TOWN OF BRIDGEWATER ENERGY MANAGEMENT REPORT JULY 2014

July 4 2014

Prepared by the Bridgewater Planning & Engineering Departments

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Town of Bridgewater Energy Management Report July 2014

PREPARED BY THE BRIDGEWATER PLANNING & ENGINEERING DEPARTMENTS

INTRODUCTION

Background

In 2008 the Town of Bridgewater launched its Energy Management Program. Early achievements included the implementation of facility-wide energy audits in 2008 and 2009, and a solar thermal energy feasibility study in 2009. Staff began regularly collecting energy data from Town facilities, operational processes, and vehicle fleets. The data was used to develop the Municipal Greenhouse Gas Emissions Inventory Report in 2009, which calculated that the Town's total operations emitted approximately 4,600 tons of GHG emissions annually, with an associated cost of just under $1,000,000 in fuel and electrical bills.

In 2009 and 2010, staff successfully applied for Federal and Provincial funding to complete a comprehensive set of energy upgrades at Town facilities. Upgrades were implemented between 2010 and 2012. The Integrated Community Sustainability Plan (2010) affirmed the Town's goals of reducing energy consumption and introducing renewable energy sources, and recommended that the Town continue improving the energy performance of its municipal facilities and operations. In 2012, an internal energy awareness campaign called "Responsibility Starts With Us" was launched. It encourages all staff and visitors to be mindful of their energy consumption, and to report problems as well as good ideas as soon as they occur. In 2013, the Town completed its Municipal Climate Change Action Plan (MCCAP), which established energy reduction targets for municipal operations.

Energy Management Plan for Facilities

The Energy Management Plan for Facilities plan was adopted by Senior Management in September 2011. The Plan established targets for improvements in energy efficiency and the reduction of greenhouse gas emissions from specific Town facilities, and set out a strategy and process for meeting those targets. Facilities included in the plan are:

1. Town Hall (60 Pleasant St)
2. Coughlan Building (48 Pleasant St)
3. DesBrisay Museum (130 Jubilee Rd)
4. Bridgewater Library (547 King St)
5. Bridgewater Fire Station (81 Dominion St)
6. Bridgewater Police Station (45 Exhibition Dr)
7. Bridgewater Memorial Arena (123 Empire St)
8. Bridgewater Swimming Pool (154 Jubilee Rd)
9. Public Works Garage (134 St Phillips St)
10. Waste Water Treatment Plant (16 LaHave St)
11. Water Treatment Plant / Public Service Commission (50 Century Dr)

Note: energy consumption from water and waste water treatment processes, pumping stations, street lights, and the Town's vehicle fleet are excluded from the 2011 energy management plan and its goals.

The Energy Management Plan for the above facilities established the following goals:

1. **By 2012-13, reduce annual energy consumption from Town facilities by 15% compared to 2007-08 levels.** *This is equivalent to a reduction of 22,000kWh in electricity and 16,000L in heating oil. This will annually reduce energy costs by about $40,000 (at 2011 rates), and greenhouse gas emissions by about 235 tons.*
2. **By 2012-13, achieve a self-evaluated energy management rating of 50% or better according to the Energy Management Priorities Good Practice Guide.** *This is a self-evaluation tool which staff review on an annual basis. The 2008 rating was 34%, and the 2011 rating was 43%*

Progress toward achieving these goals is monitored on a regular basis (monthly for energy consumption, and annually for the self-evaluation). This year, as directed by the MCCAP, the Energy Management Plan for Facilities will be renewed and expanded to incorporate energy consumption from water and waste water treatment processes as well as pumping stations. New 2017-2018 energy reduction targets for facilities compared to 2007-2008 levels are as follows:

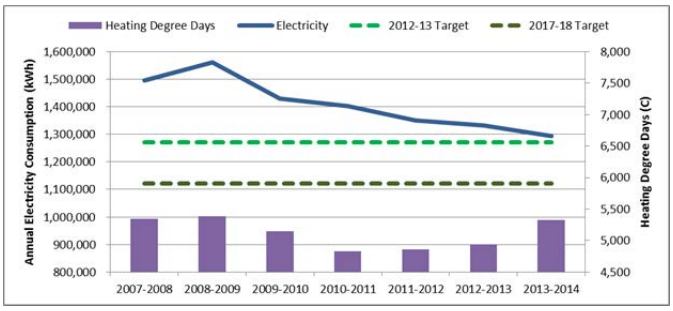
- **Town Facilities: 25%**
- **Water and Waste Water Infrastructures: 5%**

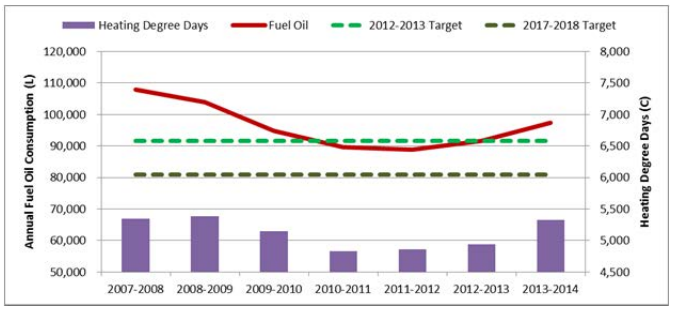
Achieving these reductions means that the Town will reduce overall greenhouse gas emissions from municipal facilities by a total of 235 tons compared to 2007-2008 levels.

ENERGY CONSUMPTION SUMMARY

Energy Consumption Update

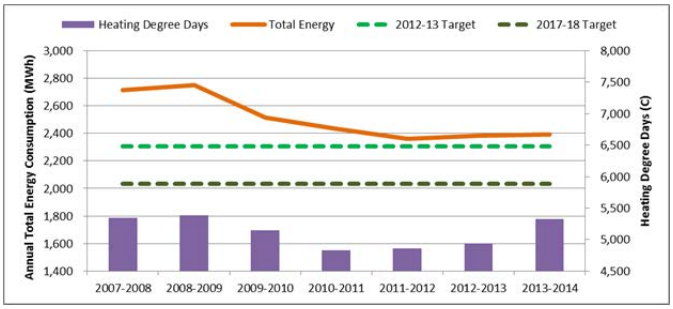
The following graphs demonstrate the Town's progress toward achieving its energy consumption targets for **electricity** and **fuel oil** consumption for the facilities currently included in the Energy Management Plan *(note: does not include water and waste water infrastructures):*

