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Prepared for:

Halifax Regional Municipality

Community Energy Plan

Task 1 Final Report

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1 INTRODUCTION AND BACKGROUND

Halifax Regional Municipality (HRM) has embarked upon a path that will eventually see it become a leader in sustainable energy among large urban municipalities in Canada. It has now been ten (10) years since the first emissions inventory was conducted in HRM, making it one of the first large municipalities to complete this key step in developing a workable strategy to address greenhouse gas emissions and sustainable development. HRM was among the first large municipalities in Canada to join the Partners for Climate Protection (PCP) program of the Federation of Canadian Municipalities (FCM). This Community Energy Plan (CEP) is a key part of HRM's energy commitment to following the requirements of this program.

The Regional Planning process that was begun several years ago has identified the need for many Functional Plans that further develop the goals outlined in the Regional Planning Strategy and create implementable measures that are intended to meet the goals of emissions reduction and sustainable development. The Community Energy Plan, of which this is the First Task Report, was identified in the Regional Planning Strategy as being a key Functional Plan.

The CEP project will strive to achieve the following objectives:

.1 To be consistent and integral with existing and ongoing HRM strategic, environmental and planning objectives, as well as the region's 25-year Regional Plan and its integrated systems approach to clean air, land, water and energy.

.2 To ensure continued delivery of municipal services that require energy inputs such as buildings, infrastructure, public transit, municipal fleet, waste management, traffic lights, etc.

.3 To generate goals that will ensure energy security within the municipality – that is, to ensure safe and readily available and cost effective supply.

.4 To lead corporate and community HRM to greater greenhouse gas (GHG) emissions reduction in concert with the municipality's GHG Reduction Plan.

.5 To be environmentally, fiscally and socially sustainable; and to promote and encourage energy efficiency by establishing commitment to renewable energy capacity.

.6 To provide effective options around energy for short and long term land use planning.

To create a CEP document that addresses the above objectives, HRM has attained the services of a multi-disciplinary consulting team (CEP Team) who are responsible for the delivery of the following outputs:

- Existing Energy Resource Assessment
- Future Energy Supply and Demand Assessment
- Implementation Plan for the CEP

- Monitoring Program
- Consultation Program
- Education and Awareness Program

This report summarizes the finding of the first item on the above list. It describes the initial investigations by the CEP Team as we have assessed the resources amassed to date as part of various completed and ongoing HRM initiatives and how these resources can assist with the development of subsequent phases of the CEP. Other resources developed by other levels of government and the public and private sectors are also reviewed. These reviews will later be combined with the results of an extensive stakeholder and community consultation program to devise a plan that attempts to balance the needs and values of the existing community with the need for development as the community continues to grow.

2 EMISSIONS INVENTORY REVIEW

2.1 Review of 2002 Energy Utilization and the GHG Emission Inventory

The International Council of Local Energy Initiatives (ICLEI), through its Energy Services (IES) division, was contracted by HRM to initiate the first two of a five-milestone GHG reduction framework set out by the Partners for Climate Protection (PCP) to which HRM obtained membership in 1997. This initiative resulted in a study that compiled the GHG emissions inventory for HRM at the corporate and community levels, and also set a recommended target for HRM to reduce GHG emission rates by 20% below the 2002 rates by 2012, both at the corporate and at the community levels. Further to this, Dillon Consulting was contracted to carry out the third milestone of the framework which was to establish a comprehensive local action plan (LAP) for HRM to realize its GHG reduction targets. The LAP study and the ICLEI study were reviewed and analysed to establish background and understand the big picture for HRM's goals, ambitions and direction in the short, medium, and long term time frames. It is important that the 2002 emissions inventory, used in the ICLEI report, be firmed up to ensure that future progress and goals are set and checked against solid baseline values. Furthermore, the authors of the ICLEI study gave a description of how data were collected, what assumptions were made and what sources were used to arrive at the conclusions. This is helpful because it allows for creation of other perspectives from which to view the data and review conclusions. A special mention was made in the ICLEI report that estimates on consumption of electrical energy within HRM were very rough as the research team had not received electricity consumption data from Nova Scotia Power Incorporated (NSPI). However, we have now received HRM-specific electrical energy consumption estimates from NSPI's Conservation and Energy Efficiency manager for utilization in updating future requirements and anticipated GHG emissions. The data shared by NSPI covers a 5-year period from 2002 to 2006 inclusive. These data will also be critical in improving energy requirement forecasts across all sectors in HRM. This will be discussed in more detail in Task 3 of the CEP process.

The GHG inventory for 2002 has been broken up, not only along the Community and Corporate HRM divide, but by GHG contributions from different sectors too, with emissions by energy sources summarized separately where possible. Also, due to difficulties encountered by the ICLEI team in adopting a bottom-up approach when building the inventory, emissions data were obtained indirectly from energy bills and costs, which were then converted to approximate energy quantities sold, and then applying the emission coefficients to estimate resultant emissions. Ultimately, some hybrid of a bottom-up and top-down approach was used. The ICLEI team was able to put this together in an environment where information inputs were scarce.

Tables 1 and 2 were built from content in ICLEI's work and they summarize HRM energy usage estimates for 2002 by sector.

Table 1. HRM Corporate Energy and GHG Figures for 2002

	Sector	2002	
		Energy (GJ)	GHG (t)
Corporate	Buildings	420,093	56,078
	Vehicle	123,053	8,533
	Streetlights	48,933	10,371
	Water/Sewage	138,059	25,511
	Total	**730,138**	**100,493**

Table 2. HRM Community Energy and GHG Figures for 2002

	Sector	2002	
		Energy (GJ)	GHG (t)
Community	Residential	12,322,120	1,694,518
	Commercial	14,413,803	1,624,525
	Institutional	4,820,580	607,715
	Industrial	9,745,471	1,606,160
	Transportation	12,865,735	885,826
	Waste	0	262,884
	Total	**54,167,709**	**6,681,628**

Corporate HRM consumed less than 2% of the total energy consumption in the entire HRM region with a corresponding relative contribution in GHG emissions as depicted in Figure 1 below. In Figure 1, as in Tables 1 and 2, the electrical energy component comprises of the actual delivered energy to the end user, not the power generating energy input quantities.

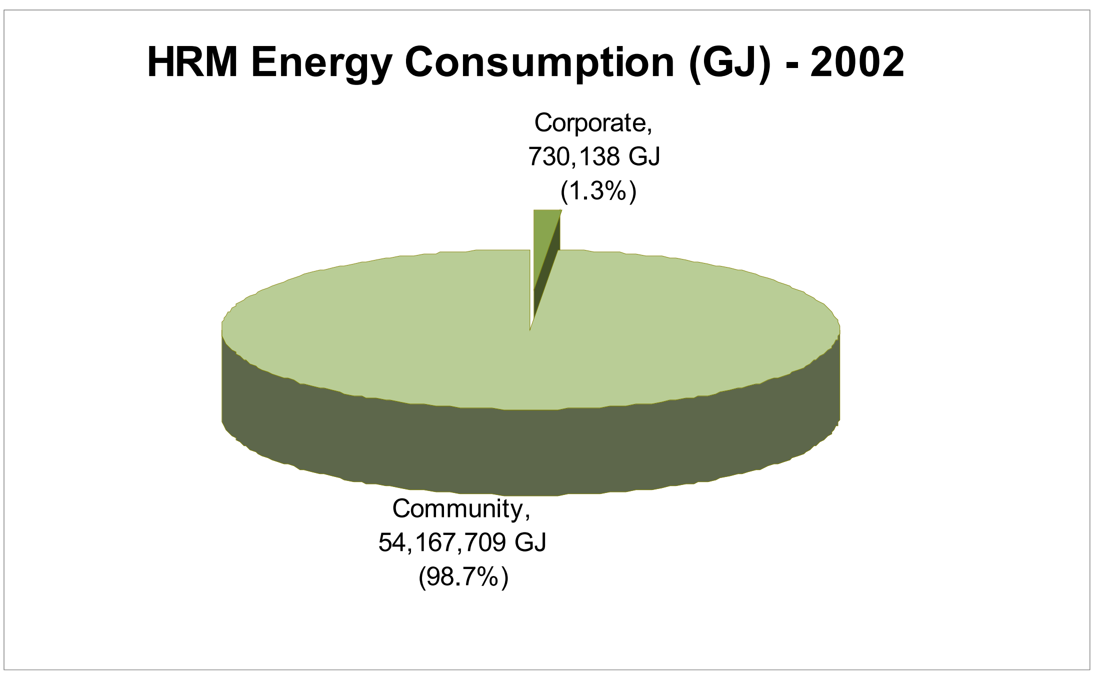

Figure 1. HRM Corporate versus Community Consumption

In addition, it was observed that within the community at the time, electricity represented about 33% of total energy consumption (Figure 2). This number is 74% in the corporate HRM, giving electrical contribution in the corporate HRM the most significant importance. Figure 2 is a graphical presentation of the different energy types consumed within the community sector and relative contribution of each energy source in 2002. The entity “Deliv Electric” distinguishes this as the actual power delivered at the end use. This distinction is important is later on the report looks into actual energy inputs at the utility’s generating stations, and that energy stream will be labelled “Elec Site Energy”.

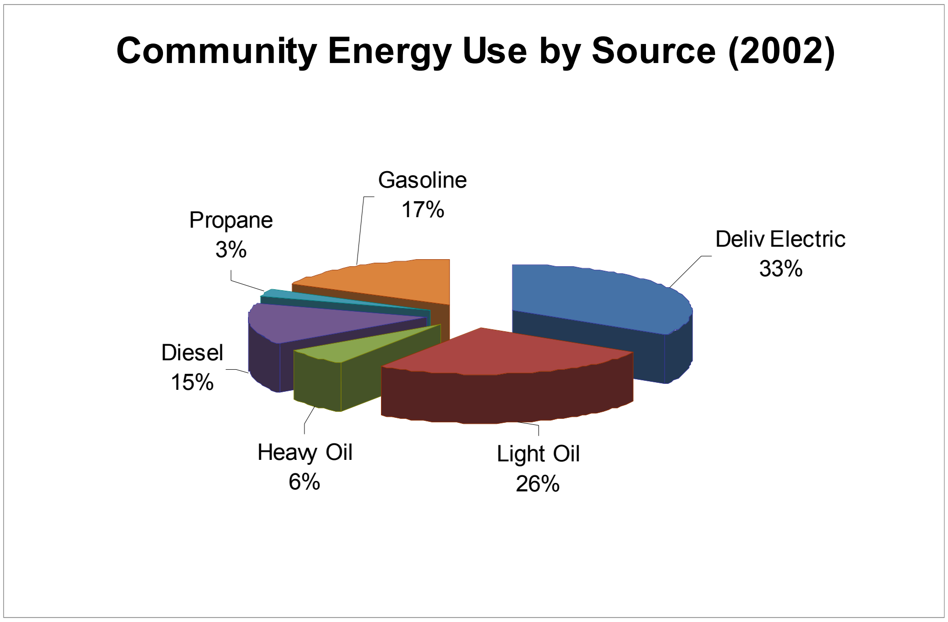

Figure 2. HRM Energy Source Make-up

In Figure 3, we summarize the exact energy quantities consumed in the HRM community by energy type. These figures do not include corporate energy, which represents only about 1.3% of total HRM energy consumption.

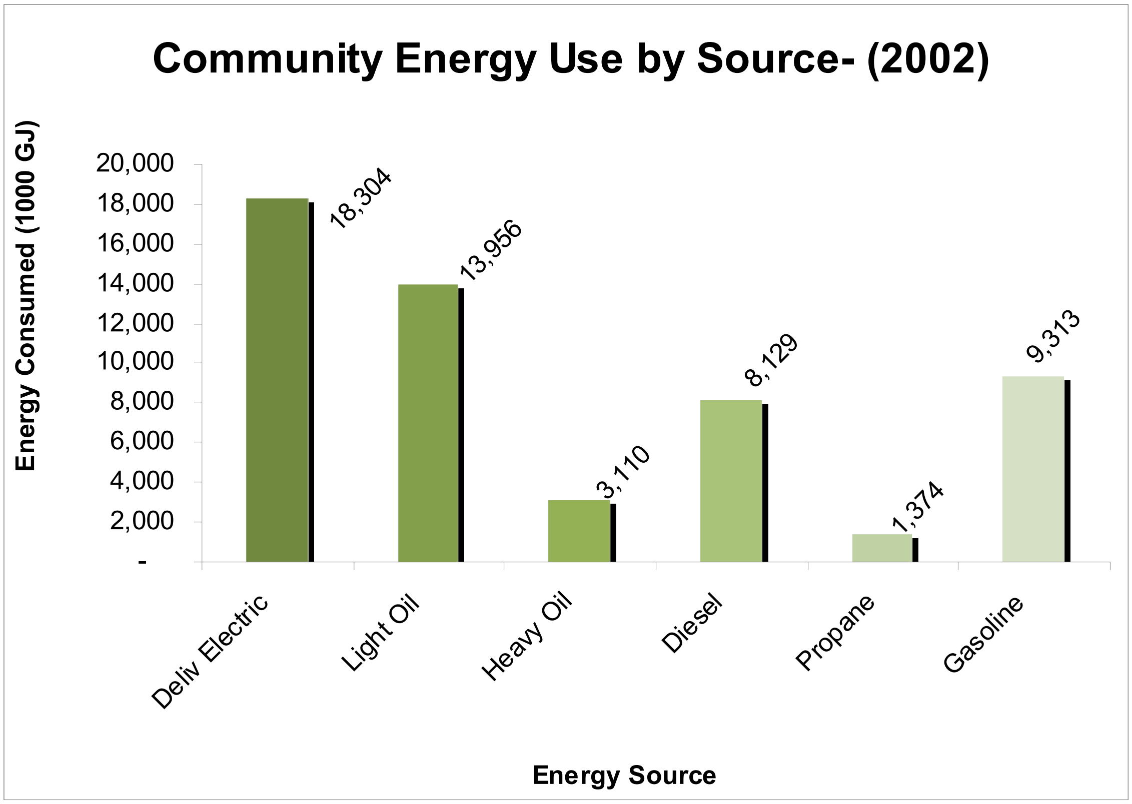

Figure 3. HRM Community Energy Use by Source

The ICLEI report gives total energy consumed by the Transportation Sector, but it does not give a breakdown of how much of it was diesel and how much was gasoline. An assumption was made to split the total fuel at 33% diesel and 67% gasoline, due to the fact that in 2002 there were far more gasoline driven vehicles than there were those taking diesel. However, diesel and gasoline figures shown in the Figure 3 also include fuel used in other applications other than transportation.

