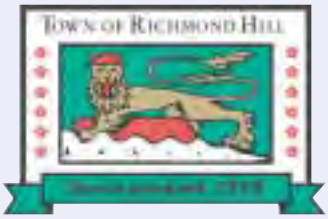
Town of Richmond Hill
LOCAL ACTION PLAN

Feasibility Study to Reduce Greenhouse Gas Emissions

April 2004



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Executive Summary

The Town of Richmond Hill was awarded funding in July 2003 from the Federation of Canadian Municipalities' (FCM) Green Municipal Enabling Fund (GMEF) to support the development of a Local Action Plan to Reduce Greenhouse Gas (GHG) Emissions. Through a competitive purchasing process, ICLEI Energy Services (IES) was awarded the contract with the Town to help design the plan. This report is a result of that work.

Scientists have predicted that climate change may have significant effects in a variety of areas. Environmental impacts could include flooding, increased risk to forest from pests and drought, changes in agricultural yields, and more frequent and severe weather conditions. Human health is at risk from high temperatures, reduced air quality, and extreme weather events.[1]

The Town of Richmond Hill is part of a worldwide movement of municipalities looking to help mitigate climate change. As population centers, urban areas will experience the most negative impacts of climate change. Apart from helping to mitigate a global climate change problem, there are numerous other reasons for the Town to take part, such as:

- Improvements in service delivery
- Reduced energy costs
- Good asset management
- Demonstration of leadership
- Improved air quality and public health
- Improved quality of life for citizens

In 2000, the Town of Richmond Hill joined a Canada-wide initiative to reduce municipal GHG emissions. This initiative, called the Partners for Climate Protection (PCP), brings 117 municipal governments together to reduce the local production of GHG emissions and improve the quality of life for citizens. The program is implemented by the FCM and the International Council for Local Environmental Initiatives (ICLEI). PCP's participants represent 60% of Canada's population, with members in all provinces and territories. Participation within the Greater Toronto Area (GTA) includes: Caledon, Halton Hills, Markham, Mississauga, Newmarket, Richmond Hill, Toronto, Peel Region and York Region.

The Canadian federal government recognizes that municipalities have a significant role to play in helping Canada meet its international commitments to reduce GHG emissions. Not only do municipalities control GHG emissions within their own operations, they also have a significant level of influence in community GHG emissions. It is estimated that municipalities can contribute 20 to 50 Mt of GHG reductions to Canada's 240 Mt Kyoto commitment through corporate and community initiatives [2]

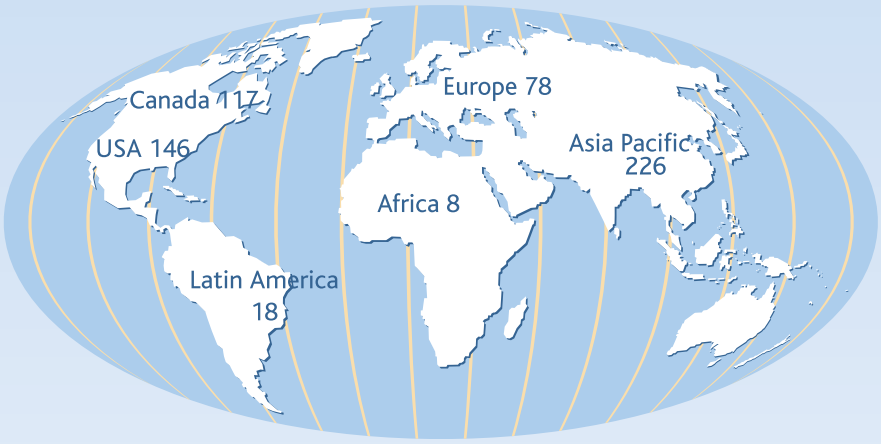

Figure I: Cities for Climate Protection (CCP) Participants Worldwide

The PCP is part of ICLEI's international campaign called the Cities for Climate Protection (CCP) where 593 municipalities worldwide are working to achieve the same goal (Figure I).

[1] Environment Canada, Climate Change Plan for Canada. Factsheets on Climate Change. URL: http://www.climatechange.gc.ca/plan_for_canada/climate/index.html.

[2] Federation of Canadian Municipalities. The Role of Municipal Governments in Climate Protection. URL: http://kn.fcm.ca/ev.php?URL_ID=2805&URL_DO=DO_TOPIC&URL_SECTION=201&reload=995607936

All municipalities follow a similar milestone process:

- **Milestone One** – Complete a GHG emissions inventory and forecast
- **Milestone Two** – Set a GHG emissions reduction target
- **Milestone Three** – Design a Local Action Plan to reduce GHG emissions
- **Milestone Four** – Implement the Local Action Plan
- **Milestone Five** – Measure Progress

Richmond Hill Approach

This report is a compilation of the first 3 milestones. The Town had already completed Milestone One at the onset of this project. The results of Milestone One are presented in this report as well as the measures, or activities which have already lead to GHG emission reductions. Some suggestions on future measures that could further reduce GHG emissions are also presented. The measures are aggregated and compared against the inventory and forecast to identify a realistic yet challenging GHG emissions target to set (Milestone Two).

All municipalities participating in the PCP and CCP follow the same GHG quantification Protocol. The analysis was divided into two sections: corporate operations and the community-at-large. Since the Town has direct control over its own operations, they have the power to reduce GHG emissions further and can therefore set a higher emission reduction target. Within the community, the Town only has indirect control, or influence and must take that into consideration when designing a Local Action Plan and setting an emissions reduction target.

Sector	Source
Corporate Inventory	
Buildings	Electricity bills Natural gas bills
Streetlighting	Electricity bills
Vehicle Fleet	Vehicle fuel consumption records
Water & Sewage	Electricity bills
Waste	Waste haulage records
Community Inventory	
Residential, Commercial & Industrial	Electrical utility Natural gas utility
Transportation	Annual average daily traffic counts
Waste	Waste haulage records

Table I: Inventory Data Inputs

Emissions coefficients were used to calculate GHG emissions from energy consumption. Within every energy source (i.e. gasoline or natural gas) there is a given amount of GHG emissions released when it is consumed. The GHG emissions produced from electricity consumption are based on the annual mix of fossil fuels used to generate the electricity. In Ontario, the electricity emissions coefficient was fairly high in 1990, decreased to 1994 and then rose through to 2000 to slightly higher levels than 1990. This pattern is out of the municipality's control, but has a strong effect on the Town's GHG emissions inventories.

For corporate operations, energy usage information from the buildings, streetlights, vehicle fleet, and water and sewage sectors were gathered from the Town's historic records and used to calculate GHG emissions. For the community sector, energy consumption from the residential, commercial, industrial, and transportation sectors was gathered from local utility companies and the Town's records and used to calculate the GHG emissions in the inventory. In addition, GHG emissions are generated from organic waste in landfills, therefore waste data was also used in the GHG inventory calculations (Table I).

Results

Milestone One - Taking Stock

The GHG emissions inventories were completed for 1994 to 2000, and backcasted to 1990 to ensur e future compatibility with the Town's plan and any future Kyoto requirements. This provided background information and insight into the trend of GHG emissions growth over time. GHG emissions within corporate operations increased by 91% between 1990 and 2000, while energy use increased by 65%, and the Town's total population increased by 70% (Figure II). The increase in energy consumption was mainly due to the growing population in Richmond Hill and the expansion of corporate services to meet the needs of the community. GHG emissions increased more than energy consumption because the fossil fuel content of the electricity generation mix was higher in 2000 than it was in 1990, therefore more GHG emissions were generated per unit of electricity use.

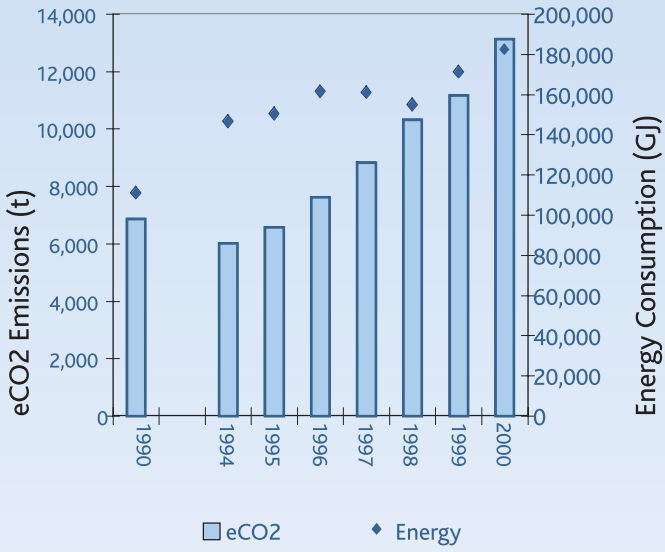

Figure II: Corporate eCO2 Emissions and Energy Consumption, 1990 to 2000

Per capita energy consumption significantly decreased from 1,504 gigajoules/1000 people to 1,340 gigajoules/1000 people, demonstrating that the energy consumption within the Town's operations has actually become more efficient over the years and that the energy efficiency activities implemented by the Town have been effective.

The analysis of the measures the Town has already put in place to improve energy efficiency show that as of 2000 the Town was actually saving $416,000 annually in avoided energy consumption costs. This has resulted in reduced GHG emissions of 1,400 tonnes annually. Some of these measures include: building and lighting retrofits, vehicle downsizing, alternative fuels, energy efficient purchasing policies and streetlighting retrofits.

Figure III illustrates the GHG emissions breakdown within corporate operations. Energy use within buildings, such as recreational and administration facilities, is responsible for 71% of the Town's corporate emissions, followed by streetlighting at 21% and the vehicle fleet at 7%. An understanding of this breakdown is important when designing a plan to reduce GHG emissions so that efforts can be focused in the sectors where they will have the most impact.

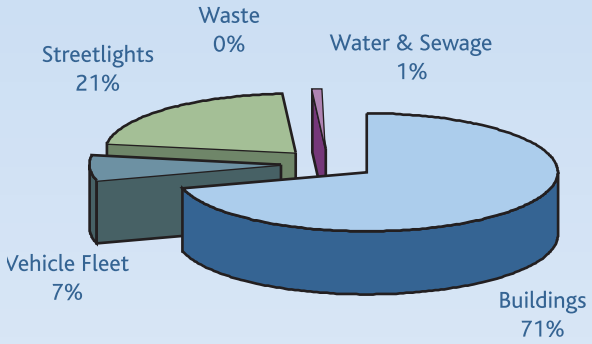

Figure III: Corporate eCO2 Emissions Breakdown by Sector, 2000

The Town has the opportunity to demonstrate leadership within the community by reducing GHG emissions within its own operations. However, since the Town's emissions are less than 2% of the community's emissions, it is important for the Town to promote emission reductions within the community in order to have a significant environmental impact (Figure IV).

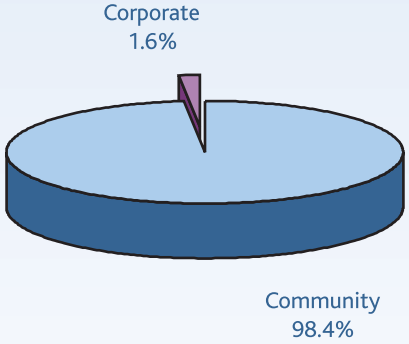

Figure IV: Corporate Versus Community GHG Emissions, 2000

The community GHG emissions inventory follows the same general rising trend in GHG emissions as a result of the growing population of Richmond Hill. Total GHG emissions increased by 65% between 1990 and 2000 (Figure V).

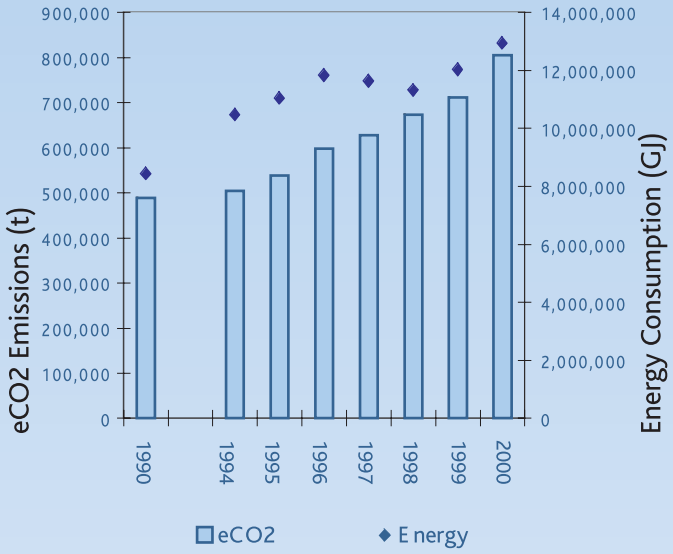

Figure V: Community eCO2 Emissions and Energy Consumption, 1990 to 2000

Forty two percent of the community emissions come from energy use within the residential sector. Thirty eight percent come from the commercial and industrial sector, while 20% came from the transportation sector (Figure VI). It is important to recognize this breakdown when considering implementing measures to reduce GHG emissions within the community

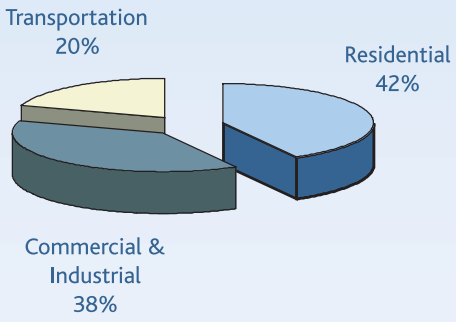

Figure VI: Community eCO2 Emission Breakdown by Sector, 2000

Milestones Two & Three – Setting a Target & Local Action Plan

The inventory completed in Milestone One also included a forecast of GHG emissions into the future. The forecast was used in modeling the GHG emissions target. The corporate forecast year is 2009, whereas the community forecast year is 2010 to allow sufficient time to develop the community Local Action Plan.

The Town has already been involved in implementing corporate energy efficiency measures for many years. The measures analysis considered future measures that could be implemented to further improve upon the historical energy efficiency initiatives the Town has already implemented. This analysis demonstrated that the Town could achieve additional savings of 65,000 GJ annually, resulting in approximately $1 million in avoided annual energy costs and a reduction of 5,000 tonnes in annual GHG emissions. The measures identified in the buildings sector, such as building retrofits and block heater timers, will achieve 60% of the total corporate target. Streetlighting measures, such as technology improvements to traffic signals and street lamps, will account for 32% of the target, and vehicle fleet measures including the use of alternative fuels and hybrid vehicles will account for 8% of the target.

The results of the corporate analysis led to the recommendation of a corporate emissions reduction target. It is suggested that the Town establish a corporate GHG emissions reduction target of 20% reduction in 2000 GHG emissions by 2009, equivalent to a 36% reduction in per capita GHG emissions. This is demonstrated in Figure VII.

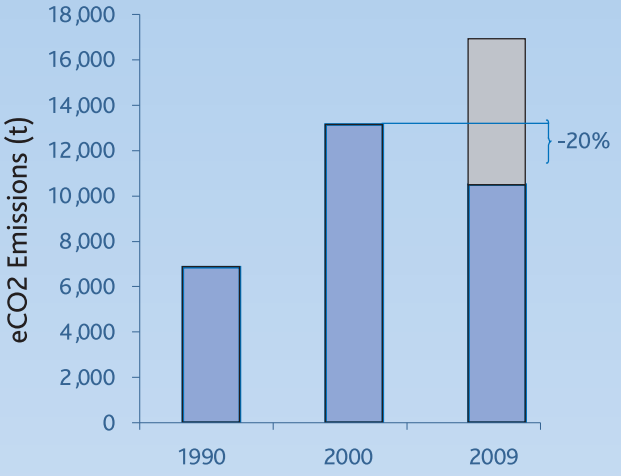

Figure VII: Corporate Emissions Target

The Town is currently involved in many initiatives that will help to reduce GHG emissions within the community, including those addressing residential and transportation energy consumption as well as waste generation. This report recommends that they take a leadership role within the community by promoting programs that have already demonstrated success. These programs include the Region of York's 20/20 Program, Natural Resources Canada's EnerGuide for Houses and Commercial and Industrial incentive programs, Enbridge Rebate, Smart Commute Initiative, and the 1 Tonne Challenge.

The results of the community analysis led to the recommendation of a community emissions reduction target. It is suggested that the Town establish a community GHG emissions reduction target of 6% below 2000 levels by 2010, equivalent to a 16% reduction in per capita levels.

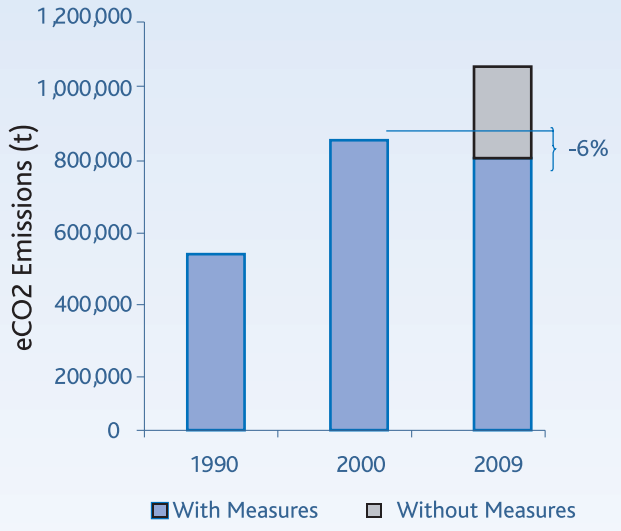

Figure VIII: :Community Reduction Target

Conclusion and Recommendations

This report recommends that the Town of Richmond Hill should:

1. Adopt a corporate operations GHG emissions target of 20% below 2000 levels by 2009.
2. Adopt a community GHG emissions target of 6% below 2000 levels by 2010.
3. Work to implement the recommended corporate emission reduction measures outlined in this report.
4. Take a leadership role to promote energy efficiency programs to achieve GHG emission reductions within the community.

The targets and recommendations from this report satisfy the intent of Milestones One, Two and Three of the Partners for Climate Protection program.

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Glossary

Units

%	Percent	A ratio that compares a number to one hundred.
GJ	Gigajoule	1 billion joules
J	Joule	A unit of energy equal to the work down when a current of one ampere passes through a resistance of one ohm for one second.
kWh	Kilowatt hour	A measure of electrical energy equivalent to a power consumption of 1,000 watts for one hour.
m^2	Square metre	Standard International unit of area.
m^3	Cubic metres	A metric unit of volume or capacity equal to 1000 liters. A common unit of measurement for natural gas.
t	Tonne	Metric ton, equivalent to 1,000 kilograms or 2,200 pounds.

