EOS ECO-ENERGY/ ÉCO-ÉNERGIE INC

Partners for Climate Protection Milestone One

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Final Report – Partners for Climate Protection

MILESTONE ONE – TANTRAMAR REGION

Executive Summary

The purpose of this report is to achieve Milestone One of the Partners for Climate Protection Program for the municipalities of Dorchester, Port Elgin, and Sackville, New Brunswick.

In 2011, the Village of Dorchester's baseline corporate level of Greenhouse Gas (GHG) Emissions is estimated to be 185 metric tonnes of carbon dioxide equivalent (t CO_2e), which is the standard unit for emissions measurement. For the same year – 2011 – the Village of Dorchester's baseline community level of GHG emissions is estimated to be 6,402 tonnes CO_2e.

In 2011, the Village of Port Elgin's baseline corporate level of Greenhouse Gas (GHG) Emissions is estimated to be 99 metric tonnes of carbon dioxide equivalent (t CO_2e), which is the standard unit for emissions measurement. For the same year – 2011 – the Village of Port Elgin's baseline community level of GHG emissions is estimated to be 6,069 tonnes CO_2e.

In 2011, the Village of Sackville's baseline corporate level of Greenhouse Gas (GHG) Emissions is estimated to be 1,860 metric tonnes of carbon dioxide equivalent (t CO_2e), which is the standard unit for emissions measurement. For the same year – 2011 – the Village of Sackville's baseline community level of GHG emissions is estimated to be 74,818 tonnes CO_2e.

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1.0 INTRODUCTION

Climate change is a significant and long-lasting challenge facing individuals and organizations on many spatial scales. Greenhouse Gases (GHGs) have been recognized as one of the primary factors influencing global climate change. Warming temperatures, rising sea levels, changes to precipitation patterns and intensities, the invasion of pests to higher latitudes and altitudes, and increased frequency of extreme weather events have already been documented and are expected to worsen as GHG emissions increase. These GHG emissions are directly attributable to human development and proliferation, and require significant regulation and reduction if the effects of climate change are to be softened. The regulation and reduction of these emissions pose a serious challenge to emerging provincial, federal, and international protocols.

Municipalities and regional governments continue to lead GHG emission reduction efforts through legislation and effective leadership on cost-saving and sustainable planning measures. With guidance from the International Council on Local Environmental Initiatives (ICLEI), the Federation of Canadian Municipalities (FCM) designed the Partners for Climate Protection (PCP) program to help facilitate GHG emissions reduction success at the municipal level.

1.1 Community Profiles

The three municipalities involved in the PCP program and this report are located within the Tantramar Region of New Brunswick. The Tantramar Region is concentrated in south-eastern New Brunswick and north-western Nova Scotia, specifically around the Tantramar marshes.

1.1.1 Village of Dorchester Profile

The Village of Dorchester has a population of 1167[1] spread across roughly 90.89km^2. The village overlooks Shepody Bay and is known for hosting over 80% of migrating semipalmated sandpipers. The village's largest employer is the Correctional Service of Canada – Dorchester Penitentiary.

[1] Statistics Canada; Dorchester. Census Profile. 2011.

1.1.2 Village of Port Elgin Profile

The Village of Port Elgin has a population of 418[2] spread across roughly 18.55km^2. The village is located along the Northumberland straight and is known for its rich natural diversity and saltwater marshes.

1.1.3 Town of Sackville Profile

The Town of Sackville has a population of 5560[3] spread across roughly 74.32km^2. The town is located along the Tantramar Marshes and the Bay of Fundy and was named a Cultural Capital of Canada in 2008.

1.2 Methodology

The following protocol, guidance, and standards documents and reports were considered when developing the GHG emission inventory:

- Cities for Climate Protection Guidelines (ICLEI)
- Developing Inventories for Greenhouse Gas Emissions and Energy Consumption (PCP 2009)

Real energy consumption and waste production data were used as the preferred statistics in GHG emission calculations. Where these data sets were not available or deemed unreliable, activity data from authoritative, defensible sources were used to estimate the necessary unfound statistics in GHG emission calculations.

A data set is considered real consumption data when the data was obtained from actual energy-consumption datasets compiled through stringent accounting of consumption by a vendor or distributor of energy products.

A data set is considered activity data when indicators, averages, and/or survey results are used in calculating a specific data point. Activity data estimates are less detailed than real consumption data and are typically used when real consumption data is unavailable, too expensive, or held in datasets that don't match with the chosen inventory year.

2.0 PARTNERS FOR CLIMATE PROTECTION

[2] Statistics Canada; Port Elgin. Census Profile. 2011.
[3] Statistics Canada; Sackville. Census Profile. 2011.

The Partners for Climate Protection (PCP) program is a Canada-wide initiative developed by the Federation of Canadian Municipalities (FCM) in partnership with the International Council of Local Environmental Initiatives (ICLEI). There are over 190 Canadian municipalities enrolled under the program.

2.1 Partners for Climate Protection Program Overview

The PCP program's main vision is the reduction of greenhouse gas (GHG) emissions from municipal office operations and community activities. The PCP program is made up of five milestones which, alongside facilitating the reduction of GHG emissions, aim to provide cost saving opportunities for municipalities, create jobs and encourage local economic development, and protect the climate for generations to come.

The PCP program's five milestones are as follows:

Milestone 1: Create a Greenhouse Gas Emissions Inventory
Milestone 2: Set Greenhouse Gas Reduction Targets
Milestone 3: Develop a Local Action Plan to Meet Targets
Milestone 4: Implement the Local Action Plan
Milestone 5: Monitor Progress and Report Reductions

2.2 Milestone 1 – Creating a Greenhouse Gas Emissions Inventory

EOS Eco-Energy, an environmental non-profit organization located in Sackville, New Brunswick has begun work on Milestone 1: Create a Greenhouse Gas Emissions Inventory for the four municipalities located in the Tantramar Region in New Brunswick. The creation of the GHG emissions inventory includes the collection of data from a number of sectors within the municipality, and is only completed through cooperation among energy providers, federal statisticians, municipal staff, and local stakeholders.

The average cost to complete Milestone 1 of the PCP program is cited as between $5000 to $50000 for each inventoried municipality. EOS Eco-Energy has received a grant to complete Milestone 1. This integrated approach to the completion of Milestone 1 will produce four separate inventories and provides an opportunity for significant cost-savings between municipalities in the Tantramar Region.

Two separate sub-inventories exist within a Greenhouse Gas Emissions Inventory: the Corporate Inventory and the Community Inventory. The Corporate Inventory includes all municipal office operations and energy consumption from municipal buildings,

streetlight, traffic, and area lights, water and wastewater management systems, fleet vehicles, and solid waste management. The Community Inventory includes all public operations and energy consumption from the residential, commercial and institutional, and industrial sectors, transportation, and solid waste management. A summary is provided in Table 2.0 below.

Table 2.0 – Comparison of sub-inventory sectors in the Port Elgin Greenhouse Gas Emissions Inventory.

Corporate Sectors	Community Sectors
Buildings	Residential
Fleet Vehicles	Commercial and Institutional
Street, Traffic, and Area Lights	Industrial
Water and Wastewater Management	Transportation
Solid Waste	Solid Waste

3.0 DORCHESTER

3.1 Corporate Inventory

The GHG emissions inventory for the Corporate Sector of Dorchester is presented in the following section. All data presented is from the base year of 2011 and was sourced from Village of Dorchester staff.

The Corporate GHG emission inventory includes data from the following sectors:

Buildings;
Vehicle Fleet;
Street, Traffic, and Area Lighting; and
Water and Waste Water Systems.

The following table presents the types of data used for each section of the Corporate Inventory.

Table 3.0 Data types used in Dorchester corporate inventory sectors.[4]

[4] 'AD' indicates activity data; 'RC' indicates real consumption data; '-' represents not applicable.

	Electricity	Fuel Oil	Gasoline	Other Fuel
Buildings	RC	RC	-	-
Fleet Vehicles	-	-	RC	-
Streetlights and Area Lights	RC	-	-	-
Water and Wastewater	RC	-	-	-
Waste Management	-	-	-	-

3.1.1 Buildings

The Building sector traditionally accounts for a significant proportion of local government operations emissions. Six buildings were accounted for in this Inventory. All six buildings consumed electricity while the Recreation Center, St. Edwards, and the Fire Hall also consumed fuel oil used for heating. Building data was acquired from the Dorchester village office.

Table 3.1 Energy consumption, total cost, and GHG emissions of Dorchester municipal buildings.

Building or Building Group Name	Electricity (kWh)	Fuel Oil (L)	Total Cost ($)	Total eCO2 (t)
Recreation Center	27,785	570	3,866	16
St. Edwards	9,520	7,559	7,947	26
Town Hall	28,588	-	3,451	15
Fire Hall	21,347	1,271	3,714	14
Library	12,556	-	1,516	6
Rink	8,594	-	1,037	4
Total	108,390	9,400	21,530	81

Table 3.1 outlines the electricity and fuel oil consumption for all municipal buildings. The total electricity consumption was found to be 108,390 kWh and the total fuel oil consumption was found to be 9,400 liters. The total cost of all energy consumption was $21,530. The total eCO_2 produced by all municipal buildings was calculated to be approximately 81 tonnes. This represents 44% of all corporate sector emissions.

3.1.2 Vehicle Fleet

Similar to the building sector, the vehicle fleet sector accounts for a large portion of municipal emissions while also offering the potential for significant emissions reductions and cost-saving measures. Four vehicles were accounted for in this inventory. Vehicle data was acquired from the Dorchester village office.

Table 3.2 Gasoline consumption, total cost, and GHG emissions of Dorchester fleet vehicles.

Vehicle or Vehicle Group Name	Gasoline[5] (L)	Total Cost ($)	Total eCO_2 (t)
Van	3672.39	4406.87	9
Truck	8211.76	9854.11	20
Lawn Tractor	441.667	530	1
Snow Plough	1297.13	1556.56	3
Total	13,623	16,348	33

Table 3.2 outlines gasoline fuel consumption for all fleet vehicles. Total fuel consumption was estimated to be 13,623 liters at a cost of $16,348. The total eCO2 produced by all fleet vehicles was calculated to be approximately 33 tonnes. This represents 18% of all corporate sector emissions.

3.1.3 Street, Traffic, and Area Lights

Street, traffic, and area lighting generally account for a small portion of electricity consumption and GHG emission for municipalities. Nevertheless, significant cost-savings can be identified in this sector. Street, traffic, and area lighting data was acquired from the Dorchester village office.

Table 3.3 Electricity consumption, total cost, and GHG emissions of Dorchester street, traffic, and area lights.

Streetlight Group Name	Electricity (kWh)	Total Cost ($)	Total eCO_2 (t)
101 100W Streetlights	44,238	12,349	23
Yellow Light	2,208	275	1
1 200W Streetlight	876	-	0
Total	47,322	12,624	24

[5] Note: Gasoline volumes were calculated from the total amount paid on gasoline in 2011 and the estimated average price of fuel during the same year ($1.20/L gasoline). This average was determined using GasBuddy and Statistics Canada data on gas price trends in New Brunswick in 2011.

Table 3.3 outlines electricity consumption for all Dorchester street, traffic, and area lights. Total electricity consumption was found to be 47,322 kWh at a cost of $12,624. The total eCO2 produced by all street, traffic, and area lighting was calculated to be approximately 23 tonnes. This represents 13% of all corporate sector emissions.

3.1.4 Water and Wastewater Management Systems

The emissions associated with water and wastewater management systems can be highly variable in local government operations inventories. A number of factors influence this variability, including any sanitary sewer and potable water treatment plants in the system, and the local topography which affects the pumping and movement of water. Water and wastewater management systems data was acquired from the Dorchester village office.

Table 3.4 Electricity consumption for all Dorchester water and wastewater management systems.

Facility or Facility Group Name	Electricity (kWh)	Total Cost ($)	Total eCO_2 (t)
Pump House	30,320	2,750	15
Water Plant	39,920	2,951	20
Lift Station	20,430	1,983	10
Total	90,670	7,684	46

Table 3.4 outlines electricity consumption for all Dorchester water and wastewater management systems. Total electricity consumption was found to be 90,670 kWh at a cost of $7,684. The total eCO2 produced by all water and wastewater management systems was calculated to be approximately 46 tonnes. This represents 25% of all corporate sector emissions.