In this task, combined electrical energy consumed both by the community and HRM corporate was broken down into the NSPI energy mix for power production. The 2002 energy mix was estimated from the Statistics Canada website and shows that NSPI mix was about 70% coal, 11% heavy oil, 2% natural gas and approximately 17% hydro/wind. Also, conversion efficiency of about 35% was assumed so that actual energy input far exceeds the resultant energy delivered to end users. Still, transmission and distribution (T&D) losses have not been factored in the 35%. Figure 4 is a bar chart similar to Figure 3, but it shows approximate quantities of energy inputs "Elec Site Energy" at the power production side as opposed to delivered electrical power in 2002 at NSPI's generating stations province wide.

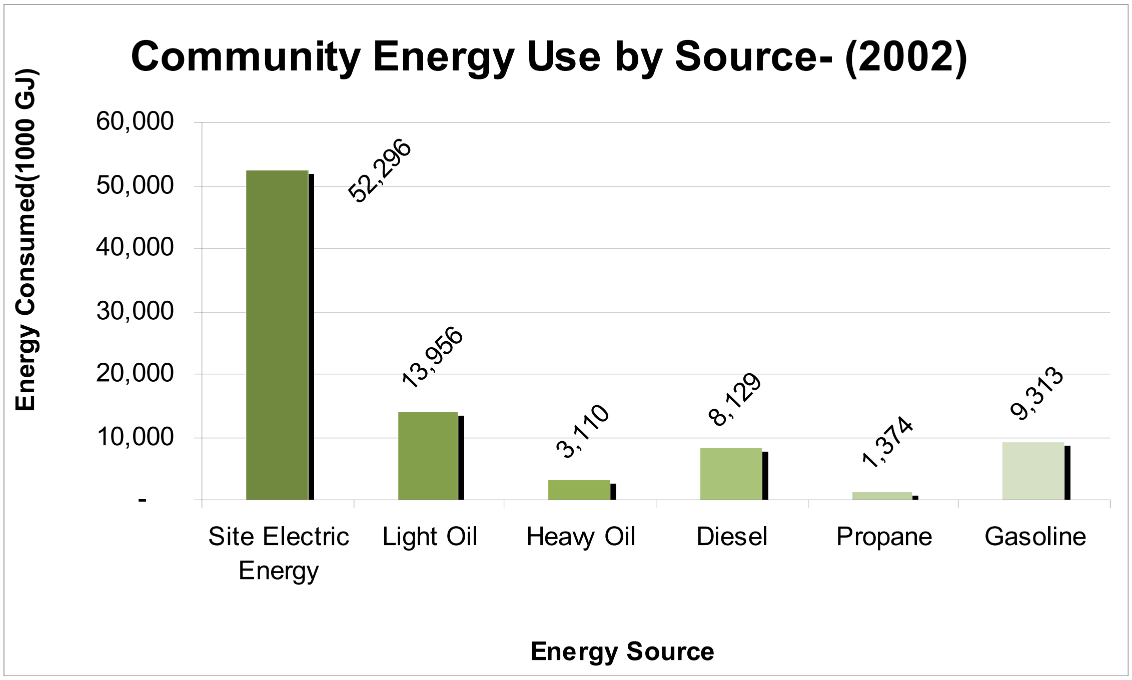

Figure 4. HRM Community Energy Inputs

As per the ICLEI Report, total GHG emissions corresponding to the 2002 energy use profiles summarized above are presented in Figure 5. The report does not stipulate the assumed electric utility energy mix for the derived emissions; however eCO2 emission coefficient used by ICLEI for the 2002 power production in Nova Scotia was 0.763 kg/kWh.

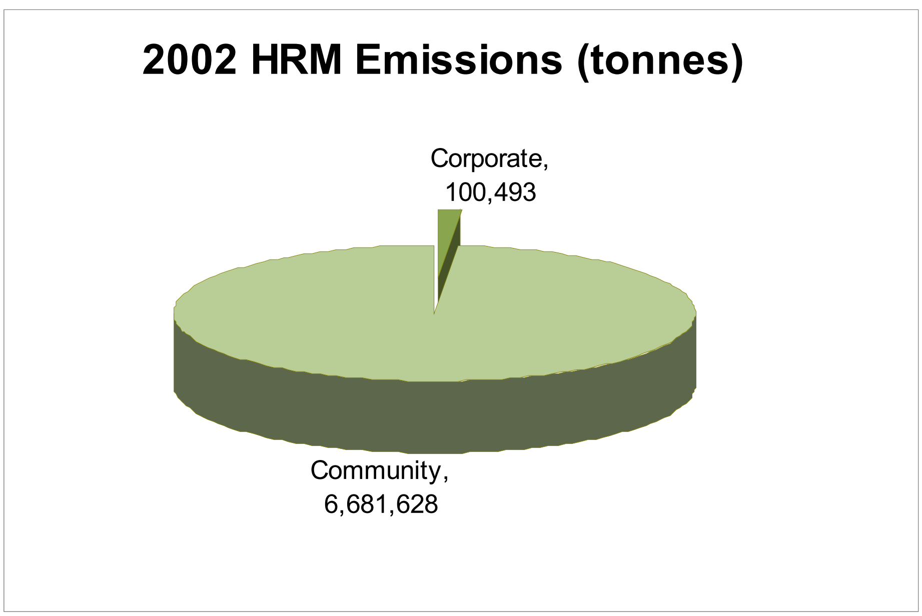

Figure 5. Corporate vs. Community GHG Emissions

For combined corporate and community HRM, sources of GHG emissions are itemized and the relative emissions of each source are captured in Figure 6 on the left, while the exploded pie chart to the right shows the relative GHG contributions by sector in the Community sector emissions profile for 2002.

	Sector	GHG (t)
Corporate	Buildings	56,078
	Vehicle	8,533
	Streetlights	10,371
	Water/Sewage	25,511
	Total	**100,493**
Community	**Sector**	**GHG (t)**
	Residential	1,694,518
	Commercial	1,624,525
	Institutional	607,715
	Industrial	1,606,160
	Transportation	885,826
	Waste	262,884
	Total	**6,681,628**

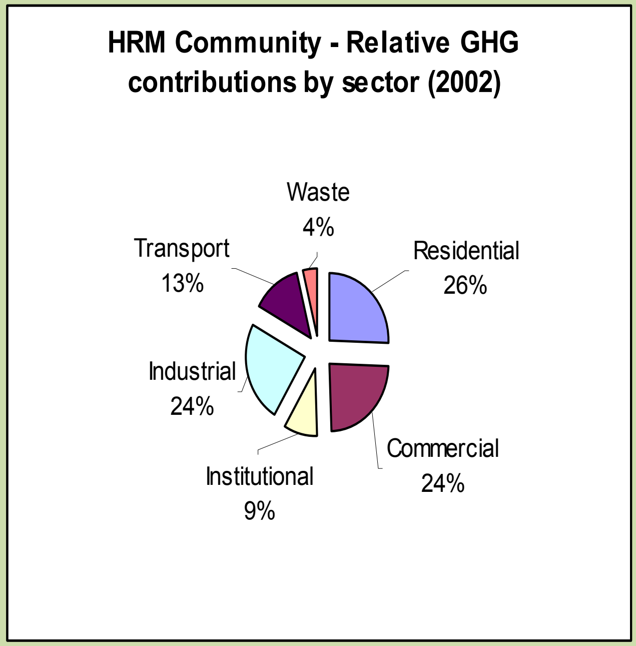

Figure 6. GHG Emissions in 2002 and Community Relative Sector Contributions

2.2 Present and Future Energy Demand and GHG Emission Trends

The snapshot of the energy usage and GHG emissions just given in section 2.1 above is used as a baseline for projections into the present and likely future energy demand and possible emissions under various scenarios. At this point, combined future energy requirements are estimated on the basis of changes in growth metrics for HRM. While the trend in the population growth is expected to remain unchanged, the actual energy requirements to support the growing population and increasing economic activities are subject to a number of scenarios and outcomes.

The major determinants of the level of energy usage and the corresponding emissions in the future are:

- The efficiency with which energy is utilized in all community and corporate sectors of HRM and,
- The sources of energy used to fuel the economy and support the energy needs for a growing population.

The only other configuration apart from the two above is the obvious "Business-As-Usual" case where past trends are expected to carry on unaltered, namely that energy needs will increase proportionately with growth in population and increased economic activity; and that as more energy is used GHG emissions increase in proportion. This case is much more likely if renewable and alternative energy sources remain untapped in HRM over the next decade or so. At present, the link between economic growth, energy use and GHG emissions is very strong in HRM. This means that with great certainty, economic and population growth leads to increased energy demand, which leads to more increased emissions. HRM needs to reach a point where this link is weakened. This is a state where economic and population growth do not necessarily imply increased energy demand because improvements in energy use efficiencies translate to more being achieved by the same or even reduced energy quantities. At the same time, these energy efficiencies together with a regional energy portfolio which contains an "appreciable" mix of renewable or alternative energy leads to reduced emissions even in the face of increasing economic activity. According to the report on preliminary consultations by the National Energy Board (NEB), *2007 Energy Futures Report*, this reality is possible for the nation as a whole. So by extension, it should be possible for HRM and, that should be the goal of HRM in the context of energy security, sustainable future energy supplies as well as suitably targeted GHG emissions for the region.

Using the population growth trend established between 1997, 2002 and now 2006 (346,430 362,691and 382,153 respectively), it is evident that HRM's population is increasing at a rate much greater than the provincial or regional average. On the basis of the logic and the strength of the link described above, HRM's upwards population growth necessarily means that more energy will be required to fuel new homes, cars, as well as keep up with the increase in economic activity resulting from population increase; and that increased energy requirements and utilization under the current energy portfolio will result in sharper increase in GHG emissions.

Currently, the projections are that energy demand will grow upwards. Figure 7 is a BAU graphical representation of projected changes in energy requirements over the years 2005 and 2007, using the 2002 community energy levels as the basis. Note that the future energy requirements for the category labelled "Elec Site Energy", which is the input NSPI energy mix at the power stations, should not necessarily be dependent on the growth indicators. For instance, these bars would be reduced to zero if all of the electrical energy consumed in HRM were produced from hydro, wind, tidal, solar or other indigenous carbon-neutral energy sources regardless of what the actual delivered electrical energy demands were to become. The impact of such a provision would have very impressive GHG emissions control statistics because there would be no GHG emissions in the production of power irrespective of load sizes in HRM.

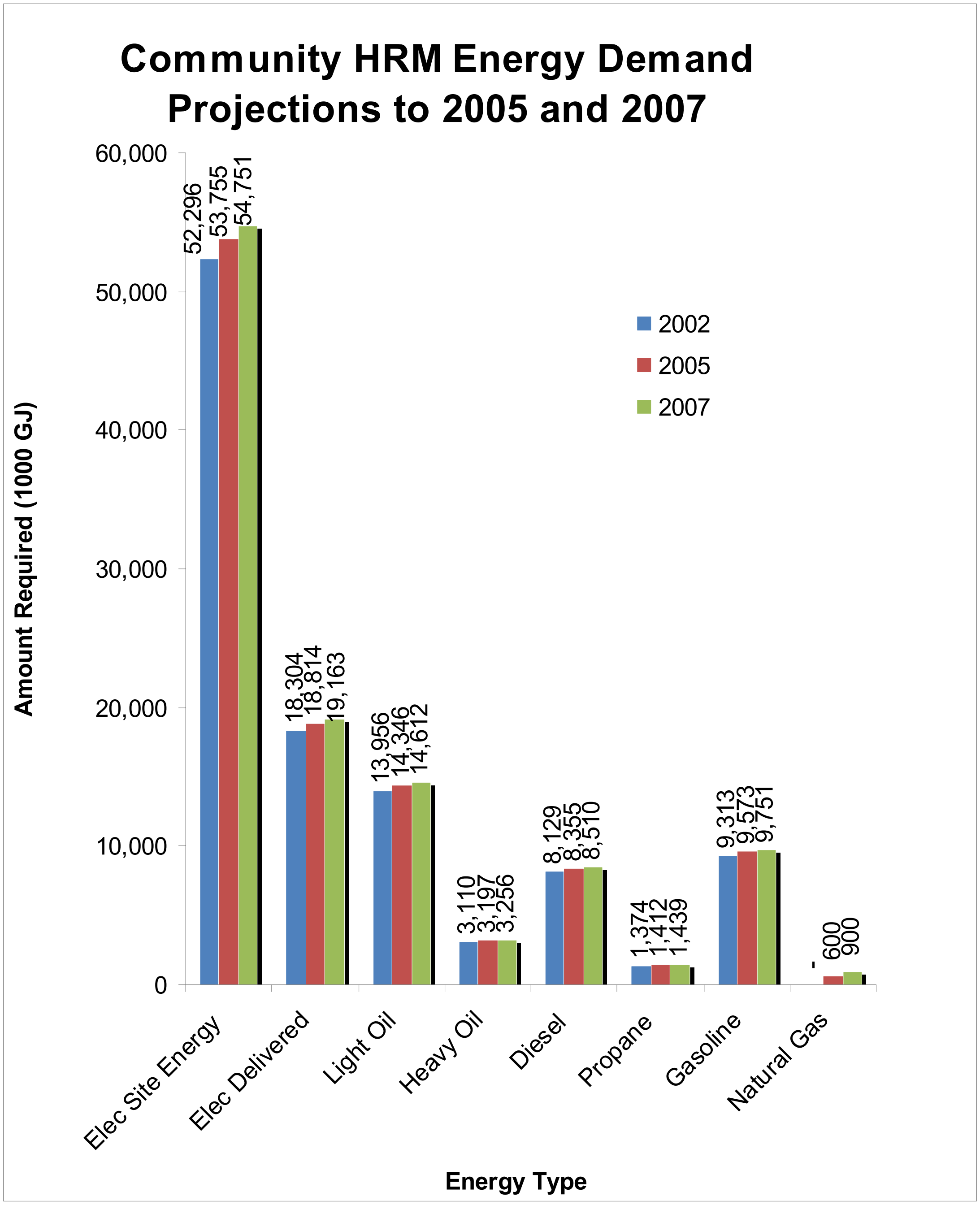

Figure 7. HRM Energy Usage in 2002, 2005 and the Projected 2007 Requirements

As stated above, while energy demand goes up, GHG emissions do not necessarily have to escalate if sufficient infusion of renewable and cleaner energy sources is utilized. Therefore, the GHG emissions are better presented under different scenarios each of which is a result of the energy and choice behaviour by HRM community and corporate. As similarly demonstrated in the ICLEI Report, there are several possible GHG emission outcomes from NSPI power production utilized within HRM depending on the level of effort in place to curb emissions. Tables 3 and 4 give examples of what was achieved between 2002 and 2005 from varying the energy mix at NSPI's power production facilities.

