Ajax

Community

Greenhouse Gas Emissions

Inventory

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Contents

1.0 Introduction

1.1 Background

In 2008, the Region of Durham initiated a multi-stakeholder advisory committee called the Durham Region Roundtable on Climate Change ("the Roundtable") to address climate change challenges in the Region both through mitigation and adaptation. In May 2009, Durham Sustain Ability (DSA) was retained to provide a community baseline greenhouse gas (GHG) emissions inventory for the Region as a whole, which was completed in October 2009.

The Town of Ajax has been able to leverage this initiative by retaining DSA to unpack the regional data and provide a community baseline GHG emissions inventory specifically for Ajax.

1.2 Climate Change – Local Actions within a Global Context

Greenhouse gas concentrations in the atmosphere (the most common of which include carbon dioxide CO_2, methane CH_4, and nitrous oxide N_2O) have been increasing significantly over the past 150 years contributing to tangible global climate change effects. This is mainly caused by human activity: primarily by the burning of fossil fuels as well methane from landfills, and the removal of carbon sinks through deforestation and agricultural practices.

An excellent summary paper outlining the current climate change science, GHG emission reduction targets and current/proposed strategies to meet those targets on the international, national and provincial/state levels along with comments and conclusions was endorsed by Durham Regional Council in September 2009. The document is Report No. 2009-J-37 and can be found at http://www.durhamclimatechange.ca.

Climate change is a global issue requiring local action, mainly in the areas of responsible energy consumption and shifting to renewable energy sources. In Canada, the Federation of Canadian Municipalities (FCM) and the International Council for Local Environmental Initiatives (ICLEI) have developed a framework for reducing greenhouse gas (GHG) emissions for municipalities called Partners for Climate Protection (PCP). Currently, 194 Canadian municipalities have registered in the PCP program.

The PCP program consists of five milestones:

1. Conduct a baseline GHG emission inventory analysis for municipal operations and the community.
2. Establish GHG reduction targets for municipal operations and the community.
3. Develop a local action plan outlining actions that reduce GHG emissions and energy consumption for municipal operations and the community at large.

4. Establish a program to implement adopted actions that will reduce GHG emissions as outlined in the local action plan.
5. Establish a monitoring and reporting system to verify GHG reduction achievements. Revise the action plan periodically to reflect new ideas and strategies.

Milestone 1 will be deemed complete with the submission of this community report to the PCP secretariat along with the Ajax corporate inventory that will be developed by staff.

1.3 Methodology

Establishing a community GHG emissions inventory involves gathering data on fuel, energy and waste from all sectors comprising the community at large. Energy consumption data in the residential, industrial, commercial and institutional (IC&I), and transportation sectors are gathered along with waste generation and disposal information.

Early in the process, the major Durham energy providers of electricity and natural gas were gathered at a summit meeting in which they endorsed the program and participation in the energy data gathering as the start of a longer-term partnership. They were willing to become partners in subsequent stages of the program including participation in working teams addressing Milestone 3 local action plan work.

The following energy providers supplied the energy data specifically for Ajax:

Residential, IC&I sector electricity usage and prices – Veridian

Residential, IC&I sector natural gas usage and prices – Enbridge

Transportation sector data was gathered from existing survey information for Ajax residents based on annual average daily trips and kilometers driven.

Durham Region provided waste generation and disposal data.

Once energy consumption and waste generation data were collected, appropriate emission coefficients were applied for each source of energy and waste to landfill to calculate the resulting GHG emissions. Annual emissions are expressed in absolute terms and are not corrected for weather or population growth, however emissions are also expressed on a per capita basis for trend analysis.

The equivalent carbon dioxide coefficient (eCO2) for electricity is based on the annual average amount of fossil fuel (coal, natural gas, oil) used at Ontario's electricity power plants. Other sources such as hydropower, nuclear and renewable energy do not directly produce eCO2 emissions. As Ontario's electrical generation mix changes from year to year so does the eCO2 electricity coefficient.

This means that the GHG emissions associated with electricity consumption in Ajax can vary year to year, even if there is no significant change in energy usage. In fact when a municipality reduces its energy consumption, its GHG emissions may actually increase if the provincial fossil fuel mix significantly increases.

All municipalities participating in the PCP program use this GHG calculation methodology (PCP Protocol) in Canada and throughout the world.

2.0 Community Inventory, Trends and Forecast

2.1 Background

The community baseline year of 2005 was selected to coincide with a number of proposed cap-and-trade programs (e.g. U.S.Western Climate Initiative of which Ontario is a member) use 2005 as the baseline year.

Canada currently uses 2006 as a baseline (although this may change in order to harmonize with the US which is proposing to use 2005 for its cap-and-trade program). In order to potentially harmonize with these programs and to provide trend data, it was decided that inventories would be established for the years 2005, 2006, 2007 and 2008. A business-as-usual (BAU) forecast for the year 2020 will also be provided based on population and household forecasts and the absence of any further efforts to reduce GHG emissions.

2.2 Community Summary

Ajax's population has grown by 16.7% from 89,015 in 2005 to 103,855 in 2008. The population is forecasted to substantially grow by 47.3% from the baseline year to 131,125 by 2020.

Table 1 summarizes the annual energy consumption, energy cost and GHG emissions on an absolute and per capita basis.

Table 1: Summary of Energy Consumption, Energy Cost and GHG Emissions

	2005	2006	2007	2008	BAU 2020
Energy Use (GJ)	8,728,952	8,497,736	9,052,404	8,935,756	11,282,086
Per Capita Energy (GJ/capita)	98.1	90.6	90.6	86.0	86.0
Energy Costs ($'000)	$178,147	$179,273	$183,590	$196,961	$248,678
Per Capita Energy Costs ($/capita)	$2,001	$1,911	$1,838	$1,896	$1,896
GHG Emissions (t eCO2)	521,250	489,760	543,348	538,836	680,322
Per Capita GHG Emissions (t eCO2/capita)	5.86	5.22	5.44	5.19	5.19

From 2005 to 2008, GHG emissions have increased by 3.4% on an absolute basis and have declined by 11.4% on a per capita basis. Energy consumption has risen by 2.4% on an absolute basis and dropped by 9.6% on a per capita basis. During this time, total energy costs have gone up by 10.6% due to increasing energy prices as well the small increase in energy consumption.

