

CORPORATE GREENHOUSE GAS EMISSIONS INVENTORY

PCP MILESTONE 1

Baseline Year 2002



May 2009

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1.0 Introduction

Various global efforts have been initiated to fight climate change and reduce greenhouse gas emissions. Climate change refers to the long-term change in average weather including temperature, precipitation and wind patterns. A rise in the global temperature, referred to as global warming, is a measure of climate change and is partly attributed to the greenhouse gas effect. Like the glass of a greenhouse, gases in our atmosphere, including carbon dioxide (CO₂), trap the sun's heat and prevent it from escaping. Human activities such as the burning of fossil fuels increase the amount of greenhouse gases (GHG) in our atmosphere and therefore intensify the natural greenhouse gas effect.

The Partners for Climate Protection Program (PCP), managed by the Federation of Canadian Municipalities (FCM) and the International Council for Local Environmental Initiatives (ICLEI), was designed to guide municipal governments in reducing their GHG emissions. There are currently 183 municipal governments which are members of the PCP program. The program is based on a five-milestone framework to be completed for both the corporation and the community. The five milestones include:

- Creating a GHG emissions inventory
- Setting an emissions reduction target
- Developing a local action plan (LAP)
- Implementing the local action plan
- Monitoring progress

It is recommended that municipalities first develop a GHG inventory and action plan for their operations before developing the community inventory and action plan. This report summarizes milestone 1, the GHG emissions inventory, and strictly deals with emissions resulting from municipal operations. A baseline year of 2002 was selected for the inventory as accurate data was not available for earlier years.

FCM recommends a corporate GHG emissions reduction target of 20% within a ten-year time frame. Since the selected baseline year is 2002, to achieve FCM's recommended target the City would need to reduce its corporate emissions by 20% below 2002 levels by 2012. To evaluate the City's progress in reducing its emissions and to help select a realistic and achievable emissions reduction target, inventories were also completed for 2003 to 2007.

The following report includes the corporate profile, the methodology that was used in preparing the corporate GHG emissions inventory, the corporate baseline inventory (2002), a GHG emissions forecast (2012), existing GHG reduction initiatives and recommendations for future action.

2.0 Corporate Profile

According to Statistics Canada's last census, the City of Moncton's population in 2006 was 64,128. This represents a growth of approximately 1% per year or a 5% growth since 2001.

Table 1 presents the number of full-time, contract and casual City employees from 2002 to 2007. The yearly increase in the total number of City employees varied between 0.3 to 4.9% between 2002 and 2007. This information was obtained from the Human Resources Department.

Table 1 City of Moncton Employees

Year	Number of Employees				% Increase
	Permanent/ full-time	Contract*	Casual*	Total	
2002	520	3	121	644	
2003	531	3	124	657	2.0
2004	540	3	126	669	1.8
2005	542	3	126	671	0.3
2006	569	3	133	704	4.9
2007	588	3	137	728	3.4

Note: The number of contract and casual employees from 2002 to 2006 was estimated using the actual number of contract and casual employees in 2007 (contract = 0.51% of permanent employees and casual = 23.3% of permanent employees).*

3.0 Methodology

The GHG emissions inventory was developed by the City's Environmental Program Coordinator, with the help and participation of staff from various City departments.

The first task was to select an appropriate baseline inventory year. The year 2002 was selected as the baseline year since accurate data was not available for earlier years. The year 2002 is also a suitable year as most of the City's emissions reduction initiatives were implemented after 2002 and will therefore be accounted for. The FCM recommends a corporate emissions reduction target of 20% within a ten-year timeframe. A forecast year of 2012 was therefore selected for evaluation purposes.

The real consumption data method was used to calculate GHG emissions. Electrical energy consumption data was obtained from NB Power invoices and fuel oil, natural gas, gasoline and diesel consumption data was obtained from respective service provider invoices. The emissions were calculated using the PCP Inventory Quantification Spreadsheet supported by the PCP Secretariat and available on FCM's Website.