Table 3. Conditions as Described by ICLEI for 2002

Source	Proportion	Energy Input (GJ)	Energy Quantity (tonnes or m3)	2002 Emissions (tonnes)
Coal	70%	37,308,338	1,346,871	3,724,773
Oil	11%	5,862,739	140,492	434,121
NG	2%	1,065,953	28,007,160	52,653
Hydro/Wind	17%	9,060,596	-	0
Total	**100%**	**53,297,625**	**-**	**4,211,547**

Table 4. 2005 GHG Emissions – Actual (Fuel mix proportions from NSPI)

Source	Proportion	Energy (GJ)	Energy Quantity (tonnes or m3)	2005 Emissions (tonnes)
Coal	55%	29,565,358	1,067,341	2,951,733
Oil	26%	13,976,351	334,923	1,034,913
Natural Gas	2%	1,075,104	28,247,607	53,106
Hydro/Wind	17%	9,138,384	-	-
Total	**100%**	**53,755,197**	**-**	**4,039,751**

Under the cases in the two tables above, although the 2005 electrical energy requirements went up approximately 1% above the 2002, GHG emissions from power production for HRM actually dropped by 4% below the 2002 GHG levels. This was mainly due to reduction in the use of coal by about 280,000 tonnes on the annual basis resulting from increased use of heavy oil in lieu of bituminous coal. Along with the fuel mix proportions shown in the table above, NSPI operates its forty-four (44) generation stations as follows.[1]

Coal and petroleum coke burn constantly to provide the province-wide base load; oil and natural gas are introduced for intermediate loads; oil, natural gas, wind and hydro top up for peak loads. Although 13% of NSPI's generating capacity is capable of utilizing natural gas, a 2% proportion was used in the scenarios above and below due to the rarity of occasions in which natural gas is actually fired by NSPI to generate power.

A few other examples of hypothetical energy mix scenarios and their corresponding emission impact are explored below.

Table 5. 2005 GHG Emissions if coal were reduced to 20% in lieu of more natural gas

Source	Proportion	Energy (GJ)	Energy Quantity (tonnes or m3)	2005 Emissions (tonnes)
Coal	20%	10,751,039	388,124	1,073,357
Oil	13%	6,988,176	167,462	517,457
Natural Gas	50%	26,877,599	706,190,187	1,327,638
Hydro/Wind	17%	9,138,384	-	-
Total	**100%**	**53,755,197**	**-**	**2,918,452**

The energy mix in Table 5 above would have reduced power related emissions by 31% over the 2002 GHG levels.

Table 6. 2005 GHG Emissions if all coal was replaced by natural gas

Source	Proportion	Energy (GJ)	Energy Quantity (tonnes or m3)	2005 Emissions (tonnes)
Coal	0%	-	-	-
Oil	13%	6,988,176	167,462	517,457
Natural Gas	70%	37,628,638	988,666,262	1,858,693
Hydro/Wind	17%	9,138,384	-	-
Total	**100%**	**53,755,197**	**-**	**2,376,149**

Better still, if all power generation to HRM were produced from sources other than coal as shown in the portfolio in Table 6, the GHG emissions from power generation for the entire HRM community and corporate would be reduced by nearly 44% over the 2002 emission levels. As a fraction of total HRM emissions in 2002 (including non-power production energy uses), the GHG emission reduction in Table 6 represents a 27% reduction over the 2002 emissions. This would have more than met HRM's 20% reduction target for 2012 exactly seven years earlier for both community and corporate combined. However, issues around and analysis of security of energy supply which will be part of Task 3 of this work will discuss the shortfalls of some of these scenarios. This latter scenario could also be achieved if all of the emissions from use of coal underwent complete carbon sequestration if that technology were available and relatively cost-effective in 2005. Continued use of coal and mitigation of coal burning emissions is a subject that is more a matter of provincial policy than it is anything within the means of HRM.

The scenarios described above serve to show the impact that alternative energy use and a carefully crafted energy portfolio for HRM would have on the efforts to reduce GHG emissions. These deep, hypothetical GHG cuts were achieved by replacing one form of fossil fuel with another cleaner fossil fuel source. Section 4 will attempt to show the level of GHG emissions reduction impact that biomass and biodiesel for thermal, electrical and transportation needs within HRM would have on the rate of GHG emissions in the years 2005, 2007 and 2012.

3 INVENTORY COST ANALYSIS

3.1 Direct Energy Costs

This section focuses on the financial impact of energy acquisition by the final consumer within HRM. There is no sure way to truly demonstrate the "financial impact" because what might seem an unbearable cost to one individual may in fact be only pocket change to another. Still, on a 'per capita' basis, this section reflects the type of energy cost analysis that helps a region understand what the energy cost implications are for its residents, operations and economic activity. Table 7 summarizes average energy price assumptions that were made to enable the analysis.

Table 7. Energy Cost Assumptions in HRM

Energy Type	2002	2005	2007	2012
Electricity (kWh)	$0.100	$0.120	$0.131	N/A
Light Oil (L)	$0.533	$0.836	$0.720	N/A
Heavy Oil (L)	$0.230	$0.350	$0.370	N/A
Diesel (L)	$0.695	$0.998	$0.900	N/A
Propane (L)	$0.700	$1.000	$1.020	N/A
Gasoline (L)	$0.725	$1.039	$1.000	N/A
Natural Gas (GJ)[2]	-	$11.800	$15.330	N/A

Tables 8 to 10 show the combined Community and Corporate HRM total costs of energy consumed by source in each of three years of analysis. The figures reflect the growing penetration of natural gas in the residential and commercial markets, primarily as a replacement for light fuel oil.

Table 8. Total HRM Energy Costs, 2002

Category	Energy (GJ)	Energy (L)	Cost ($)
Electricity	18,486,862	-	518,354,557
Fuel Oil	14,190,675	360,532,445	194,418,315
Heavy Oil	3,109,860	74,480,000	17,130,400
Diesel	8,128,677	212,792,591	147,890,851
Propane	1,376,652	53,697,150	37,659,052
Gasoline	9,313,443	269,174,653	195,151,624
Total			**1,110,604,799**

Table 9. Combined HRM Energy Costs, 2005

Category	Energy (GJ)	Energy (L)	Cost ($)
Electricity	19,002,712	-	633,424,244
Fuel Oil	13,986,646	355,348,824	297,071,617
Heavy Oil	3,196,636	76,562,685	26,796,940
Diesel	8,355,497	218,730,287	214,355,682
Propane	1,415,065	55,195,472	55,195,472
Gasoline	9,573,321	276,685,578	287,476,315
Natural Gas	600,000	-	7,080,000
Total Cost			**1,521,400,270**

Table 10. Projected Combined HRM Energy Costs, 2007

Category	Energy (GJ)	Energy (L)	Cost ($)
Electricity	19,354,584	-	703,217,118
Fuel Oil	13,656,746	346,967,288	249,816,447
Heavy Oil	3,255,828	77,980,394	28,852,746
Diesel	8,510,215	222,780,496	200,502,446
Propane	1,441,268	56,216,588	57,340,920
Gasoline	9,750,590	281,804,261	281,804,261
Natural Gas	1,200,000	-	18,396,000
Total Cost			**1,539,929,938**

With financial statistics such as the provincial GDP and average personal income by year also included, Table 11 gives the energy cost as a fraction of average personal income for the years 2002, 2005 and 2007. Data for 2002 and 2005 exists and this was used to forecast the approximate 2007 projections based on the 2006 census data.

Table 11. Energy Cost as a Percentage of Personal Average Income

Indicator	2002	2005	2007 Forecast
Population	362,691	372,811	382,153
Total Energy Cost	1,110,604,799	1,521,400,270	1,539,929,938
Per Capita Energy Cost	$3,062	$4,081	$4,030
GDP (Mkt Prices)[3]	27,082,000,000	31,344,000,000	34,551,500,000
Income Per Capita[4]	$25,426	$28,076	$29,994
Energy Cost/Income %	**12.0%**	**14.5%**	**13.4%**

Therefore, on average energy end users spend approximately 13% of their annual income directly on the purchase of energy. For figures on the total price that HRM residents pay for their use of energy (including health and environmental costs) please see Section 3.2. The life-cycle costs for use of energy in homes in HRM is a much larger percentage than that derived in Table 11 above. The life-cycle costs are larger in some buildings than in others. In buildings where developers built houses with low insulation levels and low energy efficient equipment in order to lower upfront capital cost and therefore the selling price for the house, energy related life-cycle costs are much higher. Buyers of these homes are attracted to moderate sale prices, while in fact the actual ownership costs of these low energy-efficient homes can become considerably significant overtime since houses are built to last decades rather than a few years.

3.2 True Costs of Emissions Inventory

In addition to direct financial costs to consumers, the production, transmission and use of energy have various other side effects on the natural and social community. These impacts, when converted to monetary terms, can be significant. This is especially true in an energy environment that is dominated by fossil fuels, as is the case for HRM. Discussions around the "true cost" of energy include monetization of natural and human resources and damage to them from the energy sector. Various studies have been conducted on the true cost of energy, the most relevant being the GPI Atlantic *Energy Accounts for the Nova Scotia Genuine Progress Index*[5]. This 400-page report, which was published in 2005 after two full years of research, is the first in-depth study of the sustainability of Nova Scotia's energy system and represents one of the most comprehensive assessments of energy ever compiled for the province. The analysis below follows the approach, analysis and information from the GPI Atlantic Report.

In determining the true costs of energy, all the unwanted spin-off costs which can occur at any stage of energy supply (exploration, production, transportation, storage, conversion, distribution), as well as at the demand end, are calculated. The main costs associated with energy supply and demand in HRM would be those related to health, environment and climate change. Human health concerns are largely associated with emissions, including air pollutants (a major root of respiratory diseases) and spills or harmful materials which eventually make their way into our food chain. Occupational health and risk of accidents can also be a factor. As the main consumer of energy in the province, HRM can be held responsible for these costs even if our energy extraction sites (e.g. coal mines, off shore oil rigs) are located outside of the municipality's footprint. We pay for these health impacts through our Medicare system, but costs are also borne by other sectors of society, like our schools and workplaces (through absenteeism and lower productivity).

Environmental concerns associated with the energy sector are also largely associated with air pollutants and spills. Emissions of CO_2, SOx, NOx, VOCs and particulate matter impact the quality of the air and are also responsible for acid rain, smog, ozone depletion, and species and habitat health. Oil spills, exploration and extraction of fossil fuels and impounded hydro-electric generation can have negative impacts on water quality and aquatic life. The release of toxic pollutants such as arsenic, mercury and lead, which can be generated in thermal generation stations, are also of particular concern to species and ecosystem health. Large scale energy projects also have various land-use impacts ranging from changes to habit, biodiversity, water flow, movement of species and invasive species. The waste generated from energy production (e.g. ash produced in coal combustion) also introduces environmental challenges related to waste management. Costs of environmental damages are borne by society through various channels including our health system. The degradation of our natural environment also imposes large opportunity costs, both direct (e.g. lowering of agricultural productivity, loss of tourism) and indirect (e.g. aesthetic value of nature, culture, history, etc.)

The contribution from the energy sector to climate change is of particular note in this discussion. It is now a well-known fact that we are experiencing climatic change and with it changes to our built and natural environments. This is at least in part due to the release of GHGs in the process of generating energy from fossil fuels. Judging from the latest reports on the impacts of climate change, including the Intergovernmental Panel on Climate Change (IPCC)'s Fourth Assessment Report (2007), it is also clear that the impacts of climate change will be very costly to society. In fact the 2006 Stern Review Economics of Climate Change puts the cost of the damage from climate change at a minimum of $85 for each tonne of CO2 we emit (more than twice the high estimate from the GPI Energy Accounts report) and calls climate change "the greatest and widest-ranging market failure ever seen". The cost of climate change will include expenses imposed by rising sea levels, more prevalent natural disasters, agricultural failures, changes in water quantity and quality, human health and many other factors.

Virtually all energy sources are associated with unwanted spin-off costs, though the impacts and the costs differ from one technology to another. Table 12 summarizes the nature of the health and environmental concerns for various energy sources.