Acronyms

BAU	Business as Usual	The absence of any emissions reduction measures.
CBIP	Commercial Buildings Incentive Program	NRCan's incentive program for commercial buildings.
CCP	Cities for Climate Protection	ICLEI's campaign for local governments to reduce GHG emissions.
CIPEC	Canadian Industry Program for Energy Conservation	An industry-government partnership that promotes energy efficiency improvements and GHG emission reductions.
DSM	Demand Side Management	An attempt by utilities to reduce customers' demand for energy by encouraging efficiency
eCO2	Equivalent carbon dioxide	A common unit that allows varying strengths of GHG emis sions (such as CO2 and CH4) to be expressed in like terms.
EII	Energy Innovators Initiative	A federal government program that encourages business to invest in energy efficiency.
FCM	Federation of Canadian Municipalities	The national association of municipal governments.
GHG	Greenhouse gas	Any gas that absorbs infrared radiation in the atmosphere. The 3 main greenhouse gases are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O).
GTA	Greater Toronto Area	An area including the City of Toronto and the Regions of Durham, York, Peel and Halton.
GTA-CAC	Greater Toronto Area - Clean Air Council	An inter-governmental working group with a mission to reduce air pollution in the GTA.
ICLEI	International Council for Local Environmental Initiatives	The international association for local governments imple menting sustainable development.
LAP	Local Action Plan	A municipality's plan of action to reduce GHG emissions.
MEU	Municipal Electrical Utilities	Municipally owned electrical utilities
NRCan	Natural Resources Canada	A federal government department specializing in the use of natural resources, energy, minerals and metals, forests and earth sciences.
PCP	Partners for Climate Protection	A program implemented by the FCM and ICLEI to assist local governments to reduce GHG emissions.
REDI	Renewable Energy Deployment Initiative	A federal government grant program to stimulate demand for renewable energy systems.
WPPI	Wind Power Production Incentive	A federal government incentive program to encourage elec trical utilities to gain experience in wind power production.

1.0 Introduction

The Town of Richmond Hill was awarded funding in July 2003 from the Federation of Canadian Municipalities' (FCM) Green Municipal Enabling Fund (GMEF) to support the development of a Local Action Plan to Reduce Greenhouse Gas (GHG) Emissions. Through a competitive purchasing process, ICLEI Energy Services (IES) was awarded the contract with the Town to help design the plan. This report is a result of that work.

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.[3] 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 5 and 10 degrees. [4]

1.3 Climate Change Impacts

Scientists have 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 agricultural 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. [5]

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. [6]

1.4 Why Should the Town of Richmond Hill Take Action?

Municipalities around the world are taking action against climate change. As the population centers, urban areas will experience the most negative impacts of climate change. Apart from helping to mitigate a global climate change problem, there are numerous other reasons for the Town to take part in this effort.

- **Improved Service Delivery** – Through the implementation of energy efficiency initiatives in its corporate facilities and operations and throughout the community, the Town will be able to offer its services more efficiently and economically.

[3] Intergovernmental Panel on Climate Change Working Group I, Third Assessment Report, 2002.

[4] Government of Canada Climate Change Web site. http://www.climatechange.gc.ca/english/issues/what_is/index.shtml, last updated May 15, 2002.

[5] Ibid.

[6] Ibid.

- **Reduced Costs** – By reducing its energy consumption, the Town and its citizens will save money on their energy bills.
- **Improved Air Quality and Public Health** – The combustion of fossil fuels used to generate energy emit a variety of pollutants into the atmosphere that are known to have negative health impacts and reduce local air quality. By reducing energy consumption, local air pollutants will also be reduced.
- **Asset Management** – By taking a proactive approach to facility improvements, the value of the Town's assets is improved by reducing facilities' operating costs, modernizing equipment and decreasing deferred maintenance. Not only does asset management make good business sense, it also reduces GHG emissions.
- **Leadership** – The Town has a long history of taking the lead on environmental issues. By taking specific steps to address climate change within its own operations, the Town is able to 'practice what it preaches' and provide a solid example to the community.
- **Quality of Life for Citizens** – By reducing expenditures on energy, the Town can apply savings towards improving its community services. This may include more green space or improved water and waste services. 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 GHG emissions by 2008-2012, based on 1990 levels.

Federal Government

In October 2000 the federal government announced its Action Plan 2000 on Climate Change. This plan aims to reduce Canada's GHG emissions by 65 million tonnes per year by the period 2008-2012, taking Canada one-third of the way to its Kyoto target.

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 minimum efficiency standards by a specified compliance date before they are sold or leased in Ontario.

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 GHG 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 million tonnes.[7]

The 114 Canadian municipal members of the Partners for Climate Protection have made commitments to implement concrete actions to reduce their greenhouse gas emissions. Collectively, over 570 local governments participating in the international Cities

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

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. [8]

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 Richmond Hill's Involvement in Climate Protection

The Town of Richmond Hill demonstrated its commitment to taking action against climate change by joining the Partners for Climate Protection (PCP) in 2000. PCP is a national program implemented by the Federation of Canadian Municipalities and ICLEI that brings Canadian municipal governments together to reduce the local production of GHG emissions and improve quality of life. Currently, over 114 Canadian municipal governments belong to PCP and over 570 municipalities participate in ICLEI's Cities for Climate Protection (CCP) Campaign internationally. (The CCP is the international program, but it is referred to as PCP in Canada due to the par tnership with FCM.)

All PCP members follow a similar five-milestone process:

- **Milestone One: Take Stock** – Complete a GHG inventory and forecast. PCP provides software to measure energy use and emissions for both municipal operations and the community. Select a base year; forecast energy use and emissions for the next 10 or 20 years for municipal operations and the community.
- **Milestone Two: Set a Reduction Target** – Establish a reduction target. Preferred targets are 20% reduction in GHG emissions from municipal operations, and a minimum 6% reduction for the community, both within 10 years of joining PCP.
- **Milestone Three: Develop a Local Action Plan** Develop and finalize a local action plan that aims to reduce emissions and energy use in municipal operations and the community.
- **Milestone Four: Implement the Plan** – Implement the community and corporate measures identified in the plan.
- **Milestone Five: Measure Progress** – Monitor, verify and report GHG reductions.

ICLEI Energy Services' analysis consists of three parts: Milestone One (update), Two and Three. Milestone One is a GHG emissions inventory, which involves a summary, analysis and forecast of the energy consumption, energy costs, landfilled waste and the corresponding GHG emissions. The corporate section focuses on municipal buildings, vehicle fleet, streetlights, water and sewage operations and municipally produced waste and the community section centers in on the GHG emissions of the residential, commercial, industrial, transportation and community waste sectors and. The Town already completed Milestone One, although it was updated for this report.

Milestones Two and Three do not need to be done in order, in fact many municipalities choose to design their Local Action Plans before they set an emissions reduction target to ensure the target is attainable. The Local Action Plan in this report is a summary of GHG measures that can lead the Town towards reducing GHG emissions. Some of these measures have already been implemented, while others are recommended for the future. Ultimately, the GHG emission impact of all the measures is combined and analyzed in order to recommend a GHG reduction target.

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

2.0 PROJECT APPROACH

2.1 PHASE 1 - PROJECT START-UP

The project started with the establishment of a project team with key staff from the Town that could provide valuable information to the process and staff from ICLEI Energy Services (IES). The team members were:

- **Saroj Acharya**, Manager, Facility Systems, Engineering & Public Works
- **Lisa Chen**, Capital Analyst, Finance
- **George Flint**, Development Coordinator - Transportation, Engineering & Public Works
- **Marcel Lanteigne**, Manager, Transportation, Traffic & Site Plans, Engineering & Public Works
- **Daniel Olding**, Environmental Coordinator, Engineering & Public Works
- **Rodney Young**, Fleet Supervisor, Engineering & Public Works
- **Megan Jamieson**, Program Coordinator, ICLEI-Canada
- **Rob Kerr**, Director, ICLEI-Canada
- **Al Seskus**, Manager, ICLEI Energy Services

This phase of the project also included a review of the Town's existing GHG emissions inventory and projection (PCP Milestone One). The existing inventory had been completed for 1994 to 1999. The project team resolved that it was necessary for IES to update the inventory to 2000 and backcast the 1994 data to 1990 in order to get a clearer picture of the Town's current and historic emissions profile.

2.2 PHASE 2 - QUANTIFY HISTORIC & EXISTING MEASURES

This phase of the project involved reviewing the historic and existing energy efficiency and GHG reduction measures the Town has already put in place. Information about each of the projects (i.e. municipal building retrofit or vehicle replacement) was gathered and compiled by IES via the project team members. With this information, IES used the PCP Software and Protocol to quantify the GHG reduction impact of the measures (see Methodology section for more information).

2.3 PHASE 3 - IDENTIFY POTENTIAL NEW MEASURES

In phase three of the project potential new measures to be included in the Town's Local Action Plan (LAP) were identified. The inventory and forecast completed by the Town provided a basis from which to identify target GHG emission reduction areas/sectors. Additionally, the analysis of historic and current measures revealed the GHG emission reductions accrued in each sector. With this information at hand, the project teams gathered to brainstorm potential new measures (or expansion of current measures) that could be implemented within the Town to help reduce GHG emissions. IES added to this process by providing information about best practices within the ICLEI and PCP network. IES then reviewed the potential new measures and determined the potential GHG reductions of each measure utilizing the PCP Software and Protocol.

2.4 PHASE 4 - IDENTIFY A GHG EMISSION TARGET

The previous phases led to the development of recommended GHG emission reduction targets for both the community and corporate operations. The historic, current and potential future measures were analyzed and compiled to create future GHG emission scenarios. By comparing the scenarios against the baseline inventory and Business as Usual (BAU) Forecast completed in Milestone One, future GHG emissions targets were established. At this stage in the project the project team was brought together again to consider the results of the measures quantification process and agree upon a recommended GHG emissions target.

2.5 PHASE 5 - FORMULATE AND APPROVE LOCAL ACTION PLAN

The last phase in the involved drafting the Local Action Plan report. It was written by IES and then circulated to the project teams for comment. The Local Action Plan report was presented to the Senior Management Team and the Committee of the Whole (CW) and Council, prior to a public release of the plan.

3.0 METHODOLOGY

A greenhouse gas (GHG) emissions inventory involves collecting actual data on fuel, energy, and waste from all the sectors that make up a community and corporate operations. In a corporate emissions inventory, energy consumption in the buildings, vehicle fleet, streetlighting, and water and sewage sectors are collected along with the waste generation information from corporate operations. In a community emissions inventory, energy consumption data in the residential, commercial and industrial, and transportation sectors are gathered, along with community waste generation and disposal information. Table 1 shows the sources for the inventory data.

Sector	Source
Corporate Inventory	
Buildings	Electricity bills Natural gas bills
Streetlighting	Electricity bills
Vehicle Fleet	Vehicle fuel consumption records
Water & Sewage	Electricity bills
Waste	Waste haulage records
Community Inventory	
Residential, Commercial & Industrial	Electrical utility Natural gas utility
Transportation	Annual average daily traffic counts
Waste	Waste haulage records

Table 1: Inventory Data Inputs

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 (Appendix A). 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 electrical energy does not emit GHGs when it is used, there are significant GHG emissions 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 carbon dioxide coefficient (eCO2) 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 eCO2 emissions. Because Ontario's electrical generation mix changes from year to year so does its eCO2 electricity coefficient. This means that in some cases, even when a municipality reduces its energy consumption, its GHG emissions may remain constant or even increase because the amount of fossil fuel electricity generation in the province's electricity generation mix has increased. (See Appendix A for more information on emission coefficients)

All municipalities participating in the PCP and CCP use the GHG calculation methodology described above. The Protocol was established to ensure that local governments around the world are using the same methodology in calculating and reporting the GHG emissions and emission reduction. A copy of the PCP Protocol is available on the Partners for Climate Protection (PCP) website: http://kn.fcm.ca/

The PCP Protocol was followed for the Town's Local Action Plan. The Protocol advises that Local Action Plans be divided into two-sections. The first section is the Local Action Plan for corporate operations. The second section is the Plan for the community at large. The Town has much more control over its own operations, therefore it is recommended that corporate operations be separated from the community. This format is mirrored in this report, with the corporate plan presented first, and then the community plan presented second.

Data Estimates

The Town's GHG inventory was compiled before the onset of this project. It was completed for the years 1994 to 2000. It also included a Business as Usual (BAU) forecast to 2009, which was updated based on projected population and commercial development growth in the community and the anticipated growth in municipal operations. A BAU forecast estimates GHG emissions in the future in the absence of any further efforts to reduce GHG emissions.

The Project Team resolved that it would be useful to estimate the 1990 baseline emissions due to its relevance to the Kyoto Protocol baseline and in preparation for any future requirements. It would have been very time intensive to attempt to collect new raw energy consumption data for 1990, and likely unsuccessful given that data tracking techniques were not as rigorous at the time and that the data would not have been easily accessible. Therefore it was resolved that the 1990 data would be estimated given backcasting techniques commonly used in the PCP. The 1990 estimate was based on the change in population and commercial development for the community inventory. For the corporate inventory the estimates were based on the change in floor area, number of streetlightings, fuel consumption in the fleet, and the number of employees.

4.0 CORPORATE INVENTORY & TARGET

4.1 CORPORATE INVENTORY SUMMARY

This section of the report summarizes the energy consumption, eCO2 emissions and energy cost analysis for corporate operations as a whole. It includes buildings, vehicle fleet, streetlights, water and sewage as well as corporate waste. The following 5 sections of the report elaborate on the trends experienced in each sector.

A general rising trend in energy consumption, energy costs and eCO2 emissions is illustrated throughout the corporate inventory. This is mainly due to increased use of energy in providing services to an expanding population. In 1990, the Town's population was 79,739 and by 2000 the population has reached 135,833, a 70% increase.

Overall, energy consumption increased by 65% between 1990 and 2000, from 111,000 GJ to 182,000 GJ. Energy costs increased by 56%, from $2.0 million in 1990 to $3.2 million in 2000. eCO2 emissions increased in the same time frame from almost 7,000 t in 1990 to 13,000 t in 2000, equivalent to a 91% increase. eCO2 emission increased at a higher rate than energy consumption because the fossil fuel content of Ontario's electricity profile increased by 23% from 1990 to 2000 (Appendix A). These trends are presented in Table 2 and Figure A. The reasons for the increases in eCO2 emissions, energy consumption and costs are elaborated on in the following sections on buildings, streetlights, water and sewage and corporate waste.

Year	eCO2(t)	Energy (GJ)	Cost ($)
1990	6,868	110,925	2,050,430
1994	6,008	146,532	2,416,660
1995	6,573	150,331	3,088,265
1996	7,630	161,344	2,531,399
1997	8,828	160,932	2,496,309
1998	10,311	154,835	2,469,298
1999	11,172	171,103	2,918,552
2000	13,136	182,493	3,207,893

TABLE 2: Annual Inventory Data Summary

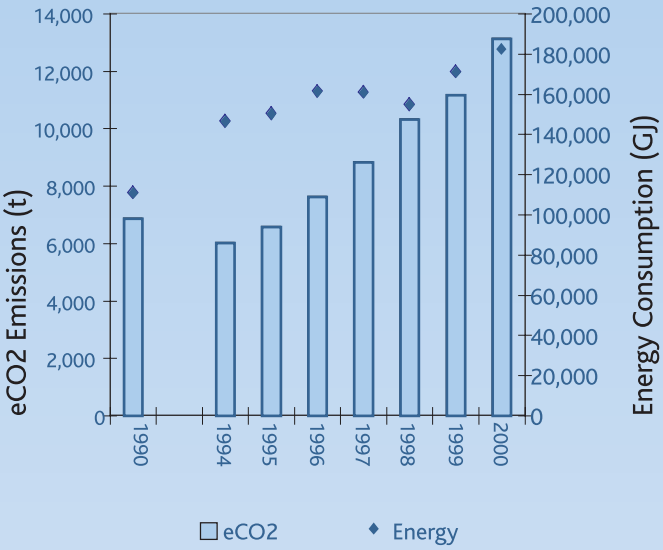

FIGURE A: Corporate Operations Profile - eCO2 and Energy, 1990 to 2000

Figure B demonstrates the amount of eCO2 emissions and energy consumption relative to the Town's growing population. The bars demonstrate the eCO2 emissions per 1000 people. In 1990, there was 93 t of eCO2 emissions per 1000 people, and by 2000 this had increased to 97 t per 1000 people. This increase was minimized by the fact that that energy consumption within the Town's operations has become more efficient over the years. As illustrated by the diamonds on Figure B, energy consumption per 1000 people has decreased from 1,504 GJ in 1990 to 1,343 GJ in 2000.

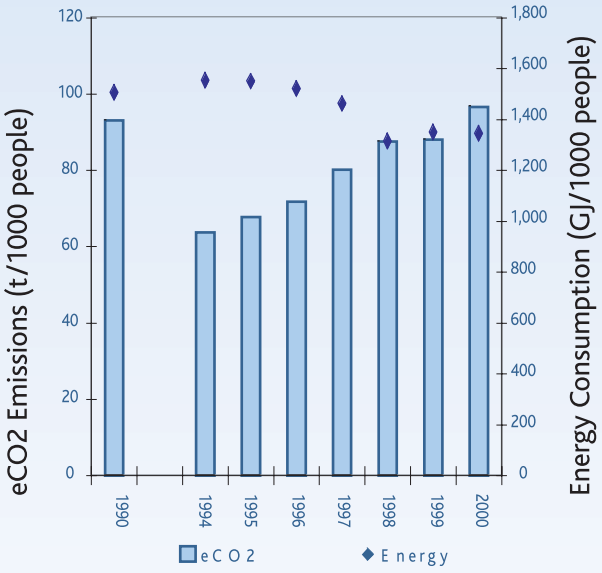

FIGURE B: Corporate Operations Profile - Per Capita eCO2 and Energy, 1990 to 2000

Sector	1990 eCO2 (t)	Energy (GJ)	Cost ($)	2000 eCO2 (t)	Energy (GJ)	Cost ($)
Buildings	4,277	73,803	1,117,011	9,327	135,604	2,175,341
Vehicle Fleet	726	10,396	183,074	944	13,546	328,080
Streetlights	1,857	26,045	729,688	2,820	32,284	665,193
Water & Sewage	49	681	12,673	93	1,059	26,612
Waste	-41		7,985	-48		12,667
Total	6,868	110,925	2,050,430	13,136	182,493	3,207,893

Table 3: eCO2, Energy & Costs Sector Breakdown, 1990 & 2000

As Table 3, and Figures C and D demonstrate, buildings have dominated the energy, emission and cost profiles from 1990 through to 2000. In 1990, buildings were responsible for 61% of the Town's emissions, followed by streetlights at 27%, vehicle fleet at 10%, corporate waste and water and se wage and waste each at 1%. The profile shifted slightly in 2000, with buildings expanding to 71% of the pr ofile, streetlighting decreasing to 21%, the vehicle fleet decreasing to 7%, water and sewage remaining at 1% and waste at less than 1%.