3.1.5 Corporate Solid Waste

Emissions from solid waste, mostly in the form of methane, enter the air directly as waste decomposes. The corporate solid waste sector is often a small portion of total corporate sector emissions. Nonetheless, cost-savings and emission reduction opportunities are present within this sector.

The data for this sector was deemed inconclusive or not statistically significant. The overall admissions for this section are *ad minimus*.

3.1.6 Summary of Corporate GHG Emissions

The summary shown in Table 3.5 below provides a holistic view of the corporate sector and GHG emissions associated with Dorchester municipal operations

Table 3.5 Summary of corporate sector GHG emissions.

Sector	Total Cost ($)	Energy (GJ)	Total eCO_2 (t)
Buildings	21,530	755	81
Vehicle Fleet	16,348	477	33
Streetlights	12,624	170	24
Water and Sewage	7,684	326	46
Corporate Waste	-	-	*Ad minimus*
Total	58,186	1,728	185

The total cost of all operations within the five corporate sectors was found to be $58,186. The total eCO2 produced by all operations within the five corporate sectors was estimated to be 185 tonnes.

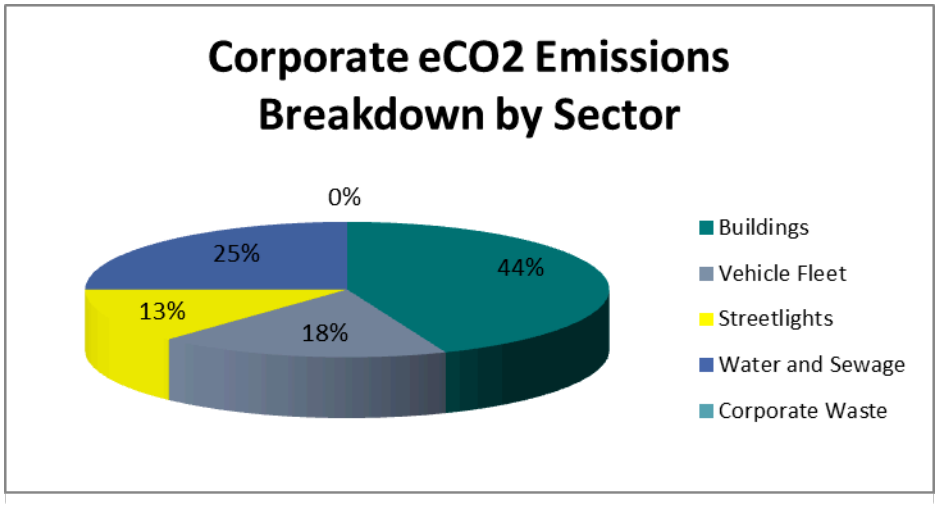

Figure 3.0 Corporate eCO2 emissions breakdown by sector.

3.2 Community Inventory

The GHG emissions inventory for the Community Sector of Dorchester is presented in the following section. All data presented is from the base year of 2011 and was sourced from NB Power, Westmorland Albert Solid Waste Corporation, Statistics Canada, and other Community Sector stakeholders.

The Community GHG emission inventory includes data from the following sectors:

Residential;
Commercial and Institutional;
Industrial;
Transportation; and
Waste Management.

Table 3.6 Data types used in each section of the Community Inventory[6]

	Electricity	Natural Gas	Fuel Oil	Other Fuel
Residential	RC	AD	AD	AD
Commercial & Institutional	RC	AD	AD	AD
Industrial	RC	AD	AD	AD
Transportation	-	-	AD	AD
Waste Management	-	-	-	-

Table 3.6 identifies the types of data used for each section of the Community Inventory. When Real Consumption data was unavailable, activity data was determined and the associated method was recorded. Any methodology unique to each sector will be described in the associated section. Any methodology common to all Community Inventories can be found in Appendix A under the appropriate subsection.

3.2.1 Residential Sector

Similar to the building sector in the municipal inventory, the residential sector is a large producer of GHG emissions and often holds many opportunities for emissions reductions. Real consumption data for the residential sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 3.7 Residential Sector Energy Use by Energy Source and Estimated Consumption in Dorchester.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Dorchester (GJ)[7]

[6] 'AD' indicates activity data; 'RC' indicates real consumption data; '-' represents not applicable.
[7] Values are calculated based on Electricity Real Consumption data.

Electricity	59.8	*16234*
Natural Gas	1.6	434
Heating Oil	18.1	4914
Other	0.8	217
Total	-	21799

Table 3.7 details the residential sector energy consumption breakdown and the related energy consumption value for each fuel source in Dorchester. All data is estimated from calculations based on residential electricity consumption in Dorchester, the value of which was found to be 16,234 gigajoules.

Table 3.8 Residential Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	*4,521,951*	2,306
Natural Gas	m^3	11,302	22
Fuel Oil	L	126,639	346
Propane	L	8,581	13
Total	-	-	2,687

Table 3.8 contains the total estimated usage of electricity, natural gas, fuel oil, and propane in the residential sector alongside the total eCO2 produced. The total value of all eCO2 produced by the residential sector in Dorchester is estimated to be approximately 2,687 tonnes. This represents 42% of all community sector emissions.

3.2.2 Commercial and Institutional Sector

Commercial and institutional sector energy consumption and GHG emissions can vary across municipalities. Real consumption data for the commercial and institutional sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 3.9 Commercial Sector Energy Use by Energy Source and Estimated Consumption in Dorchester.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Dorchester (GJ)[8]
Electricity	45.4	*3656*

[8] Values are calculated based on Electricity Real Consumption data.

Natural Gas	3.3	266
Light Fuel Oil and Kerosene	31.4	2529
Heavy Fuel Oil	14.9	1200
Other	5.1	411
Total	-	8062

Table 3.9 details the commercial sector energy consumption breakdown and the related energy consumption value for each fuel source in Dorchester. All data is estimated from calculations based on commercial electricity consumption in Dorchester, the value of which was found to be 3,656 gigajoules.

Table 3.10 Residential Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	1,018,508	519
Natural Gas	m^3	6,916	13
Fuel Oil	L	65,178	178
Heavy Fuel Oil	L	28,757	91
Propane	L	16,229	25
Total	-	-	826

Table 3.10 contains the total estimated usage of electricity, natural gas, fuel oil, heavy fuel oil, and propane in the commercial sector alongside the total eCO2 produced. The total value of all eCO2 produced by the commercial sector in Dorchester is estimated to be approximately 826 tonnes. This represents 13% of all community sector emissions.

3.2.3 Industrial Sector

Similar to the commercial and institutional sector, industrial sector energy consumption and GG emissions can vary across municipalities based on the level of industry present within the municipality. Real consumption data for the industrial sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 3.11 Industrial Sector Energy Use by Energy Source and Estimated Consumption in Dorchester.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Dorchester[9] (GJ)
Electricity	17.9	*1853*
Natural Gas	10.2	1056
Light Fuel Oil and Kerosene	5.9	611
Heavy Fuel Oil	10.6	1097
Coke	28.5	2950
Coal	0.2	21
	-	7856

Table 3.11 details the industrial sector energy consumption breakdown and the related energy consumption value for each fuel source in Dorchester. All data is estimated from calculations based on industrial electricity consumption in Dorchester, the value of which was found to be 1,853 gigajoules.

Table 3.12 Industrial Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	516,070	263
Natural Gas	m^3	27,471	52
Heavy Fuel Oil	L	26,291	83
Fuel Oil	L	15,739	43
Coke	Mg	102	254
Coal	Mg	1	2
Total	-	-	697

Table 3.12 contains the total estimated usage of electricity, natural gas, fuel oil, heavy fuel oil, coke, and coal in the industrial sector alongside the total eCO2 produced. The total value of all eCO2 produced by the industrial sector in Dorchester is estimated to be approximately 697 tonnes. This represents 11% of all community sector emissions.

3.2.4 Transportation

Transportation sector GHG emissions are often a significant portion of community sector emissions. Activity data for the transportation sector (in the form of total gasoline and fuel consumption) was acquired from the VKT estimation method. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 3.13 Transportation Sector Fuel Consumption Estimates.

[9] Values are calculated based on Electricity Real Consumption data.

	Autos	Light Truck	Heavy Truck	Bus	Total	Total Fuel Used (L)
Gasoline	627	629	50	0	1,306	535,295
Diesel	2	17	527	0	545	203,280
Propane	15	0	0	0	15	9,900
Compressed Natural Gas	0	0	0	0	0	0
Ethanol Blend	0	0	0	0	0	0
Total	644	646	576	0	1,867	-

Table 3.13 contains transportation fuel consumption estimates alongside the total eCO2 produced. The total value of all eCO2 produced by the transportation sector is estimated to be approximately 1,867 tonnes. This represents 29% of all community sector emissions.

3.2.5 Waste

Emissions from solid waste, mostly in the form of methane, enter the air directly as waste decomposes. The community solid waste sector is often a small portion of total community sector emissions. All community solid waste data was acquired from Westmorland-Albert Solid Waste Management Corporation.

The total mass of waste sent to landfill from Dorchester was 675 tonnes. The decomposition of this waste is estimated to release 325 tonnes of eCO2. This value represents 5% of all community sector emissions.

3.2.6 Summary of Community GHG Emissions

The summary shown in Table 3.14 below provides a holistic view of the community sector and GHG emissions associated with Dorchester community activity.

Table 3.14 Summary of corporate sector GHG emissions.

Sector	Energy (GJ)	Total eCO2 (t)
Residential	21844	2687
Commercial	8062	826
Industrial	7856	697
Transportation	26772	1867
Community Waste	-	325
Total	64533	6402

The total energy consumption within the five community sectors was found to be 64,527 gigajoules. The total eCO2 produced by all activity within the five community sectors was estimated to be 6,402 tonnes.

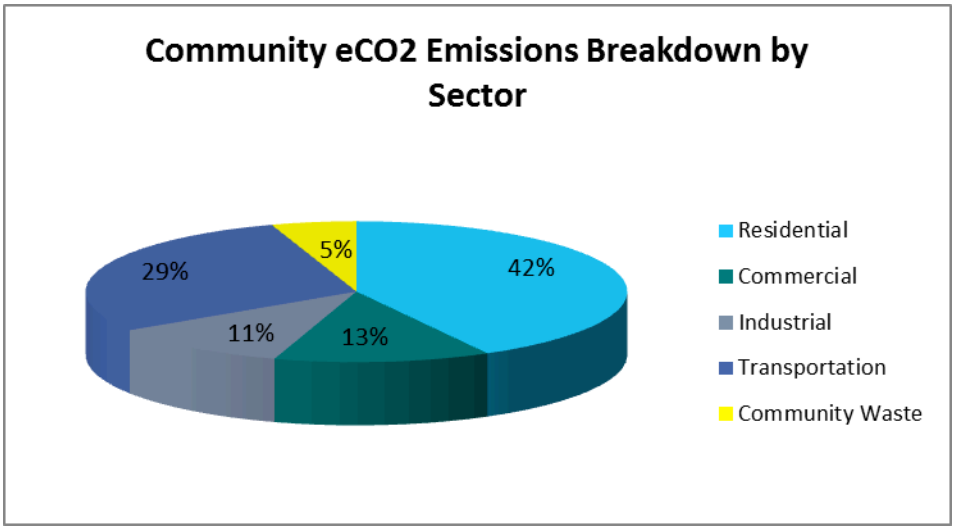

Figure 3.1 Community eCO2 emissions breakdown by sector.

3.3 Forecasts

Sections 3.3.1 and 3.3.2 depict the corporate and community forecasts for Dorchester. These values were found using population increase or decrease estimates.

3.3.1 Corporate BAU Forecast

The graph shown in Figure 3.2 depicts the total emissions from the year 2011 and the projected emissions for the year 2021 broken down by sector.

