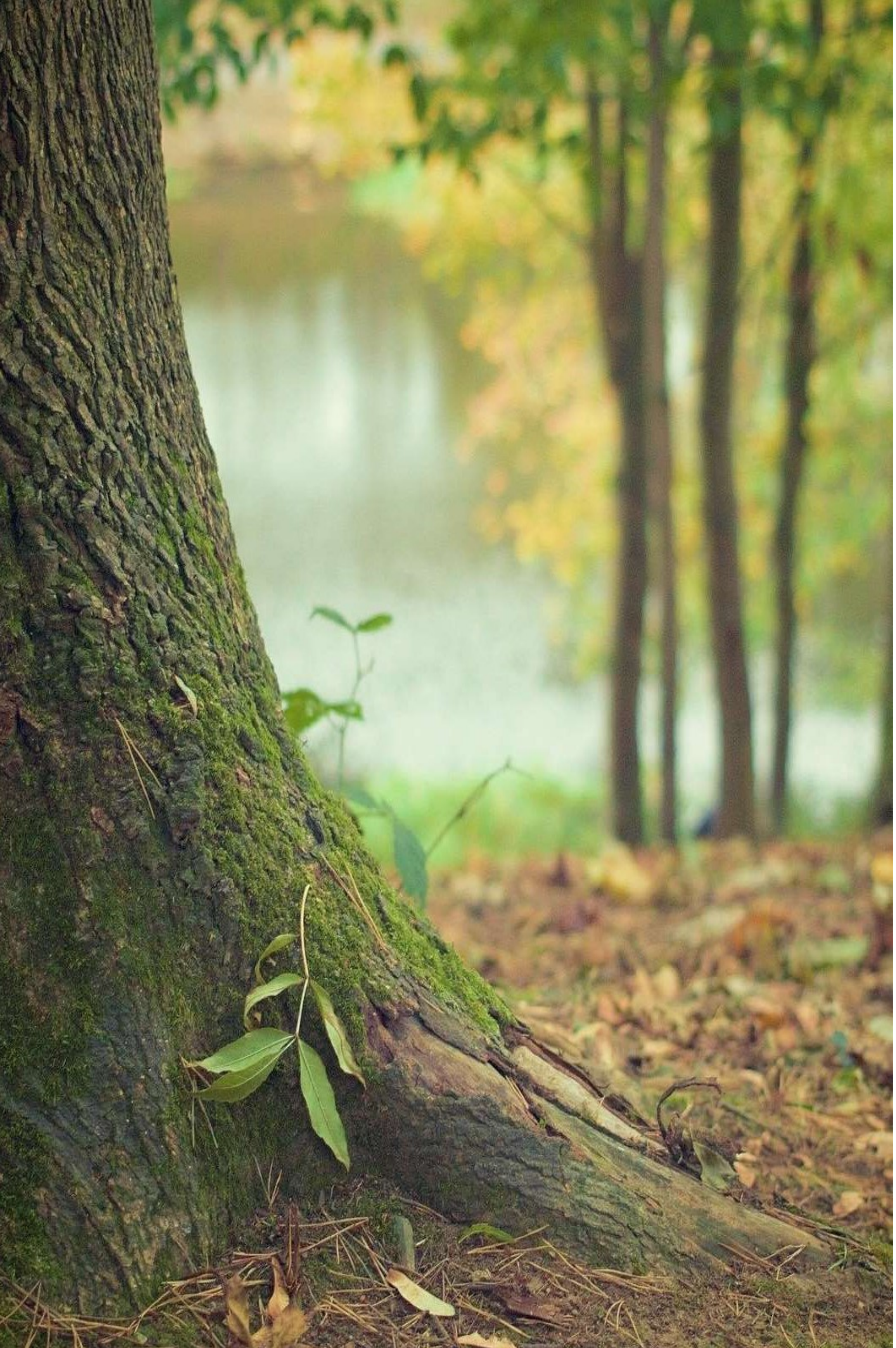
[25] https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en



Scope 3 Emissions

Water Emissions

Data Source

Seneca Polytechnic maintains water consumption records in a MS Excel spreadsheet. Data from 2019 was used for this analysis. King Campus uses a local water system not linked to the city.

A water consumption emission factor of 0.028 kg-CO_{2e}/m^3 was used based on open data from the City of Toronto[26].

Data Quality

The data quality is considered poor despite the water consumption being sourced from water bills. While it is realistic that emission intensities between Toronto and all water plants serving Seneca Polytechnic's campuses, there may be significant variance in the water production and pumping processes that could result in differences in emission factors.

On Site Waste Water Treatment Emissions

Data Source

Information on the on site water treatment was reviewed and it was determined that minimal emissions were generated from the process with

[26] https://open.toronto.ca/dataset/annual-energy-consumption/

the exception of emissions associated with the electricity used for pumping power.

Electricity for pumping power is captured in the utility data for King campus and, as such, is captured under scope 1 and 2 emissions, direct and indirect facility utilities.

Data Quality

Not applicable.

Personal Vehicle Commuting Emissions

Data Source

Emissions from transportation of employees to and from work are accounted for in scope 3, Category 7 of the Greenhouse Gas Protocol. It is defined as follows:

Transportation of employees between their homes and their worksites during the reporting year in vehicles not owned or operated by the reporting company.

Students of the polytechnic have also been included in the commuting estimates since they make up a significant portion of the polytechnic population. Consequently, the mode of transportation for non-bus students travelling to and from polytechnic may have a substantial impact on this scope 3 emissions category.

It has been assumed that staff drive to campus 5 days per week and students drive to campus 3.5 days per week. The number of people choosing to drive and carpool were determined based on the Smart Commute Survey Presentation - July 20 2018. The average typical distance travelled was also estimated based on the 2018 survey presentation.