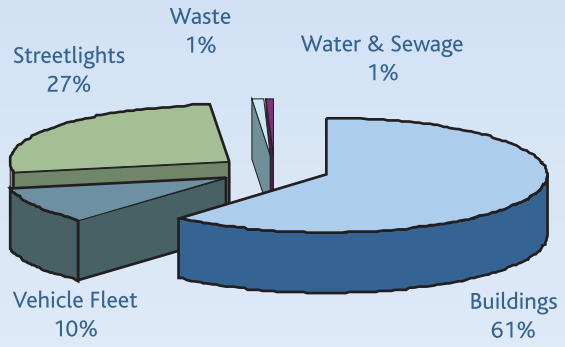

Figure C: 1990 eCO2 Emission Profile

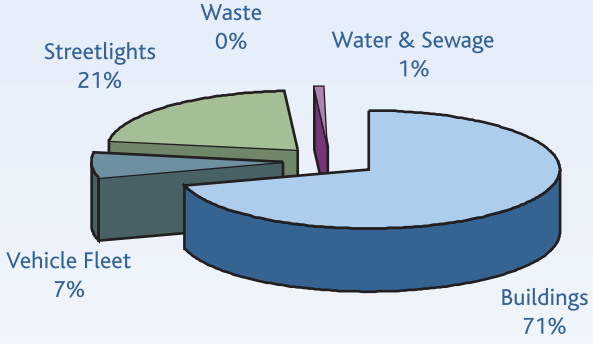

Figure D: 2000 eCO2 Emissions Profile

These profiles are typical of municipal government operations. Generally buildings occupy a large portion of the profile. Water and sewage operations often occupy a large por tion of the profile because the treatment process is energy intensive. Since the Region of York is responsible for the majority of water and sewage services within the Town, energy consumption, eCO2 emissions and costs would be included in the Region's corporate inventory. Streetlighting and the vehicle fleet typically take-up a smaller por tion of the profile, and waste from corporate operations is rarely significant.

4.2 Corporate Target

The following sector summaries analyze the energy and emission reductions that have been achieved by the Town to date and those that could be implemented in the future. This analysis was used to determine a reasonable overall corporate eCO2 emissions target. By compiling the eCO2 emissions and measur es from each corporate sector we can determine the overall corporate emissions forecast. This, compared with a summary of all the measures in each sector combined will illustrate the modeled future eCO2 emissions scenario.

Table 4 summarizes the results of the measures analysis for each corporate sector. It includes the estimated annual energy savings, eCO2 savings, and energy cost savings for the measures that have already been put in place by the Town, and the measures that are suggested within this report. As a result of the measures that have already been put in place to r educe energy consumption, costs and emissions, the Town is achieving annual eCO2 savings of 1,397 t, annual

energy savings of 16,000 GJ and annual energy costs savings of $416,000. It is estimated that the Town could be savings a further 5,000 t of eCO2 emissions, 65,000 GJ, and $1 million per year by implementing the measures suggested in this report. More information about the measures suggested in this report is provided in the sector summaries.

Sector	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)
Historic and Current Measures			
Buildings	6,893	696	207,372
Vehicle Fleet	611	43	9,989
Streetlighting	8,808	658	198,167
Total Historic & Current	16,312	1,397	415,528
Future Measures			
Buildings	45,299	3,042	635,050
Vehicle Fleet	1,564	383	491
Streetlighting	18,284	1,597	372,882
Total Future	65,147	5,022	1,008,423
Grand Total	81,459	6,419	1,423,951

Table 4: Historic, Current, and Future Measures

Figure F illustrates the Town's absolute eCO2 emissions in 1990, 2000 and 2009. The 2009 projection includes anticipated growth, the measures that have already been implemented by the Town, and the future measures that are suggested in this report. The Town has already implemented measures that amount to nearly 1,400 t of eCO2 savings per year. If the measures suggested in this report are implemented, the Town has the potential to save an additional 5,000 t of eCO2 emissions annually. Achieving the 2009 emissions projection would result in annual eCO2 emissions 20% lower than 2000 levels. 2009 total emission levels would still be significantly higher than 1990 levels due to the increase in services provided by the Town to the growing population. To examine the effect of a growing population, the next figure illustrates the target on a per capita basis.

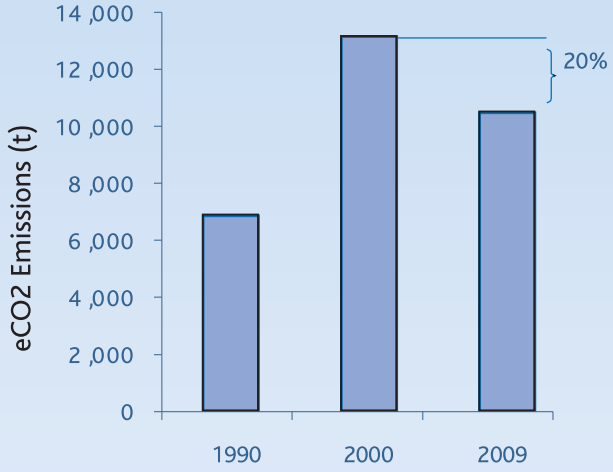

Figure E: Absolute Corporate Emissions Target

Figure F illustrates the 1990, 2000, and 2009 projected emissions per capita. Achieving the 2009 emissions projection would actually result in a 34% decrease in per capita eCO2 emissions levels from 1990 levels, and a 36% decrease from 2000 per capita levels.

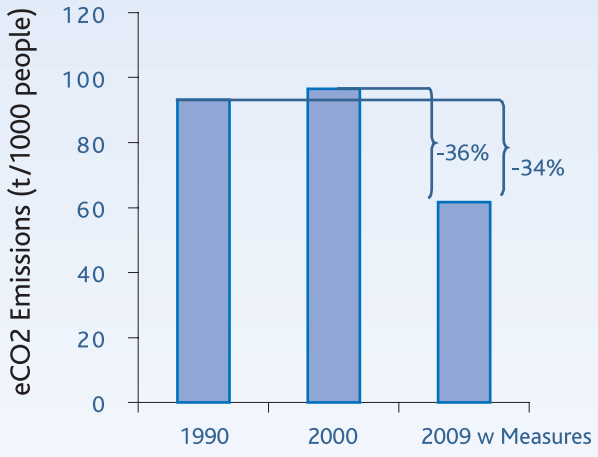

Figure F: Per Capita Corporate Emissions Target

4.3 BUILDINGS SUMMARY

4.3.1 Buildings Inventory

The Buildings sector represents all the buildings owned and leased by the Town of Richmond Hill. This includes administration facilities, recreation centres, arenas, pools, libraries, maintenance buildings etc. Buildings occupied the largest portion of the Town's corporate eCO2 emissions profile, 61% in 1990 and 71% in 2000.

Year	eC02 (t)	Energy (GJ)	Cost ($)	Area	t/m^2	GJ/m^3	$\$/m^2$
1990	4,277	73,803	1,117,011	581,516	0.0074	0.1269	1.92
1994	4,525	111,853	1,692,898	881,323	0.0051	0.1269	1.92
1995	4,559	108,010	2,232,173	881,323	0.0052	0.1226	2.53
1996	5,525	119,864	1,669,295	894,748	0.0062	0.1340	1.87
1997	6,305	118,782	1,607,970	937,323	0.0067	0.1267	1.72
1998	7,076	110,574	1,557,371	937,323	0.0075	0.1180	1.66
1999	7,766	123,831	1,943,769	947,158	0.0082	0.1307	2.05
2000	9,327	135,604	2,175,341	1,024,387	0.0091	0.1324	2.12

Table 5: Buildings Inventory Data Summary

Energy consumption in this sector has fluctuated over the years, but in general it has increased by 84% between 1990 and 2000, from 74,000 GJ to 136,000 GJ. Within the same timeframe, the Town increased its building stock by over 442,000 m2, by expanding existing facilities or adding new facilities. Despite the growth in floor area, energy consumption per unit area only increased by 4%, from 0.1269 GJ/m2 to 0.1324 GJ/m2.

Within the same timeframe energy costs increased by 95% from $1.1 million to $2.2 million. The cost of energy per unit area raised from $1.92/m2 in 1990 to $2.12/m2 in 2000.

In absolute terms, eCO2 emissions more than doubled from 1990 to 2000, from 4,300 t to 9,300 t. Relative to the floor area of municipal buildings, this was equivalent to an increase from 0.0074 t/m2 to 0.0091 t/m2.

Figure G illustrates the buildings sector eCO2 emissions and energy consumption over time, between 1990 and 2000 inclusive. Energy consumption increased slightly in 1996, likely due to the addition of 5 new buildings: Mill Street Comfort Station, Richmond Green Poultry Buildings, Rawlinson Property, Oak Ridges Fire Hall, and the building at 4 Arnold Crescent. Energy consumption then decreased slightly in 1998, possibly due to energy efficiency retrofits, and increased again in 1999 and 2000. The increases in 1999 and 2000 were mainly due to the addition of 5 new facilities: Crosby Tennis and Field House, Hill House Hospice, Leslie Street Washrooms, Hellenic Club, and Elgin Mills Fire Station.

Energy costs essentially followed the same trend as energy consumption, with the exception of 1995 when there was an increase in natural gas prices throughout North America.

eCO2 emissions increased after 1995. A small part of this was due to the increase in energy consumption, but in large part it was due to the increase in fossil fuel content of the electricity provided in the provincial electric power grid (Appendix A).

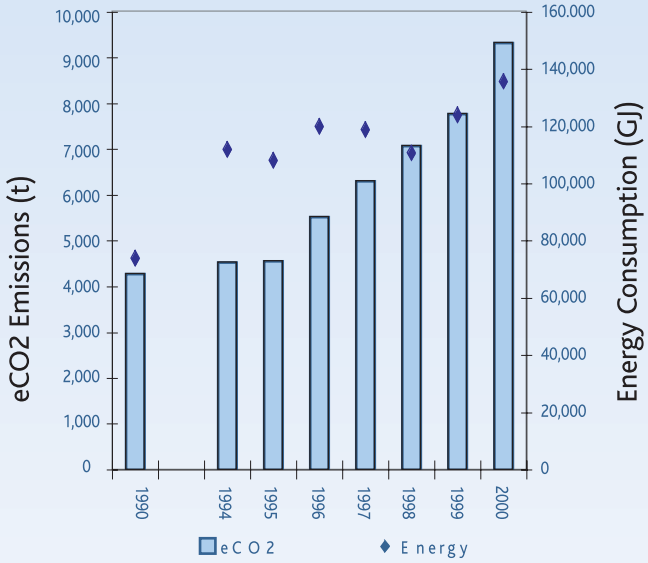

Figure G: Buildings Profile - eCO2 and Energy, 1990 to 2000

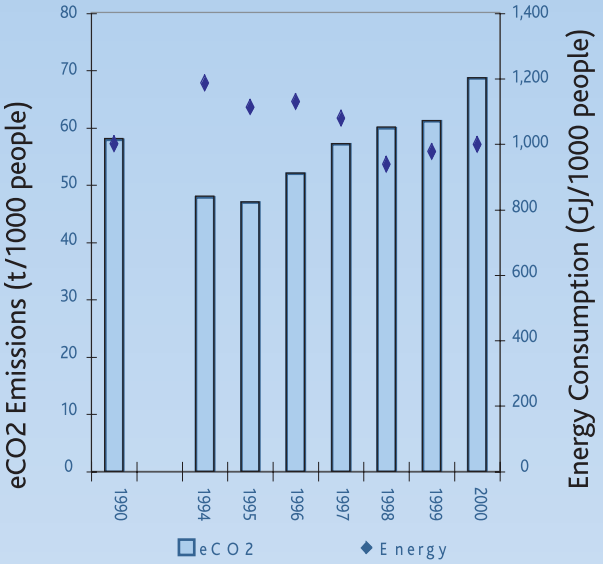

Figure H: Buildings Profile – Per Capita eCO2 and Energy, 1990 to 2000

Figure H illustrates the building sector energy consumption and eCO2 emissions relative to the Town's population growth. While eCO2 emissions per 1000 people grew from 59 t in 1990 to 69 t in 2000, energy consumption from municipal operation of buildings per 1000 people decreased from 1001 GJ to 998 GJ over the same time period. This trend reflects an increase in the energy efficiency of services provided for a growing population.

4.3.2 Building Measures

Over the years the Town has implemented many measures that have reduced energy consumption, energy costs, and eCO2 emissions. These measures range from green purchasing strategies to building energy efficiency retrofits.

Table 6 displays the estimated annual savings from each of these measures. The final column demonstrates the cost savings per tonne of eCO2. Appendix B describes each measure in more detail and demonstrates how the annual savings were calculated.

In total, it is estimated that the Town is saving 6,893 GJ of energy per year because of the measures it has already implemented. The associated energy costs savings are over $207,000, and 696 t eCO2 are avoided each year.

The Town is considering some future building measures that will further reduce energy consumption, emissions and energy costs (Table 7). These measures include installing block heater timers, air exchangers and developing a policy to reduce the water temperature in Town owned pools. It is impossible to model every scenario to reduce energy within the buildings sector, therefore a simple bulk estimate labeled Various Future Measures which may include anything from additional energy efficiency retrofits to the use of renewable energy is also included (the project team felt that 10% reduction using miscellaneous measures was reasonable). Appendix B elaborates on the types

Title	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)	Cost Savings per eCO2 Savings ($/t)
Infrastructure Program	-1,359	33	42,428	1,286
Central Library Lighting Retrofit	1,076	4	24,533	261
225 East Beaver Creek Lighting Retrofits	3,020	264	68,856	261
Multiple Lighting Retrofits	2,474	216	56,506	262
Building Automation System (BAS), Fire Hall	86	8	1,964	246
Operations Centre Upgrades	193	17	4,408	259
Decommissioning of one Historical Home	9	0.4	69	173
Energy Efficient Purchasing Policy	3,345	234	53,189	227
Total	6,893	696	207,372	298

Table 6: Historic & Current Building Measures

Title	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)	Cost Savings per eCO2 Savings ($/t)
Block Heater Timers or Controllers	4,535	396	8,062	20
Air Exchangers	23,664	1,500	366,535	244
Water Temperature Policy in Pools	4,144	252	59,631	237
Various Future Measures	12,956	894	200,822	225
Total	45,299	3,042	635,050	209

TABLE 7: Future Building Measures

of measures the Town may want to consider in the future.

4.3.3 Buildings Forecasts

In order to set a realistic eCO2 emissions target for the future, two different emissions projections were created. Figure I illustrates the predicted eCO2 emissions for 2009 under a Business as Usual (BAU) scenario. The BAU scenario anticipates growth in the absence of any future emission reduction measures. The Town anticipates building some new facilities during this time such as 3 libraries, a youth centre, a community centre, a discovery centre, and an arts and cultural facility, as well as expanding some existing facilities. The figure below illustrates that these new facilities are expected to increase energy consumption, eCO2 emissions and energy costs by approximately 40%.

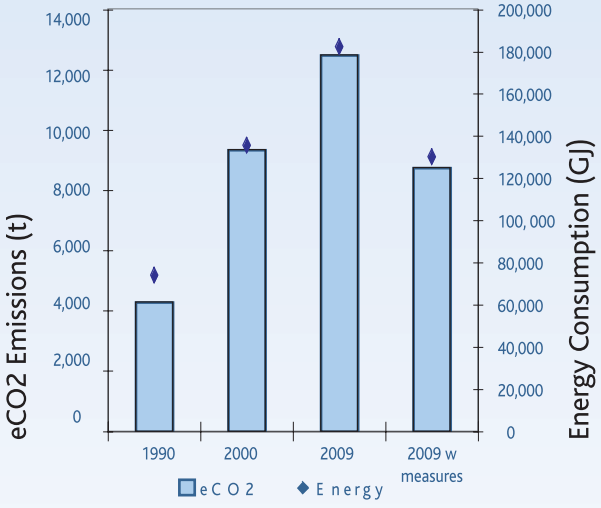

FIGURE I: eCO2 and Energy Building Forecast

The final point in Figure I demonstrates the anticipated level of energy consumption and eCO2 emissions if the Town implements the measures described in Table 7. If they are successful in achieving the modeled savings, eCO2 emissions would decrease to 6% below 2000 levels and energy consumption would decrease to 4% below 2000 levels.

4.4 VEHICLE FLEET SUMMARY

4.4.1 Vehicle Fleet Inventory

The vehicle fleet sector represents all the vehicles owned by the Town such as those used in parking control, administration, parks, roads, etc. This includes cars, trucks, mowers, loaders, and sanders etc. Since employee's personal vehicles are used part of the time for the Town's purposes (i.e. permit inspection and by-law licensing), this portion is also included. In total, the vehicle fleet sector occupied 10% of the Town's total corporate eCO2 emission profile in 1990, and 7% in 2000.

Overall, fuel consumption increased from 10,000 GJ in 1990 to 14,000 GJ in 2000, a 30% increase (Table 8). Over the same timeframe, fuel costs increased by 79%, from $183,000 to $328,000 and eCO2 emissions increased by 30% from 700 t in 1994 to 900 t in 2000. The increasing trend in fuel costs, consumption and eCO2 emissions can be partially attributed to the fact that the Town is providing services to a population that has increased by 70% between 1990 and 2000.

A detailed analysis on the rates of energy consumption per vehicle, distance traveled or department cannot be performed because the Town only began tracking individual and departmental vehicle fuel consumption in 1999.

Year	eCO2(t)	Energy (GJ)	Cost ($)
1990	726	10,396	183,074
1994	726	10,396	183,074
1995	1,151	16,570	284,045
1996	976	14,047	248,203
1997	955	13,729	267,198
1998	957	13,752	263,707
1999	1,055	15,150	296,181
2000	944	13,546	328,080

TABLE 8: Vehicle Fleet Inventory Data Summary

Figure J illustrates the eCO2 emissions and energy consumption from municipal fleet operations from 1990 to 2000. Unlike the buildings sector, energy consumption and eCO2 emissions track together because the carbon content of the fuel does not change with time. Overall there has been an increasing trend in energy consumption and eCO2 emissions. In 1995 there was a spike in fuel use, which then lowered from 1996 to 1998.

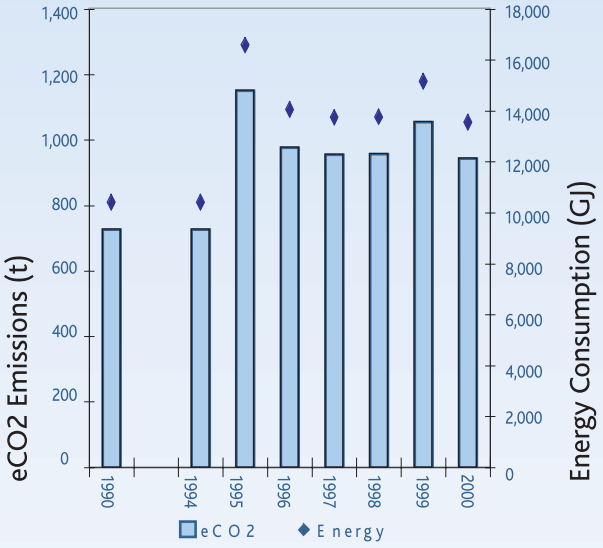

FIGURE J: Vehicle Fleet Profile - eCO2 and Energy, 1990 to 2000

Figure K illustrates the vehicle fleet energy consumption and eCO2 emissions relative to the Town's growing population. In 1990, eCO2 emissions from the Town's fleet operations were 10 t/1000 people, while in 2000 they had lowered to 7 t/1000 people. Over the same time period energy consumption decreased from 141 GJ/1000 people to 100 GJ/1000 people.