In figure A, the business-as-usual (BAU) forecast for 2020 assumes no further efforts to reduce energy consumption such that the per capita GHG emissions remain the same as 2008. This results in a GHG emissions increase of 159,073 tonnes (t) or 30.5% from the 2005 baseline level due to the significant growth in population.

The per capita GHG emissions provide additional trend analysis as it removes population as a variable. From 2005 to 2008, the per capita GHG emissions have been reduced from 5.9 t/capita to 5.2 t/capita.

Figure A: Absolute and Per Capita GHG Emissions with BAU Forecast

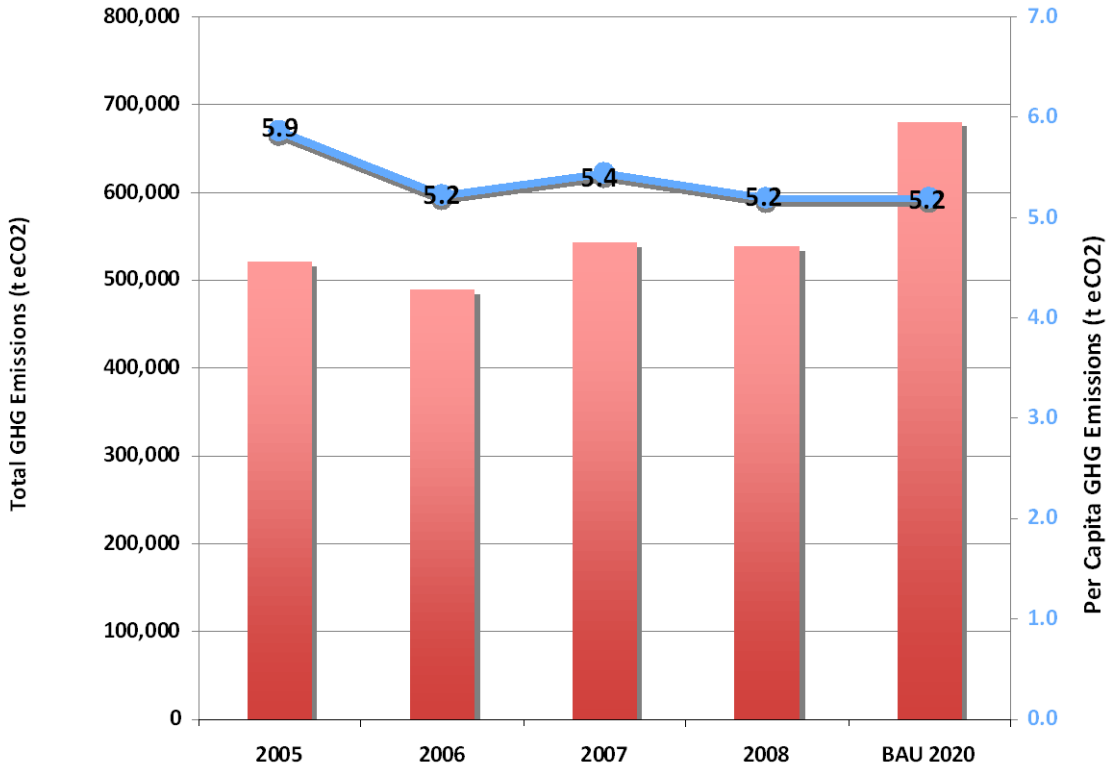
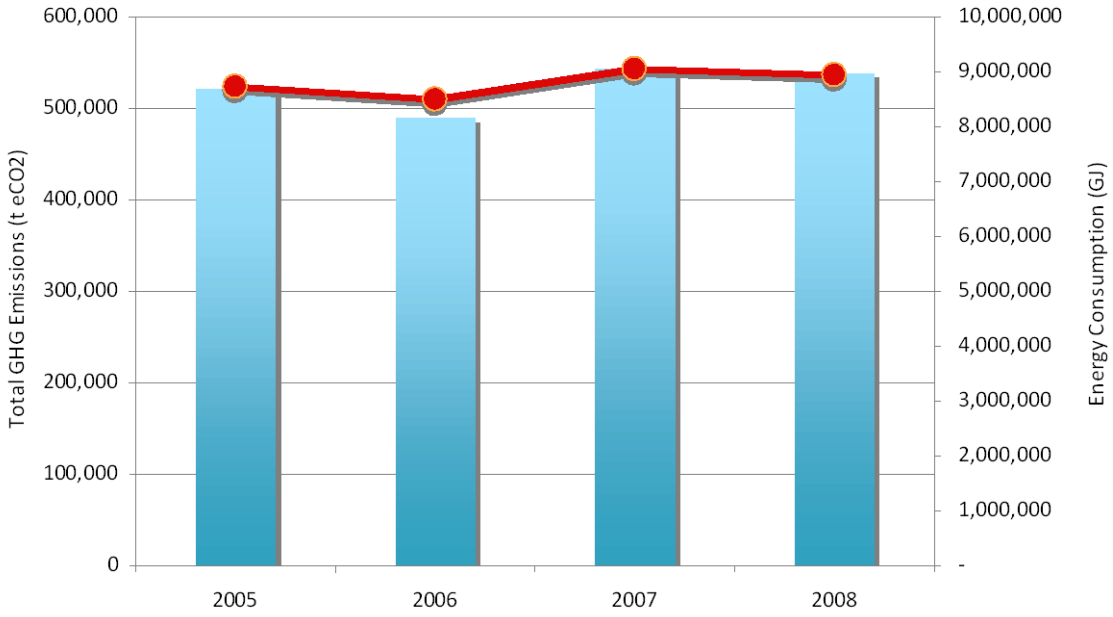


Figure B shows the close relationship between GHG emissions (blue bars) and energy consumption (red line). The energy consumption provides further refinement as it removes the effect of annual changes in the provincial electricity eCO2 emission coefficient. From 2005 to 2008, energy consumption has risen by 2.4%, whereas GHG emissions have increased by 3.4%. The 1% difference is mainly the result of a slight increase in the provincial electricity eCO2 coefficient between 2005 and 2007 (the latest published year).

