HRM CORPORATE GREENHOUSE GAS EMISSIONS INVENTORY 2008

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EXECUTIVE SUMMARY

HRM is committed to reducing greenhouse gas emissions in order to decrease its overall impact on the climate. This report details HRM's corporate greenhouse gas (GHG) emissions inventory for fiscal year 2008. HRM measured its corporate and community emissions in 2004/2005, using data from fiscal year 2002. As a result of the 2002 estimates, HRM Regional Council approved a Local Action Plan for reducing corporate GHGs, as well as a corporate emissions reduction target of 20% below 2002 levels by 2012.

Total corporate emissions for 2008 were estimated to be 115,564 tonnes of equivalent carbon dioxide emissions. The 2002 inventory estimated 121,352 tonnes. However, the 2002 and 2008 inventories cannot technically be compared due to several developments since 2002, including corporate changes within HRM and significant differences in data quality and availability. Despite the problems with comparability, based on the 2008 inventory results, HRM will not meet its 2012 reduction target. However, HRM has completed many successful energy efficiency projects and actions in order to reduce overall GHG emissions at the corporate level, particularly in the buildings sector, the number one corporate source of GHG emissions. HRM is committed to an ongoing effort of GHG emissions monitoring and reduction, and anticipates setting new targets for 2020 and 2050 that are in line with provincial and national goals.

HRM plans to revise its Local Action Plan to include new measures for reductions, and to re-estimate its corporate emissions inventory on an annual basis. Future inventory estimates will be comparable to the 2008 estimate, allowing HRM to track its progress more effectively moving forwards. HRM plans to begin an estimation of community-wide emissions in the near future, and to begin working with the larger community towards absolute reductions in GHG emissions in the municipality.

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1. BACKGROUND

Halifax Regional Municipality (HRM) joined the Partners for Climate Protection (PCP) program in 1997, and committed to taking action against climate change. The PCP is led by the Federation of Canadian Municipalities (FCM) and ICLEI-Local Governments for Sustainability. The PCP is a network of more than 200 Canadian municipal governments committed to reducing greenhouse gas (GHG) emissions in their corporate operations and in their communities. Further information on the PCP program is available on the FCM website through the following link: http://gmf.fcm.ca/Partners-for-Climate-Protection/.

In 2004, ICLEI Energy Services (ICLEI) was hired to measure HRM's corporate and community GHG emissions to provide a baseline and suggest a reduction target. Data from 1997 and 2002 fiscal years were used for this estimate, and the suggested target was to reduce GHG emissions by 20% below 1997 levels by 2012 (ICLEI 2005). HRM decided to focus on corporate emissions first, in order to clean up its own house and lead by example. However, a community emissions inventory for 2008 will be conducted and a target will be set once the corporate emissions, inventory system and targets are advanced. Once the community inventory is re-measured and a system for ongoing measurement is in-place, HRM's Community Energy Plan will be revised and actions will be taken to reduce community GHGs.

In 2005, HRM hired Dillon Consulting to write a Corporate Greenhouse Gas Emissions Reduction Local Action Plan (Dillon 2005). HRM Regional Council approved the Local Action Plan (LAP), along with a revised corporate GHG emissions reduction target of 20% below 2002 levels by 2012.

2. INTRODUCTION

This report has been prepared in order to evaluate HRM's progress on its corporate GHG emissions reductions since setting a reduction target in 2005. It is important to understand the status of HRM's emissions in order to measure the success of its efforts based on the LAP.

This report is also required as part of the PCP program requirements for achieving the fifth and final milestone. The milestones in the PCP program are as follows:

- ✓ Milestone 1: Create a GHG Emissions Inventory and Forecast
- ✓ Milestone 2: Set a Reduction Target
- ✓ Milestone 3: Develop a Local Action Plan
- ✓ Milestone 4: Implement the Local Action Plan
- Milestone5: Measure Progress and Report Results

In order to complete Milestone 5, HRM must assess its progress and submit a report to the PCP program for approval. HRM must demonstrate that it took actions to reduce GHG emissions, and that these actions resulted in real reductions.

HRM is committed to an ongoing effort of GHG emissions monitoring, and anticipates setting new targets for 2020 and 2050 that are in line with provincial and national goals. The *NS Environmental Goals and Sustainable Prosperity Act* (EGSPA) states that GHG emissions will be at least 10% below 1990 levels by 2020. The federal government has committed to reducing GHG levels by 20% from 2006 levels by 2020. Canada's long-term goal is to reduce emissions by 60 to 70% from 2006 levels by 2050.

3. METHODS

Since the 2002 inventory, ICLEI has released a new protocol for emissions analysis titled, International Local Government GHG Emissions Analysis Protocol (IEAP) (ICLEI 2009). This protocol differs somewhat from the previous protocol that was used in measuring HRM's corporate emissions in 2004. Furthermore, HRM has seen some significant organizational changes since 2002. Namely, the responsibility for stormwater and wastewater management has shifted from HRM to Halifax Water. Therefore, some sources of GHG emissions that were previously considered as corporate emissions are now considered community-wide emissions.

