



City of Richmond

Report to Committee

To: Public Works and Transportation Committee
From: John Irving, P.Eng, MPA
Director, Engineering
Re: 2014 Corporate Energy Management Update

Date: June 25, 2014
File: 10-6000-01/2013-Vol
01

Staff Recommendation

That the staff report titled "2014 Corporate Energy Management Program Update" report from the Director of Engineering, dated June 25, 2014, be received for information.

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:
APPROVED BY CAO 	

Staff Report

Origin

The Corporate Energy Management Program (EMP) supports Council's Term Goal 8.1 Sustainability:

Continued implementation and significant progress towards achieving the City's Sustainability Framework, and associated targets.

The EMP is a key contributing program towards achieving the Sustainability Framework Goals of a Sustainable Resource Use-Energy Smart City and Climate Prepared City. This report summarizes the recent achievements of the Corporate EMP and highlights upcoming initiatives. Attachment 1 includes a summary of key highlights of recent City energy initiatives.

Background

The City's EMP contributes to increased energy efficiency and is a major component of the City's "Towards Carbon Neutrality Implementation Strategy", adopted by Council in October 2013. The EMP achieves this 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)

Similar to recent years, the City enters into a funding agreement with BC Hydro, with the commitment to reduce corporate electricity use by a target of 1.6% or 660,000 kWh by April 2015 (from 2013 levels), which is equal to the energy used by approximately 20 homes in BC per year. This target and the continued collaboration with BC Hydro helps to maximize the incentive funding the City receives and allows for the continued delivery of projects. Due to the City's continued focus on energy efficiency and collaboration with BC Hydro, the City of Richmond recently received three recognition awards for completed projects and has been nominated again as a BC Hydro PowerSmart Leader Award finalist for 2014. The final determination of this year's award recipients will be made in October 2014.

Findings of Fact

EMP Achievements – 2007-2012 EMP Highlights

Energy conservation work at the City and energy related projects have saved approximately 35.0 GWh of energy (equal to the energy consumption in 970 BC homes per year) since 2007. In this same period, the City has avoided approximately \$1,750,000 in operational costs and over 5,000 tonnes of greenhouse gas emissions (equal to emissions from 1,500 Richmond cars). Since 2007, the City received approximately \$1,000,000 in external funding which has supported

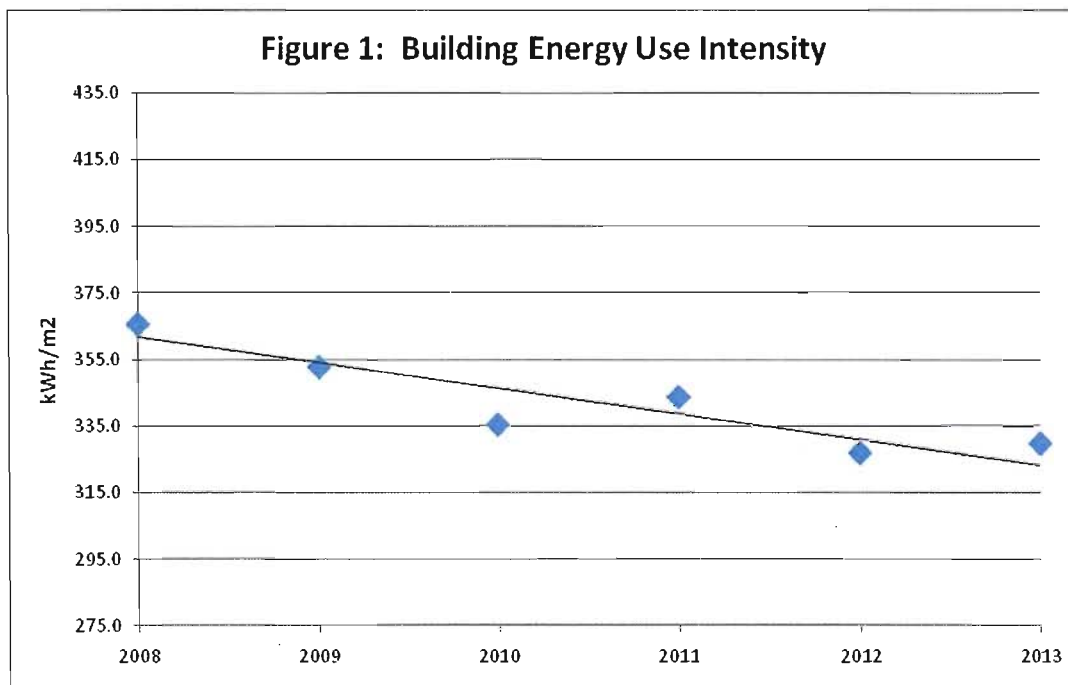
expanded EMP projects and increased the repayment of capital funding to the corporate Enterprise Fund, where funds are internally borrowed for funding many projects.

