Town of Stratford

2021 Greenhouse Gas Emissions Inventory

January 2023

Town of Stratford
PRINCE EDWARD ISLAND

Imagine that!

Table of Contents

Table of Figures

1 Executive Summary

The Town of Stratford is committed to building a strong local economy, preserving our heritage, celebrating our diverse culture, and respecting the natural environment entrusted to us for present and future generations. Stratford is situated on a peninsula just south of Charlottetown, the provincial capital of Prince Edward Island. Stratford is surrounded by magnificent water views bound by Fullerton's Marsh, the Hillsborough River, the Charlottetown Harbour and the Hillsborough Bay. The Trans-Canada Highway, which connects the eastern end of the province to Charlottetown and areas further west, bisects the Town of Stratford.

In early times the area was a Mi'kmaq summer camping location. The Stratford area was first permanently settled in the 1750s by Acadian families, and early economic activities included farming, shipbuilding, and brickmaking. The Town of Stratford was created in 1995 from the former communities of Bunbury, Southport, Crossroads, Keppoch-Kinlock and the unincorporated area of Battery Point. Stratford covers a land area of 22 square kilometres (5,230 acres) and is a highly desirable, peaceful community with a rich rural heritage and high quality of life.

Stratford has been a member of the Partners for Climate Protection (PCP) program since 2008. The PCP program provides tools, and a standardized emissions framework to communities, allowing consistent tracking of greenhouse gas (GHG) emissions and energy consumption between communities.

In 2015, baseline community and corporate inventories were created. Stratford's community inventory tracks all residential, commercial, and transportation-related emissions within the municipal boundaries. Stratford's corporate inventory tracks all emissions directly caused by municipal operations. Only emissions the Town directly influences are included, such as municipal buildings, streetlights, and water utilities. The data collected in 2015 was used in developing the Stratford Community Energy Plan (CEP). The CEP identifies actions and initiatives to reduce community emissions by 6% and corporate emissions by 20% before 2026.

The CEP determined that a full review and updated inventory would be required in 2022. The inventory has been updated, and we are currently working on reviewing and updating the CEP. Our updated inventory contains emissions data for 2020 and 2021; however, we will mainly focus on data from 2021 for analysis.

1.1 Key Highlights:

In 2021, Stratford produced a total of 85,358 tonnes of carbon dioxide equivalent (tCO_2e) emissions. This is 8.7% lower than the 93,517 tCO_2e emitted in 2015.

In 2021, corporate emissions totaled 761 tCO_2e. 19.6% lower than the 946 tCO_2e produced in 2015.

Stratford is currently on track to meet and exceed the emissions reduction targets set by the 2015 community energy plan.

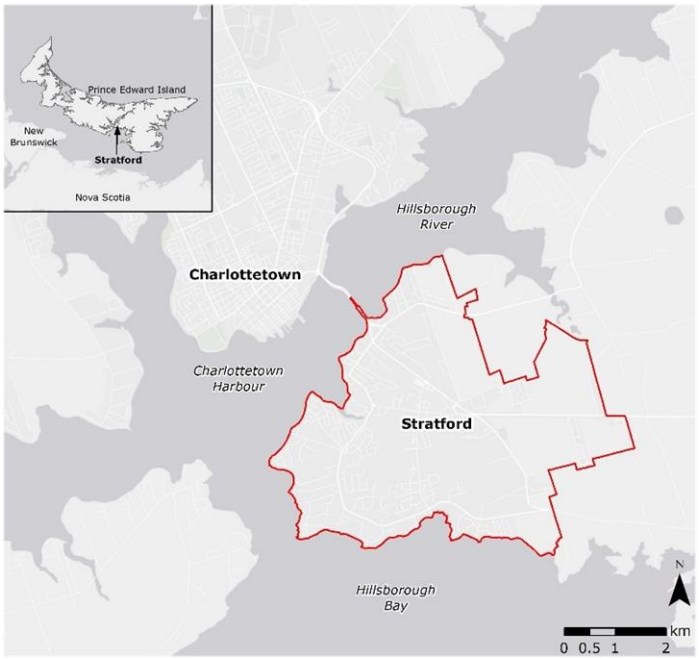
Many residents are switching to more efficient heating sources, such as heat pumps and solar.

Gasoline continues to be the most prominent emission source, closely followed by electricity.

The increasing efficiency of the electrical grid has been the most significant factor in the decreased emissions.

The Covid-19 pandemic greatly impacted all sectors, reducing energy consumption and emissions. Many of these reductions are likely temporary, as some sectors' emissions have already risen to pre-pandemic levels.

Figure 1 Map of Stratford, PEI



2 Background and Boundaries

Stratford is the third largest community on Prince Edward Island. In 2021, the population was 10,927. Since 2015, the population has grown by 10.8%. Stratford continues to be one of the fastest-growing communities in Atlantic Canada.

Stratford has a total land area of 22 square kilometres. Currently, the majority of residents live in single-family dwellings.

In 2015, the Town of Stratford began its journey to reduce emissions by creating a baseline GHG inventory. Stratford's community and corporate emissions are tracked in two separate inventories.

Stratford's community inventory tracks all residential, commercial, and transportation-related emissions within the municipal boundaries. The corporate inventory tracks all emissions directly caused by municipal operations. Only emissions the Town directly influences are included, such as municipal buildings, streetlights, and water utilities.

Both inventories use Stratford's geographic boundaries to track emissions. These boundaries led to specific GHG accounting methods being used over others. For example, only T3 transit lines operating within Stratford's borders are included in the inventory. Residents can also indirectly cause emissions, such as power generation or waste incineration. Despite originating outside the Town's boundaries, these emissions are still included.

Table 1 Stratford Community Overview

Stratford Community Overview	
County	Canada
Province	Prince Edward Island
Inventory Year	2021
Land Area	22 km^2
Population	10,927

2.1 Reporting Methodology

Reporting follows the **"GPC scopes framework"**[1] to categorize GHG emissions by source. The scope framework is helpful as it allows us to categorize the source of GHG emissions:

- **Scope 1:** GHG emission sources located within the Town's boundaries.
- **Scope 2:** GHG emissions occurring due to grid-supplied electricity within the Town's boundary.
- **Scope 3**: All other GHG emissions occurring outside the Town's boundary resulting from activities within the Town's boundary.

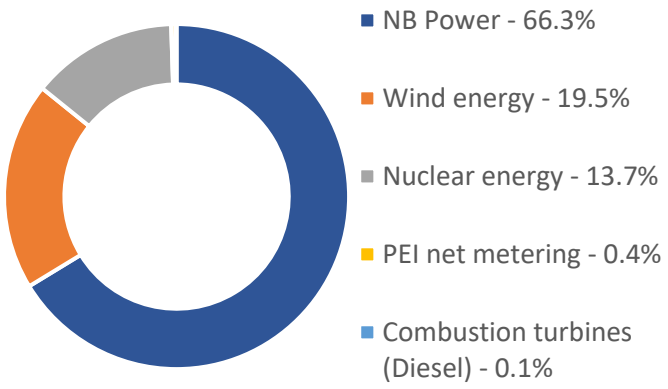
Stratford's Inventories follow the **BASIC** reporting level outlined in the GPC Reporting Protocol:

- All scope 1 emissions from Stationary Energy Sources.
- All scope 1 emissions from Transportation sources.
- All scope 1 emissions from Waste sources.
- All scope 2 emissions from Stationary Energy sources and transportation.
- Scope 3 emissions from the treatment of exported waste.