Vehicle efficiencies of 10 L/100 km and the average of car and SUV performance were taken from the 2021 NRCan Fuel Consumption Guide[27] and resulted in an emission factor of 0.23 kg-CO_{2e}/km.

Data Quality

Data quality is considered fair. Current staff and student surveys are recommended to improve confidence in assumptions. Other sources of data such as student and staff postal codes could be used to better quantify commuting distances. Gathering vehicle efficiency or actual consumption data that is a higher quality than national or regional averages will likely be challenging, making very good data quality challenging for estimating commuting emissions for the long term.

Public Transit Commuting Emissions

Data Source

Transit ridership was estimated using the number of staff and students at the campus and the results of the Smart Commute Survey Presentation - July 20, 2018. The average typical distance travelled was also estimated based on this 2018 survey presentation. Similar to vehicle commuting, it

[27] https://www.nrcan.gc.ca/sites/nrcan/files/oee/pdf/transportation/fuel-efficient-technologies/2021%20Fuel%20Consumption%20Guide(1).pdf

was assumed that staff travelled to campus 5 days per week and students 3.5 days per week.

Vehicle efficiencies of 0.45 L/ km and the average of bus performance was taken from the Transport Canada Economic Analysis Directorate[28] and the emission factor for diesel from Environment and Climate Change Canada[29].

Data Quality

Data quality is considered fair. Current staff and student surveys are recommended to improve confidence in assumptions. Gathering actual ridership data that is a higher quality than regional averages will likely be challenging, making very good data quality challenging for estimating commuting emissions for the long term.

Livestock Enteric Fermentation Emissions

Data Source

The average number of animals kept on King Campus in 2022 was used for this study. The enteric fermentation emission factor for each animal is based on Environment and Climate Change Canada data for GHG sources in agriculture[30]. The nitrous oxide emissions from the management and storage of manure were also considered with an emission factor based on the same Environment and Climate Change Canada source. The emission factors are presented in the following table on a per year basis.

Animal	Emission Factor Category	Emission Factor
Horses	Enteric Fermentation	18 kg-CH_4/head
	Manure Management	2.6 kg-CH_4/head
	Manure N Excretion	49.3 kg-N/head
Sheep	Enteric Fermentation	8 kg-CH_4/head
	Manure Management	0.33 kg-CH_4/head
	Manure N Excretion	4.1 kg-N/head
Cattle	Enteric Fermentation	43.8 kg-CH_4/head
	Manure Management	3 kg-CH_4/head
	Manure N Excretion	26 kg-N/head

Emissions for the dogs, cats, rodents, guinea pigs, rabbits, and chickens were not included in this analysis due to their negligible emissions.

Data Quality

The data quality is considered poor, due to the livestock emissions estimate being based on average value of animals present over the course of past years and not specific to the reporting year.

[28] http://www.bv.transports.gouv.qc.ca/mono/0965385.pdf
[29] https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/D-Emission-Factors/?lang=en
[30] https://publications.gc.ca/collections/collection_2020/eccc/En81-4-2018-2-eng.pdf

Purchased Goods and Services Emissions

Data Source

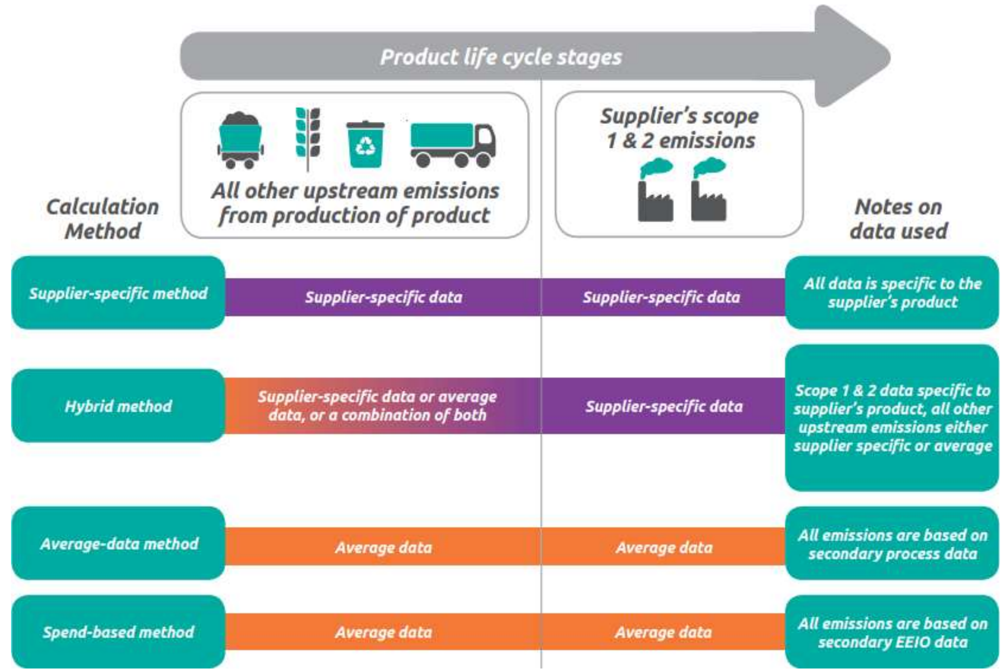
This category includes all upstream emissions from the production of products purchased or acquired by the polytechnic in the reporting year. This study considered the emissions generated by the following purchase categories:

- Publishing and paper
- Computers and electronic products
- Food services

The GHG Protocol provides four calculation methods to estimate the emissions from purchased goods and services. These calculation methods are outlined in the figure from the GHG Protocol Scope 3 Calculation Guidance on the following page[31].

Since data from suppliers was not available at the time of the study, a screening level of analysis was completed using the spend-based method. Information on the annual amount spent on the above categories was based on data provided by Seneca.

