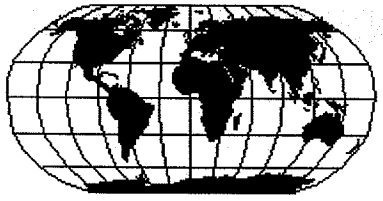


CITY OF MISSISSAUGA: CORPORATE LOCAL ACTION PLAN AND COMMUNITY EMISSIONS INVENTORY & CONSULTATION PLAN

FINAL

Prepared for:
City of Mississauga
Air Quality Advisory Committee

Prepared by:
ICLEI Energy Services
City Hall, West Tower, 16th Floor
100 Queen Street West
Toronto, ON
M5H 2N2

June 14, 2002

EXECUTIVE SUMMARY

This paper is a three-part report on the City of Mississauga's energy-based greenhouse gas emissions. It was prepared to quantify the historic energy consumption and resulting emissions of both the City's operations (corporate inventory) and the City itself (community inventory). The report's highlights include:

- In recent years the City of Mississauga's population has grown at a steady rate, and is one of the fastest-growing cities in Canada. From 1990 to 1998, Mississauga's population increased by 29%.

- From 1990 to 1998, Mississauga's total corporate equivalent carbon dioxide (eCO_2) emissions (from City facilities and operations) increased by 28%, and its community emissions (from the community at large) grew by 29%.

- While eCO_2 emissions increased in absolute terms, corporate and community efficiency improvements resulted in a stabilization or decrease in eCO_2 emissions on a per capita basis in most sectors.

- In 1998, the buildings sector accounted for 63% of total corporate eCO_2 emissions. Streetlighting was responsible for 22% of emissions, followed by vehicle fleet with 14% and corporate waste with 1%.

- The commercial sector was responsible for 32% of total community eCO_2 emissions, followed by the transportation sector at 24%. The residential sector accounted for 22%, the industrial sector contributed 20%, and community waste 2%.

- The Mississauga Local Action Plan Project Team considered three forecast scenarios for Mississauga's corporate emissions and recommended that the Conservative 2010 target with a 1998 baseline year be adopted. This means that the City will aim for a 12% reduction in its corporate eCO_2 emissions by 2010, compared to 1998 levels.

- In order to develop a more accurate community emissions reduction target and list of feasible future community emission reduction measures, ICLEI has laid the foundation for a community consultation process.

Local Action Planning requires a long-term commitment and the involvement of a wide variety of stakeholders in order for the City of Mississauga to successfully meet its greenhouse gas emission reduction commitments. The City of Mississauga is a natural leader and facilitator for this community consultation process, based on its significant progress in implementing emission reduction measures within its own facilities and operations and in the community.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 PART ONE: INTRODUCTION

1.1 WHAT IS CLIMATE CHANGE?

At its most basic level, climate change is a change in the long-term average weather (temperature, precipitation, wind patterns) that a given region experiences. On a global scale, climate change refers to changes in the Earth's climate as a whole.

The Earth's temperature is regulated by a natural system known as the "greenhouse effect" where a delicate balance of naturally-occurring gases trap some of the sun's heat near the earth's surface. Over time human activities and lifestyles have resulted in an increase in the amount of heat-trapping gases in the atmosphere, thereby enhancing the warming capability of the natural greenhouse effect. It is the human-induced enhanced greenhouse effect that causes environmental concern and has the potential to warm the planet at a rate that has never been experienced in human history.

1.2 SCIENTIFIC RESEARCH

An international scientific consensus has emerged that our world is getting warmer. Climate data gathered during the past 150 years has shown that while the earth has gone through a series of warming and cooling cycles, the global average temperature has increased overall.

Most experts agree that average global temperatures could rise by 1.4 to 5.8 degrees Celsius over the period from 1990 to 2100.[1] Temperature increases will not be uniform around the globe. In Canada, this could result in an increase in annual mean temperatures in some regions of between five and ten degrees.[2]

1.3 CLIMATE CHANGE IMPACTS

Scientists have also predicted that climate change may have significant effects in a variety of areas. Environmental impacts in Canada could include flooding and erosion in coastal regions, increased risk to forests from pests and drought, changes in agriculture yields, a decrease in the quality and quantity of drinking water as water sources are threatened by drought, more frequent and more severe weather conditions, and negative impacts on fisheries and wildlife.

Climate change will also affect human health. Higher air temperatures could result in increased heat stress that can lead to illness or death, particularly in the very young, the ill, and the elderly. There are also some indirect health impacts. Respiratory disorders or allergies could worsen as a result of increased heat and humidity and declining air quality in some areas, as could the spread of vector-borne infectious diseases (such as the West Nile Virus) normally not found in Canada. Extreme weather events could result in increased deaths and injuries.

---

[1] Intergovernmental Panel on Climate Change Working Group I, Third Assessment Report, 2002.
[2] Government of Canada Climate Change Web site.
http://www.climatechange.gc.ca/english/issues/what_is/index.shtml, last updated May 15, 2002.

1.4 WHY SHOULD THE CITY OF MISSISSAUGA TAKE ACTION?

As the population centres of the world, urban and suburban areas will experience most of the negative impacts of climate change. Apart from the City's responsibility to do its part to reduce Canada's total contribution to the climate change problem, there are numerous co-benefits for the City of Mississauga.

- **Improved Service Delivery**

Through the implementation of energy efficiency initiatives in its corporate facilities and operations and throughout the community, the City will be able to offer its services more efficiently and economically.

- **Reduced Costs**

By reducing its energy consumption, the City and its citizens will save money on their energy bills. While energy efficiency initiatives may require an initial capital investment, in many cases paybacks of between four and seven years can be expected, savings will continue well beyond the payback period. Also, by reducing the amount paid for energy the City and its citizens will be less vulnerable to fluctuations in the market price of energy.

- **Improved Air Quality and Public Health**

The combustion of fossil fuels used to produce electricity, heat our buildings, and power our vehicles, emits a variety of pollutants into the atmosphere that are known to have negative health impacts and reduce local air quality. Reduced energy consumption will result in a reduction in local air pollutants such as sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), non-methane volatile organic compounds (NMVOC), particulate matter (PM_{10}), and carbon monoxide (CO). In the long term, taking steps to reduce greenhouse gas emissions reduces the likelihood of climate-related health problems, such as the spread of vector-borne diseases.

- **Asset Management**

Proper asset management reduces emissions and also makes good business sense. It involves developing a plan to systematically review the state of facility operations and equipment and implementing a logical repair or upgrade schedule that focuses on a proactive approach to facility improvements. Preventative maintenance improves the value of the City's assets by reducing facilities' operating costs, modernizing equipment, and decreasing deferred maintenance. As well, increasing the efficiency of facilities and operations leads to better-run operations, greater client satisfaction, along with increased energy efficiency and the resulting cost savings.

- **Leadership**

The City of Mississauga has a history of taking the lead on a variety of issues. By taking concrete steps to address climate change and reducing the emission of greenhouse gases from its own facilities and operations, the City is able to "practice what it preaches" and provide a solid example to the community. The City has already made commitments to reduce greenhouse gas emissions as part of various City transportation and strategic plans. The City's establishment of the Mississauga Air Quality Advisory Committee and

its participation in the Partners for Climate Protection program demonstrate the City's interest in taking action to reduce greenhouse gas and smog-producing emissions. As well, as a member of the International Council for Local Environmental Initiatives and a participant in the international Cities for Climate Protection program, the City is part of a network of municipalities around the globe taking steps to reduce greenhouse gas emissions.

- **Quality of Life for Citizens/ Healthy Cities**

By reducing expenditures on energy and fuel the City of Mississauga can apply the savings towards improving its community services. These may include an increase in number of bike paths, improved public transit and greener public areas. Cutting greenhouse gas emissions with measures that make Mississauga residents less dependent on automobiles can reduce traffic congestion, clean the air, and contribute to more efficient homes, offices, and land use patterns. Together, these types of measures can help build healthier, more sustainable communities.

1.5 Action Undertaken by Various Levels of Government

On a global scale, many national governments have been involved in the development of the Kyoto Protocol, an international agreement that commits its signatories to varying reductions in their greenhouse gas emissions by 2008-2012, based on 1990 levels.

1.5.1 Federal Government

In October 2000 the federal government announced its Action Plan 2000 on Climate Change. This plan aims to reduce Canada's greenhouse gas emissions by 65 megatonnes per year by the period 2008-2012, taking Canada one-third of the way to its Kyoto target. While the government has not ratified the Kyoto Protocol, it has committed over $1 billion to its climate change response.[3]

The federal government has also taken steps to address climate change by earmarking $250 million for the Green Municipal Funds, which stimulate investment in innovative and environmentally advanced projects for Canadian municipal governments and their public and private-sector partners. As well, in its regulatory capacity, the federal government has set stringent emission standards for fuels and vehicles, as well as efficiency standards for vehicles.

1.5.2 Province of Ontario

Through its *Energy Efficiency Act*, the Province sets standards for the energy efficiency of 51 different energy-using products, including vending machines, commercial refrigerators, and incandescent reflector lamps. The *Act* allows the government to write regulations stipulating that appliances and products must meet set minimum efficiency standards by a specified compliance date before they are sold or leased in Ontario.

---

[3] Government of Canada Climate Change web site.
http://www.climatechange.gc.ca/english/actions/what_are/federal.shtml

Ontario's 1998 *Smog Plan* is a multi-stakeholder partnership that aims to reduce by 75% the number of times the province's criterion for ground-level ozone is exceeded. In order to achieve this goal, a significant reduction in provincial NO_x and VOC emissions is needed.

The Province is also participating in the federal government's national consultation process regarding the signing of the Kyoto Protocol and working on the development of an emissions trading program.

1.5.3 MUNICIPALITIES

Communities can make a significant contribution to climate protection. Up to half of Canada's greenhouse gas emissions (350 million tonnes) are under the direct or indirect control or influence of municipal governments, and by the year 2008, it is estimated that municipal governments could reduce that total by 20 to 50 megatonnes.[4]

The 92 Canadian municipal members of the Partners for Climate Protection program have made commitments to implement concrete actions to reduce their greenhouse gas emissions. Collectively, over 550 local governments participating in the international Cities for Climate Protection campaign represent 8% of global greenhouse gas emissions.

To date, 152 Green Fund projects (through both the Green Municipal Enabling Fund and the Green Municipal Investment Fund) have been approved for funding of more than $10 million, leveraging $46 million in total municipal spending to act on cleaner air, water, soil and climate change across Canada.[5]

As well, municipalities have developed air quality plans, established inter-municipal air quality working groups (such as the Greater Toronto Area Clean Air Council), implemented building retrofit projects, promoted transportation alternatives, and investigated renewable energy options, such as district heating and wind power.

1.6 MISSISSAUGA'S INVOLVEMENT IN CLIMATE PROTECTION

The City of Mississauga became a member of the International Council for Local Environmental Initiatives (ICLEI) in 1995 and joined ICLEI's Cities for Climate Protection Campaign (CCP). The Campaign calls for member municipalities to reduce greenhouse gas emissions to help mitigate the effects of climate change by following a five-milestone process. In 1998, ICLEI and the Federation of Canadian Municipalities (FCM) created the Partners for Climate Protection (PCP) program, a Canadian version of ICLEI's CCP Campaign.

Participants in the PCP program follow a five-milestone process to reduce their greenhouse gas emissions, which is summarized below. The milestones are usually

---

[4] Federation of Canadian Municipalities Web site.
http://www.fcm.ca/scep/support/PCP/pcp_cc_canadian_action.htm

[5] Federation of Canadian Municipalities Web site.
http://www.fcm.ca/english/communications/april82002.htm

completed sequentially, but municipalities have the flexibility to complete them in the order they choose.

- **Milestone One**
  Completion of a greenhouse gas inventory (profile of energy use and emissions) using PCP software for both municipal (ie. corporate) operations and the community for the base year 1990 (or 1994, or the year with the best available data); forecast energy use and greenhouse gas emissions for the next 20 years for corporate operations and the community.

- **Milestone Two**
  Establish a greenhouse gas emissions reduction target. Preferred targets are a 20% reduction in emissions from municipal operations and a minimum 6% reduction in the community, both within 10 years of joining the PCP program.

- **Milestone Three**
  Develop and finalize a Local Action Plan that aims to reduce emissions and energy use in corporate operations and the community.

- **Milestone Four**
  Implement the Local Action Plan.

- **Milestone Five**
  Monitor, verify, and report greenhouse gas reductions.

The City has long been involved in energy conservation, pollution prevention, and emission reduction initiatives as part of its environmental management program. Many of Mississauga's City plans, including its *Mississauga Strategic Plan*, *City Plan*, and *Transportation Management Plans* address environmental and sustainability issues to varying degrees. As well, City staff have prepared a variety of reports that address air quality issues such as *City Air Quality Action Plans,* and the *City of Mississauga Smog Alert Response Plan.* Mississauga is involved in several air quality programs as a member of the Peel Air Quality Working Group, the GTA Clean Air Council, and the Southern Ontario Clean Air Network Initiative (SO CAN I).

In November 1998, Mississauga City Council approved City Air Quality Action Plans to reduce greenhouse gases and smog-producing emissions as recommended by the Mississauga Air Quality Advisory Committee (MAQAC). One action plan, Emissions Inventory and Monitoring, addressed Milestone One of the PCP program: the preparation of an emissions inventory of the City's corporate operations and the community at large. The two inventories were conducted by staff and interns in the Transportation and Works Department (Infrastructure and Environmental Planning section) and Community Services Department (Facilities and Property Management division) and completed in October 2000.

After the completion of Milestone 1, the City of Mississauga focused on maintaining its momentum by working towards completing Milestones Two and Three. The City decided to first prepare a Local Action Plan (Milestone Three) before setting a greenhouse gas emissions reduction target (Milestone Two).

1.7 THE DEVELOPMENT OF MISSISSAUGA'S LOCAL ACTION PLAN

A Local Action Plan is a "living" strategy document that outlines how a community will achieve its greenhouse gas reduction target. The Plan documents the greenhouse gas emission reduction measures that the community has already implemented and proposes new actions that would be necessary to close the gap between the projected growth in emissions and the reduction target.

In June 2001, the City hired ICLEI Energy Services to assist with the preparation of Mississauga's Local Action Plan. Working closely with the City's Environmental Coordinator, a multi-departmental City Local Action Plan Project Team, a sub-committee of Mississauga's Air Quality Advisory Committee, was formed to share knowledge and ideas about the City's past emission reduction activities and suggest potential new measures.

1.8 LOCAL ACTION PLANS IN OTHER MUNICIPALITIES

An increasing number of municipalities around the world understand the many benefits of reducing greenhouse gas emissions and are taking action in their own corporate operations and in their community. Mississauga is one of over 550 international municipal participants in ICLEI's Cities for Climate Protection Campaign, and one of 92 Canadian participants in the Canadian Partners for Climate Protection (PCP) program.

While PCP participants are at various stages of progress in their greenhouse gas reduction efforts, four Canadian municipalities that have made great strides in their Local Action Plans include Edmonton, Regina, Perth, and Sudbury. Because each municipality is unique, so too has been the development and implementation of these cities' Local Action Plans.

2 PART TWO: CORPORATE LOCAL ACTION PLAN

2.1 INTRODUCTION

The corporate component of a Local Action Plan is a strategy document that outlines the City's historic and future corporate equivalent CO2 emissions[6], energy use, and energy costs. A multi-year eCO_2 emissions inventory was completed for the Mississauga Air Quality Advisory Committee (MAQAC), which provided the background information necessary to devise a plan to address future eCO_2 emission levels and recommend a reasonable and achievable target.

In order to gain a better understanding of the Corporation's future eCO_2 emissions, three different eCO2 emission forecast scenarios were developed: **Business As Usual** (BAU), **Conservative**, and **Optimistic**, based on:

- projected growth in population and corporate operations
- effectiveness of historic and current energy and eCO_2 emission reduction initiatives implemented by the City
- effectiveness of energy and eCO_2 emission reduction initiatives implemented by other municipalities and corporations

The three scenarios provide a picture of the City's future eCO_2 emissions in relation to various years. Each scenario requires varying levels of effort and investment. A staff Project Team (a subcommittee of the MAQAC) was established to assist in this process. They were able to provide key information related to the quantification of current and historic energy and eCO_2 emission reduction initiatives as well as provide feedback on the feasibility of the three eCO_2 emission forecast scenarios. Through consultation with the Project Team one scenario was recognized as the most practicable and feasible and was therefore recommended as the Corporation's eCO_2 emissions target. A comprehensive measures financing strategy outlining the estimated investment cost, payback, and financing options necessary to achieve the recommended target was then developed.

[6] Equivalent CO2 (eCO2) emissions refers to the three major greenhouse gas emissions (carbon dioxide, nitrous oxide, and methane) expressed in like terms.

3 CORPORATE GREENHOUSE GAS EMISSION INVENTORIES

The City of Mississauga is a high-growth community, where the population increased by 29% between 1990 and 1998. Such dramatic growth is reflected not only in the community's energy use and eCO_2 emissions, but also in the Corporation's operations since it has expanded its services to meet the growing population.

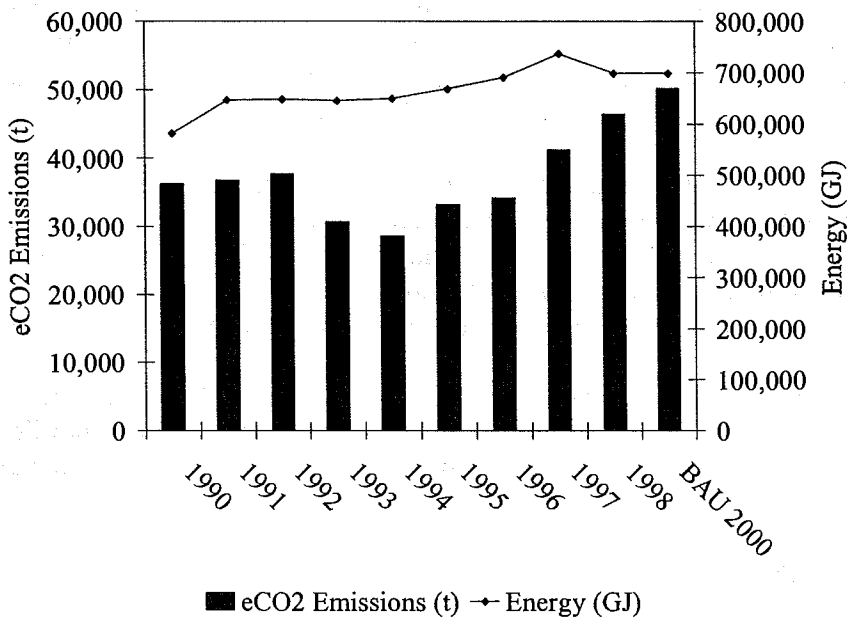
In order to measure the Corporation's impact on eCO_2 emissions an inventory was completed in accordance with the international municipal protocol established by the International Council for Local Environmental Initiatives (ICLEI). Energy use, energy cost and waste disposal information were collected for the City and then analyzed in the following categories: buildings, vehicle fleet, streetlighting, and corporate waste.

Inventories were completed for the years 1990 to 1998 inclusive. A Business As Usual (BAU) forecast to the year 2000 was determined to illustrate a more current profile. Since 1998 was the most recent inventory completed with empirical data, it is used as a reference year in the following analyses.

3.1 MACRO LEVEL ANALYSIS

The macro level analysis focuses on how the combined eCO_2 emissions, energy consumption, and costs from each corporate sector contribute to the 10-year profile. Figure A illustrates the growth in energy use and eCO_2 emissions between 1990 and 2000 in absolute terms. Emissions of eCO_2increased by 28% between 1990 and 1998, while energy use increased by 20%. The difference is reflected in the fact that eCO_2 emissions from electricity use varies depending on the fossil fuel mix used in its generation. During that same timeframe, energy costs for the City increased from approximately $7.2 million to $9.8 million, a 36% increase.

