



2006 Community GHG Emissions Inventory
September 2010

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

- Fulfill the community portion of Milestone One of the ICLEI/FCM Partners for Climate Protection Program.
- To better understand how community-wide greenhouse gas emissions might grow and change if we do not take action.
- To facilitate discussion on how we can collectively reduce community greenhouse gas emissions in developing an action plan.
- To discuss how this information might be used in decisions that may have impact on community carbon footprint.

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 community consumes energy and generates waste. This report provides a comprehensive GHG emissions inventory for the Niagara community. It is the first step in the development of a broader Niagara Climate Action Plan (NCAP). A corporate GHG emissions inventory has already been prepared and approved by Council in March of 2010 and recognized by FCM. The NCAP, 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 the first milestone 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 community component of Milestone One of the Partners for Climate Protection Program.

Milestone One: Community Greenhouse Gas Emissions Inventory

This inventory tracks and reports three principal greenhouse gases that originate from community sources: 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 homes and work spaces, and to run day-to-day 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, the Niagara Region is establishing a baseline from which to measure the performance of initiatives designed to reduce the community carbon footprint and mitigate the effects of climate change.

This report represents the first step in the process and sets the baseline required for monitoring and planning. Following the adoption of this report there will be a focused dialogue on how the Niagara community 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.

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 a 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.

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 **Residential, Commercial, and Industrial** buildings has been collected from energy suppliers (Enbridge and Niagara Area LDC's), and in some cases, the Ontario Energy Board's 2006 Yearbook of Electricity Distributors. Emissions from propane have been estimated based on Ontario per capita average consumption, according to the Propane Market Study commissioned by the Propane Gas Association of Canada prepared by Purvin and Gertz Inc. in April 2007.

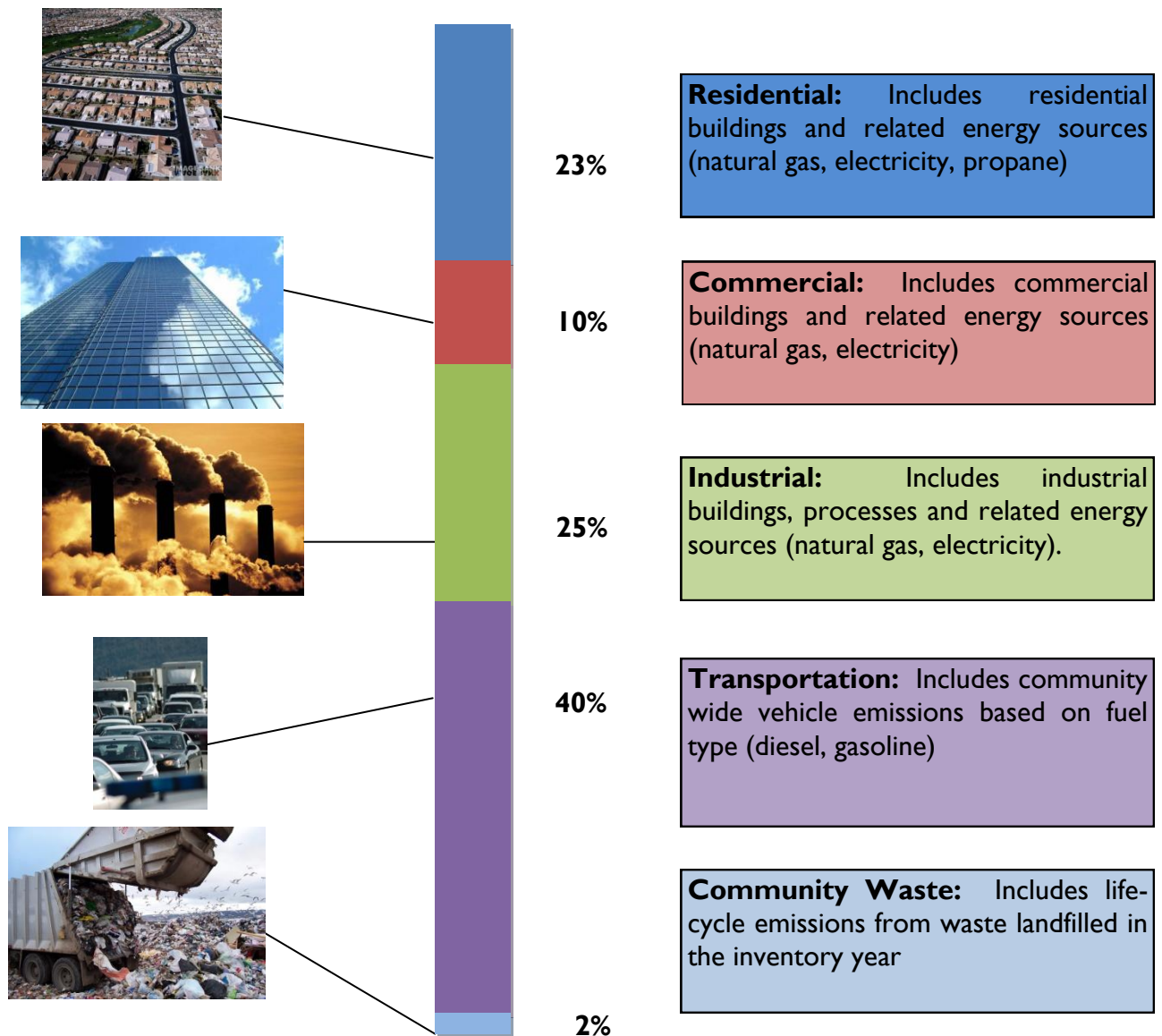
Data for **transportation**, namely fuel consumption (gasoline, diesel, etc.) for vehicles has been estimated based on the Public Works TransCAD model using traffic counts from Provincial, Regional and Municipal roads collected in 2006. The model calculates the total vehicle kilometres travelled for segments of all roads within the Region. This data is translated to an emissions value based on recommended traffic composition percentages and fuel consumption assumptions and assessed against a variety of technical studies and local fuel sales data.