2.2 Stratford's Energy Supply

Emissions from electricity are directly tied to the efficiency of the power grid. Our community and corporate emissions will continue to decrease as more clean energy sources are implemented. In 2021, 86% of the power used on PEI produced zero emissions.[2]

Figure 2 Energy supply mix, 2021 (Maritime Electric)[3]



[1] (Greenhouse Gas Protocol, 2020)
[2] (Maritime Electric, 2022)
[3] PEI net metering includes all residential solar that is fed back into the grid. 32% of NB Power is from zero emission sources.

3 Community Inventory Results

In 2017 Stratford set the goal to reduce Community Emissions by 6%. Since then, community emissions have decreased by 5.5%. Stratford has also seen a significant reduction in emissions per capita. In 2015, 9.48 tCO_2e were emitted per capita. This was reduced to 8.01 tCO_2e per capita in 2021.

Historically, one of the most significant factors for decreased emissions was the provincial shift toward clean and renewable energy. However, starting in 2020, we saw a reduction in GHG emissions in all sectors due to the Covid-19 pandemic. Similar results have been well-documented country-wide.[4] We believe this drop in community emissions is temporary as, in 2021, emissions began to rise again.

The Community GHG Inventory is constructed from direct and indirect emissions of three dominant sectors, Stationary Energy, Transportation, and waste.

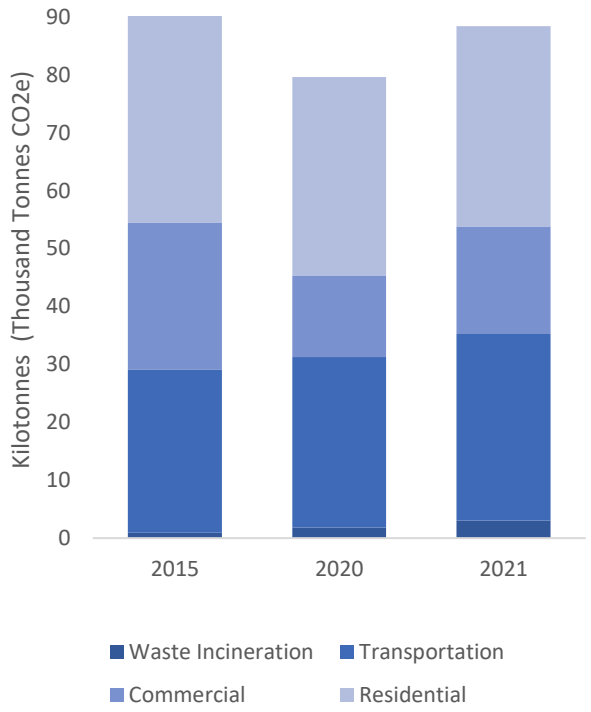
- **Stationary Energy** includes all residential, commercial, and industrial facilities. Building electricity and heating are the primary stationary emission sources.
- **Transportation Emissions** include all on-road vehicles, such as passenger vehicles, heavy trucks, and buses. Transportation emissions are often challenging to quantify, especially when separating "in-boundary" and "pass-through" traffic. This section aims to present the best estimate with the information available.
- **Waste Emissions** primarily consist of municipal solid waste (MSW) incineration. On PEI, any waste that is not recycled or composted is incinerated and used as district energy.

The 2020 and 2021 Community Inventories results can be found in Table 2. Sectors with no occurring emissions have been excluded.

Table 2 Stratford Community Greenhouse Gas Inventory, 2021

Sectors and subsectors	tCO_2e Emissions by Year		
	2015	2020	2021
Stationary energy			
Residential	38,535	34,234	34,583
Commercial[5]	25,939	14,096	18,593
Transportation			
On-road	28,087	29,456	32,191
Waste[6]			
Incineration of Waste	956	3,063	3,042
Total tCO2e	**93,517**	**80,849**	**88,409**
Per Capita tCO2e	**9.48**	**7.28**	**8.01**

Figure 3 Community GHG Emissions in Kilotons (1,000 Tonnes)



[4] (Environment and Climate Change Canada, 2022)
[5] Commercial total also includes industry emissions, due to the low amount of industry within the town.
[6] Waste Emissions for 2015 utilized a different methodology and are likely under reported.

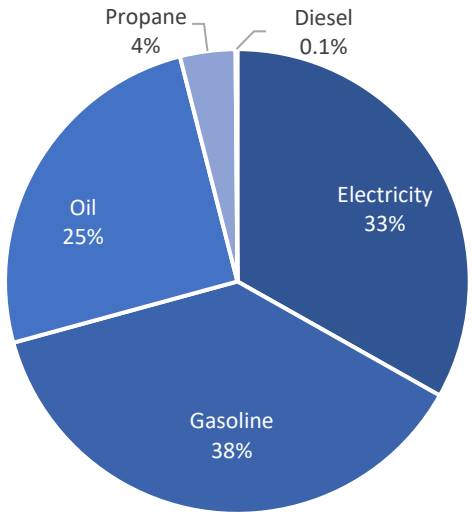
The community inventory also monitors each energy use of all the potential GHG sources in the community. We can see that gasoline is the most prominent GHG source, followed closely by electricity and heating oil. The total emissions by source can be found in Table 3. The percent share of each energy source can be found in Figure 4.

Energy sources are recorded in their "natural units" and converted to gigajoules (GJ). Emissions are calculated using a conversion factor (given per natural unit). For the complete list of conversions factors, see Appendix A - Table 8

Table 3 Stratford Community Energy Usage, 2021

	Natural Units		GJ	tCO_2e
Electricity	136,118,333	kWh	490,026	28,312
Oil	7,825,814	L	302,702	21,564
Gasoline	14,681,118	L	484,551	32,082
Diesel	810,883	L	1,521	109
Propane	2,126,375	L	53,819	3,291
Total			**1,332,619**	**85,358**

Figure 4 Community GHG Emissions by Source, 2021



3.1 Residential and Commercial Emissions

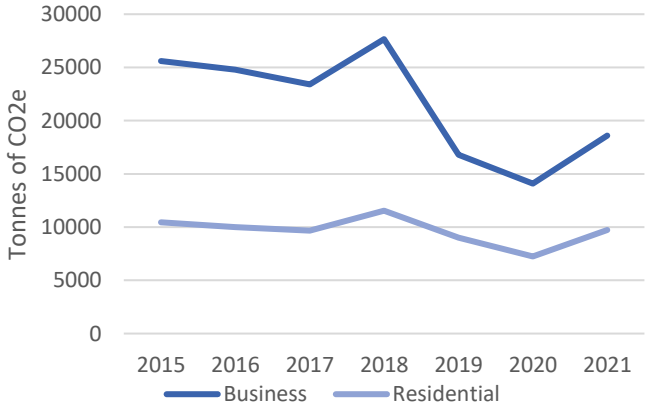
Electricity was the largest source of stationary emissions. Despite the growing population of Stratford, oil and electricity emissions are down compared to 2015. While still relatively low compared to oil, propane use increased by about 25% in the last six years. A complete comparison of heating fuel usage is included under section 9.3.1 Stationary Energy Use.