Figure B: GHG Emissions and Energy Consumption



2.3 Inventory Baseline Year - 2005

In the baseline year of 2005, the community generated 0.52 million t of GHG emissions from energy consumption and waste disposal corresponding to 5.9 t per person.

The residential sector is the largest consumer of energy and emitter of GHG emissions followed the institutional, commercial and industrial (IC&I) sector and vehicle transportation. In 2005, the community produced an estimated 66,728 t of residential and commercial waste of which 28% was diverted from landfill. The landfill waste produced 23,168 t of GHG emissions, corresponding to 4% of the total community emissions.

Table 2 provides a percentage breakdown of energy consumption and GHG emissions by sector.

Table 2: Percentage Energy Use and GHG Emissions by Sector

Sector	Energy Use (%)	GHG emissions (%)
Residential	44%	39%
IC&I	34%	31%
Vehicle Transportation	22%	26%
Community Waste	-	4%

Figures C and D provide a breakdown of energy consumption and GHG emissions by sector, respectively.

Figure C: 2005 Energy Consumption By Sector

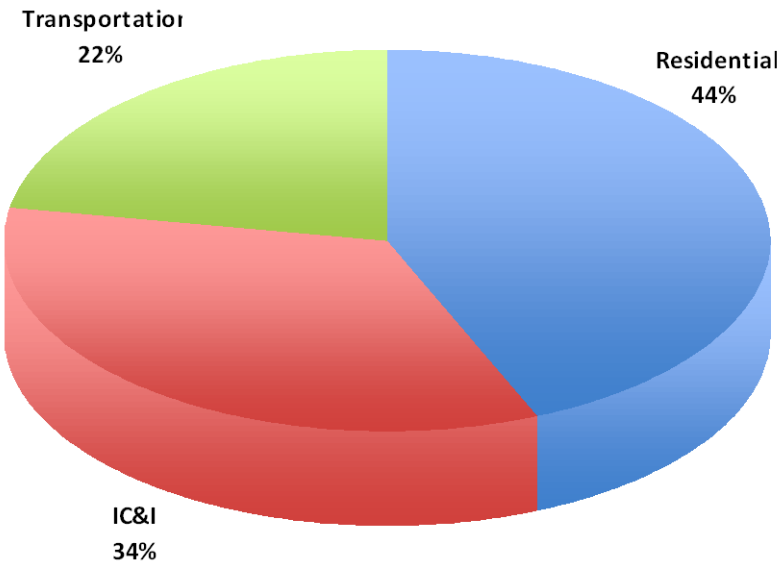


Figure D: 2005 GHG Emissions By Sector

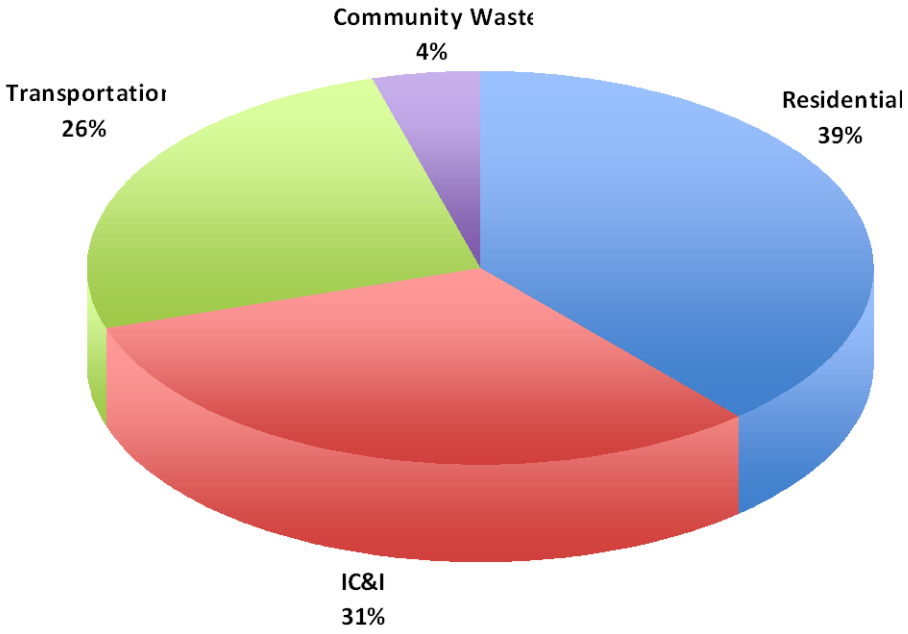


Table 3 provides a percentage breakdown of energy consumption, energy cost and GHG emissions by source. Electricity represents the largest source of energy consumption and GHG emissions followed by natural gas. Almost half of all energy usage (48%) is from natural gas, however it represents only one quarter (26%) of the total energy costs. Electricity cost is much more significant at 42%; and therefore, a much greater economic driver for energy conservation.

Table 3: Percentage Energy Use, Energy Cost and GHG Emissions by Source

Source	Energy Use (%)	Energy Cost (%)	GHG emissions (%)
Natural Gas	47%	26%	40%
Electricity	26%	42%	25%
Gasoline	10%	19%	17%
Diesel	8%	9%	10%
Fuel Oil	3%	3%	3%
Propane	1%	1%	2%
Community Waste	-	-	4%

Figures E, F and G provide a breakdown of energy consumption, energy cost, and GHG emissions by source.