Corporate Energy Use Overview - 2013

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. Through the City's workplace conservation awareness program, staff are further encouraged to look at behavioural-based ways to reduce energy use. Key staff in operational roles carry out more active roles in managing or coordinating energy use reporting, completing inventories, and implementing reduction programs for all civic buildings, lighting, and water/wastewater services.

In 2013, City assets, including the Richmond Oval, consumed approximately \$6.0 million dollars of conventional energy¹ (electricity and natural gas), which equals 81.1 GWh (equivalent to the amount of energy used on average each year by approximately 2,300 homes in BC). This total does not include the energy used in the City's corporate fleet operations. Compared to the last three years, the corporate energy consumption for buildings, water/wastewater services, and lighting has relatively remained stable, while the City's infrastructure continues to increase to meet increasing demand.

Energy use at civic buildings accounts for a majority (approximately 83%) of total reported corporate energy use². As shown in the following Figure 1, civic building energy use intensity has decreased from approximately 365 kWh/m² in 2008 to 329 kWh/m² in 2013. Decreasing energy use intensity in civic buildings (improving energy use efficiency) demonstrates that corporate energy management remains an effective tool for managing costs over time.



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

² This total corporate energy use does not include Fleet services.

EMP Achievements - 2013 EMP Highlights

The City is on track to achieve a reduction of approximately 1.4 GWh of electrical and natural gas energy use (representing approximately 1.8% of its current use) from a variety of projects that began in 2013. Due to scheduling changes for two projects delaying them to a 2014 start, projects completed by the end of 2013 are anticipated to result in approximately 1.2 GWh of energy savings or 1.5% of corporate energy use. These savings are anticipated to be realized in the 2014 calendar year, and represent approximately \$85,000 in operational cost avoidance and a reduction of approximately 150 tonnes of CO₂e (equal to removing approximately 45 Richmond cars from our roads each year). Based on the approximate \$550,000 capital cost of the 2013 EMP projects, it is anticipated that these projects overall have a 6.5 year payback.

A detailed overview of EMP projects highlights in 2013 is provided in Attachment 2; highlights include:

- External Funding: \$100,000 of external funding was leveraged to support the Corporate Energy Management Program and Sustainability Unit in 2013.
- Showcase projects: Achieved excellent results with sewage heat recovery at Gateway Theatre, with reductions of approximately 45% in natural gas use and approximately \$15,000 annually in cost avoidance savings. Through the optimized refrigeration and mechanical upgrades at Richmond Ice Centre in 2014, it is anticipated that approximately 1.32 gigawatt hours (GWh) of energy consumption at the facility will be saved in 2015. This represents an approximate 20% reduction and approximately \$80,000 annually in cost avoidance savings.
- Policy Review: Council adoption of the City's High Performance Building Policy, which retained LEED as a sustainable building construction measurement tool but included strategic revisions such as: acknowledging the importance of occupant comfort and functionality, establishing new energy performance targets for new and existing buildings, and embedding long term goals of constructing net zero energy and carbon neutral corporate buildings by 2030.
- New Technology: Working with BC Hydro, City staff will help deliver a pilot project that will install high efficient light-emitting diode (LED) street lighting fixtures on BC Hydro poles, improving the lighting on high priority roadways.

