



# City of Richmond

## Report to Committee

**To:** General Purposes Committee

**Date:** May 30, 2016

**From:** John Irving, P.Eng, MPA  
Director, Engineering

**File:** 10-6125-05-01/2015-  
Vol 01

**Re:** 2015 Corporate Energy Management Program Update

### Staff Recommendation

That Council endorse a target of reducing greenhouse gas (GHG) emissions from corporate buildings by 65% from 2007 levels by 2020 to help the City meet the community greenhouse gas emissions reduction target of 33% reduction from 2007 levels by 2020.

John Irving, P.Eng, MPA  
Director, Engineering  
(604-276-4140)

Att. 2

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER 	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: DW
APPROVED BY CAO 	

## **Staff Report**

### **Origin**

The City's Energy Management Program (EMP) and energy initiatives described in this report support the following Council 2014-2018 Term Goals:

#### **#4 Leadership in Sustainability:**

- 4.1. Continued implementation of the Sustainability Framework.*
- 4.2. Innovative projects and initiatives to advance sustainability.*

#### **#5 Partnerships and Collaboration:**

- 5.1. Advancement of City priorities through strong intergovernmental relationships.*
- 5.2. Strengthened strategic partnerships that help advance City priorities*

#### **#6 Quality Infrastructure Networks:**

- 6.1. Safe and sustainable infrastructure.*

Attachment 1, "Energy Update Report," includes a summary of key highlights of the Energy Management Update Report and recent City energy initiatives.

### **Background**

The City's EMP contributes to the increased energy efficiency and reduced greenhouse gas (GHG) emissions in the corporation. The EMP helps support the City's long term goal of maintaining carbon neutral corporate operations, mainly through decreased natural gas use. The continuing support and enhancement of the energy efficiency and reduction initiatives is integral to maintaining the City's Climate Action Charter commitments and overall corporate sustainability.

The City's EMP has continued to be successful in increasing energy resource use efficiency by the corporation by focusing on three main action areas:

1. Energy conservation – reduce the overall demand for energy (e.g., increased energy use awareness and improved operational control to reduce waste)
2. Energy efficiency – reduce the energy required for operations (e.g., lighting retrofits to more efficient technologies)
3. Renewable and clean energy – increase the use of renewable energy and reduce the carbon intensity of emissions (e.g., installation of solar thermal energy systems)

With Council's sustained support of the City's EMP, the City continues to develop and implement innovative corporate and community energy efficiency projects, and embed energy efficiency within the City's corporate culture.

The City continues to work closely with utility partners to bring forward reduction initiatives and maximize partnerships opportunities. Based on the City's continuing efforts and success with its

energy efficiency and conservation work, the City remains the only municipality in BC to have achieved the Leadership Excellence Award designation (the highest level of recognition BC Hydro presents).

In addition to this overall corporate program recognition, the City was also recognized by BC Hydro for its continuing partnership and volume of projects delivered in 2014/2015, with a sponsored Vancouver Sun article promoting the City's energy efficiency achievements to date and energy management vision.

As part of the 2016-2017 EMP funding agreement with BC Hydro, the City has committed to an electricity reduction of 3.2% or 1,200,000 kWh by April 2017 (from 2015 levels), which is equal to the energy used by approximately 30 single-family homes in Richmond per year. This target and continued collaboration with BC Hydro helps to maximize the overall incentive funding the City receives, and allows for the continued delivery of energy management projects and helps to maintain focus on optimization initiatives.

Moving forward, the City will be focusing on reducing corporate GHG emissions, which may include fuel switching from natural gas to electricity. It is imperative that projects aimed at electricity use reduction continue to be developed so that overall corporate energy reduction can be achieved.

## **Findings of Fact**

### **EMP Achievements – 2008-2014 EMP Highlights**

Energy conservation work at the City and energy related projects have cumulatively saved over 48.0 GWh of energy since 2008 (equal to the energy consumption in 1,200 Richmond single-family homes per year). In this same period, the City has avoided approximately \$2,400,000 in total operational costs and over 6,800 tonnes of greenhouse gas emissions (CO<sub>2</sub>e) (equal to emissions from 2,100 Richmond cars). Since 2008, the City has received over \$1,700,000 in external funding that has supported expanded EMP projects and accelerated the repayment of capital funding to the corporate Enterprise Fund. The Enterprise Fund is an internal corporate fund that many EMP projects are funded through, with energy utility savings used to repay the Fund.

