



2006 Corporate GHG Emissions Inventory

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The 2006 Corporate GHG Emissions Inventory has been compiled and prepared to:

- Fulfill the corporate portion of Milestone One of the Federation of Canadian Municipalities Partners for Climate Protection Program.
- To better understand how corporate greenhouse gas emissions might grow and change if we do not take action.
- To facilitate discussion on how the Region can reduce corporate greenhouse gas emissions in developing an action plan.
- To prepare the Region for potential participation in emerging carbon trading markets.

Introduction

In 2004 the Region assessed itself against the Melbourne Principles, resulting in the identification of several key gaps where additional effort was needed to effectively manage large 'sustainability' policy directions. One of these gaps was 'action on air quality and Kyoto'. Regional Council acknowledged and moved to address this gap through Regional Council's Business Plan (CBP). The CBP highlights the importance of environmental stewardship as a key objective in increasing the health and sustainability of our region. Energy conservation and action on climate change are two strategic actions identified as important considerations in achieving Council's objectives.

In order to take meaningful action on climate change and reducing greenhouse gas emissions, it is important to understand how the Region consumes fuel and energy and generates waste. This report provides a comprehensive GHG emissions inventory for the Region's corporate operations and services. It is the first step in the development of a broader Niagara Climate Action Plan. A community-wide GHG emissions inventory is being prepared and will be complete in 2010. The Niagara Climate Action Plan, encompassing corporate and community actions, will be developed in 2010-2011.

Taking action on climate change demonstrates Regional Council's commitment to environmental stewardship and fulfills a key component of the Region's membership in the Partners for Climate Protection program.

Partners for Climate Protection

The Partners for Climate Protection (PCP) Program is a network of municipal governments that have committed to reducing greenhouse gas (GHG) emissions and acting on climate change. PCP is administered by the Federation of Canadian Municipalities (FCM) in partnership with the International Council for Local Environmental Initiatives (ICLEI). It consists of a five milestone framework to guide municipalities to reduce greenhouse gas emissions by:

1. Creating a greenhouse gas emissions inventory and forecast;
2. Setting an emissions reductions plan;
3. Developing a local action plan;
4. Implementing the local action plan or a set of activities; and
5. Monitoring progress and reporting results.

This inventory has been compiled to fulfill the requirements of the corporate component of Milestone One of the Partners for Climate Protection Program.



What is a **carbon footprint**? the total set of greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organization, event or product.

Milestone One: Corporate Greenhouse Gas Emissions Inventory

This inventory tracks and reports three principal greenhouse gases that originate from corporate operations: carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄), expressed as a CO₂ equivalent (eCO₂). These greenhouse gases are generated from:

1. Burning fossil fuels to light, heat, cool and ventilate buildings and offices, and to run municipal operations, processes and vehicles; and
2. Decomposing organic waste in landfills.

As the adage goes, 'you can only manage what you measure'. By inventorying and reporting energy use and GHG emissions, Niagara Region is establishing a baseline from which to measure the performance of initiatives designed to reduce the corporate carbon footprint and mitigating the effects of climate change.

This report represents the first step. The information contained in the following pages sets a baseline. Immediately following the adoption of this report there will be a focused dialogue on how the Region can set a target to reduce emissions and develop a comprehensive action plan to fulfill Milestones Two and Three of the Partners for Climate Protection Program.

Reporting Protocols and Inventory Methods

This inventory has been prepared in accordance with the FCM Partners for Climate Protection Guidance Document 'Developing Inventories for Greenhouse Gas Emissions and Energy Consumption'.

Where the PCP Guidance document did not sufficiently address GHG accounting issues, every effort has been made to consult and comply with internationally recognized GHG accounting protocol including;

- The ICLEI International Local Government GHG Emissions Analysis Protocol; and
- The IPCC Guidelines for National Greenhouse Gas Inventories.

