



City of Fredericton

FIRST TO KYOTO

CORPORATE INVENTORY & ACTION PLAN *for Greenhouse Gas Emissions Reduction*

PREPARED FOR: The Federation of Canadian Municipalities (FCM)
ICLEI – Local Governments for Sustainability
Partners for Climate Protection (PCP)

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1 PROJECT INTRODUCTION AND SUMMARY

1.1 Background

The City of Fredericton is among ten municipalities in the Province of New Brunswick, and more than 124 nationwide, who have joined Partners for Climate Protection (PCP). Under this program, cities work with the Federation of Canadian Municipalities (FCM) to identify, quantify, and reduce greenhouse gas (GHG) emissions at both the corporate and community levels.

Fredericton joined PCP in 2000, at which time a project called, "First to Kyoto" was conceptualized. In subsequent months, the City worked with representatives of the Environment and Sustainable Development Research Centre at the University of New Brunswick to develop and submit a proposal for funding to FCM's Green Municipal Enabling Fund (GMEF). This proposal was approved, and Federal funding for the First to Kyoto project (\$25,000) will be forthcoming upon completion and acceptance of this document, the City's Corporate Inventory and Action Plan for Greenhouse Gas Emissions Reduction (funded by the City with their match of \$25,000).

Completion of both the Corporate and Community GHG Inventories and Action Plans requires documentation of GHG emissions at a benchmark year, (preferably 1990), current GHG emissions, reduction goals, and strategies to meet those goals, as well as a monitoring and evaluation protocol to track future progress. In the event that data are incomplete or not available for 1990, the first year for which complete data can be obtained may be used as the benchmark year.

The goals of the First to Kyoto project are to:

1. Reduce the City of Fredericton's corporate GHG emissions by 20 percent below benchmark levels by 2010.
2. Reduce the City of Fredericton's community GHG emissions by 6 percent below benchmark levels by 2010.
3. Be the first City in Canada to attain compliance with the Kyoto Protocol.

1.2 Introduction to this Report

This report provides both an inventory of the City of Fredericton's GHG emissions between 2000 and 2004 (with adherence to the GHG emission accounting protocol of the PCP program); and an action plan to reduce GHG emissions at the corporate/municipal level.

The GHG emissions presented in this report are those that are released by the City of Fredericton as a result of its corporate operations. The sources of these corporate emissions are as follows:

1. Buildings
2. Vehicle Fleet (*excluding transit, as required by FCM*)
3. Streetlights and Traffic Signals
4. Water and Sewage
5. Solid Waste



1.3 Overview of Data Collection Process

During 2004/05, City representatives gathered and supplied archived data for calculation of GHG emissions. The Federation of Canadian Municipalities provides an MS Excel tool for data entry and calculation of emissions, as well as analysis of relative emissions by source. As listed in the previous section, there are five areas in which emissions are documented and calculated: buildings, vehicle fleet, streetlights, water and sewage, and solid waste.

The first year for which complete data are available is 2000; thus 2000 became the City of Fredericton's benchmark year. Changes in GHG emissions were calculated by comparing benchmark emissions to those in 2004.

1.4 Summary of Findings

Calculations indicate that the City of Fredericton's corporate greenhouse gas emissions increased by 1.96% between 2000 and 2004, due to a number of aggressive emissions reduction strategies presented in the following paragraphs and described in detail later in this report. It is important to note, however, that the benefits derived from several of these initiatives were not present in the 2004 calculations, but will contribute greatly to GHG reduction goals between 2004 and 2010. For example, the majority of retrofits as part of the streetlight rationalization initiative occurred in 2005, and will be finished in 2006.

In addition, the City of Fredericton is in the process of, or has developed, a number of policies related to standard operating procedures that are directed at reduction of GHG emissions and cost

savings for the City. These include: anti-idling programs for City vehicles, hybrid vehicles in the City's fleet, an induction lighting pilot program, green seal purchasing, increased tree planting, natural gas installations, and an environmental policy audit.

Likewise, the City is pursuing a number of initiatives that will facilitate the reduction of GHG emissions in the wider community, that are directly aimed at reducing emissions associated with transportation. These include: a bike plan and trail system to provide alternatives to standard commuting practices, park-and-go sites to encourage carpooling, a revamped transit system including bike racks on buses, a city-wide car free day, and a vehicle scrappage program for older high-emissions vehicles.

The City also provides leadership and encourages citizens to reduce their greenhouse gas emissions through other initiatives such as a woodstove campaign, an aquifer protection program, a recycling program, neighbourhood gardens, and through participation in the Partners for Climate Protection. Combined, these activities demonstrate to the City's private, corporate, and institutional citizens and partners that environmental protection and enhancement are important elements of life in Fredericton, and the City is excited to be the leader on this front.

In order to carry on with this leadership role in Fredericton and beyond, it will be necessary that the City as a corporate entity take some fairly aggressive action to reach its target of reducing its emissions by 20 percent below 2000 levels, by 2010. The two greatest contributors to its overall corporate emissions are the water and sewage facilities, and the streetlights. In total, the City needs to reduce its emissions by 4697 tonnes, or about one third of its current emissions of 13262 tonnes.



1.5 Summary of Action Plan

Like many environmental initiatives, several strategies combined can contribute significantly to reduced greenhouse gas emissions. It is likely that such a combination of strategies within the five emissions categories will be necessary to allow the City to reach its emissions target. And indeed, many are already under way.

The first of these, undertaken recently by the City of Fredericton, is to identify and reduce emissions through changes in standard operating procedure and/or purchasing decisions. Generally, these initiatives are both cost-effective and have minimal impact on the standard operating procedures of the staff in various City divisions and departments. The next steps, however, will require changes in behaviour of City staff members. Examples include an anti-idling policy for the City vehicle fleet in winter and summer, corporate waste reduction and recycling efforts, learning to use new energy efficient equipment, use of only 'green seal' cleaning products in City buildings, etc.

Several strategies already underway or complete include: upgrading of municipal buildings to render them more energy efficient, which resulted in a 20 percent reduction in building GHG emissions between 2000 and 2004; reducing the size of the City's fleet of vehicles, including replacement of some old vehicles with hybrids; and changing street lights from incandescent to LED units.

The following additional reductions strategies are still to be implemented:

1. Retrofit additional municipal buildings to maintain current rates of reductions.

2. Raise awareness among managers and staff, of opportunities for reduction through purchasing decisions and changes in departmental standard operating procedures.
3. Work with the Department of Public Works and Engineering to identify and implement means of reducing GHG emissions for municipal facilities; including reducing demand for clean water by large users in the city, thus reducing the amount of waste water requiring treatment by municipal facilities.
4. Identify and repair municipal pipes which receive and send storm water to water treatment facilities.
5. Implement energy reduction strategy for streetlights and traffic signals through continuing to reduce streetlight wattage, and replacing incandescent bulbs with LED bulbs in traffic signals.
6. Continue to consider and replace aging vehicles in City fleet with hybrids, biodiesel, and alternative fuels in where feasible.

These initiatives will require the full participation and cooperation of municipal staff at all levels. In order to achieve participation, municipal staff will be educated about the First to Kyoto project, as well as their potential contributions to the achievement of its goals.