### **Corporate Energy Use Overview - 2015**

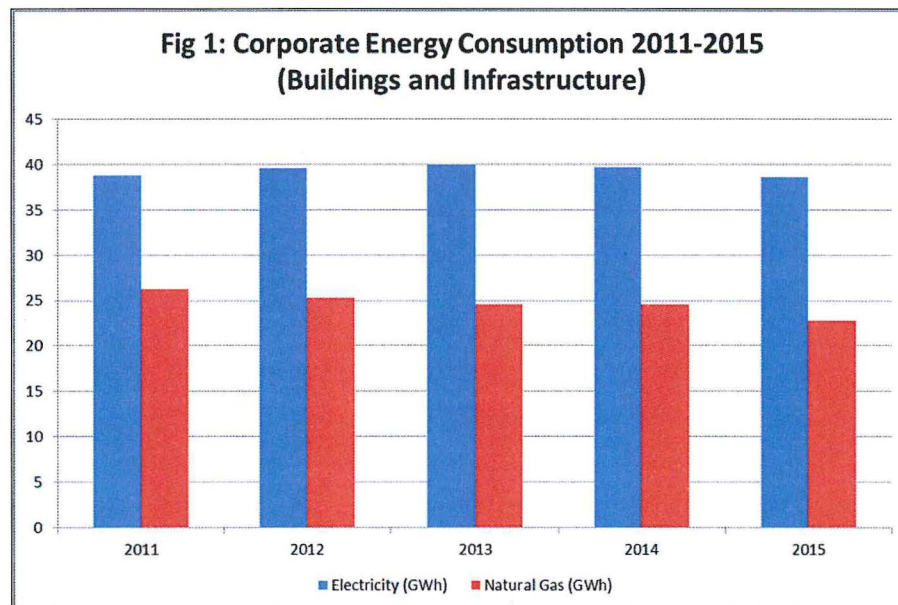
In 2015, City assets, not including the fuel used by the City's fleet, consumed approximately \$5.0 million dollars of conventional energy<sup>1</sup> (electricity and natural gas), which equals 60.0 GWh (equivalent to the amount of energy used on average each year by approximately 1,500 homes in Richmond). This energy use resulted in corporate emissions of approximately 4,300 tonnes of CO<sub>2</sub>e.

As shown in Figure 1 below, the total electricity use for City buildings and infrastructure has remained fairly stable since 2011. This is a positive result over that time, given that the City has added infrastructure and has switched building energy use from natural gas to cleaner electricity where feasible. Given a focus on GHG emissions reductions, natural gas use has been steadily decreasing, with an approximate reduction of 13% since 2011. With a continued focus on reducing corporate GHG emissions, the City expects to continue the trend of a levelling or slight increase to electricity use, in conjunction with decreasing natural gas use.

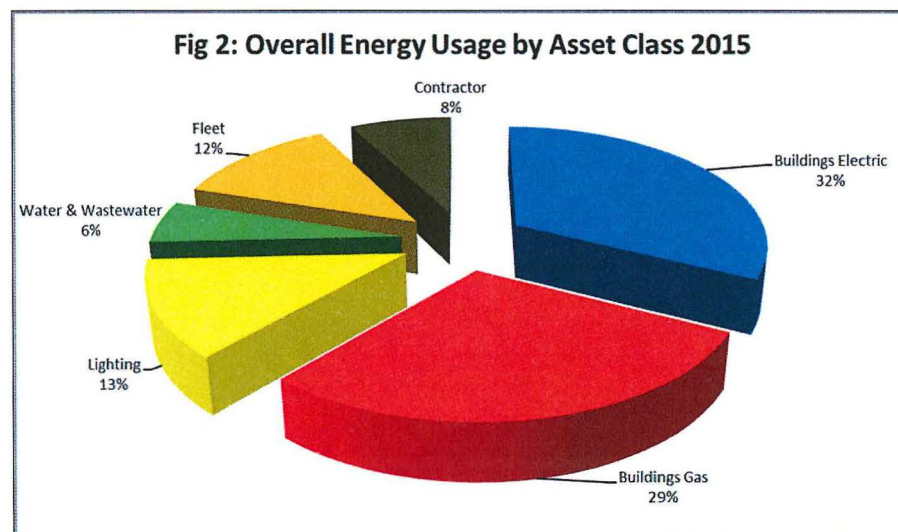
---

<sup>1</sup> There are civic buildings that have renewable energy systems (e.g. solar thermal hot water heating at Steveston Community Centre), which obtain "free" solar energy that is not accounted for in our total corporate energy use/cost amount.