Table 12. Summary of Key Impacts of Energy Sources (After GPI Atlantic Energy Accounts)

Source	Emissions and other by-products released	Health and environmental concerns	Specific health and safety concerns
Oil (and oil products)	CO_2, SOX, NOX, CO, VOCs, waste heat	Climate change, air pollution, acid rain, oil spills, oil rig accidents	Respiratory illnesses, accidents, hearing loss, musculoskeletal and repetitive strain injuries
Natural gas	CO_2, methane, CO, NOx, waste heat	Climate change, pipe leakage, methane explosions	Respiratory conditions, accidents
Liquefied natural gas	Same as natural gas though higher CO_2 per unit energy	Same as natural gas but with potentially more damaging explosions and spills	Same as natural gas but with potentially more damaging accidents
Coal	CO_2, SO_2, NOx, Ash, PM, Hg, waste heat	Climate change, smog, mercury contamination	Accidents, silicosis, pneumoconiosis, cancer
Nuclear	Radon, radioactive release, waste heat	Disposal of radioactive waste, risk of accidents, routine release of radioactive substances, terrorist attack, spread of nuclear weapons	Cancer, burns, cataracts, spontaneous bleeding, neurological and genetic damage, lost fertility, deformities, death from accidents
Biomass	VOCs, PM, Ash	Land use, incomplete combustion	Respiratory conditions, cancer from indoor inhalation of fumes
Hydro	Methane from rotting material in large dams (under study)	Displacement of people, ecosystem flooding, hydrological disruptions	Displacement of people, noise, accidents

Source	Emissions and other by-products released	Health and environmental concerns	Specific health and safety concerns
Wind		Noise, visual intrusion, bird mortality	Noise, visual intrusion (though not necessarily more than for other energy systems), accidents during construction
Tidal bore		Flooding/disruption of ecosystems, fish mortality or disruption of migration routes	Flooding accidents
Solar		Use of toxic materials in manufacturing process (especially photovoltaic), battery disposal (if off-grid), possible land use issues and visual intrusion with large scale development	Exposure to toxic materials, work place accidents

To generate monetary values from the qualitative description of environmental and health impacts described above, economists use different monetization methods. The methodology used by GPI Atlantic, and by extension in this report, is called Damage Cost, which as suggested by the name involves the monetization of various environmental and social damages (on human health, land use, visibility, agricultural and forest productivity, etc.) through the development of models or projected per tonne damage costs for each pollutant emission. It is acknowledged that the methodology is far from perfect mainly because of limitations in information and the complexity of the task (e.g. the fact that damages witnessed in one jurisdiction are often caused by activities in another jurisdiction). Full cost accounting remains an imprecise science, perhaps because environmental and social systems do not lend themselves well to measurement within our current economic system.

Following the example of GPI Atlantic, full cost accounting presented here draws on studies from a variety of locations that have linked ultimate damages on a regional or global scale with initial actions to develop a per tonne cost of emissions for each pollutant and for greenhouse gases. Having considered at least twenty (20) different studies on the subject from Canadian, American and European sources, the following per tonne cost of emissions is used in this calculation.

Table 13. Cost Estimates Per Unit of Pollution

Pollutants	$C 2007/tonne	
	Low	High
CO	$2.34	$7.02
GHGs (C.eq)	$7.34	$42.76
TPM	$2,480.40	$6,060.60
SOx	$1,614.60	$12,285.00
NOx	$1,649.70	$14,566.50
VOCs	$2,340.00	$9,640.80
Hg	$9,571,068.00	$13,480,155.00

Note: Dollar values for damage cost were taken from GPI Atlantic Energy Accounts and adjusted based on a 2.26% annual inflation rate between 2000 Canadian dollars and 2007 Canadian dollars.

As shown in Table 13, there is a large degree of uncertainty and, therefore, a large range of possibilities around the dollar value of damages that can be assigned for each tonne of emission for various pollutants. The low and high estimates are applied to the tonnes of emissions of various types of pollutants estimated for 2007 (Table 14).

Table 14. Estimates of Pollution Costs in HRM Community

Pollutant Type	Pollution (tonnes)	$C2007/tonne (LOW)	Damage Cost (LOW)	$C2007/tonne (HIGH)	Damage Cost (HIGH)
CO	113,989	$2.34	$266,735.35	$7.02	$800,206.05
GHGs (C.eq)	6,777,000	$7.34	$49,715,394.30	$42.76	$289,808,239.50
TPM	6,596	$2,480.40	$16,360,667.12	$6,060.60	$39,975,592.31
S0x	60,212	$1,614.60	$97,218,976.29	$12,285.00	$739,709,602.24
N0x	26,739	$1,649.70	$44,110,690.88	$14,566.50	$389,488,015.25
VOCs	13,513	$2,340.00	$31,619,856.22	$9,640.80	$130,273,807.63
Hg	0.108	$9,571,068.00	$1,031,191.81	$13,480,155.00	$1,452,358.86
Total	**221,049**		**$240,323,511.98**		**$1,591,507,821.85**

Note: Emission values were taken from GPI Atlantic Energy Accounts and adjusted from 2000 Nova Scotia figures to 2007 HRM figures based on population ratios. The calculations assume no change in the types of energy sources generating the pollutants between 2000 and 2007 and no significant difference in energy use between HRM and other part of the province. Although the major sources of pollution (i.e. power plants) are not located in HRM, this per capita accounting of province wide pollution levels properly assigns the correct share of the pollution to HRM residents.

The calculation above suggests that the true cost of HRM's energy includes somewhere between about 240 million and 1.6 billion dollars worth of damage to the environment and society. Assuming a population of about 380,000 by the end of 2007, this translates to an average of $632 per person per year on the lower end, and $4,191 per person per year on the higher end in health and environmental costs to HRM's citizens. Given that the data were derived from province-wide assumptions, it is more likely that the actual costs of the local pollutants (NOx, SOx, VOCs etc.) are towards the higher end of the range, considering that the impact of local pollutants increases with concentration. Despite the large range of possibilities, the calculations clearly indicate that there is a large health and environmental price tag associated with energy use in HRM. If we add the cost to health and environment borne by each HRM resident to the average price that they pay directly to purchase energy, the true cost of energy to each HRM resident is estimated at $4,662 at the lower end of the range (or 15.5% of the average income) and at $8,221 at the higher end of the range (or 27.4% of the average income.)

4 REVIEW OF RENEWABLE ENERGY RESOURCES IN HRM

Figure 7 in Section 2 is referenced to recap community HRM's state of energy requirements in the years 2002, 2005 and 2007. Figure 8 below summarizes community GHG emissions resulting from energy consumption in the same years.

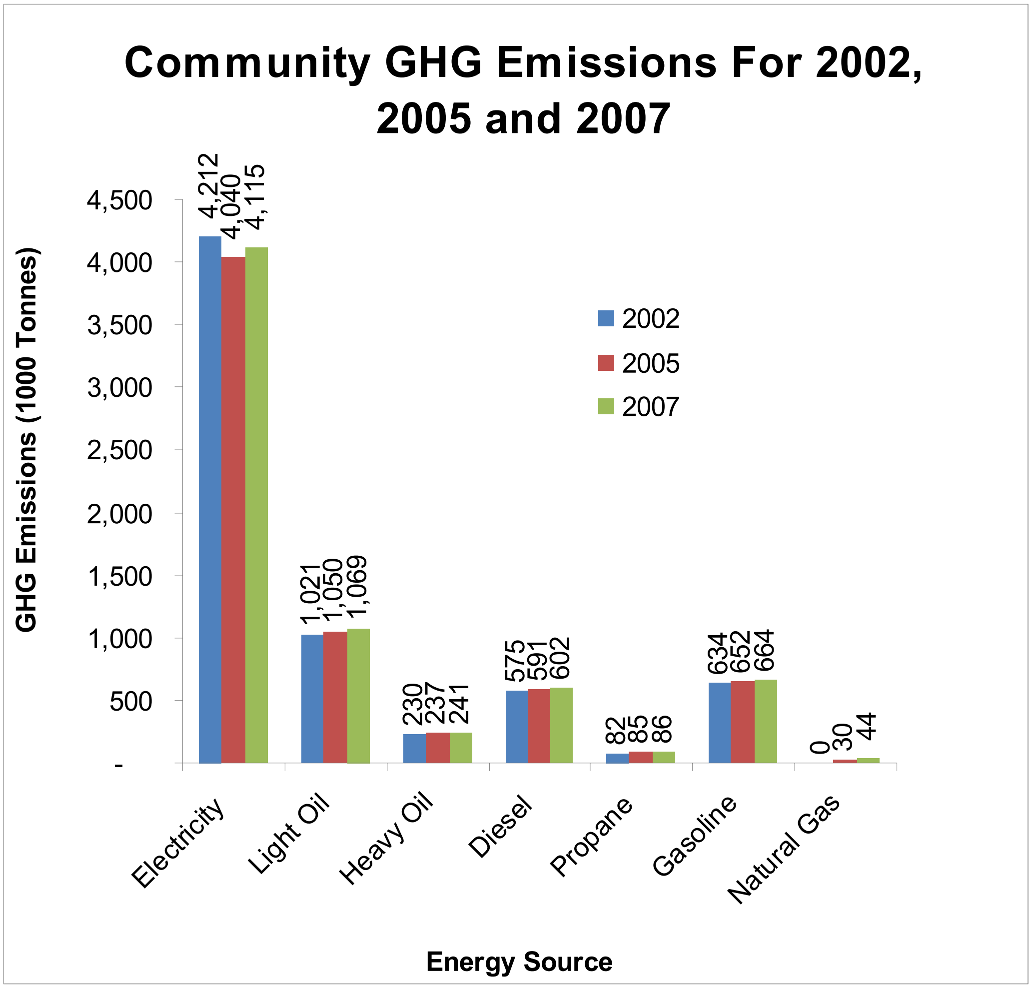

Figure 8. HRM GHG Emission Estimates for 2002, 2005 and 2007

Studies carried out by Natural Resources Canada, GPI Atlantic, and other independent and government agencies show that there are more alternative and renewable forms of energy available in Nova Scotia than Nova Scotians seem prepared to try out at present. Many of these published studies have presented energy and energy utilization statistics that are a province-wide aggregation and not specific to any municipality or region. Though not directly specific to HRM, however, many of these provincial-based energy matrices could be applied to HRM and other Nova Scotia regions.

Nova Scotia is touted to have potential technically and commercially viable reserves of the following forms of renewable energy resources:

- Biomass
- Landfill gas
- Liquid biofuels and other forms of biogas
- Wind
- Solar
- Hydroelectric
- Earth Energy
- In Stream Tidal Energy

The above energy sources are rapidly renewable, non-polluting and very relevant to HRM. As such, it is the major focus of this CEP study to find ways to optimize inclusion of some of these sources into the current and future energy supply for security and sustainability of HRM. This report presents only brief discussions around the availability and potential of these resources. In-depth exploration, harvest feasibility, cost-effectiveness and the energy policies will form part of the ensuing reports at the latter stages of the project when developing implementation strategies. Although not a form of renewable energy, natural gas is a much cleaner alternative to currently available fossil energy sources in much of HRM. Greater utilization of natural gas as a substitute for more carbon intensive fossil fuels will have a positive environmental impact. Natural gas utilization has therefore been included in this analysis.

4.1 Biomass

Sources of this form of fuel are numerous and include residues from sawmills and wood furniture manufacturers; long-horn brown beetle invested trees in most forest areas within HRM; agricultural residues; municipal solid waste and forest floor residuals. Use of biomass in HRM is especially feasible in small and medium scale cogeneration plants utilizing steam to provide thermal loads as well as produce electricity for the grid or direct distribution where applicable. Due to its greenhouse gas-neutral characteristics (the same amount of carbon dioxide being absorbed by the plants during photosynthesis as released during combustion), biomass is seen as a “must-burn”, abundant, competitive and sustainable energy source. According to Natural Resources Canada’s study titled “Alternative Energy Sources For Potential Community Use” (CETC-CANMET, 2003)[6], hundreds of tonnes of bone-dry sawmill and lumber plant residues are currently being landfilled and/or incinerated without heat recovery across the country. Given its carbon dioxide neutral status, its low SO_2, NOx and metals emissions from combustion, biomass fuel can also be used in blending and co-firing applications with coal in coal-fired generating stations (CETC-CANMET, 2003).

This 2003 CANMET study reported that great progress was being made in R&D for bringing to markets highly efficient, reliable equipment for firing a variety of biomass fuels. Many of these were already in use as of 2005, and more advances are being achieved technologically through continued R&D efforts. According to the same study, a 1-MW biomass-fired unit would require a biomass feed rate of approximately 0.5 to 0.75 tonnes per hour. The annual energy output from this unit would exceed 32,000 GJ of electrical energy, and about 25,000 GJ of thermal capacity in the form of steam for HRM’s thermal load requirements depending on the desired power/thermal balance of the cogeneration plant. To produce this quantity of energy from this unit annually, approximately 5,500 tonnes of biomass would be required every year.

To put this into perspective, the 1-MW biomass-fired unit would produce enough energy to meet close to 10% of the total corporate HRM 2002 energy requirements (bearing in mind that Transit is not included in total corporate energy and GHG analysis in this framework). Depending on the amount of biomass sources that are confirmed available and sustainable within HRM, larger cogeneration units, or multiples of the 1-MW project described above would be possible. If 30,000 tonnes of average to high grade biomass were available to HRM annually, more than 50% of all of corporate HRM energy requirements would be met while reducing GHG by about 50,250 tonnes, or a 50% reduction below the 2002 level. Mactara Ltd lumber company located in Upper Musquodoboit claims to produce approximately 120,000 tonnes of bark pellets. Nearly all of these are transported to the Port of Halifax for shipping to Europe and elsewhere. This pellet production rate would be capable of supplying 100% of HRM corporate electrical and thermal energy needs. There are numerous sawmills located within and near HRM. The following mills (Table 15) are listed in order of size and are currently operational and located in HRM, with the exception of Laurie Isenor Sons that is marginally beyond the political HRM boundary, but practically near enough to count in this list:

Table 15. Sawmill Locations in HRM

SAWMILL	LOCATION	CAPACITY
Mactara Ltd.	Upper Musquodoboit Valley	TBD
Ledwidge Lumber Company Ltd	Old Post Office Rd, Enfield	TBD
Hefler Forest Products Ltd.	Lower Sackville	TBD
F.W. Taylor Lumber Ltd	Middle Musquodoboit	TBD
Barrett Lumber Company Ltd	Beaverbank Rd	TBD
Laurie Isenor & Sons Ltd	Lantz	TBD

While the above scenario demonstrates the impact of biomass combustion alone, other biomass fuels can be derived from other varieties such as landfill gas, anaerobic digestion, bio-oil, ethanol and biodiesel in transportation and heavy fuel-fired machinery. The combined effect of utilizing these potential fuels across HRM transportation needs, electricity generation and thermal uses highlights the opportunities that HRM could exploit to reduce the level of dependence on fossil fuels, while also dramatically improving the wellbeing of the residents and the environment through cutting deep the levels of GHG, SO_2 and NOx emissions.