Figure A: 10-Year Energy & eCO2 Emissions Profile



It is very important to note that although this analysis shows there has been significant growth in eCO_2 emissions, energy use, and energy costs, this has been in the face of major community and population expansion. ***The City has shown efficiency improvements which would have resulted in an overall net reduction in eCO_2 emissions and energy consumption had there not been the need to expand corporate operations to service the growing population.*** Efficiency improvements are discussed in the detailed micro level analysis below.

3.2 MICRO LEVEL ANALYSIS

The micro level analysis focuses on the eCO_2 emissions, energy consumption, and energy costs relative to each corporate sector: buildings, vehicle fleet, streetlighting, and corporate waste. The sector-by-sector eCO_2 emissions, energy consumption and energy costs are displayed in Table 1. Additionally, the percentage breakdown for each sector is illustrated in a pie chart.

Table 1: eCO2 Emissions, Energy Consumption & Costs by Sector (1990-1998)

Sector	1990			1998		
	eCO2 Emissions (t)	Energy (GJ)	Cost ($)	eCO2 Emissions (t)	Energy (GJ)	Cost ($)
Buildings	22,737	396,995	4,030,891	29,149	469,928	5,771,904
Vehicle Fleet	3,093	44,818	572,133	6,442	93,840	1,270,418
Streetlighting	9,939	140,205	2,635,083	10,402	135,192	2,794,426
Waste	458	-	-	453	-	-
Total	**36,227**	**582,018**	**7,238,107**	**46,446**	**698,960**	**9,836,748**

Note: See Appendix A for the multi-year detailed inventory data

Figures B through D clearly illustrate that the building sector is responsible for the majority of the City's eCO_2 emissions, energy use and energy costs, followed by streetlighting, vehicle fleet, and waste. Establishing this fact is necessary because it enables the City to set eCO_2 emission reduction priorities within different sectors based on where emission reduction measures will be most effective.

Figure B-1: 1990 eCO2 Emission Breakdown

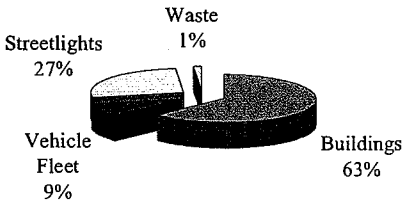


Figure B-2: 1998 eCO2 Emissions Breakdown

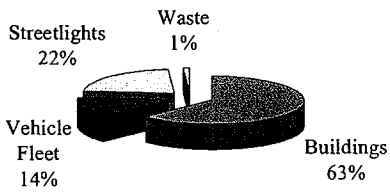


Figure C-1: 1990 Energy Use Breakdown

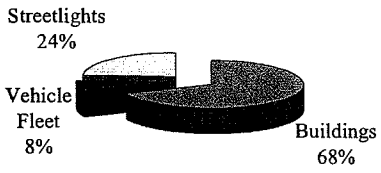


Figure C-2: 1998 Energy Use Breakdown

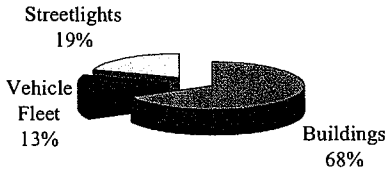


Figure D-1: 1990 Energy Costs Breakdown

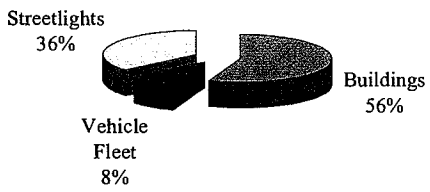
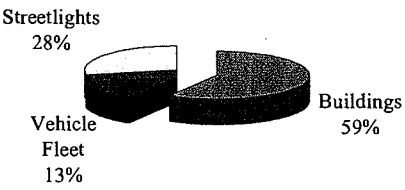


Figure D-2: 1998 Energy Cost Breakdown



3.2.1 1990 TO 1998 INVENTORY PROFILE CHANGES

Within Mississauga's corporate operations, eCO_2 emissions increased by 28%, energy consumption increased by 20% and energy costs increased by 36% between the 1990 and 1998 inventory period. The buildings sector was responsible for the majority of that growth, as displayed in the Change in Total section of Table 2. Although the buildings sector was responsible for the majority of the overall absolute growth, it was the vehicle fleet sector that experienced the greatest change: an increase of 108%, 109% and 122% in eCO_2 emissions, energy use and energy costs respectively. Reductions were found in the streetlighting energy costs and the corporate waste's eCO_2 emissions.

Table 2: Change in eCO2 Emissions, Energy Use, & Costs by Sector (1990-1998)

Sector	Change in Sector (1990 to 1998)			Change in Total (1990 to 1998)		
	eCO_2 Emissions	Energy	Cost	eCO_2 Emissions	Energy	Cost
Buildings	28%	18%	43%	18%	13%	24%
Vehicle Fleet	108%	109%	122%	9%	8%	10%
Streetlighting	5%	-4%	6%	1%	-1%	2%
Waste	-1%	-	-	0%	-	-
Total	**28%**	**20%**	**36%**	**28%**	**20%**	**36%**

4 CORPORATE MEASURE ANALYSIS

This section examines historic, current and potential eCO_2 reduction measures. 'Measures' refer to any action or means that the City has taken or will take to reduce the quantity of eCO_2emissions produced. By analyzing and quantifying the historic and current measures implemented within each sector, their effectiveness at reducing eCO_2 were assessed. Potential future eCO_2 emissions reduction measures then were evaluated based on:

- projected growth in population and corporate operations
- effectiveness of historic and current energy and eCO_2 emissions measures implemented by the City
- effectiveness of energy and eCO_2 emission reduction measures initiated by other municipalities and corporations

Three different future eCO_2 emission forecasts are presented in this report: **Business As Usual** (BAU), **Conservative**, and **Optimistic**. The BAU Forecast is an estimate of the future eCO_2 emissions in each sector based on the assumption that the past trends revealed in the inventory continue with the absence of any new reduction measures. The Conservative Forecast estimation incorporates future measures that are already planned or being considered by the City. The Optimistic Forecast incorporates future measures that are above and beyond today's anticipated measures. In the Conservative and Optimistic Forecasts, examples of other successful municipal measures are provided. The final segment of the Corporate Measure Analysis section summarizes the scenarios presented in each sector into three overall corporate scenarios.

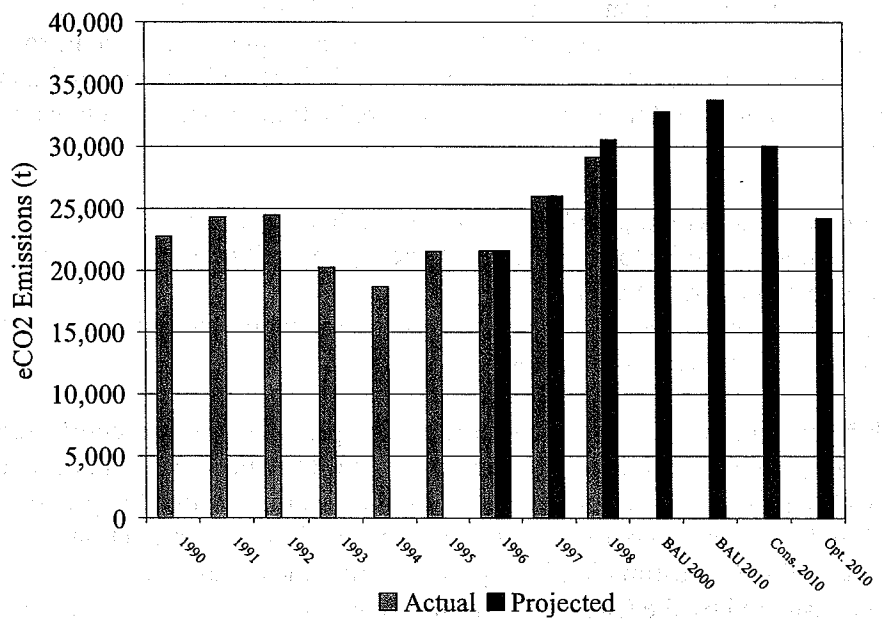
One of the reasons this Local Action Plan was developed was to determine a future eCO_2 emissions target. The City has experienced significant growth, which is reflected in the inventory, and growth is expected to continue into the future with the 2010 population predicted at over 150% that of 1990. One of the recommendations of this report is the adoption of a target that takes into consideration Mississauga's high growth rate but still remains challenging enough to have a positive environmental impact. This is discussed in the section 9, Corporate Summary & Target Recommendation.

4.1 LOCAL ACTION PLAN PROJECT TEAM INVOLVEMENT

The Local Action Plan Project Team, a subcommittee of the Mississauga Air Quality Advisory Committee (MAQAC), consisting of technical staff from the City was struck to assist in the Corporate Measure Analysis and Target Recommendation sections. Staff provided key information related to the quantification of current and historic measures, as well as planned future measures. The Project Team provided feedback on the proposed measures brought forward by ICLEI Energy Services (IES). Their feedback on the applicability, feasibility, and possibility of proposed measures was essential to this process because they have an understanding of the operations in which they work and they will be involved in any future implementation of the eCO_2 reduction measures recommended in this report.

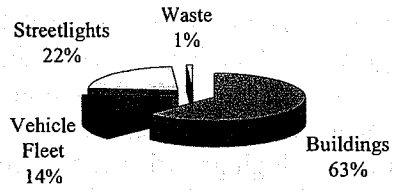
5 BUILDINGS SUMMARY

Figure E: Building Sector eCO2 Emissions



5.1 SECTOR OVERVIEW

Figure F: 1998 eCO2 Emissions Breakdown



The buildings sector consists of municipal facilities that are owned by the City. In 1998, 63% of the Corporation's emissions were generated by the buildings sector. Energy consumption was nearly 470,000 gigajoules (GJ) costing over $5.7 million. Since such a large portion of the City's eCO_2 emissions, energy consumption and costs are associated with the buildings sector there are also many opportunities for savings.

5.2 HISTORIC & CURRENT eCO2 EMISSIONS

The building sector eCO2 emissions profile illustrated in Figure E shows that eCO_2 emissions increased by 28% between 1990 and 1998. Energy consumption increased from 397,000 GJ to 470,000 GJ (18%) and energy costs increased from $4,031,000 to $5,772,000 (43%). These increases were despite the fact that the City's corporate building area nearly doubled from 215,000 m^2 to 420,000 m^2 (2,314,000 ft^2 to 4,521,000 ft^2) and energy use per unit area decreased by 39%. The Facilities and Property Management division is responsible for the energy management of City facilities and have implemented numerous demand side initiatives including everything from lighting upgrades to Energy Management Systems (EMS). For a detailed description of these measures, see Appendix B. The dark bars on Figure E between 1996 and 1998 illustrate

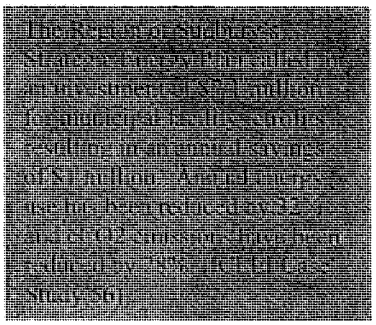
what the eCO2 emissions would have been had energy reduction measures *not* been implemented.

5.3 BAU 2010 FORECAST

In the BAU Forecast, the energy use trends in existing facilities remain constant. Facilities and Property Management anticipate adding four new facilities to the building stock, including an arena, library, sports complex, and the redevelopment of a community centre, together totaling over 20,000 m^2 (215,300 ft^2). The energy use patterns of similar facilities operated by the City were used to project the expected energy use and eCO_2 emissions. The results of the BAU forecasting indicate that eCO_2 emissions for 2010 are anticipated to be 48% above 1990 levels and 16% above 1998 levels.

5.4 CONSERVATIVE 2010 FORECAST

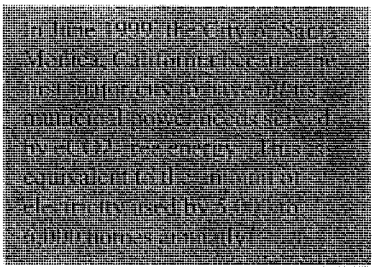
In response to a 33% increase in energy costs over the past two years, Facilities and Property Management have established the 'Energenius' program with the goals of reducing utility consumption by 5%, improving the energy efficiency of existing facilities, and creating energy awareness among staff. An Energy Management Team has developed a strategy to meet the program goals by improving energy monitoring systems, evaluating energy procurement potential, and identifying energy efficiency opportunities.



It is anticipated that the eCO_2 emissions in this Conservative Forecast for 2010 will amount to 32% above 1990 levels and 3% above 1998 levels.

5.5 OPTIMISTIC 2010 FORECAST

The Optimistic Forecast was formulated with the consideration of two types of eCO_2 reduction measures: energy efficiency and energy procurement. Research by building science experts indicates that a 25% improvement in energy efficiency in typical building stock using market proven conventional upgrades is considered economical within a 5- to 7-year payback range. This general finding is supported by numerous sources[7].



The City will soon have its choice of electricity suppliers with Ontario's electricity market being opened up to competition. This not only enables the City to choose suppliers based on service and value, but also enables the City to consider the eCO_2 emissions related to its electricity usage. This presents a significant opportunity as the City could choose to purchase low-eCO_2 or eCO_2-free power to help meet its target if and when it becomes available and practicable.

---

[7] National Climate Change Secretariat's Municipalities Table; Commercial and Institutional Options, KPMG; High-Performance Commercial Buildings: A Technology Roadmap, U.S. Department of Energy, Office of Building Technology

The Optimistic Forecast considers the foreseen growth in the building stock and includes an overall reduction in energy use of 25%, to be met using a combination of energy efficiency initiatives and green power purchasing strategies. The anticipated eCO_2 emissions in the optimistic forecast for 2010 amount to 6% above 1990 levels and 17% below 1998 levels.

5.6 FORECAST SUMMARIES

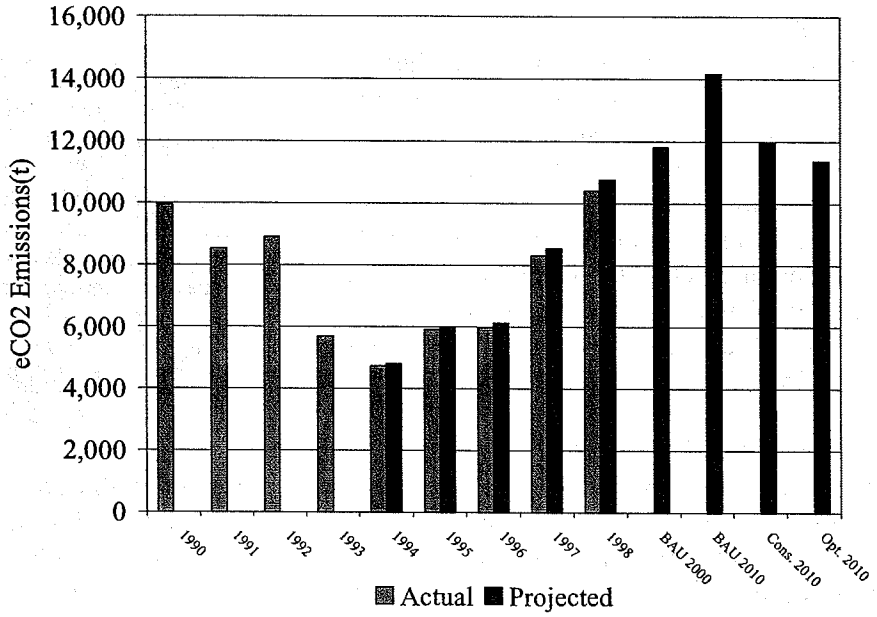
Table 3 displays the three different forecast results in relation to 1990 and 1998 levels. An absolute decrease in eCO_2 emissions is only achievable when the optimistic forecast is related to 1998 levels.

Table 3: Building Sector Forecast Summaries

Forecast Type	2010 Forecast from 1990	2010 Forecast from 1998
BAU Forecast	+48%	+16%
Conservative Forecast	+32%	+3%
Optimistic Forecast	+6%	-17%

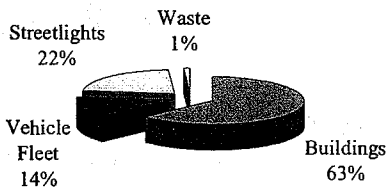
6 STREETLIGHTING SUMMARY

Figure G: Streetlighting Sector eCO2 Emissions



6.1 SECTOR OVERVIEW

Figure H: 1998 eCO2 Emissions Breakdown



The streetlighting sector in the corporate profile includes traffic signals, parks and outdoor recreation lights, and street lights. Streetlighting accounted for 22% of the Corporation's 1998 eCO_2 emissions profile. Approximately 135, 000 gigajoules (GJ) of energy was consumed at a cost of $ 2.7 million.

6.2 HISTORIC & CURRENT eCO2 EMISSIONS

Emissions of eCO_2 from the streetlighting sector increased by 5% between 1990 and 1998. Energy consumption decreased from 140,000 GJ to 135,000 GJ (4%) and energy costs increased from $2,635,000 to $2,794,000 (6%). Over that time the number of streetlights increased by approximately 3% per year, but an increase in energy use was offset by lighting retrofit projects including the total conversion from mercury vapour streetlights to high-pressure sodium, and with the installation of krypton gas traffic signalss. Detailed descriptions of these retrofits are included in Appendix B. Had these retrofits not been completed, eCO_2 emissions would have been 8% higher than 1990 levels in 1998, which is illustrated by the dark bars between 1994 and 1998 on the above graph.

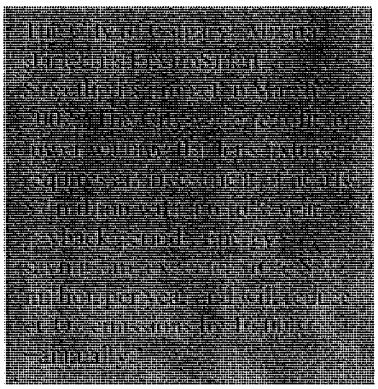
6.3 BAU 2010 FORECAST

The BAU Forecast predicts an annual 2% growth in the number of streetlights between 1998 and 2010 and that no further eCO_2 reduction measures are implemented. With this

scenario, eCO_2 emissions are expected to increase to 43% above 1990 levels and 36% above 1998 levels by 2010.

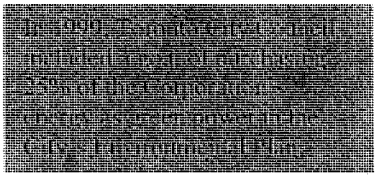
6.4 Conservative 2010 Forecast

The City currently has LED traffic signals installed on left hand turning signals and is considering retrofitting the remaining traffic signals to increase the maintenance and energy costs saving. LED traffic signals save 85% of the energy used by incandescent bulbs. The Conservative Forecast takes into consideration the expected growth in the sector, but also anticipates that the LED conversion of traffic signals will be completed. With this scenario, eCO_2 emissions in 2010 are expected to increase to 20% above 1990 levels and 15% above 1998 levels.



6.5 Optimistic 2010 Forecast

With the opening of Ontario's electricity market the City is presented with new opportunities for green power procurement. The Optimistic Forecast includes the growth in streetlights and retrofit program from the conservative forecast, but also includes a 5% eCO_2-free power purchase. The City will have the opportunity to purchase any or all of its power as green power, but considering that the cost and availability of such power is uncertain, a 5% scenario was considered as a starting point. Under this scenario, eCO_2 emissions in 2010 are expected to increase by 14% above 1990 levels and 9% above 1998 levels.