Without the continued investment and improvement in resource use efficiency in existing buildings and equipment over the past number of years (i.e. given business as usual replacements and development), it is estimated that the City's energy use would have increased by 15% since 2011.

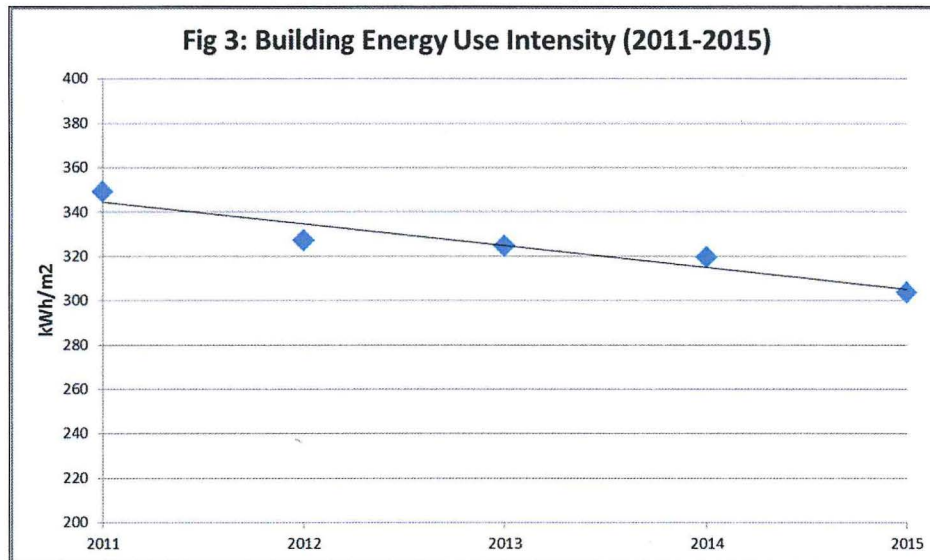


Since energy use at civic buildings accounts for a majority (approximately 61%) of total reported corporate energy use in 2015, a continued focus of the City's EMP has remained on increasing the energy efficiency at City facilities (see Figure 2 – Overall Energy Usage by Asset Class).



As shown in the following Figure 3, civic building energy use intensity has decreased from approximately 349 kWh/m<sup>2</sup> in 2011 to 303 kWh/m<sup>2</sup> in 2015. This reduction in energy use intensity is a strong indication that the City's EMP remains an effective tool to reduce corporate energy use. Further reduction in building energy use intensity will occur once the replacement of Fire Hall No.1 and Fire Hall No.3, and the replacement of the Minoru Aquatic Centre and Older Adults Centre have been completed in 2017.





The Corporate EMP focuses significantly on facilitating energy use reduction and optimization initiatives, as well as maximizing external incentive opportunities. At the same time other corporate and community benefits are also pursued (e.g. improved lighting/safety, increased client comfort, and improved operator control). Energy reduction and optimization projects are conducted in collaboration with multiple stakeholders, to ensure that numerous project benefits are achieved from building improvements or infrastructure replacements.

Energy management best practices are the responsibility of all staff, and staff are encouraged to play an active role in identifying energy efficiency and reduction opportunities whenever possible.

#### EMP Achievements - 2015 EMP Highlights

In conjunction with the City's Capital Buildings Project Development, Facilities Services, and Engineering Planning sections, energy efficiency projects that have been recently completed are anticipated to save the City approximately 1,700,000 kWh in electricity and natural gas use (equal the power used in 44 homes in Richmond in a year) and avoid over \$90,000 in operational costs. This total energy savings represents a reduction of approximately 2.8% in overall City energy use, and will result in reduced emissions of over 260 tonnes of CO<sub>2</sub>e (equal to removing approximately 80 Richmond cars from the roads each year). Based on the net capital cost to the City of approximately \$575,000 to complete these 2015 EMP projects, it is anticipated that these projects overall will have a 6.4 year payback.

As part of the previous 2014-2015 EMP funding agreement with BC Hydro, the City committed to reduce electricity use by 1.3% or 523,000 kWh by April 2016 from 2014 levels. The City was able to exceed that target this past year through various energy reduction initiatives that are expected to reduce electricity use by 550,000 kWh.