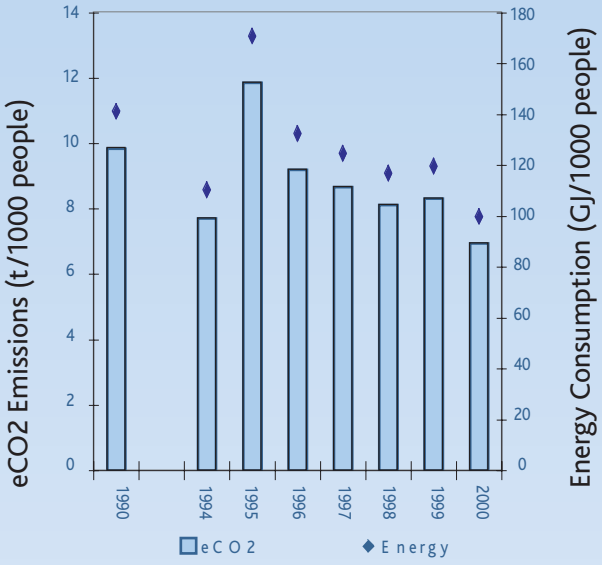

FIGURE K Vehicle Fleet Profile - Per Capita eCO2 and Energy, 1990 to 2000

4.4.2 Vehicle Fleet Measures

The Town has implemented many measures that have reduced the fuel consumption, costs and associated eCO2 emissions in the vehicle fleet sector. Table 9 displays these measures and their estimated energy consumption, eCO2 and energy costs savings. The final column displays the cost savings per tonne of eCO2 saved. A description of each measures and the methodology used to calculate the savings are presented in Appendix B.

In total, the Town is saving nearly $10,000 per year on avoided fuel expenditures. They are also saving 611 GJ of energy consumption and 43 t of eCO2 emissions.

Title	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)	Cost Savings per eCO2 Savings ($/t)
Honda Civic Hybrid	116	8	2,170	271
Solar Powered LED Arrow Boards	97	7	1,500	214
Water Dept. Cube Van	28	2	436	218
Vehicle Downsizing	33	2	618	309
Water Dept. Truck Replacement	167	12	2,600	217
Roads Dept. Truck Replacement	167	12	2,600	217
Parks Dept. Equipment Replacement	3	0.2	65	325
Total	611	43	9,989	232

TABLE 9: Historic and Current Vehicle Fleet Measures

Title	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)	Cost Savings per eCO2 Savings ($/t)
Bio Diesel	0	252	-19,502	-77
Ethanol Blend Gasoline	0	23	-6,664	-290
Battery Packs and Inverters	140	10	2,180	218
Honda Civic Hybrid	116	8	2,170	271
Water Dept. Cube Van	28	2	436	218
Vehicle Downsizing	17	1	309	309
Water Dept. Truck Replacement	167	12	2,600	217
Anti Idling Campaign	276	19	5,008	264
Planned Expansion of Anti Idling Campaign	299	20	5,492	275
Purchase of Additional Hybrid Vehicles	48	24	6,509	271
Low Roll Resistance Tires	173	12	1,953	163
Total	1,564	383	491	1

TABLE 10: Future Vehicle Fleet Measures

Table 10 displays many of the future measures the Town has already planned for the fleet sector as well as a few measures they want to consider in the future. According to this modeling, the Town could save an additional 383 t eCO2 by implementing these measures. They could also save 1,564 GJ of energy and $491. The total annual energy cost savings are only $491 because it will cost more to purchase biodiesel and ethanol blended fuels, however these measures do result in significant eCO2 savings.

4.4.3 Vehicle Fleet Forecasts

Figure L illustrates the forecasted energy consumption, costs, and eCO2 emissions under a BAU scenario. The BAU forecast tool is used to demonstrate growth in the absence of any future measures.

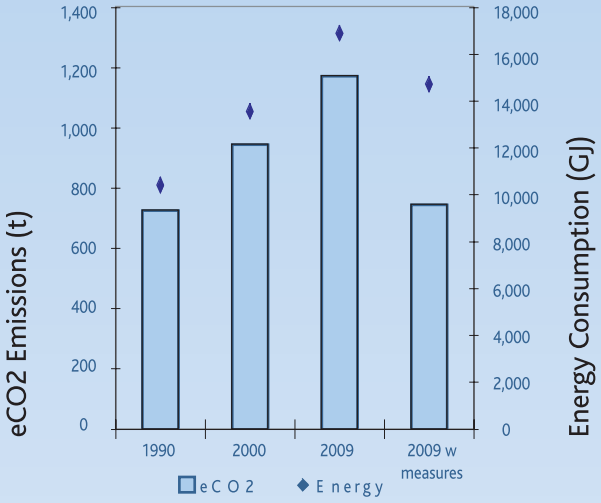

Figure L: Vehicle Fleet Profile - Per Capita eCO2 and Energy, 1990 to 2000

The growth to 2009 is based on the anticipated need for more fuel for Town vehicles and the continued growth trend in personal vehicle use for business operations. Energy consumption and eCO2 emissions are expected to increase by approximately 25%, while costs are expected to increase by 37%. The main reason for the high cost forecast is that personal vehicle use reimbursement increased by over 90% between 1996 and 2000, and this trend is projected to continue. The increase in mileage reimbursements is due to an increase in permits, increase in staff, and an increase in roads and services for a growing population. There was a steady increase in construction activity starting in 1996 and an increase in staff to handle inspections. Plumbing inspections were downloaded from the Region in 1999 and more staff were hired to handle the inspections.

The final data points in Figure L demonstrate the anticipated levels of energy consumption and eCO2 emissions if the Town implements the measures outlined earlier. The Town is already saving 43 t eCO2 per year, and there is the potential to save an additional 383 t eCO2, for a total annual savings of 426 t eCO2. Achieving this reduction would put 2009 eCO2 levels at 25% below 2000 levels. Energy consumption would be at 9% above 2000 levels, and costs would be 34% higher than 2000 levels.

4.5 Streetlights Summary

4.5.1 Streetlights Inventory

The streetlighting sector of this analysis includes the park lighting, traffic signals and streetlights operated by the Town. The Region of York is responsible for the traffic signals and illumination at the major intersections, therefore those streetlights would be included in the analysis of their operations. Streetlighting occupied 31% of the Town's total corporate eCO2 emissions profile in 1990 and 21% in 2000.

Year	eC02 (t)	Energy (GJ)	Cost ($)	# of Streetlights	GJ/ Streetlights
1990	1,857	26,045	[9]	26,438	4.05
1994	779	23,602	519,446	8,014	2.95
1995	886	25,140	543,552	8,517	2.95
1996	1,146	26,801	587,247	9,000	2.98
1997	1,577	27,789	598,655	9,371	2.97
1998	2,257	29,578	618,241	9,741	3.04
1999	2,334	31,171	647,612	9,800	3.18
2000	2,820	32,284	665,193	10,000	3.23

Table 11: Streetlighting Inventory Data Summary

The majority of the energy consumption for the streetlighting sector was estimated because the electric utilities charge the Town a flat rate rather than charge them based on the amount of electricity consumed. Therefore, it is assumed that as electricity costs increased, so did the electricity consumption.

According to the electricity use estimates, overall energy consumption has steadily increased since 1990. In 1990, the total energy consumption was 26,000 GJ and by 2000 it had increased by 24% to 32,000 GJ (Table 11). However, between this time the Town added approximately 3,500 new streetlight lamps. The

[9] 1990 Streetlighting costs not available.

energy use per streetlight actually decreased by 20%.

Figure M illustrates the energy consumption and eCO2 emissions from 1990 to 2000. Energy consumption followed a general rising trend. This increase would have been higher had the Town not implemented energy efficiency measures such as lighting controls and more efficient technology. The eCO2 emissions increase over time was due in part from the increasing energy consumption, but mainly due to the increase in fossil fuels in the provincial electrical power mix.

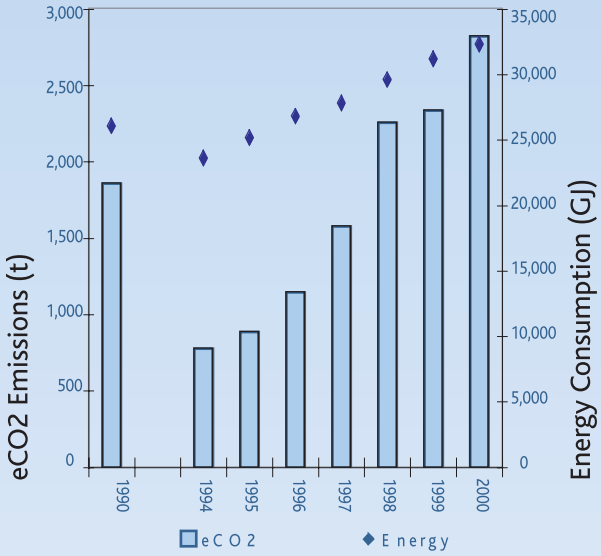

Figure M: Streetlighting Profile - eCO2 and Energy, 1994 to 2000

Figure N illustrates the energy consumption and eCO2 emissions from the streetlighting sector relative to the Town's population. The points on the graph demonstrate that the energy consumption per resident decreased, from 353 GJ/1000 people in 1990 to 238 GJ/1000 people in 2000.

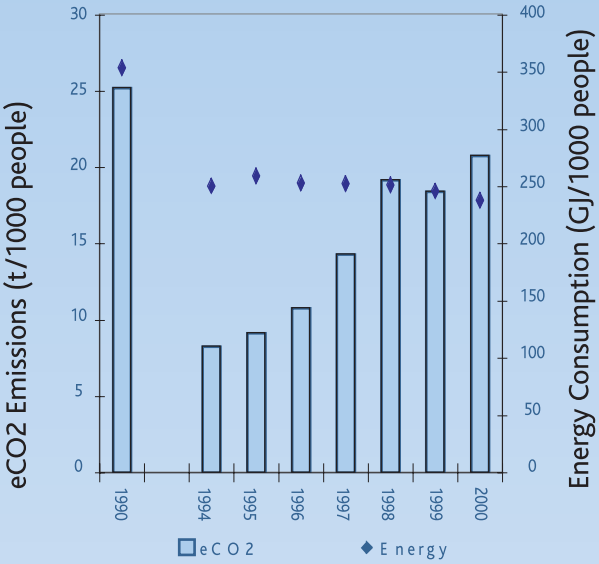

Figure N: Streetlighting Profile - Per Capita eCO2 and Energy, 1990 to 2000

4.5.2 Streetlights Measures

The Town has implemented many measures that have reduced energy consumption and eCO2 emissions. For the purposes of this report, only measures implemented after or during 1990 are counted towards meeting an emissions reduction target, therefore light level controls, and Parks Lighting program completed in the mid to late 1980s do not qualify. The measures implemented must also have a quantifiable effect on energy consumption or eCO2 emissions. Although the light pollution bylaw has certainly had an impact on outdoor lighting energy consumption within the Town, it is mainly focused on the commercial and industrial sectors and it is impossible to quantify the impact it has had.

From 1989 to 1994 all the incandescent and mercury streetlights were switched to high pressure sodium, which resulted in major energy savings. As well, the Town initiated a retrofit project in 1993 to switch incandescent traffic signals to light emitting diode technology. This retrofit project continues today and it is anticipated that it will be completed within the next few years. The final measure in the list is the light pollution bylaw, which ensures excess light pollution is controlled.

Title	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)	Cost Savings per eCO2 Savings ($/t)
Streetlighting Retrofit	7,084	507	156,485	309
Light Level Controls (pre 1990)	-	-	-	
Park Lighting Program (pre 1990)	-	-	-	
Traffic Signal Retrofits	1,724	151	41,682	276
Light Pollution Bylaw	-	-	-	
Total	8,808	658	198,167	301

TABLE 12: Historic & Current Streetlighting Measures

Title	Annual Energy Savings (GJ)	Annual eCO2 Savings (t)	Annual Energy Cost Savings ($)	Cost Savings per eCO2 Savings ($/t)
Traffic Signal Retrofits	1,724	151	41,682	276
Streetlighting Retrofits	16,560	1,446	331,200	229
Off-Grid Lighting	-	-	-	-
Total	18,284	1,597	372,882	233

TABLE 13: Future Streetlighting Measures

The Town has a number of options available to further reduce energy consumption and eCO2 emissions in the future. The traffic signal retrofit to LED technology that was initiated in 1994 will result in further savings as it is completed. There is also the option of retrofitting the current streetlighting with new LED technology as it becomes available. As well, as the technology becomes available the Town may want to consider installing solar technology to remove streetlights from the grid altogether. Of course, some of this technology is not currently available or affordable, however it can be expected that new technologies will become feasible in the future (therefore no savings have been included in this option for the time being). One of the major barriers to implementing energy and eCO2 emission savings options within the streetlighting sector is the fact that the Town pays a flat rate for the majority of its outdoor lighting and signals, therefore there is no incentive to save energy in order to save costs. If the Town were to invest in further energy savings they would want to consider working with their electricity supplier to review the billing format.

In total, the Town has the potential to save an additional 1,597 t eCO2, 18,284 GJ of energy and nearly $373,000 in energy costs savings.

4.5.3 Streetlights Forecasts

Figure O illustrates the eCO2 emissions, energy consumption and energy costs from 2000 to 2009. The forecast of energy consumption to 2009 is a BAU forecast, assuming growth in the absence of any future measures. Electricity needs are expected to increase by 20% by 2009.

The final data points in Figure O demonstrate the energy and eCO2 levels in 2009 if the Town contin-

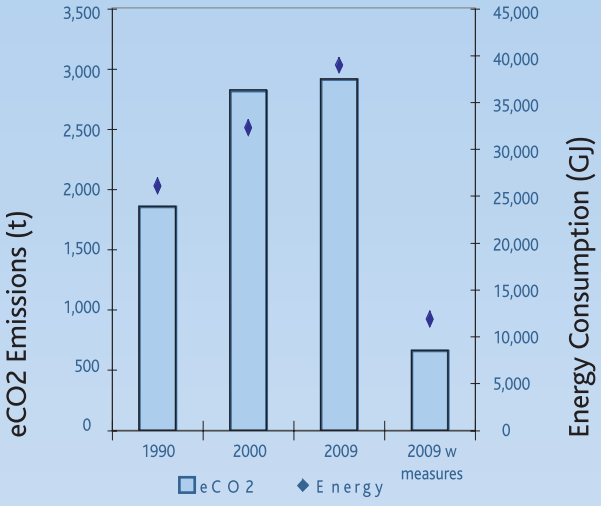

Figure O: eCO2 and Energy Streetlighting Profile, Forecast

ues to implement the measures in place, and implements the new measures suggested. Under this scenario, eCO2 emissions would fall to 59% below 2000 levels, energy consumption would fall to 41% below 2000 levels, and electricity costs would fall to 68% below 2000 levels.

4.6 WATER & SEWAGE SUMMARY

4.6.1 Water & Sewage Inventory

The water and sewage sector of this analysis reviews the energy consumption, costs and eCO2 emissions associated with the water and sewage services provided by the Town. Since water and sewage treatment falls under the Region of York's jurisdiction, the Town provides limited services in this area. All the energy use in this sector is for water and sewage pumping. Water and sewage operations occupied 1% of the Town's corporate eCO2 emission profile in 1990 and 2000.

From 1990 to 2000 energy consumption increased by 55% from 681 GJ to 1,059 GJ (Table 13). In 1997 the energy consumption increased by approximately 300 GJ due to the addition of the temporary Waterford Road sewage lift station. This sewage station has remained in use through to 2000. The slight increase in consumption in 2000 was mainly due to increased energy use at the Waterford Road station.

Energy costs have nearly tripled within the 6-year time frame, from $13,000 to $27,000. The Town went from paying $19/GJ ($0.68/kWh) in 1990 to $25/GJ ($0.90/kWh) in 2000. This is due to the rise in electricity costs over time. The same trend was not seen in the building energy costs mainly because some facilities have been switched to natural gas, a cheaper energy source. So, while electricity prices still rose in the buildings sector, the switch to natural gas made the increase in electricity prices less obvious.

Year	eC02 (t)	Energy (GJ)	Cost ($)	$/GJ
1990	49	681	12,673	18.61
1994	22	681	12,673	18.61
1995	22	611	19,583	32.05
1996	27	632	18,201	28.80
1997	36	632	15,552	24.61
1998	71	931	22,519	24.19
1999	71	951	22,885	24.06
2000	93	1,059	26,612	25.13

Table 14: Water & Sewage Inventory Data Summary

Figure P illustrates the energy consumption and eCO2 emissions between 1990 and 2000. The eCO2 emissions increase, in small part due to the overall increased energy consumption, but mainly due to the change in the emissions profile of the provincial power

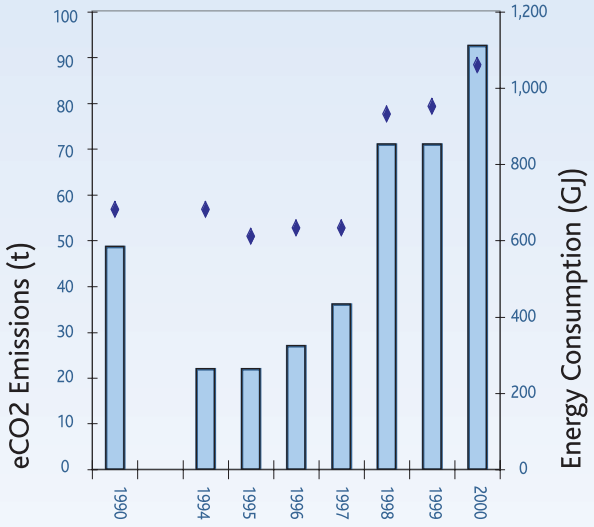

Figure P: Water and Sewage Profile - eCO2 and Energy, 1994 to 2000

grid.