6.6 Forecast Summaries

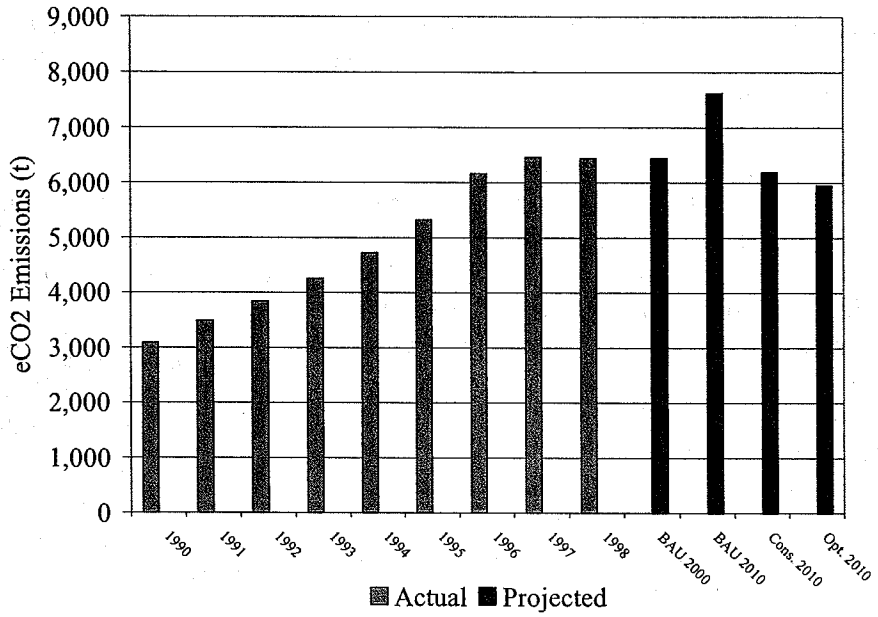
Table 4 summarizes the three forecast scenarios in relation to 1990 and 1998 eCO_2 emission levels. All three scenarios predict an increase in emissions based on both 1990 and 1998.

Table 4: Streetlighting Sector Forecast Summaries

Forecast Type	2010 Forecast from 1990	2010 Forecast from 1998
BAU Forecast	+43%	+36%
Conservative Forecast	+20%	+15%
Optimistic Forecast	+14%	+9%

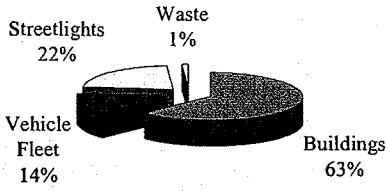
7 VEHICLE FLEET SUMMARY

Figure I: Vehicle Fleet Sector eCO2 Emissions



7.1 SECTOR OVERVIEW

Figure J: 1998 eCO2 Emissions Breakdown



The vehicle fleet sector in the Corporate profile includes energy use related to vehicles and specialized equipment owned and rented by the City as well as employees' personal vehicles used on City business. The vehicle fleet sector contributed 14% of the Corporation's eCO_2 emissions in 1998. Approximately 94,000 gigajoules (GJ) of energy were consumed, costing over $1.2 million.

7.2 HISTORIC & CURRENT eCO2 EMISSIONS

The vehicle fleet profile in Figure I shows that the eCO_2 emissions in this sector have nearly doubled since 1990 despite the fact that the City has purchased more efficient vehicles. Energy use has increased from 45,000 GJ to 94,000 GJ (109%) and energy costs have increased from $572,000 to $1,270,000 (122%). The number of vehicles in the City's fleet increased from 298 in 1990 to 383 in 1998 (28%), with the greatest increase occurring in the light truck vehicle category. Over the 8-year timeframe, personal vehicle energy use nearly tripled, accounting for 55% of the vehicle fleet emissions in 1990 and 74% in 1998.

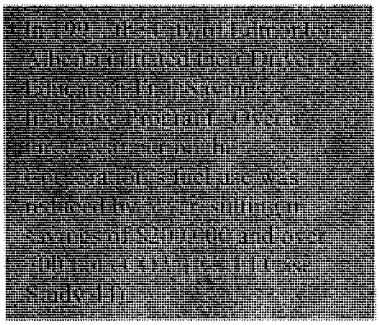
Although vehicle fleet emissions have increased significantly, the City has initiated several reduction efforts, including: the corporate ride share program, bike to work promotions, and the City's emissions testing of its heavy duty vehicles and buses. For a detailed description of these measures, see Appendix B.

7.3 BAU FORECAST

The BAU Forecast includes the assumption that the City's vehicle fleet will continue to grow in the same proportion to population growth as it did between 1990 and 1998. Should this be the case, eCO_2 emissions in 2010 will increase to 146% above 1990 levels and 18% above 1998 levels.

7.4 CONSERVATIVE 2010 FORECAST

The City has a corporate ride share program that has so far demonstrated limited success. This forecast anticipates that the trip reduction program be enhanced to begin reducing associated eCO_2 emissions. This forecast was based on typical municipal trip reduction programs, which commonly demonstrate successes near 15%. Components of a trip reduction plan may include, but are not limited to:

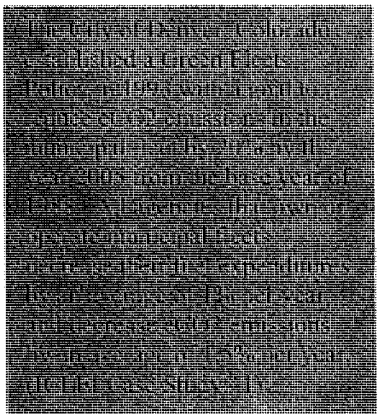


- Telephone conference calls
- Reduction in the number of City owned vehicles
- Driver education on vehicle idling
- Preferential parking for car/van-pools, bicycles
- Improved vehicle maintenance

Should a 15% reduction in eCO_2 emissions from a trip reduction program be achieved, 2010 emission levels will be 100% above 1990 levels and 3% below 1998 levels.

7.5 OPTIMISTIC 2010 FORECAST

There has been significant growth in the City's fleet, from 298 vehicles in 1990 to 383 vehicles in 1998 (28%) while personal vehicle use for City business nearly tripled. No organized effort to control this growth from an energy use and eCO2 emissions perspective has been made. The Optimistic Forecast includes the potential to manage fleet growth in a 'green fleets' program, for which other municipalities experience typical reductions in eCO_2 emissions of 5% as well as an employee trip reduction program demonstrating an additional 15% eCO_2 reduction. A 'green fleets' program may include, but is not limited to:



- More efficient engines
- Expansion of voluntary vehicle emission testing not required under Ontario's Drive Clean program
- Purchasing policies for alternative vehicles and fuels
- Parking fees

Achieving a 5% emissions reduction from an employee trip reduction program and a 15% reduction from a green fleets program would reduce eCO_2 emissions in 2010 to 93% above 1990 levels and 7% above 1998 levels.

7.6 FORECAST SUMMARIES

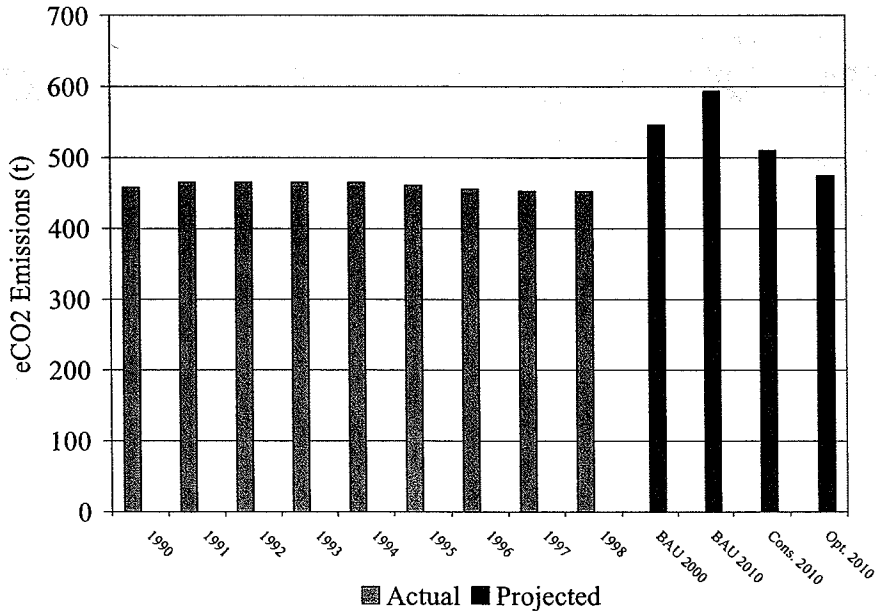
Table 5 displays the three different forecast scenarios in relation to 1990 and 1998 eCO_2 emission levels. It shows that absolute reductions are only feasible in the conservative and optimistic forecasts in relation to 1998.

Table 5: Vehicle Fleet Sector Forecast Summaries

Forecast Type	2010 Forecast from 1990	2010 Forecast from 1998
BAU Forecast	+146%	+18%
Conservative Forecast	+100	-3%
Optimistic Forecast	+93%	-7%

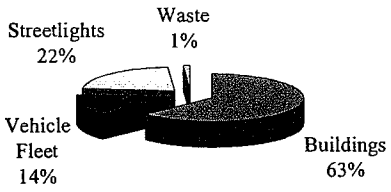
8 WASTE SUMMARY

Figure K: Waste Sector eCO2 Emissions



8.1 SECTOR OVERVIEW

Figure L: 1998 eCO2 Emissions Profile



The waste sector profile in the eCO_2 emissions profile includes waste generated through corporate operations, *not* the community at large. (The eCO_2 emissions from the community at large are included in the City's community inventory). Waste from corporate operations accounted for only 1% of the entire eCO_2 emissions profile.

8.2 HISTORIC & CURRENT eCO2 EMISSIONS

The eCO2 emissions from corporate waste remained fairly constant between 1990 and 1998, despite a 13% increase in the number of City employees (from 4,083 in 1990 to 4,630 in 1998). The eCO_2 emissions per employee decreased due to the implementation of the GO Green Program in 1995 (a waste separation and recycling program). Although information relative to the quantification of eCO_2 emissions avoided for this program are not available, the program has demonstrated successes, such as a 20% decrease in the amount of waste generated at the Civic Centre within a year of starting the program. The 2000 BAU projection is based on the eCO_2 emissions per employee remaining constant and the known increase in the number of employees.

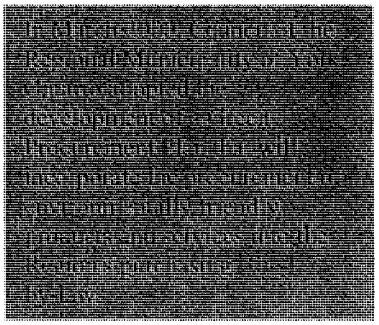
8.3 BAU 2010 FORECAST

The number of City employees has already increased to 5,577 in 2001. If the growth in the number of employees relative to the population growth experienced between 1990 and 2001 remains constant to 2010, then the number of City employees can be expected

to reach 6,063. With the assumption that eCO_2 emissions per employee will remain constant, then the total eCO_2 emissions from the waste sector in 2010 can be expected to be 30% above 1990 levels and 31% above 1998 levels.

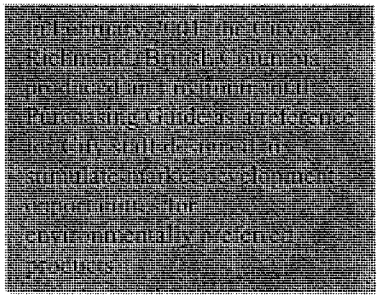
8.4 CONSERVATIVE 2010 FORECAST

There are plans to expand the City's GO Green Program into more facilities each year. In the Conservative Forecast scenario the projected growth in City employees is included, and the amount of waste generated per employee is expected to decline by an additional 14%, as it did between 1990 and 1998. Given this scenario, 2010 eCO_2 emissions are expected to be 10% above 1990 levels and 13% above 1998 levels.



8.5 OPTIMISTIC 2010 FORECAST

The Optimistic Forecast anticipates that the GO Green program will be expanded to incorporate more waste reduction and diversion measures resulting in further eCO_2 emission reductions. This could include employee education, which is currently not a key feature in the GO Green Program, green purchasing policies, and the expansion of electronic storage space on employees' computers to avoid unnecessary printing. It is estimated that these program expansions could result in an additional 6% reduction in eCO_2 emissions, resulting in a 4% increase from 1990 levels in 2010 and a 5% increase from 1998 levels.



8.6 FORECAST SUMMARIES

Table 6 shows the three forecast scenarios in relation to 1990 and 1998 eCO_2 emissions levels. In each scenario the projected emissions are greater than 1990 and 1998 levels.

Table 6: Waste Sector Forecast Summaries

Forecast Type	2010 Forecast from 1990	2010 Forecast from 1998
BAU Forecast	+30%	+31%
Conservative Forecast	+10%	+13%
Optimistic Forecast	+4%	+5%

9 CORPORATE SUMMARY & TARGET RECOMMENDATION

Figure M: Corporate eCO2 Emission Scenarios

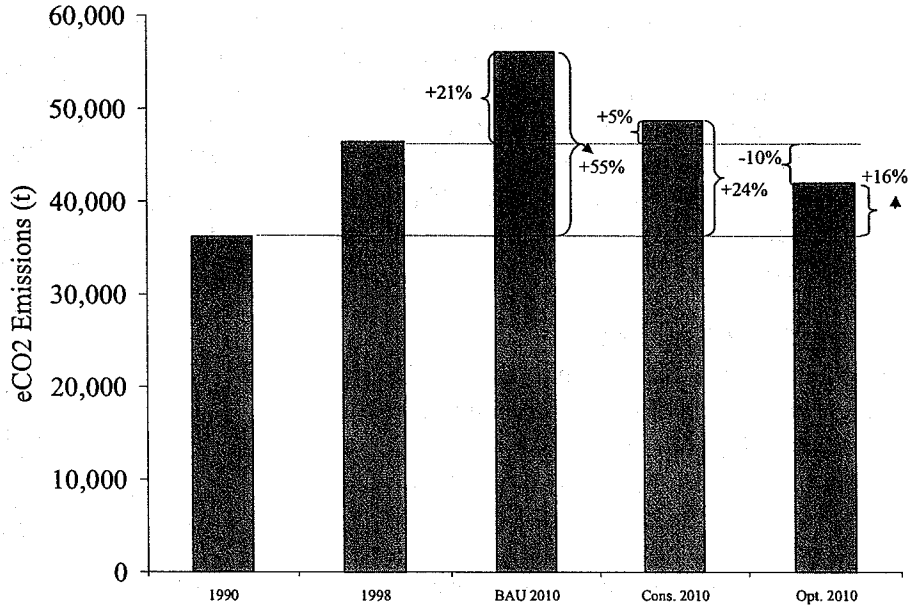


Table 7: Corporate Forecast Summary

Forecast Type	2010 Forecast from 1990	2010 Forecast from 1998
BAU Forecast	+55%	+21%
Conservative Forecast	+24%	+5%
Optimistic Forecast	+16%	-10%

Figure M and Table 7 demonstrate the three summarized 2010 forecast scenarios in relation to the overall 1990 and 1998 eCO_2 emission levels. Should BAU trends continue 2010 eCO_2 emissions will be 55% higher than 1990 levels and 21% higher than 1998 levels. Under the Conservative Forecast eCO_2 emissions are expected to rise to 24% above 1990 levels and 5% above 1998 levels. Finally, under the Optimistic Forecast, a 16% increase from 1990 levels is expected and a 10% decrease from 1998 levels.

With a good understanding of what future eCO_2 emissions will be under different scenarios based on varying degrees of effort and investment on behalf of the City, the next task is to choose an eCO_2 emissions target that will be challenging yet feasible. The City is faced with a difficult situation in that growth has been so high that achieving a future target based on an absolute reduction from 1990 levels would be ***near impossible.*** Another approach that municipalities facing high growth scenarios often use in addressing eCO_2 emissions is to view them on a relative basis rather than an absolute basis, such as eCO_2 emissions per capita. This essentially removes a variable, in this

case, population, one of the major contributors to the City's historic and forecasted growth.

Per capita eCO_2 emissions are displayed in Table 8. Under the **BAU** 2010 Forecast, eCO_2 emissions are expected to increase by 1.5% per capita from 1990 levels and 1.9% per capita from 1998 levels. The **Conservative** Scenario forecasts a 13.6% decrease in eCO_2 emission per capita from 1990 levels and 11.6% from 1998 levels while in the **Optimistic** Forecast eCO_2 emissions are predicted to decrease by 24.0% per capita from 1990 levels and 23.7% per capita from 1998 levels.

Table 8: Forecast Scenarios Per/Capita for 2010

eCO_2 Emissions Level	BAU 2010 Forecast *8.24e-2 t/capita*	Conservative 2010 Forecast *7.15e-2 t/capita*	Optimistic 2010 Forecast *6.17e-2 t/capita*
1990 *(8.12e-2 t/capita)*	+1.5%	-13.6%	-24.0%
1998 *(8.09e-2 t/capita)*	+1.9%	-11.6%	-23.7%

In order to define an eCO_2 emissions target, three decisions must be made:

1. What will the baseline year be? *Baseline year refers to the reference year from which the target will be set.*
2. What will the forecast year be? *Forecast year refers to the year in which the target will be met.*
3. What will the eCO_2 emissions reduction be?

Most PCP members with established eCO_2 reduction targets have adopted the PCP's preferred targets of a 20% reduction in emissions for municipal operations and a minimum 6% reduction in the community, both within 10 years of joining the PCP program. The suggested 6% reduction in the community is based on Canada's Kyoto Protocol commitment while the 20% corporate operations target was designed to be more rigorous because it is an area over which the corporation has direct control and can demonstrate leadership. The three future eCO_2 emissions forecasts were developed to ensure Mississauga adopts a target that is achievable in light of the City's high population growth and expanded corporate services.

The three forecast scenarios were considered by the members of the Project Team and it was recommended that the Conservative 2010 target in relation 1998 baseline levels would be the most appropriate given the City's historic and future growth patterns and the City's ability to implement a reduction program. A 1998 baseline year was selected because it is historic enough that the City can obtain credit for its successful eCO_2 emission reduction measures and the eCO_2 emissions are at a level from which future absolute eCO_2 emissions can be achieved. A 2010 forecast year was chosen because it provides sufficient time to initiate and witness the benefits of new eCO_2 emission reduction measures.

Therefore, the recommended target can be expressed in absolute terms as ***'limiting eCO_2 emissions to a 5% increase from 1998 levels by 2010'***. Alternatively, this may be expressed as ***'reducing per capita eCO_2 emissions to 12% below 1998 levels by 2010'***.

9.1 Estimated Savings, Investment, & Payback

Achieving the Conservative Forecast scenario will mean finding opportunities to save 66,000 gigajoules (GJ) of energy annually within the buildings, vehicle fleet, and streetlighting sectors. This will require a broad range of measures with varying costs and paybacks. These are aggregated into a comprehensive plan with a single investment and payback goal. This deep retrofit approach will allow for an aggregated payback of up to seven years. In effect, short-term paybacks in the two- to three-year range will offset the cost of longer term paybacks over the seven-year target. See Appendix C for the principles of a deep retrofit approach.

The Conservative Forecast scenario calls for a reduction in energy use of nearly 66,000 GJ within the City's buildings, vehicle fleet, and streetlighting sectors. While enhanced streetlighting technologies enable practicable and environmentally beneficial retrofits that reach the energy savings potential within an average two-year payback range, the vehicle fleet and buildings sectors will require an aggregated payback range of seven years.