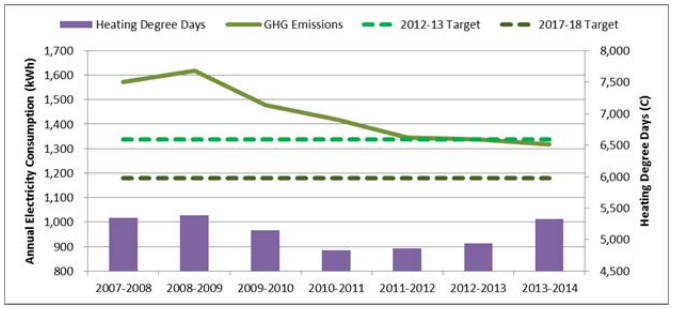




The graphs show that energy consumption for both electricity and fuel oil has generally been declining since 2007-2008. The Town met and exceeded its target of reducing fuel oil consumption by 15% from 2010-2013, though heating oil consumption has recently risen in the past year, as a result of the cold winter (indicated by the higher purple bars which represent relative heating needs). In all, heating oil consumption has been reduced by 10%. Electricity consumption is still higher than the target, having dropped by 13% compared to 2007-2008 levels.

These trends are reflected in the **total energy** consumption and **greenhouse gas emissions** trends for these facilities, which are displayed in the graphs below:

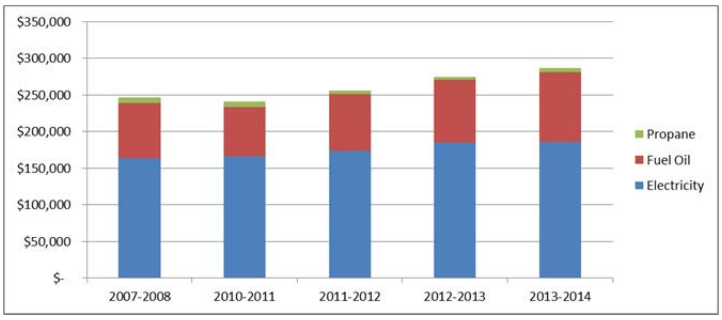




The graphs show that total energy consumption has dropped by 12% compared to 2007-2008 levels, and that greenhouse gas emissions have met and exceeded the target by dropping 16% over the same time period. The extra decrease in emissions is due to the fact that electrical production is cleaner today than it was in 2007-2008, with a greater share of renewable energy being supplied to the Nova Scotia grid.

These trends demonstrate that excellent progress has been made in achieving the 2012-2013 energy reduction targets, and that a number of targets have been met. Ongoing energy reduction efforts will be required to further reduce these consumption levels to the 2017-2018 targets.

Financial Costs & Benefits

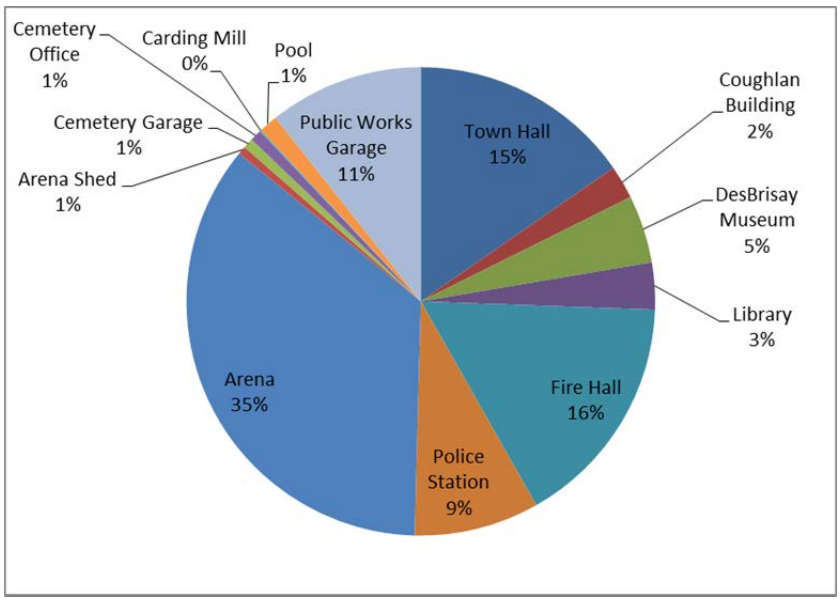


The graph at the left shows the annual total financial cost of energy at all facilities included in the Energy Management Plan (excludes water & waste water infrastructure), for fiscal years 2007-2008, and 2010 through to 2014. Financial data includes only direct energy unit costs (excludes repairs, leases, and other costs included on bills), and also excludes HST. As the graph demonstrates, the total cost of energy bills has generally risen over the past 6 years, despite a demonstrated 12% reduction in energy consumption. The reason for this contradiction is that energy prices have been rising faster than the Town has been able to make reductions to its energy consumption. The chart below indicates average annual energy costs paid by the Town for these energy services, based on historical billing data.

Energy Type	2007-2008	2010-2011	2011-2012	2012-2013	2013-2014
Electricity (kWh)	$0.11	$0.12	$0.13	$0.14	$0.14
Fuel Oil (L)	$0.71	$0.75	$0.87	$0.94	$0.98
Propane (L)	$1.08	$0.84	$0.68	$0.49	$0.92

This financial analysis also demonstrates that significant savings have been realized as a result of the energy management program, due to the fact that these energy costs have been rising. If current energy consumption was still at 2007-2008 levels, the Town would be paying an additional $39,000 per year in utility bills at 2013-2014 rates. This difference (and therefore savings) will continue to grow each year if energy prices continue to rise.

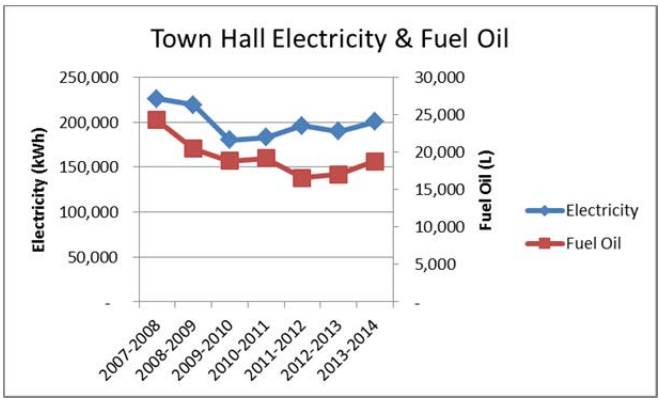
The graph below shows a breakdown of total energy costs per facility for fiscal year 2013-2014.

