SUBJECT: Corporate Energy Management Plan progress report

TO: Committee of the Whole

FROM: Capital Works

Report Number: CW-09-18
Wards Affected: All
File Numbers: 210-01
Date to Committee: May 7, 2018
Date to Council: May 22, 2018

Recommendation:
Submit the relevant content/data in Appendix A of capital works department report CW-09-18 to the Ontario Ministry of Energy and publish on Burlington’s website in order to encourage energy awareness, conservation and meet the reporting requirements under Ontario Regulation 397/11.

Purpose:
The purpose of this report is to update Council on Burlington’s corporate energy management activities and utility consumption in 2017 and also respond to provincial legislation.

A Healthy and Greener City
- Environmental and Energy Leadership – the city’s operations are net carbon neutral (by 2040)

Executive Summary:
This report presents data on corporate energy and green house gas emissions from corporate operations in 2017. The report also includes detailed facility energy and water consumption data for 2017 compared to 2016. The method of presenting the data is consistent with Ontario Regulation 397/11 which requires municipalities to report and publish energy consumption data and greenhouse gas emissions.
Background and Discussion:

In 2009, Council approved a corporate energy policy (CSI-3/09) which provides guidance and direction to staff on the development and implementation of a comprehensive corporate energy management program.

In 2009, the Green Energy Act and Green Economy Act (GEGEA) directed the broader public sector (municipalities, universities, schools, and hospitals) to develop and report their energy conservation and demand management plans. Specifically, Ontario Regulation 397/11 – Energy Conservation and Demand Management Plans enacted in August 2011, mandates:

- Completion, publication and submission to the Minister of Energy of Burlington’s corporate energy consumption and greenhouse gas emission template for one year of operation (Jan 2011 to Dec 2011) by July 1, 2013 and annually thereafter (completed Mar 2013 CSI-06-13);
- Development and publication of a detailed energy conservation and demand management plan with targets approved by senior management by July 1, 2014 (completed Apr 2013 CSI-09-13); and
- By July 1, 2019 and every five years thereafter publish an update to the original plan that reviews measures implemented, their actual results and forecasted impacts of planned measures, and any changes made to achieve our targets.

Energy conservation typically means reducing the total amount of energy consumed (kWh of electricity and m³ of natural gas). Demand management refers to either using efficient technologies or changing usage to reduce peak load. These are designed to help manage Ontario’s total use and peak demand for electricity.

The City of Burlington has a significant energy and environmental impact associated with its own operation. The City’s Environment and Energy Services staff ensure the City is identifying, implementing and reporting on opportunities that reduce the City’s direct environmental footprint, reduce current and future operating costs, and generate revenue. The Corporate Energy Management Plan was approved by council in 2013; a summary of progress on actions included in the plan is found in Appendix B.

A number of energy management initiatives were undertaken and completed in 2017, including:

- Upgrading and improving building systems efficiency;
- Developing a corporate culture focused on behaviors which improve efficiency and management methods;
- Analyzing consumption and demand to highlight and report on anomalies and implementation of corrective measures; and,
• Implementing a new electricity sub metering system at the city’s three largest electricity consuming facilities.

Strategy/Process:
The following section highlights initiatives that were initiated and/or implemented in 2017. For a list of energy management initiatives completed in 2016, please refer to report CW-25-17.

1. Real Time Electricity Sub Metering Systems:
In 2017, three real time electricity submetering systems were installed at Tansley Woods Community Centre, Appleby Ice Centre and Mainway Recreation Centre. These projects were partially funded through the Canada 150 Program as well as incentive programs through Burlington Hydro. These systems allow staff to review where, when and how buildings use electricity by installing wireless meters on the facilities’ largest electrical loads. Through this system and in conjunction with various automation systems staff are able to fine tune building systems, including refrigeration plants in arenas. The ability to see energy use real-time allows staff to make changes to systems and see the effect on energy use within hours or minutes rather than waiting to review billings on a monthly basis.