4.0 The Corporate GHG Emissions Inventory - 2002

4.1 Buildings

The GHG emissions inventory for the “buildings” category includes emissions resulting from the operation (electricity, heating and cooling) of municipal facilities including City Hall, fire stations, police stations, arenas, pools and various others. The energy consumed at municipal parks is also included with the “buildings” category. A complete list of included municipal facilities is provided in Appendix A.

The public transit authority’s building (Codiac Transit) and the Police Station are located within the City of Moncton limits. Therefore, even though they are tri-community services, the energy consumed by those facilities was included in the corporate inventory.

The electrical energy consumption data was obtained from NB Power invoices and the fuel oil and natural gas consumption data was obtained from respective service provider invoices. Energy consumption was converted to tonnes (t) of CO₂e using the conversion factors embedded in the GHG inventory quantification spreadsheet provided by FCM.

As indicated in Table 2, GHG emissions from municipal facilities in 2002 were approximately 8,258 tonnes of CO₂e. There is a slight discrepancy between the sum of the CO₂e columns in Table 2 and the total tonnes of CO₂e presented in Appendix A due to rounding. The actual totals from Appendix A are reported in Table 2.

Table 2 Total GHG Emissions from Buildings – 2002

Buildings	Electricity		Natural Gas		Fuel Oil		Total
	kWh	CO ₂ e (t)	m ³	CO ₂ e (t)	Litres	CO ₂ e (t)	CO ₂ e (t)
Parks	822,529	407			2,483	7	414
Fire Stations	517,800	256	15,531	29	129,210	366	651
Arenas	4,946,040	2,448	69,259	130			2,579
Magnetic Hill	739,957	366					366
City Hall	1,162,320	575					575
Other Municipal Facilities*	6,741,582	3,337	52,343	98	84,462	239	3,675
Total	14,930,228	7,390	137,133	258	216,155	612	8,258

Note: Refer to inventory spreadsheet included in Appendix A for complete list of buildings.

4.2 Vehicle Fleet

The vehicle fleet inventory includes fuel consumed by all vehicles used for municipal operations including cars, trucks, graders, loaders, street sweepers, snow blowers and also

includes fuel consumed by miscellaneous small equipment (i.e. lawn mowers). The complete list of vehicles and equipment included is provided in Appendix A.

The vehicle fleet data was gathered from Fleet Management Reports in Business Objects Infoview. A fuel transaction report (by card ID) was run for January to December 2002 and the litres of gasoline and diesel purchased under City Card IDs was totalled.

Emissions from public transit are not included in the corporate GHG inventory. Public transit emissions will be included with the community inventory. As they are tri-community services (for the City of Moncton, the City of Dieppe and the Town of Riverview), the inventory also doesn't include emissions from police services and the Pest Control Commission.

As shown in Table 3 the total amount of fuel, including gasoline and diesel, consumed by the municipal vehicle fleet in 2002 was 836,893 litres, and the total GHG emissions were approximately 2,176 tonnes of CO₂e.

Table 3 GHG Emissions from the Municipal Vehicle Fleet - 2002

	Gasoline		Diesel		Total
	litres	CO ₂ e (t)	litres	CO ₂ e (t)	CO ₂ e (t)
Vehicles & Equipment	295,304	697	541,589	1,479	2,176

It is important to note that many variables can effect the yearly fuel consumption from the vehicle fleet. These variables can include the amount of snow precipitations during the subject year, the average daily temperature and instances where the City's fuel pumps were down and the fuel was purchased elsewhere.

4.3 Streetlights

The emissions inventory for the streetlights category includes both NB Power owned and City owned area lights, streetlights and traffic lights. NB Power charges the City a flat rate for the area lights, streetlights and the un-metered traffic lights. The energy consumed by the area lights and the streetlights were calculated using the know wattage (100 to 400 watts) in the following formula:

$$\text{kWh} = [\text{load (watts)/1000}] \times [12 \text{ hrs/day}] \times [\# \text{ of Lights}] \times [\# \text{ of days in the month}]$$

Example:

Type: 100 HPS Lights

Number: 5,203

Month: January

$$\text{kWh} = [100/1000] \times [12] \times [5,203] \times [31]$$

$$\text{kWh} = 193,552 \text{ KWh}$$

This formula was used to calculate the monthly consumption for each light and then totaled for the year.