2 CONTEXT

2.1 Partners for Climate Protection

The Partners for Climate Protection (PCP) program is a network of more than 124 Canadian municipal governments who have committed to reducing greenhouse gases and acting on climate change. PCP is the Canadian component of International Council for Local Environmental Initiatives' (ICLEI) Cities for Climate Protection (CCP) network that comprises more than 600 communities worldwide making the same efforts. PCP is a partnership between the Federation of Canadian Municipalities (FCM) and ICLEI – Local Governments for Sustainability. PCP receives financial support from the Government of Canada through the Climate Change Action Fund (CCAF).

Municipal governments have an important contribution to make to climate protection. Up to half of Canada's greenhouse gas (GHG) emissions (350 million tonnes) are under the direct or indirect control or influence of municipal governments. By 2012, communities could cut GHG emissions by 20 to 50 million tonnes from municipal operations and community-wide initiatives with investments in environmental infrastructure and sustainable transportation infrastructure. Municipal governments can reduce emissions through:

- Land-use, energy, and transportation planning;
- Infrastructure design;
- Green procurement;
- Building retrofits;

- Water conservation;
- Solid waste diversion; and
- Renewable energy.¹

2.2 Five Milestones

PCP greenhouse gas emissions accounting and reductions are based on a framework of five milestones. While these are often conducted in the sequence presented below, this is not always necessary. Some municipalities, including Fredericton, initiate projects to reduce their greenhouse gas emissions prior to conducting an emissions inventory.

The Five Milestones are listed below.

1. Greenhouse Gas Emissions Inventory and Forecast
2. Setting an Emissions Reduction Plan
3. Developing a Local Action Plan
4. Implementing the Local Action Plan
5. Monitoring Progress and Reporting Results

¹http://kn.fcm.ca/ev.php?URL_ID=2805&URL_DO=DO_TOPIC&URL_SECTI ON=201&reload=1112751847 (downloaded June 7, 2005)



2.3 *Fredericton's Corporate Leadership Role*

The City of Fredericton has undertaken a variety of activities, in addition to those required by PCP and FCM, to reduce its greenhouse gas emissions and to increase its energy efficiency. The City understands the important leadership role it can play in the local community. By setting a strong example, the City hopes that other large institutions such as the University of New Brunswick and the Provincial government will undertake similar initiatives to reduce emissions and increase efficiency.

Initiatives undertaken by the City include:

- Anti-idling program
- Bike Plan
- Woodstove campaign
- Transit system upgrades (e.g. bike racks on buses)
- Trail system
- Smaller fleet vehicles
- Citizens Environmental Forum
- Park and Go sites
- Induction lighting pilot
- Aquifer Protection program
- PCP steering committee
- Green seal purchasing (City using only 'green' cleaners)
- Vehicle scrappage
- Destination conservation
- Car free day
- Blue/Grey box recycling
- Neighbourhood gardens
- Tree planting expansion
- Environmental policy audit

- Natural gas installations
- LCD Computer Monitor Replacement Program
- Changes in vehicle purchase program that uses fuel mileage as part of overall purchase decision.

Many of these initiatives lie at the interface between the municipal government and the citizens it serves. By demonstrating strong corporate leadership, the City of Fredericton has laid the groundwork necessary to encourage individual, corporate, and institutional citizens to reduce their own emissions. It remains to publicize and promote efforts such as these.

2.4 *Commitment to Economic Efficiency*

The City of Fredericton has also demonstrated a strong and ongoing commitment to economic efficiency. In this context, GHG emissions reductions make a great deal of sense. In some cases, the City's expenses may increase initially or even perpetually, however, the overall savings to be had from emissions reductions have already been demonstrated through the City's efforts to date.

2.5 *Municipal Sector: Opportunities and Constraints in Fredericton*

Climate

As a Canadian city, Fredericton is subjected to fairly dramatic fluctuations in temperature between summer highs and winter lows. This can cause a draw on power sources during both peak seasons, as residents attempt to stay either cool or warm. This includes air conditioning and heating municipal buildings, facilities and vehicles.



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Regional Context

Fredericton is a small city nested in a growing region; according to the 2001 Canadian Census, there were 48,000² people living in Fredericton. However, within the Census Agglomeration, there were 81,355, and in the greater region, 124,172 people.³ As such, the City of Fredericton, by default, provides amenities and services to many citizens who are not actually residents of Fredericton proper. The majority of new houses in the area are built just beyond the City limit. Thus, the City maintains infrastructure as well as facilities that are used by residents of a region that is home to over 120,000 people; almost triple the population of the City proper. Roads are built to handle additional incoming and outgoing traffic, and must be kept clear of snow in the winter and in good repair in the summer. Traffic lights must be constructed, maintained, and paid for in order to facilitate the flux of commuters from our surrounding areas. The arenas in the city host regional hockey and other skating events; and the parks of Fredericton are enjoyed by residents of the City, as well as residents of the surrounding areas.

It is well documented that regional growth, often termed urban sprawl, contributes to higher levels of greenhouse gas emissions due to increased commuting from outlying areas into the city. In addition, as described previously, regional growth represents a potential added burden on the municipal infrastructure. Thus, this regional growth story in Fredericton must be incorporated into any municipal greenhouse gas emissions reductions strategy⁴, and it is anticipated that the need and commitment by the City to reduce GHG emissions will be a powerful means of facilitating and encouraging regional cooperation in the Fredericton area.

Population Distribution

Figures 1 and 2, on the following page, display the relative distribution of age cohorts in the Fredericton regional population⁵. The median age of the Fredericton area is 37 years, lower than both the Canadian mean of 37.7 and the New Brunswick mean of 38.7.

² Data source: http://en.wikipedia.org/wiki/Fredericton,_New_Brunswick

³ Data source: Team Fredericton website, citing Statistics Canada Census 2001: (<http://www.teamfredericton.com/Statistics01.asp>)

⁴ Due to lack of data, the impact of regional growth on GHG emission numbers in Fredericton could not be included in the forecasts.

⁵ Data source: Team Fredericton website, citing Statistics Canada Census 2001, and the Development Services, City of Fredericton.

Thus, 50 percent of the people living in this region are younger than 37, and 50 percent are older. There is a cluster of young professionals (31 percent of the regional population; see Figure 2) between the ages of 25 and 44; and another 25 percent are between the ages of 45 and 64. The latter will be the next cohort of retirees. The population of New Brunswick, broadly, is aging. This trend is different in Fredericton, whose universities and active promotion of high-tech industry attracts a disproportionate number of younger adults to the area. However, despite the current age structure, there is a vibrant and growing elderly community in Fredericton, to whose needs both the municipality and the developers are actively catering.

These numbers have implications for greenhouse gas emissions rates for the City, as different age groups require different municipal services, and therefore affect municipal greenhouse gas emissions in different ways. For example, the elderly may avail themselves of public transportation, or require high-density assisted care residential facilities. Younger professionals may be more self-sufficient in terms of transportation but consume greater volumes of water for lawn maintenance, and require recreational amenities such as skating rinks and parks for their young families.

These differential service requirements are not new to municipalities, however, their relationships to corporate greenhouse gas management strategies is a new opportunity for municipalities to rationalize the delivery of many services. As such, “business as usual” scenarios are likely to come to mean something different than they have in the past.