Figure E: 2005 Energy Consumption By Source

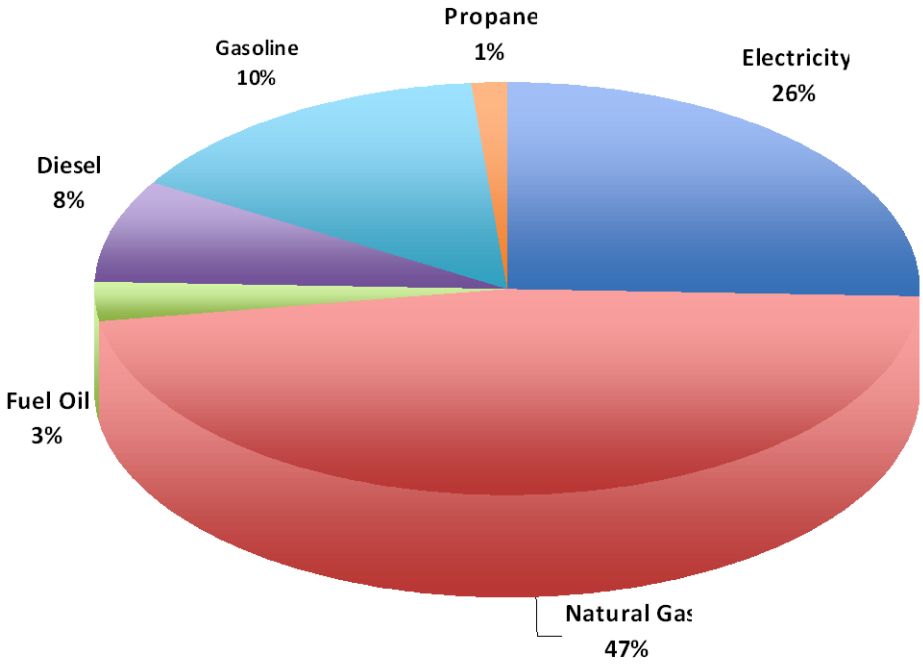


Figure F: 2005 Energy Cost By Source

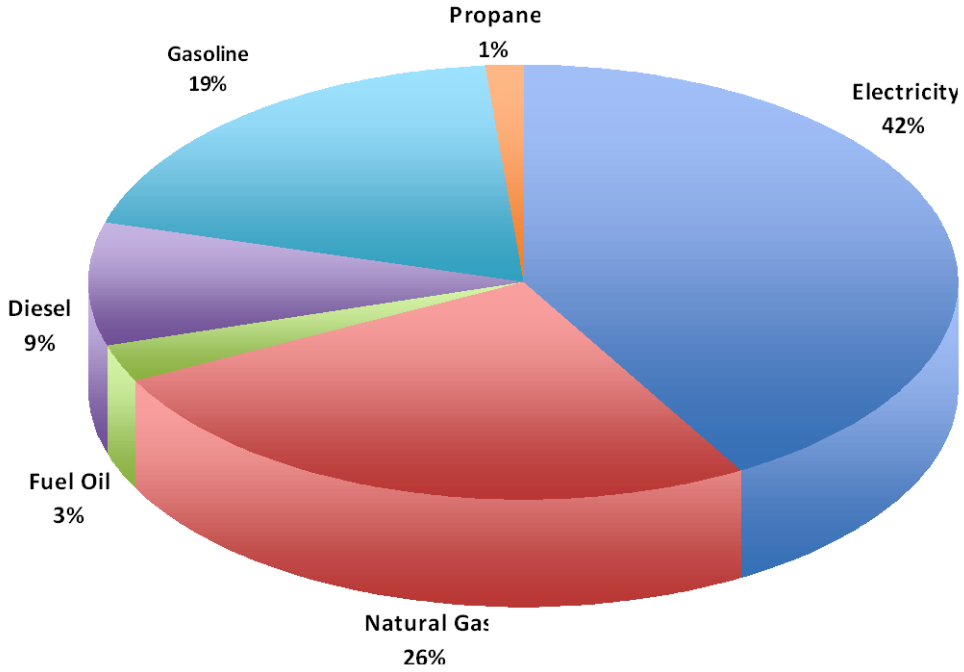
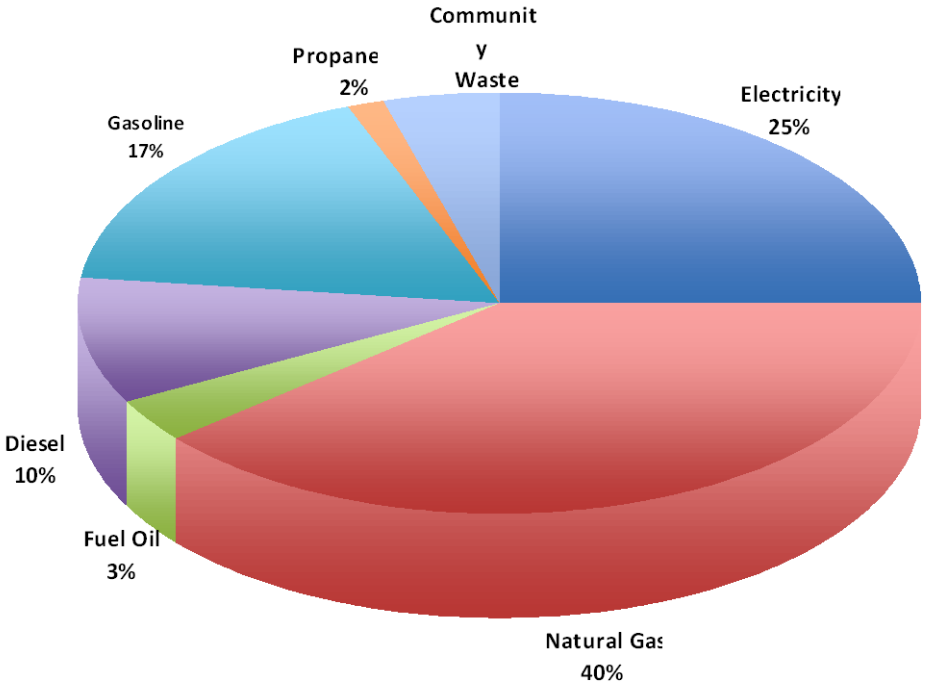