3.1 Measured GHGs

GHG emission inventories are estimated in tonnes of equivalent carbon dioxide (eCO_2). The six major GHGs that contribute to climate change are:

- carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)
- perfluorocarbons (PFCs)
- hydrofluorocarbons (HFCs), and
- sulphur hexafluoride (SF_6)

In most cases, the emissions from CO_2, CH_4 and N_2O from fossil fuel combustions, electricity generation, waste disposal and wastewater are the most significant sources of GHG emissions in community and government operations inventories. Therefore, HRM's 2008 inventory calculates CO_2, CH_4 and N_2O emissions.

3.2 Scopes of Emissions

The ICLEI 2009 Protocol (herein referred to as the IEAP) categorizes government operations emissions into three different scopes. Scope 1 emissions are direct emissions sources owned or operated by the local government. A municipal vehicle powered by gasoline is an example of a Scope 1 emission. Scope 2 emissions are indirect emission sources limited to electricity, district heating, steam and cooling consumption. Purchased electricity used by the local government is an example of a Scope 2 emission. It is associated with the generation of greenhouse gas emissions at a power plant. Scope 3 emissions are all other indirect and embodied emissions over which the local government exerts significant control or influence, such as emissions resulting from contracted waste hauling services.

The IEAP requires local government to report Scope 1 and 2 emissions. Scope 3 emissions are optional. HRM's 2008 corporate inventory includes Scope 1 and 2 emissions.

3.3 Emissions Calculations

Energy consumed (e.g. litres (L) of fuel or kilowatt-hours (kWh) of electricity) is the relevant measure of energy use for the inventory. These measures are used in conjunction with emission factors to determine emissions, using the following general equation:

Fuel consumed x emission factor = emissions

Emissions must be converted into eCO_2 so that all energy can be compared under a common unit of analysis. Different gases have different warming potentials, which are accounted for in the calculations. Emission factors, or coefficients, are specific to each individual energy source and measured in tonnes of GHG/unit of fuel. These numbers are published in the National Inventory Report by Environment Canada, 2008. The 2008 electricity coefficient for Nova Scotia is 0.790 kg/kWh.

Sample Calculation:

An HRM fleet passenger car burns 1860.8 L of diesel fuel in fiscal year 2008. To calculate the vehicle's annual eCO_2 emissions:

eCO_2 = (1860.8 x emission coefficient for CO_2) + (1860.8 x emission coefficient for N_2O) + (1860.8 x emission coefficient for CH_4)

= (1860.8 x 0.00273) + (1860.8 x 0.0000004) + (1860.8 x 0.0000002)

= 4 tonnes

3.4 Tiers of Data

The IEAP defines three tiers of data, based on the level of methodological complexity. Inventory reports must explicitly state the tier used for collecting each type of data in the analysis. Tier 1 is the basic method, often using country-level defaults recommended by the Intergovernmental Panel on Climate Change (IPCC). Tiers 2 and 3 are much more demanding in terms of complexity and data requirements, and are considered to be more accurate while requiring higher levels of effort.

Tier 1: A tier 1 emission estimate is the result of the use of any of the following for an emission source:

- a default emission factor (provided by the IPCC);
- national average fuel use per capita;
- national average solid waste generation per employee, and
- methane recovery system effectiveness estimates based on the assumption that the system meets regulatory guidelines.

Tier 1 is only to be used in cases where more accurate data is unavailable.

Tier 2: Tier 2 estimates require an intermediate level of complexity and locally specific data. Generally the use of a Tier 2 approach requires:

- a country-specific emission factor;
- engineering estimates of energy used based on system use and design;
- estimates of heating fuel use based on known historical use modified for population changes and variations in annual temperatures (heating degree days);
- fuel use estimated from distance traveled times average fuel efficiencies;
- methane recovery system effectiveness estimates based on system design;
- total community distance travelled estimates based on systematic traffic counts and road segment lengths, and
- quantity of fuel used in a year based on known price paid times average fuel cost in that year.

Tier 3: Tier 3 estimates are the most complex and require the most specific data. A Tier 3 approach considers the following variables:

- type of fuel combusted;
- combustion technology;
- operating conditions;
- control technology;
- quality of maintenance;
- age of the equipment used to burn the fuel;
- metered energy use;
- metered methane recovery, and
- quantity of solid waste as weighed at a transfer station.

HRM's 2008 inventory incorporates Tier 2 and 3 estimates.

3.5 Data Types & Sources

Data collection involved the engagement and collaboration of multiple HRM Business Units as well as service providers. The Sustainable Environment Management Office (SEMO) acknowledges these efforts with thanks.

Data for the 2008 HRM Corporate GHG Emissions Inventory was drawn from several sources, as listed in Table 3-1.

Table 3-1: Data Sources

SECTOR	TYPE OF DATA	SOURCE	SCOPE	TIER
Buildings (includes emergency generators)	Power	• NSPI (power utility) • Estimates	2	2 & 3
	Furnace Oil	• Invoices through SAP (HRM's accounting program) • Estimates	1	2 & 3
	Natural Gas	• Heritage Gas	1	2
	Diesel	• SAP		
Lighting (includes street, traffic, park, sports fields lights)	Power	• NSPI	2	2 & 3
Fleet (includes transit)	Gasoline	• SAP	1	3
	Diesel	• SAP	1	3

3.6 Assumptions

Some assumptions had to be made during the process of creating HRM's 2008 Corporate GHG Emissions Inventory. The most complex category for HRM corporate emissions is the building sector. HRM owns more than 200 buildings, but leases some of these buildings to community groups or private companies. Therefore, HRM does not receive regular invoices in order to track fuel and power consumption in these buildings. Data were available for the larger of these buildings, such as the Metro Centre, Dartmouth Sportsplex, and other large recreation centres and arenas, through a benchmarking initiative that HRM Infrastructure and Asset Management has been implementing for several years. HRM also leases space in some buildings, and therefore must calculate a percentage used of total power and fuel throughout a fiscal year.