A detailed overview of EMP projects highlights in 2015 is provided in Attachment 2. General highlights include:

- External Funding: \$280,000 of external funding was leveraged to support the City and the Corporate Energy Management Program in 2015.
- Showcase project: Control and equipment optimization work at Watermania has resulted in significant reductions in natural gas use at that facility, and accounts for the majority of the anticipated energy savings from 2015 projects. Additional work is scheduled to be conducted in 2016 to further reduce natural gas use, and optimize equipment run time at the facility. This continued work will increase the amount of heat recovery occurring at the facility, to reduce the amount of waste heat that the facility has to dissipate.

The 2015 Watermania project is on track to achieve over 800,000 kWh in net energy savings after a full year of implementation. These savings represent an overall reduction of 10% in energy use and a reduction of approximately 25% in GHG emissions at the facility. The planned 2016 projects are expected to further reduce energy use at the facility by 20% and reduce GHG emissions by another 40%.

- Policy Implementation: To help ensure that City's building and equipment infrastructure that is developed by the City or by a third party is as standard as possible and meets a minimum level of energy efficiency, the City has created a Building Equipment, Monitoring, and Integration Requirements document. The document encompasses strategically important areas for building operation, including equipment standards and energy monitoring, water use efficiency, indoor environmental quality, building automation system integration and lighting system control and equipment.

It is envisioned that this document will be used as a guide when clarification and direction is needed by internal corporate departments, and by external designers, consultants, and contractors. The implementation of this internal document will help to enable the greater standardization of equipment and controls in City buildings, which will increase maintenance and operational efficiency, as well as energy use efficiency.

- Building Control Upgrades: Upgrades to building automation systems at key corporate facilities is on-going, with projects at City Hall and the Works Yard almost complete. The City is working to complete upgrades to Thompson Community Centre, Gateway, Steveston Community Centre and the Library Cultural Centre through Phase 2 of the management plan. Currently this plan has two of the three Phases funded with Phase 3 getting submitted for council consideration in 2016. If all three phases of the plan get completed, the City will have modernized more than half of its current automated control buildings with new control infrastructure to better respond to occupant needs, to allow for closer monitoring of building equipment, and to better track energy use.

In addition to corporate energy management activities, the City is active in the development of community energy and emissions reduction actions through the advancement of district energy. The City has two renewable district energy systems in operation, the Alexandra District Energy Utility, and the Oval Village District Energy Utility. These investments will help the City transition from conventional energy sources to more sustainable and stable energy systems, reducing long term costs to customers and greenhouse gas (GHG) emissions.

### EMP Goals for 2016 and Upcoming Projects

The following main focus areas remain in place for the EMP for 2016:

- Increase energy use awareness within the organization and show leadership in the community
- Pursue external funding and partnerships with outside agencies
- Maintain a leadership role in municipal energy systems and policy
- Improve the usability of energy use data at key facilities, to allow for more detailed analysis and the increased optimization of energy use
- Incorporate a more systematic approach to building energy use performance analysis in civic facilities, to allow for the continued improvement of facilities, and the extension of their usefulness
- Continue to ensure that energy use and GHG emission accounting (in relation to reduction goals) is a high priority during the designing of new facilities and developments

The following key energy initiatives are in various stages of implementation, and are scheduled to be completed in 2016:

- Solar photovoltaic renewable energy system installation at City Hall
- Heating plant and mechanical improvements at Watermania Aquatic Centre
- Completion of building automation system upgrades and improved energy monitoring capabilities at Thompson Community Centre and Gateway Theatre
- Lighting retrofits and heating system improvements at various facilities, including City Hall and various Fire Halls.

### GHG Emissions Reductions Target – Corporate Buildings

The two main GHG emissions sources for the City are natural gas use in buildings and fuel use by Fleet. Currently there is a GHG emission reduction target for Fleet that has been approved by Council through the Green Fleet Action Plan of a 20% reduction in emissions by 2020 from 2011 levels. A reduction target for emissions from existing corporate buildings has not been previously presented to Council for consideration. Staff recently undertook a review of the anticipated corporate GHG emissions reduction from approved major projects and potential GHG emissions reduction from projects that are planned to be submitted for Council consideration starting in 2016.

With the completion of the Phase I of the Major Facilities Plan and approved EMP projects at Watermania by the end of 2017, it was identified that the City has the opportunity to reduce corporate building emissions by 48% from 2007 levels. This anticipated reduction combined with previous corporate reductions, will position the City to be within reach of achieving the community GHG emissions reduction target of 33% from 2007 levels by 2020. To meet and exceed the community GHG reduction target, additional projects that focus on reduction of natural gas usage through equipment upgrades, fuel switching and renewable energy integration at corporate buildings will need to be implemented.

