The City of Guelph Energy Usage and Greenhouse Gas Emissions 2010

March 2012

Prepared by
Guelph Hydro Inc.

Executive Summary

As stated in the Community Energy Initiative (CEI), the City of Guelph aims to reduce its energy usage and Greenhouse Gas (GHG) emissions by 50% by the year 2031, despite the anticipated 50% increase in population over this time period. To ensure the City of Guelph is continuing on a successful path, the City of Guelph and Guelph Hydro Inc. (GHI) have completed yearly inventories of the City's energy usage and GHG emissions.

This 2010 report illustrates that the City of Guelph overall continues to decrease the amount of energy used and greenhouse gas emissions produced. Since 2005, the City of Guelph, on a per capita basis, have reduced their energy usage and equivalent CO_2 emissions produced, by 13% and 19%, respectively, despite a population increase of 16%. However, between the years 2009 to 2010 the GHG emissions per capita increased 5.4% and the energy usage only decreased slightly, 0.69%, (**Table 2** or **Figure 1**).

Additionally, Guelph as an entire city increased its energy usage by 2.6% and increased its GHG emissions by 9.1% since 2009 as shown in **Table 3** and **Table 5**. This increase in energy usage was mainly the result of population growth, increased electricity usage throughout the city, and possibly economic upturn. The significant increase of GHG emissions may have been due to the 26% increase of coal fired generation plants, and the 32% increase of natural gas consumption for electricity generation throughout Ontario since 2009. Many of the renewable and clean generation projects proposed in Guelph are not yet in-service.

Guelph has made significant progress by reducing the City's community waste, however, Guelph's population still continues to grow and there has been a large increase in energy usage and GHG emissions since 2009. Further measures must be implemented to extensively reduce the amount of energy used and equivalent CO_2 emissions produced to meet Guelph's future targets.

Background Information

The Community Energy Initiative (CEI) was approved by City council in 2007. It is a plan with three ambitious goals: to use less energy in 25 years than the city does today, to consume less energy per capita than comparable Canadian cities, and to produce fewer greenhouse gas emissions per capita than the current global average.

Guelph is confident the CEI has, and will continue to contribute to the long-term success and prosperity of the city. The CEI will act as an agent not only to attract the new "Green" employers, but it will also inspire the Guelph community to take action.

The CEI will engage the community around energy, and this will make it easier to re-think how a city generates, distributes and conserves energy.

The following results were generated using the International Council for Local Environmental Initiatives (ICLEI) protocol. The ICLEI Inventory Quantification Support Spreadsheet provides very thorough information when up-to-date data is used in the model. It establishes energy usage and GHG emissions produced on a per capita basis and as a city total.

Although the ICLEI Inventory Quantification Support Spreadsheet does not provide a forecasting function or the capacity to quantify equivalent CO_2 reductions from measures, it allows Guelph to continuously monitor and re-evaluate their targets/ goals to reach future milestones. The data collected and analyzed with this spreadsheet tool will be transferable to additional milestone support tools currently under development by Partners for Climate Protection (PCP).

The ICLEI model allows Guelph's total energy usage and equivalent CO_2 emissions produced to be graphed by sector or by source, which allows for comparison throughout the modeled year or comparison to previous modeled years. This provides incentive for the City to make decisions, develop plans, and build on existing plans based on the resulting information.

Methodology & Analysis

- The Finance and Governance Committee recommended using the ICLEI Model as a monitoring tool to report the City of Guelph's yearly energy usage and Greenhouse Gas (GHG) emissions. This method was granted approval by the Mayor's Task Force and has been used yearly to report the City of Guelph's progress towards the Community Energy Initiative. The International Council for Local Environmental Initiatives (ICLEI) Inventory Quantification Support Spreadsheet has become the adopted method and monitoring tool to report the City of Guelph's yearly energy usage and Greenhouse Gas (GHG) emissions.
- The GHG emissions and energy use for the City of Guelph 2010 were calculated based on the usage quantities provided by the City of Guelph, Union Gas Limited, Statistics Canada, Environment Canada, Guelph Hydro Electric Systems Inc., and Kent Marketing. These values were inputted into the ICLEI Inventory Quantification Support Spreadsheet tool to produce emission data for the city.
- The results of the ICLEI model for the year 2010 use the most up-to-date information provided from the currently released 1990-2009 National Inventory Report. The 2009 and 2010 models were revised using updated emission factors; however, the electricity emission factor in the 2010 model was modified to account for yearly variations in energy usage. Once up-to-date 2010 data is received from the National Inventory Report 1990-2010 then the 2010 ICLEI model will be updated. Currently the 2010 ICLEI model is to be interpreted as a good approximation of GHG emissions produced due to the fact that new emission factors may be released in the National Inventory Report 1990-2010 that may differ from the current model.