When fuel and power data were not readily available, assumptions were made in order to calculate estimated amounts, and are noted in the spreadsheets in Appendix B.

A relatively small number of HRM buildings have not been captured in this analysis. These primarily consist of park washrooms and some small community centres. Upon completion of the 2008 corporate inventory, HRM plans to implement a process for continued monitoring and analysis of its annual GHG emissions. It is hoped that as efforts continue, all buildings will be more easily accounted for. It is anticipated that HRM will seek permission from operators of leased HRM buildings to allow service providers of fuel and power to share annual consumption figures with HRM for calculation and tracking purposes.

4. INVENTORY RESULTS

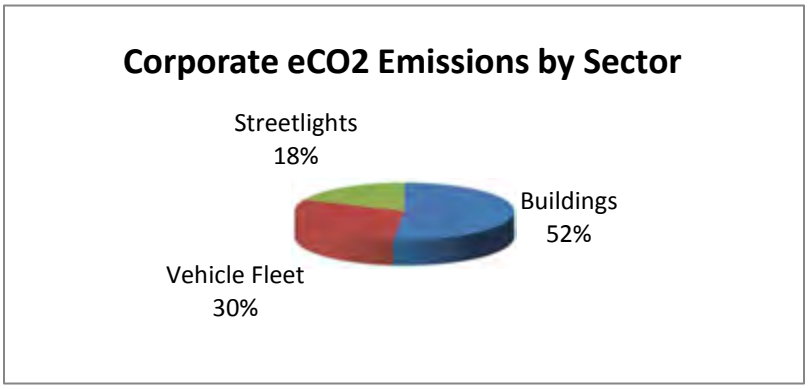
4.1 Inventory Summary

Total corporate emissions for 2008 were estimated to be 115,564 tonnes eCO_2. Table 4-1 shows the breakdown of emissions by sector. Figure 4-1 displays this breakdown by percentage.

Table 4-1: Emissions by Sector

Sector	Total eCO2 (t)
Buildings	59,620
Vehicle Fleet	34,538
Streetlights	21,407
Total	**115,564**

Figure 4-1: Emissions by Sector

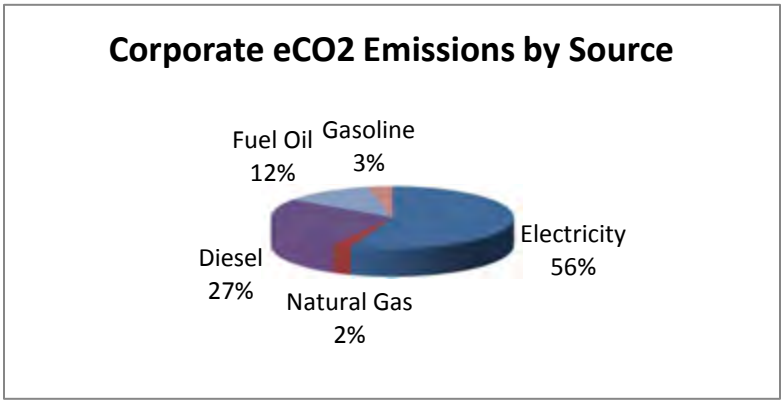


As seen in the above table and figure, HRM buildings are the largest source of corporate emissions, followed by fleet and then streetlights. Table 4-2 shows the breakdown of HRM emissions by source. Figure 4-2 displays this breakdown by percentage.

Table 4-2: Emissions by Source

Energy Type	Total Use	Total eCO2 (t)
Electricity	81,335,923	64,255
Natural Gas	1,513,155	2,861
CNG	0	0
Diesel	11,265,512	30,762
District Energy	0	0
Ethanol Blend	0	0
Fuel Oil	4,874,644	13,795
Gasoline	1,647,232	3,891
Propane	0	0
Total		**115,564**

Figure 4-2: Emissions by Source



As seen in the above table and figure, electricity represents the largest source of corporate GHG emissions. This is partly because HRM uses a substantial amount of electricity in both its buildings and lighting sectors, but also because electricity generation in Nova Scotia is primarily derived from coal, leading to higher GHG emissions than if it were generated by other sources.

The large use of diesel can be attributed to HRM's transit vehicles, both buses and passenger ferries. Natural gas can be expected to increase as a heating source for buildings in the years to come, as its availability expands throughout HRM. This will decrease overall emissions from heating, as natural gas results in fewer emissions than fuel oil or electricity.