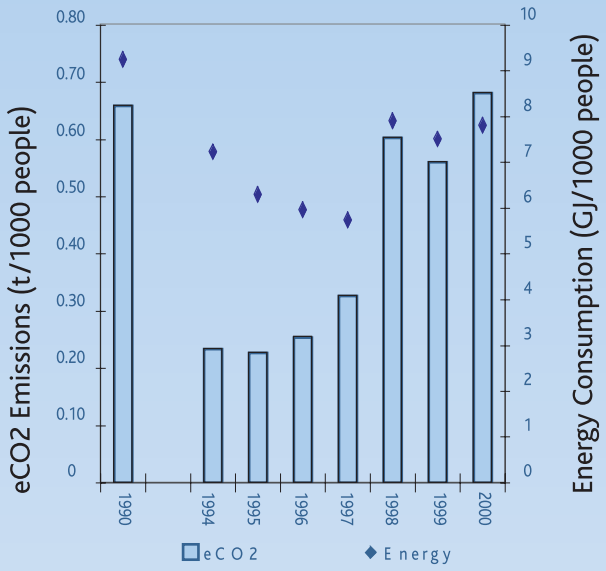

Figure Q: Water and Sewage Profile - Per Capita eCO2 and Energy, 1990 to 2000

4.6.2 Water & Sewage Measures & Forecasts

Since water and sewage services represent such a small portion of the Town's overall profile, there have been no specific measures implemented to reduce energy consumption or eCO2 emissions. And, for the same reason we are not recommending the Town focus its efforts on implementing any new measures in this sector.

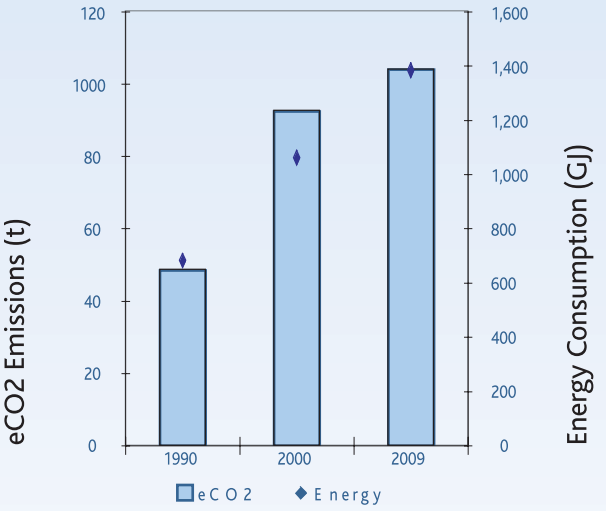

Figure R: eCO2 and Energy Water & Sewage Profile, Forecast

Figure R illustrates the anticipated energy consumption, costs and eCO2 emissions based on a BAU projection to 2009.

4.7 WASTE SUMMARY

4.7.1 Waste Inventory

The corporate waste sector profiles the emissions associated with the waste produced from corporate operations. It is a very small portion of the corporate eCO2 emissions profile, only 2% in 1994, and 1% in 2000. The eCO2 emissions from waste produced by the community at large are included in the community inventory (Community Inventory and Target section of report).

In 1990, municipal employees produced 236 t of waste (Table 15). By 2000, municipal employees had produced 41% more waste for a total of 333 t. The number of employees producing this waste also increased. In 1990 there were approximately 422 employees and in 2000 there were 499. The total waste from each employee increased by 19%, from 0.56 t to 0.67 t.

Since the waste is shipped to a landfill where the landfill gas emissions are captured, the amount of GHG emissions associated with the waste is balanced by the credit received from the burning of the captured landfill gas. In fact, since landfill gas is about 50% methane and methane has a global warming equivalent measure of 21 times carbon dioxide, it appears to be slightly beneficial to landfill waste rather than reduce it. However, this reduction in emissions is offset by the shipping associated with transporting waste to other community landfills and the avoided energy use that would come along with reusing and recycling waste. Table 15 and Figure S show the negative eCO2 emissions that resulted from corporate waste.

Year	eC02 (t)	Costs ($)	Waste (t)	Waste (t)Employee
1990	(41)	7,989	236	0.56
1994	(44)	8,569	253	0.56
1995	(45)	8,912	258	0.56
1996	(44)	8,453	257	0.56
1997	(45)	6,934	260	0.58
1998	(50)	7,460	290	0.62
1999	(54)	8,105	312	0.64
2000	(48)	12,667	333	0.67

Table 15: Waste Inventory Data Summary

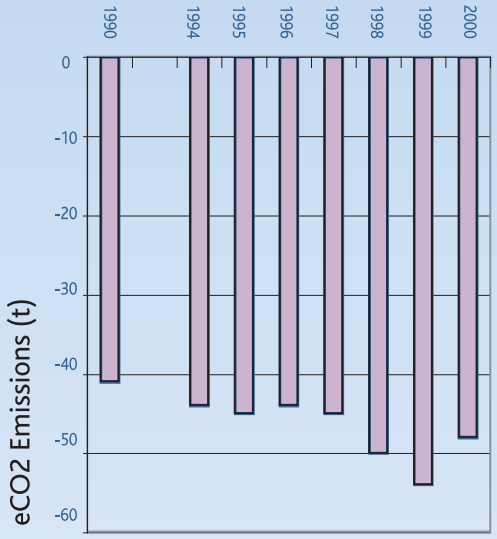

Figure S: Waste eCO2 Profile, 1990 to 2000

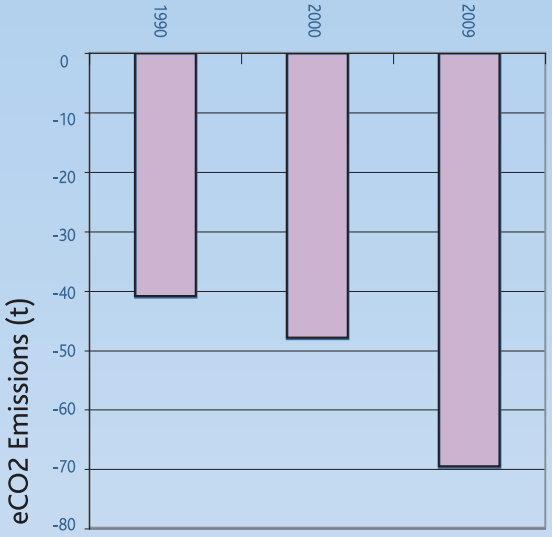

Figure T: eCO2 Waste Profile, Forecast

4.7.2 Waste Measures & Forecasts

Measures directed specifically at corporate waste production have not been implemented, nor are they suggested since they represent such as small portion of the emissions profile. However, the Town has been involved in many waste management initiatives that are highlighted in the community waste section of this report. These initiatives have been highly successful, and it is recommended that the Town continue to implement them and consider how they can further incorporate these initiatives into their own operations.

Figure T illustrates the anticipated increase in eCO2 emissions from 2000 to 2009. They are expected to decrease, along with increase in associated waste to landfill rates, by 45%.

5.0 COMMUNITY INVENTORY & TARGET

The following section of the report presents the results of the community energy consumption and eCO2 emissions inventory. First, the community-wide results are presented, followed by a breakdown of each sector including: Commercial and Industrial, Transportation, Residential and Waste.

5.1 COMMUNITY SUMMARY

In recent years the Town of Richmond Hill has grown at a steady rate, and is one of the fastest-growing municipalities in Canada. From 1990 to 2000, Richmond Hill's population increased by 70%, from 79,739 to 135,833. Consequently, the number of new homes, industrial and commercial establishments, new services, and the amount of traffic have increased, resulting in a rise in GHG emissions in the Town. The growing trend is expected to continue into the future, with an anticipated population of 170,500 in 2009, a 114% increase from 1990 levels. Without efforts to reduce energy consumption, GHG emissions will continue to rise.

Table 16 displays the annual energy consumption and eCO2 emissions in absolute and per capita terms. Energy consumption increased from 8,430,000 GJ in 1990 to 12,929,000 GJ in 2000, and is anticipated to increase to nearly double the 1990 levels in the absence of any energy and emission reduction measures. GHG emissions followed a similar increased trend, from 489,000 t in 1990 to 804,000 t in 2000. GHG emissions are expected to increase to 1,001,000 t by 2009 if there are no further measures implemented to reduce energy use in the community.

Despite the fact that absolute energy and eCO2 emission values have increased, the energy use and GHG emissions per capita have decreased over time. In 1990, the Town's per capita energy consumption was 114 GJ, and by 2000 it had decreased by 17% to 95 GJ/capita. Similarly, eCO2 emissions decreased from 6.6 t/capita in 1990 to 5.9 t/capita in 2000, an 11% decrease. This demonstrates that despite the fact that absolute values have increased, there has been an overall improved efficiency in energy use and eCO2 emissions per capita.

Year	Energy (GJ)	Per capita Energy Use	eCO2 (t)	Per capita eCO2 (t/capita)
1990	8,430,093	114.32	488,450	6.62
1994	10,461,550	110.86	504,514	5.35
1995	11,033,359	113.63	537,739	5.54
1996	11,814,842	111.28	597,530	5.63
1997	11,618,656	105.41	628,264	5.70
1998	11,301,670	95.86	673,413	5.71
1999	12,016,034	94.72	711,893	5.61
2000	12,929,775	95.19	804,357	5.92
BAU 2009[10]	16,229,684	95.19	1,009,643	5.92

Table 16: Community Energy Consumption and eCO2 Emissions

Figure U illustrates the total community energy consumption and GHG emissions over time. The bars on the graph illustrate the increasing trend of absolute annual GHG emissions, and the diamonds illustrate growth in absolute annual energy consumption.

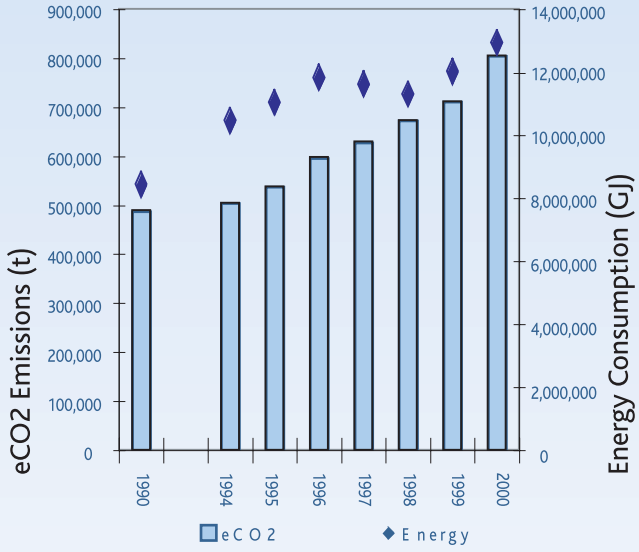

Figure U: Total Community Energy Consumption and GHG Emissions

[10] BAU or Business as Usual was estimated based on assumptions that growth and emissions would continue at a rate forecast in 2000.

Figure V illustrates the annual community energy consumption and GHG emissions relative to the annual population. Both the bars representing eCO2 emissions and the diamonds representing energy consumption are lower in 2000 than they are in 1990, demonstrating that despite the fact that absolute values have increased, there has been an overall improved efficiency.

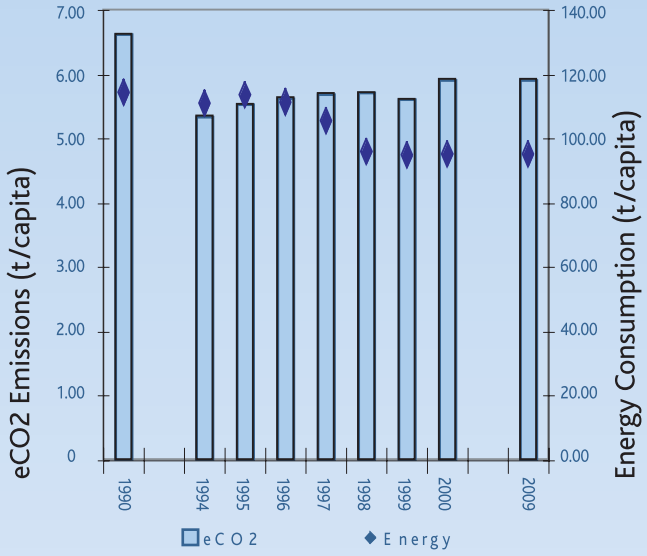

Figure V: Per Capita Community Energy Consumption and GHG Emissions

Figures W, X, Y, and Z illustrate the breakdown in energy consumption and eCO2 emissions between the residential, commercial and industrial, and transportation sectors for 1990 and 2000. In 1990, the commercial and industrial sector was responsible for the majority of energy use and eCO2 emissions, followed by the residential and transportation sectors. This phenomenon changed slightly by 2000 when the residential sector became the sector responsible for the largest portion of energy use and eCO2 emissions, followed closely by the commercial and industrial sector, and then the transportation sector. Since the population has grown so significantly in Richmond Hill in this timeframe, it is understandable that the residential sector profile would expand accordingly.

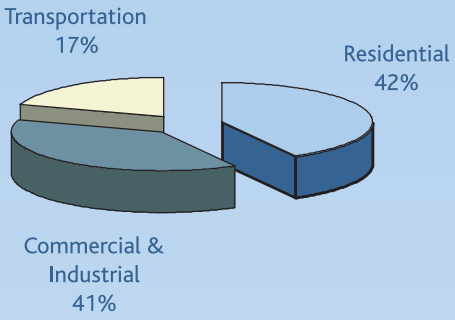

Figure W: 1990 Energy by Sector

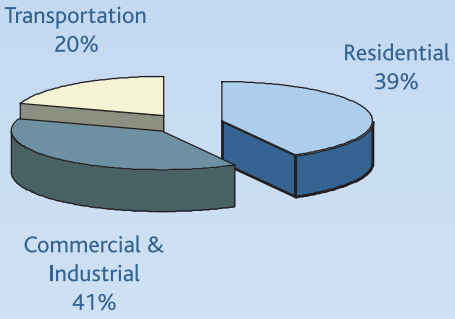

Figure X: 1990 eCO2 Emissions by Sector

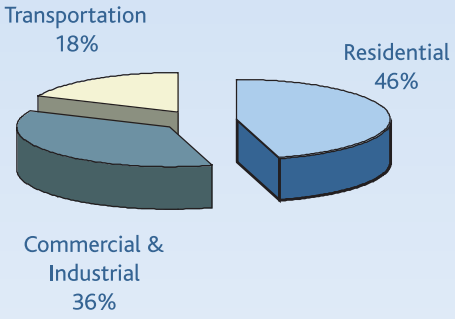

Figure Y: 2000 Energy by Sector

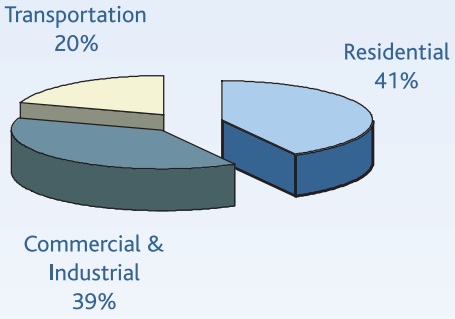

Figure Z: 2000 eCO2 Emissions by Sector

5.2 COMMUNITY TARGET

A component of the Local Action Plan is a community emissions reduction target. The reduction target is the specific eCO2 emissions reduction goal the Town aims to achieve by a designated year. It is usually expressed as a percentage reduction below the quantity of emissions released in the baseline year. For example, the PCP recommends participants adopt a community emissions reduction target of 6% below baseline levels within 10 years.

The Town 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 since the Town has little control over the provincial electricity generation mix. 1990 emission levels were 62% lower than 2000 emissions levels. As well, achieving emission reductions from 1990 within 10 years would be impossible given that 14 years have already passed since that baseline.

It is much more appropriate and realistic for the Town to set an emissions reduction target based on the 2000 eCO2 emission levels. Population is expected to increase to 25% above 2000 levels by 2009, therefore setting a target against the year 2000 would still require overcoming significant population growth. It would also give the Town time to initiate emissions reduction measures and measure progress towards the goal.

It is commonplace for municipalities with high population growth to adopt baseline years close to the current year. Many municipalities in the GTA, such as the Region of Peel, Region of York and City of Mississauga have high population growth and are therefore considering a target based on a base year close to 2000.

IES recommend the Town adopt the PCP recommended target of 6% below the year 2000 baseline levels by 2010. The potential community measures and future developments listed in the previous section makes this reduction target achievable even when considering the growth that is underway in Richmond Hill.

Figure AA illustrates the recommended 6% reduction target in relation to 1990 and 2000 eCO2 emissions levels.

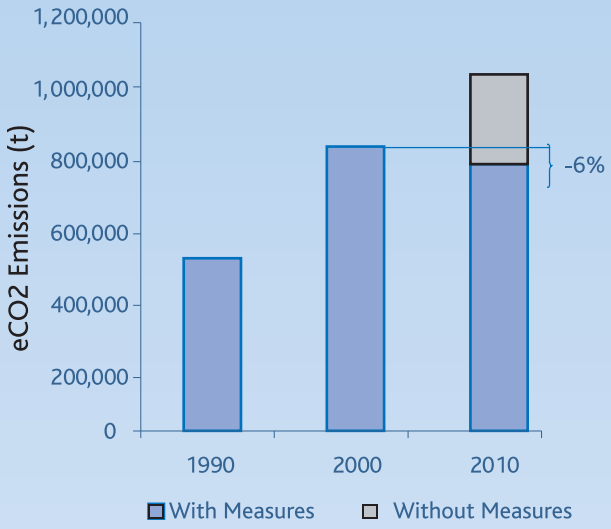

Figure AA: Absolute Community Reduction Target

Figure BB illustrates the recommended 6% reduction target in per capita terms. This target actually represents a decrease in per capita eCO2 emissions from 1990 levels. The 2010 target is actually 18% below 1990's per capita emissions of 6.6 t/capita. Therefore, although the recommended target will not result in an absolute reduction from 1990 levels, it will result in a significant decrease in per capita emissions.

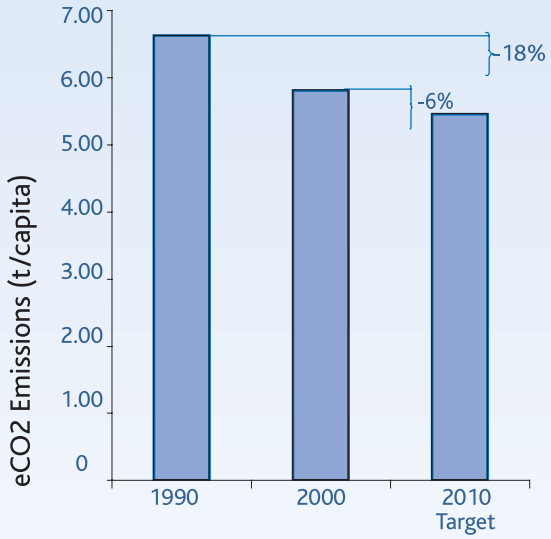

Figure BB: Per Capita Community Reduction Target

5.3 COMMERCIAL & INDUSTRIAL SUMMARY

The commercial and industrial sector includes institutions (churches, government, hospitals, museums, non-town recreational facilities, and schools), offices (medical, financial, multi-use offices and buildings), retail (restaurants, shopping centres, storefronts, grocery stores, garages, and warehouses), small industry, and any other unspecified commercial and industrial structures. Richmond Hill does not have a significant industrial sector, therefore it was not isolated for this analysis.