- The calculations were carried out in the model using factors that gave energy usage in Giga Joules (1 GJ = 1,000,000,000 J) and GHG emissions in equivalent Tonnes of Carbon Dioxide.
- The results of the model for 2010 are shown below in **Table 1**. This table also includes the results for years 2005 to 2009 for the purposes of comparison.

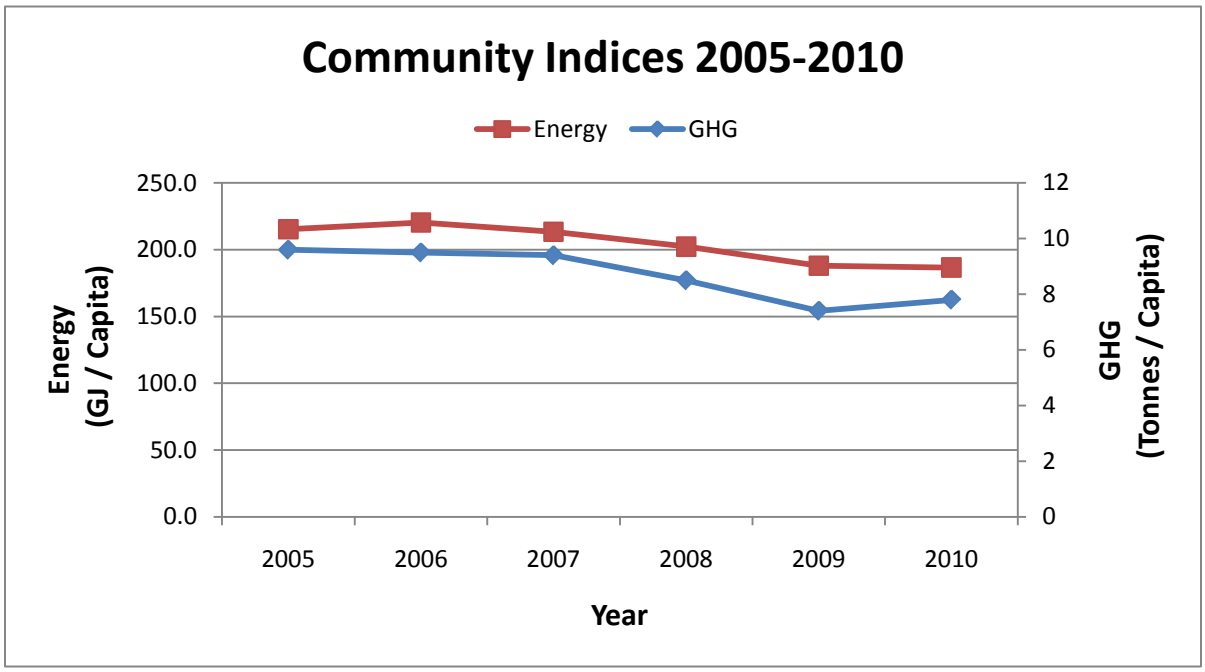
Table 1: 2005 - 2010 GHG Emissions per capita

Per Capita Energy Use and GHG Emissions - Guelph			
	Population	**GJ per Capita**	**Tonnes of eCO_2 per Capita**
Guelph 2010	131,605	186.7	7.8
Guelph 2009	127,439	188.0	7.4
Guelph 2008	123,274	202.3	8.5
Guelph 2007	119,108	213.5	9.4
Guelph 2006	114,943	220.4	9.5
Guelph 2005	113, 844	215.4	9.6

Table2: Percent Differences of Energy Usage and Equivalent CO_2 Emissions per Capita