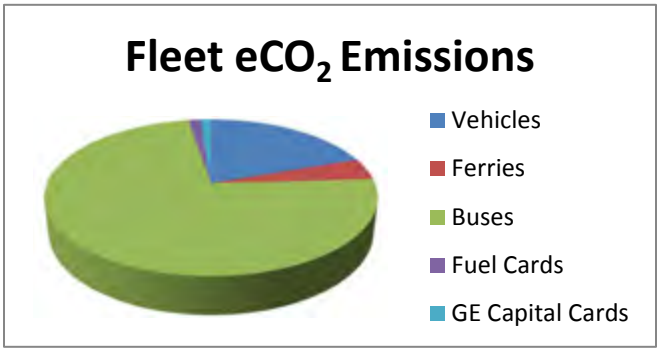
4.2 Fleet

Fuel consumption per fleet vehicle is tracked in HRM's accounting system, SAP. Table 4-3 displays fuel consumption by fleet type, with totals in litres as well as eCO_2. Total eCO_2 emissions from HRM fleet, including transit, are 34,538 tonnes. Figure 4-3 illustrates the breakdown of fleet emissions by category. The detailed GHG calculations by vehicle can be viewed in the spreadsheets attached as Appendix A.

Table 4-3: Fleet Fuel Consumption

TYPE	DIESEL	GAS
Vehicles	1,245,067	1,435,364
Ferries	564,557	--
Buses	9,266,634	--
Fuel Cards	55,341	138,699
GE Capital Cards	91,964	73,168
TOTAL (L)	**11,223,563**	**1,647,232**
TOTAL eCO_2 (t)	**30,647**	**3,891**

Figure 4-3: Fleet eCO2 Emissions



As evident in Figure 4-3, transit buses are responsible for the large majority of the HRM fleet's GHG emissions. While bus emissions add to HRM's corporate inventory, they help to reduce HRM's community-wide inventory by providing public transit and ultimately reducing the number of single-occupancy vehicle trips in the municipality.

HRM is currently conducting a pilot project to reduce emissions from transit buses with an engine upgrade. If this project proves effective, large-scale bus retrofits may be an action item for reducing GHGs in the future. Furthermore, in 2009 HRM experimented with a 20% biofuel blend in its transit buses. Despite some difficulties with the product, efforts are ongoing and should ultimately result in further GHG reductions.

4.3 Lighting

Emissions from streetlights, traffic lights, park and sports field lights, and any other lights not associated with buildings on lands owned by HRM were calculated in the 2008 inventory. Usage data (in kilowatt-hours) was provided by Nova Scotia's electricity utility, Nova Scotia Power Inc. (NSPI).

It is estimated that HRM used a total of 27,097,175 kWh of electricity for lighting purposes in 2008. This translates into 21,407 tonnes of eCO_2. Detailed lighting calculations are attached as Appendix A.

4.4 Buildings

As mentioned previously, the buildings sector was the most complex in terms of calculating GHG emissions. Power and fuel consumption per building are listed in detail in Appendix A. All assumptions made for estimates where data were not available are noted in Appendix B.

It is estimated that HRM buildings used a total of 54,238,748 kWh of power, 4,874,644 L of furnace oil, and 1,513,155 L of natural gas. 41,949 L of diesel was used in emergency generators. This translates into a total of 59,620 tonnes of eCO_2 for HRM buildings.

Efforts to reduce HRM building emissions include boiler retrofits, natural gas conversions, energy efficiency audits and updates, and more. All new HRM buildings are currently being built to the LEED (Leadership in Energy and Environmental Design) Silver standard. As HRM continues to build in a greener, more energy efficient manner, and to upgrade many of its older buildings, building-related emissions will decline.

5. DISCUSSION

5.1 Comparing Results

While it would be ideal to compare HRM's 2008 inventory to its 2002 inventory, this is not possible for several reasons. First, the HRM corporate inventory no longer includes emissions related to waste water and storm water, as these are now controlled by Halifax Water and not by HRM. These emissions will now be considered in the community inventory.

Second, emissions related to solid waste will now be considered only in the community inventory and not the corporate inventory. ICLEI advised HRM that this is the best practice, since corporate waste cannot readily be accounted for as separate from total community waste.

Third, data availability and quality in 2008 is far superior to the data used in 2002. For example, for the 2002 inventory, an estimate of emissions from lighting was made based on HRM-tracked costs alone. In 2008, the kWh from all metered and unmetered lights owned or leased by HRM were accounted for, as all data was provided by NSPI. Based on these facts, it is assumed here that the 2002 estimate was far less than the actual emissions associated with HRM lighting for that year.

Fourth, the 2008 inventory captures many more of HRM's buildings than the 2002 report. Approximately 135 buildings were included in the 2002 report, while approximately 190 buildings were included in the 2008 report. This is a result of new SAP reports that were able to provide building-specific fuel consumption, as well as the availability of NSPI data for all power used in buildings under HRM accounts. In 2002, most of the data came from paper files and estimation, and does not appear to have been quite as inclusive. There was an 'all other buildings' category in the 2002 inventory, which included approximately 143 buildings with an average size of 3000 square feet. Rough estimates for fuel and power consumption were made for this group of buildings. Estimates were also made for many of HRM's larger buildings for which data could not be easily obtained. Calculations were based on an estimated cost per square foot associated with a given fuel. Therefore the 2008 report includes a more comprehensive list of HRM buildings, with more accurate consumption numbers and less estimation.