The U.S. EPA's Supply Chain GHG Emission Factors for US Commodities and Industries database[32] was used in combination with the provided cost information to estimate the baseline emissions for most of the categories.



The following purchase categories from the database, were used to estimate emissions:

- Publishing and paper: "paper products" and "printing and publishing"
- Computers and electronic products: "computers" and "electrical equipment, appliances, and components"
- Culinary services: "food, beverage, and tobacco products"

The Greenhouse Gas Protocol Scope 3 Screening Tool was used to estimate the cleaning emissions associated with food services[33].

[31]https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf

[32]https://pasteur.epa.gov/uploads/10.23719/1524524/SupplyChainEmissionFactorsforUSIndustriesCommodities%20v1.1.xlsx

[33] https://quantis-suite.com/Scope-3-Evaluator/

For paper product information provided as units, emission factors provided by EPA Victoria[34] were used in conjunction with use information provided by Seneca.

Where usage information was not allocated by campus, a weighted average based on campus area was used to separate the greenhouse gas emissions by campus.

Data Quality

The data quality is considered fair for those categories calculated based on the Supply Chain GHG Emission Factors for US Commodities and Industries. However, the emission factors from the database were lacking granularity so the factors applied to the Seneca data may have been too general. The calculations that used the Scope 3 Screening Tool required an even higher level of generalization for the data. Thus, the data quality for cleaning supplies is considered poor. More specific supplier data and/or emission factors would be beneficial for refining the emission estimates of all purchase categories.

Waste Related Emissions

Data Source

Seneca provided waste audits conducted at the Markham, Newnham, Seneca@York, and King campuses. Information was not available for the Peterborough campus. The performance period for the waste audits was March 2019 to February 2020.

Greenhouse gas emissions from waste production were calculated using the Environment Canada Greenhouse Gas Calculator for Waste Management[35].

Data Quality

The data quality is considered poor. A waste audit for Peterborough campus would be ideal for accurately determining the total waste and recyclables production from the polytechnic.

It is uncertain that all volumes from the specialty streams are reflected in the audit data. The Environment Canada Greenhouse Gas Calculator for Waste Management uses Canadian GHG emission factors for materials commonly occurring in the Canadian waste stream. It would be more accurate to use emission factors from the actual waste provider.

[34] https://www.epa.vic.gov.au/-/media/epa/files/publications/1374-1.pdf

[35] https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/municipal-solid/greenhouse-gases/calculator.html

Maintenance & Refurbishment Emissions

Data Source

OneClick life cycle cost analysis software provides benchmark LCA data that is intended to be representative of commercial and institutional Canadian construction projects.

The life cycle analysis of a building breaks down the embodied carbon emissions into four categories:

- Product Stage
- Construction Stage
- Use Stage
- End of Life Stage

The embodied carbon emissions from the whole life cycle were not considered at this time. However, material replacement and refurbishment emissions were included in the analysis because they represent the emissions associated with the maintenance of the buildings.

The material replacement and refurbishment emissions are captured under the Use Stage of the life-cycle assessment. The embodied carbon emission results for a similar building type and construction were used as the basis of the embodied carbon emission intensity factor for calculating Seneca Polytechnic's emissions. To determine the approximate emissions from maintenance, the material replacement and refurbishment emissions intensity was applied to the total area of all Seneca Polytechnic buildings.

Data Quality

Data quality is considered poor. This section is included to help quantify the magnitude of building maintenance GHG emissions relative to other Seneca Polytechnic emission sources with emissions based on industry averages. The composition of the emissions can vary significantly based on building age, location, and construction material, so it is highly likely that the breakdown of GHG emissions from the base building may not be representative of the emission from all Seneca Polytechnic buildings.

footprint

Offsetting & Insetting Emissions

Solar Photovoltaics

Data Source

Photovoltaic (PV) solar panels have been installed on the CITE building at Newnham Campus. This PV system is directly connected to the CITE building and is separately metered. Seneca Polytechnic maintains monthly records of the PV power production in a MS Excel spreadsheet. Data from 2020 was used for this analysis.

The annual marginal emissions factor from The Atmospheric Fund[36] of 0.134 kg-CO_{2e}/kWh was used for calculating solar PV emissions reductions. This factor accounts for the solar PVs providing energy during peak electrical consumption periods.

Natural gas-fired generation is relied on to supply peak power to the Ontario electrical grid. The solar PV system generates electricity during typical peak demand periods (i.e. high temperature days in the summer), reducing the load supplemented by the natural gas-fired generation. As such, the factor for avoided emissions due to solar PV generation is

[36] https://taf.ca/wp-content/uploads/2019/06/A-Clearer-View-on-Ontarios-Emissions-June-2019.pdf and https://taf.ca/wp-content/uploads/2021/11/20211116_TAF_Emissions-Factors-Guidelines.pdf

higher than the average electricity emission factor (0.029 kg-CO_{2e}/kWh). This is consistent with the Zero Carbon Building program guidance[37].

Data Quality

The data quality is considered very good, with the PV power production sourced from the PV output report.

Carbon Sequestration

Data Source

Tree planting information was provided by the Toronto Region Conservational Authority (TRCA). Data provided included the number of plantings species, survival factor and annual sequestration rate. Based on this information, TRCA has estimated the carbon sequestered for the tree planting at King Campus. The data from 2019 was used for this analysis.

Data Quality

The data quality is considered good with the information being provided by a credible and reliable source.

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[37] https://www.cagbc.org/wp-content/uploads/2022/06/CAGBC_Zero_Carbon_Building-Design_Standard_v3.pdf

Results

The methodology and data described in the previous sections were applied to determine the emissions from the various sources on a per-campus basis. The per-campus emissions were combined to calculate the total Seneca Polytechnic GHG emissions.