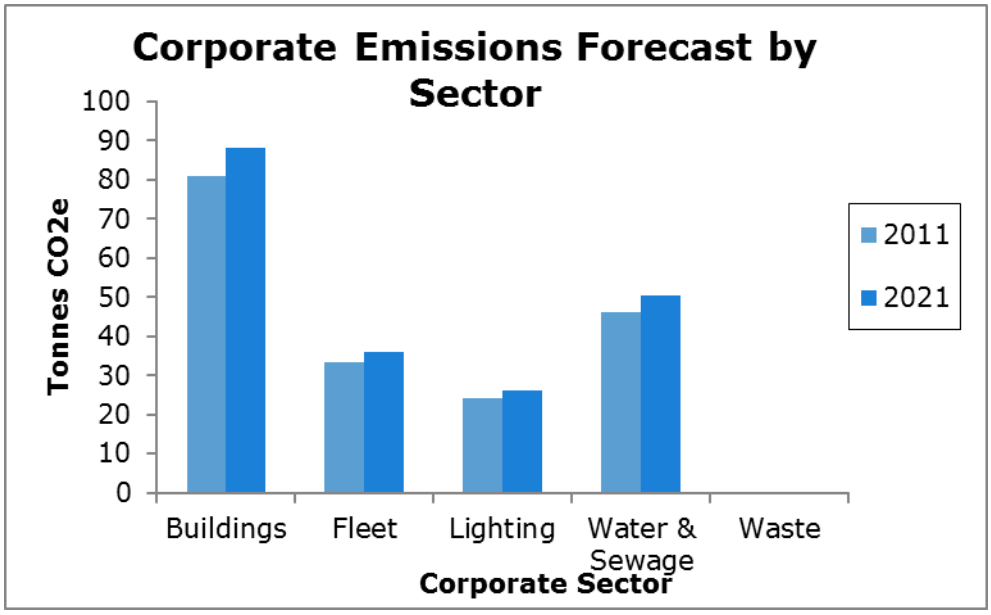

Figure 3.2 Corporate eCO2 emissions forecast for 2021 by sector.

The graph shown in Figure 3.3 shows the total emissions from the year 2011, the total projected increase in emissions up to and including the year 2021 (denoted by Business as Usual (BAU), and a relative 20% decrease in emissions over the same time period from 2011 levels.

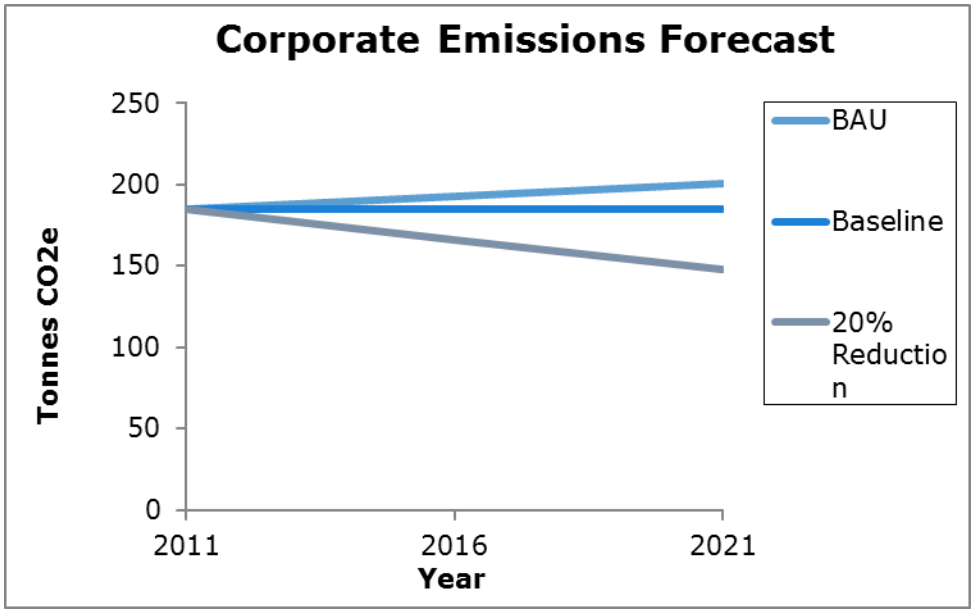

Figure 3.3 Total corporate eCO2 emissions forecast for 2021.

A BAU forecast predicts an increase in total eCO2 emissions of 16 tonnes by 2021, bringing total corporate emissions to 185 tonnes from 201 tonnes in 2011. A 20%

reduction in emissions would see a decrease of 37 tonnes by 2021, bringing total corporate emissions to 148 tonnes from 185 tonnes in 2011.

3.3.2 Community BAU Forecast

The graph shown in Figure 3.4 depicts the total emissions from the year 2011 and the projected emissions for the year 2021 broken down by sector.

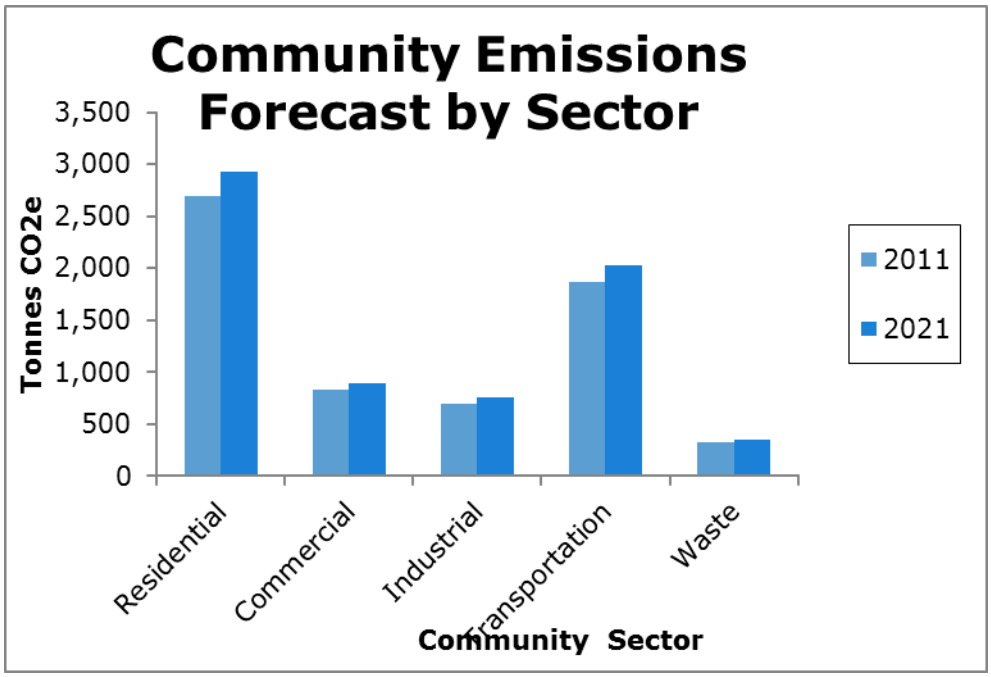

Figure 3.4 Community eCO2 emissions forecast for 2021 by sector.

The graph shown in Figure 3.5 shows the total emissions from the year 2011, the total projected increase in emissions up to and including the year 2021 (denoted by Business as Usual (BAU), and a relative 6% decrease in emissions over the same time period from 2011 levels.

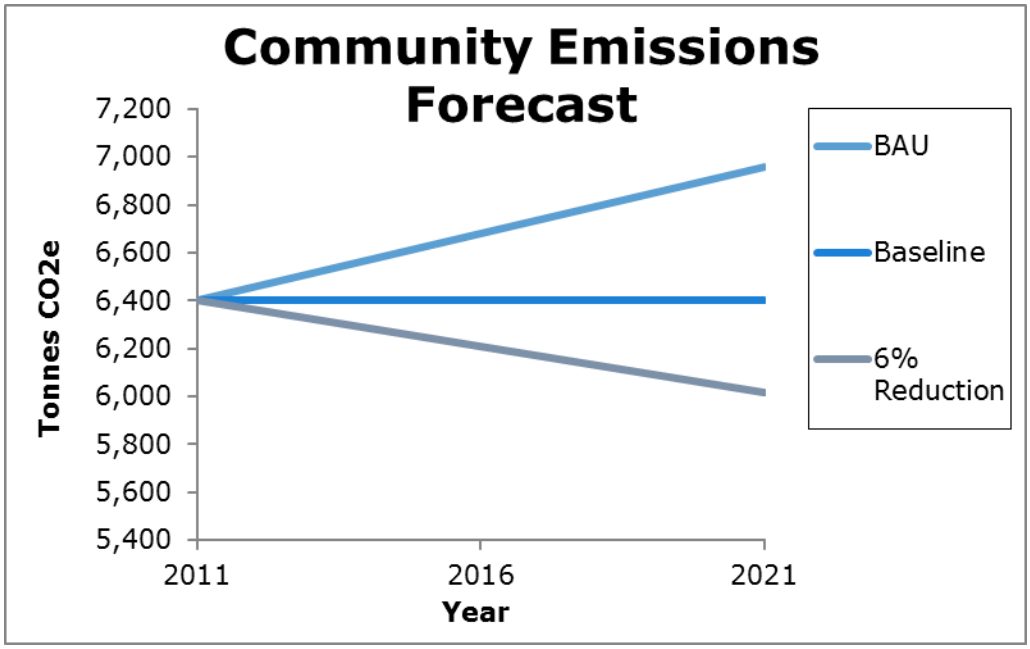

Figure 3.5 Total community eCO2 emissions forecast for 2021.

A BAU forecast predicts an increase in total eCO2 emissions of 557 tonnes by 2021, bringing total community emissions to 6,959 tonnes from 6,402 tonnes in 2011. A 6% reduction in emissions would see a decrease of 384 tonnes by 2021, bringing total community emissions to 6,018 tonnes from 6,402 tonnes in 2011.

4.0 PORT ELGIN

4.1 Corporate Inventory

The GHG emissions inventory for the Corporate Sector of Port Elgin is presented in the following section. All data presented is from the base year of 2011 and was sourced from Village of Port Elgin staff.

The Corporate GHG emission inventory includes data from the following sectors:

Buildings;
Vehicle Fleet;
Street, Traffic, and Area Lighting; and
Water and Waste Water Systems.

The following table presents the types of data used for each section of the Corporate Inventory.

Table 4.0 Data types used in Port Elgin corporate inventory sectors.[10]

	Electricity	Fuel Oil	Gasoline	Other Fuel
Buildings	RC	RC	-	-
Fleet Vehicles	-	-	RC	-
Streetlights and Area Lights	RC	-	-	-
Water and Wastewater	RC	-	-	-
Waste Management	-	-	-	-

4.1.1 Buildings

The Building sector traditionally accounts for a significant proportion of local government operations emissions. Four buildings were accounted for in this Inventory. All four buildings consumed electricity while the Office Building/ Fire Hall/ Library also consumed fuel oil used for heating. Building data was acquired from the Port Elgin village office.

Table 4.1 Energy consumption, total cost, and GHG emissions of Port Elgin municipal buildings.

Building or Building Group Name	Electricity (kWh)	Fuel Oil (L)	Total Cost[11] ($)	Total eCO_2 (t)
Office Building /Fire Hall /Library	14,554	5,749	-	23
Municipal Garage	4,437	1,579	-	7
Skating Rink	2,199	-	-	1
Museum/ Munroe House	3,559	-	-	2
Total	24,749	7328	14656	33

Table 4.1 outlines the electricity and fuel oil consumption for all municipal buildings. The total electricity consumption was found to be 24,749 kWh and the total fuel oil consumption was found to be 7,328 liters. The total cost of all energy consumption

[10] 'AD' indicates activity data; 'RC' indicates real consumption data; '-' represents not applicable.
[11] Note: A cost breakdown for electricity and oil consumption for buildings in the corporate sector was not provided.

was $14,666. The total eCO_2 produced by all municipal buildings was calculated to be approximately 33 tonnes. This represents 33% of all corporate sector emissions.

4.1.2 Vehicle Fleet

Similar to the building sector the vehicle fleet sector accounts for a large portion of municipal emissions while also offering the potential for significant emissions reductions and cost-saving measures. Four vehicles were accounted for in this inventory. Vehicle data was acquired from the Port Elgin village office.

Table 4.2 Gasoline consumption, total cost, and GHG emissions of Dorchester fleet vehicles[12].

Vehicle or Vehicle Group Name	Gasoline (L)[13]	Total Cost ($)	Total eCO_2 (t)
2001 Kubota Tractor	-	-	-
2004 Ford F150	-	-	-
1999 GMC Pumper	-	-	-
2000 Ford E350 Rescue Van	-	-	-
2008 Int. Fire Truck	-	-	-
Total	4657	5588	11

Table 4.2 outlines gasoline fuel consumption for all fleet vehicles. Total fuel consumption was estimated to be 4,657 liters at a cost of $5,588. The total eCO2 produced by all fleet vehicles was calculated to be approximately 11 tonnes. This represents 6% of all corporate sector emissions.

4.1.3 Street, Traffic, and Area Lights

Street, traffic, and area lighting generally account for a small portion of electricity consumption and GHG emission for municipalities. Nevertheless, significant cost-savings can be identified in this sector. Street, traffic, and area lighting data was acquired from the Port Elgin village office.