2. Corporate Building Automation System (BAS):
The BAS has been operating and helping save energy and operating costs since 2011. Building operations staff have received annual training and support since implementation in 2011. In 2017, Nelson arena received additional building automation capability and work began on a building automation system replacement at Burlington Transit HQ to bring the automation system up to current city standards. The BAS continues to be monitored and improved upon by city staff. A number of alarm points were added in 2017 to allow operations staff to be notified immediately of equipment issues, allowing for a better approach to detect equipment failure or unsatisfactory conditions in their buildings.

3. Mainway and Appleby De-Ox Systems:
In 2017 a De-Ox system for Zamboni water filling was installed at Mainway recreation centre. The De-Ox system saves energy by not requiring Zamboni water to be heated and subsequently reduces the load on refrigeration plant. Additionally, the De-Ox water produces ice that is harder, faster, more resilient to cuts and runs, and has greater clarity to show painted lines and logos in the ice. Additional value can also be seen in the reduction of carbon emissions from lowering the facilities’ natural gas use. Additional measures were added to the system to make it easier for operations staff to
use. Two more systems are being installed at Appleby Ice Centre in early 2018. All three De-Ox systems were partially funded by the Canada 150 Fund.

4. LED Lighting Upgrade at Mainway Arena
Over the past few years, Capital Works has been upgrading indoor and outdoor lights on buildings to enhance lighting levels and achieve greater energy savings using LED technologies as well as control strategies to further minimize energy use in lighting systems. Staff take advantage of funding opportunities to assist with larger capital investment projects. This year the lighting over the rinks, stands and in the lobby was replaced with new LED fixtures at Mainway recreation centre as part of the Canada 150 Funding program. Staff and patrons have noticed energy savings as well as improved lighting quality on the rink surface.

5. LED Lighting Upgrade at Burlington Transit Headquarters
Burlington Transit also received a lighting upgrade in their bus storage area, maintenance area and mezzanine. The lighting upgrade in the storage area as well as the mezzanine includes a lighting controls system featuring occupancy sensors in each fixture and dimmable drivers to allow lights to respond to an appropriate level depending on the movement around it. This project was partially funded through the Public Transportation Infrastructure Fund.

6. City Wide Streetlight Replacement
In 2017 the City partnered with Burlington Hydro to implement a community wide streetlight replacement project. The project replaced existing metal halide and high-pressure sodium fixtures with new LED fixtures. The project will save approximately 40% per year in electricity consumption as well as drastically reduce streetlight maintenance costs due to the low maintenance and long life of LED fixtures.

7. Corporate Fleet Data Collection
In 2017 fleet staff engaged Fleet Carma to provide technology in various city vehicles to assess the possibility of replacing them with partially electric or fully electric vehicles.

8. Transit Electric Buses
In 2017, Burlington Transit made application for funding to the Municipal Greenhouse Gas Challenge Fund to purchase a number of electric buses and charging infrastructure. Although the funding application was not successful staff continues to investigate the technology as it is a necessity to reach our carbon neutral operations goal.
Next Steps:
Below is a list of next steps staff is taking to ensure that the City of Burlington continues to be a leader in energy management and conservation

1. **Real Time Energy Metering System**
   Our collegiate pool facilities (Angela Coughlan, Aldershot and Centennial) are billed for energy by the Halton District School Board twice a year. Due to the low number of billings issued to the city, it has been difficult to track and assess the energy use of these facilities. With the implementation of the real-time electricity metering systems in 2017, we now have the ability to expand the systems to include our collegiate pools and gather improved data on their use and energy profile to staff to identify energy saving opportunities.

2. **RETScreen Energy Portfolio**
   RETScreen is a widely used and globally recognized software tool developed by Natural Resources Canada, that allows users to conduct performance and feasibility analysis. The software also allows users to create building models to review possible energy saving projects and processes, assess past projects that have been implemented, as well as predict energy use for future years given certain conditions.

   In 2017 staff engaged with Natural Resources Canada (NRCan) to assist The City of Burlington with creating a RETScreen energy model portfolio of all city facilities. A trial was done for each of the eight fire stations and once they had been fine tuned NRCan was advised to proceed with creating base models and analysis of all city facilities that will be refined by city staff.