Total Seneca Polytechnic Emissions

Seneca Polytechnic Total Scope 1 & 2 Emissions

The following table shows the total estimated scope 1 and 2 greenhouse gas emissions for Seneca Polytechnic from all campuses.

Emission Source	Scope 1 & 2 GHG Emissions ($kg\text{-}CO_{2e}$)	Percent of Scope 1 & 2 Emissions
Natural Gas	5,408,491	61.1%
Electricity	873,797	9.9%
District Steam	1,012,460	11.4%
Diesel	35,064	0.4%
Propane	135,283	1.5%
Refrigerants	227,244	2.6%
Fleet Shuttle Busses	393,414	4.4%
Fleet Grounds & Maintenance	42,100	0.5%
Aviation Fuel	750,741	8.5%
Solar Photovoltaics	-24,989	-0.3%
Total Scope 1 & 2 Emissions	8,853,605	100%

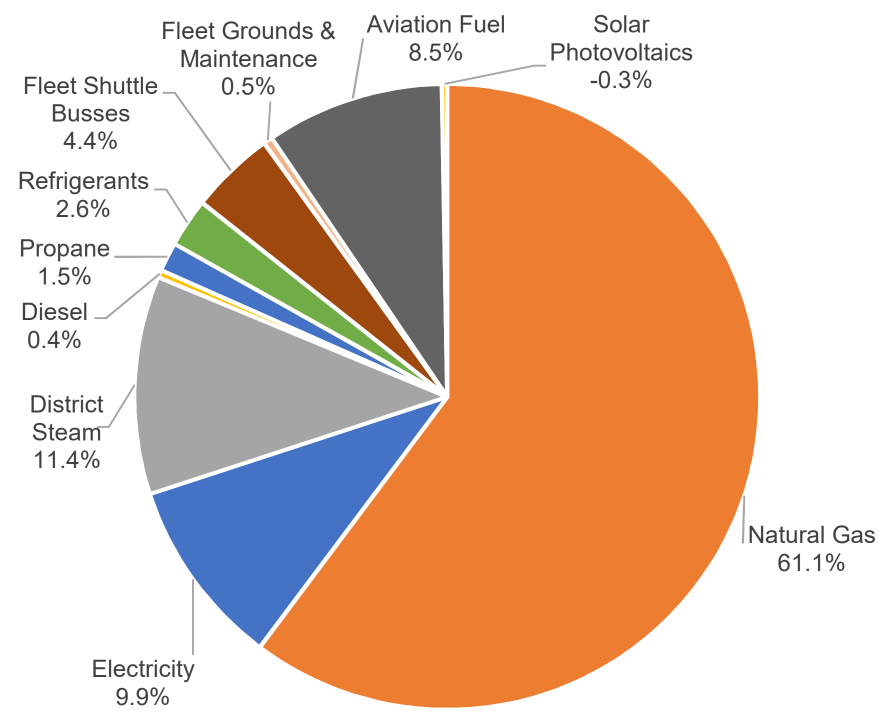


Figure 7: Breakdown of scope 1 and 2 emissions

Seneca Polytechnic Total Scope 1, 2 & 3 Emissions

The following table shows the total estimated greenhouse gas emissions for Seneca Polytechnic including all campuses.

Emission Source	Total GHG Emissions ($kg\text{-}CO_{2e}$)	Percent of Total Emissions
Natural Gas	5,408,491	16.9%
Electricity	873,797	2.7%
District Steam	1,012,460	3.2%
Diesel	35,064	0.1%
Propane	135,283	0.4%
Refrigerants	227,244	0.7%
Fleet Shuttle Busses	393,414	1.2%
Fleet Grounds & Maintenance	42,100	0.1%
Aviation Fuel	750,741	2.4%
Water	4,070	0.01%
On Site Water	-	-
Personal Vehicle Commuting	18,071,287	56.6%
Public Transit Commuting	2,546,664	8.0%
Livestock Enteric Fermentation	40,793	0.1%
Purchased Goods & Services	1,700,112	5.3%
Waste	262,467	0.8%
Maintenance & Refurbishment	487,061	1.5%
Solar Photovoltaics	-24,989	-0.1%
Carbon Sequestration	-53,152	-0.2%
Total Emissions	31,912,908	100%