Year	**Percent Difference (%)**	
	GJ per Capita	**Tonnes eCO_2 per Capita**
2009-2010	-0.69	+5.4
2008-2009	-7.07	-13
2007-2008	-5.25	-9.6

Figure 1: Community Indices 2005-2010



- Shown above in the Community Indices Graph (**Figure1**) is a similar decline between the energy usage and GHG emission plotted lines. This trend shows that Guelph, on a per capita basis, consumed a reduced amount of energy (GJ per Capita) and released fewer GHG emissions (Tonnes per Capita) since 2005. However, in 2009 to 2010 the energy usage per capita did not decline as significantly compared to the large drop in energy usage per capita from 2007 to 2009. In 2009 to 2010 the GHG emissions per capita increased from 7.4 tonnes CO_2 per capita to 7.8 tonnes CO_2 per capita **(Table 1)**, this may have been the outcome of the economic upturn or the increase of coal and natural gas use in Ontario for electricity production. The significant difference in energy usage and GHG emissions per capita of previous years is shown in **Table 2** and **Figure 1** above.
- GHG emissions per capita are anticipated to decline faster than energy usage per capita giving the GHG trend line a steeper declining slope. This assumption was based on Ontario's scheduled target to remove all coal burning electricity generation plants in Ontario by 2014. If or once all coal burning generation plants are removed in 2014 the GHG emissions trend line is then anticipated to follow the energy usage per capita trend line more closely.
- The displayed trend of energy usage per capita of 2009 to 2010 may have a smaller decline compared to previous years; however, it still concurs with the reduction goals of the City of Guelph's CEI (**Figure 1**). The City of Guelph may have decreased its GHG emissions since 2005 overall; however, it increased its emissions per capita by 5.4% since 2009 and this result is not in favour with the City of Guelph's CEI.

Figure 2: Community Equivalent CO_2 Emissions Breakdown by Sector 2010

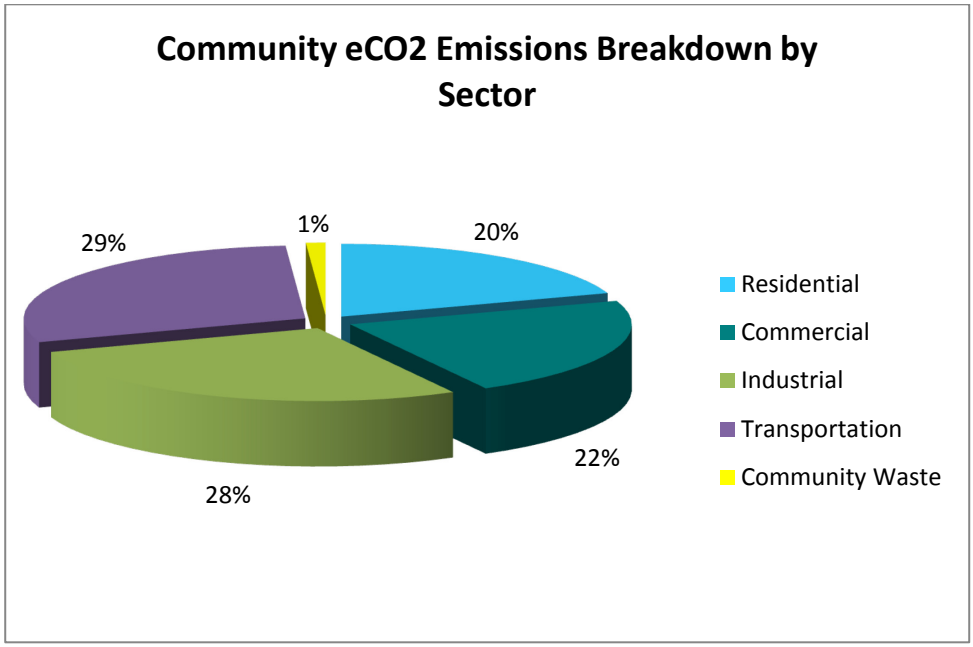
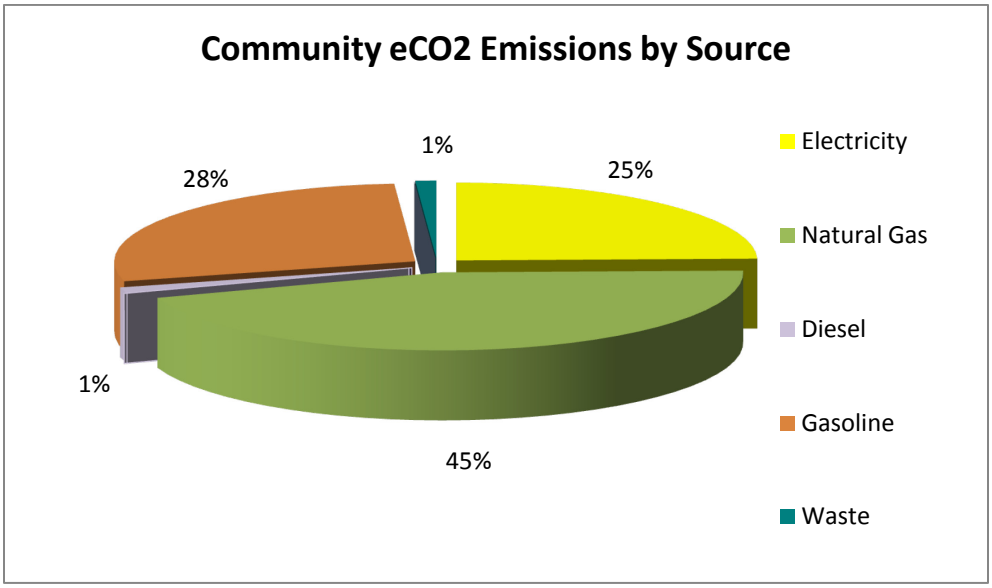