3. **Revision and Updating of the Corporate Energy Management Plan**
   In 2018 staff will be updating the existing Corporate Energy Management Plan (CEMP) and associated city policies to reflect new corporate strategic goal of being carbon neutral in our operation by 2040. This will include the road map to carbon neutrality and what steps and goals will be targeted along the way.

4. **Staff Engagement Initiative**
   With the shift towards focusing on carbon emissions rather than dollars saved it is important for staff to understand the implications of operational changes and actions with respect to the carbon footprint. Along with updating of the CEMP, a new staff engagement initiative will be undertaken to inform city employees their impact on energy use and the city’s carbon footprint, and actions to improve the efficiency of city operations.
5. HVAC Upgrades

Upgrading HVAC (heating, ventilation and air conditioning) systems is an excellent way to decrease energy consumption as well as improve air quality in facilities. Upgrades are currently being designed for City Hall and Appleby Ice Centre. These upgrades will be aimed at improving energy and occupant comfort as well as reducing carbon emissions wherever possible.

6. Corporate Fleet

Upon completion of the Fleet Carma vehicle assessments, staff will undertake an update to the green fleet strategy.

Building Performance Charts:

The following charts provide Burlington’s 2017 utility use by building categories. Individual building performance values are included in Appendix A.

Chart 1: Electricity Consumption

The overall electricity consumption decrease can be attributed to improvements in equipment operation, control and monitoring, and energy efficiency measures. The overall electricity decrease in 2017 is approximately 842,566 kWh or 2.8% compared to 2016. It should be noted that part of the increase in the administration area is due to the addition of vehicle charging stations, which will be a growing trend across the city’s facility.
Chart 2: Water Consumption

Water consumption decreased by approximately 47,553 m$^3$ or 11.8%. This decrease can be attributed to a number of causes including a generally cooler summer and lower requirements for irrigation.

![Water Consumption by Building Type](chart)

<table>
<thead>
<tr>
<th>Building Type</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>22,158</td>
<td>21,257</td>
</tr>
<tr>
<td>Arenas</td>
<td>54,609</td>
<td>70,416</td>
</tr>
<tr>
<td>Fire Stations</td>
<td>4,614</td>
<td>4,538</td>
</tr>
<tr>
<td>Rec Centers and Pools</td>
<td>59,291</td>
<td>56,509</td>
</tr>
<tr>
<td>Cultural Facilities</td>
<td>22,249</td>
<td>21,324</td>
</tr>
<tr>
<td>Parks and Open Spaces</td>
<td>166,920</td>
<td>113,761</td>
</tr>
<tr>
<td>Other Buildings</td>
<td>54,098</td>
<td>49,911</td>
</tr>
<tr>
<td>Irrigation</td>
<td>20,027</td>
<td>18,697</td>
</tr>
</tbody>
</table>

Chart 3: Natural Gas Consumption

2017 had an increase in natural gas consumption by 10.4% or 236,637 m$^3$. This can largely be attributed to colder weather in 2017 compared with 2016.

![Natural Gas Consumption by Building Type](chart)

<table>
<thead>
<tr>
<th>Building Type</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin</td>
<td>312,927</td>
<td>319,439</td>
</tr>
<tr>
<td>Arenas</td>
<td>820,382</td>
<td>840,083</td>
</tr>
<tr>
<td>Fire Stations</td>
<td>102,716</td>
<td>128,696</td>
</tr>
<tr>
<td>Rec Centers and Pools</td>
<td>654,530</td>
<td>713,234</td>
</tr>
<tr>
<td>Cultural Facilities</td>
<td>85,786</td>
<td>106,184</td>
</tr>
<tr>
<td>Parks and Open Spaces</td>
<td>174,310</td>
<td>282,679</td>
</tr>
<tr>
<td>Other Buildings</td>
<td>117,380</td>
<td>114,228</td>
</tr>
</tbody>
</table>
Chart 4: Normalized City Usage

The chart below was produced using energy models for 50 of the city’s highest energy use facilities in RETScreen (project highlighted above). The chart indicates total energy use in equivalent kilowatt hours which considers electricity and gas usage. Using these models, we can normalize against the factors of influence for the city’s facilities, specifically weather and the amount of time refrigeration plants operate in arenas: This provides a more accurate representation of avoided energy usage.