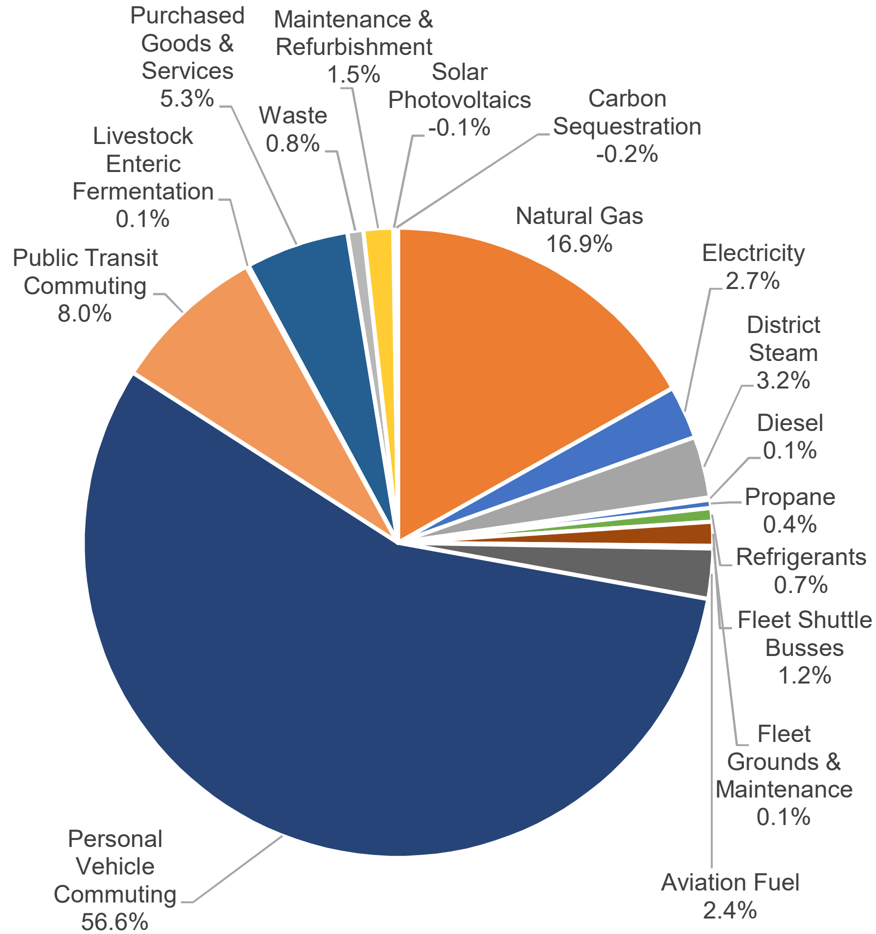


Figure 8: Breakdown of scope 1, 2 and 3 emissions

As expected, the study shows that scope 3 emissions, those emissions from sources not owned or directly controlled by Seneca but that are a consequence of the activities of the polytechnic, represent a significant portion of the total emissions.

The following figures show the magnitude of difference between the scope 1 and 2 emissions versus scope 3.

The majority of scope 3 emissions where the polytechnic does not have control (e.g. student and employee commuting) are typically quantified using lower quality data sources.