The ICLEI International Protocol has been recently updated and is informed by recent developments such as:

- IPCC 2006 methodological changes;
- GHG Protocol Initiative Corporate Standard and Project Accounting Protocols;
- ISO 14064 Greenhouse Gases series of standards;
- GRI Public Sector Agency Supplement

Data Sources

Data for energy consumption (electricity, natural gas, etc.) for buildings, traffic signals and beacons, water and wastewater facilities has been collected from a central database. Invoices and/or bills from various utilities are collected and entered into a corporate database that tracks consumption and costs. This database has been operational since 2004 and is capable of generating annual reports which have provided the raw data for the emissions calculation. Records in the database have been randomly audited and confirmed for accuracy.

Data for fuel consumption (gasoline, diesel, etc.) for vehicle and equipment fleets have been collected from invoices and bills. Data for waste generated corporately was estimated using a calculation suggested by the PCP Guidance Document 'Developing Inventories for Greenhouse Gas Emissions and Energy Consumption'. Other specific assumptions and inclusions/exclusions are explained throughout the text of this report.

Direct Emissions vs. Indirect Emissions

GHG emissions inventories generally include two types of emissions: direct and indirect. Direct emissions are those produced immediately upon consumption of energy by an end user within the boundaries of the municipality. Indirect emissions are those produced by an energy utility upstream of consumption by the end user.

For example, when natural gas-fired furnace or water heater is operating it is creating a direct emission: natural gas is burned, and air pollutants are emitted directly into the air. Conversely, when a light bulb is switched on it creates an indirect emission, because the actual emissions are produced upstream at a power plant, which may be burning fossil fuel to produce the electricity.

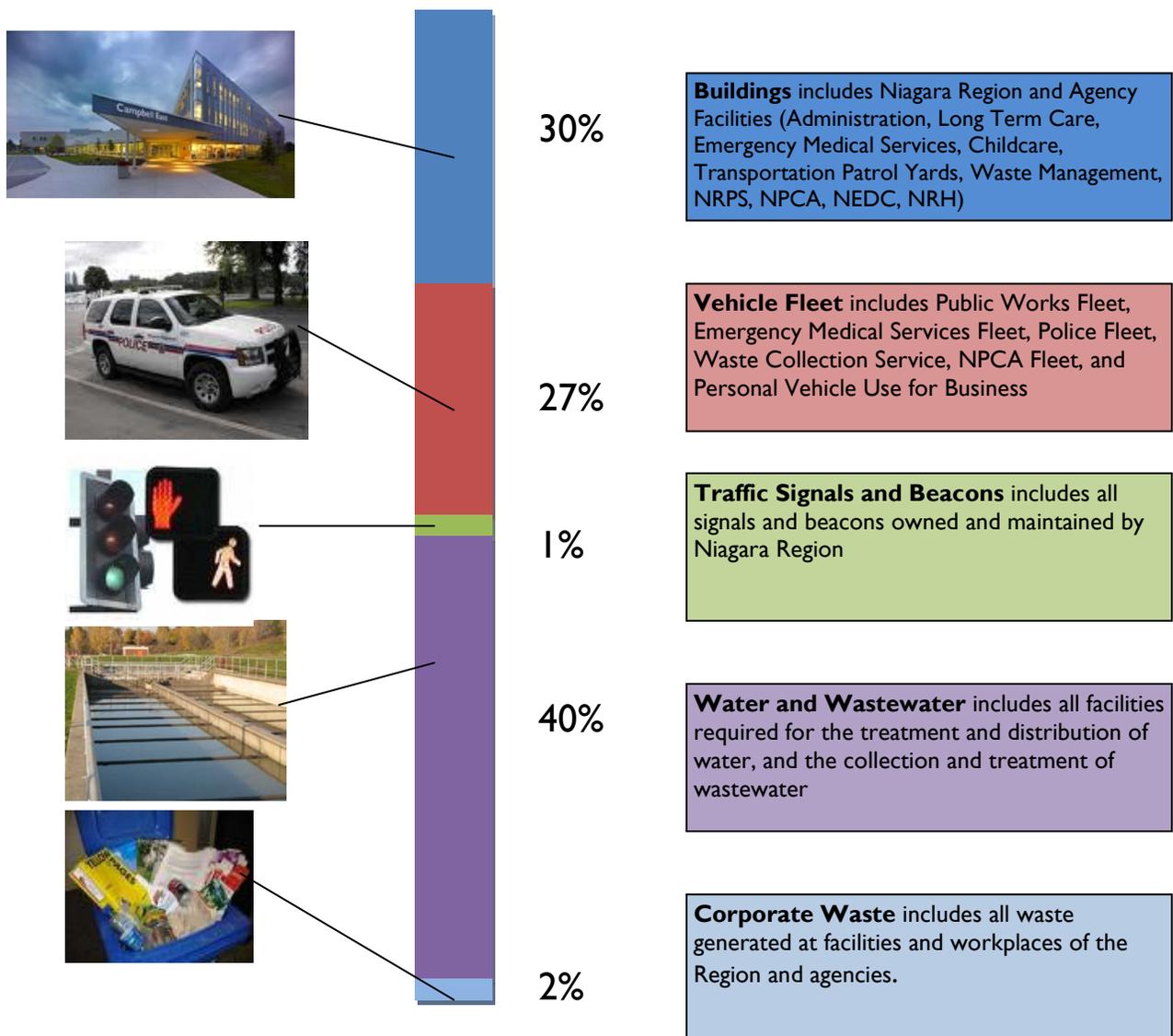
In Niagara, we are fortunate to have major sources of renewable hydroelectric power located physically within our Region: the Sir Adam Beck and Decew Falls generating stations. These generation sources represent only a portion of the many types that power the electricity grid in Ontario. The other major generating fuel sources are Nuclear, Natural Gas and Coal. Emissions from electricity are calculated based on the annual average generation mix for 2006 in accordance with PCP protocol.