Figure G: 2005 GHG Emissions by Source



2.4 GHG Emissions Trends and Forecast By Sector

2.4.1 Summary

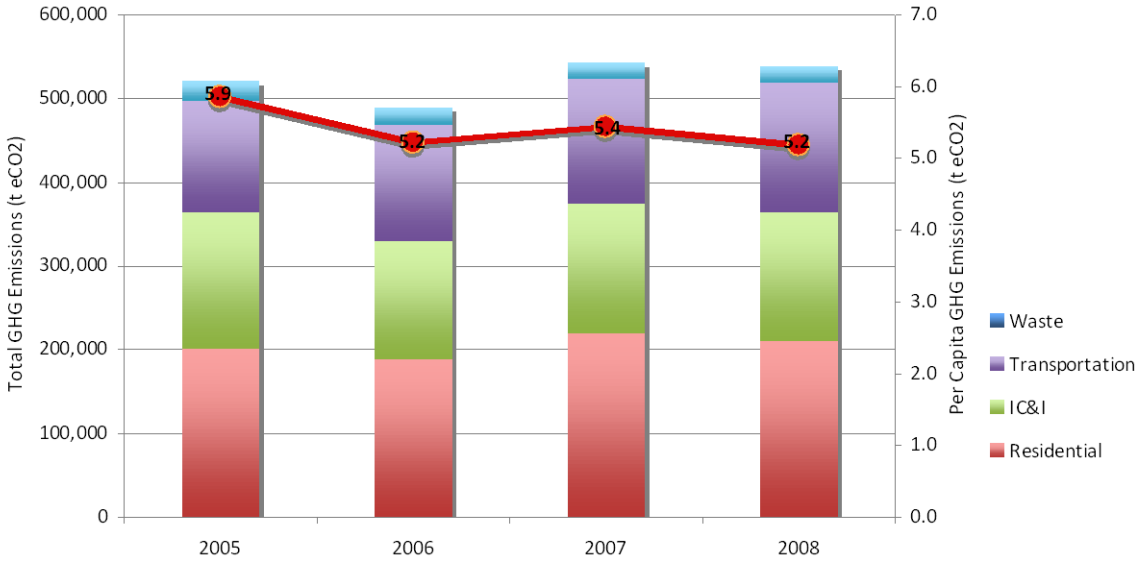
Table 4 summarizes the GHG emissions by sector on an absolute and per capita basis for the years 2005 through 2008 and the 2020 BAU forecast.

Table 4: Absolute and Per Capita GHG Emissions By Sector

GHG Emissions (t eCO2)	2005	2006	2007	2008	2020 BAU
Residential	201,329	188,690	219,959	210,225	265,425
Residential Per Capita	2.26	2.01	2.20	2.02	2.02
IC&I	163,176	140,700	155,305	154,415	194,961
IC&I Per Capita	1.83	1.50	1.55	1.49	1.49
Transportation	133,577	139,457	148,503	154,406	194,949
Transportation Per Capita	1.50	1.49	1.49	1.49	1.49
Waste	23,168	20,914	19,581	19,791	24,987
Waste Per Capita	0.26	0.22	0.20	0.19	0.19
Total GHG Emissions	521,250	489,760	543,348	538,836	680,322
Total Per Capita	5.9	5.2	5.4	5.2	5.2

Figure H provides an indication of the absolute changes by sector (stacked bars) and the overall per capita trend (red line).

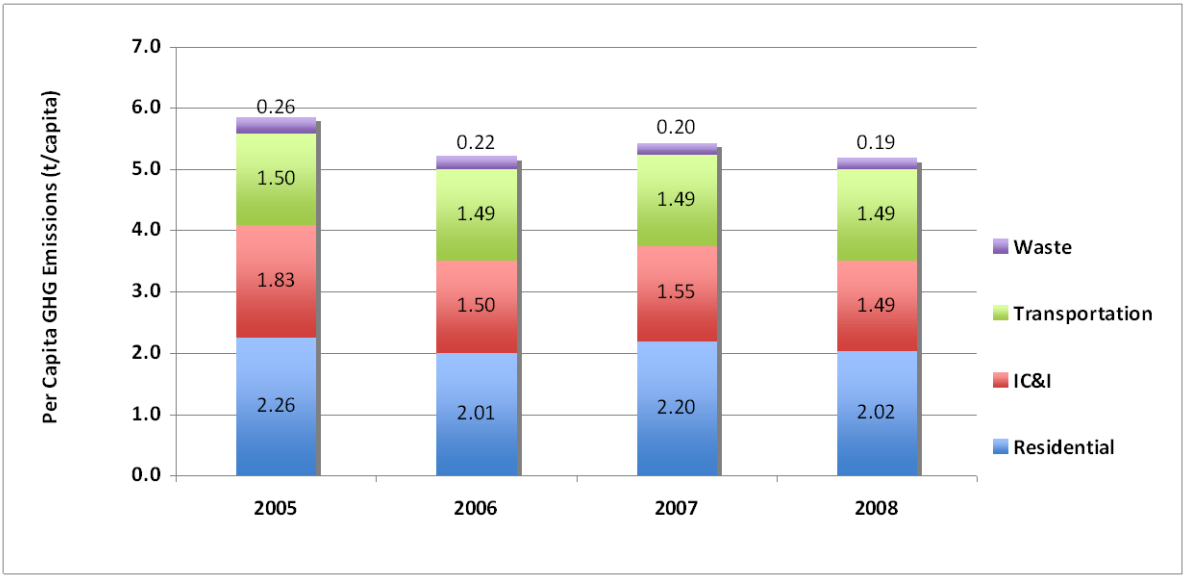
Figure H: Absolute GHG Emissions by Sector and Total Per Capita Trend Line



The residential sector increased GHG emissions by 4.4% on an absolute basis while reducing emissions by 10.5% on a per capita basis over the four years. The IC&I sector reduced both absolute and per capita emissions by 5.4% and 18.9%, respectively. Improved waste diversion rates reduced absolute and per capita emissions from landfill waste by 14.6% and 26.8%, respectively. GHG emissions from transportation vehicles increased by 15.6% on an absolute basis and were reduced slightly by 0.9% on a per capita basis.