As the wattage for those lights was unknown, the energy consumed by City owned streetlights and un-metered traffic lights was calculated using the NB Power fixed rate of 11.31 cents per kWh. The following formula was used to determine monthly energy consumption and then compiled for the year:

$$\text{KWh} = [\text{monthly cost} / \$0.1131 \text{ per kWh}]$$

The energy consumed by the metered traffic lights was obtained directly from NB Power invoices.

As shown in Table 4, the total GHG emissions from the streetlights and traffic lights in 2002 were approximately 2,940 tonnes CO₂e.

Table 4 GHG Emissions from Street and Traffic Lights - 2002

Street and Traffic Lights	Electricity	
	kWh	CO ₂ e (t)
NB Power Area Lighting (unmetered)	92,232	46
NB Power Street Lights (unmetered)	4,293,232	2,125
City-Owned Facilities (unmetered)	744,515	369
City-Owned Street Lights (un-metered)	181,034	90
City-Owned Traffic Lights (un-metered)	272,920	135
Traffic Lights (metered)	356,176	176
Total	5,940,110	2,940

4.4 Water and Sewage

The water and sewage category includes the energy consumed by sewage lift stations, pumping stations, City well, water tank and potable water treatment plant. The wastewater treatment plant, which is located in the neighbouring town of Riverview, is operated by the Greater Moncton Sewerage Commission (GMSC) and also receives wastewater from the City of Dieppe and the Town of Riverview. The energy consumed by the wastewater treatment plant is therefore not included in the corporate inventory.

As shown in Table 5, GHG emissions resulting from water and sewage operations in 2002 were approximately 426 tonnes of CO₂e.

Table 5 GHG Emissions from the Water and Sewage - 2002

Water & Sewage	Electricity	
	kWh	CO ₂ e (t)
Sewage Lift Stations	149,989	74
Turtle Creek Water Plant	29,654	15
1200 McLaughlin Rd. – Water Plant	532	0
Mapleton Rd. – City Well	11,340	6

Ryan Rd. – Water Tank	635	0
Pumping Stations	667,920	331
Total	860,070	426

4.5 Waste

The waste category includes emissions produced from waste generated at municipal buildings and public municipal facilities such as parks and recreational buildings.

Industrial waste, construction waste and demolition waste, including concrete, wood, tires and contaminated soil, are not included in the corporate emissions inventory. A very small portion of this type of waste ends up in the landfill and undergoes very little decay. Recyclables have also been excluded from the total, as they are not landfilled.

The emissions resulting from corporate waste disposal in 2002 were calculated using the commitment method and were estimated at approximately 156 tonnes of CO₂e.

Table 6 GHG Emissions from Waste Disposal - 2002

Waste to Landfill (tonnes)	CO ₂ e (tonnes)
323	156

4.6 Corporate Inventory Summary

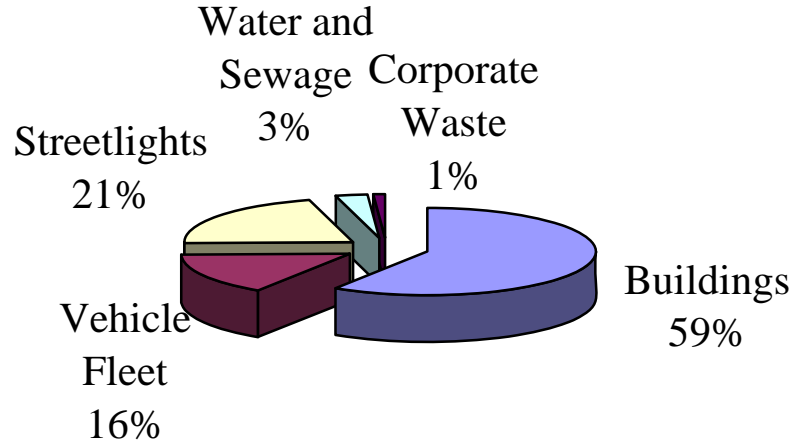
A summary of the corporate GHG emissions inventory for the year 2002 is presented in Table 7. Total corporate GHG emissions in 2002 were approximately 13,956 tonnes of CO₂e. As shown in Figure 1, the buildings category is the largest source of GHG emissions within the corporate inventory followed by street lighting and vehicle fleet.