In the last six years, many residents have started to shift to alternative heating sources. In 2021, the Town's Annual Resident Survey found that 60% of respondents listed a geothermal or air-source heat pump as a heating source. There has also been a dramatic increase in home solar installations, with 7% of respondents listing solar energy or solar heating as one of their energy sources. These results are significantly higher than in 2015, where only 17% of residents reported a heat pump as their energy source, and less than 1% listed solar.[7]

Many new homes and developments in Stratford choose to use propane instead of oil as a secondary heating source. A propane-based system, on average, produces 20 – 25% less CO_2 emissions than a similar oil system.[8]

Despite Stratford's total electricity use steadily rising, overall emissions have fallen. Figure 5 shows Stratford's commercial and residential emissions from electricity.

Figure 5 Total Community Emissions (tCO2e) From Electricity



This graph highlights why transitioning to electricity is essential. Solar and wind installations will continue to reduce emissions on a community-wide scale.

[7] (Town of Stratford, 2022)
[8] (Natural Resources Canada, 2018)

3.2 Transportation Emissions

Gasoline is currently the most prominent source of emissions, causing approximately 32,000 tonnes of CO_2e emissions. In 2020 transportation emissions dropped slightly and then raised again in 2021. Work-from-home policies during Covid-19 meant that there was significantly less traffic.

Electric cars have started to become more common in the last five years. In the Town's 2022 Annual Resident Survey, 5% of residents reported buying or leasing an electric car.

Transportation emissions were generated using fuel sale data from gas stations within the Town. Emissions were calculated based on the tCO2e emitted per litre of gasoline and diesel. This approach was preferred over the vehicle kilometre travelled (VKL) used in the 2015 inventory since it more accurately models the total emissions. The 2015 baseline inventory was updated using this new methodology.

Table 4 Total transportation emissions

Year	Gasoline GHGs (tCO2e)	Diesel GHGs (tCO2e)
2015	28,014	72
2020	29,315	105
2021	32,082	109

3.3 Waste Emissions

According to a 2014 Statistics Canada Survey, Prince Edward Island Residents keep more waste out of landfills (per person) than every other province. Each person, on average, diverted 429 kilograms of waste. The National Average was 255 kilograms per person.[9] Any solid waste that isn't recycled or composted in Stratford is incinerated. The incineration of waste resulted in a total of 3,042 tCO_2e.

The methodology for waste emissions has been updated for 2020 and 2021. Correspondents at PEI Energy Systems and Stantec calculated an emission factor per tonne of MSW, which was then used along with the total tonnage of waste incinerated.

Table 5 Total waste emissions

Year	Residential MSW (t)	Commercial MSW (t)	Total tCO2e Emitted
2020	1375	3926	3064
2021	1396	3869	3042

[9] (Statistics Canada, 2014)

4 Corporate Inventory Results

Stratford's corporate emissions have reduced by 19.8% compared to the baseline year of 2015. In 2021, a total of 759 tCO_2e were emitted by the Town. As with the community inventory, we believe the Covid-19 pandemic significantly impacted the results.

The corporate inventory tracks all emissions caused by Stratford's municipal operations. All services and utilities where the municipality has significant financial or operational control are included in this inventory. The Town of Stratford is responsible for the following local government services:

- Administration and Governance
- Drinking water, Stormwater and wastewater
- Arts, Recreation and Cultural Services
- Fire Protection
- Public Transportation

Solid waste collection and policing services are notably excluded, as the Provincial Government provides these services. The Town of Stratford does not maintain its roads and has an agreement with the Provincial Department of Transportation. All road maintenance and associated traffic operations emissions were excluded from the inventory. The total tCO_2e emitted by each sector can be found in Figure 6.

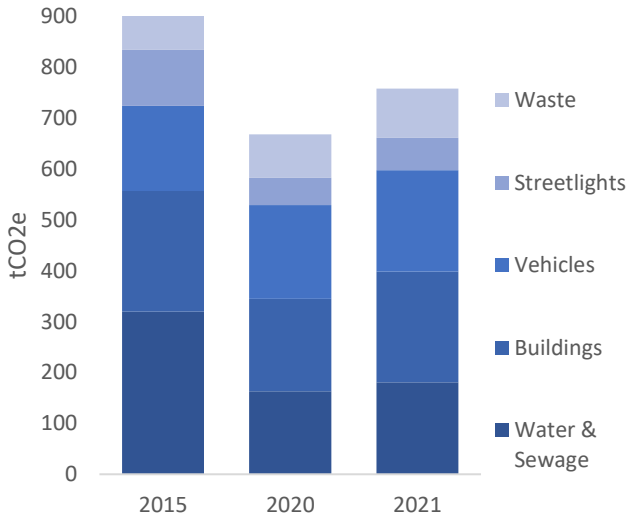
All energy was recorded in "natural units" and converted into gigajoules (GJ). The total energy usage by source can be found in Table 6

Electricity, Heating Oil, Diesel, and Gasoline are the four primary energy sources used in municipal operations. Energy consumption was tracked through monthly utility and fuel invoices.

Table 6 Corporate Energy Use by Source, 2021

	Natural Units		GJ	tCO_2e
Electricity				
Buildings	1,004,167	kWh	3,615	174
Streetlights	305,834	kWh	1,101	63
Water and Sewage	866,945	kWh	3,121	181
Heating Oil				
Buildings	15,807	L	580	44
Water & Sewage	1,370	L	50	4
Gasoline				
Employee commuting	NE[10]	L	180	15
Gasoline Trucks	15,807	L	576	48
Hybrid Vehicles	135	L	5	0
Diesel				
Diesel Trucks	4,151	L	161	14
T3 Transit	40,321	L	1,560	110
Firetrucks	4,598	L	178	13
Waste				
Waste	95	t		95
Total			**10,947**	**761**

Figure 6 Stratford Corporate Emissions by Sector (tCO2e)



[10] Not Estimated (Unable to Quantify)

4.1 Town Building Emissions

Town buildings were the most significant cause of emissions for the corporate inventory for 2021, causing 216 tCO_2e. Most Town buildings use fuel oil or a heat pump. Oil and electricity invoices allow the calculation of building emissions. Figure 7 shows the buildings that were included in the inventory and their total GHG emissions for 2021:

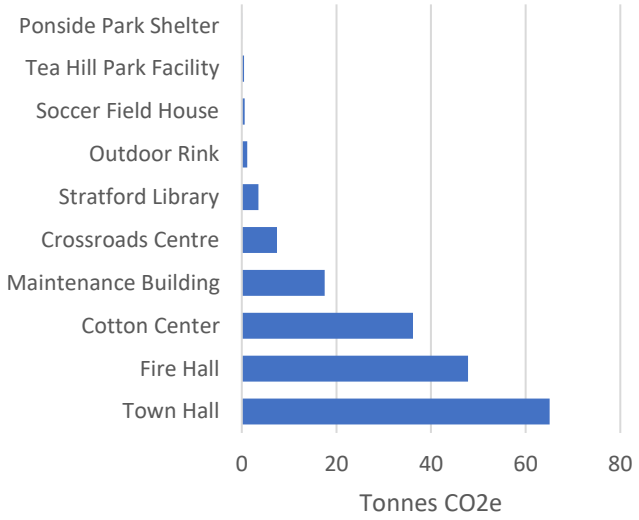


Figure 7 Total GHG Emissions (tCO2e) for Town Buildings (2021)

Only the Cotton Center, Crossroads Community Center, and the Town's Maintenance Buildings use fuel oil. Since 2015 the Library, Cotton Center, and Crossroads Community center have all installed electric heat pump systems, reducing the need for heating oil.