FIGURE 1 – Population Distribution of Age Cohorts for Greater Fredericton Region

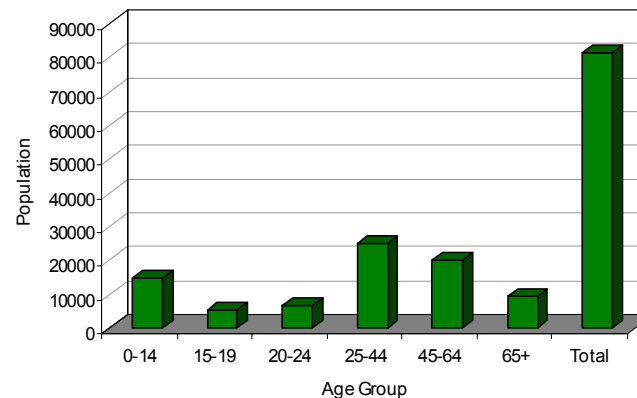
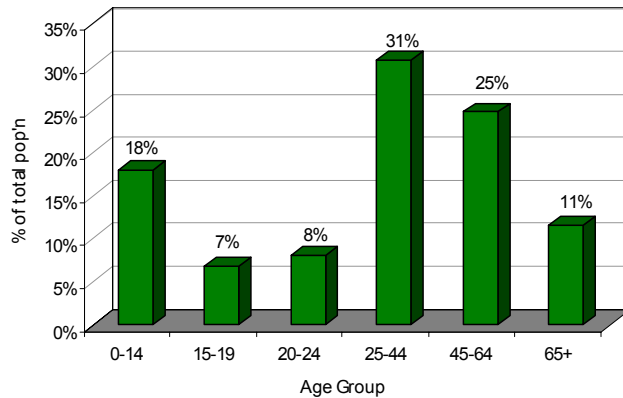


FIGURE 2 – Percent Distribution of Age Cohorts for Greater Fredericton Region



Development Outlook

Development in Fredericton is expected to continue at current high levels in the coming years. Given that the downtown core is already developed, it is anticipated that there will be increased pressure in the forested upstream areas. The City continues to face the challenge of developing so as to protect the structure and function of ecosystems in urban areas. Though given the growth trend in surrounding areas, it is expected that the population will continue to move away from urban cores into the surrounding hinterland. This presents additional planning challenges and scenarios that depart from the status quo.

Currently, the UNB Woodlot is being rezoned by City Council; the Allison Boulevard Knowledge Park corridor is under development; and major development is planned in the Killarney Brook Watershed. The total value of construction in the City of Fredericton in 2004 was \$99.4 million – the highest level of building activity in the City's history. A total of 500 new residential units were constructed in

2004. This is the eighth consecutive year that there have been more than 300 units constructed. In addition, a number of commercial and institutional buildings were also built.

In 2005 development continued to set records: for example, \$19.3 million in construction activity for September 2005 – up \$11 million from the same month in 2004. By October, 2005, the City of Fredericton had seen almost \$73 million invested in commercial and residential development. This was a \$10 million increase over the same time the previous year.⁶

While development is strong within the City, it is still preferable to outside-City residential development. In outlying areas, residential construction requires one acre of land, while high density residential development within the City can accommodate hundreds of residents on the same amount of land. As such, higher density development is preferable for the urban environment as it utilizes less green space while still meeting the housing demands of residents.

⁶All development information provided by City of Fredericton representative: Frank Flanagan, Director, Development Services.

3 METHODS

3.1 Data Availability

The City of Fredericton has no data available for the recommended benchmark year of 1990. As shown in Table 1, data became more available beginning in 1996, though availability was erratic between 1996 and 2002. The first year for which complete and reliable data was available is 2000, and thus became the City of Fredericton’s benchmark year for the purposes of this greenhouse gas inventory and analysis.⁷

TABLE 1 – Data Availability for Corporate Inventory of GHG Emissions

Year	Buildings	Vehicle Fleet	Streetlights	Water & Sewage	Waste
1990	N/A	N/A	Incomplete	Incomplete	Incomplete
1996	Poor quality	Poor quality	Incomplete	Incomplete	Available
1999	N/A	N/A	N/A	Available	Available
2000	Available	Available	Available	Available	Available
2001	N/A	N/A	N/A	Available	Available
2002	Available	Available	Available	Available	Available
2003	N/A	N/A	N/A	Available	Available
2004	Available	Available	Available	Available	Available

3.2 Data Collection

Representatives of the City of Fredericton and NB Power provided data for this project. It was necessary, in most cases, to assemble data from archived records. In some cases, data sources varied depending upon the type of expenditure required to calculate emissions. Furthermore, although it was desirable to use 1990 as the benchmark year for greenhouse gas accounting, this was not possible due to lack of data.

The earliest year for which the most complete, reliable data were available was 2000. The data were provided by representatives of the Departments of Public Works and Engineering, the Fredericton Pollution Control Commission, and the Fredericton Region Solid

⁷ Approved by Megan Jamieson at ICLEI – Local Governments for Sustainability.

Waste Commission, in some cases via the Assistant City Administrator's office.

The data were entered into spreadsheets provided by the Federation of Canadian Municipalities (FCM); changes in emissions were calculated using 2000 as the benchmark year, and 2004 as the comparison year. Although data were incomplete for many of the years between 1996 and 2004, all available data were entered into spreadsheets, in case of a need for future work.

3.3 Data Analysis

Data analysis was facilitated by the spreadsheets provided by FCM. Limitations include a lack of space for entering the data for each corporate holding, as well as the fact that emissions coefficients for years beyond 2000 are not yet available from FCM. Thus, final numbers may change when these new coefficients are available from FCM. To address the lack of space in the spreadsheets, a separate Excel document was created in which raw data were consolidated and kWh gasoline, diesel, natural gas, fuel oil, etc. were calculated and then exported by category to the FCM spreadsheets for analysis. All data as well as FCM spreadsheets for this project are included in the electronic appendices submitted with this document.

Once the data were entered into the spreadsheets, the calculations of changes in greenhouse gas emissions overall and by sector were carried out. These calculations are displayed in the following table, Table 2.

**TABLE 2 – Corporate Greenhouse Gas Emissions by Sector
2000–2004**

YEAR	Building	Vehicle Fleet	Street-lights	Water & Sewage	Solid Waste	TOTAL eCO2 (T)
2000	5184.4	2352.1	1721.0	3595.1	154.7	13007.0
2004	4121.9	2342.5	1736.0	4902.5	159.0	13262.0
Percent Change	-20.5	-0.4	0.87	36.4	2.8	1.96



4 GREENHOUSE GAS EMISSIONS ANALYSIS

4.1 Present Emissions and Projections of Future Emissions

Overall, the City of Fredericton's corporate greenhouse gas emissions increased by less than 2 percent, or 255 metric tonnes (T) of CO₂, between 2000 and 2004. Thus, in order to meet its corporate commitment to reduce to 20 percent below its benchmark year (2000) by 2010, the City will have to reduce its GHG emissions to 10406T. This represents a decrease of 2856T, or just over 20 percent below current levels. Figure 3, below, shows the proportion of corporate emissions rates in 2004 from the five sectors analyzed in this study. Figures 4 and 5 show the change in emissions in the 2000–2004 timeframe, by amount (T) and percentage, respectively.