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 and new community programs. The City has one renewable district energy system in operation, the Alexandra District Energy Utility, and one in the design stages for City Centre. These investments will help the City transition from conventional energy sources to more sustainable and stable energy systems, reducing long term costs and greenhouse gas (GHG) emissions.

Through Council support, staff are also launching energy and carbon reduction initiatives in the Community, entitled Richmond Energy Challenge and Richmond Carbon Marketplace. The programs both aim to support energy efficiency and GHG emissions reductions in the community, and facilitate external funding for Richmond organizations. It is through these types of programs that the City strives to act as a catalyst within the community and encourage further energy efficiency and GHG emissions reductions.

EMP Goals for 2014 and Upcoming Projects

The following main focus areas remain in place for the EMP for 2014:

- 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 and benchmarking 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 2014:

- Major refrigeration plant and mechanical improvements at Richmond Ice Centre
- Completion of building automation system upgrades and improved energy monitoring capabilities at several civic facilities, including City Hall
- Lighting retrofits at various facilities, including Richmond Courthouse and the Minoru Park tennis courts
- Solar thermal pool heating system optimization at Steveston and South Arm facilities

Financial Impact

None at this time. Capital projects related to energy management are reviewed and approved by Council as part of the capital budget process.

Conclusion

It is through Council and staff's continued commitment to corporate energy efficiency that effective energy management and energy efficiency practices are becoming more embedded into the City's culture and decision making processes. Cumulatively since 2007, energy conservation projects in buildings at the City have saved approximately 35.0 GWh of energy (equal to the energy consumption in 970 BC homes per year), which amounts to approximately \$1,750,000 in total operational cost avoidance and over 5,000 tonnes of greenhouse gas emissions reduced (equal to emissions from 1,500 Richmond cars). These efforts have allowed the City to add new facilities and infrastructure, without increasing overall energy use. This achievement is in line with the corporate target of maintaining building energy use and GHG emissions at 2012 levels while

incorporating new infrastructure and services. With continuing focus on reducing our corporate footprint through energy conservation, energy reduction, and increased integration of renewable energy sources, the corporation will be well positioned to limit its future operating cost and conventional energy use increases.

The City has made excellent progress in retrofitting buildings to minimize energy consumption and the staff will continue to develop similar retrofitting opportunities. Future success of the EMP program will increasingly depend on maximizing energy efficiency opportunities in new capital projects and replacement equipment, and increasing operational efficiencies through building automation systems and scheduling. As such, the City's updated High Performance Building Policy will become a critical tool for achieving future reductions.



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Att. 1	Energy Report Summary – 2013
Att. 2	City Energy Management Program 2013 Key Initiatives

REDMS# 4268878
REDMS# 4260178

Energy Update Report

Summary 2013



- Cost of energy in 2013 for the City of Richmond buildings, lighting, water and wastewater services = **\$6.0 million dollars** or **81.1 GWh** (this is equal to the average power consumed in ~2,300 homes in BC in 1 year).
- As compared with the last three years, overall energy consumption for these civic assets has remained stable.
- Although overall energy use has not decreased as compared to the previous few years, our building energy use intensity (kWh/m²) has decreased. This indicates that corporate energy use efficiency is increasing.
- Cumulatively since 2007, energy conservation projects at the City have saved approximately **35.0 GWh** of energy (equal to the energy consumption in ~970 BC homes per year), and over 5,000 tonnes of greenhouse gas emissions (equal to emissions from ~1,500 Richmond cars)