4.2 Wind

HRM could certainly benefit from wind projects for power generation. Pending legislation and pertinent provincial policies, energy harvesting from wind farms within and around HRM could prove to be very key to ensuring clean and free energy for HRM. HRM already has several initiatives to test potential sites for wind harvesting under the Wind Energy Program being conducted by Mr. Shayne Vipond of HRM following the adoption by Council of the HRM Wind Energy Master Plan in late 2006. Two of six information sessions were scheduled for March 2007 for communities within areas that have lucrative wind regime for energy provisions. While HRM is pushing forward to do its part in assessing all possibilities, provincial power production and distribution regulatory authorities will have to do some work to ensure adequate modifications to policies to enable HRM's transition to renewable energy. Also, through adoption of the Green Power Purchasing Strategy, HRM is on the verge of achieving greater energy security and GHG reduction results through procurement of wind power, on the condition of removal of regulatory and other barriers by Nova Scotia Department of Energy and other relevant key stakeholders.

4.3 Solar

Solar energy can be harnessed in various ways to provide energy to different HRM sector needs. Primarily, solar energy applications are either active or passive. The different solar absorption and use potential and technologies are described below:

4.3.1 Photovoltaic Cells (PV)

Photovoltaic technology remains the surest way for conversion of solar energy directly to electricity. R&D breakthroughs in Canada and in the USA have modified PV cells to become more affordable without compromising effectiveness. This form of energy has not been very affordable in the past, but the CETC-CANMET study projected that by 2010 the production price of electricity from PVs in Canada could be expected to drop to approximately US$0.14/kWh, and further to about US$0.08/kWh by 2020. Some of the issues to be resolved for enabling wide-spread adoption of PV modules in HRM include access to provincial electricity grid system and feed laws legislation. The lack of scale economy is a disincentive to prospective investors within the Nova Scotia legislative regime.

For HRM's voluntary GHG reduction target of 20% by 2012 below the 2002 emission rates, it is important to note that each installed kW of PV power has the potential to offset about 1.6 tonnes of CO_2/yr when replacing coal-generated electricity; 1.3 tonnes per year when replacing oil; and 0.7 tonnes per year when replacing natural gas (CETC-CANMET, 2003).

4.3.2 Solar Air Heating

For thermal applications, solar energy has been utilized very optimally through pre-heating and heating of ventilation air in commercial, industrial and some residential buildings. The technology used in this application is known as the Solarwall System. The Solarwall System consists of a perforated dark-coloured metal cladding which is installed on south facing building walls to form an airspace (cavity) between the Solarwall and the building's outer wall surface. This system can pre-heat ventilation air by between 17 - 30º C, with the efficiencies improving slightly at colder temperatures and when the nearby ground is covered in snow. There are three such installations in Nova Scotia, one of which is in HRM on Waverly Road. This technology is best suited to large industrial or institutional buildings.

Considerable amounts of energy are used annually across HRM to preheat ventilation air for a variety of space types. Most abundantly used fuel types for ventilation preheat in HRM are oil for hot water and steam boilers, and electricity in electric-fired preheat coils in air handling units. Use of solar air heating through the Solarwall system could potentially cover 33% of all of HRM industrial and institutional space heating needs with zero emissions to the atmosphere. Conserval Engineering, based in Downsview Ontario is currently the sole provider of this technology, which is endorsed by Natural Resources Canada and subsidized by the Federal government through a program known as Renewable Energy Deployment Initiative (REDI). The Federal REDI subsidy is 25% of total project cost up to $60,000 per project if design is verified by either SWIFT or RETScreen Software. The Solarwall system can be applied to new constructions as well as in renovations of existing buildings without major, and sometimes any, disturbance to existing ventilation distribution infrastructure.

A residential solar air heating system manufactured by Cansolair Limited is capable of heating 1000 square feet of floor area with a single 4 by 8 unit mounted on a south facing wall. These units retail for approximately $2000 each and claim paybacks of less than 8 years based on current energy prices. The units are manufactured in Newfoundland and sold through solar dealers across Canada.

4.3.3 Solar Water Heating

Within HRM, there are already many residences and rental apartment units which have long been utilizing solar energy to heat water for domestic hot water and for hot water heating applications. According to Solar Nova Scotia[7], the current solar hot water industry leader in Canada is Thermodynamics Ltd, owned by a Dalhousie University Engineering Professor, and located in Burnside. From the company's monitored installations, system payback has been typically seven (7) to ten (10) years. One of the largest examples of this technology in HRM is the 100-collector system at Quinpool Tower on Quinpool Road. In this facility as in the similar other installations, solar energy supplements conventional fuel to heat water for domestic use and for space heating. With many proven installations within HRM and without, Thermodynamics has demonstrated that there is plenty of under-utilized capacity for use of solar energy in HRM and other Nova Scotia communities. While all solar water heating installations in Canada are of individual nature with the exception of the Drake Landing project in Okotoks, solar district heating has been used and is highly utilized in the European Community (EC). EC reported over 10 million m^2 of installed glazed solar panels in 2001 for small-scale residential and commercial water heating systems. By 2002 nine solar district heating systems had been funded and installed across five member countries. By following the example of the EC, and given the fact that there exists locally owned and operated solar water heating industry leader in Burnside, HRM surely stands a good chance to equal and even outperform the EC example. Currently, the bulk of the production orders received by Thermodynamics are from Europe and as far as Southeast Asia and Japan. Demand for solar water heating devices and technology in Canada and HRM as a region continues to lag behind other parts of the world.

4.3.4 Passive Solar Applications

Passive solar applications can be considered a demand side management approach in which buildings are constructed and orientated so as to maximize the capture of solar radiation. In collaboration with the Nova Scotia Home Builders Association, emphasis should be placed on designs that allow for optimal intake of solar heat and light through windows and skylights so as to reduce heating and lighting costs. This is partly a function of Land Use planning by HRM, as well as an Energy Code for Buildings (which does not exist in Nova Scotia), but federally there is Energy Efficiency Act under the federal Office of Energy Efficiency. When buildings are designed for optimal solar and light absorption, large energy expenditure can be avoided from natural heat through maximized fenestration, while technology allows indoor lighting to be coordinated with natural outdoor light for maximum savings and comfort.

4.4 Hydroelectric Power

According to NSPI's website, currently there are thirty-three (33) hydro plants across seventeen (17) river systems in Nova Scotia. These plants are estimated to generate up to 360 MW of electricity, which is approximately 16% of total capacity for Nova Scotia Power. Reports by NRCan assert that hydro provides about 60% of Canada's needs with the bulk uses in Quebec, BC and Ontario weighing in at 32,000 MW, 12,000 MW and 8,000 MW respective capacities. NRCan also acknowledges that Nova Scotia is at a disadvantage for hydro resources due to its unfavourably flat landscape.

Our team has taken a brief examination of the possibilities for small hydro opportunities within HRM through exploration of the following river systems:

- Musquodoboit River (At Crawford Falls; Near Middle Musquodoboit; and at Upper Musquodoboit)
- Sheet Harbour (At East River at Malay Falls; at Half Way Brook; and at Little West River)
- Ecum Secum
- Moser River

Some historic flow statistics by Environment Canada have been compiled and are available in their hydrometric database for Musquodoboit and West Sheet Harbour rivers. However, monitoring seems to have been discontinued and the flow data are a little old for use with confidence. These streams will be further assessed for feasibility and cost-effectiveness of installing small run-of-the-river hydroelectric generations for HRM. Assessment will also employ the RETScreen software tool to determine technical viability and eligibility for funding through the federal REDI program.

4.5 Earth Energy

The proximity of the Halifax Harbour to most energy intensive institutions, industrial centres and Metro Halifax commercial buildings presents HRM with opportunities to explore use of harbour water for space conditioning loads within HRM. There are numerous plausible configurations either through open-loop or closed loop systems. Hydrological surveys and actual feasibility studies for earth energy projects are eligible for funding through REDI and the Green Municipal Enabling Fund. The City of Toronto's Deep Lake Water Cooling project is a groundbreaking initiative using a bulk water supply system where the year-round temperature is about 4º C. This project was designed to reduce peak summer cooling demand by over 250 MW. More information on the technicalities and feasibility of a variety of earth energy systems is available at the Earth Energy Society of Canada's website[8]. Varying degrees on implementation of this type of system are possible and could lend themselves to great use in HRM.

Currently, Purdy's Wharf towers and Casino Nova Scotia make use of the harbour's abundant water supply for space conditioning. Feasibility studies show good potential for harbour water to provide space conditioning at other buildings along the harbour such as the Nova Scotia Hospital and Dartmouth General Hospital.

Ground source heat pumps (GSHP) and water source heat pump (WSHP) are another major area of opportunity for utilization of earth energy. Configuration of these systems comes in either vertical ground loops or horizontal closed or open loops where the amount of available land permits. In the environment where jurisdictions are using energy efficiency as a tool to combat climate change, GSHP and WSHP are a great way to get more for less as coefficients of performance (COPs) are generally higher than those in electric air conditioning and heating systems.

4.6 Natural Gas

Natural gas is not a renewable fuel source; however, it is a much cleaner burning fuel than coal and oil. From the GHG reduction and environmental standpoint, it is better to burn natural gas for energy provisions than it is for coal or oil combustion. Table 16 below shows the increase in GHG emissions by burning oil and coal compared with an equivalent energy output using natural gas, while Figure 9 shows GHG emissions rates of all four fossil fuels when combusted to produce the same amount of energy, say 100 gigajoules (GJ).

Table 16. GHG Emission of Some Energy Sources Compared to Natural Gas

Energy	GHG Rate Above NG
Light Oil	32.5%
Heavy Oil	33.3%
Coal	50.5%

The content in Table 16 above was worked out from the emissions values featured in Figure 9.

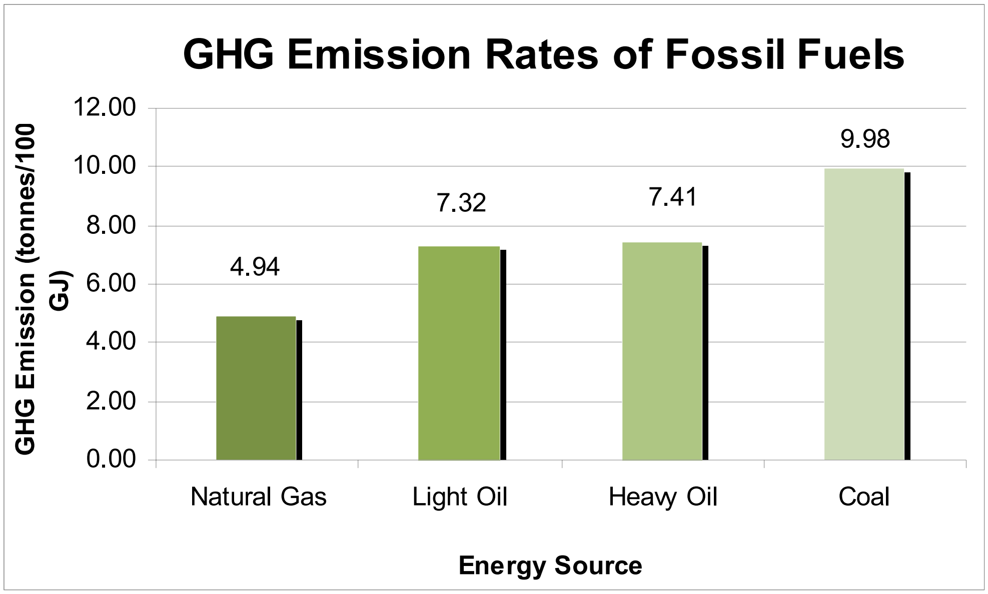

Figure 9. GHG Emission Intensity of Various Energy Sources

As seen both from Table 16 and Figure 9, natural gas burns more cleanly than bituminous coal and the oil variations from a greenhouse gas emissions perspective. Table 17 shows a comparison between natural gas and oil fuels for other products of combustion.

Table 17. Comparison of Pollutant Content Levels Between Natural Gas and Oil[9]

Type of Pollutant	Natural Gas	#6 Fuel Oil	#2 Fuel Oil
Carbon Monoxide (CO) (in grams/GJ)	36.3	18	18
Nitrogen Dioxide (NO2) (in grams/GJ)	43	75	66
Particulate Matter (PM) (in grams/GJ)	3.3	43	2
Sulphur Dioxide (SO2) (in grams/GJ)	0.26	1167	132
Carbon Dioxide (CO2) (in kilograms/GJ)	50.8	74	73

Natural gas was first introduced and used in HRM in 2002. Until 2004, distribution was limited to industrial uses in Burnside and at Tuft's Cove power generating station. In 2004, distribution was extended to residential and commercial applications in the north end of Dartmouth. Heritage Gas reported that in 2006 alone 300 customers were connected to the gas pipeline bringing the total number of natural gas consumers to just over 600. At the end of the 2005 calendar year, approximately 600,000 GJ of natural gas had been utilized from the beginning of the year to end of December. Ninety (90%) percent or 540,000 GJ of these were consumed by commercial buildings while the remainder went to residential. The distribution system is continuing to expand in Dartmouth and with plans in place for directional drilling under the harbour to bring natural gas to the Halifax Peninsula, Heritage Gas forecasters project that an additional 500 customers will be added to their distribution system annually, including several large industrial and institutional customers.