5.2 Noteworthy Findings

While the 2002 and 2008 reports cannot technically be compared, there are some interesting findings that deserve consideration. First, the increase in building emissions between 2002 and 2008 is minimal despite the development of some new, large buildings and the inclusion of more of HRM's buildings in the 2008 inventory. Diesel for emergency generators was also included in the buildings section of the 2008 inventory. Total eCO_2 emissions for buildings in 2002 were 56,078 tonnes, and were 59,620 tonnes in 2008. This is a great achievement, due primarily to the many building retrofits conducted by HRM as part of its GHG Emissions Reduction Local Action Plan (LAP). As more retrofit, renewable and district

energy, and LEED construction projects are completed in HRM, overall building emissions are expected to decline.

Fleet calculation methods in 2002 and 2008 were similar, and therefore can be more easily compared. Total emissions from the HRM fleet have risen since 2002, from 27,789 to 34,538 tonnes of eCO_2. Much of this increase can be attributed to the expansion of Metro Transit in the last few years. If we were to only examine the emissions from transit, in 2002 it resulted in 19,256 tonnes and in 2008 it resulted in 26,845 tonnes. This is an increase in emissions by 7,589 tonnes. Since the difference in total fleet emissions between 2002 and 2008 is only 6,749 tonnes, this implies that there was an overall decrease in emissions with the rest of the HRM fleet, excluding transit.

Since 2002, Metro Transit has introduced the MetroLink (bus rapid transit service to downtown) and MetroX (commuter transit service to Tantallon), and it has continued to expand its service network throughout HRM. The increase in emissions from Metro Transit expansion is acceptable to HRM, as it will ultimately result in a decrease in community emissions. Increased public transit reduces the need for single-occupancy vehicle trips within the municipality. These gains in GHG reductions will be clear once an updated estimate is calculated for the community-wide inventory.

The lighting estimates for 2002 and 2008 are the most difficult to compare. In 2002, lighting emissions were estimated based on costs and annual budgets, wattage and average run times. Traffic light emissions were estimated based on streetlight emissions. NSPI provided power consumption, in kWh, for all HRM accounts for the 2008 inventory. This led to a much more complete capturing of the data.

While the 2008 estimate is 21,715 tonnes and the 2002 estimate is 10,371 tonnes, it is assumed that HRM lighting emissions have remained relatively constant since 2002. While HRM has installed some new lighting, what with the development of new communities, for example, it certainly has not doubled the amount of lighting in the municipality. Furthermore, HRM has undertaken significant lighting retrofits that are reducing emissions substantially. All HRM traffic lights are in the process of being replaced by LED traffic lights, estimated to use 80% less energy than traditional traffic lights. LED streetlights are also being tested, estimated to use 60% less energy than traditional streetlights. As HRM moves forward and recalculates its corporate inventory for 2009, 2010 and so on, a more realistic trend in lighting emissions should result.

5.3 The 2012 Reduction Target

Even if HRM were to adjust the 2002 estimate to make it as similar as possible to the 2008 estimate, the HRM corporate GHG reduction target of 20% below 2002 levels by 2012 will not be met. There are several contributing factors for this result, discussed below.

The LAP commitment using absolute numbers based on corporate growth leaves HRM 6% above 2002 levels

The reduction measures in the Local Action Plan (LAP) were estimated to reduce total emissions by 18,884 tonnes, which was estimated to result in the production of 109,917 absolute tonnes of GHGs in 2012. Dillon suggested these actions based on an assumption that it was acceptable to consider emissions in relative terms, instead of in absolute terms, in order to account for HRM's population and municipal growth. Relative emissions account for growth, and they do not represent actual emissions (total emissions numbers are "adjusted" to account for growth). Absolute emissions are the quantity of GHG emissions that HRM is actually emitting.

Our actions must go above and beyond the LAP to meet the 20% commitment, which was a target set in absolute, not relative terms. It is essential (and accepted practice) to measure absolute emissions, because without an absolute reduction in GHG emissions (for HRM, NS, Canada and globally), society will continue to face the serious risks and consequences of climate change.

Wind power contracts failed to be implemented

Wind Power Contracts were completed by HRM; however, the Province and NSPI prevented their execution. It was anticipated that wind power would be one of the major ways for HRM to reduce its emissions.

Funding

The LAP called for $12 million in funding. HRM has executed approximately $7 million in projects to-date, with about half of the funds coming from programmes such as the EcoTrust Fund.

Growth

HRM has expanded Metro Transit significantly, resulting in an increase of GHG emissions corporately. As mentioned previously, this will be positive for reducing community-level emissions. HRM has also expanded its building network since 2002, with several new community facilities and fire stations to better service the municipality.

Time lag between setting the target and implementing LAP actions

While the target was set in 2005, projects were not 'shovel-ready', so to speak. They required research, reward, capacity-building and incubation. Therefore, project implementation began closer to 2007. This lag period, while necessary, slowed HRM's progress in reaching its 2012 target. However, the many actions taken by HRM, as well as those planned for the future, will likely begin to decrease corporate emissions more substantially in the years to come.

While the 2012 target will not be met as planned, HRM has succeeded in realizing some significant reductions in emissions at the corporate level, particularly in the buildings sector. HRM has implemented many of the LAP measures for lighting, buildings and transit, all resulting in substantial reductions in GHG emissions. HRM's ongoing commitment to reducing GHGs will continue to decrease emissions over time. HRM is also looking ahead to new reduction targets for the future.