[12] Note: A breakdown of vehicle fuel consumption was not provided.
[13] Gasoline volume was calculated from the total amount paid on gasoline in 2011 and the estimated average price of fuel during the same year ($1.20/L gasoline). This average was determined using GasBuddy and Statistics Canada data on gas price trends in New Brunswick in 2011.

Table 4.3 Electricity consumption, total cost, and GHG emissions of Port Elgin street, traffic, and area lights.

Streetlight Group Name[14]	Electricity (kWh)	Total Cost ($)	Total eCO_2 (t)
Port Elgin Streetlights	40,734	16,615	20.77

Table 4.3 outlines electricity consumption for all Port Elgin street, traffic, and area lights. Total electricity consumption was found to be 438 kWh at a cost of $14,406. The total eCO2 produced by all street, traffic, and area lighting was calculated to be approximately 20.77 tonnes. This represents 21% of all corporate sector emissions.

4.1.4 Water and Wastewater Management Systems

The emissions associated with water and wastewater management systems can be highly variable in local government operations inventories. A number of factors influence this variability, including any sanitary sewer and potable water treatment plants in the system, and the local topography which affects the pumping and movement of water. Water and wastewater management systems data was acquired from the Port Elgin village office.

Table 4.4 Electricity consumption for all Port Elgin water and wastewater management systems.

Facility or Facility Group Name	Electricity (kWh)	Total Cost ($)	Total eCO2 (t)
Riverside Drive Water Pump	2,181	154	1
Water Tower	6,374	450	3
Woodside	23,640	1,670	12
Station Street Lift Station	5,829	412	3
Main Street Lift Station	26,020	1,838	13
Shemogue Road Lift Station	13,550	957	7
Total	77,594	5,480	40

Table 4.4 outlines electricity consumption for all Port Elgin water and wastewater management systems. Total electricity consumption was found to be 77,594 kWh at a cost of $5,480. The total eCO2 produced by all water and wastewater management

[14] Note: A breakdown of streetlight energy consumption was not provided.

systems was calculated to be approximately 40 tonnes. This represents 40% of all corporate sector emissions.

4.1.5 Corporate Solid Waste

Emissions from solid waste, mostly in the form of methane, enter the air directly as waste decomposes. The corporate solid waste sector is often a small portion of total corporate sector emissions. Nonetheless, cost-savings and emission reduction opportunities are present within this sector.

The data for this sector was deemed inconclusive or not statistically significant. The overall admissions for this section are *ad minimus*.

4.1.6 Summary of Corporate GHG Emissions

The summary shown in Table 4.5 below provides a holistic view of the corporate sector and GHG emissions associated with Port Elgin municipal operations

Table 4.5 Summary of corporate sector GHG emissions.

Sector	Total Cost ($)	Energy (GJ)	Total eCO_2 (t)
Buildings	24,749	373	33
Vehicle Fleet	2,830	82	6
Streetlights	16,615	147	21
Water and Sewage	5,480	279	40
Corporate Waste	-	-	0
Total	49,674	881	99

The total cost of all operations within the four corporate sectors with applicable data was found to be $49,674. The total eCO2 produced by all operations within the five corporate sectors was estimated to be 99 tonnes.

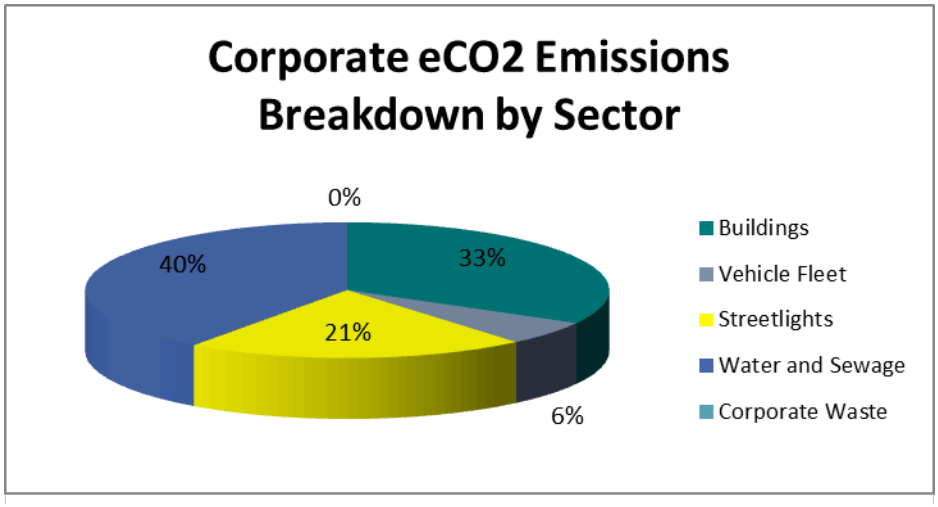

Figure 4.0 Corporate eCO2 emissions breakdown by sector.

4.2 Community Inventory

The GHG emissions inventory for the Community Sector of Port Elgin is presented in the following section. All data presented is from the base year of 2011 and was sourced from NB Power, Westmorland Albert Solid Waste Corporation, Statistics Canada, and other Community Sector stakeholders.

The Community GHG emission inventory includes data from the following sectors:

Residential;
Commercial and Institutional;
Industrial;
Transportation; and
Waste Management.

The following table presents the types of data used for each section of the Community Inventory.

Table 4.6 Data Types used in each Inventory[15]

	Electricity	Natural Gas	Fuel Oil	Other Fuel
Residential	RC	AD	AD	AD
Commercial & Institutional	RC	AD	AD	AD
Industrial	RC	AD	AD	AD
Transportation	-	-	AD	AD

[15] 'AD' indicates activity data; 'RC' indicates real consumption data; '-' represents not applicable.

Waste Management	-	-	-	-

Table 4.6 identifies the types of data used for each section of the Community Inventory. When Real Consumption data was unavailable, activity data was determined and the associated method was recorded. Any methodology unique to each sector will be described in the associated section. Any methodology common to all Community Inventories can be found in Appendix A under the appropriate subsection.

4.2.1 Residential Sector

Similar to the building sector in the municipal inventory, the residential sector is a large producer of GHG emissions and often holds many opportunities for emissions reductions. Real consumption data for the residential sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 4.7 Residential Sector Energy Use by Energy Source and Estimated Consumption in Port Elgin.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Port Elgin (GJ)[16]
Electricity	59.8	*9734*
Natural Gas	1.6	260
Heating Oil	18.1	2946
Other	0.8	130
Total	-	13055

Table 4.7 details the residential sector energy consumption breakdown and the related energy consumption value for each fuel source in Port Elgin. All data is estimated from calculations based on residential electricity consumption in Port Elgin, the value of which was found to be 9,734 gigajoules.

Table 4.8 Residential Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	*2,711,490*	1,383
Natural Gas	m^3	6,777	13

[16] Values are calculated based on Electricity Real Consumption data.

Fuel Oil	L	75,936	208
Propane	L	5,145	8
Total	-	-	1,611

Table 4.8 contains the total estimated usage of electricity, natural gas, fuel oil, and propane in the residential sector alongside the total eCO2 produced. The total value of all eCO2 produced by the residential sector in Dorchester is estimated to be approximately 1,611 tonnes. This represents 27% of all community sector emissions.

4.2.2 Commercial and Institutional Sector

Commercial and institutional sector energy consumption and GHG emissions can vary across municipalities. Real consumption data for the commercial and institutional sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 4.9 Commercial Sector Energy Use by Energy Source and Estimated Consumption in Port Elgin.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Port Elgin (GJ)[17]
Electricity	45.4	*6555*
Natural Gas	3.3	476
Light Fuel Oil and Kerosene	31.4	4534
Heavy Fuel Oil	14.9	2151
Other	5.1	736
Total	-	14453

Table 4.9 details the commercial sector energy consumption breakdown and the related energy consumption value for each fuel source in Port Elgin. All data is estimated from calculations based on commercial electricity consumption in Port Elgin, the value of which was found to be 6,555 gigajoules.

Table 4.10 Residential Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	1,825,923	931
Natural Gas	m3	12,398	24

[17] Values are calculated based on Electricity Real Consumption data.

Fuel Oil	L	116,847	320
Heavy Fuel Oil	L	51,554	162
Propane	L	29,094	45
Total	-	-	1,481

Table 4.10 contains the total estimated usage of electricity, natural gas, fuel oil, heavy fuel oil, and propane in the commercial sector alongside the total eCO2 produced. The total value of all eCO2 produced by the commercial sector in Port Elgin is estimated to be approximately 1,481 tonnes. This represents 24% of all community sector emissions.

4.2.3 Industrial Sector

Similar to the commercial and institutional sector, industrial sector energy consumption and GHG emissions can vary across municipalities based on the level of industry present within the municipality. Real consumption data for the industrial sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 4.11 Industrial Sector Energy Use by Energy Source and Estimated Consumption in Port Elgin.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Port Elgin[18] (GJ)
Electricity	17.9	3796
Natural Gas	10.2	2163
Light Fuel Oil and Kerosene	5.9	1251
Heavy Fuel Oil	10.6	2248
Coke	28.5	6044
Coal	0.2	42
Total	-	16097

Table 4.11 details the industrial sector energy consumption breakdown and the related energy consumption value for each fuel source in Port Elgin. All data is estimated from calculations based on industrial electricity consumption in Port Elgin, the value of which was found to be 3,796 gigajoules.

Table 4.12 Industrial Energy Consumption Estimates.

[18] Values are calculated based on Electricity Real Consumption data.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	1,057,483	539
Natural Gas	m3	56,292	107
Heavy Fuel Oil	L	53,873	169
Fuel Oil	L	32,250	88
Coke	Mg	210	520
Coal	Mg	2	4
Total	-	1,057,483	1,428

Table 4.12 contains the total estimated usage of electricity, natural gas, fuel oil, heavy fuel oil, coke, and coal in the industrial sector alongside the total eCO2 produced. The total value of all eCO2 produced by the industrial sector in Port Elgin is estimated to be approximately 1,428 tonnes. This represents 24% of all community sector emissions.

4.2.4 Transportation

Transportation sector GHG emissions are often a significant portion of community sector emissions. Activity data for the transportation sector (in the form of total gasoline and fuel consumption) was acquired from the VKT estimation method. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 4.13 Transportation Sector Fuel Consumption Estimates.

	Autos	Light Truck	Heavy Truck	Bus	Total	Total Fuel Used (L)
Gasoline	478	480	38	0	996	408,318
Diesel	1	13	402	0	416	155,060
Propane	12	0	0	0	12	7,552
Compressed Natural Gas	0	0	0	0	0	0
Ethanol Blend	0	0	0	0	0	0
Total	491	493	439	0	1,424	-

Table 4.13 contains transportation fuel consumption estimates alongside the total eCO2 produced. The total value of all eCO2 produced by the transportation sector is estimated to be approximately 1,424 tonnes. This represents 23% of all community sector emissions.

4.2.5 Waste

Emissions from solid waste, mostly in the form of methane, enter the air directly as waste decomposes. The community solid waste sector is often a small portion of total community sector emissions. All community solid waste data was acquired from Westmorland-Albert Solid Waste Management Corporation.

The total mass of waste sent to landfill in Port Elgin was 258 tonnes. The decomposition of this waste is estimated to release 124 tonnes of eCO2. This value represents 2% of all community sector emissions.

4.2.6 Summary of Community GHG Emissions

The summary shown in Table 4.14 below provides a holistic view of the community sector and GHG emissions associated with Port Elgin community activity.

Table 4.14 Summary of corporate sector GHG emissions.

Sector	Energy (GJ)	Total eCO2 (t)
Residential	13098	1611
Commercial	14452	1481
Industrial	16097	1428
Transportation	20421	1424
Community Waste	-	124
Total	64069	6068

The total energy consumption within the five community sectors was found to be 64,059 gigajoules. The total eCO2 produced by all activity within the five community sectors was estimated to be 6,068 tonnes.