Fig 1: Building Energy Use Intensity

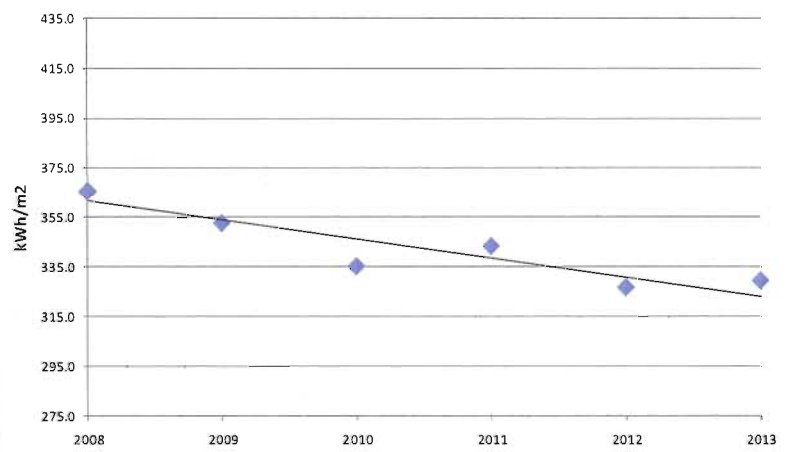
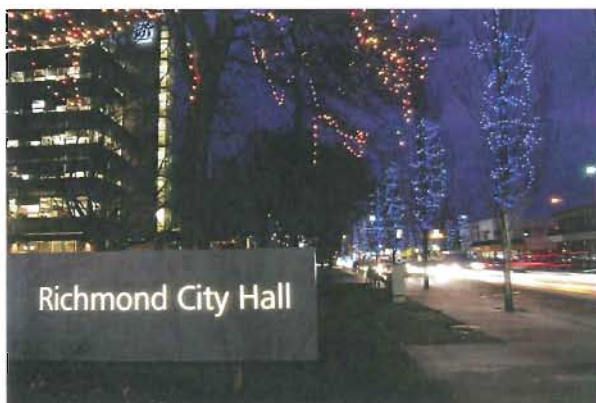
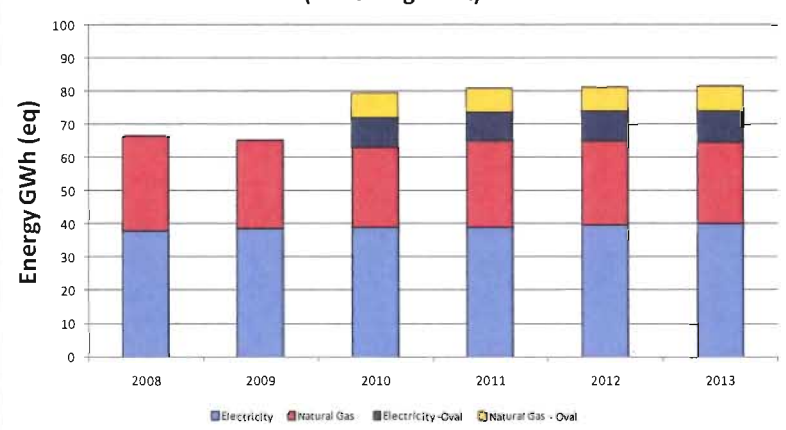


Fig. 1: Corporate Energy Consumption 2008-2013 (excluding Fleet)



- In 2013, the majority of corporate energy use (excluding fleet services) was by buildings-83%, followed by lighting-11% and water/wastewater services-5%.
- Recreational pools and ice arenas are the City's highest energy consuming facilities - with Richmond Olympic Oval, Watermania, Richmond Ice Centre, Minoru Pools and Minoru Arenas accounting for approximately 57% of the energy used by civic buildings in 2013.
- Other larger energy consuming corporate buildings/complexes include Public Works Yard, City Hall, the Steveston Community Centre Complex, and the Community Safety Building.
- Planned upgrades to the building automation systems at select high consuming buildings and associated re-commissioning, is hoped to improve operational energy efficiency from between 10% to 20%.