The potential cost savings can be extrapolated from the potential energy savings with some knowledge of predicted future energy prices. While electricity, gasoline and diesel prices are expected to remain constant, natural gas prices are expected to increase by over 130% between 1998 and 2010. See Appendix D for an explanation of future energy pricing trends.

It is estimated that under the Conservative Forecast scenario the total cost savings within the buildings, vehicle fleet and streetlighting sectors is $1.2 million per year with an investment of $6 million for a blended simple payback period of 5 years.

10 FINANCING OPTIONS

After identifying potential opportunities to reduce emissions the City will have to prioritize its list of possible measures and then examine the design and cost of implementing them (Appendix D summarizes some of the many potential emission reduction measures that City could implement). While some of the measures will be no-cost or low-cost items that can be undertaken with existing operating or capital budgets, there will remain a significant number of items that will require additional financing. These will include measures that involve more extensive retrofits and paybacks averaging seven years.

For these more significant measures there are a variety of financing choices from which the City can choose. As mentioned previously, if the measures examined are low-cost or no-cost 'no regrets' measures then frequently it is possible to implement them through existing operating or capital budgets. For more extensive measures other financing options, such as those that are described below, may be more appropriate.

10.1 INTERNAL SELF-FINANCING

Even at a time of greater accountability and budget scrutiny it is possible to make a case for **internal funds** to be allocated from either a department or the City budget for eCO_2 reduction measures. This is especially true for projects that bring additional benefits to the City over and above the reduction in eCO_2 emissions.

Besides turning to existing budgets, another internal financing option that the City can consider is the establishment of a **revolving fund** for energy efficiency and eCO_2 reduction projects. A revolving fund will require that a certain amount of capital be set aside to finance projects that meet the criteria of achieving emission reductions and energy efficiency. Projects then 'borrow' money from the fund and the fund is repaid through the projects' savings. Since the savings are always being returned to the fund, the fund can, in theory, continue to grow without the addition of new money. Depending on the design of the revolving fund, after the borrowed money is repaid all or some of the savings can be returned to the department that undertook the project as an incentive or reward for undertaking the project.

10.2 EXTERNAL FINANCING

To assist Canadian municipalities that are undertaking 'green' improvements, the Government of Canada has established a partnership with the Federation of Canadian Municipalities (FCM) to share the risk of implementing new, efficient technologies or best practices. The **Green Municipal Enabling Fund** (GMEF) is a $50 million fund that provides grants to support feasibility studies of innovative municipal projects. Grants cover up to 50% of the eligible costs. To support the implementation of municipal projects that can have a significant impact on improving environmental performance, particularly in reducing eCO_2 emissions, the **Green Municipal Investment Fund** (GMIF) is a $200 million permanent revolving fund available to municipalities.

Some eCO_2 reduction projects may be ideal candidates for **partnerships** with third parties. These may include local utilities, private companies, or other government or non-government programs and agencies.

Another financing option unique to energy efficiency projects is working with an **energy service company**. Commonly referred to as an ESCO, energy service companies will arrange for the financing of an energy efficiency project to be repaid from the savings the project achieves.

A source of funds for energy efficiency projects that municipalities can utilize is **insurance companies**. Some insurance companies will loan money for energy efficiency projects at lower rates than ESCOs can obtain. This means that rather than having to accept the borrowing rate that an ESCO charges, a municipality is able to obtain the financing for the project from an insurance lender and still work with an ESCO to benefit from its technical and project management expertise.

Other external financing options that some eCO_2 reduction measures may qualify for include the **Sustainable Development Technology Canada** (SDTC) and the **Climate Change Action Fund** (CCAF). These organizations fund innovative (often research) projects that lead to significant reductions in energy and eCO2 emissions. Since both of these organizations disburse funds by a request for proposals (RFP) procedure it is important to be aware of their deadlines and funding application requirements. Municipalities are eligible to submit applications to both programs but the rules may be different with each project RFP.

At the May 9, 2002 Ontario Throne Speech it was announced that municipalities will be given the power to borrow money through **bond issues** to finance infrastructure projects[8]. While the details of this announcement have not been worked out, issuing bonds for energy efficiency projects appears to be yet another financing source for municipalities.

Regardless of the financing option selected by the City, the key to a successful project is to monitor project costs and track savings. This will ensure that the anticipated savings are achieved and, if projects are not performing as anticipated, corrections are made in a timely fashion. The success of these projects lays the groundwork for future measures.

[8] The Honourable James K. Bartleman, Lieutenant Governor of Ontario, Speech from the Throne, A New Era for Ontario, May 9, 2002, http://www.premier.gov.on.ca:80/english/library/thronespeech-May0902.htm

11 IMPLEMENTATION OF THE LOCAL ACTION PLAN

To implement the corporate component of the Local Action Plan, the following actions need to be taken:

- The Mississauga Air Quality Advisory Committee (MAQAC) review this document and endorse the recommended eCO_2 emissions target
- City Council approve the implementation of the Local Action Plan to achieve the eCO_2 emissions target by doing the following:

1. Continue with the energy efficiency and other eCO_2 reduction efforts that are planned or underway and design and implement new eCO_2 reduction measures
2. Establish funding mechanisms to support the City's efforts towards meeting the eCO_2 emissions target by 2010
3. Establish a monitoring and verification program to ensure the City remains on track towards meeting its eCO_2 emission goals

12 PART THREE: COMMUNITY GREENHOUSE GAS EMISSION INVENTORIES

12.1 BACKGROUND

A greenhouse gas emissions inventory involves collecting data on fuel, energy, and waste from all the sectors that make up a community. In a community emissions inventory, energy consumption data in the residential, commercial, industrial, and transportation sectors are gathered, along with community waste generation and disposal information. Once energy consumption and waste generation data are collected, appropriate emission coefficients for each year can be applied to calculate the resulting greenhouse gas emissions. Annual emissions are expressed in ***absolute terms*** and are not corrected for weather or community growth, in the same way that reduction targets are based on absolute amounts, or expressed as per capita figures.

Although electricity does not emit carbon dioxide (CO_2) when it is used, there are significant emissions of CO_2 at fossil fuel (coal, oil, natural gas) power plants where electricity is generated. These emissions are incorporated into the end use of electricity through the equivalent CO_2 coefficient (eCO_2) for electricity. This coefficient is an annual average, and its value depends on how much fossil fuel generation is used in the electricity generation mix of all electricity power plants in Ontario, since the generation of electricity by hydropower, nuclear, or renewable energy does not produce CO_2 emissions. Because Ontario's electrical generation mix changes from year to year so does its CO_2 electricity coefficient. This means that in some cases, even when a municipality reduces its energy consumption, its greenhouse gas emissions may remain constant or even increase because the amount of fossil fuel electricity generation in the province's electricity generation mix has increased.

12.2 COMMUNITY GREENHOUSE GAS EMISSIONS INVENTORY (MILESTONE ONE)

Data on the five sectors in the community profile (residential, commercial, industrial, transportation, and waste) for the years 1990 to 1998 were gathered and analyzed by City staff and interns beginning in 1999. In some sectors where there were gaps, data were estimated. The greenhouse gas emissions tracked include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), expressed as equivalent CO_2 (eCO_2).

12.2.1 COMMUNITY EMISSIONS INVENTORY RESULTS

In recent years the City of Mississauga has grown at a steady rate, and is one of the fastest-growing cities in Canada. From 1990 to 1998, Mississauga's population increased by 29%. Consequently, the number of new homes, industrial and commercial establishments, new services, and the amount of traffic have increased, resulting in a rise in greenhouse gas emissions in the City.

While the City gathered inventory data from 1990 to 1998 in order to provide some updated figures, greenhouse gas emissions and energy consumption for 2000 and 2010

were estimated. The estimates were based on population growth from 1998 to 2000 or 2010, used year 2000 electricity coefficients, and assumed that no new emission reduction measures were implemented. These estimates are referred to as "Business As Usual" (BAU) scenarios. Table 9 below lists total energy consumption in gigajoules (GJ) and eCO_2 emissions in tonnes (t) in the Mississauga community, as well as per capita energy consumption and emissions.

Table 9: Community Energy Consumption and eCO2 Emissions

Year	Energy (GJ)	Per capita Energy Use (GJ/capita)	eCO_2 (t)	Per capita eCO_2 (t/capita)
1990	97,928,238	219.6	5,921,839	13.3
1991	101,510,120	219.1	5,892,577	12.7
1992	108,291,813	225.6	6,262,255	13.0
1993	117,852,851	238.1	6,333,688	12.8
1994	122,321,154	239.1	6,414,561	12.5
1995	118,132,650	223.7	6,418,988	12.2
1996	127,487,328	234.2	6,881,694	12.6
1997	129,717,241	231.6	7,291,133	13.0
1998	126,747,304	220.7	7,650,665	13.3
BAU 2000	134,859,128	220.8	8,394,943	13.7
BAU 2010	151,042,227	221.7	9,402,336	13.8

From 1990 to 1998, community energy use increased by 29% in absolute terms, as shown in Figure N below.

Figure N: Total Community Energy Consumption

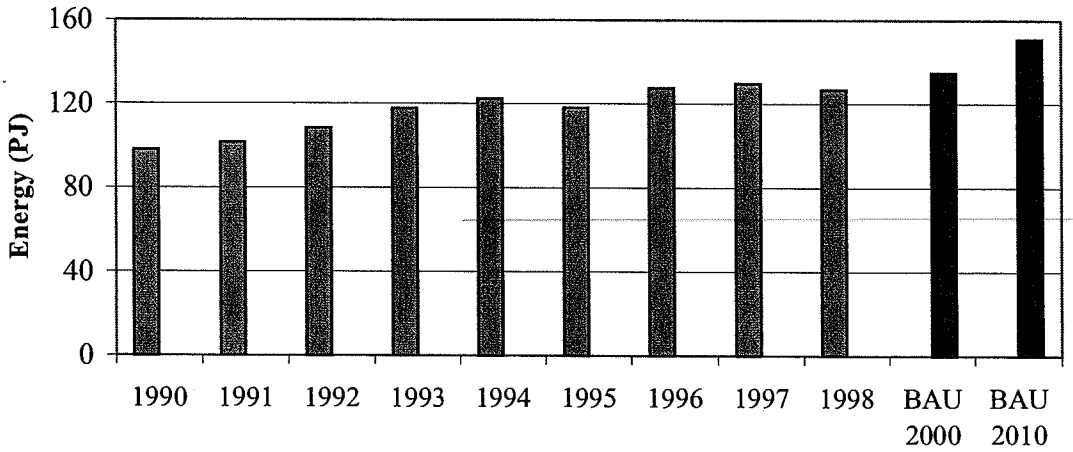
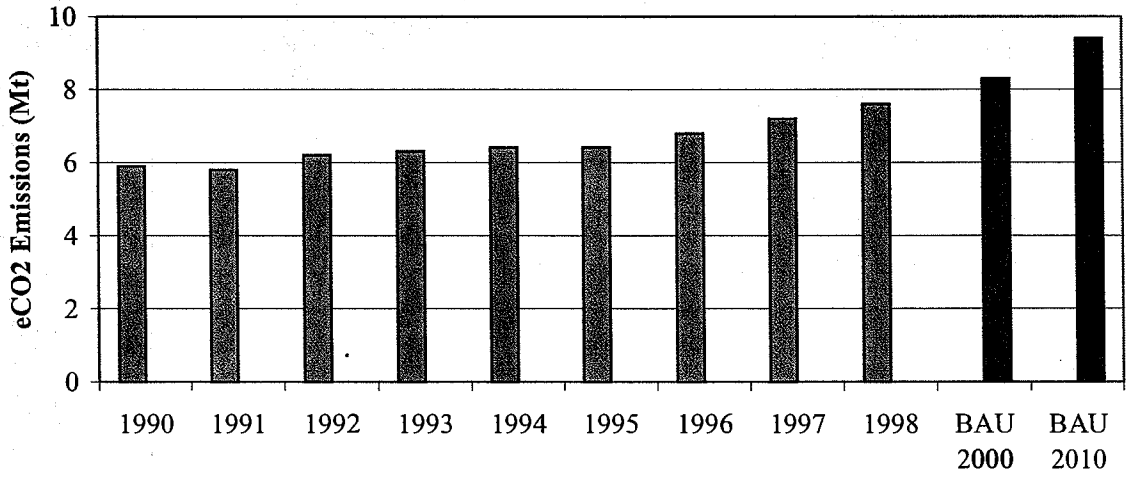


Figure O demonstrates how total community eCO_2 emissions increased by 29% from 1990 to 1998 in absolute terms. As mentioned previously, emissions of eCO_2 are inextricably linked to the amount of electricity consumed. However, changes in the method of electricity generation (coal vs. nuclear vs. hydropower) from year to year will affect the total emissions of eCO_2 from energy consumption.

Figure O: Total Community eCO2 Emissions



While energy consumption and greenhouse gas emissions have increased as a result of the City's population increase, on a ***per capita*** basis eCO_2 emissions and energy consumption remained fairly constant from 1990 to 1998, indicating that Mississauga has increased its overall energy efficiency.

Mississauga's per capita energy consumption ranged from 220 GJ per capita in 1990 to a peak of 239 GJ per capita in 1994, to 221 GJ per capita in 1998, as shown in Figure P.

Figure P: Per Capita Community Energy Consumption

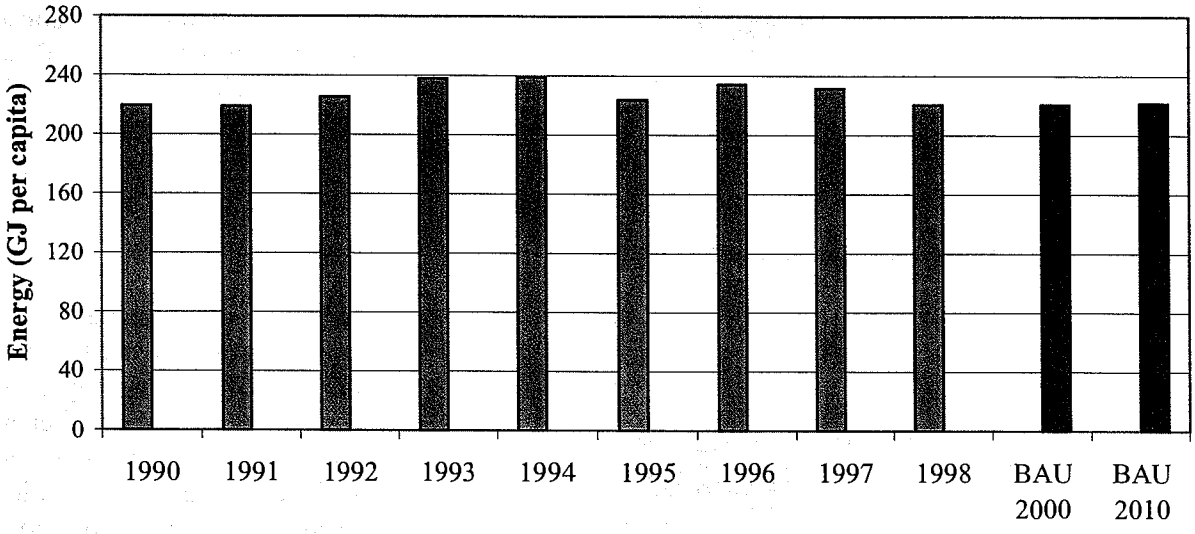
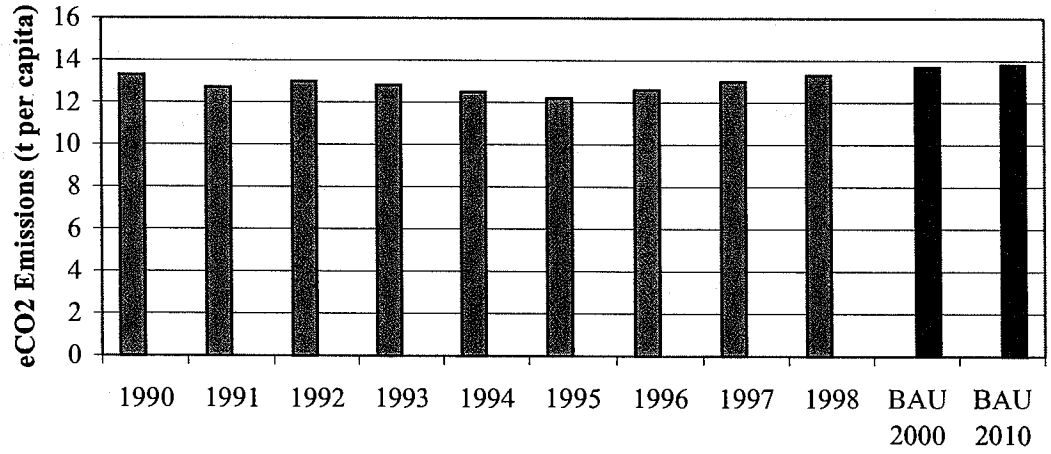


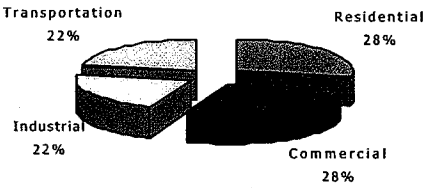
Figure Q tracks Mississauga's per capita community eCO_2 emissions, which have remained fairly constant over the years, despite variations in the Province of Ontario's electricity generation mix.

Figure Q: Per Capita Community eCO2 Emissions



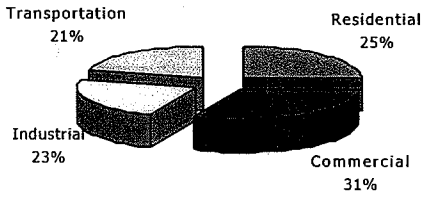
Note: Projected eCO2 emissions for 2000 and 2010 are higher than in 1998 because of the change in the electricity coefficients. Forecasts for 2000 and 2010 were developed using 2000 electricity coefficients, a year in which more electricity was produced in Ontario through the combustion of coal, compared to 1998.

Figure R: 1990 Total Energy Consumption by Sector



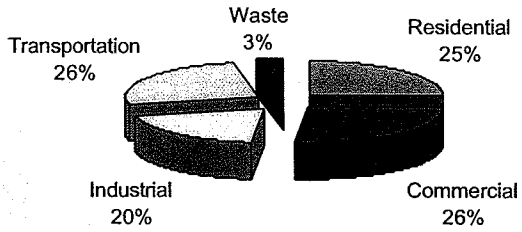
In 1990, the commercial and residential sectors each represented 28% of the total community energy consumption. The transportation and industrial sectors each represented 22% of total community energy use.

Figure S: 1998 Total Energy Consumption by Sector



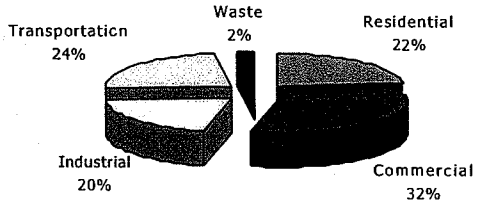
In 1998, commercial energy consumption increased to nearly one-third of total community energy consumption. Industrial energy consumption also increased slightly, while energy consumption in the residential and transportation sectors showed a small decrease.

Figure T: 1990 Total eCO2 Emissions by Sector



In 1990, total community eCO2 emissions from the commercial, transportation, and residential sectors were nearly equal, at approximately 25% each. The industrial sector accounted for 20% of total emissions, with the community waste sector accounting for only 3%.