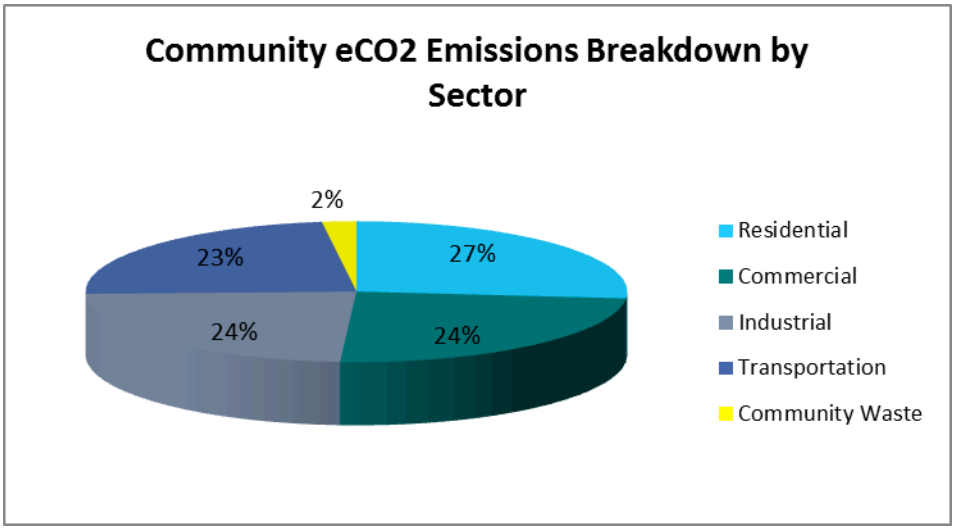

Figure 4.1 Community eCO2 emissions breakdown by sector.

4.3 Forecasts

Sections 4.3.1 and 4.3.2 depict the corporate and community forecasts for Port Elgin. These values were found using population increase or decrease estimates.

4.3.1 Corporate BAU Forecast

The graph shown in Figure 4.2 depicts the total emissions from the year 2011 and the projected emissions for the year 2021 broken down by sector.

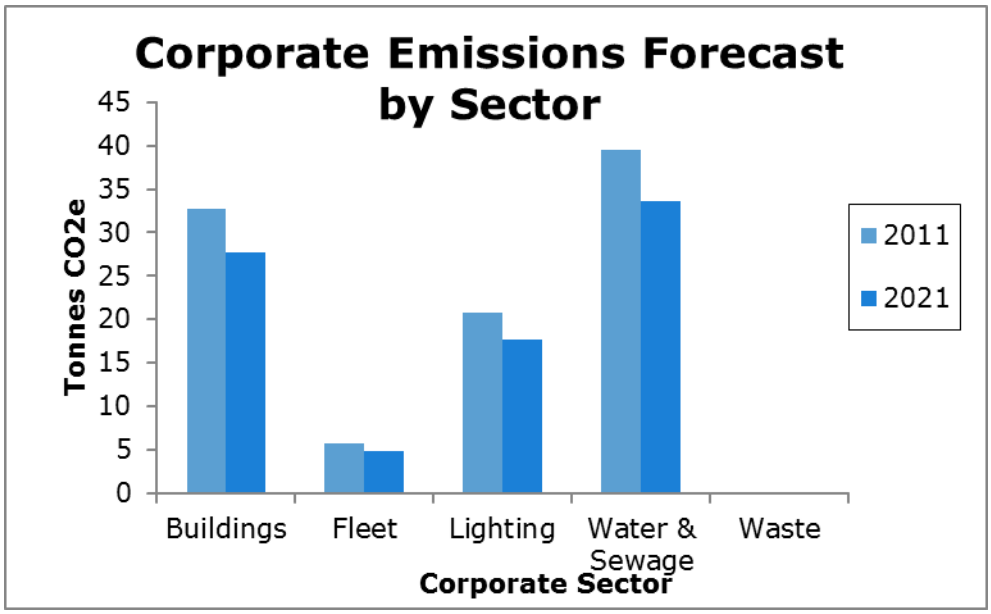

Figure 4.2 Corporate eCO2 emissions forecast for 2021 by sector.

The graph shown in Figure 4.3 shows the total emissions from the year 2011, the total projected increase in emissions up to and including the year 2021 (denoted by Business as Usual (BAU), and a relative 20% decrease in emissions over the same time period from 2011 levels.

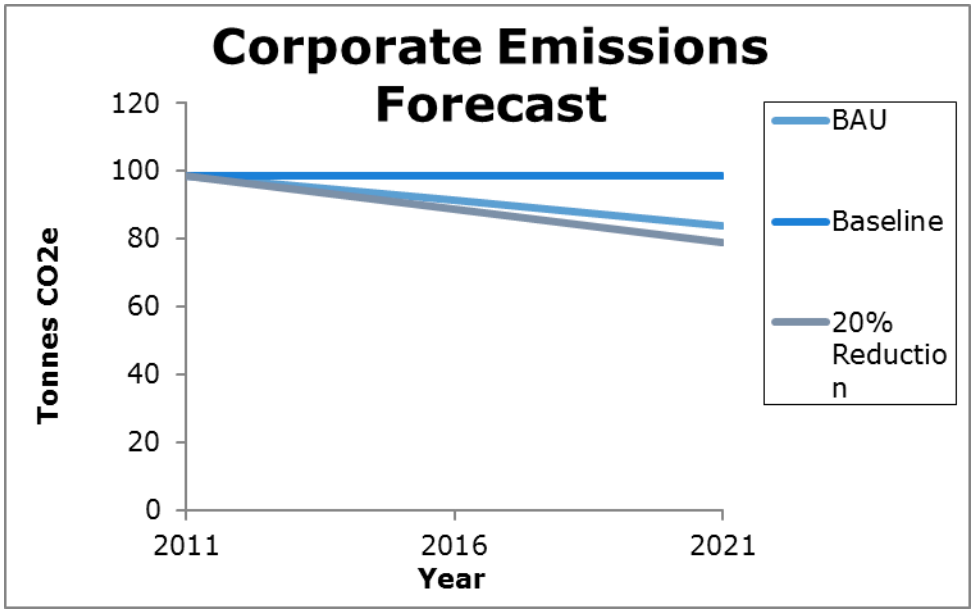

Figure 4.3 Total corporate eCO2 emissions forecast for 2021.

A BAU forecast predicts a decrease in total eCO2 emissions of 15 tonnes by 2021, bringing total corporate emissions to 84 tonnes from 99 tonnes in 2011. A 20% reduction in emissions would see a decrease of 20 tonnes by 2021, bringing total corporate emissions to 79 tonnes from 99 tonnes in 2011. The irregular decrease in emissions in Port Elgin can be attributed to population decreases in the municipality.

4.3.2 Community BAU Forecast

The graph shown in Figure 4.4 depicts the total emissions from the year 2011 and the projected emissions for the year 2021 broken down by sector.

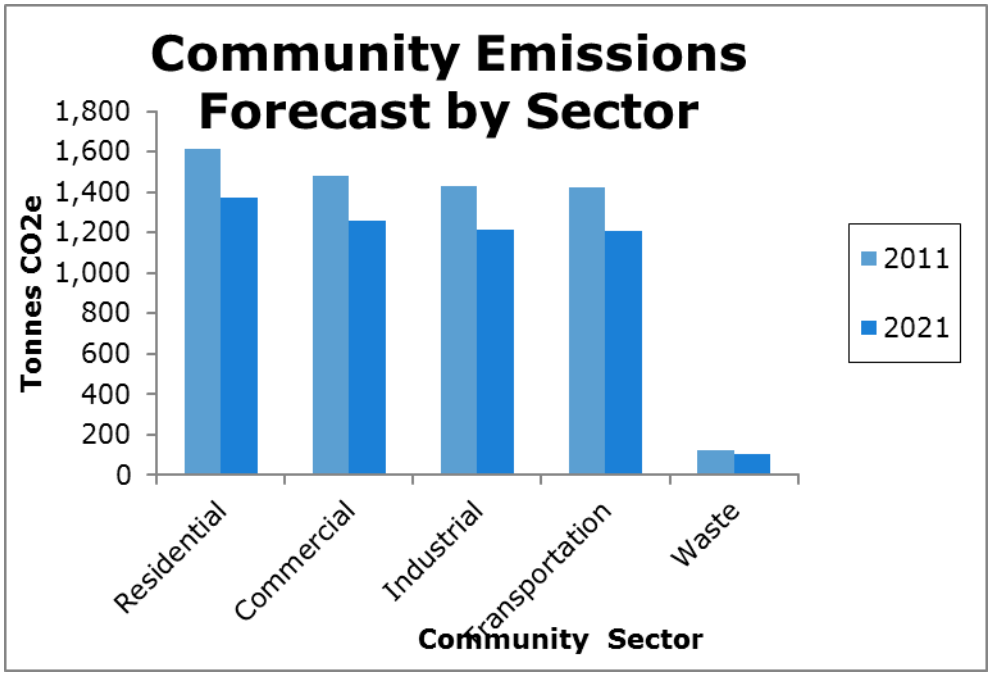

Figure 4.4 Community eCO2 emissions forecast for 2021 by sector.

The graph shown in Figure 4.5 shows the total emissions from the year 2011, the total projected increase in emissions up to and including the year 2021 (denoted by Business as Usual (BAU), and a relative 6% decrease in emissions over the same time period from 2011 levels.

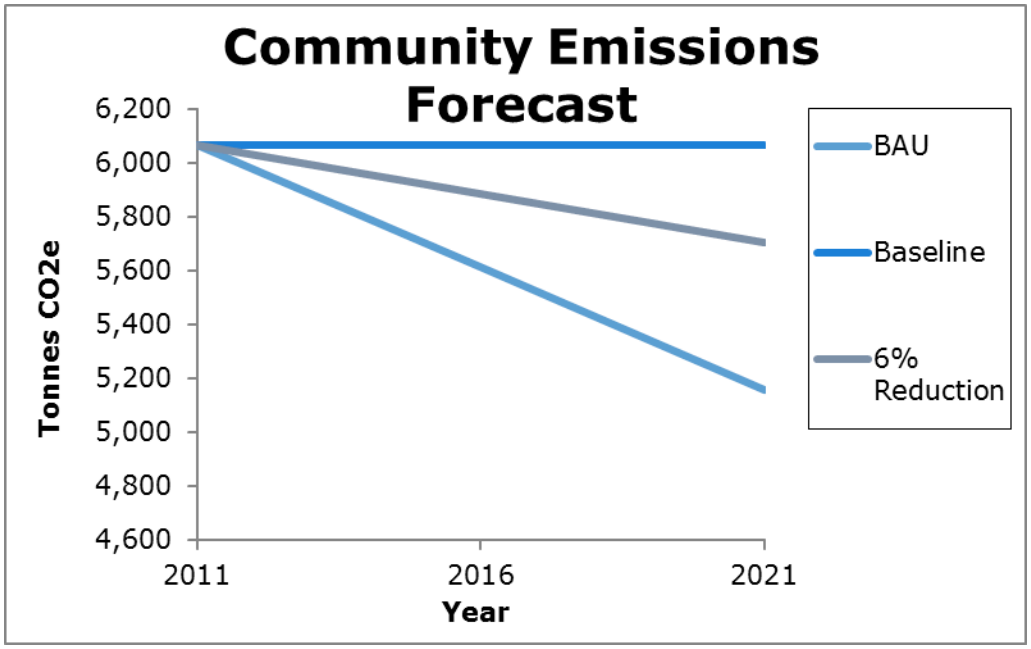

Figure 4.5 Total community eCO2 emissions forecast for 2021.

A BAU forecast predicts a decrease in total eCO2 emissions of 917 tonnes by 2021, bringing total community emissions to 5,152 tonnes from 6,069 tonnes in 2011. A 6% reduction in emissions would see a decrease of 364 tonnes by 2021, bringing total community emissions to 5,705 tonnes from 6,069 tonnes in 2011. The irregular decrease in emissions in Port Elgin can be attributed to population decreases in the municipality.

5.0 SACKVILLE

5.1 Corporate Inventory

The GHG emissions inventory for the Corporate Sector of Sackville is presented in the following section. All data presented is from the base year of 2011 and was sourced from Town of Sackville staff.

The Corporate GHG emission inventory includes data from the following sectors:

Buildings;
Vehicle Fleet;
Street, Traffic, and Area Lighting; and
Water and Waste Water Systems.

The following table presents the types of data used for each section of the Corporate Inventory.

Table 5.0 Data types used in Sackville corporate inventory sectors.[19]

	Electricity	Fuel Oil	Gasoline	Other Fuel
Buildings	RC	RC	-	-
Fleet Vehicles	-	-	RC	-
Streetlights and Area Lights	RC	-	-	-
Water and Wastewater	RC	-	-	-
Waste Management	-	-	-	-

5.1.1 Buildings

[19] 'AD' indicates activity data; 'RC' indicates real consumption data; '-' represents not applicable.