Figure I provides a per capita break down of each sector.

Figure I: Per Capita GHG Emissions by Sector



2.4.2 Residential

For purposes of this analysis the residential sector is comprised of single-family and semi-detached homes. Condominiums and apartments are generally on single meters and as such are regarded by the electricity local distribution companies (LDC's) as commercial accounts and cannot be readily segregated from other IC&I customers.

The residential sector accounted for 39% of total community GHG emissions in 2005 and has remained at 39% through 2008. Table 5 shows the residential energy consumption, energy cost and GHG emissions on an absolute and per capita basis.

From 2005 to 2008, the population grew by 16.7% and the number of households increased by 17.3%. Despite the significant increase in population and households, energy consumption and GHG emissions have only risen by 3% and 4%, respectively. The difference between the two measures is attributable to the slight increase in the provincial electricity eCO2 coefficient from 2005 to 2007. The eCO2 coefficient for the year 2007 has also been used for 2008, as it's currently the last published figure.

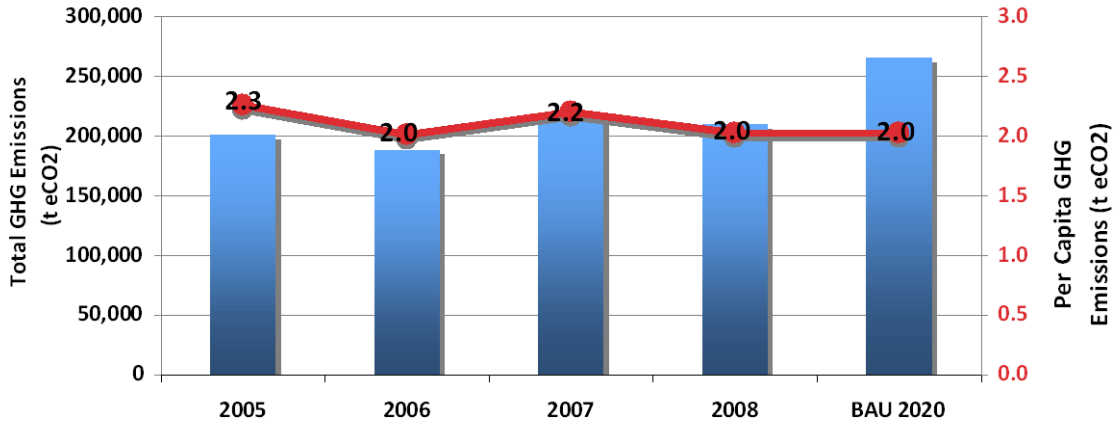
Changes in annual weather will also effect annual energy consumption and GHG emissions. Drops in per capita energy consumption from 2005 to 2006 and from 2007 to 2008 may be partially due to relatively warmer winters in 2006 and 2008 versus 2005 and 2007, respectively.

Table 5: Residential Energy Consumption, Energy Cost and GHG Emissions

Residential	2005	2006	2007	2008	BAU 2020
Energy Use (GJ)	3,808,895	3,722,303	4,114,183	3,921,691	4,951,439
Per Capita Energy (GJ/capita)	42.8	39.7	41.2	37.8	37.8
Energy Costs ($'000)	$67,831	$69,799	$71,841	$71,565	$90,356
Per Capita Energy Costs ($/capita)	$762	$744	$719	$689	$689
GHG Emissions (t eCO2)	201,329	188,690	219,959	210,225	265,425
Per Capita Emissions (t eCO2/capita)	2.26	2.01	2.20	2.02	2.02

Figure J shows the residential GHG emission trends. The bars illustrate the trend on an absolute basis and the red line provides the trend on a per capita basis. The residential GHG emissions are forecasted to rise by over 64,000 t or 32% from 2005 to 2020 if no action is taken.

Figure J: Residential GHG Emission Trends



2.4.3 Institutional, Commercial and Industrial (IC&I)

The IC&I sector comprises of institutions (government, schools, hospitals, churches, museums, and other public buildings), office buildings, retail establishments, and industrial facilities. It also includes apartments and condominiums for this analysis for reasons discussed in residential section 2.4.2.

In 2005, the IC&I sector generated 31% of community GHG emissions and by 2008 its proportional share declined to 29%. Table 6 shows the IC&I energy consumption, energy cost and GHG emissions on an absolute and per capita basis.

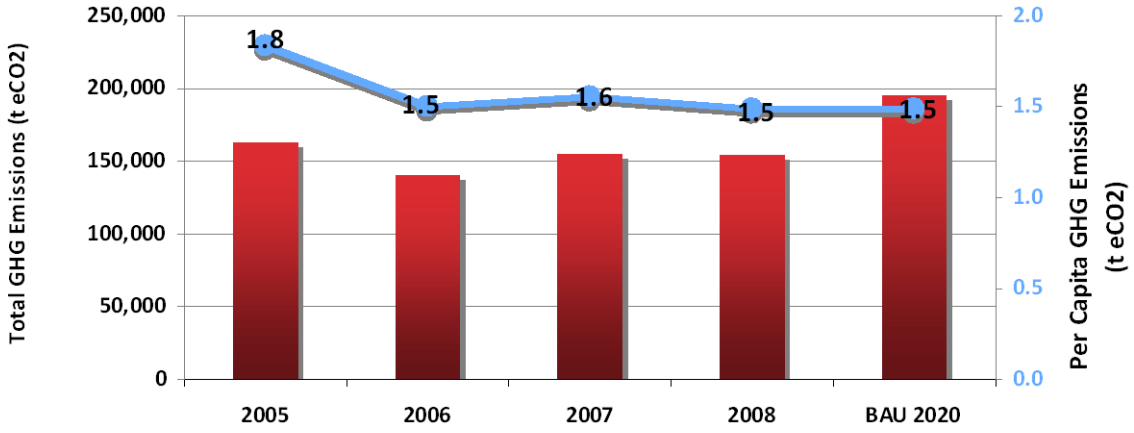
From 2005 to 2008, total energy consumption and GHG emissions declined by 7% and 5%, respectively. As in the residential sector, the difference between the two measures can mainly be attributed to the change in the provincial electricity eCO2 coefficient from 2005 to 2007.