Corporate Emissions Summary

The Corporate GHG Emissions Inventory has been compiled for the baseline year of 2006. The Inventory includes emissions resulting from all Niagara Region corporate operations and services. The Inventory also includes emissions from Niagara’s partner agencies, boards and commissions: Niagara Regional Housing (NRH), Niagara Regional Police Service (NRPS), Niagara Economic Development Corporation (NEDC), Provincial Offences Administration (POA), and the Niagara Peninsula Conservation Authority (NPCA).

The Inventory is categorized by five sectors of corporate operations that generate emissions; buildings, vehicle fleet, traffic signals and beacons, water and wastewater and corporate waste. The emissions generated in each of these sectors are outlined in Table I and explained in greater detail further in this report.

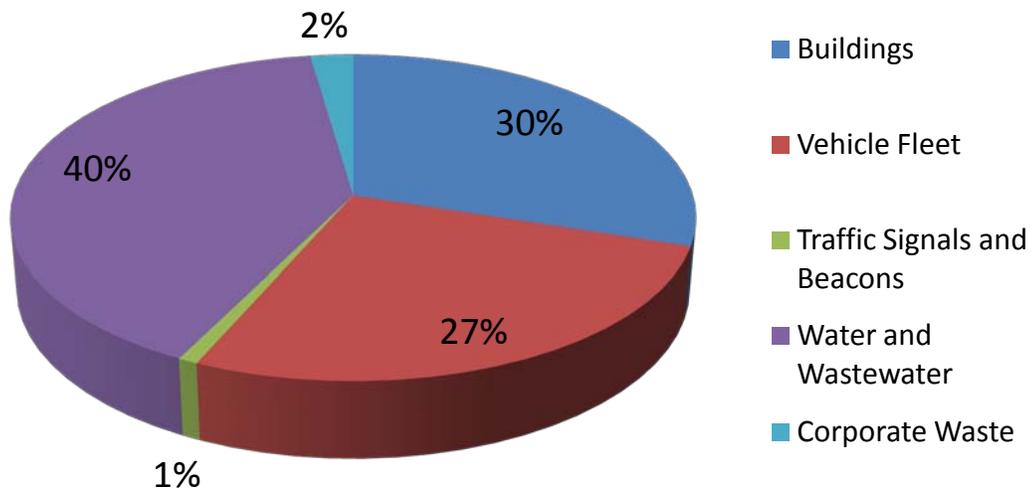


In 2006, Niagara Region and agencies produced 55,777 tonnes (t) of greenhouse gas (GHG) emissions.