Projects that focus on reducing GHG emissions are being developed for capital funding consideration by Council starting in 2016. Given the implementation of existing approved

projects and planned projects between 2017 and 2019 (pending approval), the City has the opportunity to reduce GHG emissions from buildings by 65% from 2007 levels by 2020. Achieving a 65% GHG emissions reduction target for corporate buildings by 2020 will help to ensure that the City can meet the community GHG emissions reduction target of 33% from 2007 levels by 2020 and will support progress on achieving GHG emissions reduction target of 80% from 2007 levels by 2050. Achieving these community emissions reduction targets corporately, positions the City as a leader in corporate emissions management, and enables the City to further promote the opportunity and need for community partners to follow suit.

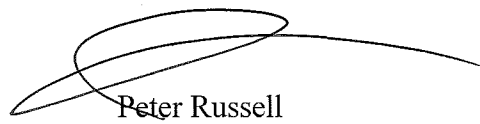
### **Financial Impact**

None.

### **Conclusion**

Through Council's sustained commitment to optimizing corporate energy use and reducing corporate GHG emissions, the main areas of focus for the City's Energy Management Program remains to facilitate energy reduction initiatives, embed energy management best practices into corporate processes, and maximize external funding support to help develop and deliver more projects and results. The Program has been very successful in developing and implementing projects at City facilities that increase energy efficiency and provide other corporate and community benefits. Cumulatively since 2008, energy conservation projects at the City have saved over 48.0 GWh of energy (equal to the energy consumption in 1,200 Richmond single-family homes per year), which amounts to approximately \$2,400,000 in cost avoidance savings and over 6,800 tonnes of greenhouse gas emissions reduced (equal to emissions from 2,100 Richmond cars). Without the continued investment and improvement in resource use efficiency in existing buildings and equipment, it is estimated that the City's energy use would have increased by 15% since 2011.

Given the development that the City has undertaken to create sustainability and energy targets for new corporate buildings and existing infrastructure, with the implementation of the City's High Performance Building Policy and Green Fleet Plan, and the City's continued focus on energy conservation and increased integration of renewable energy sources, the City is well positioned to deeply reduce operating cost and conventional energy use through the endorsement of a target to reduce building GHG emissions by 65% from 2007 levels.

  
for Levi Higgs  
Corporate Energy Manager  
(604-244-1239)  
Peter Russell  
Senior Manager, Sustainability and District Energy  
(604-276-4130)

- Att. 1 Energy Update Report – Summary 2015
- Att. 2 City Energy Management Program – 2015 Key Initiatives