In 2019, the Town decommissioned the old Fire Hall after constructing a new station. This new station is considerably larger at 1,930m^2 (20,763 sqft), compared to the 550m^2 (5,920 sqft) of the old Fire Hall. This area now also hosts EMS and Police services. Despite being 3.5 times larger in footprint, emissions for this facility are slightly lower in 2021 than in 2015 (48 tCO_2e in 2015 compared to 47 tCO_2e in 2021). The Fire Hall was designed to exceed provincial efficiency standards. This work has led to a building that is 250% more efficient. The Crossroads Fire Hall is an example of how modern building design can reduce GHG emissions.

The MacNeill Community Center is one facility that saw extensive renovations. In 2017 two electric heat pumps were installed, along with various other efficiency improvements, such as improved insulation and high-efficiency windows. These retrofits have cut building emissions by half, as shown in Figure 8. Oil and heating costs of the building were also significantly reduced.

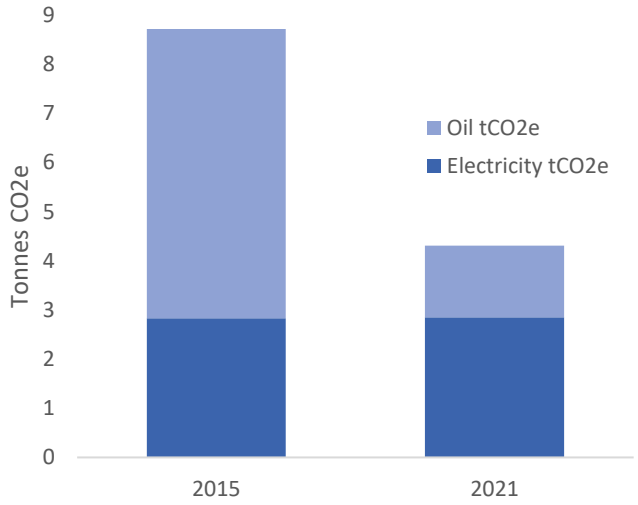


Figure 8 tCO2e produced by the MacNeill Community Center

4.2 Streetlight Emissions

In 2021 Streetlights emitted the equivalent of 64 tCO_2e or 8.3% of the Town's corporate emissions. Streetlight emissions are 30% lower than in 2015. Emissions were calculated from energy usage (kWh) from Maritime Electric invoices. Table 7 shows the number and type of streetlights in Stratford.

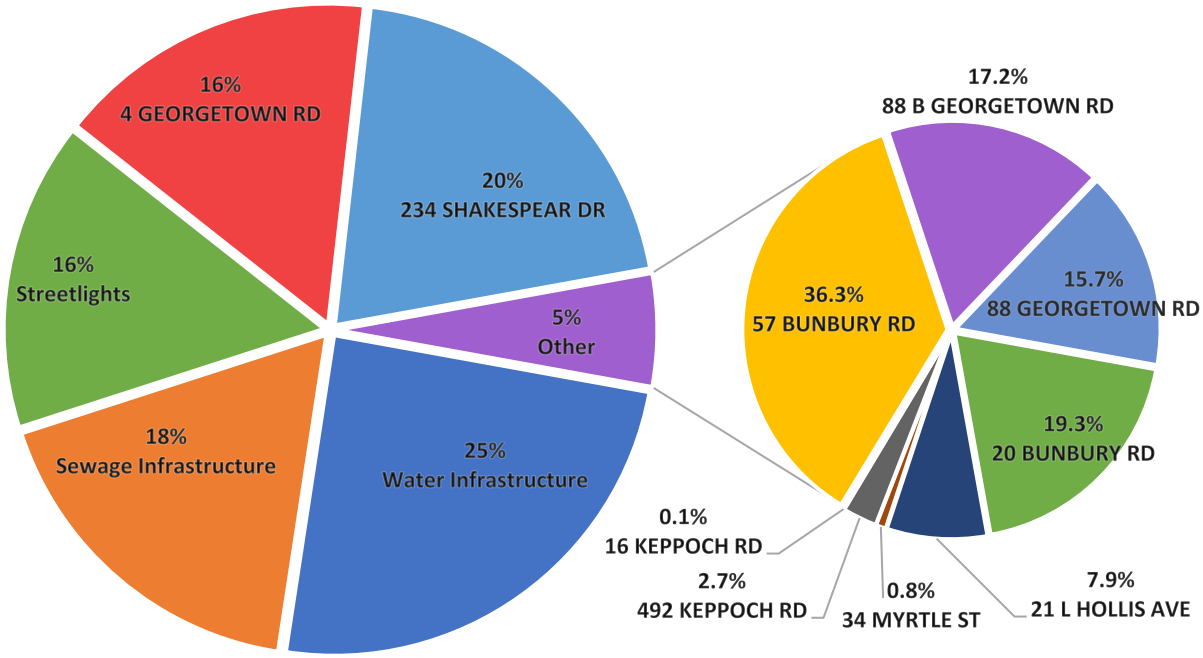
Table 7 Total number of lights by type in 2021

Type	2015	2021
Halogen	16	13
High-Pressure Sodium	775	274
Lantern	45	25
LED	101	700
Total	937	1012

Streetlights are owned and maintained by Maritime Electric. In 2021, Stratford rented 1012 streetlights from Maritime Electric. Seven hundred of these lights are LEDs, the rest being high-pressure sodium (HPS) or Halogen. Since 2015, the Town has gone from having 101 LED lights to over 700 LED lights. All new light fixtures are LED, and over half of all HPS lights are now LED.

Compared to 2015, the Town's Streetlight grid is 44% more efficient, with LEDs now representing 70% of the streetlights.

Figure 9 Corporate power consumption, 2021



4.3 Water and Sewage

The water and sewage sector includes all emissions from water pumping stations, sewer lift stations, and water treatment plants.

In 2021, Stratford decommissioned the local wastewater treatment plant (WWTP), and all wastewater was sent to the Charlottetown WWTP. Stratford accounts for 13% of all emissions generated at the Charlottetown facility. The total MSW generated by Stratford was used to find this percentage.

Stratford's percent share of MSW processed by the facility was used to account for Stratford's share in emissions.

4.4 Solid Waste

In 2021, the total GHG emissions from municipal waste were 96 tonnes. The Town follows a standard sorting protocol that all municipalities and commercial enterprises on PEI must follow. The methodology used is the same as the 2015 GHG inventory.

The emissions were calculated by measuring the bin capacity at each facility, along with the average amount of MSW collected weekly. These values, along with the MSW composition, are used to calculate the total amount of MSW in each period.