Table 1: Energy Costs and eCO2 Emissions by Sector, 2006

Sector	Total Cost (\$)	Total eCO2 (t)
Buildings	6,461,042	16,697
Vehicle Fleet	3,820,223 ¹	14,875
Traffic Signals and Beacons	367,578	458
Water and Wastewater	5,910,100	22,465
Corporate Waste	-	1,282
Total	16,558,943	55,777

Corporate eCO2 emissions by Sector, 2006



Water and wastewater operations account for 40% of all emissions generated by the Region and its agencies. Buildings account for 30%, whereas vehicle fleets account for 27%. Waste and traffic signals account for 2% and 1% of emissions respectively.

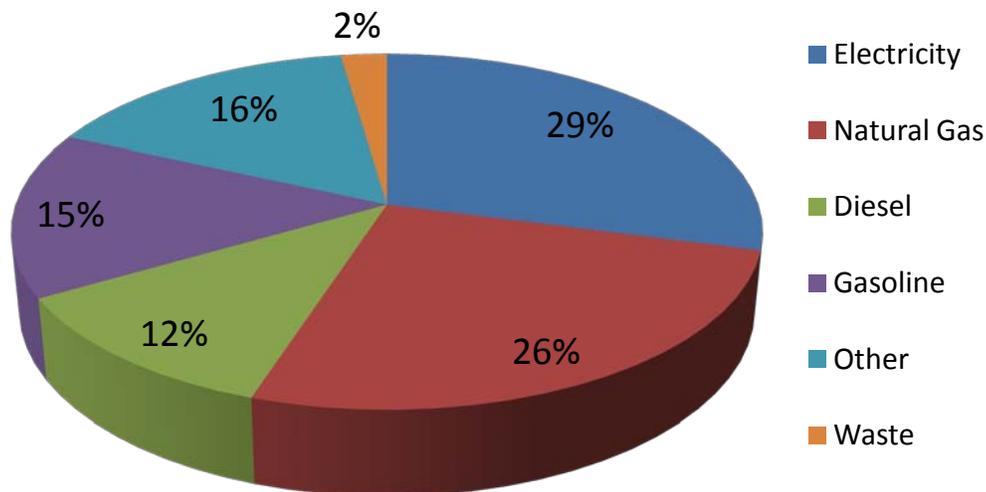
Just as emissions can be attributed to a sector of corporate operations, they can also be attributed to a particular activity or energy source. Table 2 illustrates the energy sources/activities responsible for corporate emissions and related costs.

¹ Vehicle fleet fuel cost referenced does not include costs for fuel for waste collection vehicles.

Table 2: Energy Costs and eCO2 Emission by Source, 2006

Energy Type	Total Use	Total Cost (\$)	Total eCO2 (t)
Electricity	89,986,314 kwh	9,353,695	16,198
Natural Gas	7,725,598 cum	3,380,536	14,525
Diesel	2,367,894 L	- ²	6,466
Gasoline	3,560,161 L	3,820,223	8,409
Fuel Oil	5,239 L	4,489	15
Other ³	-	-	8,883
Waste	-	-	1,282
Total	-	16,558,943	55,777

Corporate eCO2 emissions by Source, 2006



Electricity use accounts for 29% of all corporate GHG emissions. This is followed by natural gas at 26%, direct fugitive emissions from wastewater operations at 16%, gasoline at 15%, diesel at 12%, and corporate waste at 2%. Emissions from propane and fuel oil account for less than 1% of the total corporate emissions and therefore are not included in the above pie chart.

The following sections will further explore and describe emissions by sector and will outline related costs for various energy sources.

² The total cost for Diesel is included in the total cost for Gasoline – it is a combined figure.