As demonstrated in Table 16, coal produces over 50% more GHG emissions per unit energy than natural gas, while on average oil is roughly 33% more GHG intensive than natural gas. Therefore, a positive GHG impact in HRM would be realized from replacing as much coal fired generation as possible with natural gas, and then oil next. Natural gas fired cogeneration plants for district and community energy heating will have to be re-assessed more critically as they represent the greatest GHG reduction opportunities. Furthermore, existing oil fired thermal plants in the Halifax Peninsula and in Dartmouth will need studies and assessments to analyse the feasibility for conversion to natural gas.

The 600,000 GJ of natural gas used in HRM in 2005 displaced over 14,000 tonnes of GHG that would have contributed to HRM’s emissions inventory assuming that the 2005 natural gas applications replaced or diverted use of oil. The displaced GHG emissions would be even greater if these installations diverted electric heating installations.

4.7 Waste Heat Energy Recovery

Although the recovery of waste heat is not conventionally regarded as a renewable resource because the original sources of such heat may not themselves be renewable, it is in fact “free” and clean energy. There is great potential for reclamation of waste heat from industrial processes for use in homes and in commercial buildings. For example, our team has met with NSPI Executive Management to discuss this kind of potential from power generating stations such as Tuft’s Cove and Burnside for district heating applications. Of course, suitable planning of new housing and commercial developments in HRM has to be improved to allow for optimal use of this kind of energy from process waste heat. Where existing community or commercial clustering within HRM has high enough density, feasibility studies should be conducted to evaluate opportunities for recovery of process waste heat energy from the nearby industrial operations.

5 REVIEW OF EXISTING PROGRAMS AND REGULATIONS

5.1 HRM Planning Strategies and Programs

HRM has been at the forefront of Canadian municipalities with regards to sustainability. As a member of a number of provincial, regional, natural and international sustainability initiatives, HRM strives to lead the way on this issue. Figure 10 places HRM's Healthy, Sustainable, Vibrant Community Corporate Theme in the larger context of sustainability.

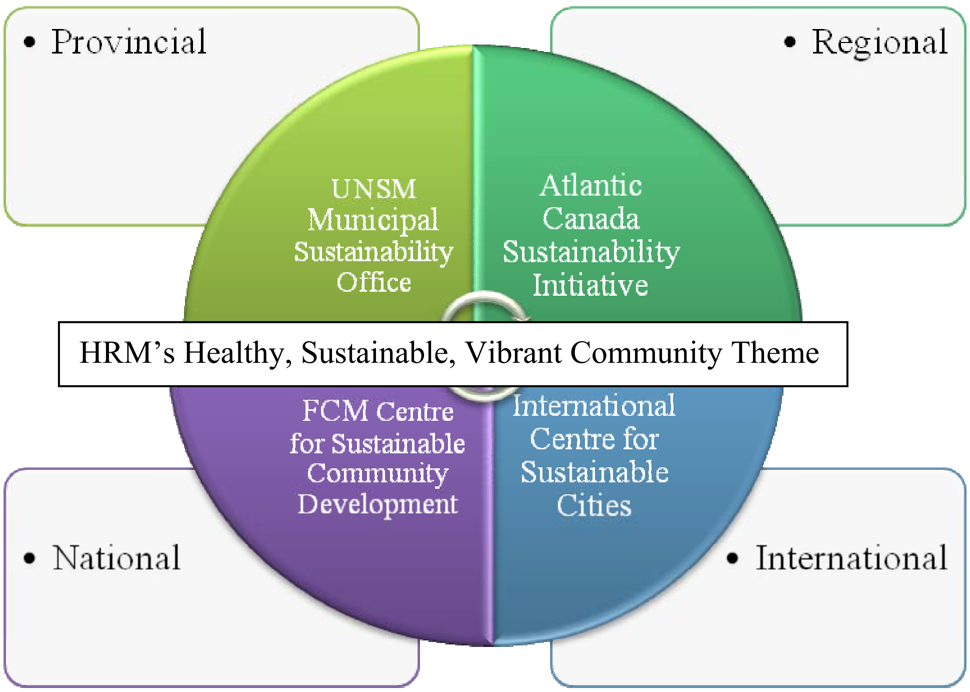

Figure 10. HRM's Sustainability Initiatives in the Broader Context

HRM Council has recognized the importance of the production and consumption of energy in the context of HRM's growth and long term prosperity. An emphasis on energy can be linked directly to HRM's Regional Council Corporate Themes as illustrated in Figure 11. Energy is a key component to environmental sustainability, which is a pre-requisite to HRM's vision of being a healthy, sustainable and vibrant community.

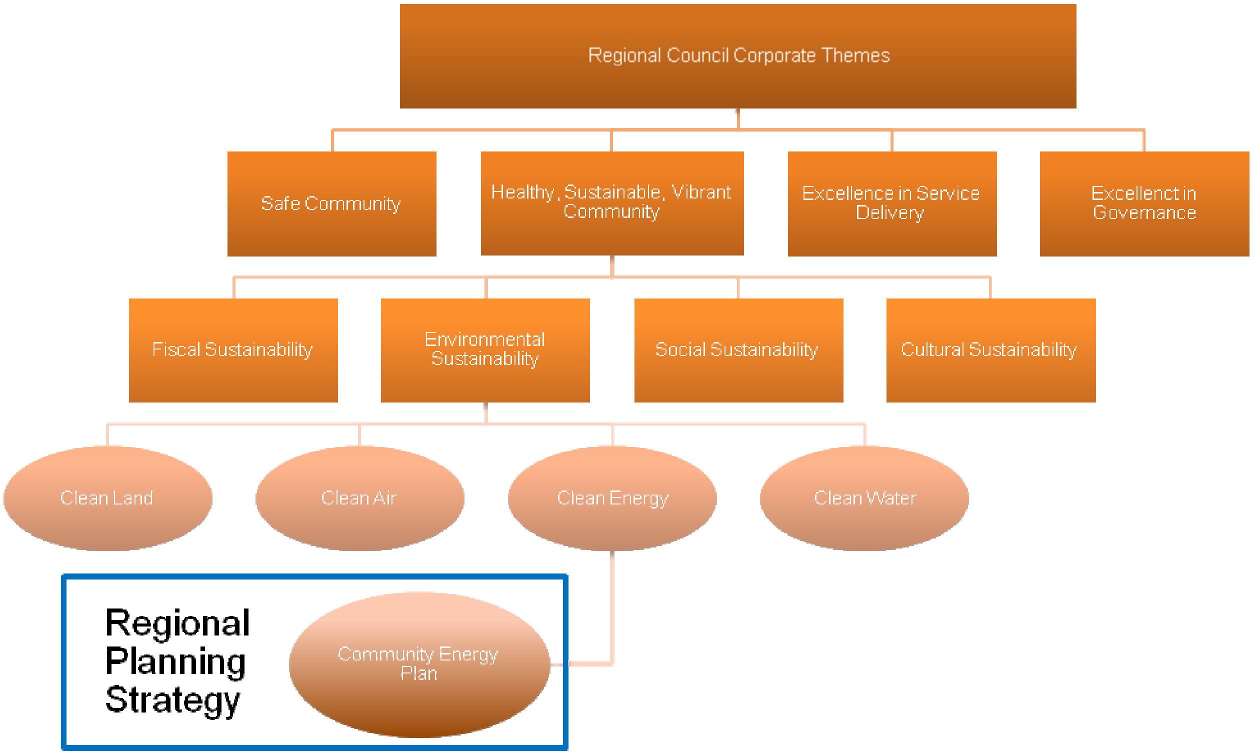

Figure 11. The CEP in the Context of HRM Corporate Themes

Even though energy is not a municipally mandated area, Council has committed to the development of an energy portfolio which will help HRM reduce costs internally, develop revenue diversity, reduce GHG emissions, address energy security, and act as a leader and advocate against impacts on the local economy and residents. HRM's commitment to action on energy has been demonstrated through a number of initiatives already. Broadly speaking, four types of energy initiatives are underway:

- **Clean Energy Projects** – these encourage a transition to cleaner forms of fossil fuels such as natural gas and biodiesel.
- **Lean Energy Projects** – these strive for energy efficiency and engage technologies that lead to overall reduction in the consumption and wastage of energy.
- **Green Energy Projects** – these promote the development of renewable energy sources.
- **Energy Strategy Projects** – these provide the framework for setting targets, objectives and plans and monitoring the progress towards a sustainable energy future.

Figure 12 illustrates examples of current and ongoing projects under each of the above-mentioned categories.

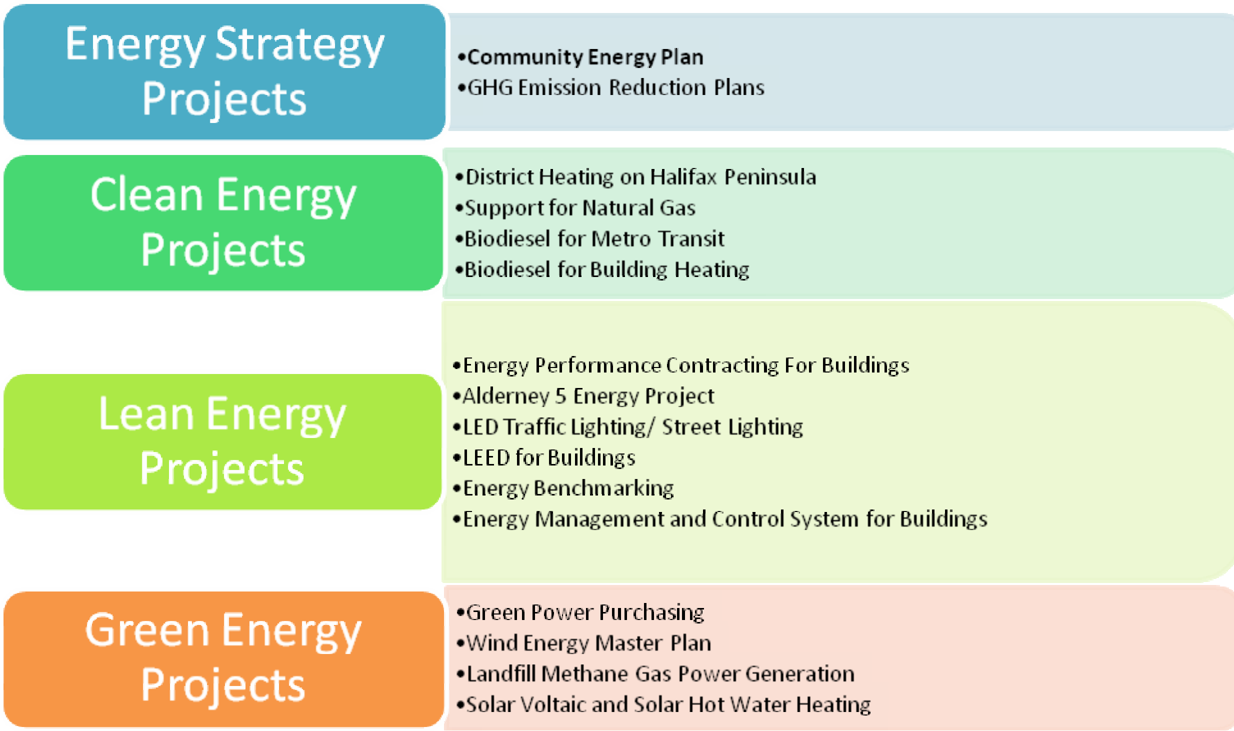

Figure 12. HRM Energy Initiatives Summary

The need for a community energy plan as an overall strategic element has been recognized in the 25-year Regional Municipality Planning Strategy (Regional Plan) completed in 2006. The CEP is one of a number of Functional Plans identified by the Regional Plan as “detailed management guidelines for setting budgets for programs, services and facilities consistent with the implementation of [the Regional] Plan”. Policy SU-30 of the Regional Plan is the policy driver behind the existing CEP project.

There are significant synergies among the CEP and various other Functional Plans. As a result, the CEP Project Team has reviewed progress to date of the various Functional Plans (Table 18).

Table 17. Synergies Between CEP and Other Functional Plans

Functional Plan Name	Policy Ref.	Status
Emission Reduction	E-22	The Clean Air Strategy and the Corporate and Community Local Action Plans to Reduce GHG Emissions were put in place once approved by Council in 2006. These documents draw on the ICLEI reports cited in Section 2, to review emission data from various sectors and recommend a set of strategies and actions for emission reduction. Due to the close links between energy use and air emissions, the Emission Reduction Functional Plans are an important parallel to the CEP. These reports have been reviewed in detail. The emissions baseline information has been extracted and updated for the CEP (see Section 2) and the recommendations are considered in the assessment of options and design of an implementation strategy for the CEP (Task 4).