Figure U: 1998 eCO2 Emissions Total by Sector



In 1998, commercial eCO_2 emissions increased, representing nearly one-third of total eCO_2 emissions, while emissions in the remaining four sectors either decreased slightly or remained the same.

12.2.2 COMMERCIAL

The commercial sector includes institutions (churches, government, hospitals, museums, non-City recreational facilities, and schools), offices (medical, financial, multi-use offices and buildings), retail (restaurants, shopping centres, store-fronts, grocery stores, garages, and warehouses), and any other unspecified commercial structures.

This sector accounts for the greatest portion of Mississauga's total community eCO_2 emissions, representing 31% of total community energy use and eCO_2 emissions in 1998. Additionally, this sector also showed the largest increase in energy consumption and eCO_2 emissions from 1990 to 1998 of all five community sectors.

Table 10 below lists the energy consumption in gigajoules (GJ) and eCO_2 emissions in tonnes (t) for Mississauga's commercial sector.

Table 10: Commercial Energy Consumption and eCO2 Emissions

Year	Energy (GJ)	eCO_2 (t)
1990	27,057,447	1,599,608
1991	26,622,620	1,450,924
1992	28,206,325	1,563,531
1993	35,289,023	1,629,758
1994	38,294,495	1,670,872
1995	37,349,503	1,769,207
1996	40,124,687	1,888,063
1997	40,522,518	2,111,844
1998	39,418,340	2,377,619
BAU 2000	41,941,114	2,700,062
BAU 2010	46,974,047	3,024,169

As shown in Figure V, commercial energy consumption increased by 45% from 1990 to 1998.

Figure V: Commercial Energy Consumption

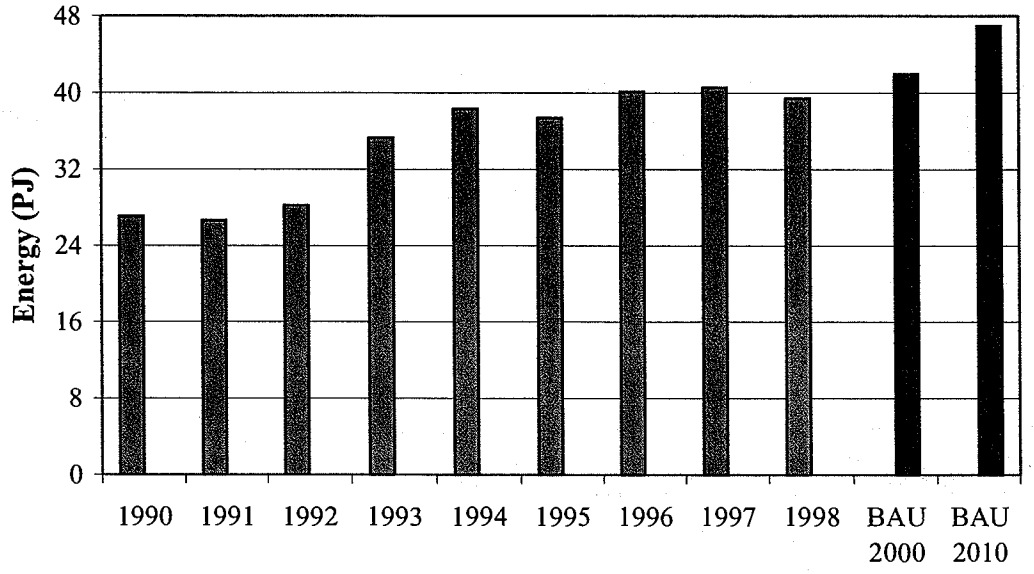
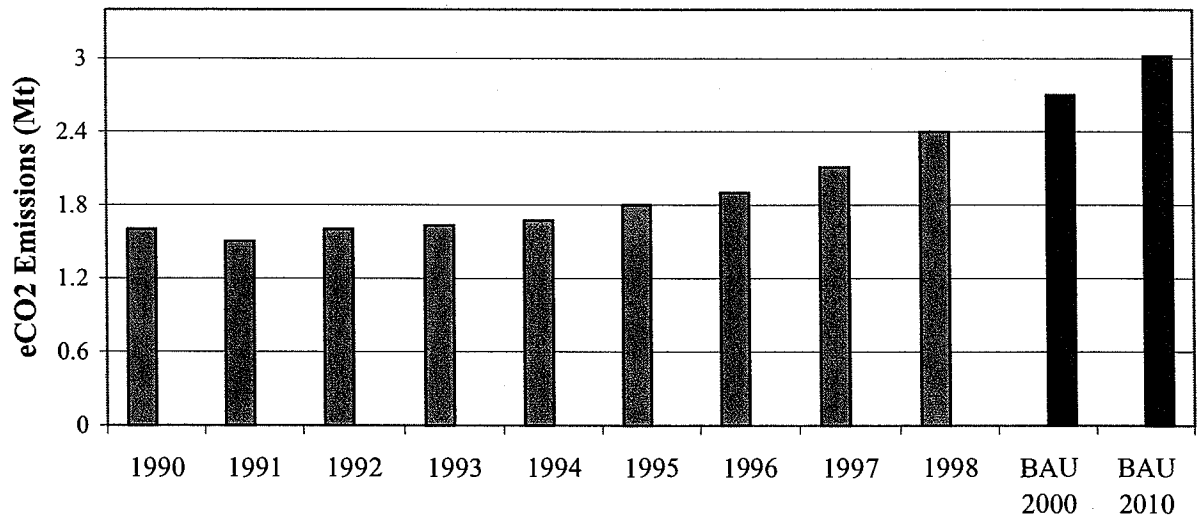


Figure W shows how commercial eCO_2 emissions increased 49% during the period from 1990 to 1998

Figure W: Commercial eCO2 Emissions



12.2.3 TRANSPORTATION

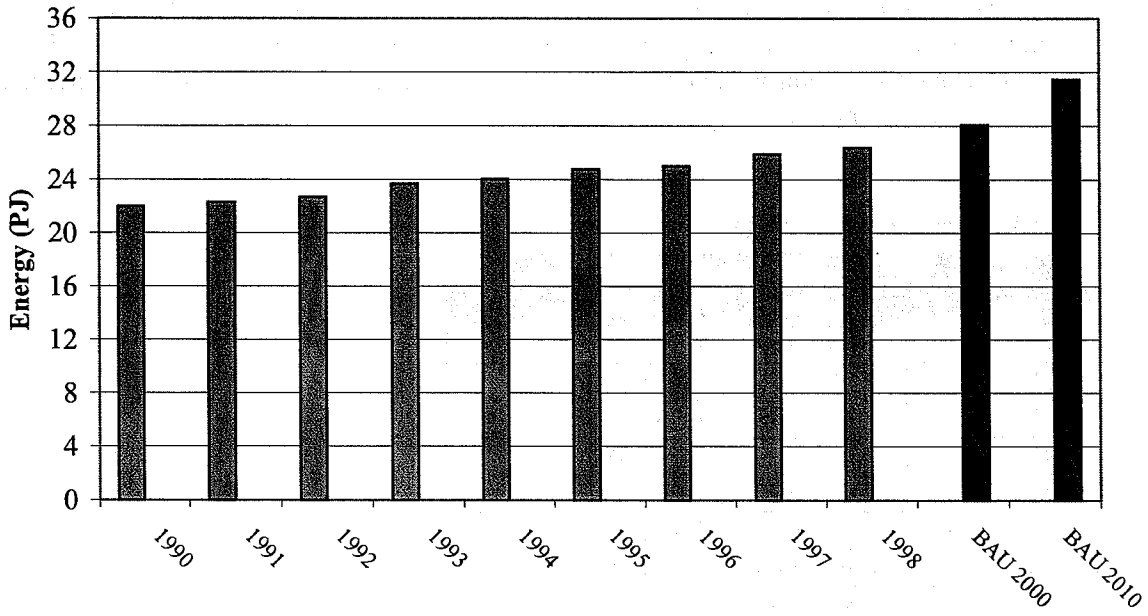
The transportation sector includes travel of all personal vehicles and public transportation vehicles (eg. buses) within Mississauga, but does not include vehicles passing through the City limits on route to destinations outside Mississauga. In 1998, the transportation sector was the second largest source of eCO_2 emissions, accounting for 24% of total community emissions. The energy and emission data from the transportation sector in Table 11 is based on total vehicle kilometres travelled within the community and includes total energy consumption in gigajoules (GJ) and eCO_2 emissions in tonnes (t).

Table 11: Transportation Energy Consumption and eCO2 Emissions

Year	Energy (GJ)	eCO_2 (t)
1990	21,973,442	1,512,112
1991	22,293,574	1,534,142
1992	22,677,856	1,560,586
1993	23,671,869	1,628,989
1994	24,032,871	1,653,832
1995	24,767,917	1,704,414
1996	24,992,883	1,719,896
1997	25,906,695	1,782,780
1998	26,392,262	1,816,194
BAU 2000	28,081,366	1,932,431
BAU 2010	31,451,130	2,164,323

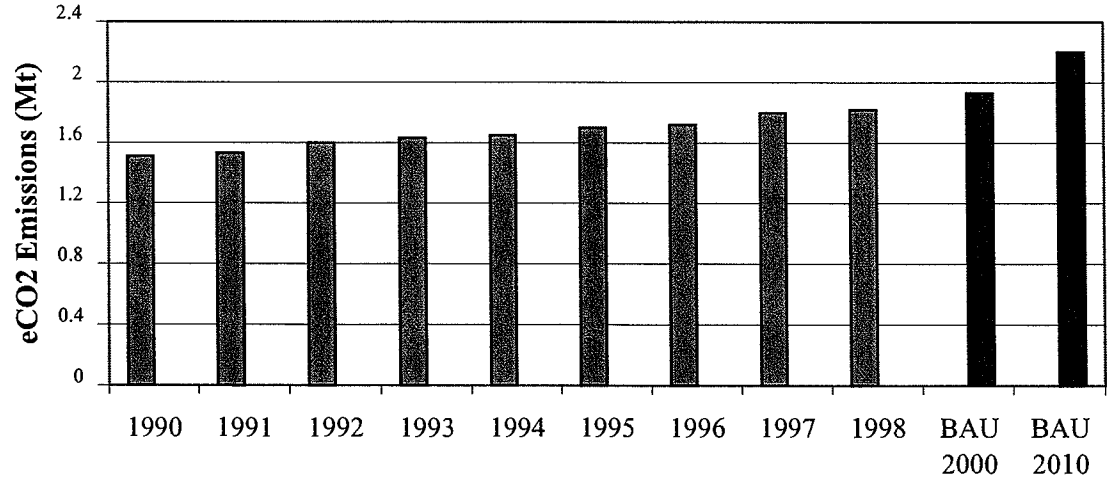
Transportation-related energy consumption grew 20% from 1990 to 1998, as shown in Figure X.

Figure X: Transportation Energy Consumption



From 1990 to 1998, eCO_2 emissions in Mississauga's transportation sector increased by 11%, as displayed in Figure Y.

Figure Y: Transportation eCO2 Emissions



Until recently, federal vehicle fuel efficiency requirements resulted in an overall increase vehicle in fuel efficiency in Canada. This accounts for the 20% increase in fuel

consumption from 1990 to 1998 but only 11% increase in corresponding greenhouse gas emissions.

12.2.4 RESIDENTIAL

The residential sector is composed of single-family homes, semi-detached homes and condominiums, and apartments. This sector was the third largest source of community eCO_2 emissions in 1998, accounting for 22% of the total. Table 12 below shows energy consumption in gigajoules (GJ) and eCO_2 emissions in tonnes (t) in Mississauga's residential sector. As mentioned previously, the City of Mississauga experienced extremely large and rapid growth in its population from 1990 to 1998, with its population increasing by 29%.

Table 12: Residential Energy Consumption and eCO2 Emissions

Year	Energy (GJ)	eCO_2 (t)
1990	27,792,165	1,466,407
1991	26,950,018	1,381,247
1992	29,277,674	1,507,277
1993	30,894,990	1,493,508
1994	33,212,274	1,576,206
1995	30,788,869	1,501,040
1996	35,077,777	1,708,956
1997	34,635,132	1,749,482
1998	31,945,127	1,716,602
BAU 2000	33,989,612	1,879,424
BAU 2010	38,068,369	2,104,954

From 1990 to 1998, residential energy consumption increased by 15%, as displayed in Figure Z.

Figure Z: Residential Energy Consumption

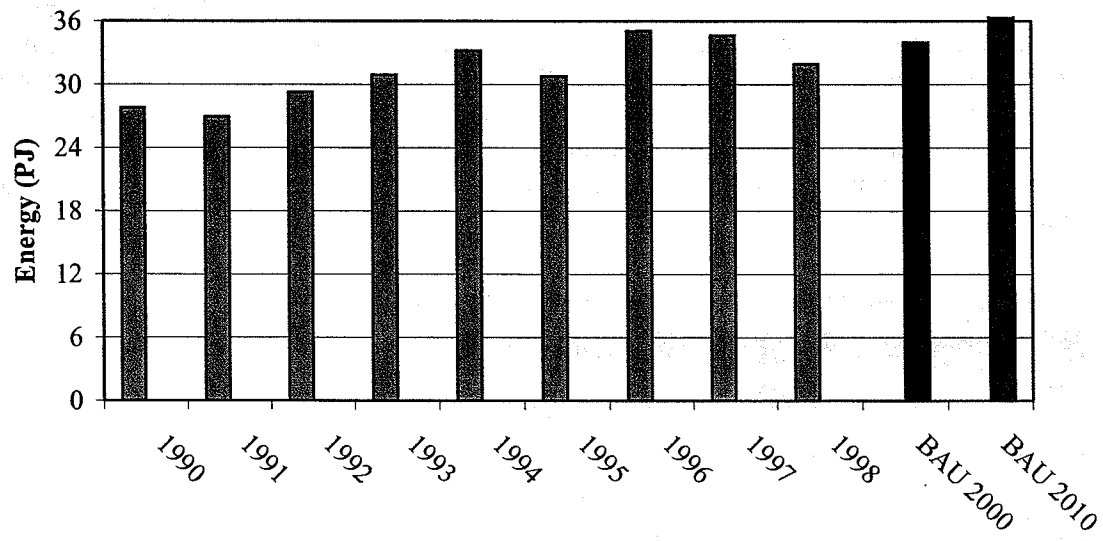
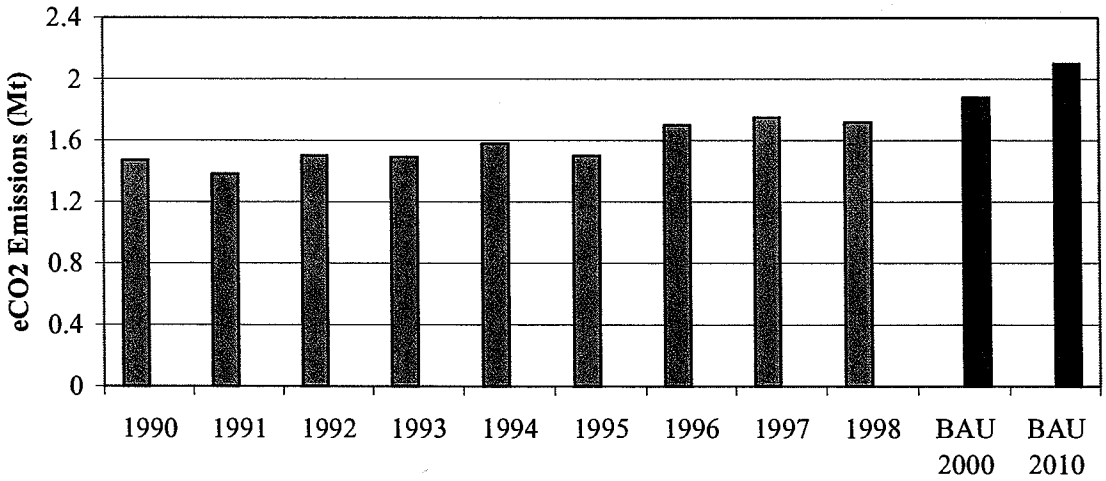


Figure AA demonstrates the 17% increase in eCO_2 emissions during the period from 1990 to 1998.

Figure AA: Residential eCO2 Emissions



12.2.5 INDUSTRIAL

The industrial sector consists chiefly of manufacturing operations. In 1998, the industrial sector accounted for 20% of total community eCO_2 emissions, the fourth largest of the five community sectors. Industrial energy consumption in gigajoules (GJ) and eCO_2 emissions in tonnes (t) are displayed in Table 13 below.

Table 13: Industrial Energy Consumption and eCO2 Emissions

Year	Energy (GJ)	eCO_2 (t)
1990	21,105,185	1,154,970
1991	25,643,908	1,345,519
1992	28,129,959	1,469,886
1993	27,996,970	1,417,917
1994	26,781,514	1,342,577
1995	25,226,361	1,282,536
1996	27,291,982	1,397,990
1997	28,652,897	1,479,679
1998	28,991,575	1,567,178
BAU 2000	30,847,036	1,698,878
BAU 2010	34,548,680	1,902,744

In the industrial sector, energy use increased by 37% from 1990 to 1998, as shown in Figure BB.

Figure BB: Industrial Energy Consumption

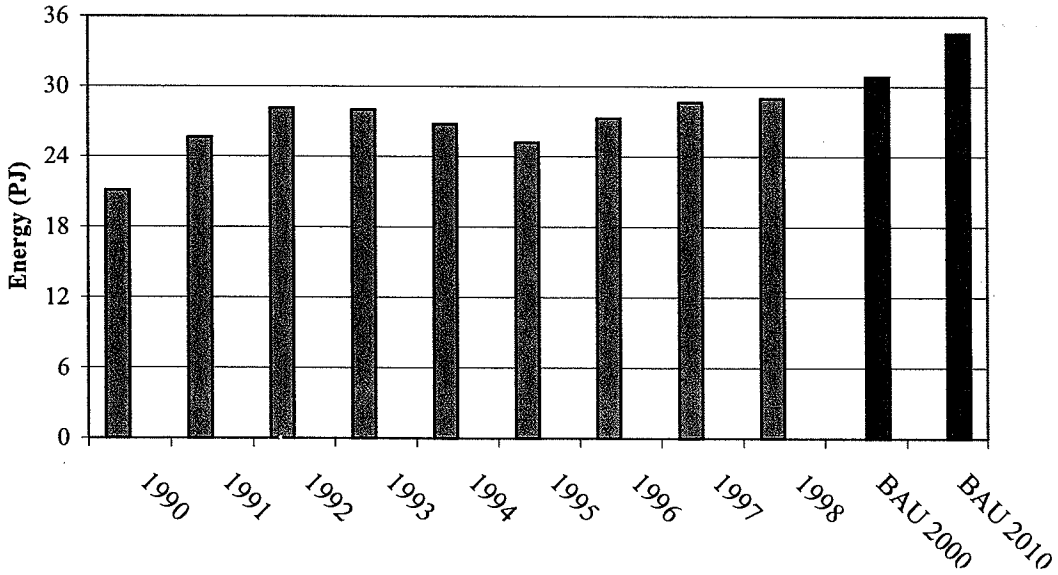
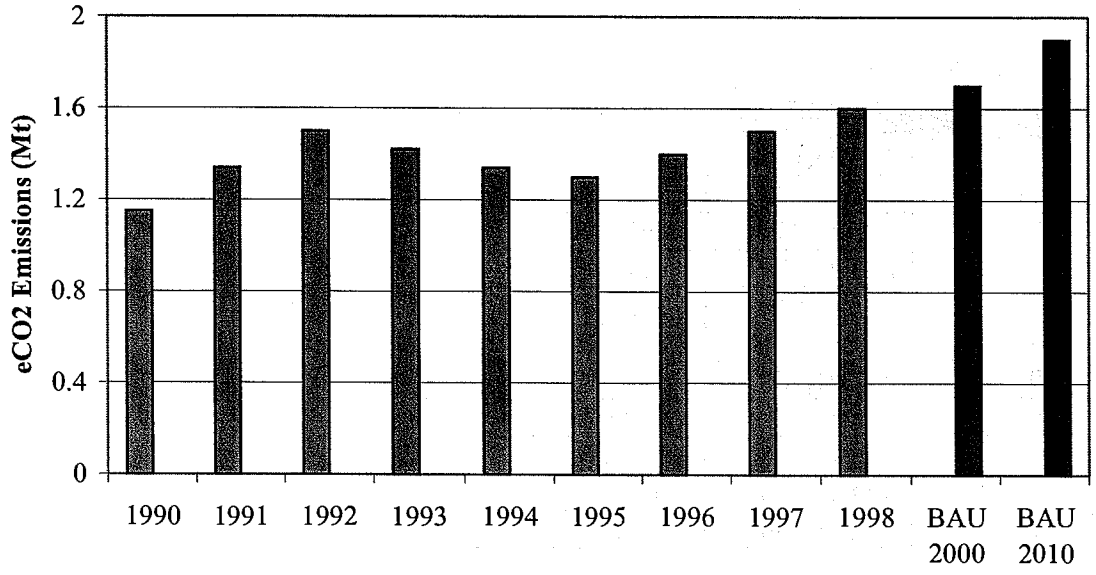


Figure CC displays the 36% increase in industrial eCO_2 emissions from 1990 to 1998.