³ Other includes direct and fugitive emissions from wastewater operations

Buildings

30% of Corporate Emissions, 16,697 tonnes of eCO₂

Niagara Region owns and manages over 70 facilities⁴. These facilities accommodate a range of service functions including; administration (offices for Region and agencies including POA, NPCA, and NEDC), child care, long term care, emergency medical services, police, transportation maintenance and waste management.

Further, agencies such as Niagara Regional Housing own and manage more than 2,600 housing units. Niagara Peninsula Conservation Authority owns and manages several buildings on over 7,000 acres of land.

In 2006, all emissions from buildings were a result of electricity use and natural gas consumption. Some NPCA facilities also rely on propane and fuel oil for heating. Emissions from buildings accounted for 30% of corporate emissions. Table 3 below summarizes costs and emissions generated from electricity and natural gas consumption.

Table 3: Summary of costs and emissions for facilities, 2006

Buildings	Total Cost (\$)	Total eCO ₂ (t)
Administration (10 incl. NEDC, POA, NPCA Admin)	676,390	1,206
Child Care Facilities (5)	51,077	128
Long Term Care Facilities (8)	1,565,216	4,293
Niagara EMS ⁵ (17)	107,259	270
Niagara Regional Housing Units ⁶ (2636)	3,059,433	8,761
Niagara Peninsula Conservation Authority (5 incl. 25 stream gauges)	61,358	91
Niagara Regional Police (11)	523,049	1,237
Transportation Patrol Yards (4)	131,401	208
Waste Management Facilities (10)	285,858	504
Totals	6,461,042	16,697



1 tonne (i.e., a metric ton) = 2204.6 pounds,
A small car such as a Volkswagen Beetle weighs approximately 1 tonne.

⁴ Excluding water and wastewater facilities as these are accounted for in a separate reporting sector

⁵ NEMS operates 17 ambulance stations, 5 of which are shared facilities and not owned by the Region. These figures represent 12 of the 17 facilities operated by NEMS.

⁶ NRH owns/manages over 2600 residential units. In 686 housing units the tenant is responsible for electricity. Emissions from electricity in these units is not included in the inventory.

Vehicle Fleet

27% of corporate emissions, 14,875 tonnes of eCO₂

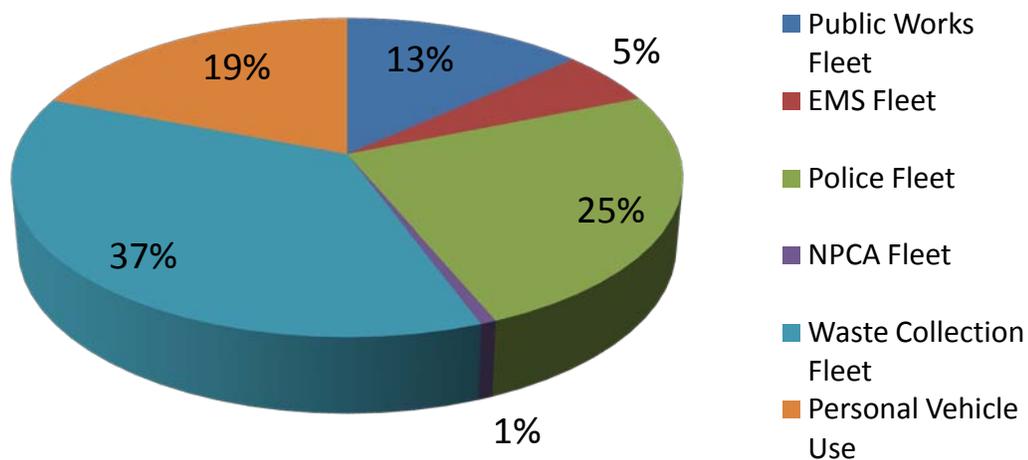
The corporate vehicle fleet captured by this inventory includes all those vehicles used by the Region for its business and operations. These vehicles (and equipment) have been classified by function:

- Regional Public Works Fleet⁷,
- Niagara Emergency Medical Services Fleet,
- Niagara Regional Police Fleet,
- Niagara Peninsula Conservation Authority Fleet,
- Waste Collection Vehicle Fleet (contracted service),
- Personal Vehicle Use (for Regional business)