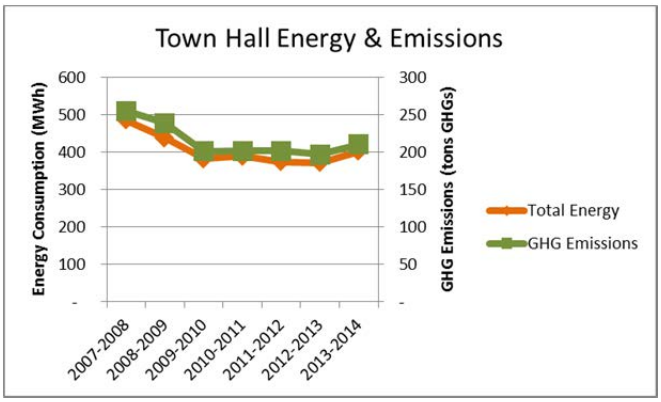


ENERGY CONSUMPTION BY FACILITY

The following pages of this report describe energy consumption patterns and improvements by facility. Emphasis is placed on the facilities included in the Energy Management Plan, though a few other facilities are included as well.

BRIDGEWATER TOWN HALL (60 PLEASANT ST)





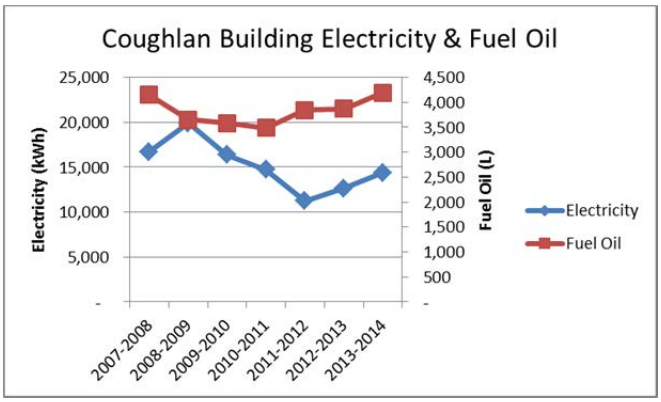
Overall energy consumption for this facility went down significantly between 2007 and 2009, and has remained fairly steady since then. Electricity consumption has increased slightly in recent years (likely a result of the humidification system), while fuel oil use has decreased slightly. The following building upgrades have been implemented at this facility since 2007-2008:

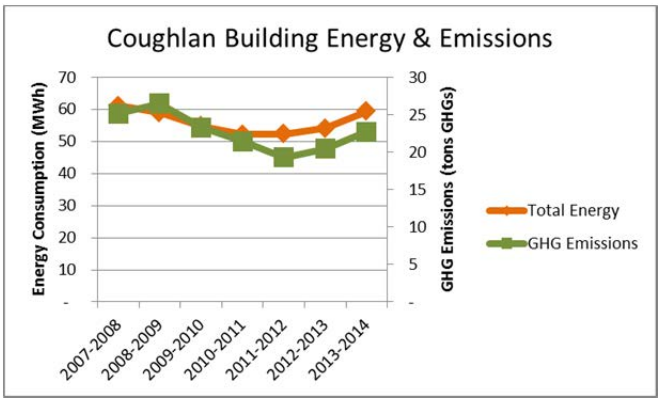
- 2011 - Lighting upgraded to more efficient technology
- 2011 - Solar thermal heating system installed (15 panels)
- 2011 - Building automation system installed
- 2014 - Outdoor lighting upgraded to LED technology

Energy improvement initiatives currently underway: the building has just completed a comprehensive retrofit of its heating, ventilation and cooling (HVAC) system, as well as building insulation upgrades. Heat pump technology is the basis for the new system. These improvements are predicted to result in significant electrical and fuel oil savings starting in fiscal year 2014-2015.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**153** *(2007-2008)*	⇨	**126** *(2013-2014)*

COUGHLAN BUILDING (48 PLEASANT ST)





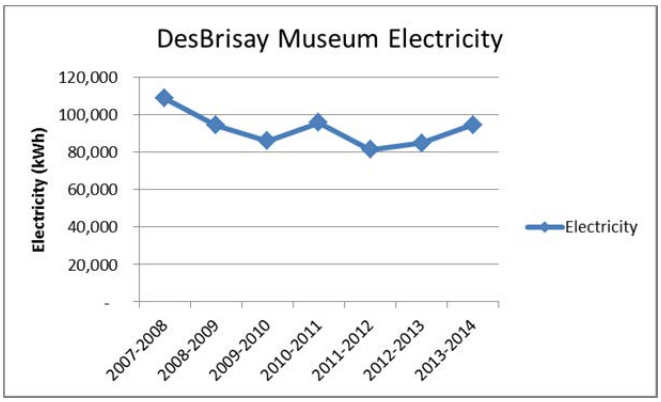
Overall energy consumption for this facility went down between 2008 and 2012, but has risen again since then, likely as a result of colder winters. The following building upgrades have been implemented at this facility since 2007-2008:

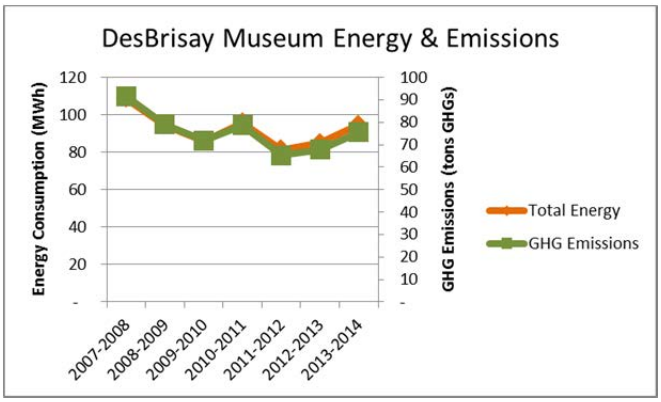
- 2010 - Boiler controls & programmable thermostats installed
- 2011 - Lighting upgraded to more efficient technology

Energy improvement initiatives currently underway: none

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**193** *(2007-2008)*	⇨	**187** *(2013-2014)*