FIGURE 3 – Percent Corporate GHG Emissions by Sector, 2004

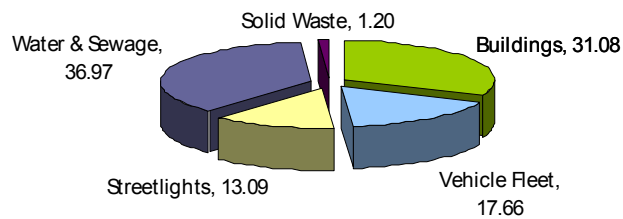


FIGURE 4 – Corporate GHG Emissions (T) by Sector, 2000 and 2004

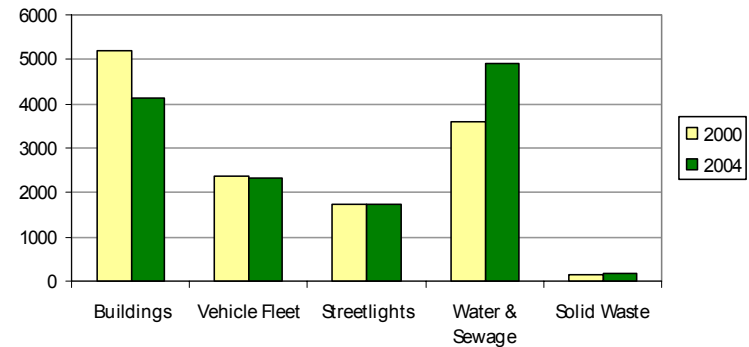
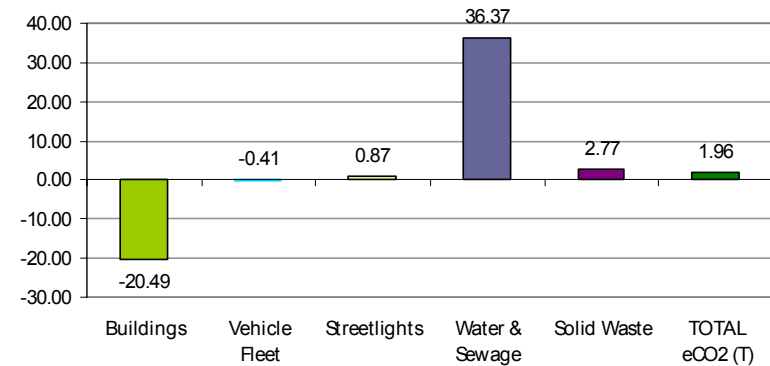


FIGURE 5 – Percent Change in Corporate GHG Emissions by Sector 2000–2004





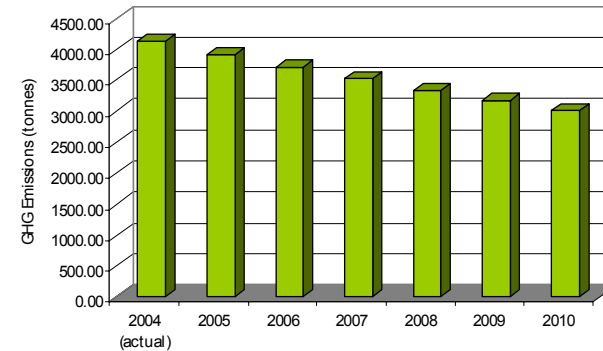
Buildings

The Buildings category includes all greenhouse gas emissions associated with energy consumption to heat and light City/corporate structures, as well as operate equipment powered by energy that is sourced from these structures.

Total greenhouse gas emissions for municipal buildings decreased by 20.5 percent between 2000 and 2004, despite the addition of several new buildings and facilities to the corporate system. This is a significant achievement, and is attributable to the upgrading of 18 municipal buildings, which saved the City 1,828,086 kwh of electricity.

If the City continues to aggressively retrofit its older buildings and build energy efficient new structures, and assuming similar savings over time, by the year 2010 it could further reduce the GHG contributions of municipal buildings by 1114.8 tonnes of CO₂. Figure 6 depicts the projected reduction in emissions to 2010 for the buildings category, under business-as-usual conditions (i.e. rate of reduction in GHG emissions continuing as was calculated for 2000-2004).

FIGURE 6 - Buildings - Projected GHG Emissions to 2010



*Build Better
Build Better*



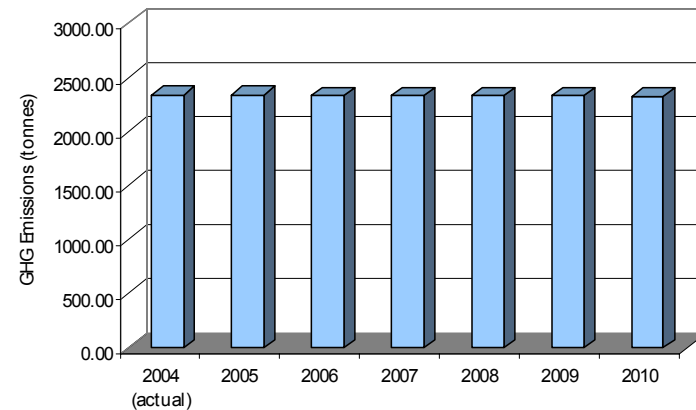
Vehicle Fleet

The Vehicle Fleet category includes all GHG emissions produced by on and off-road vehicles in the City's vehicle fleet, excluding the City's public transit system⁸, as well as all equipment used by the City: lawn mowers, snow plows, etc. The GHG emissions calculations included the consumption of gas and diesel by the entire municipal fleet, and between 2000 and 2004 emissions in this sector decreased by 9.6 tonnes of CO₂

This is a significant step, for any municipality relies heavily on its fleet to carry out its required activities, especially given that the total number of employees increased between 2000 and 2004, in the order of 20 people.

As depicted in Figure 7, continuing on this path, the City can anticipate that its vehicle fleet greenhouse gas contribution in 2010 will be 14T less than today.

FIGURE 7 - Vehicle Fleet - Projected GHG Emissions to 2010



Drive Smarter
Drive Smarter

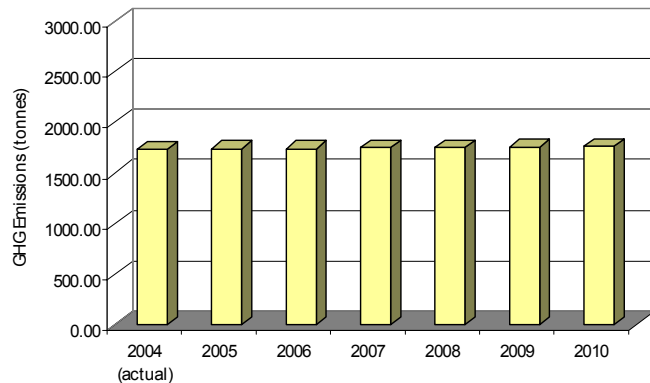
⁸ FCM excludes transit fleet in GHG calculations for corporate municipal operations. The transit fleet will be included in the Community GHG calculations (Phase II - First to Kyoto - Community GHG Inventory and Action Plan)



Streetlights

The Streetlights category includes all GHG emissions associated with the energy required to power the City's streetlight and traffic light systems. Between 2000 and 2004 the total GHG emissions from street and traffic lights in Fredericton increased by less than 1 percent. And after this analysis period, starting in 2005, the City began rationalizing its streetlight provision with a substantial anticipated reduction in energy consumption, hence GHG emissions. The benefits from this initiative will be realized in the 2005–2010 period of emissions calculations, which should yield very positive outcomes with respect to GHG emissions reductions from this sector. As presented in Figure 8, under a business-as-usual scenario, the output from streetlights would be expected to increase from 4642.3T in 2004 to 9675.3 in 2010. However, as stated previously and described in detail in later sections, this is unlikely to happen as the City has already begun to significantly decrease electricity consumption from streetlights and traffic signals.