Corporate Energy Management Plan Targets

The table below is a preliminary summary of the targets set out in the existing CEMP and our progress to date, over the course of the next year and as part of the revision to the corporate energy management plan we will be further analyzing data to provide a more accurate reflection of our overall results for each of the targets. As can be seen by our progress, significant improvements are needed in the area of fleet efficiency, which are currently underway with the collection of fleet data and revisions to the green fleet strategy. Target 3, which focuses on cost reduction was largely based upon the concept of fuel switching from electricity to natural gas where possible is not being pursued due to its impact on the city’s carbon footprint.

<table>
<thead>
<tr>
<th>No.</th>
<th>Target</th>
<th>Progress to Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15% Overall reduction of energy consumption for facilities (ekWh/ft²)</td>
<td>9% Decrease</td>
<td>Energy efficiency measures have made some improvement but more will need to be done.</td>
</tr>
<tr>
<td>No.</td>
<td>Target</td>
<td>Progress to Date</td>
<td>Comments</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------------------</td>
<td>-------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>10% Reduction of water consumption for facilities (m3/ft²)</td>
<td>4% Increase</td>
<td>Increases in programming in pools has led to an increase per sq ft. Goal will need to be re-evaluated.</td>
</tr>
<tr>
<td>3</td>
<td>20% Reduction in energy cost for facilities ($/ft)</td>
<td>n/a</td>
<td>See comments above.</td>
</tr>
</tbody>
</table>
| 4   | 10% Reduction of corporate fleet fuel consumption (L/100km)| Light Duty - Increase 12%  
Medium Duty - Increase 17%  
Heavy Duty - Increase 16% | Action is being taken with the revision of the green fleet strategy. |
| 5   | 10% Reduction of fire fleet fuel consumption (L/100km)     | n/a               | Data is within the numbers above as it is not currently tracked separately. |
| 6   | 5% Reduction for transit fleet fuel consumption (L/100km)  | n/a               | Data is not currently available.                                          |
| 7   | 20% reduction of electricity consumption for street lighting| 4% Reduction      | Streetlight replacement project is currently underway and we expect to exceed the 20% reduction goal in 2018. |

**Corporate Greenhouse Gas Emissions:**

Corporate facility assets and fleet are a source of greenhouse gas emissions, directly and indirectly because of natural gas, electricity and fuel consumption. However, due to the phasing out of coal fired generation plants, greenhouse gas emissions from the electricity sector have been minimized across the province. The city continues to implement energy conservation projects and investigates new and renewable technologies in order to mitigate greenhouse gas emissions.

In 2017, greenhouse gas emissions from city operations increased slightly from 2016, although still on a downward trend since 2012. The table below does not include emissions from transit, as under the Partners for Climate Protection Program, municipal transit systems are considered part of the community emissions profile.
The following chart breaks out greenhouse gas emissions by specific city operation from 2012 to 2017. For information purposes, transit (2nd bar) has been included in the table below. Emissions from facility operations (1st bar) continues to fluctuate as energy consumption is impacted by different factors, including weather, facility usage, and other operational issues. The most significant change has been experienced with streetlights and traffic signals (3rd bar), which is expected to decline into 2018 due to the change in streetlight technology to more efficient LED fixtures.
In 2015, Council included a target in the strategic plan for city operations to be net carbon neutral by 2040. Overall emissions from 2013 to 2017 have decreased by approximately 1000 tonnes greenhouse gas emissions. Staff have projected similar decreases to 2035, however, a steep decline with transformational change will be required to meet the 2040 target.

As noted previously, a key component in the update the Corporate Energy Management Plan will be to compile best practices for municipal operations to become net carbon neutral.

**Financial Matters:**
Appendix A summarizes utility cost on a site by site basis. This cost includes account charges, delivery, storage and various other components of the utility billings.

Ontario’s Fair Hydro plan as well as consumption reductions can explain the drop in the total cost of electricity. The new Cap and Trade program as well as the above-mentioned increases in natural gas usage can be attributed to the increased cost in natural gas.