Table 7 Corporate GHG Emissions Inventory Summary - 2002

Category	CO ₂ e (t)
Buildings	8,258
Vehicle Fleet	2,176
Street Lights	2,940
Water & Sewage	426
Waste	156
Total	13,956

Figure 1

Corporate eCO2 Emissions Breakdown by Sector



5.0 Emissions Forecast and Mitigation Measures

5.1 Population Growth Forecast

According to Statistic Canada’s last census, the City of Moncton’s population was 64,128 in 2006, which represents a 5% increase from 2001. The City of Moncton’s population in 1991, 1996, 2001 and 2006 is summarized in Table 8.

Table 8 Statistics Canada - Population Census for the City of Moncton

Year	Population	% Change
1991	56,823	4.4
1996	59,313	
2001	61,046	5.0
2006	64,128	

Statistics Canada, Census, <http://www12.statcan.ca/census-recensement/index-eng.cfm>

According to the population census, the population growth rate has been approximately 1% per year since 1991. We can therefore assume that there could be a growth rate of approximately 6% between 2006 and 2012. Based on this assumption, the population forecast for the year 2012 is estimated at 67,976.

5.2 Corporate Emissions Forecast (BAU)

Based on the population growth, a 1% per year increase was used to forecast GHG emissions from 2002 to 2012. It should be noted that the increase in the number of City

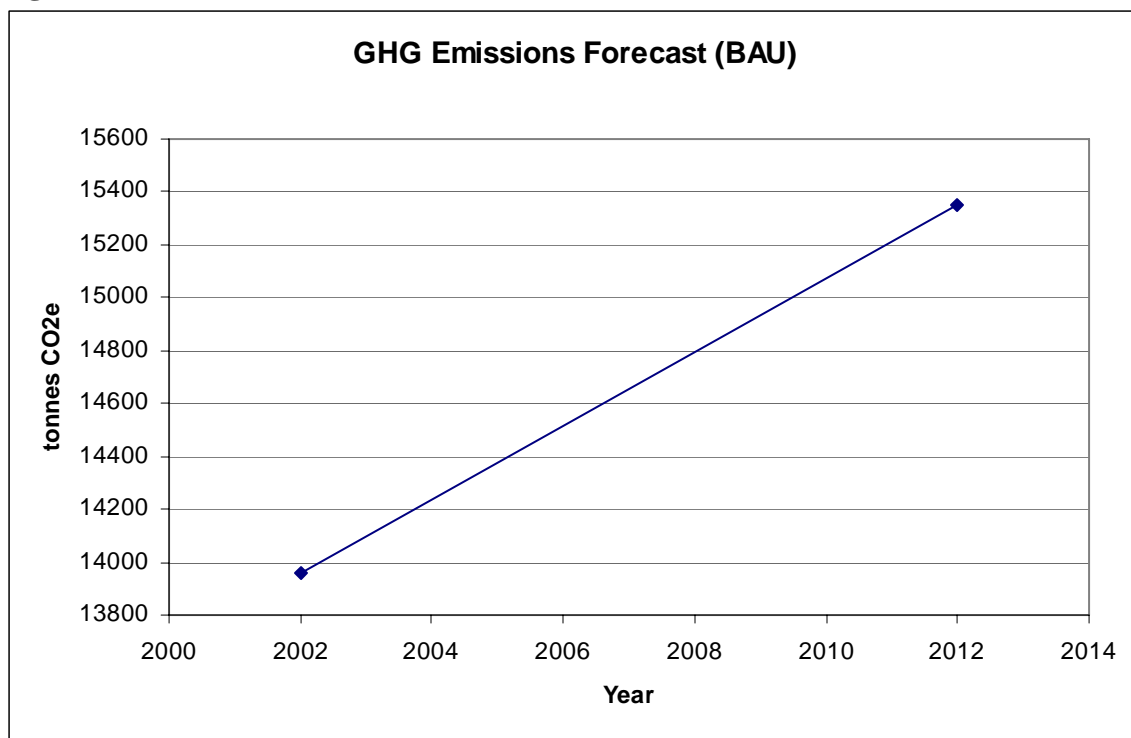
employees shown in Table 1 also supports a minimum increase of 1% per year. The growth in the City’s geographical size was not used in the forecast, as it remained fairly constant between 1996 and 2006.