Table 4: Summary of Costs and Emissions for Vehicle Fleet

Vehicle Group Name	Total Cost (\$)	Total eCO ₂ (t)
Public Works Fleet	756,979	2,002
EMS Fleet	325,229	816
Police Fleet	1,453,000	3,710
NPCA Fleet	11,366	28
Waste Collection Fleet	- ⁸	5,461
Personal Vehicle Use	1,273,649	2,858
Total	3,820,223	14,875

Corporate Vehicle eCO₂ Emissions Profile 2006



⁷ Includes Regional Courier and Court Services vehicles

⁸ Cost data for waste collection not available

Not all corporate vehicle emissions have been captured in this inventory. Some notable exclusions include:

- Emissions generated from vehicles of those services contracted by the Region and agencies. For example, service vehicles for contractors (landscaping, engineering, HVAC, consulting, planning, construction, etc.);
- Emissions from employee vehicles for travel to and from work location; and
- Contract Vehicles for Snow Removal (contractors are responsible for snow removal on approximately 1/3 of Regional Roads) have been excluded due to lack of data,

Traffic Signals and Beacons

1% of corporate emissions, 458 tonnes of eCO₂

The Region owns, operates and maintains over 390 traffic signals and beacons. In 2006, electricity consumption for traffic signal lights accounted for 1% of total corporate emissions.

Table 5: Traffic Signals and Beacons

	Total Electricity Use (kwh)	Total Cost (\$)	Total eCO ₂ (t)
All Traffic Signals and Beacons	2,546,339	367,578	458.341



A **kwh** is using 1000 watts of energy in the duration of an hour. This is the equivalent of having ten 100 watt light bulbs on for 1 hour.

Water and Wastewater

40% of corporate emissions, 22,465 tonnes of eCO₂

The Region is responsible for the operation of six water treatment facilities, eleven wastewater treatment facilities, and peripheral water and wastewater transmission infrastructure, including over 100 pumping stations. The majority of emissions relating to water and wastewater treatment and distribution were a result of electricity and natural gas use. Direct emissions from wastewater operations have also been accounted for in the Inventory.

Water Treatment and Distribution

Water treatment and distribution accounted for 6.6% of the total corporate GHG emissions in 2006 and 16% of emissions from all water and wastewater operations. Table 6 outlines emissions and energy costs from each of the six water treatment facilities and the associated distribution systems.

Table 6: Water Facilities	Energy Costs (\$)	Total eCO ₂ (t)
DECEW FALLS Treatment ⁹	0	0
DECEW FALLS Distribution	2,204,337	397
GRIMSBY Treatment	3,275,869	782
GRIMSBY Distribution	761,550	137
NIAGARA FALLS Treatment	3,008,452	770
NIAGARA FALLS Distribution	355,446	68
PORT COLBORNE Treatment	1,257,909	319
PORT COLBORNE Distribution	142,939	26
ROSEHILL Treatment	1,395,402	420
ROSEHILL Distribution	131,185	42
WELLAND Treatment	2,945,420	530
WELLAND Distribution	243,110	209
Totals	15,721,619	3,699

Wastewater Treatment and Collection

Wastewater treatment and collection accounts for 33.6% of the total corporate GHG emissions in 2006 and 84% of emissions from all water and wastewater operations.

⁹ No data is available. Decew Falls Treatment Plant is not charged for electricity use based on an historical agreement with the predecessor of Ontario Power Generation. Electricity is supplied directly to the treatment plant from Decew Falls hydro-electric station.

Table 7 outlines emissions and energy costs from each of the eleven wastewater treatment facilities and the associated collection systems.