5 Acknowledgements

The Town of Stratford would like to thank the Federation of Canadian Municipalities for their financial contributions to support this work. We would also like to thank Maritime Electric for providing community electricity consumption information regarding energy production trends, the Island Regulatory and Appeals Commission for providing information on monthly fuel sales, and PACE-Atlantic for providing data on the Switch Stratford program. Thanks to PEI Energy Systems and Stantec for calculating the efficiency factor for waste incinerated. Thank you to all the community members who helped support this project to reduce our community's greenhouse gas emissions.

6 References

Canada Energy Regulator. (2022, 07 28). *Provincial and Territorial Energy Profiles – New Brunswick*. Retrieved from Canada Energy Regulator: https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-new-brunswick.html

Canada. Environment Canada. Greenhouse Gas Division. (2022, November 21). National inventory report : greenhouse gas sources and sinks in Canada. Ottawa, Ontario, Canada: Environment Canada, c2006.

Environment and Climate Change Canada. (2022). *Greenhouse gas sources and sinks in Canada: executive summary 2022.* Ottawa: Environment Canada.

Greenhouse Gas Protocol. (2020). *Global Protocol for Community-Scale Greenhouse Gas Inventories.* Retrieved from ghgprotocol.org: https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

Maritime Electric. (2022). *Maritime Electric Sustainability 2022 Report* . Retrieved from Maritime Electric: https://www.maritimeelectric.com/Media/1959/2022-sustainability-report_final_interactive-pdf_july-28-2022.pdf

Natural Resources Canada. (2018, 12 19). *Alternative fuels for transportation - Propane*. Retrieved from Canada.ca: https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/alternative-fuels/propane/21611

Nicholson, A. (2017, April 25). *Island leads Canada in recycling and composting*. Retrieved from princeedwardisland.ca: https://www.princeedwardisland.ca/en/news/island-leads-canada-recycling-and-composting

P.E.I Statistics Bureau. (2021). *Province of Prince Edward Island Forty Eighth Annual Statistical Review.* Government of Prince Edward Island.

Sean, C., & Vincent, H. (2022, August 24). *Working from home during the COVID-19 pandemic: How rates in Canada and the United States compare.* Retrieved from Statistics Canada: https://doi.org/10.25318/36280001202200800001-eng

Statistics Canada. (2014). *Waste management industry: Business and government sectors.* Retrieved from Waste management industry: Business and government sectors: https://www150.statcan.gc.ca/n1/daily-quotidien/170324/dq170324c-eng.htm

Town of Stratford. (2022). Retrieved from Town of Stratford: https://www.townofstratford.ca/

Town of Stratford. (2022). *Annual Resident Survey.* Retrieved from Town of Stratford: https://www.townofstratford.ca/residents/think_stratford/annual_resident_survey

7 Glossary of Terms

tCO_2e	tonnes of Carbon Dioxide equivalent
CEP	Community Energy Plan
GHGs	Greenhouse Gasses
GJ	Gigajoule
kWh	Kilowatt-hour
MSW	Municipal Solid Waste
PACE	Property Assessed Clean Energy
PCP	Partners for Climate Protection
VKT	Vehicle Kilometres Travelled
WWTP	Wastewater Treatment Plant

8 Appendix A

8.1 Changes to Methodology

The 2021 community inventory includes more robust data collection methods than the 2015 inventory. When possible, data from 2015 was updated to meet current data collection standards.

Community transportation emissions were changed to a fuel-sale-based methodology. This inventory includes updated vehicle emissions for 2015.

PEI Energy Systems, which operates the waste incineration plant, provided direct emissions data for 2020 and 2021.

Residential heating was updated to use provincial fuel sales data instead of the previously used country-wide average. Residential heating data was partially incomplete for the 2015 inventory, so the new methodology was retroactively used to maintain a constant result.

8.2 Conversion Factors

Table 8 Emission Factors Used

Fuel Type	Conversion Factor	Data Source
Electricity	163 g/kWh	Maritime Electric Sustainability 2022 Report
Oil	2,753 g/L	National Inventory Report 1990-2019, Part 2, Table A6.1-5
Propane	1,515 g/L	National Inventory Report 1990-2019, Part 2, Table A6.1-4
Gasoline	2,307 g/L	National Inventory Report 1990-2019, Part 2, Table A6.1-14
Diesel	2,681 g/L	National Inventory Report 1990-2019, Part 2, Table A6.1-14
Waste Incineration	0.578 tCO2e/tonne MSW	Stantec + PEI Energy Systems

Table 9 Energy Conversion Factors

Fuel Type	Conversion Factor
Electricity	0.0036 GJ/kWh
Oil	0.039 GJ/L
Propane	0.025 GJ/L
Gasoline	0.035 GJ/L
Diesel	0.039 GJ/L

8.3 Accounting and Reporting Principles

Table 10 Data quality assessment

Data Quality	Activity Data	Emission Factor
High (H)	Detailed activity data	Specific emission factors
Medium (M)	Modelled activity data using robust assumptions	More general emission factors
Low (L)	Highly-modelled or uncertain activity data	Default emission factors

Table 11 Definition of emission scopes

Scope	Definition
Scope 1	GHG emissions from sources located within the city boundary
Scope 2	GHG emissions occur due to grid-supplied electricity, heat, steam and/or cooling within the city boundary.
Scope 3	All other GHG emissions occur outside the city boundary due to activities occurring within the city boundary.

9 Appendix B

Table 12 Notation keys

Notation Key	Definition
IE	Included Elsewhere
NE	Not Estimated
NO	Not Occurring
C	Confidential

9.1 2020 Community Inventory

Table 13 Stratford Community CO2e Emissions for 2020

GHG emissions by Source		Total GHGs (metric tonnes CO2e)		
		Scope 1	Scope 2	Scope 3
Stationary Energy	Energy use (all emissions except 1.4)	26,989	21,334	0
	Energy generation supplied to the grid	0	0	0
Transportation	(all II emissions)	29,457	0	0
Waste	Waste incinerated in the Town (III.X.1 and III.X.2)	0	0	0
	Waste incinerated outside the Town (III.X.3)			3,063
Total		56,446	21,334	3,063

Table 14 Stratford Community CO2e Emissions for 2020

GPC notation	Sectors and subsectors	Total GHGs (metric tonnes CO2e)			
		Scope 1	Scope 2	Scope 3	Notation
I	Stationary energy				
I	Stationary energy (subtotal)	26,989	21,334	0	
I.1	Residential buildings	26,989	7,245	0	
I.2	Commercial and institutional buildings and facilities	IE	14,089	0	
I.3	Manufacturing industries and construction	0	7	0	
I.4	Energy industries	0	0	0	NO
I.4.1/2/3	Energy generation supplied to the grid	0	0	0	NO
I.5	Agriculture, forestry, and fishing activities	0	0	0	IE
I.6	Non-specified sources	0	0	0	
I.7	Fugitive emissions from coal	0	0	0	NO
I.8	Fugitive emissions from oil and natural gas	0	0	0	NO
II	Transportation				
II	Transportation (Subtotal)	29,457	0	0	
II.1	On-road	29,457	0	0	
II.2	Railways	0	0	0	NO
II.3	Waterborne navigation	0	0	0	NO
I.4	Aviation	0	0	0	NO
II.5	Off-road	0	0	0	NE
III	Waste				
III	Waste (subtotal)	0	0	1,822	
III.1.1/2	Disposal of solid waste generated in the Town	0	0	0	NO
III.2.1/2	Biological treatment of waste generated in the Town	0	0	0	NE
III.3.1/2	Incineration and open burning of waste generated in the Town	0	0	3,063	
III.4.1/2	Wastewater generated in the city	0	0	0	NE