Table 6: IC&I Energy Consumption, Energy Cost and GHG Emissions

IC&I	2005	2006	2007	2008	BAU 2020
Energy Use (GJ)	2,980,353	2,750,355	2,781,773	2,771,907	3,499,747
Per Capita Energy (GJ/capita)	33.5	29.3	27.8	26.7	26.7
Energy Costs ($'000)	$61,788	$56,160	$53,184	$54,490	$68,798
Per Capita Energy Costs ($/capita)	$694	$599	$532	$525	$525
GHG Emissions (t eCO2)	163,176	140,700	155,305	154,415	194,961
Per Capita GHG Emissions (t eCO2/capita)	1.83	1.50	1.55	1.49	1.49

Figure K illustrates the IC&I eCO2 trends. The bars show the trend on an absolute basis and the line provides the trend on a per capita basis. The BAU 2020 forecast assumes that this sector will grow relative to anticipated population growth based on the 2008 per capita emissions. The IC&I GHG emissions are forecasted to rise by approximately 32,000 t or 20% from 2005 to 2020 if no action is taken.

Figure K: IC&I GHG Emission Trends



2.4.4 Transportation

The transportation sector includes travel by all Ajax residents in personal vehicles and public transportation vehicles, but not rail, marine or air transportation by residents as per PCP protocol. It also includes commercial vehicles used by Ajax businesses and institutions based on provincial proxy data. The total vehicle kilometers traveled is used to calculate fuel and emission data based on average fuel efficiencies for different classes of vehicles.

From 2005 to 2008, total transportation fuel consumption and GHG emissions increased by 16%. On a per capita basis, both energy and GHG emissions were reduced by 1% showing the close relationship between total vehicle kilometers traveled and population growth. Total energy costs in the transportation sector escalated by 46% in four years much of which is attributable to the high fuel prices in the first three quarters of 2008.

In 2005, transportation accounted for 26% of total community GHG emissions corresponding to the third largest sector for emissions. By 2008, the sector's share of emissions has increased to 29% equal to the IC&I sector, which has reduced its emissions over the four years. The transportation sector is now tied with the IC&I sector as the second largest emitter of GHG emissions in Ajax.

Table 7 shows the transportation energy consumption, energy cost and GHG emissions on an absolute and per capita basis.

Table 7: Transportation Energy Consumption, Energy Cost and eCO2 Emissions

Transportation	2005	2006	2007	2008	BAU 2020
Energy Use (GJ)	1,939,704	2,025,078	2,156,449	2,242,159	2,830,899
Per Capita Energy (GJ/capita)	21.8	21.6	21.6	21.6	21.6
Energy Costs ($'000)	$48,528	$53,314	$58,565	$70,906	$89,524
Per Capita Energy Costs ($/capita)	$545	$568	$586	$683	$683
GHG Emissions (t eCO2)	133,577	139,457	148,503	154,406	194,949
Per Capita GHG Emissions (t eCO2/capita)	1.50	1.49	1.49	1.49	1.49

Figure L shows the transportation GHG emission trends. The bars show the trend on an absolute basis and the red line provides the trend on a per capita basis. It is assumed that this sector will grow relative to anticipated population growth as demonstrated by the current trend. The transportation GHG emissions are forecasted to increase by over 61,000 t from 2005 to 2020, corresponding to a 46% rise if no action is implemented.

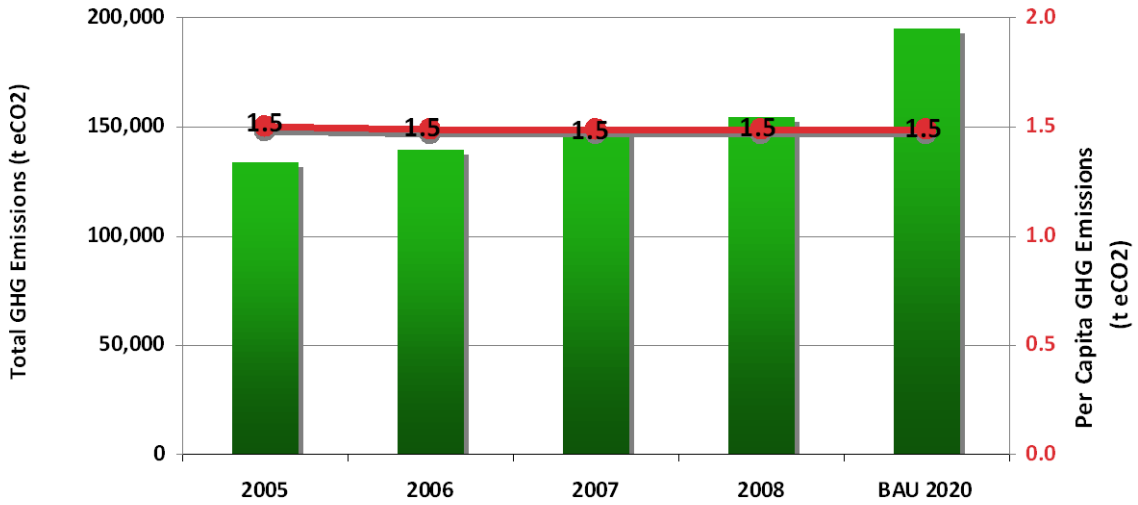


Figure L: Transportation GHG Emission Trends

2.4.5 Waste

The community waste sector includes all waste collected by Durham Region from residents, institutions and businesses. It also includes waste collected by private companies from institutions and businesses, with the exception of industrial waste and construction and demolition waste. Very little of the organic portion of this waste ends up in municipal landfills and industrial landfill conditions do not foster decay. As little data is available on private collection, provincial proxy data was used to add to Durham Region records.