Table 7: Wastewater Facilities	Energy Costs (\$)	Total eCO ₂ (t)
BAKER ROAD Treatment Plant	297,355	710
BAKER ROAD Collection	214,424	295
CRYSTAL BEACH Treatment Plant	155,455	566
CRYSTAL BEACH Collection	11,893	20
FORT ERIE Treatment Plant	254,863	521
FORT ERIE Collection	84,048	120
NIAGARA FALLS Treatment Plant	382,778	699
NIAGARA FALLS Collection	275,083	675
NOTL Treatment Plant	126,760	225
NOTL Collection	43,710	86
PORT DALHOUSIE Treatment Plant	394,507	829
PORT DALHOUSIE Collection	91,904	156
PORT WELLER Treatment Plant	438,752	2813
PORT WELLER Collection	71,987	64
QUEENSTON Treatment Plant	28,885	45
SEAWAY Treatment Plant	292,289	694
SEAWAY Collection	103,045	192
STEVENSVILLE-DOUGLASTOWN Collection	7,174	12
STEVENSVILLE-DOUGLASTOWN Lagoon	30,136	51
WELLAND Treatment Plant	418,566	941
WELLAND Collection	101,252	168
Totals	3,824,865	9882

Direct emissions from wastewater processes (anaerobic digestion) have also been accounted for in the Region's corporate emissions inventory. Although the Region uses digester gas in its boilers and flares unused digester gas, fugitive emissions accounted for approximately 8883 tonnes of eCO₂ in 2006.



Direct Emissions are those produced immediately upon consumption of energy by an individual or organization within the boundaries of the local government.

Waste

2% of corporate emissions, 1,282 tonnes of eCO₂

Waste volumes generated at Regional and agency facilities are not necessarily quantified and therefore must be estimated. In 2006 all waste generated at Regional and agency facilities was collected by a contractor in accordance with the terms of an agreement of service. The agreement describes the number and size of waste containers and the frequency of pick-up. Emissions have been calculated based on the assumptions in the FCM Guidance Document for developing GHG inventories.

On average, the Region and its agencies have containers with the combined capacity of 546 cubic yards. These have been collected from facilities every week (and in some cases more than once a week). In order to determine waste tonnage, it is assumed that in 2006 containers are 75% full at the time of pickup and one yard weighs approximately 125 kg.

Based on these assumptions, waste generated in 2006 accounts for 1,282 tonnes of eCO₂.



1 Cubic Yard = 764.55 litres,
It would take approximately 4.5 wheelbarrows full of soil
to match a cubic yard.

Emissions Forecast

The Partners for Climate Protection program requires that an emissions forecast be prepared to illustrate how emissions might grow under a ‘business as usual’ (BAU) scenario. In order to prepare a forecast, it is important to understand what plans the Region and its agencies have for new construction and additions to buildings and facilities, vehicle fleet expansions, capital projects that may in some way increase energy and fuel consumption, as well as changes in internal waste diversion practices.

In developing an emissions forecast, consumptive rates between 2006 and 2009 were analyzed. The 10 year capital budget was reviewed to determine which projects/initiatives might result in an increase or decrease in consumption. Based on this analysis, and considering initiatives that are underway to reduce or mitigate consumption, the following rates of increase have been used to portray the corporate GHG emissions forecast under a ‘business as usual’ scenario:

- Average 2.5% annual increase in electricity consumption
- Average 2% annual increase of natural gas consumption
- Average 3% annual increase of fuel consumption for vehicles
- Average 3% annual increase of direct wastewater emissions
- Average 3% annual increase in volumes of waste generated