Figure CC: Industrial eCO2 Emissions



12.2.6 WASTE

The community waste sector includes all waste generated by residents, businesses, and industries in Mississauga, except waste generated at City-owned facilities. (Corporate wastes are addressed in Part 1 of this report) Greenhouse gas emissions in the waste sector are attributed to the anaerobic decomposition of organic waste sent to landfill. The community waste sector includes all waste produced in the community, except industrial wastes and construction and demolition (C&D) waste because very little of the organic portion of this waste ends up in a landfill and industrial/C&D landfills' conditions do not foster decay.

In 1998 the waste sector represented 2% of total community eCO_2 emissions, the smallest emitter of the five community sectors. Table 14 below lists the eCO_2 emissions in tonnes (t) for Mississauga's community waste sector.

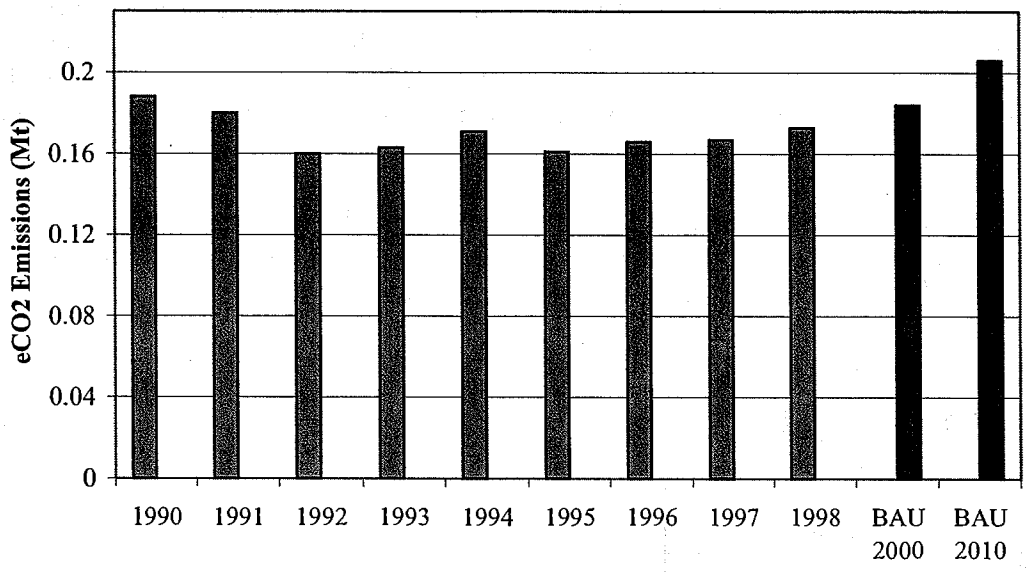
Table 14: Waste eCO2 Emissions

Year	eCO_2 (t)
1990	188,742
1991	180,746
1992	160,975
1993	163,516
1994	171,075
1995	161,790
1996	166,788
1997	167,348
1998	173,072
BAU 2000	184,149
BAU 2010[9]	206,247

[9] Several municipalities in the Greater Toronto Area are committing themselves to diverting 100% of their communities' waste by 2010. The estimated eCO2 emissions for 2010 shown in Table 14 reflect "Business as Usual" practices since the City of Mississauga has not yet made such a commitment.

As Figure DD below indicates, waste-related eCO_2 emissions decreased by 8% from 1990 to 1998.

Figure DD: Community Waste eCO2 Emissions



13 EXISTING COMMUNITY MEASURES

13.1 METHODOLOGY

A Local Action Plan typically includes baseline community and corporate emissions inventory data and emission forecasts, the quantification of existing and potential future emission reduction measures, and corporate and community emissions reduction targets. Since the City of Mississauga had previously completed its corporate and community inventories, ICLEI analyzed and summarized the information. ICLEI then conducted an extensive scoping and research process to gather information on past and ongoing community emission reduction measures. Key community stakeholders were contacted to seek their involvement in the development of Local Action Plan and collect data on emission reduction measures that they had previously implemented in the Mississauga community.

ICLEI met with representatives from the Dufferin-Peel Catholic District School Board and ecoSource Mississauga (a local environmental organization), and contacted staff at Enersource (formerly Mississauga Hydro) and Enbridge (formerly Consumers Gas). Most stakeholders were eager to participate in the development of Mississauga's Local Action Plan, but most were able to provide only limited information on past emission reduction measures. Based on the responses of the stakeholders contacted, ICLEI realized that a revised strategy was necessary. This strategy is described in section 14.

Specific information on community programs implemented by the City of Mississauga was readily available, and is outlined in the following section.

13.2 CITY PROGRAMS

The City of Mississauga has been involved in programs promoting the reduction of greenhouse gases in the community for several years. The City's program partners have included stakeholders such as:

- Enbridge Consumers Gas
- Ontario Hydro (now Ontario Power Generation)
- Mississauga Hydro (now Enersource)
- ecoSource Mississauga
- Peel school boards
- The Regional Municipality of Peel
- GO Transit
- University of Toronto at Mississauga
- Mississauga Board of Trade

City programs include:

- **Anti-Idling Campaign**

This pilot project was launched in October 2001 by the City, with funding from Natural Resources Canada and partnership with GO Transit, the University of Toronto at Mississauga, and Peel school boards. This year-long campaign features public awareness activities and uses community-based social marketing techniques to encourage residents to commit to turning off their vehicles when parked for more than 10 seconds.

- **Mississauga Cycling Advisory Committee (MCAC)**

Established in 1994, the MCAC is composed of citizen volunteer representatives, councillors, and City staff. The Committee organizes events (such as community bike rides), advises on potential new cycling routes, assists with the preparation of studies (such as the *2001 Multi-Use Recreational Trail Study*, and a trail use survey in 1999*)*, and recruits volunteer "trail checkers" to inspect the City's trail network and report problems. Since 1991 the City has added to and expanded its bicycle trail system, now a 120-kilometre trail network. A "Mississauga Cycling Workshop" was held in 1999, community bike rides in each ward are organized throughout year, and a City trail map is sold.

- **Active Transportation**

Since the first "Peel Walk to School Day" in October 2000, increasing numbers of Mississauga elementary schools are participating in this annual active transportation event organized by the Mississauga Traffic Safety Council.

- **Energy Efficiency Programs**

Energy efficiency and demand side management (DSM) programs have been delivered by Ontario Hydro, Mississauga Hydro, and Enbridge Consumers Gas throughout the 1990s and targeted the residential, commercial/multi-residential, and industrial sectors. Programs focused on the more efficient operation of water and space heating, ventilation, and water conservation, thermal envelope upgrades, energy efficient motors, energy efficient lighting, etc.

- **Transportation Initiatives**

As part of the City's Anti-Idling Campaign, fleet research was conducted to identify City idling policies and practices, examine current knowledge of idling among City fleet drivers, and identify opportunities to reduce unnecessary fleet vehicle idling. As well, Mississauga Transit is currently reviewing its anti-idling policy. A shuttle bus pilot serving Cooksville GO Station since March 2001 has been approved as a regular service. As of February 2002, approximately 900 customers use this shuttle on a weekly basis.

- **Waste Reduction Initiatives**

Within the Region of Peel, a wide variety of waste management options is offered to Mississauga residents. Multi-material recycling, organic waste composting, and household hazardous waste collection are available to residents. Industrial, commercial, and institutional organizations are also encouraged to reduce the amount of solid waste they generate that would otherwise go to landfill.

14 RECOMMENDED COURSE OF ACTION

14.1 BACKGROUND

In order to develop a comprehensive Local Action Plan and set an attainable target it is helpful to have a good understanding of historic emission levels as well as emission reduction measures that have been implemented in the past and the emission reductions achieved. With this information an attainable emission reduction target can be set based on past success and future plans.

At the outset of this project it was anticipated that the collection of information about emission reduction measures from community stakeholders would be a straightforward task. However, after consulting with several major stakeholders and despite significant efforts, ICLEI discovered that the thorough collection of this information was not feasible under the scope of work and the budget for this project. Since an accurate quantification of previous community emission reduction measures was not possible, neither was the setting of a realistic emission reduction target. Therefore, a revised strategy (with the appropriate resources) for developing the community portion of Mississauga's Local Action Plan was needed. Based on the experience of other municipalities with Local Action Planning, ICLEI has laid out the framework for a community consultation process for Mississauga, as outlined in section 14.5.

14.2 RATIONALE

The purpose of ICLEI's proposed community consultation process is to encourage and inspire these stakeholders to become active in the development of Mississauga's Local Action Plan (particularly the compilation and assessment of potential new community emission reduction measures) and the setting of a community emission reduction target. The findings of Mississauga's Community Emissions Inventory revealed that, in 1998, the commercial sector accounted for 31% of the community's eCO_2 emissions, followed by the transportation sector with 24% of emissions, the residential sector with 23%, the industrial sector with 20%, and the waste sector with 2%. The involvement of a wide variety of community stakeholders and citizens in a formal process and their commitment to actively participating in the consultation process will lead to a comprehensive plan of action to reduce Mississauga's greenhouse gas emissions.

The work completed to date by ICLEI provides a foundation for the implementation of the proposed community consultation process.

- Through ICLEI's initial scoping and research process at the beginning of this project, the community consultation process has in fact been initiated. Key stakeholders were contacted and informed of the nature of Mississauga's Local Action Plan. Several of these stakeholders have already expressed an interest in participating in the Local Action Plan process.

- Many of the measures already implemented by the City of Mississauga (as described in *Part 2: City of Mississauga Corporate Local Action Plan*) have links to the greater community. The City's Anti-Idling Campaign, for example, targets drivers of private vehicles and will therefore result in a reduction in community emissions.

- ICLEI has begun the process of seeking initial resources and support for Mississauga's community consultation process. The experience of other cities shows that stakeholders participating in Local Action Plan processes are willing to support such work.

14.3 THE CITY'S ROLE

In the past decade, the City of Mississauga has made important strides in reducing its energy consumption and the resulting greenhouse gas emissions. The City is also intent on continuing to enhance and expand its efforts to further improve the efficiency of its corporate facilities and operations. Having made a commitment on behalf of the community, the City is also eager to move forward with more greenhouse gas reduction initiatives in the Mississauga community at large.

The City of Mississauga's ideal role in the development of a Community Local Action Plan is that of a leader and facilitator. The City's visible and stated commitment to reducing greenhouse gas emissions from its own operations, its ability to bring together a variety of stakeholders, and its independent perspective make it well-suited to the facilitator's role. The City has already made inroads into the community consultation process proposed in section 14.5 by assuming a leadership role in several emission reduction programs. For example, the City is currently facilitating Mississauga's Anti-Idling Campaign, a partnership with other stakeholders including GO Transit, the University of Toronto at Mississauga, and Peel school boards. (See section 13.2)

14.4 THE STAKEHOLDERS' ROLE

While the City has direct control over energy consumption from its own facilities and operations, it has only indirect influence over community emissions. Municipal building codes and permits determine the energy efficiency of residential and commercial buildings. The City's land use planning and development decisions determine the density, mixture, and physical layout of buildings, neighbourhoods, and communities. Choices concerning the City's transportation infrastructure determine the transportation choices of residents and businesses, affecting the level and type of transportation energy consumed and the number and length of vehicle trips.

The stakeholders who have direct control and/or influence over energy consumption and greenhouse gas emissions in the community as a whole are residents, business owners, utilities, school boards, hospitals, developers, employers, and community groups, among others. The sources of energy purchased by utilities and the demand side management programs they offer to their customers affect eCO_2 emissions in many community

sectors. Whether developers and builders choose to exceed or merely to meet municipal building codes in the name of energy efficiency also affects energy consumption and consequently, eCO_2 emissions. Whether or not employers offer workplace-based trip reduction programs to their employees to reduce the number of single-occupancy vehicle trips affects the number of vehicles on the road.

14.5 PROPOSED COMMUNITY CONSULTATION PROCESS

In order to develop an effective Community Local Action Plan and to set a challenging and realistic community emission reduction target, ICLEI is proposing the development of a community consultation process that will involve key community stakeholders in the development of the community component of Mississauga's Local Action Plan. The projected outcome of this community consultation process is a list of emission reduction measures to be implemented in the Mississauga community and the selection of a community emission reduction target.

The proposed community consultation process consists of several steps:

1. **Build the Foundation**

Engage community partners by obtaining their commitment to actively participate in the development of Mississauga's Local Action Plan. The City has previously formed partnerships with a variety of stakeholders in order to implement community environmental initiatives. Utilities, environmental non-governmental organizations, school boards, and businesses should all be approached to participate in this venture. As well, representatives from different City departments need to be involved in the consultation process. A Community Local Action Plan Steering Committee needs to be established and funding secured to assist with Local Action Plan development work.

2. **Set Goals**

Community partners, with input from the greater community, establish a vision, values, and goals to guide the local action planning process. By providing community stakeholders with an opportunity to set goals for their sectors, the goals will be more realistic and tailored to the sectors. Additionally, when stakeholders are able to provide input into and to shape the goal setting process, they are more likely to remain committed to the process.

3. **Develop Local Action Plan Components**

Create working groups representing five areas:

- **Residential** (ratepayers associations, citizen environmental groups and associations, individual citizens, etc.)

- **Industrial/Commercial/Institutional** (IC&I) (Business Improvement Associations, Boards of Trade, Chambers of Commerce, industry associations, educational institutions, school boards, etc.)

- **Municipal** (City staff involved in environmental programs, environmental planners, bicycle planners, etc.)

- **Public Education and Outreach** (environmental non-governmental organizations, educational institutions, individual residents, etc.)

- **Business Plan Development** (a multi-sectoral group that includes representatives from the four other groups, this group focuses on moving the Local Action Plan forward)

Members meet to develop recommendations and detailed action steps (measures) relating to their area of focus. (For detailed lists of sample community emission reduction measures, see Appendix F) Representatives of the residential, IC&I, and municipal working groups will:

- identify and prioritize opportunities in their area of focus
- consider the barriers and benefits associated with these opportunities
- recommend strategies and actions for inclusion in the Local Action Plan

The Public Education and Outreach working group will identify opportunities to integrate climate protection activities into Mississauga's educational system (ie. school curricula), as well as recommend education and outreach strategies needed to support the recommendations of the other working groups.

The Business Plan Development working group will be charged with identifying and recommending funding and financing mechanisms to support the implementation of the Local Action Plan well into the future.

4. Prepare an Integrated Plan

The Steering Committee, with support from City staff, will integrate recommendations from the five working groups into a draft Community Local Action Plan, along with a preliminary implementation strategy and business plan.

5. Confirm the Plan

The working groups will meet to review the integrated Community Local Action Plan, and feedback from the broader community will be sought and incorporated.

6. Approve the Plan

A final Local Action Plan will be presented to Mississauga City Council for review and approval. The key aspects of the development of Mississauga's Community Local Action Plan are:

- Active involvement by as many Mississauga citizens and stakeholder groups as possible.
- Clear, effective communication to keep citizens and stakeholder groups up-to-date on the development of the Local Action Plan.
- Providing information to allow participants to gain new skills and new knowledge about climate change, emissions, and the local community
- The implementation of programs that will lead to changes in community behaviour in activities that contribute to greenhouse gas emissions and climate change.

The implementation of such a consultation and Local Action Plan development process will require a long-term commitment from the City of Mississauga and the local community. Through active participation and co-operation, the City of Mississauga will succeed in developing an effective Community Local Action Plan that will help Mississauga reduce its greenhouse gas emissions and reap the many co-benefits of emission reduction.

7. Set an Emissions Reduction Target

After preparing a plan to reduce greenhouse gas emissions in the community, the City of Mississauga will have a clearer idea of what sort of reductions are feasible. At this point, the Community Local Action Plan Steering Committee can set a target for reducing emissions in the community. As mentioned earlier, the preferred target for participants in the Partners for Climate Protection program, such as the City of Mississauga, is a 6% reduction in community greenhouse gas emissions within 10 years of joining the program. Yet, municipalities do have the flexibility to choose a target that is both challenging and realistic.

8. Implement the Community Local Action Plan

After the Community Local Action Plan has been approved and an emission reduction target set, the Plan must be implemented. With the City of Mississauga filling the role of facilitator and providing some guidance and support, the key stakeholders from various sectors are to put into action the initiatives that they proposed during the planning process.

In order to ensure that the chosen emission reduction measures achieve the desired results, ICLEI proposes the use of community-based social marketing techniques for the implementation of some of the emission reduction measures.

Community-based social marketing (CBSM) is a method of changing behaviour towards more sustainable practices by uncovering and removing barriers to sustainable behaviour and using different techniques to ensure that the new behaviour is adopted and maintained.

In the past, when organizations implemented plans or programs to encourage sustainable behaviour the plans were information-based campaigns that operated on the assumption that educating a population would change behaviours. While education and advertising are important ways of raising public awareness and changing attitudes, research shows that more is needed to change behaviours. This research holds that programs delivered at the community level that focus on removing barriers to an activity while increasing the activity's benefits, are most effective in changing behaviour. Community-based social marketing offers a valuable alternative to information-based campaigns by utilizing this social science research and applying it to environmental and sustainability issues.

Community-based social marketing has been used by a variety of municipalities and organizations as part of their environmental programs. This process has been used by the City of Greater Sudbury in the development of its Earthcare Sudbury Local Action Plan, as well as in the BC PowerSmart program, Guelph 2000 initiative, Jasper Energy Efficiency Project, and Quinte regional recycling program.

Mississauga is currently utilizing CBSM principles as part of its Anti-Idling Campaign. University of Toronto at Mississauga students have interacted with drivers in both idling and non-idling vehicles at GO Transit stations, schools, and city workplaces, handed out anti-idling information cards and asked drivers to place a decal on their window to indicate a commitment to stop idling their vehicles while parked for more than 10 seconds.

9. Monitor and Verify Emissions Reductions.

Once emission reduction initiatives have been implemented, it is important to monitor and verify the reductions in order to evaluate the effectiveness of the initiatives and assess the community's progress towards its emission reduction target.