Data for **waste** generated by the community based on waste volumes collected from the Public Works Waste Management staff and using a calculation suggested by the PCP Guidance Document 'Developing Inventories for Greenhouse Gas Emissions and Energy Consumption'. Other waste emissions data was acquired through the National Pollutant Release Inventory (NPRI) and other internal studies.

All specific assumptions and inclusions/exclusions are explained throughout the text of this report.

Community Emissions Summary

The Community GHG Emissions Inventory has been compiled for the baseline year of 2006. The Inventory includes emissions generated in five sectors of the community; residential, commercial, industrial, transportation and community waste. The emissions generated in each of these sectors are outlined in Table I and explained in greater detail further in this report. The inventory does not include those emissions that were accounted for in the Region's corporate GHG inventory, in accordance with PCP protocol.

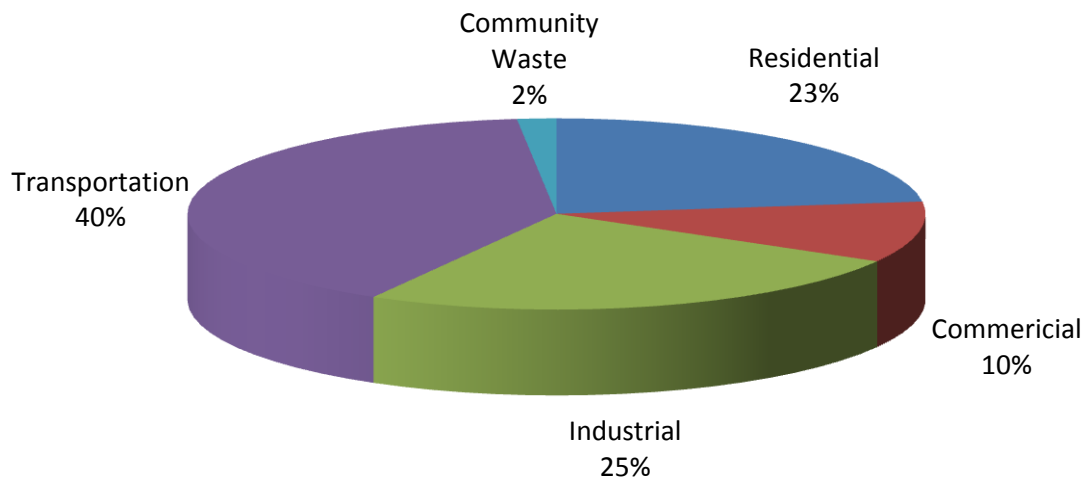


In 2006, Niagara community generated 4,140,966 tonnes (t) of greenhouse gas (GHG) emissions. Residential buildings account for 23% of all emissions generated by the community, while commercial buildings account for 10%, whereas industrial accounts for 25%. Transportation and community waste account for 40% and 2% of emissions respectively.