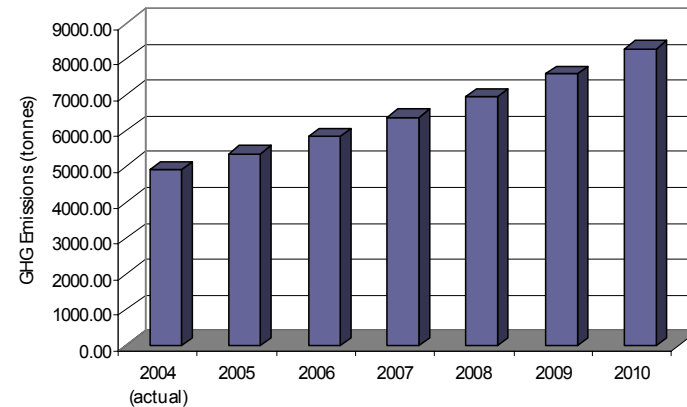
FIGURE 8 – Streetlights – Projected GHG Emissions to 2010



Water and Sewage

The Water and Sewage category includes all GHG emissions associated with the energy consumed to operate the City's water distribution, treatment and waste water facilities networks. This sector increased its GHG emissions by 1307.4T, an increase of 36.4 percent between 2000 and 2004. If this rate persists, the anticipated increase between 2005 and 2010 will be 3360.3T, as depicted in Figure 9. Again however, based on emissions reductions strategies for the water & sewage sector as presented later in this document, business-as-usual conditions are not expected to persist to yield this negative outcome.

FIGURE 9 – Water & Sewage – Projected GHG Emissions to 2010

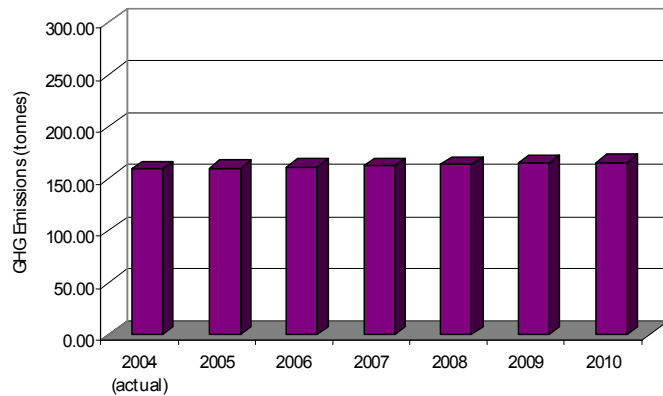




Solid Waste

The Solid Waste category includes all GHG emissions associated with waste materials generated by the City's corporate operations. At 159T in 2004, this represents a relatively small proportion of the municipality's overall greenhouse gas emissions, and increased a mere 2.8 percent between 2000 and 2004. As presented in Figure 10, if this rate were to persist, GHG emissions from the Solid Waste category would increase only slightly between 2005 and 2010 (less than 6T).

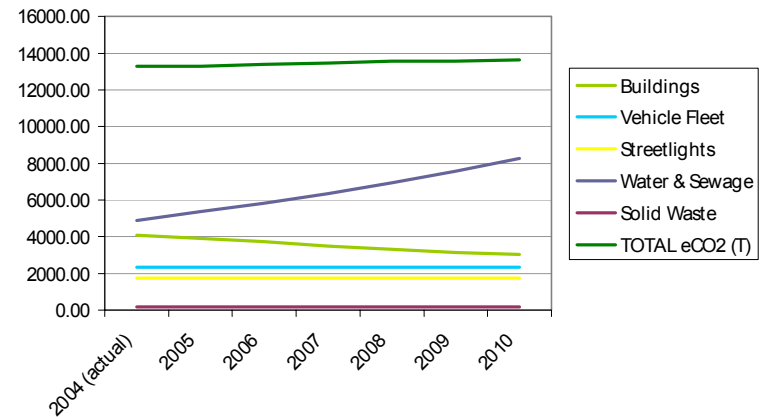
FIGURE 10 – Solid Waste – Projected GHG Emissions to 2010



The global picture of GHG projected emissions, by category, under business-as-usual conditions is presented in Figure 11. This would see emissions increasing by approximately 3000T, or 17 percent in the 2005 to 2010 timeframe. However, it is important to note, that Section 5 presents GHG emissions targets in each category and

corresponding actions and initiatives which will impact current business-as-usual or status quo conditions so as to mitigate this increase in the City's corporate GHG emissions.

Figure 11 – Projected GHG Emissions, under Business-as-Usual Conditions, 2005–2010 (by Sector & Total)



time for a NEW 'Business-as-Usual'

time for a NEW 'Business-as-Usual'



5 STRATEGIC ANALYSIS

5.1 Selected Targets

The overall cap for GHG emissions for the City of Fredericton is 20 percent below 2000's output of 13007T, or approximately 10406T. This represents a reduction of 2856T below 2004 output of 13262T – just over a 20 percent reduction in overall emissions, given today's emissions levels.

Table 3 – Greenhouse Gas Emissions by Sector, 2000–2004

Year	Buildings	Vehicle Fleet	Street-lights	Water & Sewage	Solid Waste	TOTAL eCO ₂ (T)
2000	5184.4	2352.1	1721.0	3595.1	154.7	13007.2
2004	4121.9	2342.5	1736.0	4902.5	159.0	13262.9
% Chg	-20.5	-0.41	0.87	36.4	2.8	1.96
Absolute Chg	-1062.4	-9.6	15.0	1307.4	4.3	254.6
Avg. Annual % Chg	-5.1	-0.1	0.2	9.1	0.7	0.5

The three greatest contributors to GHG emissions at the municipal level in Fredericton are water & sewage, buildings and vehicle fleet, followed by streetlights. Thus, given the magnitude and proportion of their contribution of the overall municipal GHG emissions, these categories are the most obvious targets for future emissions reductions. However, the water & sewage category may prove the most difficult category for reduction, since it will require the participation of the City's clients: the citizens of Fredericton. Reducing the GHG output of the water delivery and treatment system will require a reduction in the overall volume consumed and disposed of – that is, a reduction in daily household use. This component will be addressed in Phase II of the First to Kyoto project: Community Inventory and Action Plan for Greenhouse Gas Emissions Reduction.

Because the City's building upgrade has been so successful in reducing GHG emissions, as well as saving the City a substantial amount of money in energy bills, it is likely that additional upgrades will be of interest and value to municipal decision makers. The business-as-usual scenario presented above includes continuing municipal building upgrades. If this does take place, the 1114T additional CO₂ reductions that would accrue over this time period represents nearly 40 percent of the total target reduction amount of 2856T.