The City of Burlington bulk purchases electricity and natural gas through the Halton Purchasing Cooperative Group (HPCG). This has helped reduce the average cost of utilities for some energy accounts and provide price stability/savings. Staff continues to monitor and manage utility use and purchase contract options to obtain best value for the City.

The table below summarizes overall cost and consumption for each utility across all city utilities.

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost</td>
<td>Consumption</td>
<td>Cost</td>
<td>Consumption</td>
</tr>
<tr>
<td>Electricity</td>
<td>$4,787,788</td>
<td>29,991 MWh</td>
<td>$4,561,128</td>
<td>29,148 MWh</td>
</tr>
<tr>
<td>Water</td>
<td>$931,288</td>
<td>403,966 m3</td>
<td>$906,018</td>
<td>356,413 m3</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>$496,876</td>
<td>2,268,032 m3</td>
<td>$639,679</td>
<td>2,504,669 m3</td>
</tr>
<tr>
<td>Diesel</td>
<td>$2,022,997</td>
<td>2,656,385 L</td>
<td>$2,257,606</td>
<td>2,559,036 L</td>
</tr>
<tr>
<td>Gasoline</td>
<td>$355,891</td>
<td>353,961 L</td>
<td>$407,483</td>
<td>369,829 L</td>
</tr>
<tr>
<td>Total</td>
<td>$8,564,840</td>
<td></td>
<td>$8,771,914</td>
<td></td>
</tr>
</tbody>
</table>

**Total Financial Impact**

While not quantified at this time, transitioning city operations to be net carbon neutral by 2040 will require substantial investment over time in new technologies. Many of these upfront costs will result in operational savings, such as the LED street light program, resulting in future avoided costs. The update to the Corporate Energy Management Plan will begin to identify these investments, recognizing that technology and costs are evolving rapidly.

**Source of Funding**

Not applicable
Other Resource Impacts – Corporate Energy Management Committee:

An Energy Management Committee was initiated in 2013 involving staff from stakeholder departments for the development and future administration of the Corporate Energy Management Plan. The Energy Management Committee has the following objectives:

- Promote the wise use of energy within the municipal operating areas by providing department managers with information about available rebates and opportunities for reduced operating costs;
- Prepare action plans for opportunities that demonstrate potential for capital cost savings and reduced operating costs through energy reduction and to bring these forward for review as part of the budget process;
- Use the money saved through energy rebates to pay for facility audits that will identify further energy-saving opportunities and cost savings and pay for other energy savings and sustainability projects.

In 2018 the committee will review the 2013 Corporate Energy Management Plan in advance of an updated Corporate Energy Management Plan that will need to be prepared with completion and approval in 2019. A related initiative in the new Strategic Plan will also be considered: ‘The City will develop and implement a plan to make city operations net carbon-neutral.’

Public Engagement Matters:

The City continues to participate in energy conservation events such as Earth Hour on an annual basis. The Take Action Burlington blog is also used to engage staff and the public in energy conservation initiatives. City staff are planning initiatives to make the public more aware of our corporate energy use.

Summary:

Although there was an increase in usage in some areas, this can generally be attributed to weather factors and an increase in service to the public. Through mitigating the increase of energy use as well as increasing services, the City of Burlington continues to be in a position of leadership in municipal energy management. Progress was made in 2017 towards meeting the goals set in the Corporate Energy Management Plan. Through implementation of energy efficiency measures and initiatives, city staff continue to work towards those goals and create a corporate energy and environmental conscious work culture.

Since 2013, the Province of Ontario through Ontario Regulation 397/11 mandates municipalities to comply with annual energy consumption and greenhouse gas reporting.
requirements starting in 2013. This report illustrates that Burlington will once again be able to satisfy the legislative requirements of this regulation.

Energy Management Involves Everyone!

Respectfully submitted,

Tom Pedlar
Coordinator, Project Management - Energy
X7354

Appendices:

A. Energy consumption and cost summary
B. Corporate Energy Management Plan Action Items Update

Report Approval:

All reports are reviewed and/or approved by Department Director, Director of Finance and Director of Legal. Final approval is by the City Manager.