In 2005, waste accounted for 4.4% of total community GHG emissions and in 2008 its share has been reduced to 3.7%. Table 8 shows the waste tonnage to landfill and GHG emissions on an absolute and per capita basis.

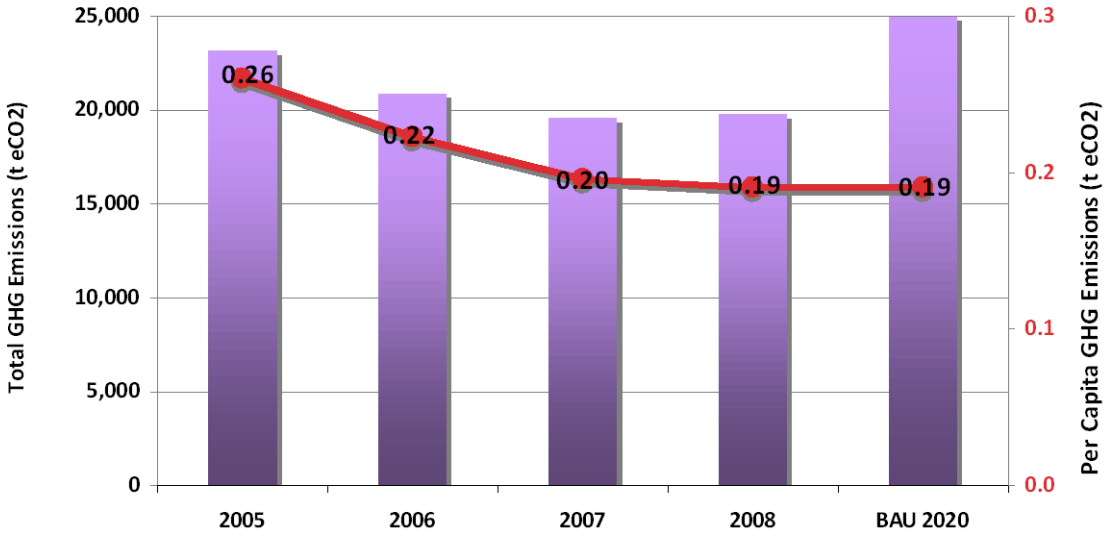
Despite a growing population from 2005 to 2007, total waste to landfill and GHG emissions were significantly reduced by 16% through successful diversion programs. However, it now appears to be reaching a point of diminishing improvements on a per capita basis in 2008 and waste to landfill has risen slightly on an absolute basis. The improvements in this sector are generally permanent systemic changes based on improvements in diversion rates.

Table 8: Waste to Landfill and eCO2 Emissions

Waste	2005	2006	2007	2008	BAU 2020
Waste to Landfill (t)	48,096	43,417	40,649	41,085	51,873
Per Capita Landfill Waste (t/capita)	0.54	0.46	0.41	0.40	0.40
GHG Emissions (t eCO2)	23,168	20,914	19,581	19,791	24,987
Per Capita GHG Emissions (t eCO2/capita)	0.26	0.22	0.20	0.19	0.19

Figure M shows the waste sector GHG emission trends. The bars show the trend on an absolute basis and line provides the trend on a per capita basis. The BAU forecast assumes that waste will grow relative to anticipated population growth. The GHG emissions from waste are forecasted to increase by over 1,800 t from 2005 to 2020, corresponding to an 8% rise if no further action is implemented.

Figure M: Waste GHG Emission Trends



3.0 Recommendations

This report recommends that the Town of Ajax:

i) Receives the *Ajax Community Greenhouse Gas Emissions Inventory Report* for information.

ii) Become a member of the Partners for Climate Protection (PCP) program.

iii) Complete the Town of Ajax's corporate energy and GHG emissions inventory and submit it along with this *Ajax Community Greenhouse Gas Emissions Inventory Report* to the PCP secretariat for Milestone 1 approval.

iv) Review future sustainability planning requirements and determine whether the PCP program and milestone framework contributes to meeting future sustainability needs of Ajax in conjunction with the development of an Integrated Community Sustainability Plan (ICSP).

Appendix A – Glossary

Units

GJ	**Gigajoule**	1 billion joules
J	**Joule**	A unit of energy equal to the work done when a current of one ampere passes through a resistance of one ohm for one second. A common metric unit of energy frequently used for all sources of energy such as electrical energy (kWh), natural gas energy (m3) and other fuels.
kWh	**Kilowatt hour**	A measure of electrical energy equivalent to a power consumption of 1,000 watts for one hour.
t	**Tonne**	Metric tonne, equivalent to 1,000 kilograms or 2,200 pounds

Acronyms

BAU	**Business as Usual**	The absence of any emissions reduction measures.
eC02	**Equivalent carbon dioxide**	A common unit that allows varying strengths of GHG emissions (such as CO2 and CH4) to be expressed in like terms.
FCM	**Federation of Canadian Municipalities**	The national association of municipal governments
GHG	**Greenhouse gas**	Any gas that absorbs infrared radiation in the atmosphere. The three main greenhouse gases are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O).
ICLEI	**International Council for Local Environmental Initiatives**	The international association for local governments implementing sustainable development. initiatives.
PCP	**Partners for Climate Protection**	A program implemented by FCM and ICLEI to assist local governments to reduce GHG emissions.