APPENDIX A: 1990 TO 1998 INVENTORY DATA

Table 15: 1990 to 1998 Inventory Data

	Buildings			Vehicle Fleet			Streetlights			Waste	Total		
Year	eCO2 Emissions (t)	Energy (GJ)	Cost ($)	eCO2 Emissions (t)	Energy (GJ)	Cost ($)	eCO2 Emissions (t)	Energy (GJ)	Cost ($)	eCO2 Emissions (t)	eCO2 Emissions (t)	Energy (GJ)	Cost ($)
1990	22,737	396,995	4,030,891	3,093	44,818	572,133	9,939	140,205	2,635,083	458	36,227	582,018	7,238,107
1991	24,296	453,980	4,748,150	3,492	50,631	650,220	8,533	142,215	2,673,430	465	36,786	646,826	8,071,800
1992	24,466	449,780	4,672,438	3,844	55,789	723,631	8,900	142,770	2,683,364	465	37,675	648,339	8,079,433
1993	20,244	441,985	4,630,057	4,260	61,892	810,486	5,698	141,572	2,660,810	465	30,667	645,449	8,101,353
1994	18,688	436,381	4,601,970	4,730	68,783	909,461	4,734	144,796	2,821,673	465	28,617	649,960	8,333,104
1995	21,519	455,866	4,414,196	5,329	77,541	1,032,961	5,907	135,440	2,622,585	461	33,216	668,847	8,069,742
1996	21,571	461,540	4,597,038	6,164	89,747	1,206,114	5,972	140,065	2,709,656	456	34,163	691,352	8,512,808
1997	25,992	496,028	5,304,839	6,465	94,158	1,268,792	8,314	147,288	2,875,474	453	41,224	737,474	9,449,105
1998	29,149	469,928	5,771,904	6,442	93,840	1,270,418	10,402	135,192	2,794,426	453	46,446	698,960	9,836,748
2000	31,391	469,928	5,771,904	6,442	93,840	1,270,418	11,809	135,192	2,794,426	546	50,188	698,960	9,836,748

APPENDIX B: CORPORATE EMISSION REDUCTION MEASURE DESCRIPTIONS

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Buildings

Measure Name

Low Emissivity Ceiling

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	153,125	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	551
Year Implemented	1996	Emission Reduction (tonnes eCO2)	48
Implementation Cost	$49,000	Savings ($/year)	$12,250
Payback Period (years)	4		

The emission reduction from this measure as a percentage of total reductions: *1.4%*

This emission reduction as a percentage of emission reductions required to meet target: *0.6%*

Full Description of Measure

Low Emissivity Ceiling
Project Number 96677

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

High Efficiency Motors

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	57,500	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	207
Year Implemented	1997	Emission Reduction (tonnes eCO2)	18
Implementation Cost	$23,000	Savings ($/year)	$4,600
Payback Period (years)	5		

The emission reduction from this measure as a percentage of total reductions: *0.5%*

This emission reduction as a percentage of emission reductions required to meet target: *0.2%*

Full Description of Measure

High Efficiency Motors
Project Number 97860

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Energy Efficient Lighting Upgrade

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	762,500	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	2,745
Year Implemented	1998	Emission Reduction (tonnes eCO2)	240
Implementation Cost	$122,000	Savings ($/year)	$61,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *7.0%*

This emission reduction as a percentage of emission reductions required to meet target: *2.9%*

Full Description of Measure

Energy Efficient Lighting Upgrade
Project Number 98876

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Energy Efficient Lighting Upgrade

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	250,000	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	900
Year Implemented	1998	Emission Reduction (tonnes eCO2)	79
Implementation Cost	$40,000	Savings ($/year)	$20,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *2.3%*

This emission reduction as a percentage of emission reductions required to meet target: *1.0%*

Full Description of Measure

Energy Efficient Lighting Upgrade
Project Number 98877

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Energy Lighting Retrofit

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	187,500	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	675
Year Implemented	1998	Emission Reduction (tonnes eCO2)	59
Implementation Cost	$30,000	Savings ($/year)	$15,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *1.7%*

This emission reduction as a percentage of emission reductions required to meet target: *0.7%*

Full Description of Measure

Energy Lighting Retrofit
Project Number 98878

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Energy Efficient Lighting Upgrade

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	262,500	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	945
Year Implemented	1998	Emission Reduction (tonnes eCO2)	83
Implementation Cost	$42,000	Savings ($/year)	$21,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *2.4%*

This emission reduction as a percentage of emission reductions required to meet target: *1.0%*

Full Description of Measure

Energy Efficient Lighting Upgrade
Project Number 98800

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Replace ballast & bulbs - high efficiency

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	75,000	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	270
Year Implemented	1998	Emission Reduction (tonnes eCO2)	24
Implementation Cost	$12,000	Savings ($/year)	$6,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *0.7%*

This emission reduction as a percentage of emission reductions required to meet target: *0.3%*

Full Description of Measure

Replace ballast & bulbs - high efficiency
Project Number 98760

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Buildings

Measure Name

Reconstruct HVAC System

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	1,666,667	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	6,000
Year Implemented	1998	Emission Reduction (tonnes eCO2)	524
Implementation Cost	$600,000	Savings ($/year)	$133,333
Payback Period (years)	4.5		

The emission reduction from this measure as a percentage of total reductions: *15.3%*

This emission reduction as a percentage of emission reductions required to meet target: *6.4%*

Full Description of Measure

Reconstruct HVAC System
Project Number 99901

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Lighting upgrades

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	250,000	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	900
Year Implemented	1998	Emission Reduction (tonnes eCO2)	79
Implementation Cost	$40,000	Savings ($/year)	$20,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *2.3%*

This emission reduction as a percentage of emission reductions required to meet target: *1.0%*

Full Description of Measure

Lighting upgrades

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Replace ballasts & bulbs to high efficiency

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	5,940	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	21
Year Implemented	1998	Emission Reduction (tonnes eCO2)	2
Implementation Cost	$6,000	Savings ($/year)	$475
Payback Period (years)	12.6		

The emission reduction from this measure as a percentage of total reductions: *0.1%*

This emission reduction as a percentage of emission reductions required to meet target: *0.0%*

Full Description of Measure

Replace ballasts & bulbs to high efficiency
Project Number 99792

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Lighting upgrades

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	225,000	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	810
Year Implemented	1998	Emission Reduction (tonnes eCO2)	71
Implementation Cost	$36,000	Savings ($/year)	$18,000
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *2.1%*

This emission reduction as a percentage of emission reductions required to meet target: *0.9%*

Full Description of Measure

Lighting upgrades
Project Number 99785

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Buildings

Measure Name

Heating and Ventillation Project

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	369,444	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	1,330
Year Implemented	2000	Emission Reduction (tonnes eCO2)	116
Implementation Cost	$133,000	Savings ($/year)	$29,556
Payback Period (years)	4.5		

The emission reduction from this measure as a percentage of total reductions: *3.4%*

This emission reduction as a percentage of emission reductions required to meet target: *1.4%*

Full Description of Measure

Heating and Ventillation Project
Phase 2
Project Number 882

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Equipment and Lighting

Measure Name

Energy efficiency lighting upgrade

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	181,250	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	653
Year Implemented	2000	Emission Reduction (tonnes eCO2)	57
Implementation Cost	$29,000	Savings ($/year)	$14,500
Payback Period (years)	2		

The emission reduction from this measure as a percentage of total reductions: *1.7%*

This emission reduction as a percentage of emission reductions required to meet target: *0.7%*

Full Description of Measure

Energy efficiency lighting upgrade
Project Number 886

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Buildings

Measure Name

Modify repair bay HVAC system

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	
Potential Energy Reduction	277,778	Potential Energy Reduction	0
Unit	(kWh)	Unit	
Price per Unit	$.08	Price per Unit	$.35
Ramp-In Factor	100%	Energy Reduction (GJ)	1,000
Year Implemented	2000	Emission Reduction (tonnes eCO2)	87
Implementation Cost	$100,000	Savings ($/year)	$22,222
Payback Period (years)	4.5		

The emission reduction from this measure as a percentage of total reductions: *2.5%*

This emission reduction as a percentage of emission reductions required to meet target: *1.1%*

Full Description of Measure

Modify repair bay HVAC system
Project Number 717

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Buildings Sector

Type of Measure: Energy Efficiency: Buildings

Measure Name

Replace building automation system (BAS)

Measure Details

Affected Energy Source 1	Electricity	Affected Energy Source 2	Natural Gas
Potential Energy Reduction	252,285	Potential Energy Reduction	15,845
Unit	(kWh)	Unit	(cubic metres)
Price per Unit	$.08	Price per Unit	$.35
Ramp-In Factor	100%	Energy Reduction (GJ)	1,511
Year Implemented	2000	Emission Reduction (tonnes eCO2)	109
Implementation Cost	$81,000	Savings ($/year)	$25,729
Payback Period (years)	3.1		

The emission reduction from this measure as a percentage of total reductions: *3.2%*

This emission reduction as a percentage of emission reductions required to meet target: *1.3%*

Full Description of Measure

Replace building automation system (BAS)
Project Number 98879

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Vehicle Fleet Sector

Type of Measure: Walking/Biking

Measure Name
Bike Riding

Measure Details

Fuel Type		Fuel Type	
Actual Use Before	0	Actual Use After	0
Unit		Unit	
Price per Unit	$.00	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	0
Year Implemented		Emission Reduction (tonnes eCO2)	0
Implementation Cost	$0	Savings ($/year)	$0
Payback Period (years)	0		
The emission reduction from this measure as a percentage of total reductions:			*0.0%*
This emission reduction as a percentage of emission reductions required to meet target:			*0.0%*

Full Description of Measure

Bike Riding
City staff encouraged to bike to work and given shower facilties at a cost of $5 per year. Number of participants unknown
Not quantifiable unless specific counts of ridership are available.

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Vehicle Fleet Sector

Type of Measure: Increase in Fuel Efficiency

Measure Name
Fleet Vehcile Emissions Testing

Measure Details

Fuel Type		Fuel Type	
Actual Use Before	0	Actual Use After	0
Unit		Unit	
Price per Unit	$.00	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	0
Year Implemented		Emission Reduction (tonnes eCO2)	0
Implementation Cost	$0	Savings ($/year)	$0
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *0.0%*

This emission reduction as a percentage of emission reductions required to meet target: *0.0%*

Full Description of Measure

Fleet Vehcile Emissions Testing
improved efficiencies...but to what level undetermined.

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Vehicle Fleet Sector

Type of Measure: Car/Van Pooling

Measure Name
Corporate Rideshare Program

Measure Details

Fuel Type		Fuel Type	
Actual Use Before	0	Actual Use After	0
Unit		Unit	
Price per Unit	$.00	Price per Unit	$.00
Ramp-In Factor	100%	Energy Reduction (GJ)	0
Year Implemented	1999	Emission Reduction (tonnes eCO2)	0
Implementation Cost	$0	Savings ($/year)	$0
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *0.0%*

This emission reduction as a percentage of emission reductions required to meet target: *0.0%*

Full Description of Measure

Corporate Rideshare Program
no known participants to date.

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Streetlights Sector

Type of Measure: Energy Efficiency: Lamp and Ballast

Measure Name
Lighting Retrofit

Measure Details

Affected Energy Source 1	Electricity		
Potential Energy Reduction	2,527,222		
Unit	(kWh)		
Price per Unit	$.08		
Ramp-In Factor	100%	Energy Reduction (GJ)	9,098
Year Implemented	1994	Emission Reduction (tonnes eCO2)	795
Implementation Cost	$0	Savings ($/year)	$206,525
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *23.2%*

This emission reduction as a percentage of emission reductions required to meet target: *9.6%*

Full Description of Measure

Lighting Retrofit
The City started to converted approx. 45,000 streetlights from mercury vapour lights to high-pressure sodium in 1994.
The difference in energy consumption between 1994 and 1995 was used to estimate the energy savings from this project.

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Streetlights Sector

Type of Measure: Energy Efficiency: Lamp and Ballast

Measure Name

Traffic Signals Retrofit

Measure Details

Affected Energy Source 1	Electricity		
Potential Energy Reduction	428,292		
Unit	(kWh)		
Price per Unit	$.08		
Ramp-In Factor	100%	Energy Reduction (GJ)	1,542
Year Implemented	1994	Emission Reduction (tonnes eCO2)	135
Implementation Cost	$0	Savings ($/year)	$35,000
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *3.9%*

This emission reduction as a percentage of emission reductions required to meet target: *1.6%*

Full Description of Measure

Traffic Signals Retrofit
conversion to Krypton gas lamps

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Streetlights Sector

Type of Measure: Energy Efficiency: Lamp and Ballast

Measure Name

LED conversion

Measure Details

Affected Energy Source 1	Electricity		
Potential Energy Reduction	288,056		
Unit	(kWh)		
Price per Unit	$.09		
Ramp-In Factor	100%	Energy Reduction (GJ)	1,037
Year Implemented	2001	Emission Reduction (tonnes eCO2)	91
Implementation Cost	$0	Savings ($/year)	$25,821
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *2.6%*

This emission reduction as a percentage of emission reductions required to meet target: *1.1%*

Full Description of Measure

LED conversion
All traffic turning signals converted to LED.
Incandesant to LED = 85% energy savings. Krypton is about 10% more effficient than incandesant. Therefore 75% energy savings.
In 98, traffic signals used 13,826 GJ (at 24.9$/GJ). Turning signals would have been one tenth of that, therefore estimated savings of 1037 GJ.

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Streetlights Sector

Type of Measure: Energy Efficiency: Lamp and Ballast

Measure Name
Potential LED Conversion

Measure Details

Affected Energy Source 1	Electricity		
Potential Energy Reduction	2,592,500		
Unit	(kWh)		
Price per Unit	$.09		
Ramp-In Factor	100%	Energy Reduction (GJ)	9,333
Year Implemented	2002	Emission Reduction (tonnes eCO2)	815
Implementation Cost	$0	Savings ($/year)	$232,392
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *23.8%*

This emission reduction as a percentage of emission reductions required to meet target: *9.9%*

Full Description of Measure

Potential LED Conversion
It is recommended that the remaining traffic signals be converted to LED. LEDs are 75% more energy efficient than Krypton gas. In 1998, traffic signals used 13,826 GJ(at 24.9$/GJ), 10% of that was for turning signals which have already been converted, therefore there is a remaining (13,826-10%)*75% = 9,333GJ

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Water/Sewage Sector

Type of Measure: Energy Efficiency: Lamp and Ballast

Measure Name

Measure Details

Affected Energy Source 1			
Potential Energy Reduction	0		
Unit			
Price per Unit	$.00		
Ramp-In Factor	100%	Energy Reduction (GJ)	0
Year Implemented		Emission Reduction (tonnes eCO2)	0
Implementation Cost	$0	Savings ($/year)	$0
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *0.0%*

This emission reduction as a percentage of emission reductions required to meet target: *0.0%*

Full Description of Measure

City of Mississauga

Corporate Greenhouse Gas Emissions Reductions in 2010

Target Year Measures Listing

Waste Sector

Type of Measure: Waste Recycling

Measure Name
Go Green / 3Rs Program

Measure Details

Waste Type Affected			
Proposed Waste Reduction	0		
Unit			
Price per Unit	$.00		
Ramp-In Factor	100%		
Year Implemented		Emission Reduction (tonnes eCO2)	0
Implementation Cost	$0	Savings ($/year)	$0
Payback Period (years)	0		

The emission reduction from this measure as a percentage of total reductions: *0.0%*

This emission reduction as a percentage of emission reductions required to meet target: *0.0%*

Full Description of Measure

Go Green / 3Rs Program
required data not available

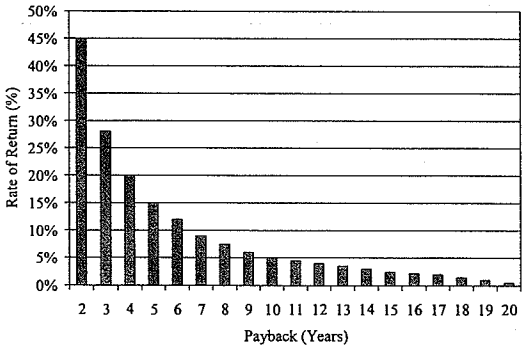
APPENDIX C: PRINCIPLES OF A DEEP RETROFIT APPROACH

Having estimated the energy and eCO2 emissions savings potential available in the City's buildings, fleets, and streetlights, the costs related to achieving these savings can be estimated given a payback period. Most municipalities use simple paybacks to assess whether or not to proceed with a recommended measure, by examining its implementation cost and predicted annual energy savings.

Simple Payback = Cost / Savings

Figure EE: Rate of Return vs. Payback[10]

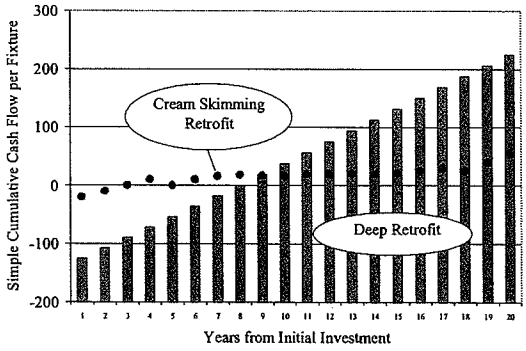
Municipalities tend to take a safe approach to measure implementation, investing in measures with short payback periods (typically two to five years) and high rates of return. Figure EE illustrates the relationship between payback periods and rates of return. Essentially, the shorter the payback period and the longer the useful life, the higher the rate of return. A two-to five-year payback corresponds to a 15 to 45 percent return on investment, which is considered exceptional.



With low-risk investments such as energy efficiency, most investors tend to settle for a much lower rate of return. The most effective approach to energy and eCO2 emissions reduction is not necessarily to obtain high rates of return and short payback periods. In fact, this approach known as 'cream skimming', can actually make it more difficult to perform comprehensive retrofits in the future.

Figure FF: Cream Skimming vs. Deep Retrofits[11]

Figure FF illustrates that measures that produce the greatest energy savings take longer to 'breakeven'. The overall benefits of 'deeper' retrofits in relation to energy and costs savings will be far greater in the long-term than those of short-term payback measures.



By expecting high rates of return like 15 to 45% only 20 to 35% of the total gross potential savings available are achieved. At lower rates of return energy savings start to rise. Municipalities that want to get the most

[10] ICLEI, Profiting from Energy Efficiency!, A Financing Handbook for Municipalities, ICLEI Policy & Practice Series, September,1993.
[11] Ibid.

out of their investments over the long-term should therefore consider rates of return comparable to other capital investments, in the order of 5 to 10% (which translates to a 7- to 10-year payback).

APPENDIX D: ENERGY PRICE FORECASTING

The Energy Forecasting Division of Natural Resources Canada has studied the energy demand and supply outlook for Canada over the next 25 years.[12] It predicts that world oil prices will remain relatively flat at their current costs. Electricity prices are not foreseen to change during the forecasted time despite the uncertainty with regards to the opening of Ontario's electricity market. However, natural gas prices are projected to increase. Market research conducted by Sproule Associated Limited was examined to estimate the degree to which natural gas prices are project to increase.

Sproule Associated Limited is a worldwide petroleum consulting company that is recognized as a leading expert in the evaluation of petroleum reserves. Its staff regularly prepare forecasts for the Canadian oil and gas industry based on information from various sources, including government agencies, industry publications, Canadian oil refiners, and natural gas marketers. Their natural gas forecast as of October 2001 indicates a 137% projected increase in price from 1998 to 2010. Their forecast done one year earlier predicted a 165% increase in price during the same time period. Recognized that there is a high degree of uncertainty associated with forecasting gas prices, there is plenty of research to support the prediction that prices will increase significantly.

[12] Energy Forecasting Division, Canada's Energy Outlook 1996 – 2020, Energy Policy Branch, Natural Resources Canada.