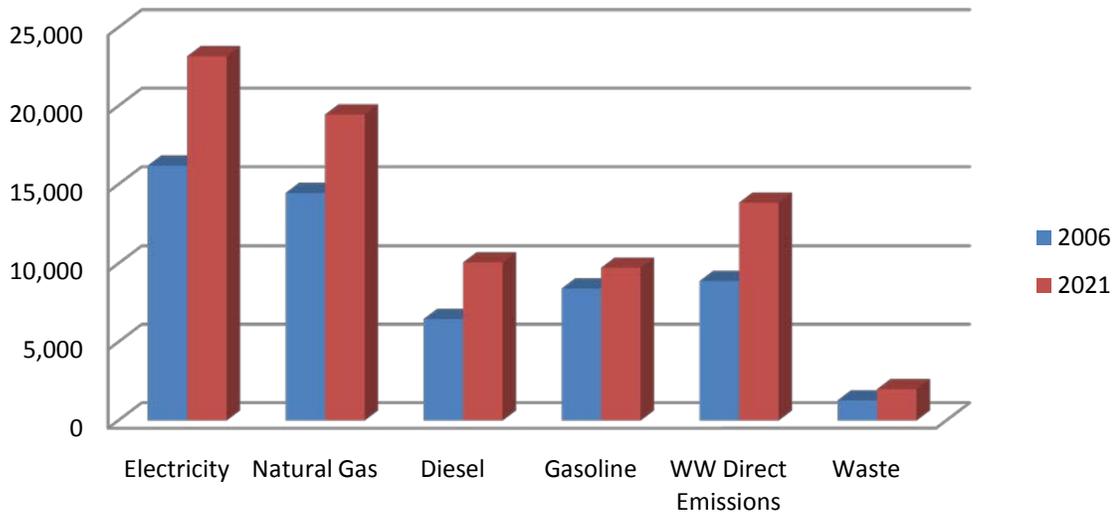
Table 8: Emissions forecast by Source, 2006

Energy Type	Total Use 2006	Total expected use by 2021 ('business as usual' scenario)	Forecasted Annual Total eCO ₂ (t) for 2021
Electricity	88,873,502 kwh	128,715,000 kwh	23,169 ¹⁰
Natural Gas	7,691,150 cum	10,351,275 cum	19,461
Diesel	2,367,894 L	3,689,101 L	10,073
Gasoline	2,643,622 L	4,118,676 L	9,728
WW Direct Emissions	8883 eCO ₂	13,839 eCO ₂	13,839
Waste	546 cubic yards	850 cubic yards	1,997
Total			78,267

If the Region continues with the ‘business as usual’ scenario defined above, by 2021 the Region and agency partners could be generating 78,267 tonnes of eCO₂. Compare that to the 2006 baseline of 55,777, which represents an annual increase of more than 20,000 tonnes of eCO₂, or 40% in total annual emissions growth in 15 years.

¹⁰ Note this value is based on the assumption that the composition of the electricity grid in the Province of Ontario is powered by similar generation sources as 2006. The Green Energy Act and other incentive programs will likely lead to the ‘greening’ of the grid by 2021, which could result in a smaller emissions value for 2021.

Forecasted Emissions Growth 2006-2021 (eCO₂)



Discussion and Next Steps

In order to make full use of the information in this report, we must understand where there may be gaps or difficulties in obtaining real data. For example, the following questions must be considered in the steps to follow:

- Are there areas in this inventory where raw data has been estimated but could have benefited from real consumption values?
- Are there accounts where we are being billed for flat rates that could be better managed by switching to consumptive rates?
- Are there data sets on consumption where we are not tracking supplementary data such as cost?
- What can we do to ensure that for future similar exercises we are working with reliable data?

It will be important to consider these questions as the report is discussed and as Niagara's Climate Action Plan is developed.

The next milestones of the Partners for Climate Protection Program will require that the Region and agencies set an emissions reduction target and develop an action plan to realize a target. It is critical that the information in this report and supplementary data collected throughout the inventory process be used to analyze where emissions reductions might be realized.

Abbreviation Index

BAU	Business as usual
CBP	Council Business Plan
CH4	Methane
CO2	Carbon Dioxide
eCO2	Carbon Dioxide equivalent
EMS	Emergency Medical Services
FCM	Federation of Canadian Municipalities
GHG	Greenhouse Gas
GRI	Global Reporting Initiatives
HVAC	Heating Ventilating Air Conditioning
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
kwh	Kilowatts per Hour
N2O	Nitrous Oxide
NEDC	Niagara Economic Development Corporation
NPCA	Niagara Peninsula Conservatory Authority
NRH	Niagara Regional Housing
NRPS	Niagara Regional Police Service
POA	Provincial Offences Administration
PCP	Partners for Climate Protection
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Questions?

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