9.2 2021 Community Inventory

Table 15 Stratford Community CO2e Emissions for 2021

GHG emissions by Source		Total GHGs (metric tonnes CO2e)		
		Scope 1	Scope 2	Scope 3
Stationary Energy	Energy use (all emissions except 1.4)	24,855	28,322	0
	Energy generation supplied to the grid	0	0	0
Transportation	(all II emissions)	32,191	0	0
Waste	Waste incinerated in the Town (III.X.1 and III.X.2)	0	0	0
	Waste incinerated outside the Town (III.X.3)			3,042
Total		57,046	28,322	3,042

Table 16 Stratford Community CO2e Emissions for 2021

GPC notation	Sectors and subsectors	Total GHGs (metric tonnes CO2e)			
		Scope 1	Scope 2	Scope 3	Notation
I	Stationary energy				
I	Stationary energy (subtotal)	24,855	28,322	0	
I.1	Residential buildings	24,855	9,729	0	
I.2	Commercial and institutional buildings and facilities	IE	18,585	0	
I.3	Manufacturing industries and construction	0	7	0	
I.4	Energy industries	0	0	0	NO
I.4.1/2/3	Energy generation supplied to the grid	0	0	0	NO
I.5	Agriculture, forestry, and fishing activities	0	0	0	IE
I.6	Non-specified sources	0	0	0	
I.7	Fugitive emissions from coal	0	0	0	NO
I.8	Fugitive emissions from oil and natural gas	0	0	0	NO
II	Transportation				
II	Transportation (Subtotal)	32,191	0	0	
II.1	On-road	32,191	0	0	
II.2	Railways	0	0	0	NO
II.3	Waterborne navigation	0	0	0	NO
I.4	Aviation	0	0	0	NO
II.5	Off-road	0	0	0	NE
III	Waste				
III	Waste (subtotal)	0	0	3,041	
III.1.1/2	Disposal of solid waste generated in the Town	0	0	0	NO
III.2.1/2	Biological treatment of waste generated in the Town	0	0	0	NE
III.3.1/2	Incineration and open burning of waste generated in the Town	0	0	3,041	
III.4.1/2	Wastewater generated in the city	0	0	0	NE

9.3 Community Inventory Methodology

9.3.1 Stationary Energy Use

Energy usage was provided directly by Maritime Electric. This dataset contains the actual power use of the Town, which assures a high level of data quality. Three different metrics can be used to measure the communities performance relating to energy use. First, we look at the overall energy consumption. We can see that residential consumption has steadily been rising. We can also see the impact covid-19 has had on commercial buildings starting in 2019. Commercial energy consumption in 2021 is still lower than pre-pandemic levels.

Table 17 Total energy consumption (GJ)

Year	Commercial	Residential	Streetlights	Town Buildings	Utility
2015	313155	129641	1365	2099	2566
2016	314265	128648	1364	2107	2343
2017	318855	134055	1361	1953	3231
2018	337519	143284	1343	2104	3706
2019	275748	150612	1348	2237	3364
2020	304785	160004	1304	2820	3553
2021	315547	168378	1272	3005	3095

The overall power consumption is then used to calculate the Town's total electricity emissions in tCO_2e. The efficiency of the grid changes each year, so the proper conversion factor for that year is used. The second column of the table is the conversion factor used. As shown in Table 18, commercial buildings make up most of the Town's emissions, followed closely by residential buildings.

Table 18 Total GHGs caused by electrical consumption (tCO2e)

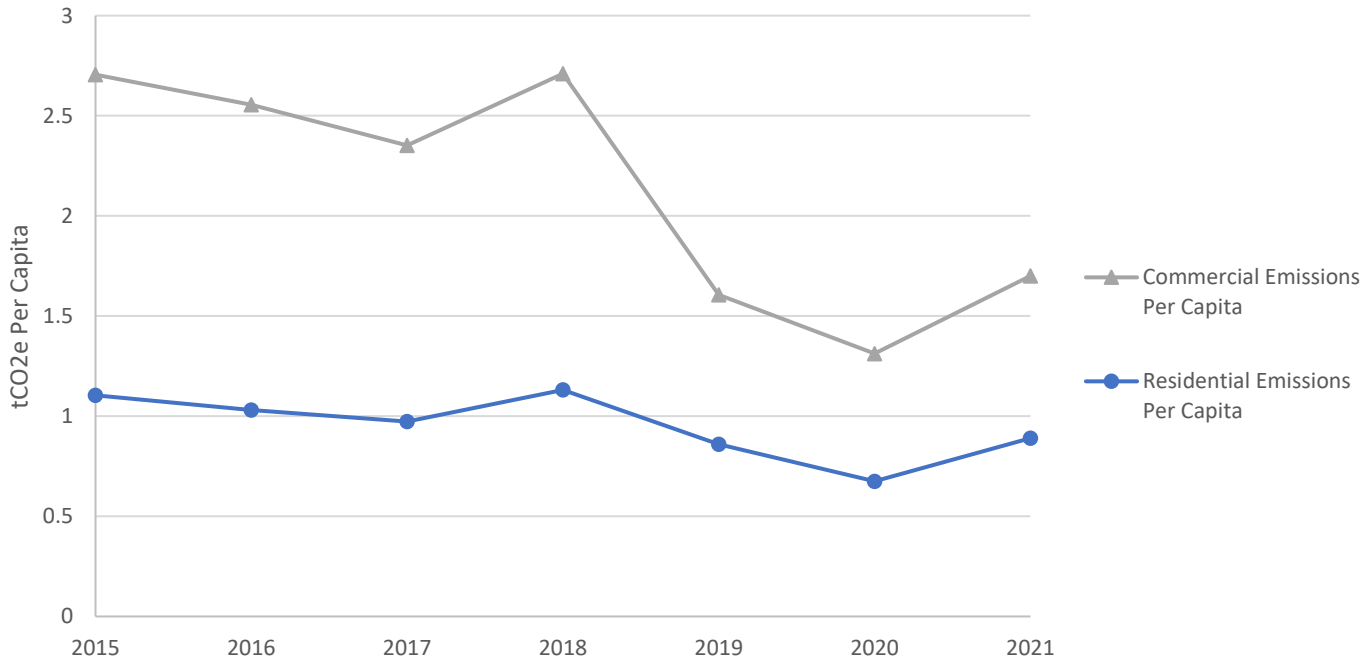
Year	G CO2 / kWh	Commercial	Residential	Streetlights	Town Buildings	Utility
2015	290	25228	10444	110	169	207
2016	280	24445	10007	106	164	182
2017	260	23030	9683	98	141	233
2018	290	27191	11543	108	170	299
2019	215	16470	8996	80	134	201
2020	163	13801	7245	59	128	161
2021	208	18233	9729	73	174	179

The last metric we will consider is the Town's electrical emissions per capita. This is the amount of CO_2e emissions in tonnes per resident. Residential and Commercial emissions are considered separately. The population used is based on the 2016 and 2021 censuses. As shown in the following figures, emissions per capita are trending downward, primarily due to the grid's increasing efficiency, as seen in Table 18