APPENDIX E: POTENTIAL CORPORATE GREENHOUSE GAS REDUCTION MEASURES

BUILDINGS SECTOR

Category		Potential New Measures	Comments	Case Example
Energy	B1	Boiler Upgrades		
	B2	Green Power Purchase		
	B3	Turn Off Building Lights After Hours		
	B4	All City Buildings Built/Retrofitted to CBIP Standard		
	B5	Energy-Efficient Lighting in All City Buildings		
	B6	Educate employees about reducing energy use at work		
	B7	Invest in all energy-efficiency measures with simple paybacks over 10 years or less		Portland/ Multnomah County
	B8	Require City construction projects to exceed energy code by 20% on new construction & 10% on retrofits		Portland/ Multnomah County
	B9	Improve energy efficiency in City facilities by 10%		Portland/ Multnomah County
	B10	Convert exit signs to LEDs		
	B11	Co-generation		
Water	B12	Install Low-Flow Toilets in All City Buildings		
Other	B13	Green purchasing policies	Focus on energy efficiency standards	

STREETLIGHTING SECTOR

	Potential New Measures	Comments	Case Example
S1	LED Traffic Signal Conversion		
S2	Use of Solar Power Where Possible/Appropriate	Eg. school crossing signals, emergency lighting	

VEHICLE FLEET SECTOR

Category		Potential New Measures	Comments	Case Example
Trip Reduction	VF1	Employee Trip Reduction Program		
	VF2	Parking Charges	Parking cash-out program, fees to park at City facilities	
	VF3	Promote Telecommuting	Enable 25% of City employees to telework or work compressed schedules	Portland/ Multnomah County
Bicycles	VF4	Provision of Bicycle Amenities at City Buildings	Showers, bike parking	
	VF5	Provide Bicycles for Employee Work Use Where Appropriate		
Vehicles	VF6	Purchase of Hybrid Vehicles		
	VF7	Fuel Switching for Fleet Vehicles	Natural gas, biofuels	
	VF8	Green Purchasing Policy for Fleet Vehicles	Consider fuel efficiency, fuel type	
	VF9	Provide employee education on fuel-efficient driving	Avoid idling, driving & maintenance techniques	
	VF10	Reduce employees' VKT in City vehicles by 20% by 2010 by promoting alternatives		Portland/ Multnomah County
	VF11	Increase awareness of departmental fuel consumption		
	VF12	Downsize Current & Future Vehicles	Done through purchasing changes	
	VF13	Reduce Fleet Size		
	VF14	Improve Maintenance for Increased Efficiency	Check tire pressure, etc.	
Transit	V15	Provide City employees with transit tickets for business travel		Portland/ Multnomah County

WASTE SECTOR

	Potential New Measures	Comments	Case Example
W1	Green Purchasing Policy	Purchase Energy Star-labeled equipment	
W2	Enhanced Recycling Program		

MISCELLANEOUS

	Potential New Measures	Comments	Case Example
M1	Green Power Purchase		
M2	Solar Panels Installed in Road Noise Barriers		
M3	Promote Photovoltaics		
M5	Review major policies & programs early on to identify ways to reduce GHG emissions		
M6	Encourage Energy-Saving & Emissions-Reducing Ideas from City Staff	Ideas could be e-mailed to Environmental Coordinator.	
M4	Utilize Wind Power		
M7	Subsidized or free transit pass for City employees		
M8	"Triple Bottom Line" Accounting		

APPENDIX F: POTENTIAL COMMUNITY GREENHOUSE GAS REDUCTION MEASURES

COMMERCIAL SECTOR

Category		Potential New Measures	Comments	Case Example
Lighting	C1	Energy-Saving Fluorescent Lamps		
	C2	Energy-Efficient Electromagnetic Ballasts		
	C3	Electronic Ballasts		
	C4	T5 &T8 Fluorescent Lamps & Ballasts		
	C5	Fluorescent Fixtures w/Efficient Lamps & Ballasts		
	C6	Improved Fluorescent Fixture Efficiency		
	C7	Fluorescent Fixtures Delamping		
	C8	Compact Fluorescent Lamps		
	C9	Compact Fluorescent Fixtures		
	C10	High-Pressure Sodium Outdoor Lighting		
	C11	LED Exit Signs		
	C12	Ellipsoidal Reflector Lamps		
	C13	Tungsten Halogen Incandescent Lamps		
	C14	Occupancy Sensors & Timers		
	C15	Automatic Lighting Controls		
	C16	Daylighting w/ Photocell Lighting Controls		
	C17	Reflectors		
	C18	Lower Lighting Levels/Task Lighting		
	C19	Relighting		
	C20	Office Building Lights Off Program		FLAP, Toronto
	C21	Light Shelves		
	C22	Light Tubes		
Refrigeration	C23	High-Efficiency Evaporator Fan Motor		

Category		Potential New Measures	Comments	Case Example
Systems				
	C24	Anti-Sweat Heater Controls		
	C25	Floating Head Pressure Control		
	C26	Parallel Unequal Compressor		
	C27	Refrigeration Glass Doors		
	C28	High-Efficiency Refrigeration Compressors		
Water Heating	C29	Water Heater Blanket		
	C30	High-Efficiency Water Heater- Increased Tank Insulation		
	C31	Heat Pump Water Heater		
	C32	Install Water-Efficiency Devices		
Water	C33	Sensors Instead of Water Taps in Washrooms		
Cooking Technologies	C34	High-Efficiency Fryers		
	C35	Solid State Cooking Controls		
	C36	Forced Convection Ovens		
	C37	Microwaves		
Dishwashing Technologies	C38	Low-Temperature Dishwashers		
Clothes Drying Technologies	C39	Heat Pump Dryers		
	C40	Moisture Sensors		
Building	C41	Roof & Wall Insulation		

Category		Potential New Measures	Comments	Case Example
Envelope				
	C42	Air Barrier		
	C43	Commercial Glazings		
	C44	Low-Emissivity Windows		
	C45	Low-Conductivity Gas-Filled Windows		
	C46	Window Films		
	C47	Interior Shades		
	C48	Awnings		
HVAC Systems	C49	Ground Source Heat Pump		
	C50	Air-to-Air Heat Pump		
	C51	Adjustable Speed Drives		
	C52	Outside Air Economizer Control		
	C53	Winter Free-Cooling		
	C54	Advanced Direct Digital Controls		
	C55	Promote District Heating		
	C56	High-Efficiency Chillers		
Energy Management	C57	Occupancy Sensors		
	C58	Programmable Controls		
	C59	Thermal Cool Storage		
Other	C60	Pilot Cargo Bike Delivery of Meals on Wheels		St. Christopher House, Toronto
	C61	Energy Audits	Do audits, provide low or no-interest loans, technical assistance	Rebuild Chicago
	C62	Revolving Building Retrofit Fund	Similar to Toronto's Better	Toronto

Category		Potential New Measures	Comments	Case Example
			Buildings Partnership	
	C63	Promote Rooftop Gardens	Develop demonstration site(s)	Perth, ON
	C64	Tree Planting	For shade, wind break	
	C65	Promote Purchase of Energy Star-labeled products		
	C66	Provide tools to businesses to estimate their GHG emissions & reductions		
	C67	Work with the 100 largest local business, industrial & institutional energy consumers	Work to establish & meet energy efficiency and GHG targets	
	C68	Lower Business Fees or Waive Permits	For energy efficiency improvements or use of solar energy	
	C69	Sustainable Business Awards Program	Encourage and recognize businesses that reduce their GHG emissions	
	C70	Deep Lake Water Cooling		

INDUSTRIAL SECTOR

Category		Potential New Measures	Comments	Case Example
Industrial Processes	I1	High-Efficiency Motors		
	I2	Motor Replacement at Time of Rewind		
	I3	Adjustable Speed Drives		
	I4	Compressed Air Systems Maintenance		
	I5	Compressed Air Systems Modifications		
	I6	Process Refrigeration Systems Improvements		
	I7	Fan, Pump, Compressor, Blower Systems Optimization		
	I8	Motor Generator Sets Improvements		
	I9	Promote Efficient Boiler Systems	Control upgrades, heat recovery measures, pipe insulation upgrades.	
	I10	Cogeneration		Redpath Sugar
Heating	I11	Promote District Heating		
Cooling	I12	High-Efficiency Chillers		
Lighting	I13	Efficient Lighting		
	I14	Improved Combustion Efficiency in Raising Stream & Providing Direct Heat		
	I15	Electroheat Technologies (eg. Microwave drying)		
	I16	Heat Recovery & Pumping		
	I17	Advanced Direct Digital Controls		

Category		Potential New Measures	Comments	Case Example
Other	I18	Energy Audits	Do audits, provide low or no-interest loans, technical assistance	Rebuild Chicago
	I19	Tree Planting		
	I20	Provide tools to businesses to estimate their GHG emissions & reductions	For shade, wind break	
	I21	Lower Business Fees or Waive Permits	For energy efficiency improvements or use of solar energy	
	I22	Workshops re. Reducing GHGs in Industrial Parks	Offer design guidance, strategies, technologies for reducing GHGs to owners, developers, mgrs, tenants	Halifax
	I23	Sustainable Business Awards Program	Encourage and recognize businesses that reduce their GHG emissions	

TRANSPORTATION SECTOR

Category		Potential New Measures	Comments	Case Example
Walking	T1	Walking School Bus		Active & Safe Routes to School, Toronto
	T2	Promote International Walk to School Day		Perth, ON
	T3	Improve Pedestrian Corridors & Connectivity w/Transit		
Transit	T4	Bus Lanes &/or HOV Lanes	Dedicated lanes can be permanent, or designated for peak hours only.	
	T5	Improve Transit Service Where Necessary		
Vehicles	T6	Parking Plans	Address: parking supply ratios, shared parking, pricing, location & design.	
	T7	Traffic Calming		
	T8	Promote Alternative Fuels & Supporting Infrastructure		Chicago
	T9	Road Tolls		
Trip Reduction	T10	Employer Trip Reduction Programs	Workshops & seminars for employers, ride-matching, "Walk to Work Wednesdays," "Bike to Work Day/Week"	
	T11	Vanpol & Rideshare Programs	Provide information services, meeting points, and/or multi-passenger vehicles to encourage carpooling.	
	T12	Promotion of Carpooling	Promote on children's soccer league schedules.	Perth, ON
	T13	Create a Transportation Mgmt Association		Black Creek Regional TMA
	T14	Alternative Work Arrangements	Promote telework, compressed workweeks, flex-schedule options	Portland/Multnomah County
	T15	Shuttle Service Connecting Neighbourhoods to		

Category		Potential New Measures	Comments	Case Example
		Commuter Lines		
	T16	Encourage parking "cash out" at workplaces	Employers who offer free employee parking also offer an equivalent payment to those who do not require it	Portland/Multnomah County
Bicycles	T17	Expand Bicycle Network		
	T18	Bicycle Parking Facilities	Provide secure facilities to park bikes at transit connection points.	
	T19	BikeShare program		Toronto: BikeShare
	T20	Bike Safety Education & Encouragement to Cycle	Public education program for students re. bike safety & encourage them to travel by bicycle.	Lochside Elementary School, Victoria, BC
	T21	Electric Bicycle Promotion		Moving the Economy, Toronto
	T22	Provide secure, covered bicycle parking at schools, in commercial districts, & other destinations		Portland/Multnomah County

RESIDENTIAL SECTOR

Category		Potential New Measures	Comments	Case Example
Building Envelope	R1	Air Sealing		
	R2	Improvements in Ceiling/Floor Insulation		
	R3	Increased Wall Insulation		
	R4	Install/Improve Basement Insulation		
	R5	Upgrade Windows		
	R6	Upgrade Doors		
	R7	Upgrade Heating Systems		
	R8	Home Insulation/Weatherization Program	Offer rebates, provide financing, partner with hardware store	
	R9	Residential Energy Efficiency Improvements Through Partnership with Hardware Store	Offer information or rebates on energy efficient products	Chicago
Home Appliances	R10	Service Refrigerators		
	R11	Remove & Recycle Old Refrigerators		
	R12	High-Efficiency Refrigerators		
	R13	Service Freezers		
	R14	Remove & Recycle Old Freezers		
	R15	High-Efficiency Freezers		
	R16	Clothes Dryers: Moisture Sensor Retrofit		
	R17	High-Efficiency Electric Clothes Dryer		
	R18	Heat Pump Dryer		
	R19	Gas Clothes Dryer		
	R20	High-efficiency Ranges/Ovens		
	R21	Gas Range/Oven		
	R22	High-Efficiency Dishwashers		
	R23	Water-Saving Clothes Washers		

Category		Potential New Measures	Comments	Case Example
Lighting	R24	Reduced-wattage Incandescent Lamps		
	R25	Compact Fluorescent Lamps	Distribution or rebate program	
	R26	Tungsten Halogen Incandescent Lamps		
	R27	High-Pressure Sodium Lamps (Outdoors)		
	R28	Metal Halide Lamps (Outdoors)		
	R29	High-Intensity Discharge Lighting		
Water Efficiency	R30	Faucet Aerators, Low-Flow Showerheads, High-Efficiency Toilets	Distribution or rebate program	
	R31	Pipe Insulation, Heat Traps, Bottom Boards, Water Heater Tank Wraps		
Water Heaters	R32	High-Efficiency Water Heater		
	R33	Heat-Pump Water Heater		
	R34	Tankless Water Heater		
	R35	Solar Hot Water Systems	Promote, provide financial assistance	
	R36	Gas Water Heater		
	R37	Hot water control systems that manage recirculating loop temperature in apartments		
Water Heater Load Shifting Equipment	R38	Water Heater Cycling		
	R39	Water Heater Clock Thermostat		
	R40	Storage Water Heater		
Space Cooling	R41	Service Room Air Conditioners		
	R42	Remove Old Air Conditioners		
	R43	High-Efficiency Room Air Conditioners		

Category		Potential New Measures	Comments	Case Example
	R44	Programmable Thermostat (for Central Air Conditioners)		
	R45	Service Central Air Conditioners		
	R46	Central Air Conditioner & Heat Pump Cycling		
	R47	High-Efficiency Central Air Conditioners		
Space Heating	R48	High-Efficiency Furnace Blower		
	R49	Programmable Thermostat		
	R50	Air Source Heat Pumps		
	R51	Natural Gas Furnace		
	R52	High-Efficiency Furnace Blower		
	R53	Service Heat Pumps		
	R54	High-Efficiency Air Source Heat Pump		
	R55	Ground-Source Heat Pump		
	R56	Heat Pump with Gas Backup		
	R57	Replace Oil Heating with Natural Gas		
	R58	Replace ineffective suite thermostats & upgrade boiler controls in apartments		
	R59	Apply speed drives to the cold water booster & heating pumps in apartment buildings		
	R60	Upgrades and Correct Sizing of HVAC Systems		
	R61	Fuel Switching to Less-Costly Fuels		
	R62	High-Efficiency Fans and Motors (including Variable-Frequency Drives)		
	R63	Individual Unit Energy Billing in Apartments		
	R64	Flat Block or Increasing Block Utility Billing		
	R65	Prepaid Energy Services	Use of credit or debit-style card	

Category		Potential New Measures	Comments	Case Example
Other	R66	Block Heater/Car Warmer Controls		
	R67	Radiant Barriers		
	R68	Energy Audits		
	R69	Tree Planting		
	R70	Demonstration "Green Home"	Show feasibility & cost-effectiveness of sustainable building practices	Chicago
	R71	Lawnmower Buy Back Program	Retire gas mowers in exchange for $ for electric/battery mower	Chicago
	R72	Public Education re. Energy & Water Efficiency Measures		
	R73	Tools for residents to estimate their GHG emissions & reductions		
	R74	Promote Purchase of Green Power by Residents	Educate public on benefits and sellers of green power, work with energy suppliers	

WASTE SECTOR

Category		Potential New Measures	Comments	Case Example
Composting	W1	Distribution of free or subsidized composters		
	W2	Neighbourhood/centralized composters for residents		Annapolis Royal, NS
	W3	Centralized composting for commercial enterprises		Annapolis Royal, NS
	W4	Commercial food waste collection program		
	W5	Residential food waste collection		
	W6	Multi-Residential Composting	At apartments, townhouses, etc.	
Reuse	W7	Reuse Centres	Create depots for reusable items	Montreal
Waste Mgmt	W8	Assist local businesses to improve waste management programs		Portland/Multnomah County
	W9	Pay-as-you-throw waste collection program		Portland/Multnomah County
	W10	Garbage Bag Limit		
Recycling	W11	Expand commercial recycling programs & services		
	W12	Multi-Residential Recycling	At apartments, townhouses, etc.	

ZONING & BY-LAWS

Category		Potential New Measures	Comments	Case Example
Composting	W1	Distribution of free or subsidized composters		
	W2	Neighbourhood/centralized composters for residents		Annapolis Royal, NS
	W3	Centralized composting for commercial enterprises		Annapolis Royal, NS
	W4	Commercial food waste collection program		
	W5	Residential food waste collection		
	W6	Multi-Residential Composting	At apartments, townhouses, etc.	
Reuse	W7	Reuse Centres	Create depots for reusable items	Montreal
Waste Mgmt	W8	Assist local businesses to improve waste management programs		Portland/Multnomah County
	W9	Pay-as-you-throw waste collection program		Portland/Multnomah County
	W10	Garbage Bag Limit		
Recycling	W11	Expand commercial recycling programs & services		
	W12	Multi-Residential Recycling	At apartments, townhouses, etc.	

MISCELLANEOUS

Category		Potential New Measures	Comments	Case Example
Education & Outreach	M1	Production of brochures & other communication materials	Use as public education device	
	M2	Public Outreach	Articles in community newspapers re. Environmental issues, public meetings, cable TV	
	M3	Inform local elected officials, community leaders, media	Focus on causes & impacts of climate change	
	M4	Hotline for Business & Household Resource-Conservation Questions	Provide educational info & referrals to other resources	
	M5	Teacher Training Workshops on Climate Change Curriculum		
	M6	Conference for Local Environmental Groups	Opportunity for networking, strategizing, establish links between City & local groups	
	M7	Breakfast Meetings about GHG Reduction	Partner w/ Mississauga Board of Trade? Focus on various sectors: retail, office, etc.	
	M8	Promote Green Purchasing		
Trees, Gardens	M9	Tree planting projects	Plant shade trees in yards free of charge, truckload tree sale, community planting	Perth, ON
	M10	Habitat Restoration Projects		
	M11	Encourage Community Gardens		
	M12	Install Plants in City Medians	Beautify and cool the City, manage stormwater	Chicago
Energy	M13	Prepare a Community Energy Plan		Kamloops
	M14	Promote Renewable Energy (eg. wind	Establish demonstration/pilot project	

Category		Potential New Measures	Comments	Case Example
		turbines)		
	M15	Promote Photovoltaics	Establish demonstration/pilot project	
	M16	Promote District Heating	Establish demonstration/pilot project	
	M17	Solar-Powered Signs, Emergency Telephones, Security Lighting		Toronto
	M18	Promote the Purchase of Green Power	Encourage purchase of 10% of electricity as green power	Portland/ Multnomah County
	M19	Financing Program for E2 improvements in the Community	Revolving loan funds through bonds, energy taxes, etc.	
	M20	Promote light-coloured roofs & paving materials, tree planting, vegetative cover	Reduce heating & cooling loads	
Schools	M21	City-wide High School Challenge to Reduce GHG Emissions		Youth Challenge International
	M22	Tree planting, climate education & sustainable energy projects in schools		Cool Schools Program, Toronto
	M23	Schoolyard Naturalization Projects		
	M24	Student Conference on GHG Emission Reduction Actions		
Water	M25	Stormwater Disconnect Program	Limited to older Mississauga neighbourhoods	