5.4 Economic Considerations

While HRM is committed to reducing GHG emissions for environmental reasons, there is also a significant economic benefit in doing so. Reduced energy use leads to reduced energy costs. Also, infrastructure updates result in lower maintenance and replacement costs in the future. Regional Council has approved a progressive funding tool for future energy efficiency projects in HRM. Energy savings from projects are saved in a reserve and used to fund new energy projects. This 'piggy bank' provides the necessary, consistent support for energy efficiency projects to continue in HRM.

The cost for energy is another important economic factor for consideration. Unit prices for energy have increased between 2002 and 2008. For example, the average cost of gasoline for HRM rose from $0.46/ L to $0.76/L and the average cost of diesel rose from $0.39/L to $0.82/L – a 39.5% and 52.4% increase, respectively. As non-renewable sources of energy, such as coal and oil, become more scarce and expensive to extract, they become more expensive. Being proactive in incorporating renewable energy technologies will help curb the increasing cost of energy over time, and help to reduce overall emissions.

HRM has invested approximately $6.8 million in energy efficiency projects in the last five years, resulting in savings of $1,214,000 per year. Therefore, the overall return on investment (ROI) on HRM taxpayers' dollars is 18.75%. The savings from HRM's major energy efficiency projects completed between 2005 and 2009 are listed below in Table 5.1.

Table 5-1: Energy efficiency project costs and savings

PROJECT	COST ($)	SAVINGS ($)
Vending Misers	7,500	7,500
Transit Facility Energy Performance Contract	Phase 1: 850,000 Phase 2: 850,000	Phase I: 200,000 Phase 2: 100,000
LED Traffic Lights	700,000	150,000
Alderney 5	3,600,000	350,000
Halifax North Memorial Library Lighting Retrofit	30,000	7,000
Gas Conversions to High Efficiency	750,000	400,000

6. RECOMMENDATIONS FOR NEXT STEPS

The following next steps are recommended in the continuation of HRM's efforts to reduce GHGs corporately and at the community level:

6.1 Update the GHG LAP

The GHG LAP must be updated, to see what actions have been completed in the LAP, what actions were not or could not be implemented, and which actions remain ongoing. New potential actions for continuing to decrease corporate GHGs will be added.

6.2 Apply for the corporate completion of PCP Milestone 5

Prepare and submit a report to FCM, requesting the completion of the PCP Program for HRM corporately. Work remains for the HRM community component of the PCP Program.

6.3 Calculate the corporate 2009 inventory

HRM will maintain momentum on the annual estimation of its corporate inventory. The 2009 inventory will be calculated and compared to the 2008 numbers.

6.4 Update HRM's community inventory

HRM's community-level emissions will be estimated for the 2008 fiscal year, and a reduction target will be recommended for adoption by HRM Council.

6.5 Revise community energy plan

Once a reduction target is approved, HRM's Community Energy Plan will be revised, with concrete actions for reducing emissions. This report will be similar to the corporate LAP.

7. CONCLUSION

HRM has made good progress in reducing its corporate GHG emissions in the last several years. The 2012 target is no longer really applicable, because the 2002 and 2008 GHG inventories cannot technically be compared due to large differences in data quality and availability, as well as inventory protocols and structural changes within HRM. However, HRM celebrates its many successes in completed energy efficiency projects, particularly in the buildings sector, resulting in major GHG emissions reductions. While HRM assumed corporate responsibility for increased emissions due to expanded public transit, this is seen as a positive situation for HRM when looking at the bigger picture. Improved transit will decrease community-wide emissions and improve the sustainability of transportation throughout the municipality. The transit expansion will continue to result in environmental and social rewards for the entire HRM community in years to come.

HRM plans to revise its LAP to include new measures for reductions, and to re-estimate its corporate emissions inventory on an annual basis. Future inventory estimates will be comparable to the 2008 estimate, and HRM will be able to track its progress more effectively from here on. HRM looks forward to setting new targets for the future that are in line with provincial and federal targets.

HRM continues to work on energy efficiency projects, with several large projects underway during the writing of this report. The progressive funding tool approved by Regional Council will allow HRM's efforts to continue in this critical area.

HRM plans to begin an estimation of community-wide emissions in the near future, and to begin working with the larger community towards absolute reductions in GHG emissions in the municipality. This will require substantial community engagement and collaboration. Ultimately, HRM aims to complete the PCP program at both the corporate and community levels. HRM wishes to be a leading Canadian municipality in the very challenging area of climate change mitigation.

8. REFERENCES

Dillon Consulting Limited. 2005. Halifax Regional Municipality Corporate Local Action Plan To Reduce Greenhouse Gas Emissions. Available online at http://www.halifax.ca/environment/documents/HRMCorporateClimateLocalActionPlan.pdf. Last accessed May 11, 2010.

ICLEI Energy Services. 2005. Greenhouse Gas Emissions Inventory, Forecast & Target.

ICLEI Energy Services. 2009. International Local Government GHG Emissions Analysis Protocol (IEAP), Version 1.0, ICLEI Energy Services, October 2009. Available online at http://www.iclei.org/fileadmin/user_upload/documents/Global/Progams/CCP/Standards/ICLEI_IEAP_2009.pdf. Last accessed May 11, 2010.