Table 1: Community Emissions (eCO₂) by Sector, 2006

Sector	Total eCO ₂ (t)
Residential	950,055
Commercial	427,571
Industrial	1,034,310
Transportation	1,657,856
Community Waste	71,173
Total	4,140,966

Community eCO₂ Emissions Breakdown by Sector

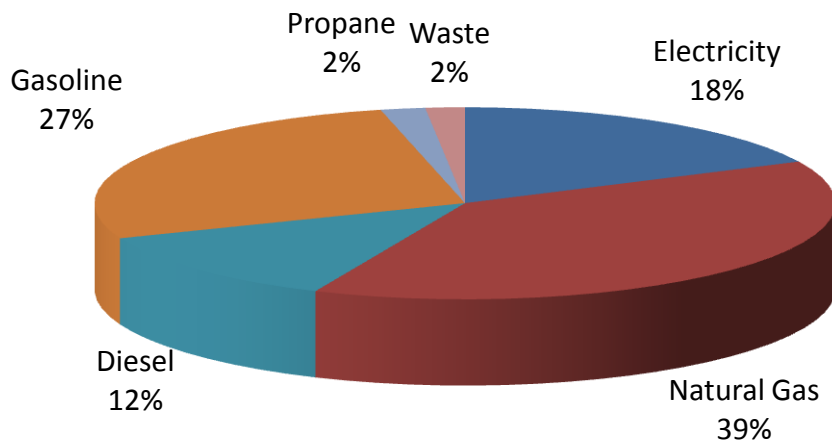


Just as emissions can be attributed to a sector of a community, they can also be attributed to a particular activity or energy source. Table 2 illustrates the energy sources/activities responsible for community emissions.

Table 2: Community Emissions (eCO2) by Source, 2006

Energy Type	Units	Total Use	Total eCO2 (t)
Electricity	kWh	4,111,137,017	740,005
Natural Gas	Cum	853,048,081	1,603,784
Diesel	GJ	188,567,348	514,902
Gasoline	L	478,638,052	1,130,490
Propane	L	52,686,256	80,612
Waste	tonnes	147,754	71,173
Total			4,140,966

Community eCO2 Emissions by Source



Natural gas consumption accounts for 39% of all community GHG emissions. This is followed by gasoline at 27%, electricity consumption at 18%, diesel at 12%, and community waste and propane at 2%. The following sections will further explore and describe emissions by sector.

Residential

23% of Community Emissions, 950,055 tonnes of eCO₂

The residential data represents all households within Niagara.

Electricity data in this sector represents the total electricity consumed for residential customers across Niagara. This data was collected from the seven LDC's (electricity distributors) who serve the local municipalities within the Region and the Ontario Energy Board.

Natural gas data represents the consumption of natural gas by residential customers of Enbridge Inc. within the Region. The data does not include consumption of gas from privately owned wells throughout the Region. There are hundreds of private natural gas wells throughout southern and west Niagara that are not accounted for in this inventory.

Community-specific data for propane consumption is currently not available. Propane gas consumption was therefore estimated based on average per capita residential (non-commercial) consumption in Ontario.

There are other energy sources in the residential sector that have not been accounted for in the inventory, but may contribute to the total carbon output of the community. For example, homes heated by fuel oil and by wood also generate GHG emissions. There are Provincial averages available for these fuels, however their use varies substantially across the Province, making it difficult to estimate our community use of these fuels.

Table 3: Summary of emissions for residential buildings by fuel type, 2006

Fuel Type	Units	Total Use	Total eCO ₂ (t)
Electricity	kWh	1,433,873,771	258,097
Natural Gas	Cum	331,803,060	623,810
Propane	L	44,540,000	68,148
TOTAL			950,055



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

Commercial

10% of Community Emissions, 427,571 tonnes of eCO₂

The commercial sector represents consumption and emissions data from businesses in Niagara. The classification of a business is determined by the respective utility for billing purposes. This may result in some businesses that are represented as a commercial customer for one utility, and an industrial or residential customer for another utility. For the purposes of the inventory this needs to be noted, but is not a significant issue.

Agricultural operations, for example, are classified by the respective utility (i.e. an LDC or Enbridge Inc.), and therefore may be represented as a commercial customer, industrial customer or even a residential customer. Efforts to quantify specific emissions from agriculture will be an important consideration as the inventory is conducted in subsequent years.

Similar to residential, the electricity consumption data was provided by the individual LDC's and the Ontario Energy Board. The rate class is determined by the LDC and commercial is synonymous with the General Service < 50kw rate class.

Natural gas consumption was also provided by Enbridge Inc., the distribution company for the Niagara area. As noted in the Residential section, the inventory does not include consumption from businesses that use gas from privately owned gas wells.