# Energy Update Report

## Summary 2015

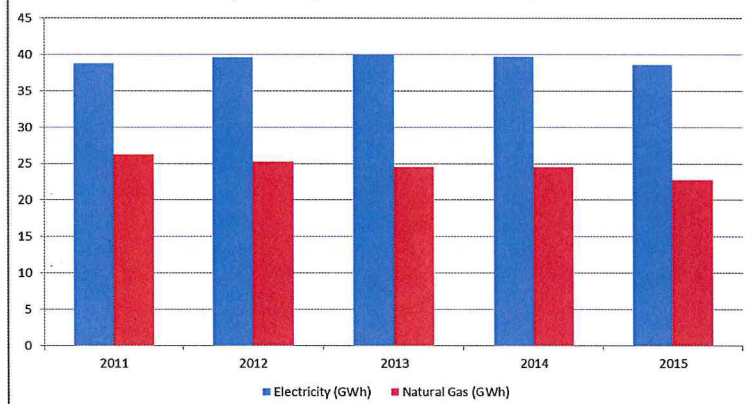




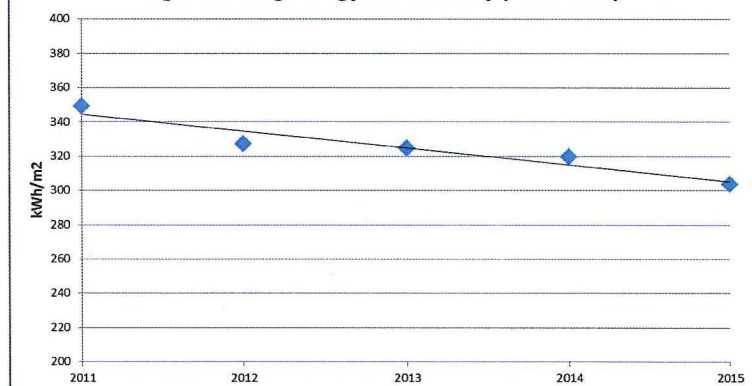
- Cost of energy in 2015 for the City of Richmond buildings, lighting, water and wastewater services = **\$5.0 million dollars or 60.0 GWh** (this is equal to the average power consumed in ~1,500 homes in Richmond in 1 year).
- This energy use resulted in approximately 4,300 tonnes of greenhouse gas (GHG) emissions.
- The total energy use for City infrastructure has remained fairly stable since 2011.
- Cumulatively since 2008, energy conservation projects at the City have saved approximately **48.0 GWh** of energy (equal to the energy consumption in ~1,200 Richmond homes per year), and over **6,800 tonnes** of greenhouse gas emissions (equal to emissions from ~2,100 Richmond cars).
- Without the continued investment and improvement in resource use efficiency in existing buildings and equipment, it is estimated that the City's energy use would have increased by **15%** since 2011.



**Fig 1: Corporate Energy Consumption 2011-2015 (Buildings and Infrastructure)**



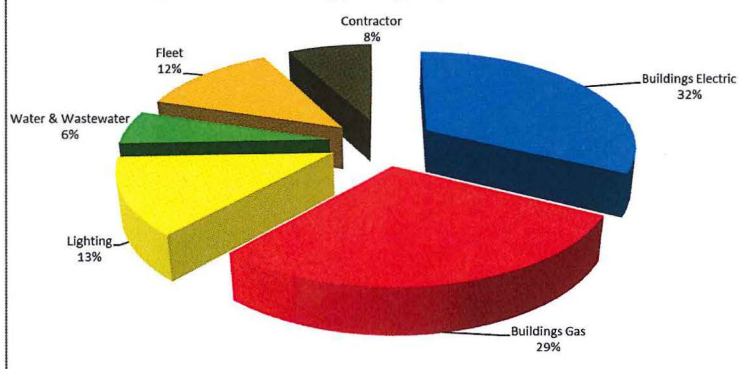
**Fig 2: Building Energy Use Intensity (2011-2015)**



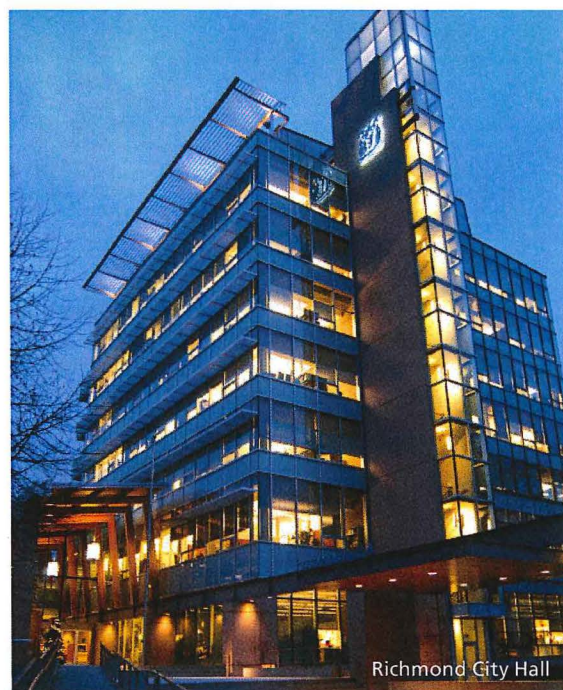
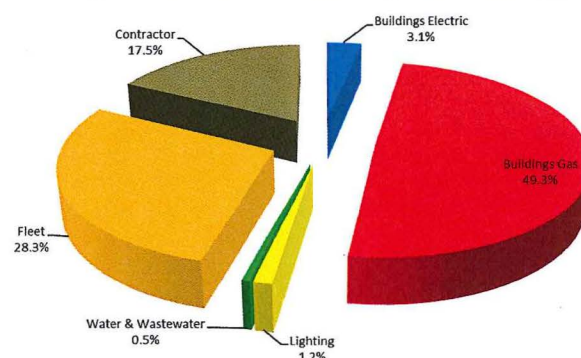


- In 2015, the majority of corporate energy use was by **buildings-61%**, followed by **lighting-13%** and **Fleet services-12%**.
- For corporate GHG emissions, natural gas usage at buildings is responsible for a majority of the City's annual emissions – accounting for approximately 50% in 2015.
- Continued focus and work is on-going in City facilities to reduce and/or displace natural gas use, which will reduce corporate GHG emissions and costs.