The emissions forecast calculated for the target year of 2012 based on a 10% increase (1% per year) from the 2002 baseline year is shown in Table 9 and Figure 2. This forecast represents the business as usual (BAU) scenario.

Table 9 GHG Emissions Forecast (BAU)

Category	Tones of CO ₂ e	
	2002	2012
Buildings	8,258	9,084
Vehicle Fleet	2,176	2,394
Streetlights	2,940	3,234
Water/sewage	426	469
Waste	156	172
Total	13,956	15,352

Figure 2 GHG Emissions Forecast (BAU)



5.3 Existing Corporate GHG Emissions Reduction Initiatives

Since it joined the PCP program in 2001, the City of Moncton has implemented various emissions reduction measures within its operations. These measures have had a positive impact on the total corporate emissions and they will help the City achieve its emissions reduction target. A brief description of these measures is provided in Table 10.

Table 10 Existing Corporate GHG Emissions Reduction Initiatives Summary

Sector	Initiative	Description	Year
Buildings	Building retrofits	As part of an Energy Management Plan, energy retrofits were completed at 16 municipal facilities	1999-2007
	Green roof installation	A green roof was installed on top of City Hall	2006
Vehicle Fleet	Greener fleet initiative	6 Smart cars were acquired and are used for municipal operations	2007
	Adoption of a vehicle and equipment anti-idling policy	City vehicles cannot be left idling for periods exceeding one minute, except in certain health and safety conditions.	2006
	Fleet Management System	The fleet management system has the capability of automatically scheduling preventive maintenance for city vehicles, which ensures that they are operating as efficiently as possible thus reducing fuel consumption and GHG emissions.	2001
Traffic lights	LED lighting	All of Moncton's traffic lights have been converted to energy efficient LED lighting.	2004-2006
Waste	Waste Separation	In 2006, the City adopted a mandatory waste separation by-law applicable to the residential sector. Although the program only covers the residential sector, the City has adopted the practice at City Hall and at the Operations Center	2006
Other	Environmental programs and employee awareness	The City actively participates and encourages employees to participate in programs and initiatives such as Earth Day, Earth Day's EcoAction Teams Program, Earth Hour and the Commuter Challenge.	

The initiatives listed above are quantifiable initiatives, which are specific to corporate operations. These initiatives should have a direct impact on the corporate GHG emissions inventory.