The Building sector traditionally accounts for a significant proportion of local government operations emissions. Twelve buildings were accounted for in this Inventory. All buildings (excluding the Arena Canteen) consumed electricity while the Engineering and Public Works Building consumed natural gas, and the Arena Canteen consumed propane. Building data was acquired from the Sackville town office.

Table 5.1 Energy consumption, total cost, and GHG emissions of Sackville municipal buildings.[20]

Building or Building Group Name	Electricity (kWh)	Natural Gas (m^2)	Propane (L)	Total Cost ($)	Total eCO2 (t)
Town Hall	106,400	-	-	14,597	54
Old DNR Building	13,740	-	-	2,239	7
Library	58,920	-	-	9,246	30
Engineering & Public Works Building	131,200	24,040	-	40,913	113
Bob Edgett's Club	2,556	-	-	634	1
Police/Fire Station	318,880	-	-	36,051	163
Civic Centre	1,004,160	-	-	220,430	512
Octagonal House	23,269	-	-	3,548	12
Tourist Bureau	105,120	-	-	13,923	54
Salt Shed	3,181	-	-	720	2
Municipal Parks Buildings	2,333	-	-	1,737	1
Arena Canteen	-	-	1,524	1,361	2
Total	1769750	24040	1524	345398	951

Table 5.1 outlines the electricity and fuel oil consumption for all municipal buildings. The total electricity consumption was found to be 1,769,750 kWh, the total natural gas consumption was found to be 24,040 liters, and the total propane consumption was found to be 1,524 liters. The total cost of all energy consumption was $345,398. The total eCO_2 produced by all municipal buildings was calculated to be approximately 951 tonnes. This represents 51% of all corporate sector emissions.

5.1.2 Vehicle Fleet

Similar to the building sector the vehicle fleet sector accounts for a large portion of municipal emissions while also offering the potential for significant emissions

[20] '-' represents not applicable.

reductions and cost-saving measures. Six departments were accounted for in this inventory. Individual vehicle data was not available. Vehicle data was acquired from the Sackville town office.

Table 5.2 Gasoline consumption, total cost, and GHG emissions of Sackville fleet vehicles.

Vehicle or Vehicle Group Name	Gasoline (L)	Total Cost ($)	Total eCO_2 (t)
Public Works Department	86,794	98,115	212
Parks & Recreation Department	5,705	6,375	14
Utility Department	11,130	12,831	27
By-Law Department	1,953	2,167	5
Fire Department	4,997	1,829	12
Public Works Department	86,794	98,115	212
Total	110597	121317	270

Table 5.2 outlines gasoline fuel consumption for all fleet vehicles. Total fuel consumption was estimated to be 110,597 liters at a cost of $121,317. The total eCO2 produced by all fleet vehicles was calculated to be approximately 270 tonnes. This represents 15% of all corporate sector emissions.

5.1.3 Street, Traffic, and Area Lights

Street, traffic, and area lighting generally account for a small portion of electricity consumption and GHG emission for municipalities. Nevertheless, significant cost-savings can be identified in this sector. Street, traffic, and area lighting data was acquired from the Sackville town office.

Table 5.3 Electricity consumption, total cost, and GHG emissions of Sackville street, traffic, and area lights.

Streetlight Group Name[21]	Electricity (kWh)	Total Cost ($)	Total eCO_2 (t)
Town of Sackville Street Lighting	441,936	177,799	225

Table 5.3 outlines electricity consumption for all Sackville street, traffic, and area lights. Total electricity consumption was found to be 441,936 kWh at a cost of

[21] Note: A breakdown of Sackville Streelight electricity consumption is available on the Sackville Inventory Quantification Support Spreadsheet.

$177,799. The total eCO2 produced by all street, traffic, and area lighting was calculated to be approximately 225 tonnes. This represents 12% of all corporate sector emissions.

5.1.4 Water and Wastewater Management Systems

The emissions associated with water and wastewater management systems can be highly variable in local government operations inventories. A number of factors influence this variability, including any sanitary sewer and potable water treatment plants in the system, and the local topography which affects the pumping and movement of water. Water and wastewater management systems data was acquired from the Sackville town office.

Table 5.4 Electricity consumption for all Sackville water and wastewater management systems.

Facility or Facility Group Name	Total Use	Total Cost ($)	Total eCO_2 (t)
Reservoir Road Building	454,680	18,540	232
Water Treatment Plant	10,328	1,494	5
Water Tower	34,886	3,141	18
Church Street Lift Station	3,481	760	2
Queens Road Lift Station	39,630	6,635	20
Morice Drive Lift Station	8,011	1,428	4
Silver Lake Lift Station	32,460	4,095	17
Charlotte Street Lift Station	2,440	617	1
Fairfield Road Lift Station	2,390	610	1
Squire Street Lift Station	22,420	3,192	11
Flow Meter	159	306	0
Shed Lift Station	42,167	5,596	22
Brooks Avenue Lift Station	300	325	0
Tantramar Place Lift Station	8,883	1,495	5
Donald Harper Road Lift Station	860	401	0
Ogden Mill Road Lift Station	14,810	2,304	8
Charles Street Lift Station	133,330	18,791	68
Total	811235	69728	414

Table 5.4 outlines electricity consumption for all Sackville water and wastewater management systems. Total electricity consumption was found to be 811,235 kWh at a cost of $69,728. The total eCO2 produced by all water and wastewater management

systems was calculated to be approximately 414 tonnes. This represents 22% of all corporate sector emissions.

5.1.5 Corporate Solid Waste

Emissions from solid waste, mostly in the form of methane, enter the air directly as waste decomposes. The corporate solid waste sector is often a small portion of total corporate sector emissions. Nonetheless, cost-savings and emission reduction opportunities are present within this sector.

The data for this sector was deemed inconclusive or not statistically significant. The overall admissions for this section are *ad minimus*.

5.1.6 Summary of Corporate GHG Emissions

The summary shown in Table 6.5 below provides a holistic view of the corporate sector and GHG emissions associated with Sackville municipal operations

Table 5.5 Summary of corporate sector GHG emissions.

Sector	Total Cost ($)	Energy (GJ)	Total eCO_2 (t)
Buildings	345,398	8,819	951
Vehicle Fleet	121,317	3,870	270
Streetlights	177,799	1,591	225
Water and Sewage	69,728	2,920	414
Corporate Waste	-	-	*Ad minimus*
Total	714,242	17,201	1,860

The total cost of all operations within the five corporate sectors was found to be $714,242. The total eCO2 produced by all operations within the five corporate sectors was estimated to be 1,860 tonnes.

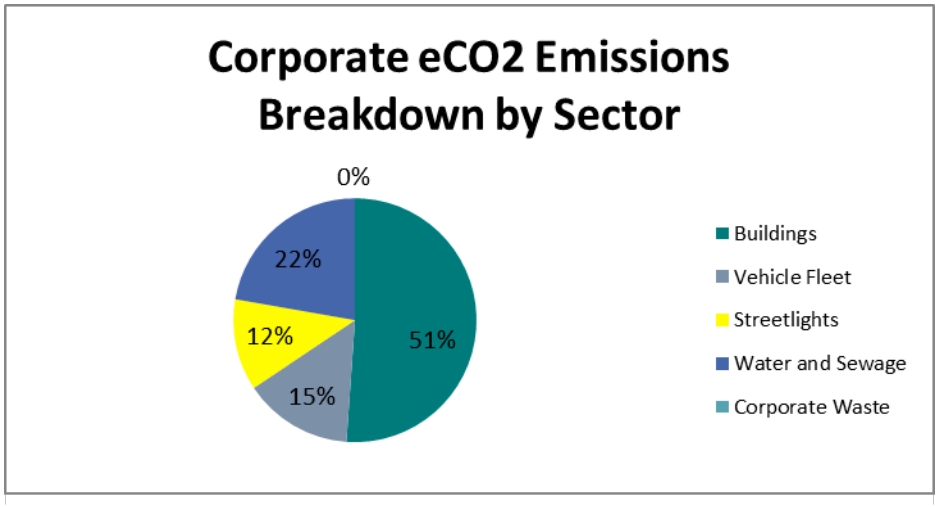

Figure 5.0 Corporate eCO2 emissions breakdown by sector.

5.2 Community Inventory

The GHG emissions inventory for the Community Sector of Sackville is presented in the following section. All data presented is from the base year of 2011 and was sourced from NB Power, Westmorland Albert Solid Waste Corporation, Statistics Canada, and other Community Sector stakeholders.

The Community GHG emission inventory includes data from the following sectors:

Residential;
Commercial and Institutional;
Industrial;
Transportation; and
Waste Management.

The following table presents the types of data used for each section of the Community Inventory.

Table 5.6 Data Types used in each Inventory[22]

	Electricity	Natural Gas	Fuel Oil	Other Fuel
Residential	RC	AD	AD	AD
Commercial & Institutional	RC	AD	AD	AD
Industrial	RC	AD	AD	AD
Transportation	-	-	AD	AD

[22] 'AD' indicates activity data; 'RC' indicates real consumption data; '-' represents not applicable.

Waste Management	-	-	-	-

Table 5.6 identifies the types of data used for each section of the Community Inventory. When Real Consumption data was unavailable, activity data was determined and the associated method was recorded. Any methodology unique to each sector will be described in the associated section. Any methodology common to all Community Inventories can be found in Appendix A under the appropriate subsection.

5.2.1 Residential Sector

Similar to the building sector in the municipal inventory, the residential sector is a large producer of GHG emissions and often holds many opportunities for emissions reductions. Real consumption data for the residential sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 5.7 Residential Sector Energy Use by Energy Source and Estimated Consumption in Sackville.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Sackville (GJ)[23]
Electricity	59.8	133110
Natural Gas	1.6	3561
Heating Oil	18.1	40289
Other	0.8	1781
Total	-	178519

Table 5.7 details the residential sector energy consumption breakdown and the related energy consumption value for each fuel source in Sackville. All data is estimated from calculations based on residential electricity consumption in Sackville, the value of which was found to be 133,110 gigajoules.

Table 6.8 Residential Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	37,077,997	18,910
Natural Gas	m^3	92,674	176

[23] Values are calculated based on Electricity Real Consumption data.

Fuel Oil	L	1,038,380	2,840
Propane	L	70,357	109
Total	-	38,279,408	22,035

Table 5.8 contains the total estimated usage of electricity, natural gas, fuel oil, and propane in the residential sector alongside the total eCO2 produced. The total value of all eCO2 produced by the residential sector in Sackville is estimated to be approximately 22,035 tonnes. This represents 29% of all community sector emissions.

5.2.2 Commercial and Institutional Sector

Commercial and institutional sector energy consumption and GHG emissions can vary across municipalities. Real consumption data for the commercial and institutional sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 5.9 Commercial Sector Energy Use by Energy Source and Estimated Consumption in Sackville.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Sackville (GJ)[24]
Electricity	45.4	117,890
Natural Gas	3.3	8569
Light Fuel Oil and Kerosene	31.4	81356
Heavy Fuel Oil	14.9	38691
Other	5.1	13243
Total	-	259930

Table 5.9 details the commercial sector energy consumption breakdown and the related energy consumption value for each fuel source in Sackville. All data is estimated from calculations based on commercial electricity consumption in Sackville, the value of which was found to be 117,890 gigajoules.

Table 5.10 Residential Energy Consumption Estimates.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	32,838,514	16,748
Natural Gas	m^3	222,980	424

[24] Values are calculated based on Electricity Real Consumption data.

Fuel Oil	L	2,101,455	5,748
Heavy Fuel Oil	L	927,171	2,916
Propane	L	523,239	808
Total	-	-	26,644

Table 5.10 contains the total estimated usage of electricity, natural gas, fuel oil, heavy fuel oil, and propane in the commercial sector alongside the total eCO2 produced. The total value of all eCO2 produced by the commercial sector in Sackville is estimated to be approximately 26,644 tonnes. This represents 32% of all community sector emissions.

5.2.3 Industrial Sector

Similar to the commercial and institutional sector, industrial sector energy consumption and GHG emissions can vary across municipalities based on the level of industry present within the municipality. Real consumption data for the industrial sector (in the form of total electricity consumption) was acquired from NB Power. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 5.11 Industrial Sector Energy Use by Energy Source and Estimated Consumption in Sackville.