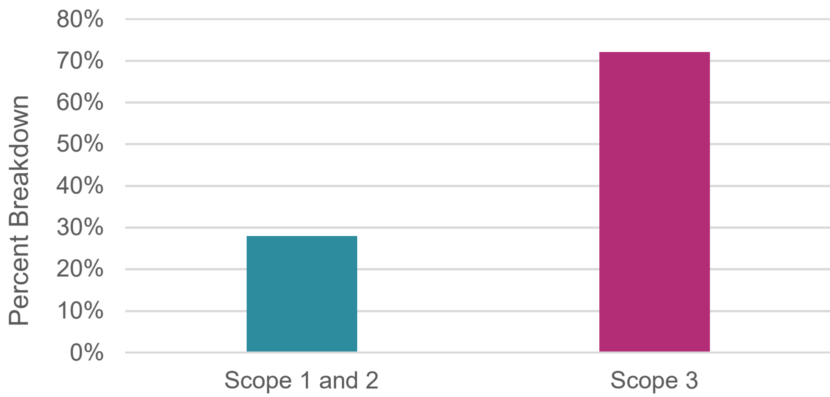


Figure 9: Breakdown of scope 1, 2, and 3 emissions by percentage

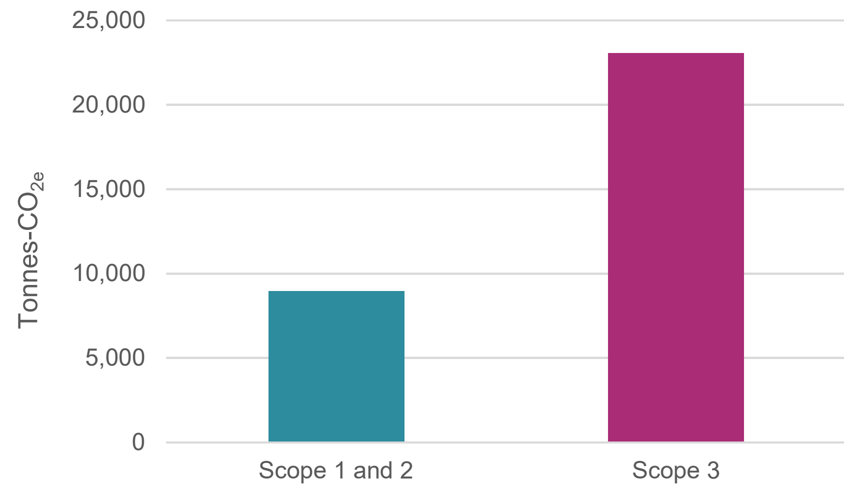


Figure 10: Breakdown of scope 1, 2, and 3 emissions by Tonnes-CO_{2e}

Campus Specific Results

Total Emissions by Campus

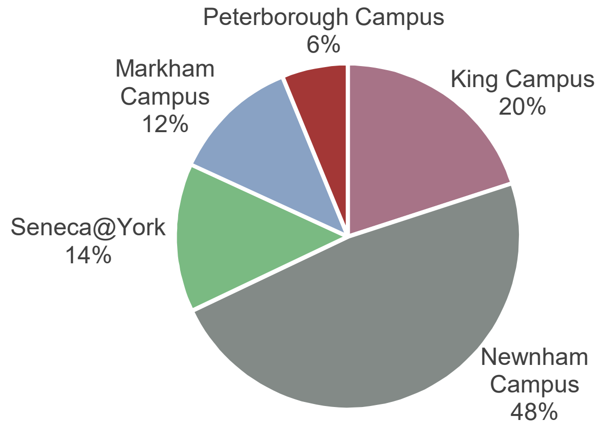


Figure 11: Breakdown of emissions for Seneca Polytechnic by campus

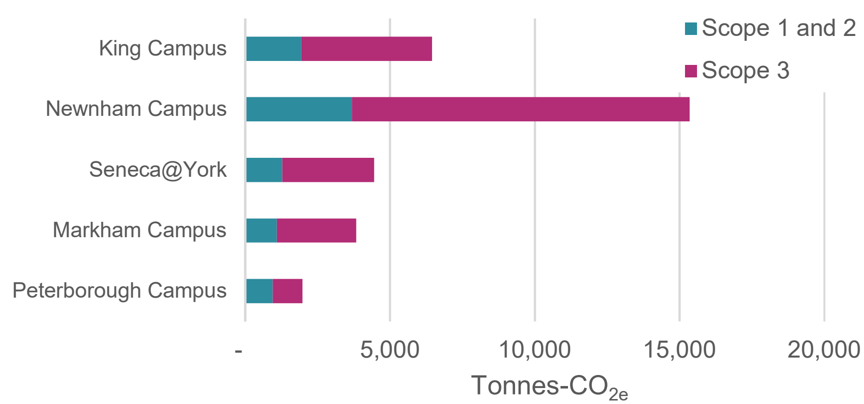


Figure 12: Breakdown of scope 1, 2 & 3 emissions for Seneca Polytechnic by campus

Campus	Total GHG Emissions (Tonnes-CO_{2e})	Percent of Total Emissions	GHG Intensity (kg-CO_{2e}/m^2)
King Campus	6,401	20%	96.4
Newnham Campus	15,329	48%	76.4
Seneca@York	4,450	14%	82.4
Markham Campus	3,833	12%	151.2
Peterborough Campus	1,899	6%	326.2
Seneca Polytechnic	31,913	100%	90.6

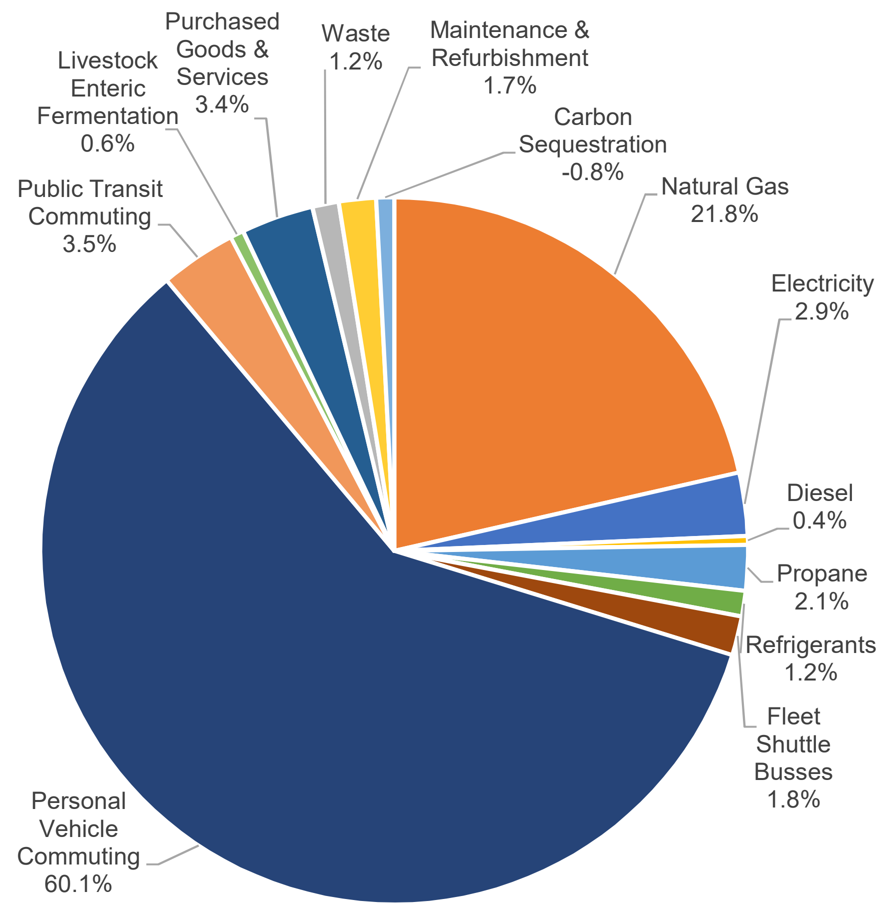
Campus	Scope 1 & 2 GHG Emissions (Tonnes-CO_{2e})	Percent of Scope 1 & 2 Emissions	GHG Intensity (kg-CO_{2e}/m^2)
King Campus	1,936	22%	29.2
Newnham Campus	3,688	42%	18.4
Seneca@York	1,286	14%	23.8
Markham Campus	1,093	12%	43.1
Peterborough Campus	875	10%	150.3
Seneca Polytechnic	8,879	100%	25.2