Fig 3: Overall Energy Use by Asset Class 2013

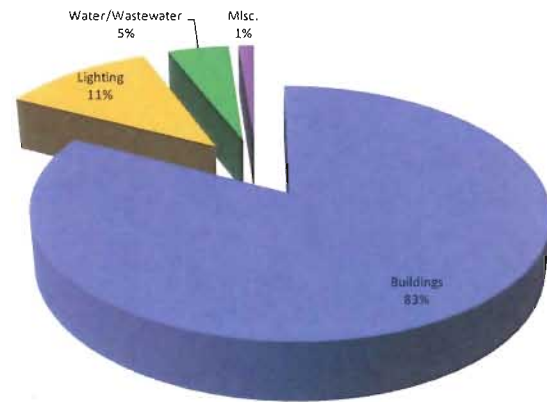
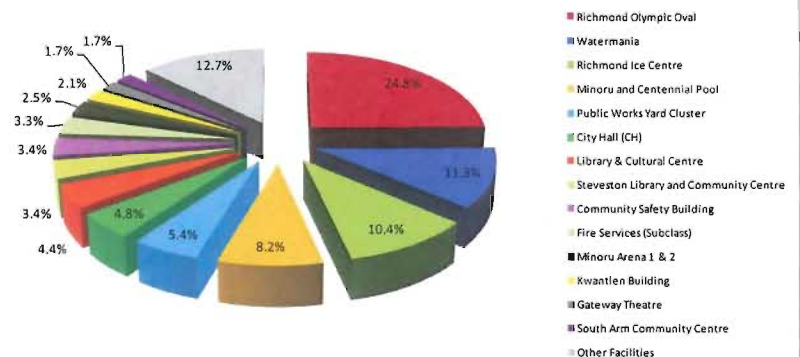


Fig 4: Building Energy Consumption Breakdown 2013



2013 Highlights:

- Secured over \$100,000 of external funding to support the Energy Management Program.
- City of Richmond recently received three recognition awards for completed projects from BC Hydro, and has been nominated again as a BC Hydro PowerSmart Leader Award finalist for 2014.
- City achieved an estimated reduction of **1.2 GWh** in electrical and natural gas use and approximately **150 tonnes** of greenhouse gas emissions from a variety of projects in 2013.
- This energy reduction represents approximately **1.5%** of our current corporate annual energy use and the GHG emissions reduction is equal to removing approximately **45 vehicles** from Richmond roads each year.
- These energy reductions will result in approximately **\$85,000** in operational cost avoidance savings.



2012 POWER SMART
LEADER BC Hydro powersmart



Showcase Projects:

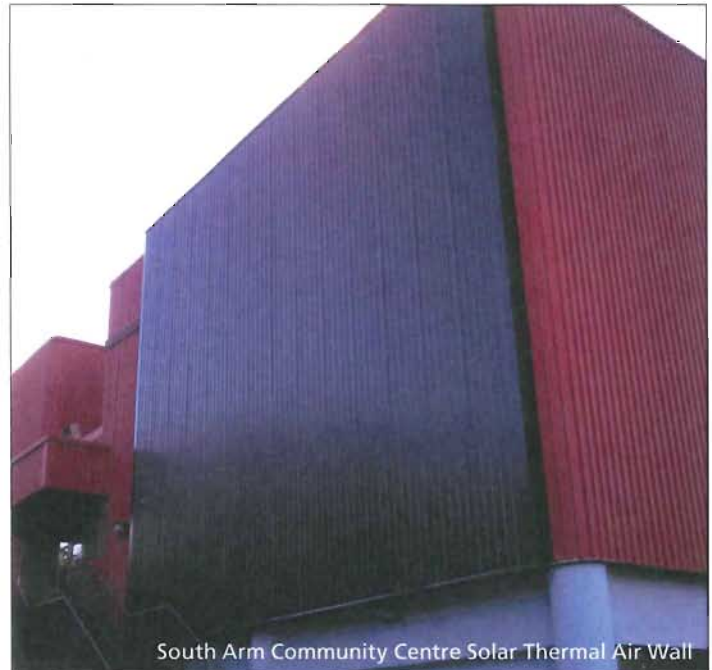
- Increased parking lot lighting levels at City Hall, with approximately 30% less energy usage.
- Solar thermal air wall in operation at South Arm Community Centre.
- Reductions of approximately 45% and 55% in natural gas use at Gateway Theatre and Minoru Arena respectively.

Policy Improvements:

- Council adopted the Corporate High Performance Building Policy, which targets LEED Gold construction for new buildings, improved energy performance for existing buildings, and long term goals of net zero energy and carbon neutral corporate buildings by 2030.