**Fig 3: Overall Energy Usage by Asset Class 2015**



**Fig 4: Overall GHG Emissions by Asset Class 2015**





# Energy Management

## Program Highlights 2015

### 2015 Highlights:

- Maintained the City's **Carbon Neutral** status for corporate operations.
- Secured over **\$280,000** of external funding to support the Energy Management Program.
- Achieved an estimated reduction of **1.7 GWh** in electrical and natural gas use and approximately **260 tonnes** of GHG emissions from a variety of projects in 2015.
- This energy reduction represents approximately **2.8%** of the City's current corporate annual energy use and the GHG emissions reduction are equal to removing approximately **80 vehicles** from Richmond roads each year.
- The energy reduction will result in over **\$90,000** in operational cost avoidance savings.



Cambie Community Centre



City Hall Atrium



BCHydro   
powersmart

2014 POWER SMART  
**LEADER**



### Showcase Projects:

- Completed controls and equipment optimization at Watermania to increase the amount of heat recovery occurring at the facility, and reduce waste heat.
- Projected energy savings for this Watermania project = **800,000 kWh or a 10% reduction in energy use at the facility.**
- Completed major lighting retrofits and re-lamping projects at Britannia Shipyards and at the Richmond Courthouse building.



### Policy Implementation:

- It is projected that the new Minoru Complex facility and Fire Hall No. 1 will achieve LEED Gold designation with a strong focus on energy efficiency.
- For the new Minoru Complex, the positive benefits that can be attributed to this high level of designation include; doubling the size of the facility with **no increase in energy use, reduction of GHG emissions by 70%**, with planned integration of **renewable energy generation** at the facility.





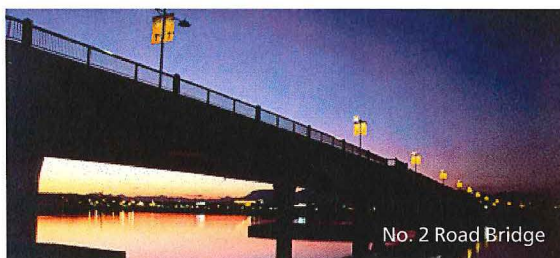
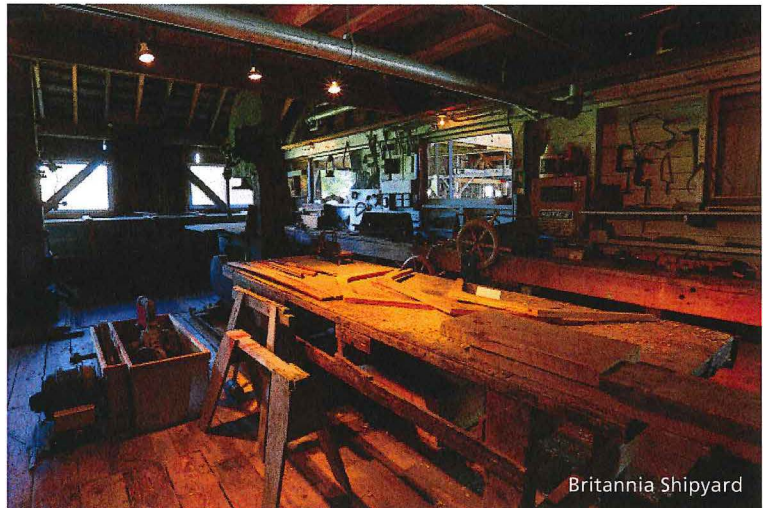
### 2016 Vision and Goals

The following main focus areas remain in place for the EMP for 2016:

- Improve the energy use monitoring at City facilities, to optimize facility operation and reduce energy use and costs.
- Ensure that energy use and GHG emission accounting (in relation to reduction goals) is a high priority during the designing of new facilities and equipment replacement.
- Continue to pursue external funding and partnerships with outside agencies.
- Continue to increase energy use awareness within the organization and community.

### 2016 Action items:

- Complete heating plant and mechanical improvements at Watermania Aquatic Centre.
- Complete building automation system upgrades and improved energy monitoring capabilities at Thompson Community Centre and Gateway Theatre.
- Implement and complete Phase 1 of the City's street lighting upgrade plan.
- Complete heating system and lighting optimization at various corporate facilities.