DESBRISAY MUSEUM (130 JUBILEE RD)





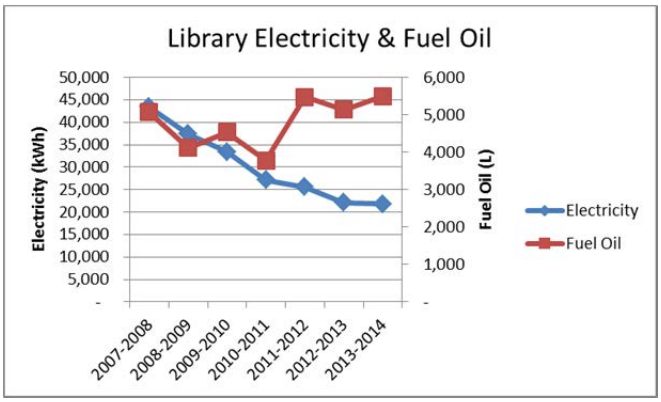
Overall energy consumption for this facility improved significantly between 2007 and 2010, and again between 2011 and 2012. However, since that time, energy consumption has risen again, likely as a result of cooler winters. The following building upgrades have been implemented at this facility since 2007-2008:

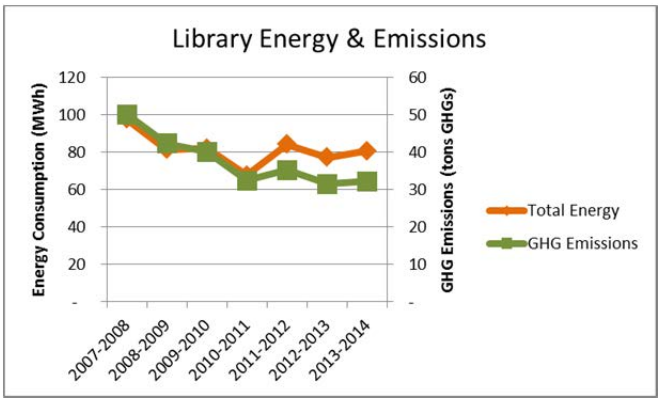
- 2011 - Lighting upgraded to more efficient technology (including LED)
- 2011 - Thermostats upgraded

Energy improvement initiatives currently underway: last year this facility underwent an extensive energy audit to assess potential improvements to the HVAC system and building envelope. The study found that total energy consumption can be reduced by 30-40% through a complete retrofit of the HVAC system to heat pump technology, and minor insulation upgrades. These recommendations are being implemented this year.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**189** *(2007-2008)*	⇨	**165** *(2013-2014)*

BRIDGEWATER LIBRARY (547 KING ST)





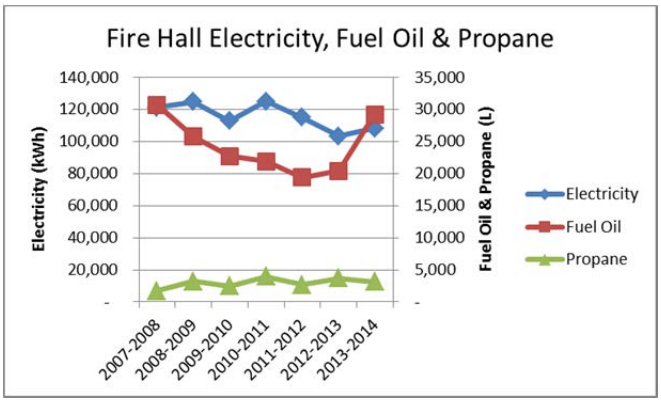
Overall energy consumption for this facility went down significantly between 2007 and 2011, and has remained fairly steady since then. Electricity consumption made a consistent reduction during this time, while fuel oil use has increased again in recent years. The following building upgrades have been implemented at this facility since 2007-2008:

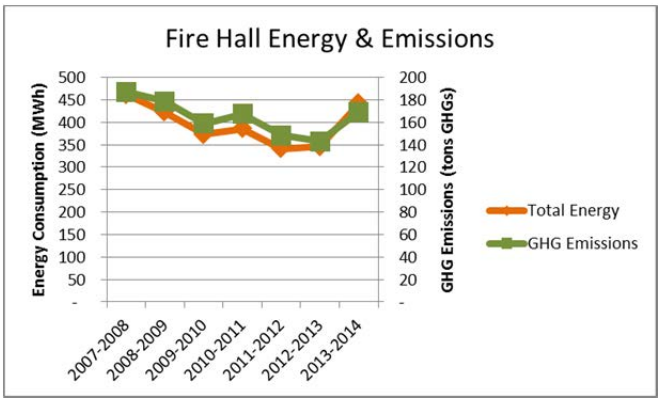
- 2010 - Boiler controls & programmable thermostats installed
- 2011 - Lighting upgraded to more efficient technology

Energy improvement initiatives currently underway: None. The facility has recently been sold, and will no longer be included in the energy management program after this fiscal year.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**131** *(2007-2008)*	⇨	**108** *(2013-2014)*

BRIDGEWATER FIRE HALL (81 DOMINION ST)





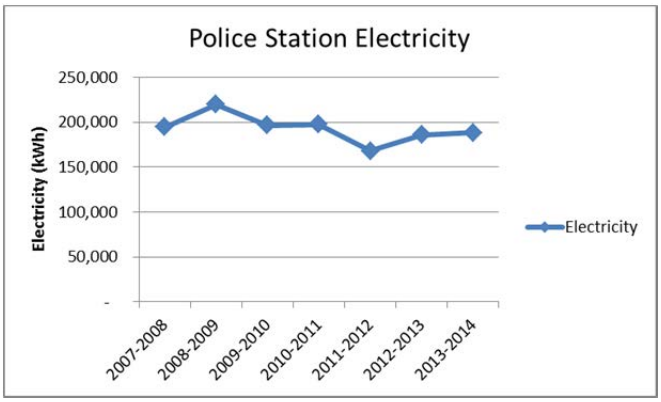
Overall energy consumption for this facility has generally been reduced since 2007, although in the last year there has been a significant upward trend in fuel oil consumption, likely as a result of a colder winter. The following building upgrades have been implemented at this facility since 2007-2008:

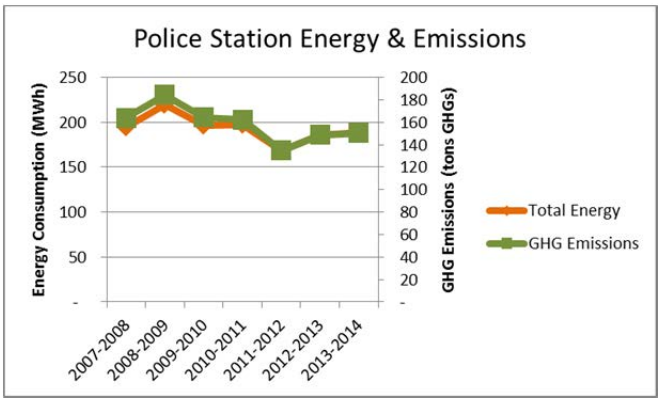
- 2011 - Lighting upgraded to more efficient technology
- 2011 - Building automation system installed

Energy improvement initiatives currently underway: None.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**287** *(2007-2008)*	⇨	**274** *(2013-2014)*

BRIDGEWATER POLICE STATION (45 EXHIBITION DR)





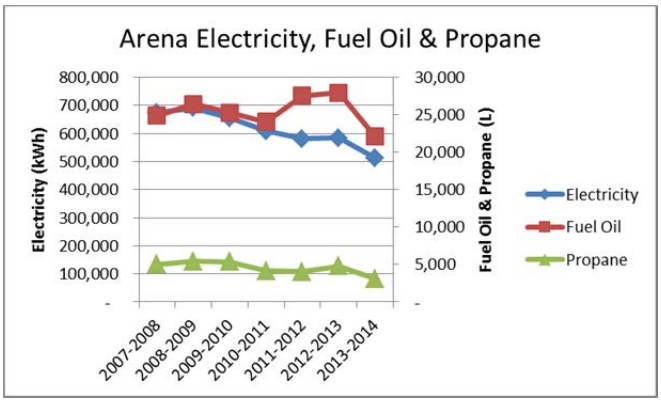
Overall energy consumption for this facility decreased slightly between 2008 and 2013. The following building upgrades have been implemented at this facility since 2007-2008:

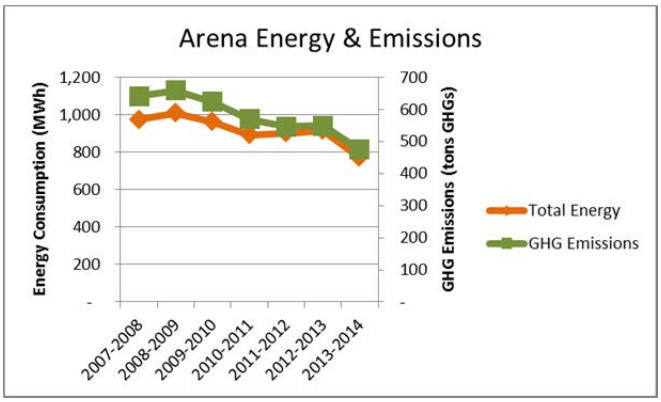
- 2011 - Solar thermal DHW heating system installed (2 panels)
- 2012 - Lighting occupancy sensors installed

Energy improvement initiatives currently underway: None.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**210** *(2007-2008)*	⇨	**203** *(2013-2014)*

BRIDGEWATER MEMORIAL ARENA (123 EMPIRE ST)





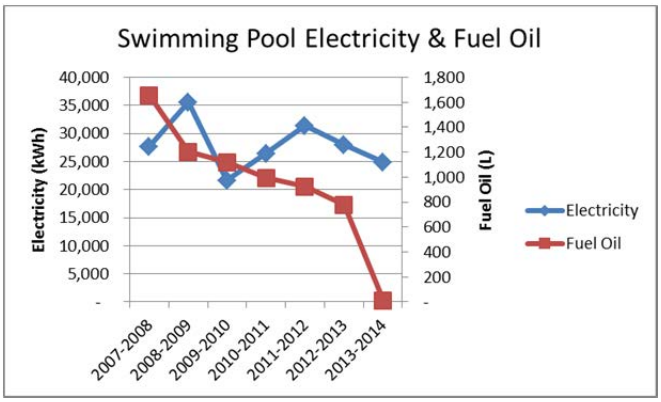
Overall energy consumption for this facility has been improving consistently since 2008, with electricity improving the most. Between 2011 and 2013, fuel oil consumption rose significantly for unknown reasons, but is trending downward once again, despite the colder winter weather of the past year. This is possibly due to reduced facility use following the opening of the Lunenburg County Lifestyle Centre. A new heat recovery system was not fully implemented until March 2014, so the benefit from that system will not be felt until the following winter. The following building upgrades have been implemented at this facility since 2007-2008:

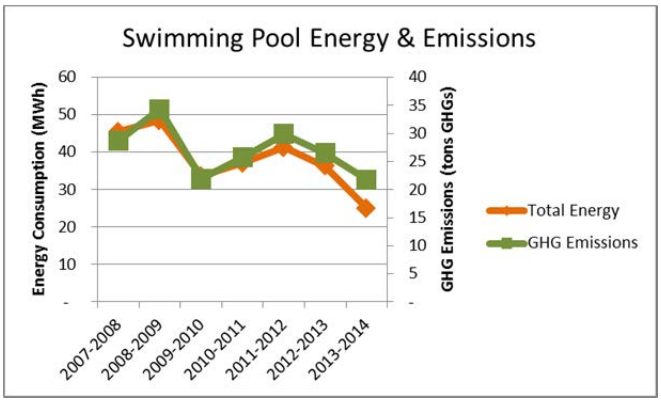
- 2010 - Lighting upgraded to more efficient technology
- 2014 - Outdoor lighting upgraded to LED technology
- 2014 - Heat recovery system installed for ice making equipment (through IREP program)

Energy improvement initiatives currently underway: none

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**110** *(2007-2008)*	⇨	**87** *(2013-2014)*

BRIDGEWATER SWIMMING POOL (154 JUBILEE RD)