Footprint

Campus-by-Campus Results

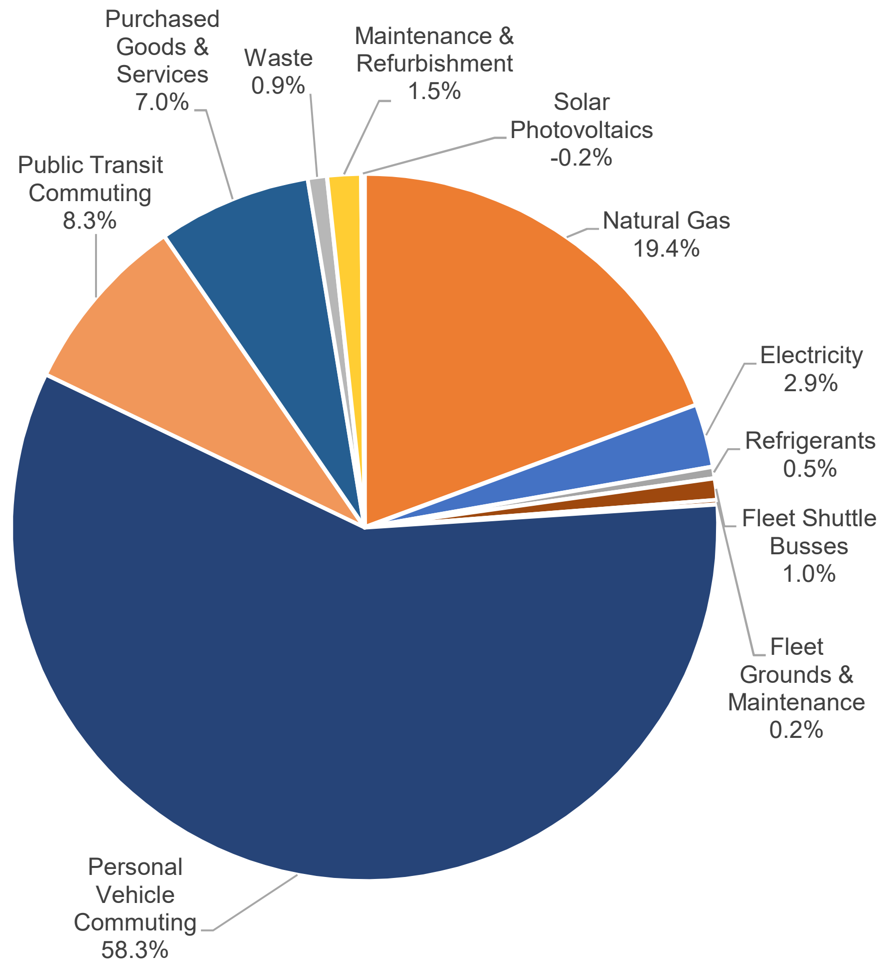
King Campus

Emission Source	Scope 1 & 2 Emissions ($kg\text{-}CO_{2e}$)	Scope 3 Emissions ($kg\text{-}CO_{2e}$)
Natural Gas	1,394,923	-
Electricity	188,523	-
District Steam	-	-
Diesel	25,424	-
Propane	135,283	-
Refrigerants	76,219	-
Fleet Shuttle Busses	116,123	-
Fleet Grounds & Maintenance	-	-
Aviation Fuel	-	-
Water	-	-
On Site Water	-	-
Personal Vehicle Commuting	-	3,847,181
Public Transit Commuting	-	225,888
Livestock Enteric Fermentation	-	40,793
Purchased Goods & Services	-	215,328
Waste	-	78,066
Maintenance & Refurbishment	-	110,303
Solar Photovoltaics	-	-
Carbon Sequestration	-	-53,152
Total Emissions	1,936,496	4,464,406



Newnham Campus

Emission Source	Scope 1 & 2 Emissions (kg-CO_{2e})	Scope 3 Emissions (kg-CO_{2e})
Natural Gas	2,975,825	-
Electricity	444,317	-
District Steam	-	-
Diesel	5,375	-
Propane	-	-
Refrigerants	80,154	-
Fleet Shuttle Busses	150,565	-
Fleet Grounds & Maintenance	31,512	-
Aviation Fuel	-	-
Water	-	3,422
On Site Water	-	-
Personal Vehicle Commuting	-	8,939,943
Public Transit Commuting	-	1,274,053
Livestock Enteric Fermentation	-	-
Purchased Goods & Services	-	1,077,596
Waste	-	135,603
Maintenance & Refurbishment	-	236,110
Solar Photovoltaics	-	-24,989
Carbon Sequestration	-	-
Total Emissions	3,687,748	11,641,739