This sector accounts for a large portion of Richmond Hill's total community eCO2 emissions, representing 41% in 1990 and 39% in 2000. Table 17 displays the annual energy consumption and eCO2 emission data. Energy consumption increased by 36% between 1990 and 2000, from 3,443,000 GJ to 4,696,000 GJ, and eCO2 emissions increased by 54%, from 201,000 t to 309,000 t. If it is assumed that this sector will grow relative to anticipated population growth, energy consumption will increase to 5,894,000 GJ in 2009 and eCO2 emissions will increase to 388,000 t.

Year	Energy (GJ)	eCO2 (t)
1990	3,442,633	200,733
1994	4,078,949	174,192
1995	4,267,219	186,129
1996	4,334,853	202,240
1997	4,296,244	225,255
1998	4,133,685	253,485
1999	4,375,032	265,127
2000	4,695,655	309,342
BAU 2009	5,894,070	388,292

Table 17: Commercial and Industrial Energy Consumption and eCO2 Emissions

Figure CC illustrates the annual absolute energy consumption and eCO2 emissions for the commercial and industrial sectors. The bars illustrate how eCO2 emissions over time have increased, and the diamonds illustrate how energy consumption over time has increased. The dip in eCO2 emissions in 1994 demonstrates how the heightened use of nuclear power decreased the electrical eCO2 emissions in all of Ontario (Appendix A). It also shows that the commercial and industrial sectors are heavy electricity users.

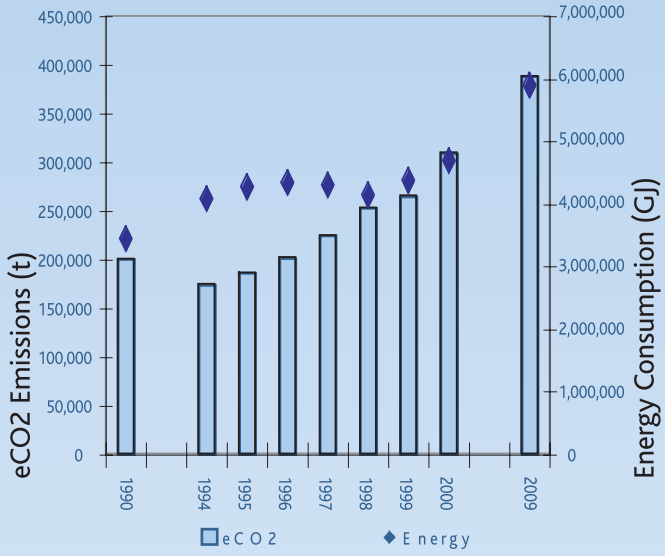

Figure CC: Commercial and Industrial Energy Consumption and eCO2 Emissions

5.4 TRANSPORTATION SUMMARY

The transportation sector includes travel of all personal vehicles and public transportation vehicles (eg. buses) within Richmond Hill, but does not include vehicles passing through the Town limits on route to destinations outside Richmond Hill. The energy and emission data from the transportation sector in Table 18 is based on total vehicle kilometres traveled within the community. In 2000, the transportation sector was the third largest source of eCO2 emissions, accounting for 20% of total community emissions.

Between 1990 and 2000, energy consumption and eCO2 emissions increased by 64%. Since population increased in that time frame, it is reasonable to assume that transportation energy use and eCO2 emissions would also increase. If growth were to continue relative to population, it could be expected that energy consumption would reach 2,953,000 GJ and eCO2 emissions would reach 203,000 t, more than double their 1990 levels.

Year	Energy (GJ)	eCO2 (t)
1990	1,438,253	98,974
1994	1,840,575	126,660
1995	1,889,352	130,017
1996	1,919,738	132,108
1997	1,960,206	134,893
1998	2,067,573	142,281
1999	2,216,799	152,552
2000	2,352,867	161,914
BAU 2009	2,953,361	203,237

Table 18: Transportation Energy Consumption and eCO2 Emissions

Figure DD illustrates the energy consumption and eCO2 emissions for the transportation sector over time. The bars illustrate how eCO2 emissions have increased and the diamonds illustrate how energy consumption has increased. The similarity in energy and emissions increase levels is due to the fact that fuels have constant emissions over time, unlike electricity, which is dependent on the mix of generation types.

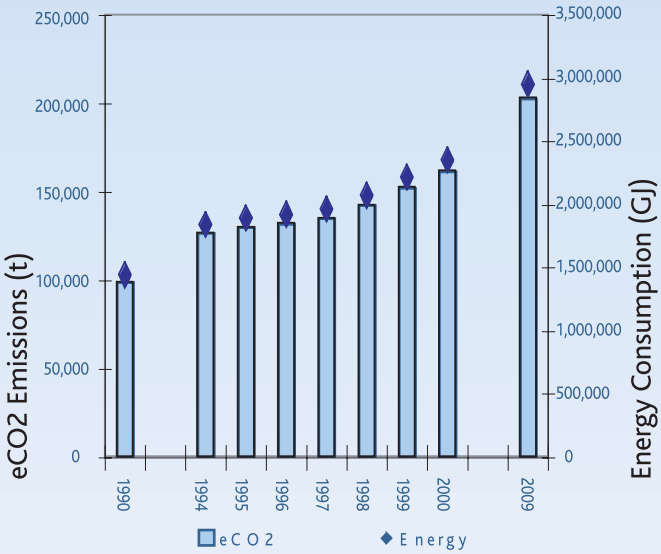

Figure DD: Transportation Energy Consumption and Emissions

5.5 Residential Summary

The residential sector is composed of single-family homes, semi-detached homes and condominiums, and apartments. This sector was the largest source of community eCO2 emissions in 2000, accounting for 41% of the total. Table 19 shows the energy consumption and eCO2 emissions in Richmond Hill's residential sector. As mentioned previously, the Town of Richmond Hill experienced extremely large and rapid growth in its population from 1990 to 2000, with its population increasing by 70%. This growth was reflected in growth in energy consumption and eCO2 emissions. In 1990, residential energy consumption was 3,549,000 GJ, and had increased to 5,881,000 GJ by 2000. eCO2 emissions increased from 192,000 t in 1990, to 338,000 t in 2000, a 76% increase.

Year	Energy (GJ)	eCO2 (t)
1990	3,549,207	192,210
1994	4,542,026	208,150
1995	4,876,788	226,149
1996	5,560,251	267,711
1997	5,362,206	272,537
1998	5,100,412	282,578
1999	5,424,203	299,513
2000	5,881,253	338,758
BAU 2009	7,382,253	425,215

Table 19: Residential Energy Consumption and eCO2 Emissions

Figure EE illustrates the annual eCO2 emissions and energy consumption for the residential sector. The bars demonstrate the growth in emissions while the diamonds demonstrate the growth in energy consumption.

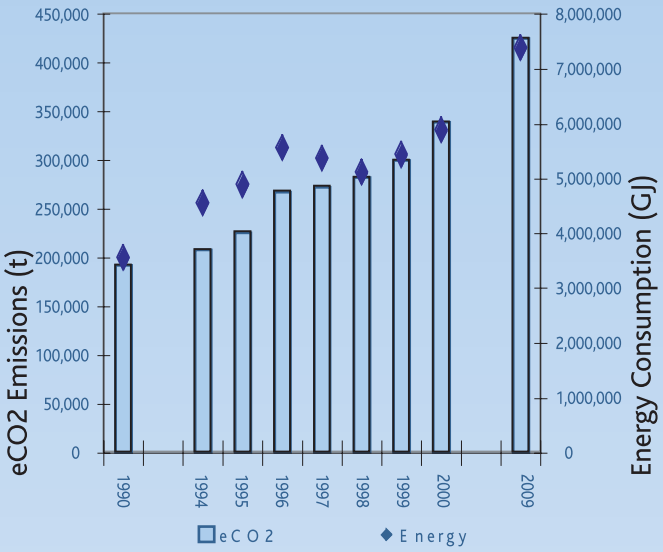

Figure EE: Residential Energy Consumption and eCO2 Emissions

5.6 WASTE SUMMARY

The community waste sector includes all waste collected by the municipality from residents, businesses, and industries in Richmond Hill, except waste generated at Town-owned facilities. (Corporate wastes are addressed in the corporate inventory) GHG 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 2000 the waste sector represented -2% of total community eCO2 emissions, the smallest emitter of the community sectors. Table 20 below lists the eCO2 emissions in tonnes for Richmond Hill's community waste sector. Since the waste is shipped to a landfill with methane capture, as assumed in this analysis, the amount of GHG emissions associated with the waste is balanced by the credit received from the burning of the captured landfill gas. In fact, since landfill gas is about 50% methane and methane has a global warming equivalent measure of 21 times CO2 it appears to be slightly beneficial to landfill waste rather than reduce it. This apparent reduction in emissions is, in fact, offset by the shipping associated with transporting waste to other community landfills and the avoided energy use that would come along with reusing and recycling waste.

Year	eCO2 (t)
1990	(3,507)
1994	(4,488)
1995	(4,556)
1996	(4,529)
1997	(4,421)
1998	(4,931)
1999	(5,299)
2000	(5,657)
BAU 2009[11]	(7,101)

Table 20: Waste eCO2 Emissions

Figure FF illustrates the annual eCO2 emission credits from the waste sector, as well at the amount of garbage that was put in the landfill. The bars increase in size over time, meaning that the eCO2 emissions credit has increased. The diamonds, or tonnes of garbage, increase over time by the same percentage. (note: the scales are inversed for emissions and tonnes of garbage to demonstrate the increasing (negative) credits of eCO2 emissions versus the increasing amount of waste landfilled.)

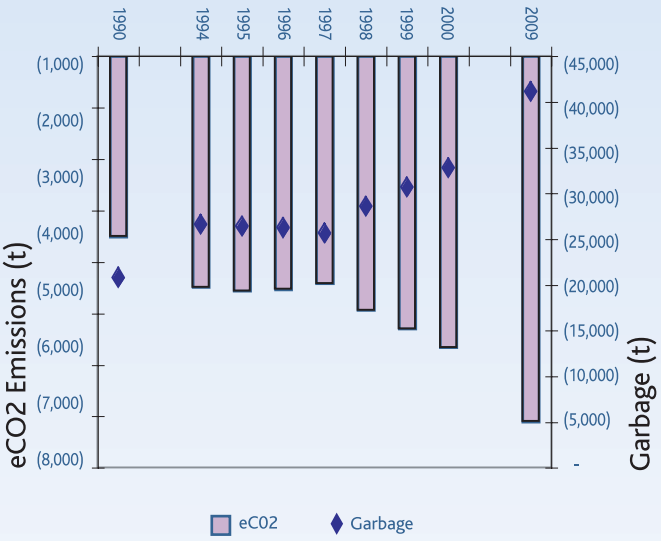

Figure FF: Community Waste and eCO2 Emissions

[11] While 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 20 reflect "Business as Usual" practices for the Town of Richmond Hill.

6.0 HISTORICAL COMMUNITY MEASURES

ICLEI conducted a scoping and research process to gather information on past and ongoing community emission reduction measures. An examination of community emission reduction measures that had been previously implemented in the Town of Richmond Hill and projection of likely reductions were compiled to provide an estimate for selecting a community baseline year and reduction target.

6.1 ENERGY EFFICIENCY PROGRAMS

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

6.1.1 Demand Side Management in Electricity

Measures were undertaken by utilities and/or consumers to control the level of energy usage at a given time, typically by decreasing total consumption or by shifting consumption to some other time period.

In the 1990's the majority of DSM programs were undertaken by Ontario Hydro and delivered to the whole province through Municipal Electrical Utilities (MEUs) such as Richmond Hill Hydro. The marketplace was primarily provided with marketing information for energy efficiency and, for a brief period in the early 1990's, with incentives to increase the awareness of new, energy efficiency products. These included efficient technologies such as high efficiency lighting, high efficiency motors, heat pumps, low-emissivity windows, and high efficiency buildings such as R2000. Also, there were considerable program efforts to influence the design of new buildings. Programs such as “Savings by Design” were targeted at consulting engineers, architects and developers of new construction. In 1990 Ontario Hydro's DSM programs generated province-wide savings of 220 MW.

Since the Ontario utility programs were in effect by 1990 the effects of delivery and participation in such programs would fall into the business-as-usual category. Post 1990 there was a significant decline in the amount of electrical utility sponsored DSM available for customers and MEU's. And since Richmond Hill was, during the period of 1990 to 2003, undergoing a growth spurt with new construction dominating load growth the affect of DSM programs was not significant in the community.

6.1.2 Demand Side Management in Natural Gas

Natural gas in Ontario was deregulated in 1995 but the natural gas utilities in Ontario have been managing DSM since the 1980's. Like electrical energy efficiency programs, most of the programs available today were underway by 1990 and the effects of these programs on the consumers in Richmond Hill fall into the category of business-as-usual. But unlike the electrical utilities, DSM in natural gas utilities has continued and are still continuing today. The principal DSM programs underway by 1990 and continuing today include information and rebates for the purchase of high efficiency furnaces, building insulation upgrades, energy efficient lighting and fuel switching customers from electricity and oil heating to natural gas. For most part the DSM programs offered in the early 1990s are still offered by the gas utilities today.

The incentives being offered by gas suppliers are typically manufacturers rebates for energy efficient technologies (high efficient furnace), fuel switching (ranges, water heaters) and energy efficiency (building insulation, windows, thermostats). These programs apply to both the new and existing markets but tend to be more for the retrofit market. Since Richmond Hill was undergoing a significant growth in new construction most of these energy efficiency upgrade programs likely did not produce significant participation in Richmond Hill.

7.0 CURRENT & FUTURE COMMUNITY MEASURES

The Town of Richmond Hill has many measures planned and in place to reduce community energy use and emissions. Theses measures will be broken down into three main components; residential, transportation, and commercial and industrial, but will also include waste and cleaner energy sources.

7.1 RESIDENTIAL

The residential sector is responsible for 41% of the GHG emissions within the Town (Figure Z). Many effective programs and services are already in place through partnerships for this sector, therefore, the challenge is to communicate the programs across the wide range of residents that make up our communities and to track the effectiveness of the programs.

The key steps to be taken as part of the Residential component of the Community Challenge will be to:

- Compile a one-stop directory of links applicable to the residential households of the Richmond Hill community.
- Promote this information:
  - at key times/locations where individuals are making decisions that effect energy efficiency/GHG emissions, such as site plan and building permit applications for new residences or renovations/additions, local home shows, renovation centers, etc.
  - to a wide spectrum of community groups, schools, faith groups and business employees within the Town through a range of communication and media tools, including creating a promotional brochure, mailings in water bills, ads in parks brochures, advertisements in the local newspaper, media articles and interviews and a prominent and easily accessible web-based resource on the Town's website.

7.1.1 Programs

7.1.1.1 20/20 The Way to Clean Air

York Region's Health Services Department is working with health units and other partners throughout the Greater Toronto Area, including the Town of Richmond Hill, to bring resources to help residents reduce home energy use and vehicle use by 20%. 20/20 is linked with many related programs such as the Clean Air Consumer Guide, to provide information on energy efficient appliances, vehicles, and home heating and cooling equipment. 20/20 also connects participants with local energy efficiency service providers.

7.1.1.2 Clean Air Consumer Guide

The Clean Air Partnership's Clean Air Consumer Guide is designed to encourage consumers to make energy efficient choices a part of their daily lives. It was funded by Suncor Energy Foundation, the Government of Canada and the Toronto Atmospheric Fund.

7.1.1.3 EnerGuide Appliances Program

Natural Resources Canada's EnerGuide Appliances Program helps consumers make energy efficiency choices when purchasing appliances by providing them with the energy efficiency ratings of the appliances available on the market.

7.1.1.4 EnerGuide for Houses – New House Label

Natural Resources Canada's EnerGuide for Houses rating is a standard measure of a home's energy performance. Ratings are calculated with information on the building plans for the new home and the results of the blower door test performed once the house has been built.

7.1.1.5 EnergGuide for Houses – Evaluation

Natural Resources Canada's EnerGuide for Houses evaluation service provides homeowners with information on energy-efficient improvements for their homes. Independent advisors are available via service organizations all across Canada.

7.1.1.6 ENERGY STAR Qualified Products Grants

Many utility companies across Canada provide

rebates or credits when customers purchase ENERGY STAR equipment in place of less energy efficiency equipment. The Province of Ontario also offers residents a tax rebate on ENERGY STAR qualified refrigerators, dishwashers and clothes washers.

7.1.1.7 Home Energy Efficiency Retrofit Grants

The Home Energy Efficiency Retrofit Grants were launched as part of the Government of Canada's Climate Change Plan for Canada. The grant program encourages homeowners, particularly those who have older homes that are in need of energy efficiency upgrades, to retrofit their homes to make them more energy efficient. Only those homeowners that have had the EnerGuide for Houses evaluation and have followed-up on the recommendations are eligible for a grant.

7.1.1.8 One-Tonne Challenge

The One-Tonne Challenge is a component of the federal government's Climate Change Plan for Canada. The program challenges all Canadians to reduce their greenhouse gas emissions by one tonne, equivalent to 20% of the average production per year. The Town will be supporting and promoting the federal government's One-Tonne Challenge within the community as it is rolled-out within the next year.

7.1.1.9 R-2000 Initiative

The R-2000 Initiative is a standard that was developed by Natural Resources Canada to promote the use of cost-effective energy-efficient building practices and technologies. The standard goes beyond what the national building code requires

7.1.1.10 The Living City Program

The Living City Program is an initiative of the Toronto and Region Conservation. It involves creating a shared vision of how a city region should look, and how it needs to function in order to flourish forever. The Living City involves collaborative action across all sectors of society toward that vision

7.2 TRANSPORTATION

The transportation sector is responsible for approximately 20% of the GHG emissions within the Town (Figure Z). The Town of Richmond Hill has currently piloted a Smart Commute Initiative in partnership with local businesses, the Chamber of Commerce and neighbouring municipalities. A program to promote bicycle & pedestrian trails to provide residents with alternatives to car travel is also underway, as is a corporate anti-idling policy. Key steps in the Transportation Community Challenge include:

- Expanding the Smart Commute Initiative throughout Richmond Hill to offer a range of transportation alternatives to commuters including site specific trip reduction, ride matching/carpool/ vanpool, transit discounts and information, newsletter and promotional materials.
- Promoting bicycle & pedestrian trails to residents throughout the Richmond Hill community.
- Expanding the corporate anti-idling program throughout the Town of Richmond Hill.
- Promoting programs to the community through a range of communication and media tools.