Functional Plan Name	Policy Ref.	Status
Transportation Master Plan including: **- Roads and Road Network** **- Public Transit** **- Active Transportation** **- Transportation Demand Management** **- Regional Parking Strategy**	T-6 T-7 T-8 T-9 T-10 T-11	Transportation is responsible for about 24% of total energy consumed in the HRM community and about 13% of GHG emissions. It also has significant environmental costs as it is largely responsible for urban air pollution and smog. The creation of a Transportation Master plan can be a significant step forward to reducing energy demand and costs to households and individuals. This task has been scheduled for the 08-09 fiscal year as part of the implementation of the Regional Plan. However, progress has been made on a number of the sub-components of this plan. In particular, the Active Transportation Plan was approved by Council in 2006. This is a detailed plan outlining a bicycle route network, a pedestrian zone system and a regional trail route system. It recommends a 20-year implementation strategy for the cost of $100 million and includes detailed policy recommendations, trail bylaws, technical recommendations, human resources recommendations, potential partners and funding mechanism, cost estimates and an education and promotion campaign. Other sub-components of the Transportation Master Plan are in early stages of development.
Urban Design Guidelines	EC-19	Urban design is linked to energy use as it defines the relationship between citizens and the built environment. Good urban design creates attractive, comfortable and functional spaces, which in turn encourages active transportation. Smart urban form also puts an emphasis on density, which is key to the success of public transit and community energy projects. Guidelines around design, orientation, building materials and distances between buildings also have implications for energy efficiency and accommodation of certain types of renewable energies. HRM is currently in the middle of the HRM By Design process, which will generate a set of recommended urban design guidelines sometime in 2007. While the focus of this study is not explicitly on energy, a review of efforts to date suggest that energy efficiency is a concern for the study team and likely recommendations will focus on density and transportation links mentioned above, in favour of increasing energy efficiency within HRM.
Opportunity Sites	S-39	The Regional Plan and the HRM by Design study have begun to generate a list of empty or underutilized sites within HRM, highlighted for their potential for development. The development of these sites, in most cases, amounts to urban infilling, which has implications for energy similar to those described above. Continuity in the urban fabric and increase in urban density, assisted by infilling, helps create communities that support active transportation, public transit, district energy projects, and more energy efficient delivery of services. The Opportunity Sites Functional Plan is currently in progress and expected to have a positive impact on the energy performance of HRM when implemented.

Functional Plan Name	Policy Ref.	Status
Business Park Development	EC-21	Business parks are major employment centers within HRM and act as the destination for a large number of daily commutes. A business park development strategy that includes a mix of residential, retail and offices can reduce these trips by creating a more complete community which can meet the multiple needs of its members. Business parks also have potential for district energy and other types of community projects. The Business Park Functional Plan has the potential to positively contribute to the energy efficiency of HRM.
Underground Utilities	SU-29	Energy efficiencies can be gained through the design and operation of municipal utilities. Combined utility ditches, for example, can reduce the energy costs of installation while making some forms of energy infrastructure more economically feasible. The Underground Utilities Functional Plan has the potential to make a positive contribution to the overall energy sustainability of HRM.
Revenue Strategy	EC-22	The implementation of most Functional Plans, including the CEP, is dependant on the existence of appropriate financial signals. As a collector of municipal taxes and a regulator in the building sector, HRM is in a position to influence financial signals and therefore residents' choices. HRM is in the very early stages of revamping its Revenue Strategy including changes to the current tax structure and incentive/disincentive systems. An explicit objective of the Revenue Strategy is to support and encourage outcomes of the Regional Plan. Ensuring that energy efficiency is considered in setting the revenue strategy can make a large difference to the ease of implementation of the recommendations within the CEP.

There are several other Functional Plans resulting from the Regional Plan that have synergies with one or more aspect of the CEP including the reduction of GHG emissions. The Urban Forest Management Plan (underway) for example, can make a contribution to reducing GHGs and air pollutants which can be taken up by forests in the process of photosynthesis. The Wastewater Management Plan and other initiatives on public utilities, can utilize methods and technologies that are more energy efficient than others. They can also contribute to the overall community form through setting development boundaries, which influences transportation choices.

Of importance to the use of energy also are the settlement patterns prescribed by the Regional Plan itself. Of the projected 58,750 additional residential units in HRM over 2001-2026, 25% are envisioned within the Regional Centre, 50% in the suburban areas, and 25% in the rural areas. These numbers are consistent with the trend over the past number of years. However, the Regional Plan superimposes a settlement pattern on the above that would require development in suburban and rural areas within designated growth centres. The scheme allows small scale infill development on existing rural roads, while large scale developments in rural areas are only permitted through an Open Design Development application, which also encourages clustering of homes as much as possible. The intent of the Regional Plan's prescribed settlement patterns is to encourage local density and discourage sprawl, so that municipal services can be provided on a more cost and energy effective basis. The creation of nodes can also lead to more complete communities, reducing the need for commuting and paving the way for community energy projects.

In addition to the Regional Plan and its associated Functional Plans there are other initiatives within HRM with a link to energy. One such initiative worth mentioning is the HRM Economic Development Strategy which was developed in parallel with the Regional Plan. The Economic Development Strategy does not explicitly touch on the topic of energy, but it does propose a number of actions that have implications for use of energy in HRM as they support existing or upcoming Functional Plans and other initiatives mentioned above. These include:

- Dedicate resources to streamline review and approval process for significant new residential, industrial and commercial expansion while meeting community objectives;
- Adjust policies and taxes to encourage business priority and clustering of economic activities;
- Modify regulatory barriers to office development in the Capital District while remaining consistent with community objectives;
- Identify strategic reinvestment areas to ensure adequate long term supply and diversity of industrial and commercial land and building types;
- Support the Strategic Joint Regional Transportation Planning Committee to coordinate bridge, road and public transit priorities, and
- Support the development of a new transit corridor as proposed in the Regional Plan.

Perhaps the most significant economic development and energy synergy can be found in the desire for a strong Capital District, termed “HRM’s Urban Heart” by the Economic Development Strategy. A compact, vibrant, healthy and attractive downtown is a magnet for economic activity, while at the same time representing one of the most sustainable forms of development as it creates opportunities for transit and efficient space heating among other benefits. The eroding density advantage in the HRM Capital District is a main concern from an economic development perspective and is thus central to the recommendations put forward in the Economic Development Strategy. It should be equally as important to the CEP, creating opportunities for cooperation between the two groups.

5.2 HRM Bylaws

Like most other communities in Canada, HRM’s bylaws were not written with specific reference to energy concerns and the word “energy” does not appear within HRM’s Bylaws. Subsequently, there is no support within HRM’s bylaws for implementing energy initiatives. In fact in some cases the existing bylaws, or lack of necessary bylaws, may be a barrier to implementing certain energy initiatives. It is difficult to identify the presence of blocking bylaws or the absence of enabling bylaws in the abstract and without reference to the energy initiatives HRM may want to implement. The CEP team may comment further on either presence of blocking bylaws or the need for enabling bylaws within the specific context of the desirable energy initiatives once they are identified through Task 4 of the CEP process.

It is worth noting that the set of bylaws accompanying the Regional Plan puts forward some provisions with implications for energy, primarily as related to implementation and enforcement of the settlement patterns and other aspects of the Regional Plan described in Section 5.1. Some examples include:

- Bylaws applicable to subdivision development within the designated rural areas restrict new road construction and the number and composition of lots to ensure the desired levels of clustering is achieved and development is directed to municipality serviced growth boundaries.
- Provisions allow reduction of lot frontage within the urban areas to allow for higher density within these areas.

Many other communities in Canada and elsewhere have, over the last few years, introduced additions to their bylaws which support sustainable development especially by encouraging development forms most appropriate from an energy perspective. These have been reviewed as part of the background study for the CEP. Some examples of other jurisdictions with innovative bylaws are presented below.

Table 18. Examples of Energy-Relevant Bylaws

Bylaw Focus	Example
Encouraging Green Building Development	The City of Vancouver has adopted a minimum energy efficiency standard for new municipal buildings. Vancouver's existing Energy Utilization Bylaw requires that new buildings comply with the Model National Energy Code for Buildings 1997 (MNECB), or with ASHRAE/IES Standard 90.1. The exact wording for the Energy Efficiency Standard for Municipal Buildings, and potentially for all commercial buildings in the future, can be taken directly from Vancouver's Energy Utilization Bylaw, located in Section 6.4 of the Vancouver Building By-Law 1999. Bowen Island has instituted a Green Design Building Checklist. The Checklist is attached as Appendix "G'" to the Bowen Island Municipality Building Bylaw, No. 65, 200241 and is introduced in the body of the Bylaw as follows: *5.3 Bowen Island Municipality supports the use of alternative and innovative methods of design and construction procedures including the use of materials and systems which fall under the heading "building green". For information purposes only, a copy of the "Green Building Guidelines" is attached as Appendix "G" to this Bylaw.* Port Coquitlam recently instituted a Sustainability Checklist for rezoning and development permit applications. It asks proponents to score themselves on a range of questions, adopting a comprehensive "triple bottom line" approach (environmental, economic and social) to assessing proposals. The Checklist flows from Port Coquitlams's recently revised OCP, which states explicitly a policy to "Incorporate sustainable development and "smart growth" principles and practices into community planning." The City of Scottsdale, in Arizona, has a fast-track plan review under its Green Building Program, which "…encourages a whole-systems approach through design and building techniques to minimize environmental impact and reduce the energy consumption of buildings while contributing to the health of its occupants." 66 The program is entirely voluntary and uses a point rating system to qualify projects; it claims that green building projects receive approval in half the time it takes for a regular plan approval. In 2005, about 33% of all buildings adhered to the criteria established by the

Bylaw Focus	Example
	Scottsdale program. The program is promoted with job site signs that distinguish the project and show the builder as environmentally responsible. The city also lists and publishes builders and architects participating in the program, and provides extra green building inspection and certification as part of the process. The program also sponsors lectures and educational materials. The City of North Vancouver currently uses density bonuses and other incentives to encourage “enhancement of the environment through high efficiency (“green”) building design.”
By-laws related to District Heating	The City of North Vancouver has established by-laws that require all new or retrofitted buildings to have hydronic space and water heating systems compatible with and connectable to a future district system. Information on their experience in pursuing a district heating system is available on the City website.
Energy Consciousness in Official Community Plan	City of Surrey's Official Community Plan, dated January 28, 2002 (By-law #12900), "build complete communities" is basic policy "C" (p.3), with "build Energy Efficient Communities as policy C-6 (p.58-59). Policy C-6 includes an extensive list of "guidelines to promote energy-conscious planning and design." Energy is addressed in section 7.4 of Richmond's Official Community Plan, approved March 15, 1999, as part of the chapter on "City Infrastructure". The energy section includes the objective to "promote a sustainable energy future by increasing energy efficiency in all sectors of the City," as well as seven subordinate policies. Policy (a) states: "recognize that efficient use of energy has a positive effect on the well-being of the community, through decreased energy costs, improved environmental quality and more efficient urban land utilization." The District of North Vancouver has revised the terms of reference for their Advisory Planning Commission to include energy considerations. Section 8 of bylaw 5872 (Advisory Planning Commission Bylaw) states that: "The APC will consider a wide range of issues, including, but not limited to energy conservation and awareness issues."
Subdivision Design	A set of Design Guidelines, along with Surrey’s Official Community Plan, the Clayton General Land-Use Plan and the Surrey Zoning By-law, will be used to guide development in East Clayton. The primary intent of these guidelines is to facilitate the co-ordinate development of an identifiable, mixed-use, and pedestrian oriented community that is consistent with the seven principles for sustainable communities. The development performance standards and guidelines are organized by the following four land use types proposed by the plan: 1. Residential areas; 2. Commercial areas; 3. Live/work, work/live areas, and 4. Techno-business park area. The Town of Okotoks encourages a suite of different housing types in an effort to attain its goal of a sustainable small town. To decrease energy use and the reliance on cars, the Town has substantially modified its urban design to create more mixed-use and higher density developments. In the

Bylaw Focus	Example
	Town's "place-making dividend" design, the employment area density is higher than in typical suburban business districts. Also, buildings are oriented to the street, surface parking is minimized and pedestrian linkages are maximized. The density of office workers is higher than in retail-only areas. Fermont, California's Design Guidelines for Small-Lot-Single-Family Residential Development were created to provide clear direction to developers on what the City expects for small lot proposals. The City provides flexibility in the planning of good quality developments under the small zoning provisions and expects variations in siting, lot sizes, density and setback and or non-conventional residential unit types. The Guidelines cover the topics of site planning, lot site plans, building configuration, building design, open space, and landscaping using clear photos and graphics.
Connect Transit Destinations	The Corridor Districts section of the Gresham (Oregan) Community Development Code creates districts for the city's transit corridors. The Central Rockwood Plan originated in the Gresham 2020 Action Plan, which called for this area to accommodate intensive commercial, residential, and mixed-use development. Central Rockwood is envisioned as a Town Center, growing into a lively pedestrian oriented, transit-supportive district. The land use districts of both the Central Rockwood Plan and the transit corridors are designed to take advantage of the substantial public investments which have been made in transit service, and to create attractive places to live, work, shop, and recreate with less reliance on the automobile than might be found elsewhere in the community.
Outdoor Lighting Regulations	The glare from streetlights makes star gazing difficult in urban areas and is a waste of energy. The Dark Sky Ordinance in the City of Tempe, Arizona regulates the installation of outdoor light fixtures to ensure that light is directed downwards to where it will be used, and will not affect astronomical observation with Tempe. All outdoor light fixtures, with limited exceptions, shall be fully shielded. The District of Saanich was the first municipality in Canada to develop light pollution guidelines. Commercial and multi-family developments must adhere to the Saanich *Municipal Outdoor Lighting Standards for the Control of Light Pollution* (Schedule B to the Zoning Bylaw). Each zone to which the standards apply contains a general provision stating that "the relevant provisions of …Schedule B of this bylaw shall apply."
Development Cost Charges	Kelowna has a detailed Development Cost Charge (DCC) program. DCC charges vary by type of infrastructure and by area within the municipality. For example, the DCC bylaw designates six different areas for road DCCs, four for water, three for sanitary sewer and one area for each of parks and storm drainage. Multi-family charges vary by density, and commercial charges vary by density for the drainage component. The result is that charges differ considerably by location and density. Kelowna is currently updating its DCC charges to include four different residential density charges. Kelowna also varies its commercial DCCs by density - the drainage charges are based on site area. The City of Nanaimo identifies three different DCC areas, the Old City Neighbourhood (which is part of Downtown), the Duke Point/SE Nanaimo area (which is primarily an industrial area) and the Nanaimo City area (which is the remainder of the City). There are no DCCs levied against new