Figure 3: Community Equivalent CO_2 Emissions Breakdown by Source 2010



- **Figures 2 & 3** show the equivalent CO_2 emissions discharged by different sectors and different sources for 2010. As shown, Guelph's transportation sector emitted the largest amount of equivalent CO_2 emissions in 2010, leading with 29%, followed by the industrial sector at 28% (**Figure 2**). Natural Gas emissions decreased by 3.1% since 2009 as shown in **Table 5**, however it still accounted for 45% of equivalent CO_2 emissions produced by source as shown in **Figure 3**.

Table 3: Equivalent CO_2 Emissions by Sector 2009-2010

Sector	Total eCO2 (t) 2009	Total eCO2 (t) 2010	Percent Difference since 2009 (%)
Residential	189,828	201,927	+6.4
Commercial	199,545	227,250	+14
Industrial	232,066	282,827	+22
Transportation	301,951	298,090	-1.3
Community Waste	13,283	11,469	-14
Total	**936,673**	**1,021,562**	**+9.1**

Table 4: Total Energy Use and Equivalent CO_2 Emissions by Source 2009-2010

Energy Type	Energy Total Use 2009 (GJ)	Total eCO2 (t) 2009	Energy Total Use 2010 (GJ)	Total eCO2 (t) 2010
Electricity	10,097,823	146,559	11,070,738	251,731
Natural Gas	9,559,761	474,880	9,265,689	460,272
Diesel	174,921	12,135	175,331	12,164
Gasoline	4,117,601	289,816	4,062,346	285,927
Waste	-	13,283	-	11,469
Total	**23,950,106**	**936,673**	**24,574,105**	**1,021,562**

Table 5: % Differences of Energy Usage and Equivalent CO_2 Emissions by Source 2009-2010

Energy Type	Percent Difference for energy usage (%) since 2009	Percent Difference for eCO2 (%) since 2009
Electricity	+9.6	+72
Natural Gas	-3.1	-3.1
Diesel	+0.23	+0.23
Gasoline	-1.3	-1.3
Waste	-	-14
Total	**+2.6**	**+9.1**