If the City were able to mimic the reductions achievement of the buildings sector (a 20 percent reduction below 2000 emissions levels, or approximately 4 percent per year) in the streetlight and water & sewage categories, the total municipal GHG output would come within a mere 700T (93 percent) of its target emissions cap of 10406T.



FIRST TO KYOTO ~ CORPORATE ACTION PLAN

The City currently has a Streetlight Rationalization Initiative underway, which aims to reduce energy consumption by 20 percent from a base year of 1998, through reducing streetlight wattage, where appropriate, and still maintaining a consistent and appropriate level of service to citizens. The key attributes of this initiative are two-fold: a reduction in energy consumption of 228,036 kwh per year; which equates to an annual cost savings to the City of \$43,000.

Simultaneously, our Traffic Lights Conversion to LED Initiative is working to change all traffic signal lights and walk lights to energy efficient LED lamps (from incandescent), so as to: increase efficiency by reducing energy consumption (as part of an overall plan to reduce GHG emissions); save money; improve signal performance; and enhance safety. This initiative is characterized by an 80 to 90 percent reduction in energy usage per signal per month (or 1552kwh), and an associated 80 to 90 percent reduction in costs per signal per month (or \$172). When all retrofits are complete the cost savings will be at least \$100,000 per year.

Given these combined aggressive plans to reduce energy consumption and therefore GHG emissions from street and traffic lights, we anticipate that this sector alone will reduce its emissions sufficiently to capture the additional emissions reductions required to meet the City's corporate goals.

Furthermore, the vehicle fleet is currently transitioning to a lower emissions fleet. The City is currently in the process of purchasing three hybrid vehicles to replace aging vehicles in the fleet. As well, a pilot project using biodiesel additives in the City's diesel vehicles is currently underway. This project has been facilitated by the Province of New Brunswick, and is a partnership between the City of Fredericton and a group of farmers in the province who are

producing the biodiesel product. The pilot is expected to yield the following benefits: 1) increased life of the City's diesel vehicles; 2) a decrease in the number of oil changes per vehicle, thus a reduction in hazardous waste; and 3) an increase in fuel efficiency. These initiatives together have the potential to reduce GHG emissions drastically.

Presented below in Table 4 are selected targets for GHG reductions (reduction of 20 percent over 2004 levels in Buildings, Streetlights, and Water & Sewage) for the different categories/ sectors within the Municipal Corporation.

Table 4 – Selected Greenhouse Gas Emission Targets by Sector

2010 GHG EMISSIONS TARGETS						
Year	Buildings	Vehicle Fleet	Streetlights	Water & Sewage	Solid Waste	TOTAL eCO2 (T)
2000	5184.4	2352.1	1721.0	3595.1	154.7	13007.2
2004	4122.0	2342.5	1736.0	4902.5	159.0	13262.9
2010	3297.5	2342.5	1388.8	3922.0	159.0	11109.7



5.2 Corresponding Actions, Measures, and Programs

Buildings

The City of Fredericton's Municipal Building Initiative aims to improve the energy efficiency of all municipal buildings by upgrading lighting, heating/ventilation, air conditioning, and arena ice plant systems. The primary goal is to increase efficiency of these facilities, while reducing pollution (GHG emissions), and increasing staff and user comfort and safety. Over the long-term it has been calculated that the upgrades will reap financial savings to the City in the order of 20 to 25 percent over the next 20 years. Furthermore, as a result of this initiative, the City was a finalist in the Energy Efficiency Canada Awards' in 2000, sponsored by Natural Resources Canada.

Through this initiative the City has upgraded 18 municipal buildings, in partnership with EnerPlan, and has already realized substantial savings. The retrofit of the original 18 facilities was finished in 2001, however since that time much additional retrofitting has occurred, specifically: as buildings require new roofing membrane, the R-value of the roofing insulation is being increased; HVAC equipment that has exceeded its life expectancy is being replaced with high energy efficiency equipment; and the overhead door replacement program continues to replace overhead doors, as required, with high R-value doors. Furthermore, the City is closing three old arenas within the next year and building four new energy efficient structures to replace them.

These actions and initiatives combined have the potential to significantly reduce energy usage, costs, and GHG emissions. As such, the already favorable business-as-usual scenario, depicted in

Figure 6, will potentially be impacted to yield a much more significant reduction in GHG emissions to 2010.

Vehicle Fleet

The corporate GHG reductions as stated above do not call for additional reductions in fleet emissions. However, there is an opportunity for the municipal fleet to provide a backstop in case of shortfalls in other areas, or in the event that some emissions reduction plans prove difficult, given the rate at which the municipal infrastructure is slated for growth in upcoming years. As discussed previously, the City is currently, and will continue to, investigate alternative fuels for its vehicles, including natural gas and biodiesel⁹, and will conduct a cost-benefit analysis of changes in fuel types for existing vehicles, conversion of existing vehicles for use of

⁹ Biodiesel is fuel derived from natural products such as vegetable oils, which can be used in many conventional vehicles. Biodiesel blends can be used in any light or heavy duty diesel engine. The most common blend of biodiesel is B20 (20% biodiesel/80% diesel), but B100 (neat biodiesel) and blends of less than 20% biodiesel can also be used. Vehicles that have successfully used biodiesel include school and transit buses, refuse haulers, farm equipment, and park maintenance vehicles (http://www.eere.energy.gov/afdc/afv/bio_vehicles.html).



alternative fuel types, and future purchasing decisions to include vehicles that use alternative fuels or are hybrids. The City is already beginning to replace aging vehicles in the City's fleet with hybrids (currently replacing three twelve-year old vehicles with hybrids); and is beginning to test and use viable biodiesel solutions via a pilot project on use of biodiesel additives in some City diesel vehicles.

In addition, the City is considering Natural Resources Canada's 'FleetSmart' program¹⁰ within the corporate vehicle fleet, which includes components such as: anti-idling practices, fuel efficiency practices for driving, and environment-friendly vehicle purchasing protocols.

Streetlights

The City already has an aggressive plan of action in place to reduce energy consumption from streetlights and traffic signals while still maintaining a consistent and appropriate level of service to citizens. A streetlight rationalization plan is being followed for all new developments within the city with regard to streetlight placement and wattage. And the wattage of existing streetlights has already

been, or is currently being, reduced (497 units converted in 2005, and 309 to be converted in 2006). Additionally, the Traffic and Walk Light Conversion to LED Initiative has already converted 46 of 65 traffic signals from incandescent bulbs to LED, with the remaining retrofits to be completed in 2006.

Indeed, these initiatives may represent the lowest-hanging fruit in the effort to reduce GHG emissions, since simply changing the bulbs in existing streetlights and traffic signals may reduce electricity consumption by up to 90 percent.

As the new streetlights come online, regular monitoring and analysis of changing consumption patterns will indicate whether the planned strategies will allow the reductions required of this sector. If this is not the case, the corporate targets will be reassessed and may be adjusted accordingly.

Water & Sewage

According to municipal representatives, there is a substantial increase in water flowing to municipal treatment facilities during wet weather. This is attributed to inflow and infiltration on the City's collection system. Currently, the City has a program under way to decrease inflow and infiltration to its sanitary sewers. Projected decreases in volume of water treated have been requested from City representatives and projected decreases in GHG emissions will be calculated when those data become available.