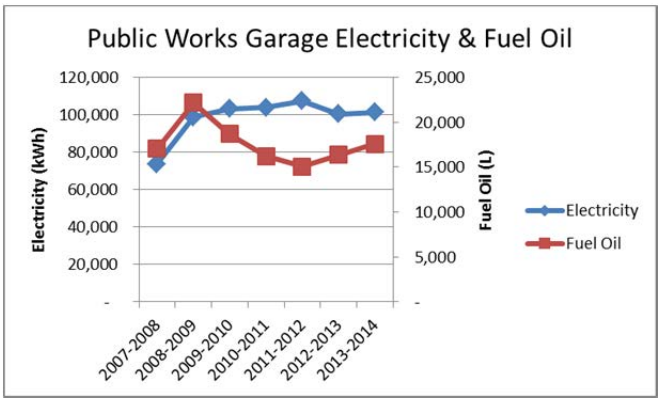
Overall energy consumption for this facility has been variable over the past few years, with a slight overall downward trend. Fuel oil consumption has decreased steadily since 2007, and no fuel oil deliveries were made in 2013-2014. The following building upgrades have been implemented at this facility since 2007-2008:

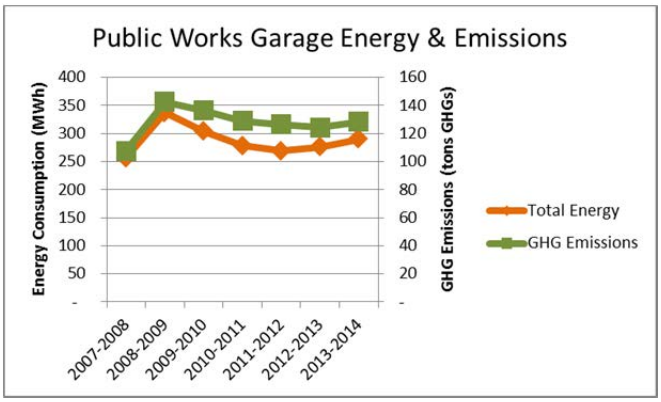
- 2011 - Lighting upgraded to more efficient technology

Energy improvement initiatives currently underway: None.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**978** *(2007-2008)*	⇨	**538** *(2013-2014)*

PUBLIC WORKS GARAGE (134 ST PHILIPS ST)





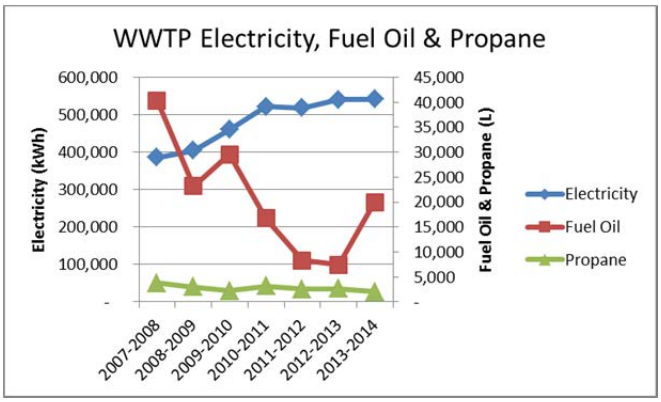
Overall energy consumption for this facility increased significantly between 2007 and 2008 as a new addition was added to the facility. Since that time, energy consumption has gradually improved, with the largest gains being attributed to a reduction in fuel oil consumption. However, consumption has risen again in the last 2 years, possibly as a result of colder winter weather. The following building upgrades have been implemented at this facility since 2007-2008:

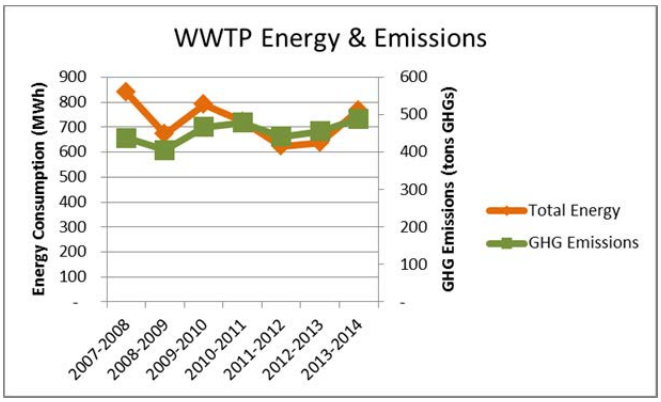
- 2011 - Lighting upgraded to more efficient technology (personnel spaces)
- 2011 - Solar thermal heating system installed (30 panels) – *incomplete / not fully commissioned*
- 2014 - Lighting upgraded to more efficient technology (vehicle bays)
- 2014 - Outdoor lighting upgraded to LED technology

Energy improvement initiatives currently underway: ongoing assessment and repair of solar thermal hot water system (contract dispute).

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**171** *(2007-2008)*	⇨	**194** *(2013-2014)*

WASTE WATER TREATMENT PLANT (16 LAHAVE ST)





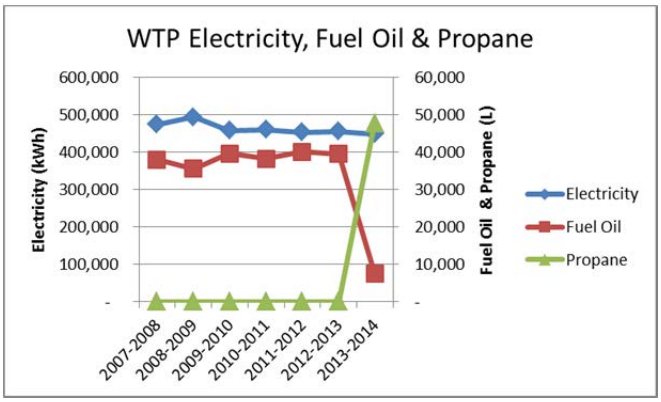
Overall energy consumption for this facility has fallen slightly in the past few years due to sharp declines in fuel oil consumption, but this has been offset by a gradual increase in electricity consumption. Electricity consumption increased starting in 2008-2009 due to the installation of a UV disinfection system to offset chlorine use. Fuel oil consumption rose again in 2013-2014, possibly as a result of the colder winter. Note that most of this facility is not currently included in the Energy Management Plan, though it will be starting later in 2014. The following building upgrades have been implemented at this facility since 2007-2008:

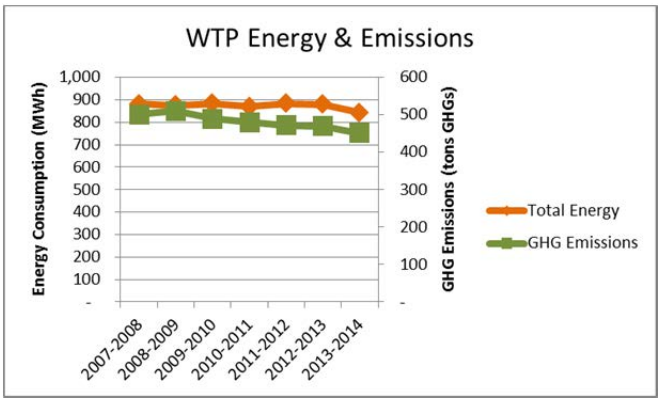
- 2011 - Upgrades to electric motors on RBC's
- 2011 - Indoor lighting upgraded to more efficient technology
- 2013 - Outdoor lighting upgraded to LED technology

Energy improvement initiatives currently underway: None.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**1012** *(2007-2008)*	⇨	**924** *(2013-2014)*

WATER TREATMENT PLANT (50 CENTURY DR)





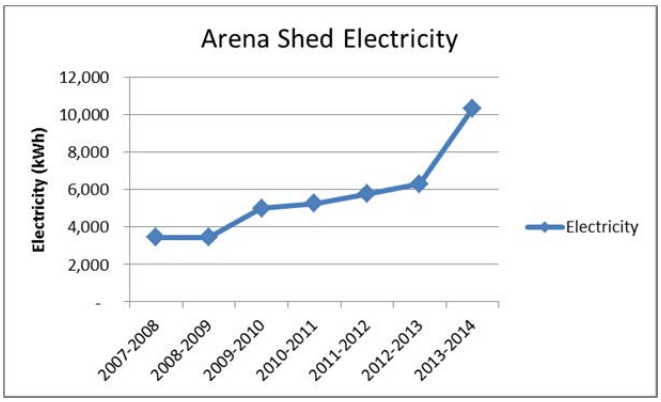
Overall energy consumption for this facility has remained relatively consistent over the past few years. Part way through 2013, the oil burning furnace was replaced with a propane burning furnace to reduce energy costs. This change is reflected in the sharp decrease in fuel oil consumption and the corresponding increase in propane consumption. Note that most of this facility is not currently included in the Energy Management Plan, though it will be starting later in 2014. The following building upgrades have been implemented at this facility since 2007-2008:

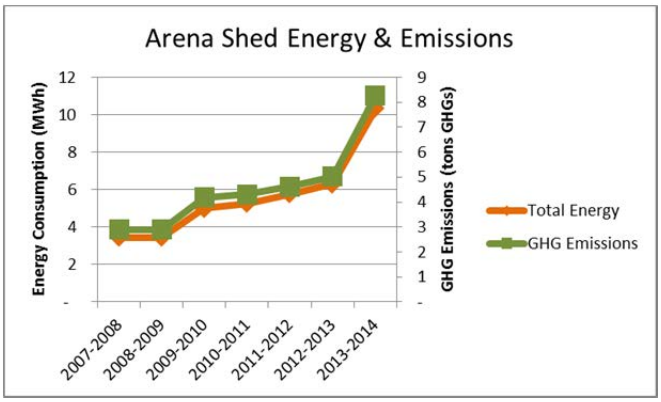
- 2013 – Outdoor lighting upgraded to LED technology

Energy improvement initiatives currently underway: None.

Building Energy Performance Index *(Smaller numbers indicate a more energy efficient building)*	**168** *(2007-2008)*	⇨	**161** *(2013-2014)*

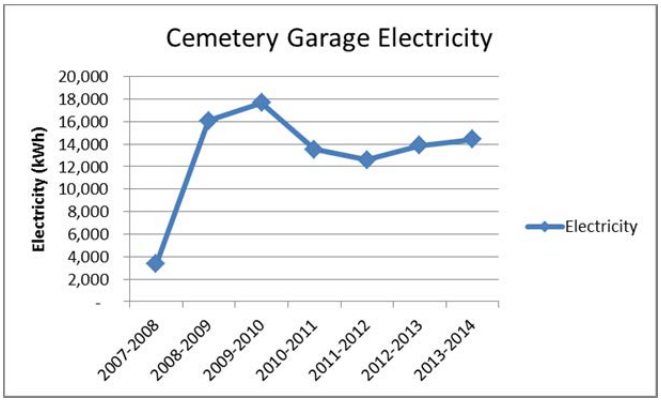
BRIDGEWATER MEMORIAL ARENA SHED (123 EMPIRE ST)

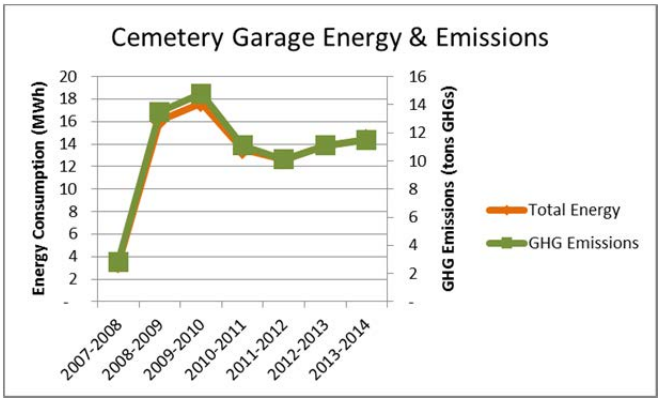




Energy consumption has risen continuously at this facility. An energy audit was completed in 2013, but found that no significant energy upgrades are practical at this time, other than improving weather stripping, monitoring energy use, and more carefully controlling thermostats.

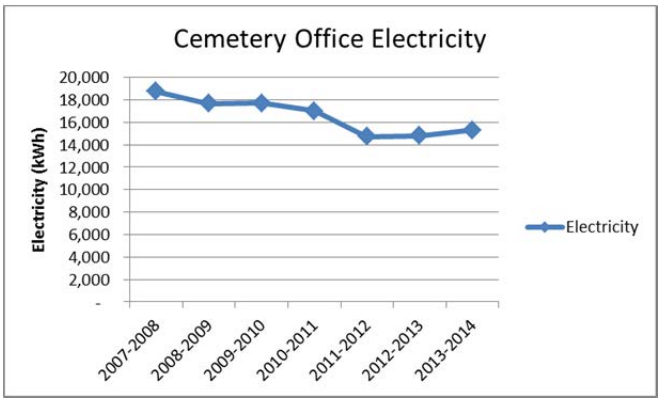
BRIDGEWATER CEMETERY GARAGE (106 VICTORIA RD)