Bylaw Focus	Example
	development in the Old City Neighbourhood or the Duke Point/SE Nanaimo area because infrastructure is already in place and upgrading is not anticipated in the near future. For single family Development Cost Charges, few municipalities vary the charge based on density. Abbotsford varies single family charges by density (units per acre).
Parking Reduction	Portland, Oregon's urban core is renowned for combining high densities with excellent transit and amenities to make a very liveable city. In several zones in the core there are no minimum parking requirements while parking maximums are low. The zoning offers car sharing, car-pooling and other provisions for reducing parking, and details long and short-term bicycle parking requirements. The City of Vancouver is considering offering a parking reduction on a 3 to 1 ratio for every parking stall designated as a shared-auto and supplied with a shared-auto vehicle. This means that for every such designated space, the City will allow a relaxation (or reduction) of 2 parking spaces. City of Vancouver has also reduced commercial parking standards where good transit access is provided The City of Surrey has reduced their minimum parking bylaw standard for City Centre by 20% to a minimum of one parking space per residential unit. The compact, transit-oriented P11-E District in Burnaby has very low parking requirements – 1 per unit with a 0.2 increase for every bedroom above the baseline, and 0.2 per unit for visitors.
Anti-Idling Bylaw	City of Vaughan is committed to reducing vehicle emissions that contribute to smog and climate change that adversely affects our air quality and health by encouraging motorists to reduce vehicle idling. In June 2004, City Council passed an Anti-Idling bylaw prohibiting the idling of vehicles for more than five consecutive minutes. The City's Environmental Task Force recommended a public education campaign designed to raise awareness of the problems caused by excessive idling. Drivers are encouraged to help reduce carbon dioxide emissions in the City of North Vancouver by eliminating unnecessary vehicle idling. As part of an environmental initiative to reduce GHGs, a new City bylaw will limit the amount of time that drivers may allow their vehicle engines to idle while stationary. The amendment to the Street and Traffic Bylaw prohibits a motor vehicle stopped on a City Street from operating its engine for more than three (3) minutes during a 60-minute period. This bylaw was prepared based on the model bylaw adopted by the GVRD Board in 2004. The City of Toronto's Idling Control Bylaw is intended to discourage the unnecessary idling of cars, trucks and buses in the city in order to help combat air pollution. The bylaw limits idling to no more than three minutes in a 60-minute period (with exceptions during extremely hot or cold weather). A model anti-idling bylaw has been developed by NRCan's Office of Energy Efficiency.

Bylaw Focus	Example
Off-Street Bicycle Storage Bylaw	A City of Vancouver off-street bicycle storage bylaw covers a range of building types. Minimum capacity for six bicycles per 20 units. Larger buildings require both storage and shower facilities. Reference: City of Vancouver web site; Planning and Land Use Bylaws, Policies and Guidelines; Parking Bylaw (No. 6059) Section 6, Off Street Bicycle Space Regulations.
Encouraging Brownfield Development	Kingston was the first municipality to embrace Ontario's Brownfields Financial Tax Incentive Program (BFTIP), a government initiative that facilitates the recycling of serviced land that has lain dormant, underutilized and contaminated for years. Under this initiative, developers in Kingston wishing to redevelop brownfields will qualify for full exemption from development charges and associated fees by municipal bylaw.

5.3 Nova Scotia Government Energy Policies

The review of energy policies in Nova Scotia shows that there are no energy efficiency related policies in the province. The remotely relevant standards are the National Building Code as applied in Nova Scotia and the Model National Energy Code for Buildings (MNECB) which is non-regulatory, but which professionals occasionally choose to use in the design of buildings. Two problems with the MNECB are that it only establishes the minimum prescriptive (and few mandatory) requirements for buildings; and that it does not cover the construction of residential and other houses smaller than 600 m^2 or with fewer than three stories above grade. By extension from the ICLEI 2005 Report, the residential sector in HRM consumes the largest annual amounts of energy than all other sectors. But, very few houses in the residential sector would fall under the MNECB coverage even if non-mandatory.

Conserve Nova Scotia (CNS) appears to be an agency that is beginning to look for ways to incorporate energy efficiencies in the broader Nova Scotia. To that end, CNS and the Department of Energy, in collaboration with the Department of Environment and Labour are currently engaged in broad consultative processes with stakeholders to determine how best to conserve energy in order to promote sustainability for the province. These activities have commenced following the energy minister's announced proposal to set a target for all new houses to have an EnerGuide 80 rating or better by 2011 in Nova Scotia.

In 2005, the Department of Energy also released the province's Green Energy Framework which focuses on developing a "vision for future energy use that relies more on energy efficiency, renewable and alternative energy, and cleaner energy technologies."[10] The department's 2002 proposed Energy Act is still being fine-tuned and was not yet released during the time of writing of this report. This Act is intended to streamline all provincial energy regulations.

In January 2007, the government announced the new provincial Energy Strategy which now includes "Renewable Energy Standards Regulations" and "Wholesale Market Rules Regulations"[11]. The new regulations set minimum renewable energy usage in the province. Some of the outstanding provisions therein are:

- That in the years 2010, 2011 and 2012, each load serving entity shall be supplying its customers with renewable electricity equal to or greater than 5% of its total sales in each year.
- That NSPI must purchase from independent power producers (IPPs) enough renewable low impact electricity to meet the 5% target for both its own retail sales and for sales to the other six municipal electric utilities. The Act Respecting Electricity stipulates that Nova Scotia Power will issue requests for proposals (RFPs) when extra capacity is required.

  [This as our team has already learnt, implies that independent power producers may not be able to directly distribute power to final consumers without NSPI or other regulated electric utility acting as the "middleman". To a large extent this provision could inhibit accelerated desire to invest in green power production, as well as be a disincentive to alternative power production innovations].

- That to meet the minimum required 5% of renewable energy standard, a municipal electric utility that purchases any of its electricity supply from a producer other than NSPI must ensure that a minimum of 5% of that non-NSPI electricity supply is supplied by a generator of renewable low impact electricity.
- And that each year beginning with the calendar year 2013, each load serving entity must supply its customers with renewable low impact electricity in an amount equal to or greater than 10% of its total sales for that year.

There are other provisions that relate to mechanisms of control and monitoring, and the certification of power generating facilities as certified renewable low impact electricity generators. The Electricity Act obtained from the Nova Scotia Department of Energy website can be viewed under the regulations cited as the "Renewable Energy Standards Regulations" and "Wholesale Market Rules Regulations".

Although not regulated, the Department of Energy and the Department of Environment and Labour have established guidelines for improving transportation fuel. Some of the objectives include use of E10 fuel in which 10% of the fuel is ethanol and 90% from gasoline. Biodiesel is also stirring interest but there is no mandatory legislation by the provincial government at this time.

5.4 Federal Government Energy Policies

There are a few regulations in place through the Federal Government that have significant implications for the energy sector, as summarized below.

5.4.1 Canada's Energy Efficiency Regulations

Canada's *Energy Efficiency Act* was passed by Parliament in 1992 and provides for the making and enforcement of regulations concerning minimum energy performance levels for energy-using products, as well as the labelling of energy-using products and the collection of data on energy use. The first Energy Efficiency Regulations came into effect in February 1995 and have been amended at least three times. These Regulations establish energy efficiency standards for a wide range of energy-using products, with the objective of eliminating the least energy-efficient products from the Canadian market. They apply to regulated energy-using products imported into Canada or manufactured in Canada and shipped from one province to another. The Regulations are administered by Natural Resources Canada through the Office of Energy Efficiency.[12]

5.4.2 Canadian Environmental Protection Act

The goal of the renewed *Canadian Environmental Protection Act (CEPA)* is to contribute to sustainable development through pollution prevention and to protect the environment, human life and health from the risks associated with toxic substances. CEPA, which came into effect in 1999, acknowledges for the first time the need to virtually eliminate the most persistent toxic substances that remain in the environment for extended periods of time before breaking down and bioaccumulative toxic substances that accumulate within living organisms. Several substances involved in the energy sector are regulated by CEPA. These include gasoline, diesel, fuels containing additives, ignition engine emissions, and petroleum products. Procedures surrounding disposal, spills and other environmental emergencies also fall under this Act. CEPA is administered jointly by Health Canada and Environment Canada.[13]

5.4.3 Motor Vehicle Safety Act

CEPA transferred responsibility for regulating vehicle emissions from Transport Canada under the *Motor Vehicle Safety Act* to Environment Canada under *CEPA* (Part 7, Division 5). The Regulations that were passed under the *Motor Vehicle Safety Act* that control vehicle emissions remain in effect under *CEPA*[14].

5.4.4 Energy Supplies Emergency Act

The *Energy Supplies Emergency Act*, administered by Natural Resources Canada, establishes the Energy Supplies Allocation Board and empowers it to take various steps to conserve and allocate supplies of petroleum products during periods of national emergency caused by shortages or market disturbances affecting national security and welfare, and the economic stability of Canada. The Board may make regulations authorizing it to issue permits to relax federal laws which regulate or prohibit the emission of sulphur compounds into the atmosphere.[15]

5.4.5 Atomic Energy Control Act

The *Atomic Energy Control Act* makes provision for the control and supervision of the development, application and use of atomic energy and for Canada's effective participation in measures of international control of atomic energy. Any license issued to operate a facility may contain such conditions as the Atomic Energy Control Board deems necessary in the interests of health, safety and protection of the environment, as well prescribe measures to be taken regarding disposal of radioactive or other hazardous material, and the maximum quantity and concentration of radioactive or other hazardous material that may be discharged.

5.4.6 Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act

This Act establishes an offshore petroleum resource management board that is responsible for offshore exploration and drilling operations. The Board is responsible for co-ordinating federal-provincial regulatory requirements, and environmental assessment and protection activities in the offshore. By virtue of a Memorandum of Understanding (MOU), Environment Canada provides advice and assistance with respect to the environmental aspects of off-shore petroleum operations. Nova Scotia Offshore Petroleum Drilling Regulations fall under this Act.[16]

5.4.7 Alternative Fuels Act

The *Alternative Fuels Act* calls for the Federal government to take the lead by progressively converting its motor vehicle fleet to alternative fuels to reduce the emissions of greenhouse gases and other pollutants. By April 1, 2004 and thereafter, where it is cost effective and operationally feasible, seventy-five per cent of motor vehicles operated by all federal departments and agencies will be operating on alternative fuels.[17]

5.4.8 Canada Oil and Gas Operations Act

The *Canada Oil and Gas Operations Ac*[18]*t* promotes safety, environmental protection, conservation of oil and gas resources, and joint production arrangements. The act is jointly administered by the Minister of Natural Resources and Indian Affairs and Northern Development. It applies to the Yukon and Northwest Territories or Sable Island, and specified submarine areas (inland waters not within a province, territorial seas and the continental shelf of Canada)

5.4.9 Canadian Petroleum Resources Act

The *Canadian Petroleum Resources Act*[19] states that the Governor in Council may, by order, stop petroleum resource activities on frontier lands due to environmental concerns. Also, every proprietor with petroleum interests in frontier lands must pay into an environmental studies research fund on a per hectare basis.

5.4.10 National Energy Board Act[20]

The *National Energy Board Act* requires the Board to review applications for licenses to export or import petroleum, natural gas, or electricity and for certificates of public convenience and necessity to construct pipelines or international power lines. The National Energy Boards Regulations and Rules of Practices and Procedures require applicants to submit an assessment of the probable environmental impact of the facility, including a description of the existing environment and a statement of the measures proposed to mitigate the impact. The Gas Pipeline Regulations set out design criteria and conservation and pollution control requirements that must be followed by pipeline.

5.4.11 Federal Regulation Requiring Renewable Fuels

The Government of Canada intends to develop and implement a federal regulation requiring renewable fuels, according to a public notice published Dec 30th, 2006. The regulation, to be developed under *CEPA*, as may be amended by *Canada's Clean Air Act*, would require fuel producers and importers to have an average annual renewable fuel content of at least 5% of the volume of gasoline that they produce or import, commencing in 2010. This regulation is currently in the initial conception stage.

5.5 NSPI Demand Side Management Program

Nova Scotia Power, in a recent rate increase hearing before the Utility and Review Board (UARB), indicated that it intended to apply a portion of the additional revenue generated from the rate increase to a system wide DSM program. Subsequent to this, a US based consultant was engaged to develop a DSM program and predict the impact of such a program on generation, revenue, and emissions. The report was issued for stakeholder review in the fall of 2006.

The DSM program is intended to form a portion of Nova Scotia Power's Integrated Resource Planning program currently underway. It is intended to build upon previous experience with energy conservation programs at NSPI and to complement existing and planned programs from the provincial and federal governments, such as the Energuide programs for new and existing houses. Much more cannot be said about NSPI's submitted DSM plan until it is acted upon by UARB and made public. At that time, it will be imperative to assess its impact on projected HRM power consumption profiles and peak loads.

6 LOOKING AHEAD

This Task One report has set the stage for many possibilities which are within HRM's reach. The energy and GHG inventories show that HRM is a consumer of large quantities of energy, and accordingly a large emitter of GHGs. However, HRM's efforts to change this trend through solid demand side management emphasis by demanding increased efficiencies in housing, transportation, appliances; and through exploration of alternative energy sources is an encouraging start to a state of leadership in sustainability. Other key stakeholders with which HRM can partner to expedite achievement of its goals include the provincial government, NSPI, Heritage Gas, and the federal government, all of whom have committed resources to demand management, fuel substitution, education and awareness, and renewable energy programs. Curbing the GHG emissions to acceptable levels, especially to reach the 2012 target of 20% GHG reduction below the 2002 emissions is a difficult task. A solid integration of this GHG focus with the community energy plan (CEP) is a very sure way to bolster the reality of achieving this goal. Through consultations with key stakeholders and research, the subsequent tasks of this work will seek to highlight compelling programs and actions that HRM and the community at large will exploit to realize these goals. These goals are very challenging, but this report has demonstrated that they are achievable. To achieve the targets, costs may be substantial in the short term, unprecedented positive changes in social and cultural behaviour respecting energy and environment will have to be demonstrated, and sacrifices might have to be endured. It would be great for HRM if these changes occurred voluntarily or through education, consultation and integration.If these measures do not produce the expected positive impacts, some required actions may have to be made mandatory.

END NOTES

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