APPENDIX A: GHG CALCULATION SPREADSHEETS

Appendix A
Emissions Indicators

The following information on community indicators was summarized from IES's Greenhouse Gas Emissions Inventory,

Forecast and Target Report

A1. Population and Growth Indicators

Table A1 provides the growth indicators used in the preparation of the inventory and forecast report. Growth to 2012 is based on an estimated population of 411,731 for a total growth in population between 1997 and 2012 of 18.8%.

Table A1 Growth Indicators 1997-2002

Growth Indicator	1997	2002
Population	346,430	362,691
Households	133,757	152,391
Commercial Employees	96,600	111,700
Institutional Employees	53,600	49,700
Industrial Employees	19,400	27,700

A2. Private Transportation

Private transportation includes the number of kilometres travelled by private (personal) vehicles in HRM as expressed by annual vheicle kilometres travelled (VKT) in Table A2.

Table A2 Total Vehicle Kilometres 1997-2002

Year	Total Vehicle Kilometres Travelled
1997	2,228,584,190
2002	2,310,161,650

A3. Public Transportation

Public transportation includes buses and ferries operated by Metro Transit. Use of these modes of transportation are expressed as distance travelled (km/year) for buses and hours of operation (per year) for ferries. The increase in the number of buses and kilometres travelled per year reflects the growth of HRM's population and resulting expansion in transit services.

The ferries operated for fewer hours in 2002 due in large part to maintenance of the fleet.

Table A3 Transit Indicators 1997-2002

Vehicle Type	Number	Distance Travelled (km/year) Hours of Operation (per year)
1997		
Buses	148	9,658,803
Ferries	-	9,743
2002		
Buses	199	9,935,499
Ferries	-	9,428

A4. Waste

IES used the two PCP recognized methods to emission calculations relate to waste: 1) methane commitment and 2) waste-in-place. The methane commitment method is used to estimated emissions from waste sent to landfill in the inventory year.

Under this method total waste to landfills was 160,768 tonnes in 1997 and 150,472 tonnes in 2002. The second method, waste-in-place is used to calculate emissions from the landfill based on the amount of waste in the landfill. Table A4 provides the estimated waste-in-place for the inventory years 1997 and 2002.

Table A4 Estimated Waste-in-Place

Location	Solid Waste (tonnes)
1997	Tonnes
Sackville	4,000,000
Otter Lake	0
2002	
Sackville	4,000,000
Otter Lake	480,451

APPENDIX B: ASSUMPTIONS FOR ESTIMATES

B1. Emissions Coefficients

Table B1 outlines the emissions generated during the production of one-kilowatt hour of electricity in the province of Nova Scotia during the years 1997 to 2002.

Table B1 Nova Scotia Emissions Coefficients

Year	CO_2 (kg/kWh)	N_2O (kg/kWh)	CH4 (kg/kWh)
1997	0.715 (eCO_2)	0	0
2002	0.763 (eCO_2)	0	0

Table B2 outlines the emissions coefficients for various fuel types. Although all of these factors were not of use for the development of this report, they are included for future reference.

Table B2 Emissions Coefficients by Fuel Type

Type Name	Base Unit	Energy Coefficient	CO_2 Coefficient	N_2O Coefficient	CH_4 Coefficient
Alta Bitum. Coal	(tonnes)	30.4	1.7	0.00011	1.50E-05
B.C. Bitum. Coal	(tonnes)	30.4	1.7	0.00011	1.50E-05
CNG	(litres)	0.007612	0.000376	4.00E-09	8.60E-09
Coal - Anthracite	(tonnes)	27.7	2.39	0.00011	1.50E-05
Coal - Cdn Bitum.	(tonnes)	27.7	2.765488	0.000120688	1.65E-05
Coal - Lignite	(tonnes)	15	1.49	0.00011	1.50E-05
Coal - Sub-Bitum.	(tonnes)	18.3	1.74	0.00011	1.50E-05
Coal - U.S. Bitum.	(tonnes)	29	2.46	0.00011	1.50E-05
Coke	(tonnes)	28.83	2.48	0.00011	1.50E-05
Diesel	(litres)	0.03868	0.00273	4.00E-07	2.00E-07
District Energy	(GJ)	1	0.05847	0	0
Ethanol Blend	(litres)	0.03244	0.00222	8.50E-07	0
Fuel Oil	(litres)	0.03868	0.00283	1.30E-08	2.60E-08
Gasoline	(litres)	0.03466	0.00236	1.65E-06	2.40E-07
Heavy Fuel Oil	(litres)	0.04173	0.00309	1.30E-08	6.00E-08
Kerosene	(litres)	0.03768	0.00255	2.30E-10	2.10E-10
Landfill Gas Electricity	(GJ)	0.999955453	0	0	0
Landfill Methane	(GJ)	1	0	0	0
MSW	(GJ)	1	0	0	0
Man. Bitum. Coal	(tonnes)	30.4	2.52	0.00011	1.50E-05
N.B. Bitum. Coal	(tonnes)	27	2.23	0.00011	1.50E-05
N.S. Bitum. Coal	(tonnes)	28.5	2.3	0.00011	1.50E-05
Natural Gas	(cubic metres)	0.03806	0.00188	2.00E-08	4.30E-08
Propane	(litres)	0.02553	0.00153	0	3.00E-08
Solar	(GJ)	1	0	0	0
Wood	(cords)	25	0	0.22225	0.00075

B2. Energy Consumption

B2.1 Residential, Commercial, Industrial and Institutional Subectors

Tables C3 provides the estimated energy consumption within HRM's Community sector for the years 1997 and 2002. Figures B1 and B2 provide the breakdown of $eC0_2$ emissions by energy/fuel type.