Table 19 tCO2e per capita

Year	Population	Commercial Emissions Per Capita	Residential Emissions Per Capita
2015	9463	2.705619	1.103643
2016	9706	2.554183	1.03099
2017	9953	2.351456	0.972793
2018	10207	2.709864	1.130925
2019	10467	1.605447	0.859425
2020	10734	1.312663	0.674998
2021	10927	1.700887	0.890391

Figure 10 Residential and commercial GHG emissions per capita (tCO2e)



9.3.2 Residential Heating

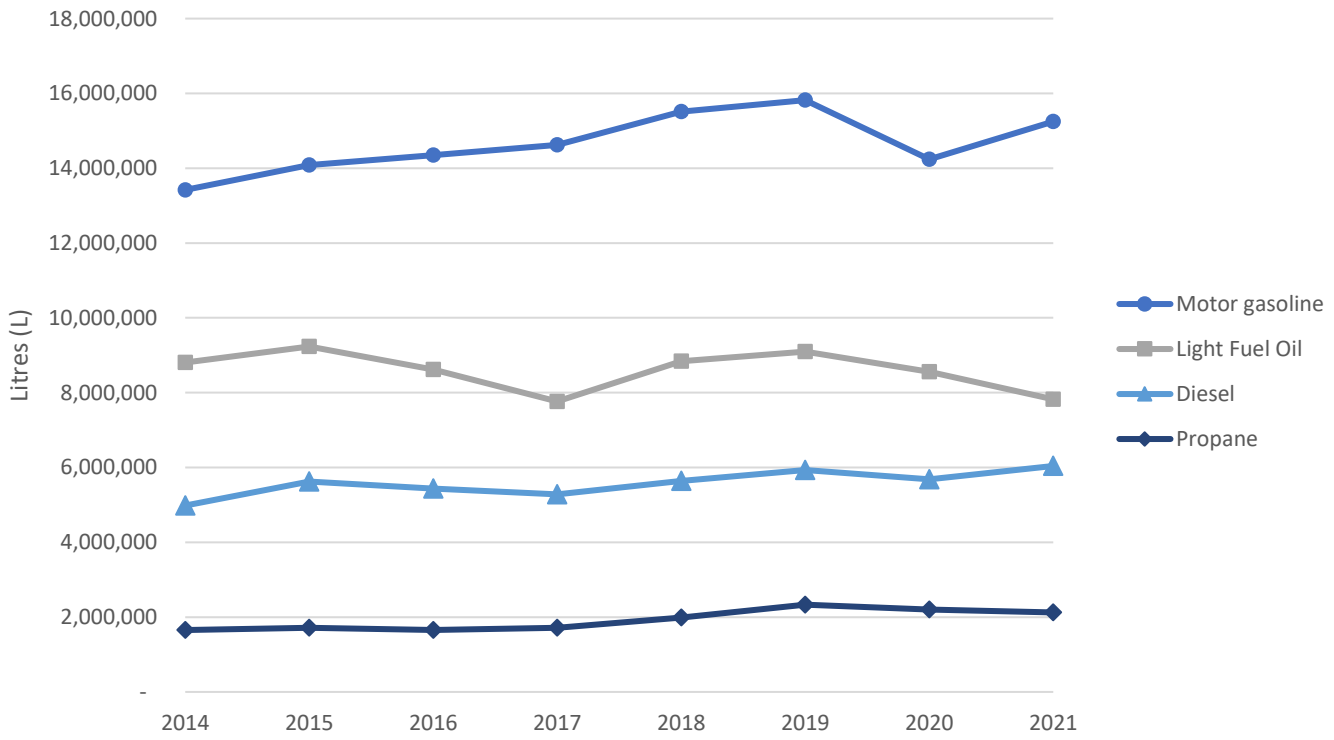
Acquiring residential heating oil and propane was more complex. Some suppliers were willing to provide their sales numbers, whereas some preferred to keep numbers confidential. Furthermore, account methods between suppliers varied, limiting the usefulness of this method. Instead, provincial fuel sale numbers were used and then scaled according to Stratford's population. Only the fuel oil and propane figures from this dataset were used in the inventory. Diesel sales are overrepresented; however, it is still helpful as a reference for general usage trends. For gasoline and diesel emissions, see Table 21.

Table 20 shows that gasoline, diesel and propane sales are trending upward. In contrast, oil is on a slight downward trend. Various factors are likely contributing to these trends, such as rising oil prices and the increased use of propane heating systems. Uncontrollable factors can cause temporary spikes in oil usage; for example, a harsh winter will increase heating demand. The impact of the Covid-19 pandemic can be seen in Figure 11, as gasoline sales were down in 2020. This is why it is essential to consider energy trends over an extended period.

Table 20 Stratford total fuel sales in litres (L)[11]

Year	2014	2015	2016	2017	2018	2019	2020	2021
Gasoline	13,420,317	14,080,889	14,353,433	14,623,353	15,515,305	15,820,071	14,242,246	15,249,309
Diesel	4,982,246	5,619,492	5,431,514	5,281,625	5,640,853	5,930,989	5,682,947	6,039,848
Fuel Oil	8,808,006	9,233,832	8,617,220	7,766,098	8,839,194	9,097,543	8,555,775	7,825,814
Propane	1,657,357	1,710,726	1,656,160	1,718,536	1,988,789	2,332,523	2,205,908	2,126,375

Figure 11 Stratford Total fuel sales in litres (L)



[11] (P.E.I Statistics Bureau, 2021) TABLE 90. Values presented only consider 6.65% of total provincial fuel sales.

9.3.3 Transportation

Transportation emissions for the 2015 baseline inventory were done using a vehicle kilometre travelled (VKT) method. This report used a fuel sale method to improve the data quality. The total litres of gasoline and diesel sold by local gas stations can then be used to calculate the total emissions. We acquired data from Kalibrate Ltd, a company which records fuel sales. To ensure consistency, we updated the 2015 baseline with this method. The total transportation emissions can be found in Table 21.

Table 21 Total transportation emissions (tCO2e)

Year	Gasoline GHGs (tCO2e)	Diesel GHGs (tCO2e)
2015	28,014	72
2020	29,315	105
2021	32,082	109

9.3.4 Waste

All MSW generated in Stratford that isn't composted or recycled is sent to Charlottetown to be incinerated. PEI Energy Systems provided the total waste incinerated for 2020 and 2021. Stantec, a local engineering consultant, calculated an emission factor of 0.578 tonnes of CO_2e per tonne of MSW. This emission factor ensures a high degree of data quality as it was generated specifically for this report. The results can be found in Table 22**.**

Table 22 Total waste emissions (tCO2e)

Year	Emission Factor	Residential MSW (t)	Commercial MSW (t)	Total tCO2e Emitted
2020	0.578t/tMSW	1375	3926	3064
2021		1396	3869	3042