5.4 GHG Emissions Reduction Progress 2002-2007

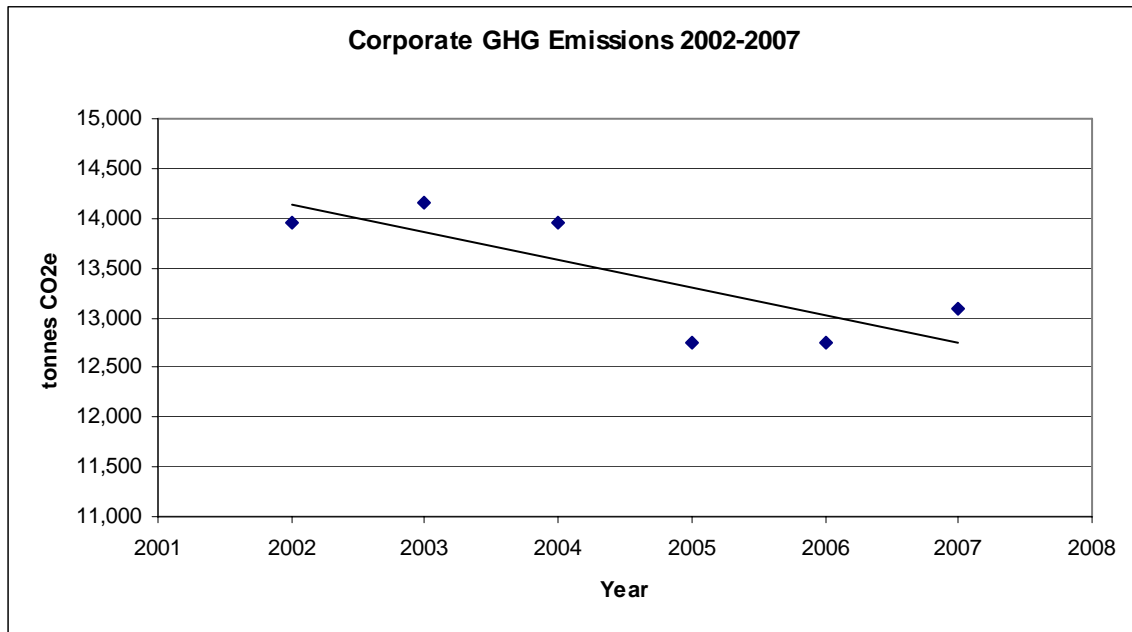
GHG emissions inventories were also compiled for 2003, 2004, 2005, 2006 and 2007 to evaluate the City’s progress in reducing its emissions. 2002 to 2007 inventories are summarized in Table 11 and Figure 3. The detailed inventories are provided in Appendix B.

Table 11 GHG Emissions Inventory Summary for years 2002 to 2007

Category	CO ₂ e (t)					
	2002	2003	2004	2005	2006	2007
Buildings	8,258	8,513	8,280	7,446	7,591	7,921
Vehicle Fleet	2,176	2,348	2,382	2,375	2,174	2,373
Streetlights	2,940	2,654	2,668	2,329	2,169	2,181
Water/sewage	426	466	439	411	402	409
Waste	156	181	184	179	406	204
Total*	13,956	14,163	13,953	12,739	12,742	13,089

**There may be slight discrepancies between the sum of the columns and the total tonnes of CO₂e presented in Appendix A and B due to rounding. The actual totals from Appendix A and B were used.*

Figure 3 Corporate GHG Emissions Inventories for 2002 to 2007



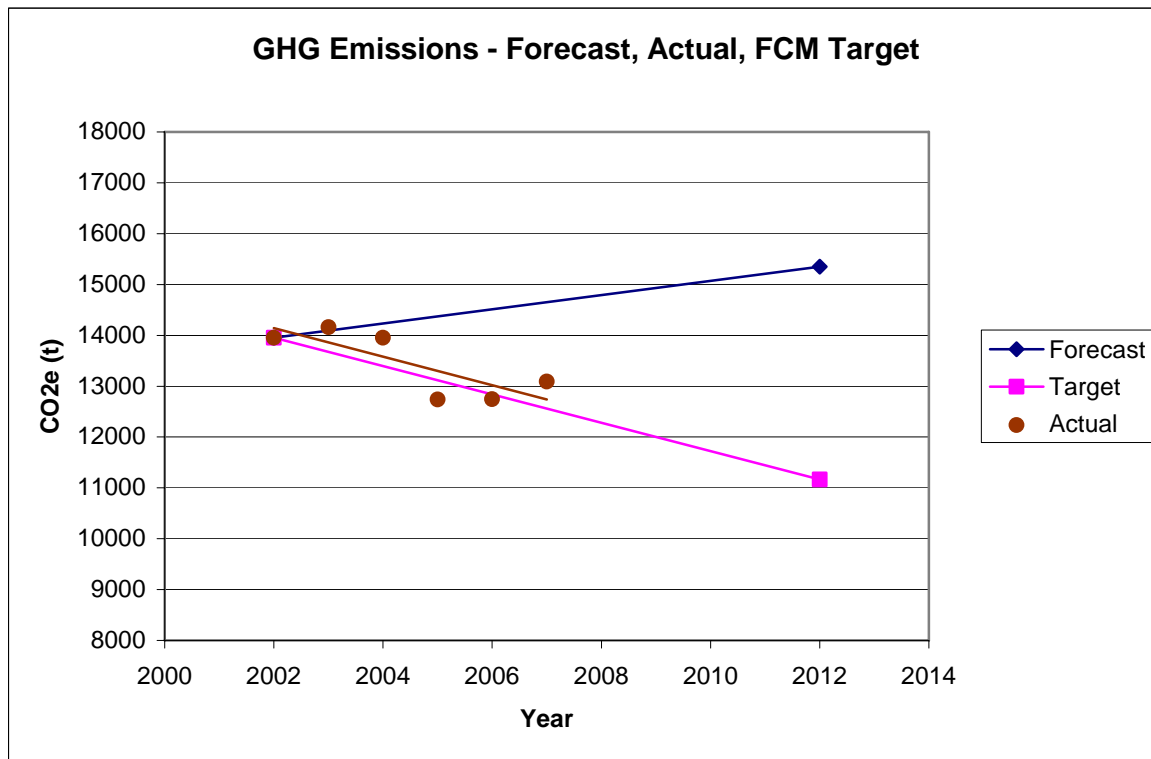
The percent change in emissions since 2002 is shown in Table 12. According to the inventories, the City has reduced its GHG emissions by approximately 6 to 9% below 2002 levels during 2005 to 2007. This confirms that the emissions reduction initiatives implemented by the City between 2002 and 2007 were successful in reducing corporate GHG emissions. To reach the FCM recommended target of 20%, the City would need to show an additional reduction of 11 to 14% between 2007 and 2012. The achievability of this target will be assessed and revised if deemed appropriate.