7.2.1 Programs

7.2.1.1 Commercial Transportation Energy Efficiency and Fuels Initiative

The Commercial Transportation Energy Efficiency and Fuels Initiative is one of the many initiatives in the Government of Canada's implementation of the Climate Change Plan for Canada. It includes a rebate for devices that reduce engine idling in the on-road commercial transportation sector.

7.2.1.2 Idle Free Campaigns

Natural Resources Canada's Office of Energy Efficiency has put together an Anti-Idling Toolkit for groups (i.e. municipalities, schools) to develop anti-idling campaigns at the local level. The toolkit includes ready-to-use graphic materials and downloadable materials to help launch an outreach campaign.

7.2.1.3 Personal Vehicle Initiative

Natural Resources Canada's Office of Energy Efficiency has developed the Personal Vehicle Initiative

to provide Canadian motorists with tips on buying, driving and maintaining their vehicles to reduce fuel consumption and GHG emissions. The Initiative includes the Fuel Consumption Guide as a tool created to compare the efficiency of various vehicles on the market, as well as information on the ENERGY STAR ratings of vehicles.

7.2.1.4 Pollution Probe Clean Air Commute

Pollution Probe is a non-profit charitable organization that promotes a Clean Air Commute event each summer. They have a program designed to guide workplaces in facilitation their own 'commute-to-work-week' events.

7.2.1.5 Smart Commute Initiative

The Smart Commute Initiative, formally the Greater Toronto Area Travel Demand Management Program is a GTA-wide program of Transportation Demand Management (TDM) initiatives and Transportation Management Association (TMA) creations. It encompasses carpooling, vanpooling and car sharing programs along with the development of a string of TMAs across the GTA.

Under this initiative the Town of Richmond Hill has already established the corporate employee travel to work program, employee car pooling, commute to work week and bike to work facility. The expected reduction from these measures is 283 tonnes of eCO2 per year (see Appendix B). Expanding the telework, carpooling and commute to work week programs are expected to deliver a further 600 tonnes of eCO2 reductions.

Working with surrounding communities Richmond Hill has undertaken a TDM Program, a Transportation Management Association (TMA) program to reduce emissions associated with commuting. Richmond Hill is also active in efforts to improve traffic and pedestrian mobility in the central business district and is undertaking the design and implementation of bicycle and pedestrian corridors to reduce community transit related emissions.

7.2.1.6 The Living City Program

The Living City Program is an initiative of the Toronto and Region Conservation. It involves creating a shared vision of how a city region should look, and how it needs to function in order to flourish forever. The Living City involves collaborative action across all sectors of society toward that vision.

7.2.1.7 York Region Rapid Transit Plan

Richmond Hill is participating in the Region of York Rapid Transit Plan which, when fully implemented, could eliminate up to 1 million car trips in the Region thus significantly reducing vehicle emissions in the Town

7.3 COMMERCIAL & INDUSTRIAL

The commercial, industrial and institutional sector is responsible for approximately 39% of the GHG emissions within the Town (Figure Z). The Town of Richmond Hill, through its corporate local action plan to reduce greenhouse gas emissions, is well positioned to become a environmental 'champion' to businesses and institutions across the Town, encouraging the implementation of energy efficiency measures that result in GHG emission reductions. Key steps include:

- Compile a one-stop directory of links to locally and nationally available programs, services and incentives applicable to the Commercial, Industrial and Institutional members of the Richmond Hill community.
- Promote this information:
    - at key times/locations where corporations are making construction and purchasing decisions that effect energy efficiency/ GHG emissions, such as at site plan and building permit applications for new buildings or renovations/ additions, and in Economic Development.
    - through a promotional brochure and a prominent and easily accessible web-based resource on the Town's website.
- Encourage a community corporate culture which embraces sustainable 'climate friendly' business practices through presentations, networking and direct communication with the local Chamber of Commerce, institutions and other businesses.

7.3.1 Programs

7.3.1.1 20/20 The Way to Clean Air

York Region's Health Services Department is working with health units and other partners throughout the Greater Toronto Area, including the Town of Richmond Hill, to bring resources to help residents reduce home energy use and vehicle use by 20%. 20/20 is linked with many related programs such as the Clean Air Consumer Guide, to provide information on energy efficient appliances, vehicles, and home heating and cooling equipment. 20/20 also connects participants with local energy efficiency service providers.

7.3.1.2 Canadian Industry Program for Energy Conservation (CIPEC)

The Canadian Industry Program for Energy Conservation (CIPEC) is an industry-government partnership that is committed to promoting and encouraging energy efficiency improvements and reductions in eCO2 emissions through voluntary action across Canada's industrial sectors. CIPEC provides technical guidebooks, newsletters on the latest energy efficiency information from Natural Resources Canada and industry, and opportunities to network with other industrial energy managers. Companies are encouraged to sign up as Industrial Energy Innovators (IEI) and make a company-level commitment to energy efficiency improvements and GHG emission reductions.

7.3.1.3 Commercial Building Incentive Program (CBIP)

Since the Town of Richmond Hill is a high growth community, a program that addresses energy efficient building design would help to avoid future eCO2 emissions from development. Natural Resources Canada's Commercial Building Incentive Program (CBIP) provides a financial incentive to owners who incorporate energy efficient measures into the design of new buildings (including multi-residential, retail food, and arenas) provided the design exceeds the requirements of the Model National Energy Code for Buildings (MNECB) by at least 25 percent.

7.3.1.4 Enbridge Commercial & Industrial Energy Efficiency Incentive Programs

Enbridge gas has a number of energy efficiency incentive programs for the commercial and industrial sectors. Three of their programs are described here. The General Energy Efficiency Program provides technical consulting and incentives to facilitate retrofits in commercial, multi-residential or institutional facilities. The High Efficiency Boiler Program promotes the specification and installation of high efficiency hydronic heating and domestic hot water heating boilers. And, the MultiCHOICE program promotes a comprehensive approach to energy and water solutions within existing multi-family buildings by providing customers with a menu of energy saving ideas along with corresponding costs, savings and payback estimates.

7.3.1.5 Energuide Appliances Program

Natural Resources Canada's Energuide Appliances Program helps consumers make energy efficiency choices when purchasing appliances by providing them with the energy efficiency ratings of the appliances available on the market.

7.3.1.6 Energy Innovators Initiative (EII)

The Energy Innovators Initiative (EII) encourages commercial businesses and public institutions to invest in energy efficiency and reductions in eCO2 emissions in existing buildings. The target group for the EII is multi-residential buildings and commercial/Institutional buildings. It helps building owners invest in energy-saving retrofits by providing financial incentives, information, advice, audits and planning assistance. By promoting the EII to business owners, the Town of Richmond Hill can reduce eCO2 emissions in the commercial and industrial sectors.

7.3.1.7 Energy Retrofit Assistance (ERA) Funding

The Energy Innovators Initiative (EII) facilitates investment in energy efficiency initiatives in the commercial and industrial sectors via the Energy Retrofit Assistance (ERA) fund. The amount of funding a project is eligible for is tied to the energy savings projections.

7.3.1.8 ENERGY STAR Qualified Products Grants

Many utility companies across Canada provide rebates or credits when customers purchase ENERGY STAR equipment in place of less energy efficiency equipment, such as windows, furnaces, boilers and general household appliances.

7.3.1.9 Industrial Energy Audit Incentive (IEAI)

Natural Resources Canada's Industrial Energy Audit Incentive encourages companies in the industrial sector to carry out energy audits to identify potential areas for reducing energy consumption. Energy audit projects must meet the conditions of a technical evaluation conducted by an independent consultant.

7.3.1.10 The Living City Program

The Living City Program is an initiative of the Toronto and Region Conservation. It involves creating a shared vision of how a city region should look, and how it needs to function in order to flourish forever. The Living City involves collaborative action across all sectors of society toward that vision.

7.4 WASTE

The Town of Richmond Hill will be implementing a Green Bin program in 2005, to separate out all food wastes, pet wastes, diapers, and sanitary products for composting. The program is expected to divert 5500 tonnes of organics from landfill in 2005. This program is part of the Town's commitment to waste reduction and it also helps meet the Provincial Target of 60% diversion by 2008.

7.4.1 Programs

7.4.1.1 Recycling, Yard Waste & Composting Programs

The Town has three measures underway in the community waste sector. Though run by the Town the reduction of emissions are recorded in the community inventory. In the waste sector Richmond Hill has a recycling program, a yard waste program and a backyard composting program underway. These three measures are estimated to reduce annual eCO2 emissions by 8,500 tonnes.

7.4.1.2 Enhanced Yard Waste Pick-Up & Recycling Programs

The Town's Waste Management Branch will be enhancing the yard waste pickup and recycling programs currently provided to residents. It is estimated the Town will be able to further reduce eCO2 emissions by 9,324 tonnes annually (Appendix B).

7.4.1.3 The Living City Program

The Living City Program is an initiative of the Toronto and Region Conservation. It involves creating a shared vision of how a city region should look, and how it needs to function in order to flourish forever. The Living City involves collaborative action across all sectors of society toward that vision.

7.5 CLEANER ENERGY SOURCES

The Town of Richmond Hill has recognized that the availability and choice of green energy sources can play a significant role in reducing a community's GHG emissions. The Town has committed to feasibility studies to pursue the local generation and purchase of electricity through clean wind power.

7.5.1 Programs

7.5.1.1 Ontario Power Generation (OPG) Evergreen Energy Program

Ontario Power Generation is challenging commercial and industrial companies, and public-sector organizations throughout Ontario to commit themselves to purchase a percentage of their annual electricity consumption as Green Power. They acknowledge participants via their Green Power Recognition Program.

7.5.1.2 Renewable Energy Deployment Initiative (REDI)

REDI provides grants to help stimulate demand for renewable energy systems. REDI focuses on promoting renewable energy systems for space and water heating and cooling, such as active solar hot water systems, active solar air heating systems, high efficiency biomass combustion systems, and ground-source heat pumps.

7.5.1.3 The Living City Program

The Living City Program is an initiative of the Toronto and Region Conservation. It involves creating a shared vision of how a city region should look, and how it needs to function in order to flourish forever. The Living City involves collaborative action across all sectors of society toward that vision.

7.5.1.4 Wind Power Production Incentive (WPPI)

WPPI is an incentive program to encourage electric utilities, independent power producers and other stakeholders to gain experience in wind power production. WPPI will provide financial support for the installation of 1,000 megawatts of new capacity over the next five years. The incentive will cover approximately half of the current cost of the premium for wind energy in Canada compared to conventional sources

8.0 Conclusion & Recommendations

This report recommends that the Town of Richmond Hill should:

1. Adopt a corporate operations GHG emissions target of 20% below 2000 levels by 2009.
2. Adopt a community GHG emissions target of 6% below 2000 levels by 2010.
3. Work to implement the recommended corporate emission reduction measures outlined in this report.
4. Take a leadership role to promote energy efficiency programs to achieve GHG emission reductions within the community.

The targets and recommendations from this report satisfy the intent of Milestones One, Two and Three of the Partners for Climate Protection program.

9.0 APPENDIX A: EMISSIONS COEFFICIENT DESCRIPTION

For every unit of fossil fuel usage, there is a proportional quantity of GHGs emitted during the combustion process. The quantity of GHG per unit consumption is referred to as an emissions coefficient, and is used to calculate emissions in energy based inventories. Emissions coefficients for fossil fuel consumption do not change according to time or location. The emissions coefficients used for the calculation of emissions from gasoline, diesel, and natural gas are presented in Table 21.

The 3 main GHGs are included: carbon dioxide (CO2), nitrous oxide (N2O) and methane (CH4). Carbon dioxide is by-far the most common pollutant, therefore total GHGs are expressed as equivalent carbon dioxide, or eCO2. Nitrous oxide and methane can be expressed as eCO2 by using their global warming potential (GWP) in relation to carbon dioxide's. Nitrous oxide has a GWP of 310 and Methane has a GWP of 21.

Fossil Fuel	t/GJ	t/unit eCO2	t/unit eCO2
	CO_2	N_2O	CH_4
Gasoline	6.81E-2	4.76E-5	6.92E-6
Diesel	7.06E-2	1.03E-5	5.17E-6
Natural Gas	4.94E-2	5.25E-7	1.13E-6

Table 21: Emissions Coefficients

Although electricity does not emit eCO2 when it is used, there are significant emissions of eCO2 at fossil fuel (coal, oil, and natural gas) power plants, where it is generated. In the approach used by the PCP to count eCO2 emissions, these power plant emissions are incorporated into the end use of electricity through the eCO2 coefficient for electricity.

The electricity coefficients are annual averages, and the values depend on how much fossil fuel generation (as opposed to hydro, nuclear, and renewable generation, which do not produce CO2 emissions) is in the electricity generation mix of all electricity power plants in Ontario.

Figure GG illustrates the annual Ontario electricity emission coefficients between 1990 and 2000. The years 1998 to 2000 have the highest associated emissions. There is a relatively steady decrease in the emission coefficients from 1990 to 1994, and then a relatively steady increase in the emission coefficients from 1994 to 1998. The year 1994 experienced the least carbon-intense electricity mix in Ontario in recent history. This is due to the fact that this was the height of nuclear power generation, which does not produce eCO2 emissions. Since 1994, nuclear power generation has been decreasing from Ontario's electricity mix, and as such, the emissions coefficients have increased.

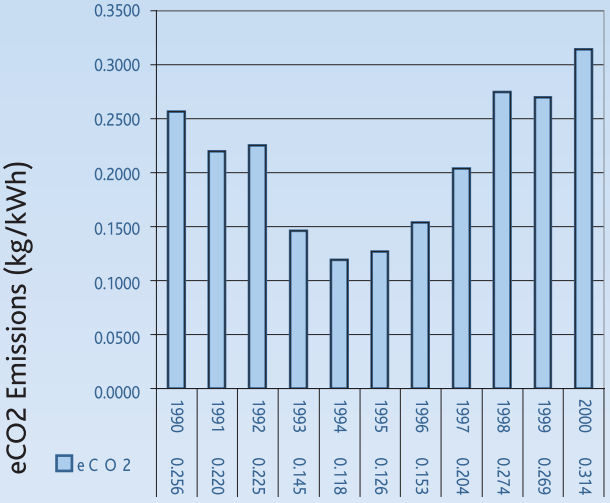

Figure GG: Ontario's Electricity Emission Coefficient

Electricity emission coefficients can have significant impacts on comparisons between eCO2 emissions inventories. If a baseline inventory was completed for a year in which the emissions coefficient was low (i.e. 1994), and the emissions were compared against an inventory year when the emissions coefficient was high (i.e. 1998), then factors that are out of the municipality's control are being considered. To compare emissions in these two years would reflect actual emissions as seen by the environment, but would not necessary reflect the efforts of the municipality, as the increase in emissions was partly due to a change in Ontario's electricity mix. The effect of the change in electricity emission coefficients over time can be seen throughout this report.

There is some uncertainty regarding the future emissions related to electricity consumption. The provincial government has stated that it will phase out electricity coal fire generation by 2009. If this does occur, than the emissions coefficient will decrease significantly, likely to 1994 levels. If a community set a target based on 2000 eCO2 emissions levels, then the opposite phenomena could occur where a community could achieve their target without effort.

Due to the uncertainly in the future electricity generation profile, the PCP protocol is to set forecasts based on currently electricity emission coefficients. Therefore, in this report the 2009 forecast includes 2000 electricity emission coefficients.

10 Appendix B: Historic & Future Corporate Measures

Buildings Historic & Current Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Infrastructure Program	Energy saving measures (lighting retrofits, electricity to gas, hot water piping insulation, dry-O-Tron unit, BAS) were implemented on the following facilities in 1996: Richmond Green Sports Complex, Operations Centre, Centennial Pool, Richvale Community Centre and Pool, Spruce Hall Community Centre, Lois Hancey Aquatic Centre, Major Mackenzie Fire Hall, Richvale Library	The total electricity savings were 731,623 kWh (2,634 GJ) = 230t eCO2. An increase of 104,924 cum (3,993 GJ)of natural gas (from conversion from electricity to gas) = 197 t eCO2. Therefore, there is an annual savings of 33 t eCO2.	-1,359	33	42,428
Central Library Lighting Retrofit	Typical lighting upgrade	They are saving 819 kWh per day. The facility runs 7 days per week, therefore this is an annual savings of 298,935 kWh (14%), 1,076 GJ, 94 t eCO2, and at average electricity cost of $22.8/GJ (or 0.08$/Kwh) in 2000, $24,533	1,076	94	24,533
225 East Beaver Creek Lighting Retrofits	Typical lighting upgrade	Lighting upgrades achieved about 20% reduction in total building electricity consumption. Use in 1994 was 3,355,179 kWh. It would have been 20% higher, therefore savings are 838,793 kWh, 3,020 GJ, 264 t eCO2, and $68,856 (at $22.8/GJ)	3,020	264	68,856
Multiple Lighting Retrofits	In 1996 lighting retrofits were done at H.J. Mills Fire Hall, Lions Hall Community Centre and Bayview Hill Community Centre.	The total electricity consumption at these facilities in 1995 was 1,452,078 kWh. Based on an estimated savings of 10%, these retrofits resulted in savings of 145,208 kWh, 523 GJ, 46 t eCO2, and $11,924 (at 2000 average of $22.84/GJ).	523	46	11,924

Buildings Historic & Current Measures Continued

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Building Automation System (BAS), Fire Hall	Fire Hall, Maj. Mack l. BAS installed in 2000.	A conservative estimate of energy savings from installing a BAS system is a 10% reduction, although 20% reductions are possible. This building used 239,840 kWh of electricity in 1999, therefore potential savings are estimated at 23,984 kWh (86 GJ), 8 t eCO2, and at $22.84 GJ, $1,964.	86	8	1,964
Operations Centre Upgrades	Roof insulation upgrade & LED conversion	There was not a lot of information available on the energy reductions associated with these measures, therefore a conservative estimate of 10% was applied. In 1999 annual electricity consumption was 545,070 kWh, therefore estimated savings are 54,507 kWh (193 GJ), 17 t eCO2, and at $22.84 /GJ, $4,408.	193	17	4,408
Decommissioning of One Historical Home	In order to save on energy consumption the Town stopped heating historical homes 24 hours a day. In 1997 they stopped opening them in winter.	Based on 6 months of operation per year, they are saving 229 cum of NG per year, 9 GJ, 0.4 t eCO2 and at average NG charge of $7.7/GJ, $69	9	0.4	69
Energy Efficient Purchasing Policy	The Town has a purchasing policy purchase only energy efficient appliances, equipment, computers, printers, etc.	Studies on energy efficient government purchase show that at a minimum it can lead to 3% savings in energy. Using 1994 as a base year, this equates to 1,526 GJ NG & 1819 GJ electricity, 234 t eCO2, and $53,189 (at 22.84$/GJ for electricity and 7.63$/GJ for NG)	3,345	234	53,189
Total Historic & Current			6,893	696	207,372