Potentially the most effective and perhaps most challenging strategy for reducing water distribution and treatment requirements, and associated GHG emissions, will be twofold:

1. Encourage reduction in individual household consumption rates.

¹⁰ <http://oee.nrcan.gc.ca/transportation/fleetsmart.cfm>



2. Encourage alternative building design and construction to reduce water consumption (e.g. through installation of toilets that use gray water from sinks, dishwashers, and showers; or through the use of gray water to irrigate lawns)

These two strategies are likely to require participation of both the municipality and the non-profit sector (for example, the City's collaboration with a local citizen-based watershed group). Corporately, the municipality has a role to play in retrofitting its existing buildings and designing future buildings to incorporate the use of gray water in its design. The community potential for reduction in this sector will be explored in Phase II of the First to Kyoto project, when the community inventory of GHG emissions is calculated and a Community Action Plan developed.

Solid Waste

Solid waste contributes less than one percent to overall municipal GHG emissions. Therefore, this is not a primary target for reduction. However, it is important to note that the Fredericton Region Solid Waste Commission is an active partner in the First to Kyoto initiative, and this sector may play a critical role in GHG reductions at the community level. For instance, the Methane Recovery Project at the regional landfill, which is starting this year, has the potential to contribute significantly to reduced GHG emissions in this sector.

Other Areas

The City has undertaken a wide variety of pollution prevention and reduction initiatives, specifically to reduce its GHG emissions and increase its energy efficiency, while increasing satisfaction, health and safety of its citizens and staff. The City understands the important leadership role it plays in the local community as many of

these initiatives lie at the interface between the municipal government and the citizens it serves. By demonstrating strong corporate leadership the City has laid the groundwork necessary to encourage individual, corporate, and institutional citizens to reduce their own emissions.

As such, there are additional areas being explored by the City in an effort to reduce greenhouse gas emissions corporately and community-wide which are not included in the pre-defined categories. For example, the City is exploring the opportunity to partner with the Fredericton Watershed Association on an Alternative Development Scenarios project. The goal of this is to protect the ecological structure and function of the landscape in the context of development, and to encourage neighborhood and building design and construction to minimize greenhouse gas emissions.

Fredericton is a city with 68 percent forest cover; much of that forest is in the headwaters, i.e. upland regions of the City's watersheds. There is an opportunity to develop and test new means of building urban residential, commercial, and industrial developments in a way that reduces loss of forest cover, employs the contours of the landscape and its existing vegetative structure to buffer new buildings from winter winds and summer sun, thereby minimizing energy consumption for heating and cooling. The Alternative Development Scenarios project aims to work with local land owners, developers, engineers, and researchers to design, build, measure, and monitor the relative greenhouse gas related, as well as other environmental effects of innovative development.



6 IMPLEMENTATION PLAN

6.1 Means of Reaching New Targets

This section presents a summary of the greenhouse gas emissions reduction initiatives and actions; the timeline; and roles and responsibilities, as described in detail in the preceding sections.

In addition to the sector-specific initiatives presented in Table 5, the City is implementing a First to Kyoto: Monitoring and Evaluation Strategy as described in Section 6.2, and finally Section 6.3 discusses anticipated barriers and strategies for mitigating or overcoming them.

Table 5 – Summary of GHG Reduction Initiatives & Actions

Category/ Sector	Action	Timeline	Lead role – City of Fredericton, in partnership with:
Buildings	4 new energy efficient arenas, and close 3 old ones	2006	
	Retrofit older buildings (Municipal Buildings Initiative)	18 bldgs completed in 2001. Now additional upgrades	Enerplan
Vehicle Fleet	Alternative fuel options (pilot project – biodiesel additives)	currently underway	Local area farmers (biodiesel additives)

	Hybrid purchasing	currently purchasing 3	
	'Fleet Smart' program	under consideration	NR Canada
Streetlights	Streetlight Rationalization Initiative	2005 – Southside complete 2006 – Northside	NB Power
	Traffic Light LED Project (from incandescent to LED)	–Conversion complete for 46 of 65 signals –Remainder in 2006	Province of New Brunswick – Environmental Trust Fund
Water & Sewage	Project to decrease inflow and infiltration to sanitary sewers	currently underway	
Solid Waste	Methane Recovery Project at regional landfill	2006	Fredericton Solid Waste Commission
Other	Alternative Development Scenarios Project	currently in discussion stages	Fredericton Watershed Association
	Phase II – First to Kyoto: Community Inventory and Action Plan	2006	FCM – Municipal Green Funds



6.2 *Monitoring and Evaluation Strategy*

In order to meet the goals and targets of the First to Kyoto project, as well as take advantage of additional opportunities to reduce GHG emissions, it will be necessary to monitor and evaluate the City of Fredericton’s ongoing performance. There are several components to this, as described in this section.

First, it will be necessary to develop internal monitoring and reporting mechanisms, in order to track progress toward the City’s corporate reduction goal of 20 percent. Second, it is required that greenhouse gas emissions reductions be tracked within each of the categories required by FCM, to identify constraints and opportunities within different sections of the City’s government structure. Third, in order to continue to aggressively work toward further reductions in GHG emissions, the City will need to stay abreast of new technologies and opportunities to adopt them within the corporate system, as they become available. Finally, the City of Fredericton can, and should, work with FCM and other PCP entities to examine means by which additional potential reductions strategies can be captured and incorporated into emissions reductions calculations.

Internal Monitoring and Reporting

Annual Data Collection

Obtaining data for the five sectors/categories required by FCM for greenhouse gas accounting was a significant undertaking. Despite this fact, the City of Fredericton did and will continue to have the requisite data available for analysis. In the future, however, there is the ability to carry out data collection and analysis in a much more efficient manner than was possible for the initial inventory. This will

be a product of the City’s corporate commitment to the First to Kyoto project, and the overall increased awareness of the First to Kyoto project among City managers and staff persons responsible for each sector/data area.

Several standard practices will make data acquisition smoother and more efficient in the future: 1) Each municipal department currently creates a year–end report, this is an obvious mechanism for monitoring greenhouse gas emissions by category; and 2) Each department reports on expenditures as well as activities, and can easily incorporate a standard section into its year–end report, dedicated specifically to progress on the First to Kyoto goals. This section should have at least two components:

1. Initiatives undertaken at the departmental level to reduce greenhouse gas emissions.
2. The effects of these initiatives. This is an opportunity for each department to report on GHG emissions either indirectly or directly. A minimum indirect emissions report should be required of each department, which comprises the data necessary to produce an annual First to Kyoto Progress Report.

Those municipal departments directly involved in monitoring and reporting on categories required by FCM will be provided with detailed guidelines indicating the data required to calculate greenhouse gas emissions. Each department will provide data to the Assistant City Administrator, whose office will coordinate annual compilation and dissemination of GHG emissions.

Calgary addressed the problem of onerous data collection, monitoring & tracking of GHG emissions data, by having their IT department & Environmental Management business unit develop a proprietary automated computer data collection system – greenHouse gas Emissions & Abatement Tracking (HEAT).