Energy Source	Consumption Breakdown (%)	Energy Consumed in Sackville (GJ)[25]
Electricity	17.9	10884
Natural Gas	10.2	6202
Light Fuel Oil and Kerosene	5.9	3587
Heavy Fuel Oil	10.6	6445
Coke	28.5	17329
Coal	0.2	122
	-	29672

Table 5.11 details the industrial sector energy consumption breakdown and the related energy consumption value for each fuel source in Sackville. All data is estimated from calculations based on industrial electricity consumption in Sackville, the value of which was found to be 10,884 gigajoules.

Table 5.12 Industrial Energy Consumption Estimates.

[25] Values are calculated based on Electricity Real Consumption data.

Fuel Type	Units	Total Use	Total eCO_2 (t)
Electricity	kWh	3,031,660	1,546
Natural Gas	m^3	161,381	307
Heavy Fuel Oil	L	154,447	486
Fuel Oil	L	92,458	253
Coke	Mg	601	1,491
Coal	Mg	4	10
Total	-	3,440,551	4,093

Table 5.12 contains the total estimated usage of electricity, natural gas, fuel oil, heavy fuel oil, coke, and coal in the industrial sector alongside the total eCO2 produced. The total value of all eCO2 produced by the industrial sector in Sackville is estimated to be approximately 4,093 tonnes. This represents 6% of all community sector emissions.

5.2.4 Transportation

Transportation sector GHG emissions are often a significant portion of community sector emissions. Activity data for the transportation sector (in the form of total gasoline and fuel consumption) was acquired from the VKT estimation method. The methodology used to acquire the activity data within this sector is detailed in Appendix A.

Table 5.13 Transportation Sector Fuel Consumption Estimates.

	Autos	Light Truck	Heavy Truck	Bus	Total	Total Fuel Used (L)
Gasoline	6,880	6,905	543	0	14,328	5,873,305
Diesel	18	184	5,778	5	5,985	2,230,412
Propane	168	0	0	0	168	108,628
Compressed Natural Gas	0	0	0	0	0	0
Ethanol Blend	0	0	0	0	0	0
Total	7,066	7,089	6,321	5	20,481	-

Table 5.13 contains transportation fuel consumption estimates alongside the total eCO2 produced. The total value of all eCO2 produced by the transportation sector is estimated to be approximately 20,481 tonnes. This represents 27% of all community sector emissions.

5.2.5 Waste

Emissions from solid waste, mostly in the form of methane, enter the air directly as waste decomposes. The community solid waste sector is often a small portion of total community sector emissions. All community solid waste data was acquired from Westmorland-Albert Solid Waste Management Corporation.

The total mass of waste sent to landfill in Port Elgin was 3,250 tonnes. The decomposition of this waste is estimated to release 1,566 tonnes of eCO2. This value represents 2% of all community sector emissions.

5.2.6 Summary of Community GHG Emissions

The summary shown in Table 5.14 below provides a holistic view of the community sector and GHG emissions associated with Sackville community activity.

Table 5.14 Summary of corporate sector GHG emissions.

Sector	Energy (GJ)	Total eCO2 (t)
Residential	179112	22035
Commercial	259737	26632
Industrial	28699	4093
Transportation	293740	20481
Community Waste	-	1566
Total	761228	74806

The total energy consumption within the five community sectors was found to be 762,260 gigajoules. The total eCO2 produced by all activity within the five community sectors was estimated to be 74,806 tonnes.

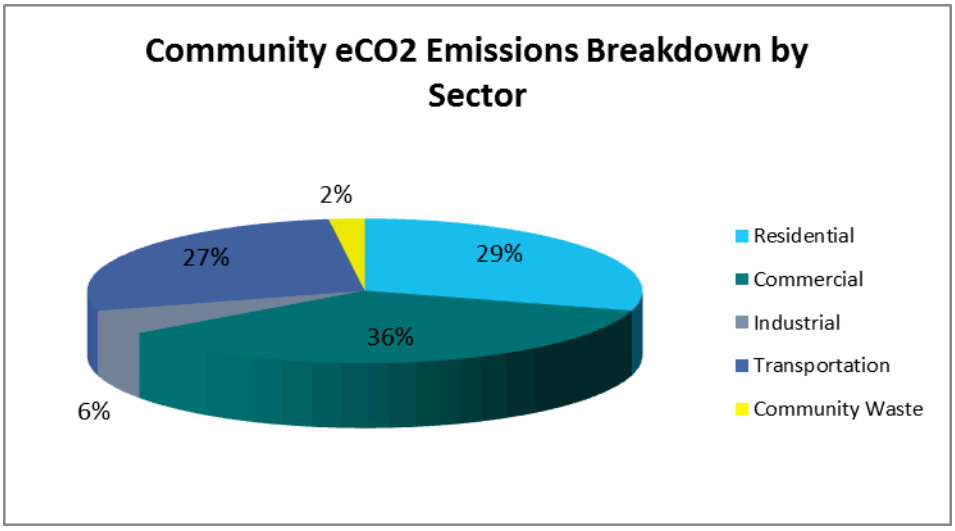

Figure 5.1 Community eCO2 emissions breakdown by sector.

5.3 Forecasts

Sections 5.3.1 and 5.3.2 depict the corporate and community forecasts for Sackville. These values were found using population increase or decrease estimates.

5.3.1 Corporate BAU Forecast

The graph shown in Figure 5.2 depicts the total emissions from the year 2011 and the projected emissions for the year 2021 broken down by sector.

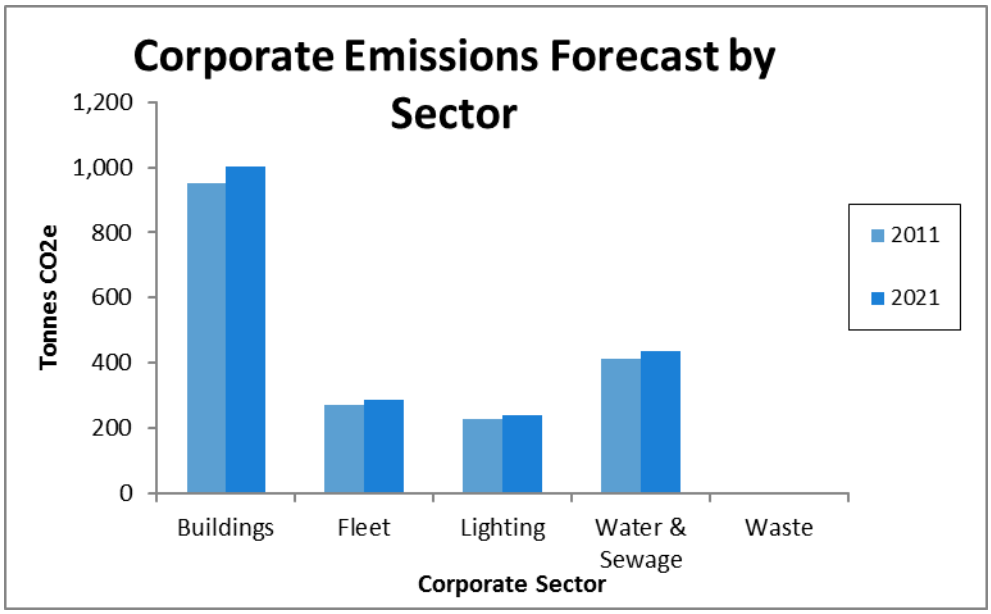

Figure 5.2 Corporate eCO2 emissions forecast for 2021 by sector.

The graph shown in Figure 5.3 shows the total emissions from the year 2011, the total projected increase in emissions up to and including the year 2021 (denoted by Business as Usual (BAU), and a relative 20% decrease in emissions over the same time period from 2011 levels.

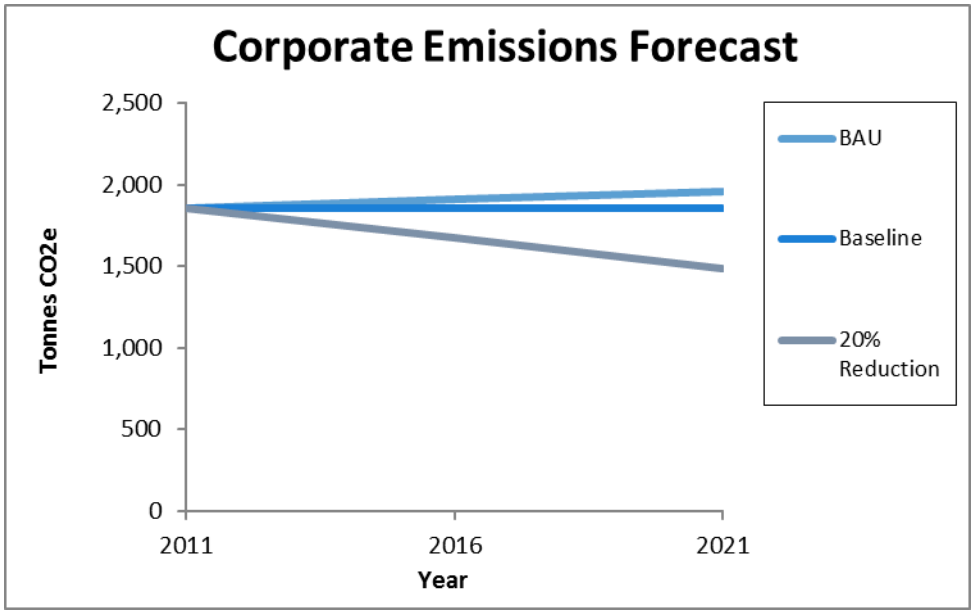

Figure 5.3 Total corporate eCO2 emissions forecast for 2021.

A BAU forecast predicts an increase in total eCO2 emissions of 102 tonnes by 2021, bringing total corporate emissions to 1,962 tonnes from 1,860 tonnes in 2011. A 20% reduction in emissions would see a decrease of 372 tonnes by 2021, bringing total corporate emissions to 1,488 tonnes from 1.860 tonnes in 2011.

5.3.2 Community BAU Forecast

The graph shown in Figure 5.4 depicts the total emissions from the year 2011 and the projected emissions for the year 2021 broken down by sector.

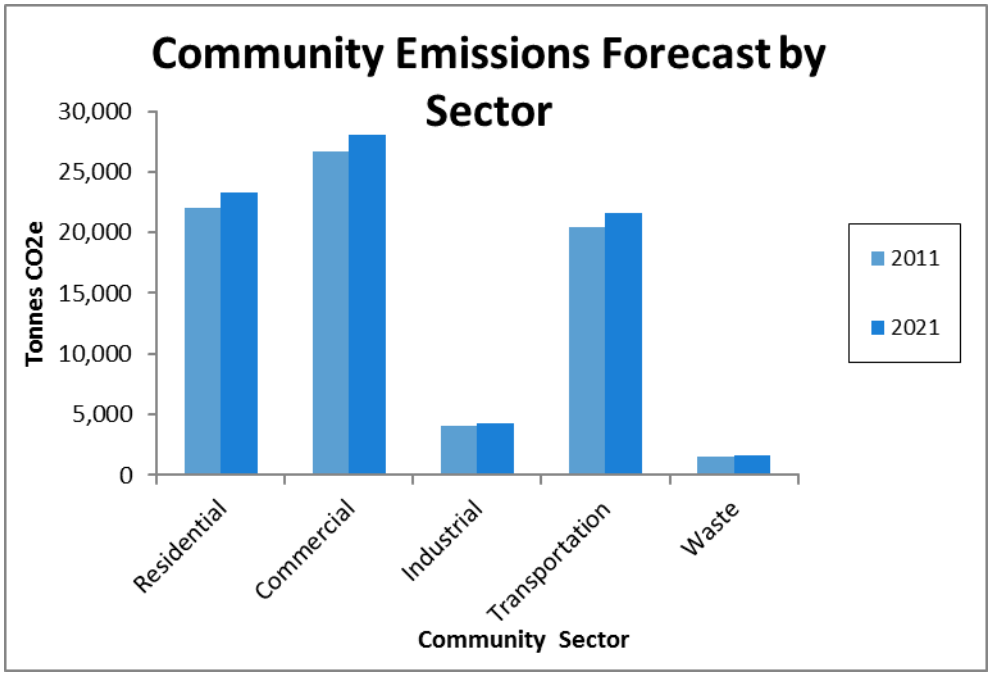

Figure 5.4 Community eCO2 emissions forecast for 2021 by sector.

The graph shown in Figure 5.5 shows the total emissions from the year 2011, the total projected increase in emissions up to and including the year 2021 (denoted by Business as Usual (BAU), and a relative 6% decrease in emissions over the same time period from 2011 levels.