- The most significant decrease from 2009 to 2010 is the amount of community waste produced and the total GHG emissions produced from this waste, with a decrease of 14% **(Table 3)**. The cause of this reduction is the result of a 7.1% decrease in Guelph's residential waste generated and a 2.7% increase in the diversion of Guelph's residential waste from 2009. This occurrence may be due to a greater use of the Wet-Dry Recycling Facility in Guelph.
- As shown in **Table 5** electricity usage increased by 9.6% since 2009 while electricity emissions significantly increased by 72%. Electricity usage increases have been influenced by the substantial rise in the industrial and commercial sectors since 2009. The commercial sector usage had 7.5% of growth and the industrial sector usage had 15% of growth, while the residential only increased 3.8%. Additionally, electricity emissions may have also significantly increased since 2009 due to the 26% increase in coal use and the 32% increase in natural gas use to produce electricity throughout Ontario. Guelph should continue to invest in local sustainable generation sources to eliminate the reliance on coal and other sources throughout Ontario that produce high emissions for electricity generation.
- Gasoline usage and the transportation sector emissions have declined slightly through the year as shown in **Table 3** and **Table 5**. This could be caused by escalating gasoline prices or it may be the result of the continuous decline of vehicles driven that pre-date 2005. These older vehicles emit larger amounts of N_2O and CH_4 emissions as they have been subjected to high-sulphur gasoline which prevents proper operation of the vehicle's catalytic converter. Low-

sulphur gasoline regulations came into effect in 2005. The emission factor used in the model for gasoline usage reflects the use of high-sulphur gasoline consumed by vehicles built prior to 2005. The updated emission factor is higher than the gasoline emission factors used in previous years as a result of the discovery of improper operation of catalytic converters due to the past use of high sulphur gasoline. This information was retrieved from Canada's National Inventory Report 1990-2009 Annex 8.

- For 2010, the weather conditions generally included a hot summer, and a warmer fall and winter. This allowed the natural gas usage to drop by approximately 3.1% compared to 2009 as shown in **Table 5**. This decrease is the result of the 5.7% reduction in residential natural gas consumption, with minimal variance of commercial and industrial natural gas consumption. This change is supported by the fact that in 2010 there were 265 heating degree days throughout the year in Guelph with a yearly mean temperature of 9.5°C, and in 2009 there were 288 heating degree days with a yearly mean temperature of 8.0°C. Therefore, in 2010 there was a reduced need for natural gas intake for heating in the city of Guelph which resulted in fewer natural gas emissions.

Conclusions:

The city of Guelph should be seen as a conservation leader throughout Canada. Guelph has set high reduction targets as shown in the Community Energy Initiative to ensure that Guelph is constantly minimizing its impacts on the environment. The residents of Guelph have been very supportive of these targets and have managed to reduce their energy usage and carbon footprint significantly since 2005. The substantial decrease of waste generated by the residents of Guelph is an enormous achievement. The city of Guelph and its residents should be congratulated on accomplishing such large reductions as it is very difficult to do in today's current economy.

2009 was Guelph's largest reduction yet for energy usage and GHG emissions produced. Guelph as a city managed to achieve a GHG emission level that was below the targets of the CEI. However, in 2010 Guelph increased its GHG emissions on a per capita basis despite the slight per capita decline in energy usage. Guelph as an entire city had significantly increased its energy usage and its GHG emissions since 2009. This may possibly be the result of the economic upturn which occurred in 2010, and/or from the increased use of coal and natural gas for electricity production throughout Ontario. Revisions to current reduction strategies must be implemented quickly to meet the CEI targets.

Currently, Guelph operates a Wet-Dry Recycling Facility which allows for more waste to be diverted or recycled. Guelph also has many renewable energy projects underway and is attracting increasing amounts of green business to the area. The City of Guelph is increasing

their development of sustainable energy projects to become more reliant on local energy production and less reliant on energy generation technologies that are large emitters of GHG emissions. This allows the City of Guelph to have increased control over their GHG emissions which will create more incentive and ease to reach the goals of the Community Energy Initiative.

APPENDIX A

Sample Calculations:

Percent Difference

Used values from Table 3 for Electricity as an example:

Performed this for all percent differences

Percent Difference = [(2010 value – 2009 value) / 2009 value] * 100%

= [(294,043 Tonne – 268,202 Tonne) / 268,202 Tonne] * 100%

= 9.63%

All other relevant calculations were performed on the ICLEI model tool.

The Inventory Quantification Support Spreadsheet is found on the Partners for Climate Protection (PCP) website.
http://gmf.fcm.ca/Partners-for-Climate-Protection/Toolkit.asp

The GHG emission factors may be found on the National Inventory Report 1990-2009.

Additional Information Retrieved from:

The National Inventory Report 1990-2009
The Independent Electricity System Operator (IESO)