### City Energy Management Program – 2015 Key Initiatives

	2015 Key Initiatives
<b>Plan</b>	<p><b><i>Energy Strategic Planning:</i></b></p> <ul style="list-style-type: none"> <li>Received \$280,000 of external funding to support the City and the Corporate Energy Management Program in 2015</li> <li>In the process of securing over \$80,000 in external project funding in to support some infrastructure upgrades and replacements in 2016 including; <ul style="list-style-type: none"> <li>Phase 1 of the City's street light LED conversion program</li> <li>Lighting retrofits and improvements at various facilities, including City Hall, Community Safety building and Fire Halls</li> </ul> </li> <li>Helped develop a street lighting fixture conversion upgrade plan, for implementation over the next four years, to replace the City's most aged street light fixture infrastructure. Once fully implemented, the plan will replace 25% of the City's 11,000 street lights that have passed or are near their end of life, with more efficient light emitting diode (LED) technology.</li> <li>In collaboration with the Project Development Unit, identified 2016 building/infrastructure improvement projects that could qualify for incentives, to maximize the City's external funding opportunities</li> </ul>
<b>Do</b>	<p><b><i>Building Capacity</i></b></p> <ul style="list-style-type: none"> <li>Workplace conservation Awareness program Year 5 completed in 2015 (initiatives included promotion of Earth Hour, stay bright by daylight campaign, and a water waste information workshop).</li> <li>Alignment of capital submissions for yearly building improvement and energy management related requests, to ensure that projects are delivered seamlessly (e.g. coordinating the building and energy improvements at Garratt Wellness Centre).</li> </ul> <p><b><i>Reducing Energy Use or Displacing conventional energy sources</i></b></p> <ul style="list-style-type: none"> <li>Optimized control and equipment at Watermania to reduce natural gas use at that facility</li> <li>Completed major lighting retrofits and re-lamping at Britannia Shipyards and at the Richmond Courthouse building.</li> <li>Optimized heating systems and controls at Steveston Community Centre Complex, including upgrading the boilers.</li> <li>Completed street lighting fixture upgrades at various locations along Miller and Garden City Roads.</li> </ul> <p><b><i>Increasing Financial Security &amp; Stability</i></b></p> <ul style="list-style-type: none"> <li>Over \$100,000 in energy and maintenance cost avoidance savings</li> <li>Continued development and completion of external project funding agreements with stakeholders, helping to reduce the capital cost of projects and provide funding for future project development</li> </ul>

	2015 Key Initiatives
<b>Monitor &amp; Report</b>	<p><b><i>Improving Energy Monitoring System</i></b></p> <ul style="list-style-type: none"> <li>• Building automation system upgrades are underway at Gateway and Thompson Community Centre, as part of an Upgrade Management Plan – Phase 2</li> <li>• The corporate energy use database is undergoing upgrades to allow of increased functionality (e.g. greater energy use reporting capabilities to stakeholders, and increased efficient reporting function for BC reporting requirements)</li> </ul> <p><b><i>Reporting Performance</i></b></p> <ul style="list-style-type: none"> <li>• Annual Corporate-wide Energy update report to Council</li> <li>• Semi-Annual reporting to Senior Management, on Energy Management Program status and work plan</li> <li>• Quarterly reporting to BC Hydro</li> </ul>
<b>Innovate &amp; Improve</b>	<p><b><i>Exploring New Approaches and Technologies</i></b></p> <ul style="list-style-type: none"> <li>• The following projects and feasibility of further evaluation will be assessed in the coming months for potential inclusion in the 2017 capital submission process <ul style="list-style-type: none"> <li>○ Natural gas major equipment upgrade at various facilities</li> <li>○ Renewable energy system installation at Library Cultural Centre</li> <li>○ Further implementation of building automation system upgrades and energy monitoring improvements at select facilities</li> <li>○ Street lighting LED and replacement plan development – Phase 2</li> </ul> </li> </ul> <p><b><i>Energy Management System Evaluation</i></b></p> <ul style="list-style-type: none"> <li>• Completed BC Hydro energy management system assessment in June 2014 five action items/areas were identified that will enhance the City's Energy Management Program and help facilitate continual corporate energy efficiency improvement – these action items were addressed in 2015 and another system assessment is planned to be conducted in 2016</li> </ul> <p><b><i>Development of Internal Building Optimization Procedures</i></b></p> <ul style="list-style-type: none"> <li>• Given the City's in-house building automation system expertise, the City is exploring the development of an optimization procedure plan for buildings, to ensure that they are operating as efficiently and optimally as possible. With occupant comfort and productivity being paramount to the successful operation of the building.</li> </ul>