Table B3 Energy Consumption, Cost and Emissions by Energy Fuel Type Area for 1997 and 2002

Sector	kWh	LFO (L)	HFO (L)	Diesel (L)	Propane (L)	Gasoline (L)
1997						
Residential	1,342,521,316	154,489,054	0	0	8,928,750	0
Commercial	1,081,287,806	166,961,468	0	30,189,300	21,624,700	10,580,000
Institutional	599,969,218	3,170,704	41,768,744	16,751,000	8,067,010	0
Industrial	4,289,253,211	324,621,226	66,806,930	63,356,600	50,619,260	16,451,700
Total	**-**	**396,083**				**272.89**
2002						
Residential	1,593,156,209	164,532,445	0	0	8,696,970	0
Commercial	1,618,579,672	193,060,000	0	44,901,300	20,499,000	13,785,300
Institutional	519,949,953	2,940,000	38,729,600	19,978,500	9,120,880	6,133,650
Industrial	1,802,643,280	0	35,750,400	35,428,000	15,380,300	0
Total	**5,084,329,114**	**360,532,445**	**74,480,000**	**100,307,800**	**53,697,150**	**19,918,950**

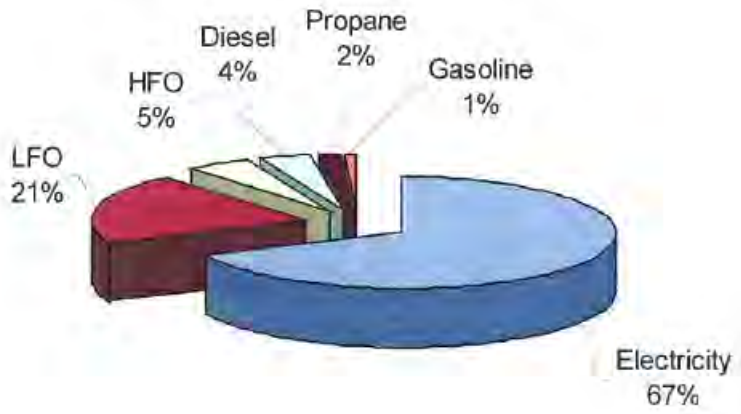


Figure B1 CO_2 Emissions 1997

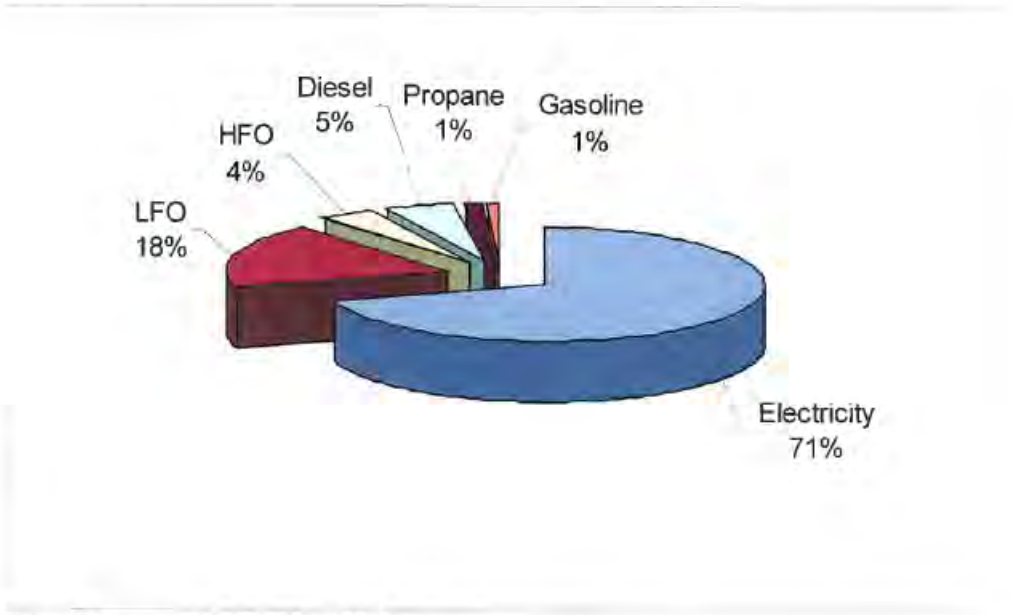


Figure B1 CO_2 Emissions 1997

B2.2 Public Transportation

Fuel consumption information by vehicle type is provided in Table B2. There was an increase in the number of buses between 1997 and 2002, which gave rise to a subsequent increase in distance travelled and fuel consumption.

Table B2 Transit Fuel Consumption

	Litres/Year
1997	
Buses	5,893,246
Ferries	591,146
Total	**6,484,392**
2002	
Buses	6,479,428
Ferries	572,320
Total	**7,051,748**