Table 12 % Change in GHG Emissions

Year	Total CO ₂ e (t)	% Change From 2002
2002	13,956	
2003	14,163	+ 1.48 %
2004	13,953	- 0.02 %
2005	12,739	- 8.72 %
2006	12,742	- 8.70 %
2007	13,089	- 6.21 %

Figure 4 shows the forecast in GHG emissions based on the BAU scenario, the actual emissions trend from 2002 to 2007 and the FCM recommended GHG emissions reduction target for 2012.

Figure 4 Corporate GHG Emissions – Actual, Forecast and Target



The following comments of interest pertain to specific inventory categories:

Buildings:

- The emissions from the building category decreased between 2002 and 2007. This reduction can be partly attributed to the energy retrofits, which were completed between 1999 and 2007. However, it should be noted that two of the arenas were demolished and replaced with a privately owned sportsplex and 4-ice center. The emissions from the 4-ice center are included in the inventory but the sportsplex is excluded.

- The Dud James Arena was converted from an arena to a recreational building between 2003 and 2004. This explains the significant decrease in energy consumption for that building. The facility is now leased to the Beauséjour Gymnos Gymnastics Club and the Moncton Squash Club.

Vehicle Fleet:

- It is difficult to accurately compare the yearly GHG emissions from the vehicle fleet as there are many variables which can impact fuel consumption. Variables include the amount of snow received during the subject winter, the average daily temperature and instances when the City's fuel pumps were down and the fuel was purchased elsewhere.

6.0 Recommendations and Next Steps

This inventory presents a reference point for the City of Moncton's corporate GHG emissions trend. The baseline inventory will become an important tool when assessing the City's progress in reducing corporate GHG emissions and achieving the selected reduction target.

The City has, since 2002, implemented various emissions reduction initiatives, which have been successful in reducing corporate emissions. The City will need to select a realistic and achievable emissions reduction target. It will then need to implement a variety of additional GHG emissions reduction measures to achieve the selected target.

It is recommended that the City continues to move forward with the PCP program and undertakes the following steps:

- Establish a realistic and achievable corporate emissions reduction target (milestone 2 of PCP);
- Develop a comprehensive local action plan for reducing emissions and achieving the established target (milestone 3 of PCP);
- Undertake a similar process for the community component of PCP.

APPENDIX A

COPORATE GHG EMISSIONS INVENTORY DATA

2002

APPENDIX B

**CORPORATE GHG EMISSIONS INVENTORY
DATA**

2003 TO 2007