Other fuel types, such as fuel oil, propane, wood and bio-mass, for example, are not accounted for in the inventory. These likely represent marginal consumption by businesses in Niagara in the inventory year, however it is noted for comparative purposes in future inventories.

Table 4: Summary Emissions for commercial buildings by fuel type, 2006

Fuel Type	Units	Total Use	Total eCO ₂ (t)
Electricity	kWh	480,713,418	86,528
Natural Gas	Cum	181,399,668	341,043
TOTAL			427,571

Industrial

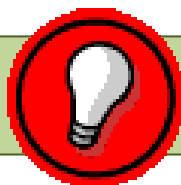
25% of Community Emissions, 1,034,310 tonnes of eCO₂

Similarly to commercial data, the industrial sector data has been collected from the LDC's, Ontario Energy Board, and Enbridge Inc.

Other energy sources, such as fuel oil and propane for example, cannot be accurately estimated based on the limited data available. Further, direct emissions from industrial operations are not included in this inventory. Other data sources may be able to assist in quantifying industrial emissions. For example, the Federal National Pollutant Release Inventory (NPRI)¹ contains annual reports from local industries on emissions (GHG and other pollutants). Also, the Niagara CAER Group², an association of chemical manufacturers in Niagara, provides annual reports on emissions and pollutants locally. Although these reports are important to capture as reference material for the inventory, the types of emissions reported are beyond the sphere of direct municipal influence and will not be the focus of future emissions reduction plans.

Table 5: Summary of costs and emissions for industrial buildings, 2006

Fuel Type	Units	Total Use	Total eCO ₂ (t)
Electricity	kWh	2,196,549,828	395,379
Natural Gas	Cum	339,845,353	638,931
TOTAL			1,034,310



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.

¹ See <http://www.ec.gc.ca/inrp-npri/>

² See <http://www.niagaracaer.com>

Transportation

40% of Community Emissions, 1,657,856 tonnes of eCO₂

Transportation emissions have been calculated using modelling software that determines peak hour traffic using real traffic count data from Regional, Provincial and local roads throughout Niagara. The modelling software determines how many vehicle kilometres have been travelled on each roadway during the peak hour, which can be translated to vehicle kilometres travelled (vkt) daily. Based on the results of the model, in 2006 the total vkt on Niagara's roads was 4,419,626,640.

Using traffic composition information recommended by the ICLEI PCP protocol and GHG quantification spreadsheet, the amount of fuel consumed by vehicle type was also determined, as outlined in Table 6 below.

Table 6: Breakdown of emissions (t of eCO₂) by vehicle and fuel types, 2006

	Autos	Light Truck	Heavy Truck	Bus	Total eCO₂ (t)	Total Fuel Used (L)
Gasoline	588,326	487,675	54,490	0	1,130,490	478,638,052
Diesel	1,720	14,366	498,430	386	514,902	188,567,348
Propane	12,464	0	0	0	12,464	8,146,256
Total	602,509	502,041	552,920	386	1,657,856	675,351,656

In order to verify the accuracy of the modelling software in capturing vkt for the inventory year, other supplementary studies and reports have been reviewed.

For example, the vkt and consumption data was assessed against the Transportation for Tomorrow Survey³, the IBI Urban Transportation Indicators Report⁴, as well as fuel sales data for area retailers acquired from Kent Marketing. These supplementary reports support the vkt and fuel consumption values generated by the model.

³ <http://www.mto.gov.on.ca/english/about/transit/TTsurvey.shtml>

⁴ <http://www.tac-atc.ca/english/resourcecentre/readingroom/pdf/uti-survey4.pdf>

Waste

2% of Community Emissions, 71,173 tonnes of eCO₂.

There are two different approaches that can be used to inventory GHG from waste. One approach determines emissions based on 'waste volumes landfilled in the inventory year'⁵, the other captures 'actual or estimated GHG emissions from landfills and composting operations'.

The GHG inventory protocol adopted by ICLEI and the Partners for Climate Protection program recommends inventorying emissions based on waste volumes in the inventory year. The advantage is that it captures the behavior in the year in which the baseline is calculated. Further, this method is being used by most municipalities in the PCP program, therefore it allows for cross comparisons and benchmarking.

In 2006, 147,754 tonnes of waste was landfilled. Based on the emissions quantification protocol, this would amount to 71,173 tonnes of eCO₂ over the life-cycle of that waste⁶. Table 7 breaks down waste volumes by the municipality in which they were generated.