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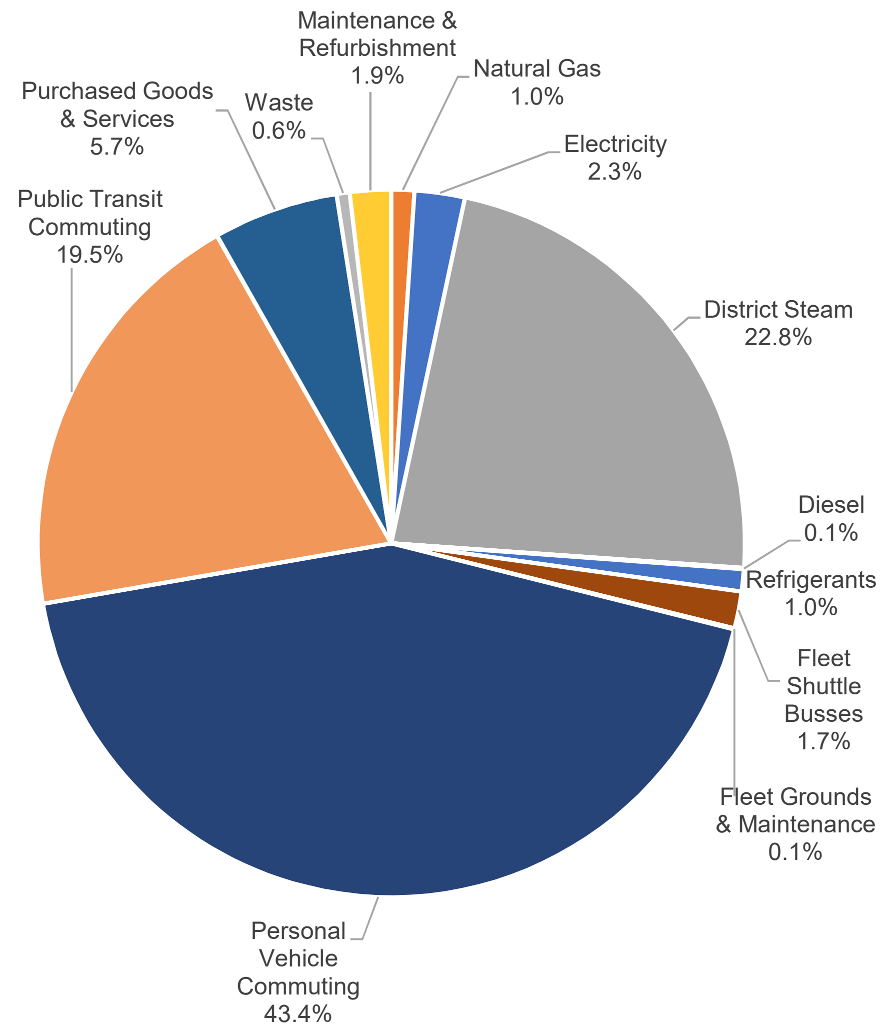
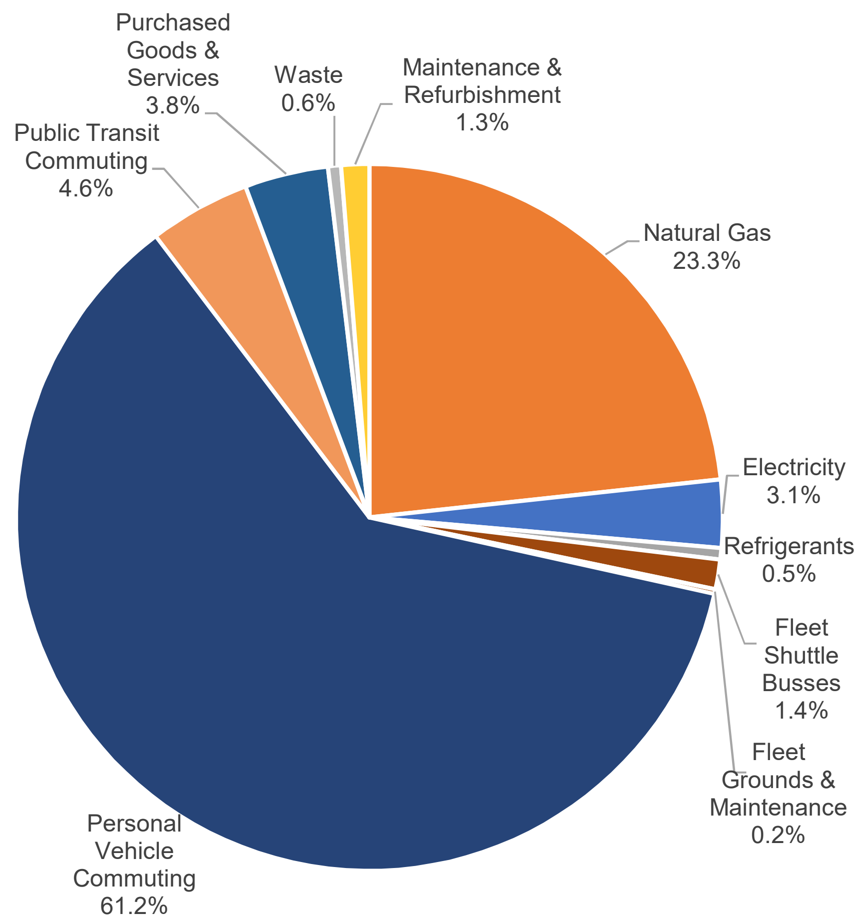
Seneca@York

Emission Source	Scope 1 & 2 Emissions (kg-CO_{2e})	Scope 3 Emissions (kg-CO_{2e})
Natural Gas	46,682	-
Electricity	102,254	-
District Steam	1,012,460	-
Diesel	2,742	-
Propane	-	-
Refrigerants	45,232	-
Fleet Shuttle Busses	74,655	-
Fleet Grounds & Maintenance	2,359	-
Aviation Fuel	-	-
Water	-	96
On Site Water	-	-
Personal Vehicle Commuting	-	1,929,470
Public Transit Commuting	-	868,805
Livestock Enteric Fermentation	-	-
Purchased Goods & Services	-	255,055
Waste	-	26,272
Maintenance & Refurbishment	-	83,849
Solar Photovoltaics	-	-
Carbon Sequestration	-	-
Total Emissions	1,286,384	3,163,547



Markham Campus

Emission Source	Scope 1 & 2 Emissions (kg-CO_{2e})	Scope 3 Emissions (kg-CO_{2e})
Natural Gas	892,207	-
Electricity	118,826	-
District Steam	-	-
Diesel	1,523	-
Propane	-	-
Refrigerants	19,742	-
Fleet Shuttle Busses	52,070	-
Fleet Grounds & Maintenance	8,228	-
Aviation Fuel	-	-
Water	-	527
On Site Water	-	-
Personal Vehicle Commuting	-	2,344,107
Public Transit Commuting	-	177,918
Livestock Enteric Fermentation	-	-
Purchased Goods & Services	-	146,510
Waste	-	22,527
Maintenance & Refurbishment	-	49,142
Solar Photovoltaics	-	-
Carbon Sequestration	-	-
Total Emissions	1,092,596	2,740,733



Peterborough Campus

Emission Source	Scope 1 & 2 Emissions ($kg\text{-}CO_{2e}$)	Scope 3 Emissions ($kg\text{-}CO_{2e}$)
Natural Gas	98,855	-
Electricity	19,878	-
District Steam	-	-
Diesel	-	-
Propane	-	-
Refrigerants	5,897	-
Fleet Shuttle Busses	-	-
Fleet Grounds & Maintenance	-	-
Aviation Fuel	750,741	-
Water	-	25
On Site Water	-	-
Personal Vehicle Commuting	-	1,010,585
Public Transit Commuting	-	-
Livestock Enteric Fermentation	-	-
Purchased Goods & Services	-	5,623
Waste	-	-
Maintenance & Refurbishment	-	7,657
Solar Photovoltaics	-	-
Carbon Sequestration	-	-
Total Emissions	875,370	1,023,889