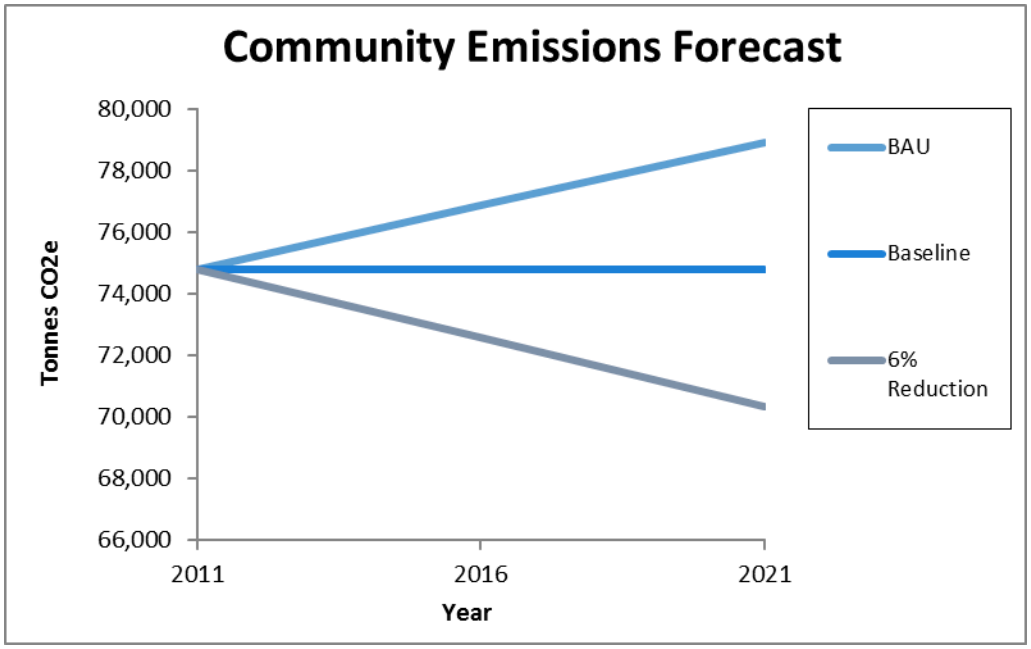

Figure 5.5 Total community eCO2 emissions forecast for 2021.

A BAU forecast predicts an increase in total eCO2 emissions of 4,115 tonnes by 2021, bringing total community emissions to 78,933 tonnes from 74,818 tonnes in 2011. A 6% reduction in emissions would see a decrease of 4,489 tonnes by 2021, bringing total community emissions to 70,329 tonnes from 74,818 tonnes in 2011.

6.0 RECCOMMENDATIONS

It is recommended that the four municipalities about give considerations to the following as they move forward with their GHG emissions quantification and reduction initiatives:

- Begin tracking the amount of corporate waste sent to landfill.
- Update the Memramcook corporate inventory as more data becomes available and continue to update all inventories at 1- or 2- year intervals to track progress.
- Further develop and implement more precise and holistic mechanisms and tools to collect data and address data gaps within the inventories.
- Ratify at municipal council the suggested emissions reductions targets presented in this report.
- Continue following the PCP program with Milestones 2 to 5 in a timely fashion.

7.0 REFERENCES AND WORKS CITED

The following is a list of references, used directly in the text and during the writing of this report.

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8.0 APPENDICES

Appendix A

The methodology followed to acquire Community consumption data for all four municipalities inventoried in this report was similar, and will be described simultaneously in this appendix section.

Corporate Inventory – Street, Area, and Traffic Lights

When calculating energy consumption by street, area, and traffic lights from wattages, a conversion factor of 438 kW/year/100W-light was applied. This was found by assuming each light on average was on for 12 hours per day over the course of 365 days each year (as suggested by NB Power).

Community Inventory – Residential, Commercial/Institutional, and Industrial Sectors

Electricity consumption data for all four municipalities for the baseline year (2011) was first acquired from NB Power. This data was then used to estimate the energy consumption of the residential, commercial and institutional, and industrial sectors of the community inventory.

Electricity consumption data (provided in kWh) for the baseline year was converted into gigajoules. The energy consumption shares shown in Table 9.0 were then found by using electricity consumption value to determine estimates of consumption for all other energy sources in gigajoules for each sector. These values were then converted to tonnes of eCO2 by using conversion factors provided by the PCP on their Inventory Quantification Support Spreadsheet.

Certain energy sources were then removed from further energy calculations as suggested by the *Developing Inventories for Greenhouse Gas Emissions and Energy*

Consumption: A Guidance Document for Partners for Climate Protection in Canada protocol. These energy sources included:

- Residential – Wood: Considered a biofuel, which is carbon-neutral.
- Industrial – Wood Waste and Pulping Liquor: Considered a biofuel, which is carbon-neutral.
- Industrial – Other: Many miscellaneous fuel types were listed and a breakdown of these fuel types and consumptions was not provided. Due to the relatively small consumption share of this source (2.6%) the source was omitted.

In a number of cases, energy sources were re-titled or condensed according to PCP guidelines for better analysis on Quantification Support Spreadsheets. A list of these changes can be found below:

- The 'Heating Oil (Residential)' energy source was analyzed as fuel oil.
- The 'Other (Residential)' energy source was defined as primarily propane by Natural Resources Canada, and was analyzed as such in further calculations.
- The 'Other (Commercial and Institutional)' energy source was defined as primarily propane by Natural Resources Canada, and was analyzed as such in further calculations.
- The 'Light Fuel Oil (Commercial and Institutional)' energy source was analyzed as fuel oil.
- The 'Diesel Fuel Oil, Light Fuel Oil, Kerosene (Industrial)' energy source was analyzed as fuel oil.
- The 'LPG and Gas Plant NGL (Industrial)' energy source was analyzed as coke (in addition to the 'Coke' energy source).

Table 8.0 Secondary energy use by energy source of the residential, commercial and institutional, and industrial sector in Atlantic Canada (2009).

Energy Source	Residential (Shares [%])	Commercial and Institutional (Shares [%])	Industrial (Shares [%])
Electricity	59.8	45.4	17.9
Natural Gas	1.6	3.3	10.2
Fuel Oil	18.1	31.4	5.9
Heavy Fuel Oil	-	14.9	10.6
Coke	-	-	28.5
Coal	-	-	0.2
Other (Residential)	0.8	-	-
Other (C&I)	-	5.1	-

The data shown in Table 8.0 was sourced from Natural Resources Canada's Comprehensive Energy Use Database Table. The table was last published in 2009, creating the possibility of reporting inconsistencies, as the baseline year is 2011. Prior to utilizing the data, a series of statistical analyses were used to determine any significant inconsistencies or trends that would limit or prohibit the use of the data. The following three tables (8.1,8.2,8.3) show the results of these analyses.

Table 8.1 Natural Resources Canada Comprehensive Energy Use Database residential sector total energy use by source share data from 2005 to 2009 with five year average, standard deviation, and linear regression analysis.

Residential									
Energy Source	2005	2006	2007	2008	2009	5 YR Average	SD (%)	5 YR Slope	5 YR RSQ
Electricity	59.9	61.5	59.3	57.6	59.8	59.6	2.10	-0.41	0.21
Natural Gas	2.3	2.2	2.4	4.3	1.6	2.6	35.68	0.07	0.01
Heating Oil	19.4	18.2	18.3	18.3	18.1	18.5	2.58	-0.25	0.55
Other	0.7	0.8	0.7	0.7	0.8	0.7	6.62	0.01	0.08
Wood	17.7	17.3	19.1	19.1	19.8	18.6	5.07	0.6	0.81

From the data in the table above it is apparent that there is strong deviation in the consumption share of natural gas, and that there is an increasing trend in the consumption share of wood fuels in the residential sector. All values, however, deviate less than 5% of total consumption over the five year period, suggesting that the use of the 2009 values would not significantly bias any particular energy source in calculations.

Table 8.2 Natural Resources Canada Comprehensive Energy Use Database commercial and institutional sector total energy use by source share data from 2005 to 2009 with five year average, standard deviation, and linear regression analysis.

Commercial & Institutional									
Energy Source	2005	2006	2007	2008	2009	5 YR Average	SD (%)	5 YR Slope	5 YR RSQ
Electricity	37	39.1	42.6	42.9	45.4	41.40	7.19	2.06	0.96
Natural Gas	1.9	2	2	3.1	3.3	2.46	24.74	0.39	0.82
Light Fuel Oil	31.9	36.8	33	35.1	31.4	33.64	6.03	-0.27	0.04
Heavy Fuel Oil	24.6	16.5	17.2	13.4	14.9	17.32	22.35	-2.25	0.68
Steam	0	0	0	0	0	0.00	n/a	0	n/a
Other	4.6	5.7	5.2	5.5	5.1	5.22	7.21	0.08	0.09

From the data in the table above it is apparent that there is a strong deviation in the consumption of natural gas and heavy fuel oil energy sources. There also appears to be an increasing trend in the consumption in electricity and a decreasing trend in the consumption of heavy fuel oils in the commercial and institutional sector. All values, however, deviate less than 10% of total consumption over the five year period, and

the majority of this deviation is caused by the inclusion of the 2005 year data. This suggests that the use of the 2009 values would not significantly bias any particular energy source in calculations.

Table 8.3 Natural Resources Canada Comprehensive Energy Use Database industrial sector total energy use by source share data from 2005 to 2009 with five year average, standard deviation, and linear regression analysis.

Industrial									
Energy Source	2005	2006	2007	2008	2009	5 YR Average	SD (%)	5 YR Slope	5 YR RSQ
Electricity	25.4	23.7	25	22.6	17.9	22.92	11.77	-1.61	0.71
Natural Gas	2	3.7	4.5	6	10.2	5.28	52.61	1.87	0.91
Diesel Fuel Oil, Light Fuel Oil, Kerosene	6.7	6.6	6.5	6	5.9	6.34	5.14	-0.22	0.91
Heavy Fuel Oil	17.4	14.3	13	11.8	10.6	13.42	17.43	-1.61	0.95
LPG and Gas Plant NGL	1	1.1	1.1	1.1	1.2	1.10	5.75	0.04	0.80
Coal	0.5	0.5	1	0.4	0.2	0.52	50.73	-0.07	0.14
Coke	21.7	23.6	22.7	24.3	27.3	23.92	7.95	1.19	0.78
Wood Waste and Pulping Liquor	22	23.3	23.2	24.9	24.2	23.52	4.18	0.60	0.75
Other	3.2	3.3	3	2.9	2.6	3.00	8.16	-0.16	0.85

From the table above it is apparent that there is a strong deviation in the consumption of natural gas and coal energy sources. There also appears to be an increasing trend in the consumption of natural gas and a decreasing trend in the consumption of electricity and heavy fuel oil in the industrial sector. All values, however, deviate less than 9% of total consumption over the five year period, suggesting the use of the 2009 values would not significantly bias any particular energy source in the calculations.

As shown above, all 2009 data was compared against 5 year averages to determine the utility of the 2009 dataset. This data was considered the most favorable data to use in determining the proportions of energy source shares in each sector due to the fact that 2009 was the most recent year data was collected by Statistics Canada, and thus was the most accurate and conclusive data available to EOS Eco-Energy at the time research was being conducted.

Community – Transportation Sector

Data for the Transportation Sector was found using the Vehicle Kilometers Travelled (VKT) model provided by the PCP. This model takes into consideration the number of households and the average vehicles per household in Canada and then extrapolates fuel usage data. These values were compared against the Fuel Sales method, which takes into consideration the total amount of gasoline and diesel fuel sold in New Brunswick and prorates it to the population of each municipality. The values generated

from these models can be found on each municipality's respective Inventory Quantification Support Spreadsheet.

In all cases, the values produced by these two methods for each municipality varied by 50-300%. Taking into consideration the different driving habits of rural and urban residents, it was determined that the VKT method was more accurate, as the Fuel Sales method may have led to a bias in transportation fuel usage for some communities over others, particularly in New Brunswick where transportation fuel sales are increased by through-traffic.

Forecasting

Emissions forecasting for each municipality was done by taking the relative change in population over the last census period (2006-2011) according to Statistics Canada and applying that change to the 10-year period being forecasted. This was done by squaring the 2006-2011 population change, which would account for compound increases or decreases. This value was then used to determine all forecasts. The compounded population increase or decrease for each community was estimated as:

- Dorchester: 8.7%
- Port Elgin: -15.1%
- Sackville: 5.5%