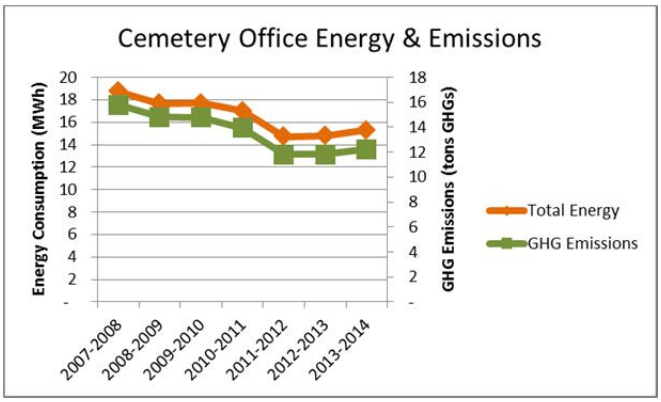




This facility was constructed in 2008, accounting for the increase in energy use between 2007 and 2008. Energy performance has improved somewhat since that time, though it has been rising recently. An energy audit was completed in 2013, and recommended lighting and occupancy sensor upgrades (implemented in 2014). Staff agreed that the built-in baseboard heaters should be disconnected entirely, switching the heat source to block heaters, rather than upgrading the heat source to a more efficient type (for example a heat pump). However, this change has not been implemented.

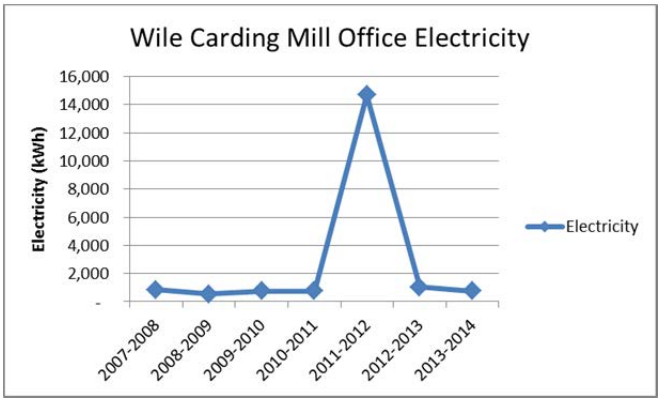
BRIDGEWATER CEMETERY OFFICE (106 VICTORIA RD)

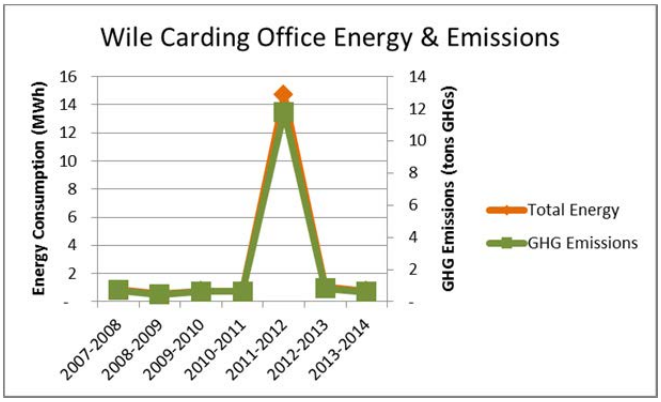




Energy has improved continuously at this facility. An energy audit was completed in 2013, and recommended lighting and occupancy sensor upgrades in the facility, and an upgrade of the cenotaph lighting that is attached to the same meter. These upgrades were implemented in 2014.

WILE CARDING MILL (242 VICTORIA RD)





No energy management initiatives have been implemented at this smaller facility. Power consumption was significantly increased in the winter of 2012 due to construction work which coincided with electrical problems. Power consumption has since been reduced to pre-construction levels.

APPENDIX: INFORMATION SOURCES & CALCULATIONS

Information	Comments
Electricity	Information was recorded directly from NSPI bills, or from consumption records provided digitally by the company. Electricity consumption data was normalized from March 2008 onwards, meaning that monthly and yearly consumption were calculated based on daily consumption levels between meter reading dates.
Fuel Oil	Information was recorded directly from oil delivery bills, or from consumption records provided digitally by the fuel oil company. All fuel oil consumption data was normalized, meaning that monthly and yearly consumption were calculated based on estimated consumption levels between oil delivery dates.
Propane	Information was recorded directly from propane delivery bills. All propane consumption data was normalized, meaning that monthly and yearly consumption were calculated based on estimated consumption levels between oil delivery dates.
Weather	Temperature information was collected digitally from Environment Canada's National Climate Data and Information Archive (www.climate.weatheroffice.gc.ca). The Lunenburg weather station used to calculate monthly Heating Degree Days (HDD), based on a heating threshold of 22 degrees Centigrade. This data was used to perform temperature-dependent regression analysis and cumulative sum (CUSUM) calculations to adjust consumption levels for annual weather patterns, and to determine relative savings achieved on a monthly and yearly basis.
Total Energy	Total energy consumption was calculated using the following energy conversion figures: ▪ Electricity: 0.001 MWh / kWh ▪ Fuel Oil: 0.0107 MWh / L ▪ Propane: 0.00655 MWh / L
Greenhouse Gas Emissions	Greenhouse gas emission levels were calculated using the following coefficients: ▪ Electricity: 0.890 (2006), 0.842 (2007), 0.838 (2008), 0.840 (2009), 0.828 (2010), 0.805 (2011), 0.799 (2012), 0.799 (2013, estimated), 0.799 (2014, estimated). All units are in kg eCO2 / kWh. Source: National Inventory Report 1990-2010 (Environment Canada) ▪ Fuel Oil: 2.68 kg eCO2 / L. Source: Union of Nova Scotia Municipalities (UNSM) GHG Emissions Inventory Spreadsheet (2008). ▪ Propane: 1.52 kg eCO2 / L. Source: Union of Nova Scotia Municipalities (UNSM) GHG Emissions Inventory Spreadsheet (2008).
Financial	All financial figures are based on the direct purchase of the fuel. Repairs, leases, and other costs included on bills are generally not included. HST is excluded from all financial figures. Historical financial savings were calculated using actual historical power and fuel oil rates on an annualized basis.
Building Energy Performance Index (BEPI)	This figure was calculated by dividing the total annual energy consumption of a facility (measured in kWh equivalent) by the total heated or cooled floor area of the facility (measured in square meters).