10 Appendix C

10.1 Corporate Inventory

Table 23 Total Corporate CO2e Emissions for 2015, 2020, and 2021

CO_2e Emissions	2015	2020	2021
Scope 1 Emissions (in tonnes of CO_2e)			
Heating Fuel Oil	75	46	43
Fleet Emissions	165	147	185
Total Scope 1 Emissions (in tonnes CO_2e)	**240**	**193**	**228**
Scope 2 Emissions (in tonnes of CO_2e)			
Electricity for building operation	169	135	174
Electricity for streetlight operation	92	53	63
Electricity for water and sewage operation	330	163	181
Total Scope 2 Emissions (in tonnes CO_2e)	**591**	**351**	**418**
Scope 3 Emissions (in tonnes of CO_2e)			
Municipal Solid Waste	95	85	96
Business travel	1	0	2
Employee commuting	19	14	15
Total Scope 3 Emissions (in tonnes CO_2e)	**115**	**99**	**113**
Total Emissions Overall (in tonnes of CO_2e)			
Total Corporate Emissions (in tonnes CO_2e)	**946**	**643**	**759**

Table 24 Stratford Energy Corporate Consumption

Fuel and Energy Consumption	2015	2020	2021
Gigajoules of Energy Consumed (GJs)			
For building operation	3,067	3,642	3,615
For streetlight operation	1,359	1,180	1,101
For water and sewage operation[4]	3,975	3,576	3,121
Total Gigajoules of Energy Consumed (in GJs)	**8,401**	**8,398**	**7,837**
Litres of Heating Fuel Oil (L)			
For building operation	26,791	16,751	15,807
For streetlight operation	0	0	0
For water and sewage operation[5]	2,105	1,379	1,370
Total Liters of Heating Fuel Oil (L)	**28,896**	**18,130**	**17,177**
Litres of Gasoline (L)			
For light-duty gasoline trucks	26,791	16,751	15,807
For hybrid vehicles	162	101	135
For staff commutes	NE	NE	NE
Total Liters of Gasoline (L)	**26,953**	**16,852**	**15,942**

Litres of Diesel (L)			
For Heavy duty diesel trucks	6,829	4,010	4,151
For T3 transit	33,601	37,050	40,321
For firetrucks	2,126	2,234	4,598
Total Liters of Diesel (L)	**42,556**	**43,294**	**49,070**

10.2 Corporate Inventory Methodology

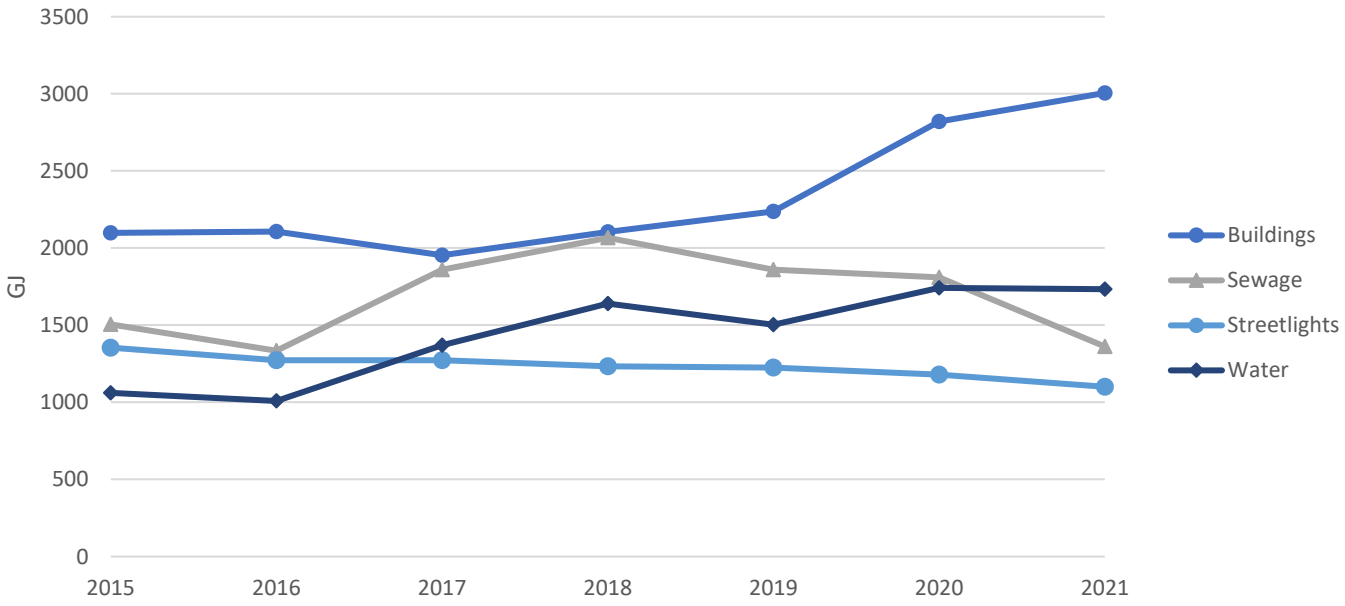
10.2.1 Electricity consumption

All utility invoices for town-owned buildings and facilities are scanned and recorded into a central database. Energy consumed by streetlights is also included in this database. All facilities are charged monthly for their metered power usage. The total power usage was previously found by manually inputting each invoice for each meter. This was a very time-consuming process as there are over 50 metered accounts. To solve this, we created a python program to automatically parse each invoice and sort by total energy. This program allows us to monitor the performance of individual Town-owned buildings and facilities while also being considerably faster.

Table 25 Total corporate energy use (GJ)

Year	Buildings	Sewage	Streetlights	Water
2015	2099	1505	1354	1061
2016	2107	1334	1274	1009
2017	1953	1860	1274	1371
2018	2104	2067	1233	1639
2019	2237	1861	1226	1503
2020	2820	1811	1180	1742
2021	3005	1362	1101	1733

Figure 12 Corporate power consumption (GJ)



10.2.2 Heating Oil

Categorizing heating oil was done using the same program we created for electricity. Data was only available for 2020 and 2021. Extensive retrofits have been made to multiple town buildings, such as improving insulation and installing heat pumps. These improvements have helped reduce the Town's overall oil consumption.

Table 26 Total litres of heating oil for town facilities (L)

	2020	2021
10 STRATFORD	1446.6	1385.74
21 HOLLIS	5602.7	5804.9
234 SHAKESPEARE	680.7	
57 BUNBURY	10620.6	9470.5
88 GEORGETOWN	1643.2	527.5
Grand Total	**19993.8**	**17188.64**

10.2.3 Fleet Vehicles

All fleet expenses, such as fuel and maintenance, are recorded in a database. This allows easy emission calculations, as the fuel total is already known. T3 Transit provided fuel numbers regarding the Stratford bus line. Staff commutes were also considered. In previous years, an internal survey was used, asking staff how many kilometres their commute to work is. For 2020 and 2021, the percentage of staff who work from home was also considered. We used a recent study from Statistics Canada to find the portion of work-from-home staff.[12] The total emissions from fleet vehicles can be found in Table 27.

Table 27 Total emissions from fleet vehicles (tCO2e)

	2015	2020	2021
T3 Transit	91	101	110
Light Duty Gasoline Trucks	32	30	48
Staff Commuting to Work	19	14	15
Heavy Duty Trucks and Tractors	19	11	14
Fire Trucks	6	14	13
Hybrid Vehicle	0	0	1

[12] (Sean & Vincent, 2022)