Table 7: Summary of volumes of waste landfilled (t) and resulting GHG emissions (t of eCO₂), by source municipality, 2006

Municipality	Volume (t)	Total eCO ₂ (t)
Fort Erie	19,115.14	9,207.76
Grimsby	8,649.13	4,166.29
Lincoln	5,603.91	2,699.40
Niagara-on-the-Lake	3,652.60	1,759.46
Niagara Falls	22,082.99	10,637.38
Pelham	4,309.46	2,075.87
Port Colborne	13,222.92	6,369.48
Thorold	3,436.60	1,655.41
St. Catharines	31,744.69	15,291.42
Wainfleet	2,553.01	1,229.78
Welland	28,891.10	13,916.84
West Lincoln	4,491.91	2,163.75
AVERAGE	12,312.79	5,931.07
TOTAL	147,753.55	71,172.84

In order to get the 'entire picture', this report also captures emissions from waste facilities and processes in 2006 as supplementary information. Table 8 contains emissions quantities estimated for various landfill sites throughout the community in the inventory year.

⁵ Based on this protocol, composting or organics diversion is not to be included in the inventory, despite the composting process is known to generate methane and carbon dioxide.

⁶ This does not assume that landfill gas will be captured and flared.

Table 8: Inventory of landfill sites generating GHG emissions in 2006

Landfill Name (status in 2006)	Ownership	Year Open/Closed	Waste Volume (m3)	eCO2 Reported in 2006 (t)
Glenridge Quarry, SC (Closed)	Region	Closed in 2001	1800000	41620
Elm Street, PC (Open)	Region	Closed in 2008	886000	15935
Station Road, Wainfleet (Open)	Region	Closed in 2008	438000	8602
Niagara Road 12, WL (Open)	Region	(until 2045)	1690000	9513
Bridge Street, FE (Open)	Region	(until 2011)	1400000	21395
Humberstone, Welland (Open)	Region	(until 2017)	2200000	40024
Niagara Waste Systems, Thorold (Open)	Walker Industries	unknown	unknown	165102 ⁷
Mountain Road, NF (Closed)	Region	Closed in 2000	1600000	no data
Line 5, N-o-t-L (Inactive)	Region	Since 1998	708000	no data
Park Road (Closed)	Region	Closed in 1995	296000	no data
TOTAL				302,191

Although the list is not exhaustive, it does identify the main sites generating emissions from waste in the community. Throughout Niagara there are many abandoned landfill sites that may be generating fugitive emissions that are not captured above. There is no data available for these sites.

In 2006, the above landfill sites generated approximately 302,191 tonnes of eCO2 in the inventory year.

⁷ Based on emissions reported to the National Pollutant Release Inventory. Includes emissions resulting from composting operations at the Thorold site.

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.

The emissions calculations for the 2006 inventory "business as usual" forecast were based on an extrapolation methodology projecting emissions from available historic data from 1990 to 2020 including provincial per capita emissions and population growth projections for Ontario and the Niagara Region. The inventory and data collected in this process will serve as the basis for developing future emissions forecasts required to develop and measure progress made in reducing the Region's carbon footprint.

Based on this methodology, if Niagara community continues with the 'business as usual' scenario defined above, by 2020 the Community could be generating 4,981,162 tonnes of eCO₂. Compare that to the 2006 baseline of 4,140,966, which represents an overall increase of more than 840,196 tonnes of eCO₂, or 20.3% in total emissions growth.

Discussion and Next Steps

In order to make full use of the information in this report, there must be some dialogue on a few key questions moving forward:

- Are there supplementary data sets that exist that can assist in explaining community consumption habits?
- How do planning, transportation, and waste management policy decisions influence energy intensity and carbon emissions in the community?
- How might we map energy intensity and carbon emissions in understanding where in our community carbon emissions are being generated?
- Are significant dollars leaving our community due to energy costs?
- How can we ensure planning decisions consider energy and emissions?

It will be important to consider these questions as we consider the next milestones of the Partners for Climate Protection Program, setting an emissions reduction target and developing an action plan to realize that 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 readily realized.

Abbreviation Index

BAU	Business as usual
CBP	Council Business Plan
CH4	Methane
CO2	Carbon Dioxide
eCO2	Carbon Dioxide equivalent
FCM	Federation of Canadian Municipalities
GHG	Greenhouse Gas
GRI	Global Reporting Initiatives
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
kwh	Kilowatts per Hour
LDC	Local Distribution Company (electricity)
N2O	Nitrous Oxide
PCP	Partners for Climate Protection
t	Metric tonne

Questions?

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