Annual First to Kyoto Progress Report

An annual report will be compiled by the Assistant City Administrator's office, and disseminated both internally and publicly. This will include an overall report of progress in terms of the initial 20 percent reduction commitment, as well as annual changes in emissions by category, and if possible, by City department.

In addition, the annual report will provide a framework to track and report on progress in meeting the short, medium, and long-term goals of First to Kyoto. Likewise, the report will also provide means by which new goals and strategies can be articulated and tracked. The Assistant City Administrator's office is the natural municipal entity for the generation of this report at present, as the First to Kyoto initiative originated from this office; it has a bird's-eye view of the entire municipal system; and because its position within the City's organizational structure demonstrates a strong commitment to greenhouse gas emissions on behalf of the entire corporate entity.

In the future, however, it may be desirable to move the monitoring and reporting functions of First to Kyoto into another municipal office, as these functions become part of the City staff's normal workload. This strategy should be reconsidered once monitoring and reporting processes have become streamlined and refined where necessary.

The City of Fredericton will publicly report its progress and GHG emissions reduction strategies in the appropriate venue each year. To date, reports on the progress of First to Kyoto have been made to the Public Safety and Environment Committee of the City Council. An annual progress report to the full Council will be made early each year, as part of the municipal reporting process.

II Categorical Comparisons

Categorical comparison will be important for several reasons. First, the categorical analysis of data on greenhouse gas emissions provides an opportunity to regularly calculate the relative contribution of each to the City's overall greenhouse gas portfolio. This will allow the City to allocate resources to reductions strategies with potential for greatest impact. Second, municipal agencies have already taken a very strong interest in First to Kyoto, and reporting on the efficacy of reductions strategies by category will allow them to track their own progress and its contribution to the City's goals. Third, understanding the relationships among the categories is important, especially as the Community Action Plan comes on line. This is because there will likely be trade-offs in terms of emissions – for example, in order to reduce private automobile use, the City may choose to increase the number of buses on the road. This increase in the Corporate fleet emissions should be justified as it increases bus usage by the public and reduces community emissions. Finally, continuing to monitor and publicly report on each of these categories will ensure there is a means of providing ongoing education, both internally, and to the greater public in Fredericton.

III External Opportunities

As a PCP member and local leader on a number of environmental initiatives, the City of Fredericton has demonstrated a commitment to adoption of leading edge strategies to provide a safe, healthy environment for its citizens. One aspect of this is understanding Fredericton's standing, relative to other municipalities of similar size and demographic composition.



The City of Fredericton will continue to monitor and, where appropriate, avail itself of new opportunities to reduce greenhouse gas emissions, adopt new strategies and technologies to do so, and provide local leadership in this arena. It will obviously be necessary to stay abreast of advances in technologies that allow the City of Fredericton to continue to provide this leadership.

Thus, the First to Kyoto Annual Report will include a section on up and coming technologies, and will highlight newly emerging strategies that may help it meet its GHG reduction goals.

IV Additional Emissions Reductions Categories

The core emissions reduction categories required by FCM are logical, as they include the obvious primary GHG sources that can be most readily tracked. However, there are additional mechanisms for reducing greenhouse gases that are not currently accounted for in the FCM software. An example is the urban forest, which sequesters carbon, reduces the need for air conditioning in the summer, and reduces heating costs by sheltering buildings from winter winds. Currently, there is no mechanism to account for, or report on, this function of the urban forest, which in a City like Fredericton, with 68 percent forest cover, may be significant.

The City of Fredericton's long-term commitment to reducing energy consumption may in the future include a variety of strategies that are currently not included in the FCM accounting standards. Therefore, Fredericton will also offer suggestions to FCM in this regard, as new emissions reductions strategies are adopted.

6.3 *Overcoming Barriers*

The City of Fredericton recognizes and takes responsibility for the fact that there are considerable barriers to overcome with regards to the planned aggressive approach to greenhouse gas emissions reduction at the corporate level. The most significant barriers are identified as follows:

Cost

Making strategic 'green' purchasing and spending choices is most often a more expensive option, in the short run, than the alternative. This is true whether in the purchase of hybrid vehicles for the City fleet or expanding the recycling program. The City recognizes this barrier and is committed to continuing to incorporate and account for this increased cost in departmental budgets, while making the case for the long run return on investment; decreased energy usage and GHG emissions; reduction in toxins and improved air quality for employee satisfaction and safety; and the many other positive environmental outcomes from making these strategic environmental choices.

Staff Training and Education

The success of many of the initiatives described in this document depend greatly on well-trained City staff feeling ownership of the initiatives and pride in their success toward meeting the First to Kyoto project goals. As such, the City is committed to ongoing education and re-training of staff, so they are able to meet the challenges that come with carrying out new work processes; using new products; driving and maintaining hybrid and biodiesel vehicles; building new energy efficient structures; installing new temperature control systems, etc.



The City has been committed to the development of staff expertise and knowledge transfer in several of the GHG reduction categories already, as evidenced by the success of past and current initiatives, such as the Municipal Building Initiative (MBI); the Streetlight Rationalization Initiative; and the Traffic and Walk Light LED Replacement program. In researching and implementing these initiatives, City staff conducted extensive research, and have become highly trained and knowledgeable in these specific areas. This knowledge has been shared via the ICLEI¹¹ Clean Air – Cool Planet exchange programs with the New England states (New York, New Jersey, Massachusetts, New Hampshire and Maine) as well, as Glaang, Thailand. The City presented on both the LED traffic signals conversion and the Municipal Building Initiative in Thailand in March of 2005.

In addition, to the best of our knowledge, the City of Fredericton is the first municipality in New Brunswick to organize a rational and precise plan for street lighting rationalization. Several other municipalities in the province have contacted City staff for advice

regarding their approach regarding the reduction/rationalization of street lighting in their municipalities.

Resistance to Change

Many of the initiatives currently underway and planned for the future involve change on many levels. Change in how the corporate entity does business; change in how employees do their job; and change in how citizens receive municipal services. As such, the City recognizes the ongoing change management effort that is required for these GHG reduction initiatives to be successful at all levels. To mitigate resistance to change the City is committed to maintaining a planned communication protocol and open dialogue between the Assistant City Administrator's office (where First to Kyoto resides), City departmental staff, and City Council on behalf of the citizens of Fredericton.

Commitment & Action
Commitment & Action

¹¹ Local Governments for Sustainability Organization

APPENDIX A – ACKNOWLEDGEMENTS

The City of Fredericton recognizes the valuable advice, input and data provided by the following organizations, individuals and groups:



- City of Fredericton staff of the following Departments:
 - Public Works and Engineering
 - Finance
 - Corporate Services
 - Development Services
- Dr. Shawn Dalton
Environmental and Sustainable Development Research Center
University of New Brunswick
- The Fredericton Pollution Control Commission
- The Fredericton Region Solid Waste Commission
- NB Power
- Sonya Hull
Crescent Management Consulting
- Megan Jamieson
Manager, Climate, Air & Energy
ICLEI – Local Governments for Sustainability
- Federation of Canadian Municipalities (FCM)

APPENDIX B – DATA TABLES

FCM data tables completed by the City of Fredericton in undertaking the Inventory of Corporate Greenhouse Gas Emissions are provided with this submission in electronic format in MS Excel files titled:

Fredericton GHG 2000.xls
Fredericton GHG 2004.xls