Buildings Future Measures

Title	Description	eCO2 Calculation	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Block Heater Timers or Controllers	Controllers would included pulsing timers and temperature sensitivity meters.	According to EPCOR's Winter Savings: Timers and Power Saver Cords, block heaters use 19 kWh of electricity per hour. When block heaters are plugged-in at night, and then un-plugged in the morning, they run for 17 hours (5pm to 9am). A maximum of 4 hours is needed to heat an engine, therefore there are 13 hours of unnecessary use amounting to 247kWh per unit (13hrsX19kWh = 247 kWh). The town uses 50 units from November 15 to March 31 (102 work days). Savings potential = 247 kWh X 50 units X 102 days = 1,259,700 kWh, 4,535 GJ, 396 t eCO2 & $8,062 (est @ $0.08/kWh = avg rate in 2000)	4,535	396	8,062
Air Exchangers	Central library. The air exchanger/humidity sensor installed in Central library resulted in 50% energy savings over 1 week. They plan to expand this retrofit to all buildings (pools, arenas, admin) and anticipate 25% savings in energy.	Energy use from pools, arenas and administration buildings totaled 94,658 GJ, 6,001 t eCO2, and $1,466,143 in 2000. A 25% savings equals 23,664 GJ, 1,500t eCO2, $366,535.	23,664	1,500	366,535
Water Temperature Policy in Pools	The Town is considering changing its pool water policy to a standard operating system maintained at 84 degrees F. They currently hold it at 86 degrees F.	U.S. Department of Energy's Reduce Swimming Pool Energy Costs! (RSPEC!) study found that reducing pool temperature by 1 degree F can reduce energy consumption by 10%. In 2000, the Town's 5 pool complexes consumed 41,438 GJ of energy, at a cost of $596,311, and yielding 2,521t eCO2. A 10% reduction would amount to 4,144 GJ, $59,631, and 252t eCO2 in savings annually.	4,144	252	59,631

Buildings Future Measures Continued

Title	Description	eCO2 Calculation	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Various Future Measures	There are many measures the Town could implement to reduce energy consumption and GHG emissions even more. It is impossible to model every scenario within this work, therefore a simple bulk estimate is that the Town could easily implement measures to reduce energy and emissions by an additional 10%.	10% reduction from 2000 levels is equal to 12,956 GJ (6,704 elec, 6,252 NG), 894 t eCO2, and $200,822 (at 22.84$/GJ for electricity and 7.63$/GJ for NG).	12,956	894	200,822
Total Future			45,299	3,042	635,050
Total Historic, Current & Future			52,192	3,738	842,423

Buildings Sector - Various Future Measures

Category	Description	Calculation Notes
Building Decommissioning	Introduce building decommissioning procedures to make sure buildings are operating as intended.	
Renewable Energy	Evaluate the use of renewable energy saving technologies as they become available.	New options being developed.
Energy Storage	Examine the use of energy storage for future HVAC.	Summer ice storage may be a way to reduce air conditioning cost. Thermal mass may store winter heat.
Dimmable Lighting	Install auto dimming fluorescent lighting when replacing existing lighting.	Reduces energy use when only some lighting is needed.
Green Power Purchase	Purchase green power (ie wind, geothermal).	Depends on market rate
Local Generation, Cogeneration	New local microgeneration options are developing, microturbines, windmills, etc	Cost and savings depend on load.
Landscaping Improvements	Reduce paved areas near buildings to lessen heat buildup which adds to heat load in buildings	Less refection of heat to buildings and more shading
Local Suppliers	Green purchasing, recycled material, local materials.	Saves on transportation
Green Roofs/Cool Roofs	Reduce heat island effect by increasing reflectance of roofs, green roofs.	Lower A/C bills.
Improved HVAC Controls	Increase ventilation effectiveness with the utilization of wireless monitoring and control of air quality and ventilation equipment.	Wireless technology promises economic control systems.
Demand Reduction	Undertake load control to flatten demand curves and maximize off peak energy.	Off peak power is often cleaner and less expensive if it can be acquired and used.
District Heating/Cooling	Examine the introduction of district heating/cooling.	One heating/cooling plant may be more economic than each building having it own plants, as usually done.

This is a description of the types of measures the Town may want to consider in the future to reduce energy consumption, costs and/or eCO2 emissions from the buildings sector. The savings from each measure was not calculated separately since many factors would come into play. However, it can be reasonably estimated that the Town could achieve a 10% reduction in eCO2 emissions given a combination of these measures.

Streetlighting Historic & Current Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Streetlighting Retrofit	From 1989 to 1993 the Town changed all its incandescent and mercury streetlights to high pressure sodium.	HPS streetlights are 50% more energy efficient than mercury. By backcasting 1994 streetlight data, it was estimated that energy, emissions and costs were 18,891 GJ, $417, 294, 1,352 t in 1990 if HPS were used. Estimating that the project was 1/4 in 1990, the following additional savings are estimated.	7,084	507	156,485
Light Level Controls	In the late 1980s the Town installed 'electric eyes' or light level controls - a photo sensor which detects light levels and turns on the streetlight when appropriate.	Since this retrofitting was done before 1990 (the earliest date the baseline can be), this does not count as an emissions reduction measure.	-	-	-
Park Lighting Program	In the early 1980s the Town switched all the metal halide and mercury vapour streetlights to high pressure sodium.	Since this retrofitting was done before 1990 (the earliest date the baseline can be), this does not count as an emissions reduction measure.	-	-	-
Traffic Signal Retrofits	The Town began switching to light emitting diodes (LEDs) in 1993, however the retrofits have not been completed. They will be completed by 2009. It is assumed that 50% of the retrofits have occurred as of 2000 and 50% will be finished by 2009.	In 2000, traffic signals consumed 239,551 kWh of electricity. LED's are approx. 75% more efficient than incandescent bulbs, therefore electricity consumption would have been 239,551kWh+ 479,102 kWh with the retrofit. This is a savings of 479,102 kWh, 1,724 GJ, 151 t eCO2. Cost for traffic signals in 2000 was 0.087/kWh = $41,681	1,724	151	41,682
Light Pollution Bylaw	-	It is impossible to estimate the energy and emission reductions as a result of the by-law, although it can be assumed it has had some effect.	-	-	-
Total Historic & Current			8,808	658	198,167

Streetlighting Future Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Traffic Signal Retrofits	The Town began switching to light emitting diodes (LEDs) in 1993, however the retrofits have not been completed. They will be completed by 2009. It is assumed that 50% of the retrofits have occurred as of 2000 and 50% will be finished by 2009.	In 2000, traffic signals consumed 239,551 kWh of electricity. LED's are approx.. 75% more efficient than incandescent bulbs, therefore electricity consumption would have been 239,551kWh+ 479,102 kWh with the retrofit. This is a savings of 479,102 kWh, 1,724 GJ, 151 t eCO2. Cost for traffic signals in 2000 was 0.087/kWh = $41,681	1,724	151	41,682
Streetlighting Retrofits	Switch from high pressure sodium to LED. This technology will not be available for at least a few years.	In 2000, HPS streetlights consumed 7,671,240 kWh, amounted to $551,262 ($0.072/kWh). HPS to LED would amount to approx. 60% savings in consumption = 4,600,000 kWh, 16,560 GJ, $331,000, 1,446 t eCO2.	16,560	1,446	331,200
Off-Grid Lighting	Solar cells to charge batteries during the day and light at night without being connected to the grid (eg in parks, laneways, etc).	By taking the streetlights off the grid and using solar cells, there is a potential to reduce GHG emissions to zero. However, this technology is not yet realistic for the marketplace. The additional cost would be $1,000 to $2,000 per light.	-	-	-
Total Future			18,284	1,597	372,882
Total Historic, Current & Future			27,092	2,255	571,049

Vehicle Fleet Historic & Current Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Honda Civic Hybrid	Electric motor assists the gasoline engine to reduce fuel consumption and allows the unit to shut-off when it is not moving. It was purchased to replace one of the Malibu vehicles used by parking control. The cost is the same as a Malibu ~$30,000 and will be traded in at 150,000 km.	Fuel rating is approx 8 L/100km. Malibu's were typically 12 - 18 L/100km. Average Malibu km/yr for parking control was 48,760km in 2002. Represents 3,333 L is gas savings/year = 8 t eCO2. Average price of gas was $0.651/L in 2002.	116	8	2,170
Solar Powered LED Arrow Boards	Arrow boards would otherwise require a generator. Used one day per week. Fuel use costs ~ $1500 per year. Arrow boards were rented before these two were purchased.	Average price for diesel was 0.601$/L in 2002, therefore $1500 worth of diesel is equivalent to 2,496 L (97 GJ) = 7 t eCO2.	97	7	1,500
Water Dept. Cube Van	A downsized unit (10') with an inverter to provide 12 volt and 120 volt to operate the necessary accessories on the job site when the unit is not running. Before this a 1 ton was used (14' long) with a generator that used 6 gallons/week of gasoline.	Rough estimate indicates a 1/4 fuel savings. Cube van used approximately 2,900 L in 2002, 1/4 savings = 725L (28GJ), 2t eCO2, $436 (Average price of diesel was .601$/L in 2002)	28	2	436
Vehicle Downsizing	Downsized pickups, vans and cars in the fleet for inspectors, office staff, various courier and service vehicles. In 1997, downsized vehicle replacement became Town policy.	10-12 vehicles (full size cars and pick-ups) have been downsized. It is estimated that downsizing vehicles resulted in a 5% increase in efficiency. By using the inspectors vehicles data, it is estimated that this downsizing would results in fuel savings of 95L/year per vehicle, or 950 L in total, 33 GJ, 2 t eCO2 and at average price of gas $0.651, $618.	33	2	618
Water Dept. Truck Replacement	2 single axle dump trucks replaced with one tandem in 1999. One tandem truck uses 2/3 the fuel of 2 singles.	The engineering dept estimates that they save 4,324 L of diesel and $2,600 per year.	167	12	2,600
Roads Dept. Truck Replacement	In 1998, the single axle dumps were replaced with tandems to reduce the number of trips to the yard and to haul more material (ie sand and construction material).	The engineering dept estimates that they save 4,324 L of diesel and $2,600 per year.	167	12	2,600

Vehicle Fleet Historic & Current Measures Continued

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Parks Dept. Equipment Replacement	The entire stock of string trimmers was replaced with 4-cycle engines (vs 2-cycle) due to air pollution. 4-cycle engines are 10% to 15% more energy efficient than 2-stoke engines.	These units use approx. 1000 L per year. At 10% increase efficiency they would use only 900 L, savings 100 L per year, 0.2 t eCO2, 3GJ, & .651$/L * 100 = $65.	3	0.2	65
Total Historic & Current			611	43	9,989

Vehicle Fleet Future Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Bio Diesel	The Town is investigating the use of bio diesel as an alternative to the high-grade diesel currently used. It is anticipated that they will change to bio diesel by spring. There is a 0.05 $/L premium for B20 and 0.20$/L premium for B50.	In 2002, 260,024 L of diesel were used at an estimated cost of $156,274 (average price of $0.601 $/L) resulting in 720 t eCO2. If B20 is used in winter (6 months) and B50 is used in summer (6 months), (360*.2)+(360*.5) = 252 t eCO2.	0	252	-19,502
Ethanol Blend Gasoline	The Town is investigating (with the Region) the use of ethanol blend gasoline as an alternative to regular gasoline. It is estimated that the premium would be 0.03 to 0.05 $/L.	The eCO2 emission coefficient for regular gasoline is 2.236E-3t/L, for ethanol blend it's 2.222E-3t/L. eCO2 Savings = (0.00236189t/L*166,608L)-(0.00222085t/L*166608) = 23	0	23	-6,664
Battery Packs and Inverters	This technology allows the unit to be shut-off at the job site and still operate all necessary safety and warning lights, as well as power attachments. Two are on order now to be used as traffic control vehicles, next year there will be an additional three.	Saving are estimated based on the saving already achieved by the Water Dept. cube van.	140	10	2,180
Honda Civic Hybrid	A second hybrid will be purchased to replace a Malibu in Parking Control	Savings are based on the 1st hybrid vehicle.	116	8	2,170
Water Dept. Cube Van	In two years the Town will purchase another cube van with a battery pack and inverter.	Savings are based on the 1st Water Dept. Cube Van	28	2	436
Vehicle Downsizing	In 2003/2004 the pick-ups and minivans used by couriers, service and stand-by vehicles will be downsized.	Savings are estimated using the same methodology as the current vehicle downsizing measure, assuming 5 more vehicles will be downsized.	17	1	309
Water Dept. Truck Replacement	Cube van to be replaced with smaller vehicle.	The engineering dept estimates that they will save 4,324 L of diesel and $2,600 per year.	167	12	2,600
Anti Idling Campaign	The Town is purchasing 5 anti-idling units to install on vehicle to help control excessive speed and idling. Staff are also being educated about idling. Currently the campaign is limited to 100 vehicles, but they are considering expanding it to the entire fleet.	The total annual campaign projections on 100 road vehicles are Gas = 2,650L (92GJ), $1,908, & 6t eCO2. Diesel = 4,750L (184 GJ), $3,100, & 13t eCO2.	276	19	5,008

Vehicle Fleet Future Measures Continued

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Planned Expansion of Anti Idling Campaign	It is projected that the Anti Idling Campaign will eventually save $10,500 is fuel costs per year. This is based on a 5% to 15% reduction in idling and a 5% savings in fuel costs. It is also estimated that the campaign will save $10,000 in annual vehicle repair costs.	The current campaign saves $5,008, therefore the expansion will save an additional $5,492 (totaling $10,500). $0.651/L in 2002, therefore fuel savings equate to 8,436 L (299 GJ), 20 t eCO2.	299	20	5,492
Purchase of Additional Hybrid Vehicles	As new hybrid vehicles including GM pickup trucks in 2004, Toyota Prius in Nov 2003 and others become available fuel efficiency will increase.	3 additional vehicles are modeled to be purchased before 2009. Savings based on savings already achieved via hybrid purchases.	348	24	6,509
Low Roll Resistance Tires	Low roll resistance tires often have lower rolling resistance than original tires. These are not currently promoted much in Canada, but they have become law in California. Selecting low rolling resistance tires will save 3-5% fuel use. The Town could consider opting for low roll resistance tires in its tire replacement schedule, however they are not recommended for large equipment.	A set of four low rolling resistance tires would cost consumers an estimated $5 to $12 more than conventional replacement tires. A % savings in onroad vehicle would result in approx. 3,000 L of fuel savings, 104 GJ, 7 t eCO2, and at average price of gasoline $0.651/L, $1,953.	173	12	1,953
Total Future			1,564	383	491
Total Historic, Current & Future			2,175	426	10,480

Waste Sector Historic & Current Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Recycling Program	Includes bottles, cans, 1&2 plastic, fibers, tetra & milk cartons. Pick-up is every other week.	The average amount of annual recycling between 1996 and 2000 was 6,171 t. This resulted in 8,146 t of avoided eCO2 emissions.	-	8,146	-
Yard Waste	Pick up is two times per month. Does not include grass.	The average amount of annual yard waste composted between 1996 and 2000 was 2,746 t. This resulted in avoided eCO2 emissions of 330 t.	-	330	-
Backyard Composting	Back yard composting is encouraged. The Town sold composters from 1989 to 1998.	The Town has sold a total of 9,865 composters. Without tracking the use of home composters, it is impossible to estimate the eCO2 emission savings from this initiative.	-	-	-
Total Historic & Current			0	8,476	0

Waste Sector Future Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Recycling Program	Includes bottles, cans, 1&2 plastic, fibers, tetra & milk cartons. Pick-up is every other week.	Estimated a 10% increase, which would result in additional eCO2 savings of 815 t.	-	815	-
Yard Waste	Pick up is two times per month. Does not include grass.	Estimated a 10% increase, which would result in additional eCO2 savings of 33 t.	-	33	-
Total Future			0	848	0
Total Historic, Current & Future			0	9,324	0

Transportation Sector Historic & Current Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Telework	12-15 people participate by working at home ~1 day/week. There is the capacity for 50 employees to be working from home.	Estimate 70km round trip per day per person. With 12 people participating once a week, it amounts to 43,680 km savings/year. Average fuel efficiency for automobiles is 10.6 L/100km, therefore gasoline savings are estimated at 4,630 L = 160 GJ = 11t eCO2.	160	11	3,014
Car Pooling	10% of 450-500 employees participate, therefore 45-50 participate.	Estimate 90km savings per day per car pool. With 45 people participating, this amounts to 1,053,000km/year savings. Average fuel efficiency for automobiles is 10.6 L/100km, therefore gasoline savings are estimated at 111,618 L = 3,869 GJ = 264t eCO2.	3,869	264	72,663
Commute to Work Week	In 2002 there were 80 participants in this program for municipal employees (80 out of 450 to 500 employees, approximately 18%)	Estimate 70km savings per person, with 80 participants this amounts to 28,000km savings. Average fuel efficiency for automobiles is 10.6L/100km, therefore gasoline savings are estimated at 2,968L = 103GJ = 7t eCO2.	103	7	1,932
Bike to Work Facilities	5 municipal staff bike to work and use the facilities provided. (One person bikes 80km round trip each day!) There is also an internal campaign to promote bike to work day.	Estimate 100km travelled by bike in total for 6 months of the year, for an annual savings of 600km per year. Average fuel efficiency for automobiles is 10.6L/100km, therefore gasoline savings are estimated at 64L = 2GJ = 1t eCO2.	2	1	42
Total Historic & Current			4,134	283	77,651

Transportation Sector Future Measures

Title	Description	Calculation Notes	Annual Energy Savings (GJ)	Annual eC02 Savings (t)	Annual Energy Cost Savings ($)
Telework	Currently there are 12-15 people participating by working at home ~1 day/week. There is the capacity for 50 employees to be working from home. This measure models what the savings would be if 50 employees participated by working at home 1 day per week.	Estimate 70km round trip per day per person. With 50 people participating once a week, is amounts to 182,000 km savings/year. Average fuel efficiency for automobiles is 10.6 L/100km, therefore gasoline savings are estimated at 19,292 L = 669 GJ = 46t eCO2.	669	46	12,559
Car Pooling	Currently 10% of 450-500 employees participate. This measure models what the savings would be if 20% (45 more) of employees participated.	Estimate 90km savings per day per car pool. With 45 additional people participating, this amounts to 1,053,000km/year savings. Average fuel efficiency for automobiles is 10.6 L/100km, therefore gasoline savings are estimated at 111,618 L = 3,869 GJ = 264t eCO2.	3,869	264	72,663
Commute to Work Week	In 2002 there were 80 participants. The measure models the savings if participation is doubled in the future.	Estimate 70km savings per person, with 80 additional participants this amounts to and additional 28,000km savings. Average fuel efficiency for automobiles is 10.6L/100km, therefore gasoline savings are estimated at 2,968L = 103GJ = 7t eCO2.	103	7	1,932
Total Future			4,641	317	87,155
Total Historic, Current & Future			8,775	600	164,806