New Technology:

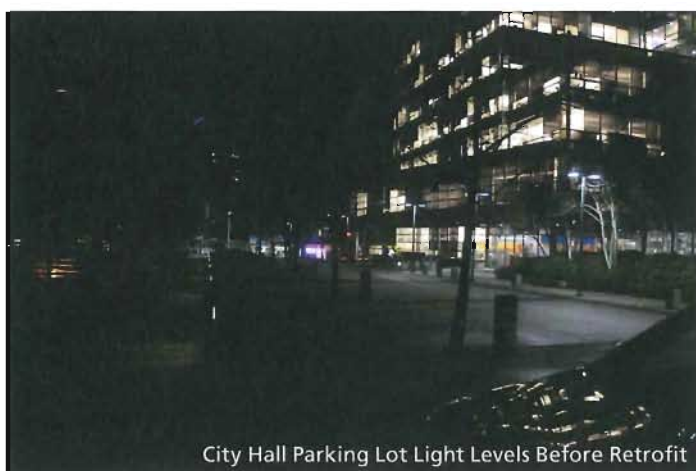
- Working with BC Hydro, City staff will help deliver a pilot project that will install high efficient light-emitting diode (LED) street lighting fixtures on BC Hydro poles, improving the lighting on high priority roadways.



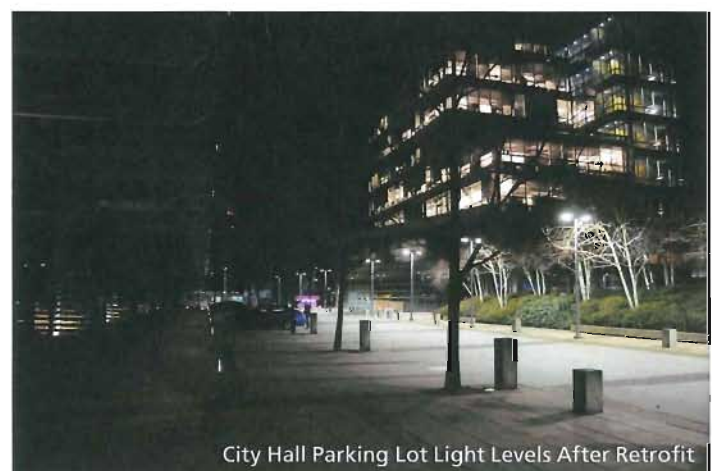
South Arm Community Centre Solar Thermal Air Wall



Gateway Theatre Performance



City Hall Parking Lot Light Levels Before Retrofit



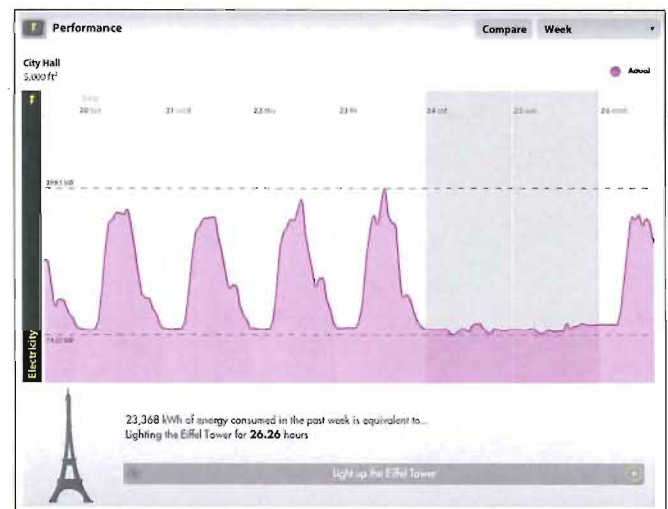
City Hall Parking Lot Light Levels After Retrofit

Vision and Goals 2014

- Continue to support the City's Carbon Neutrality commitment, through corporate energy efficiency upgrades.
- Research and facilitate the maximizing of energy efficiency opportunities for new capital projects and replacement equipment, increasing operational efficiencies through building automation systems, and continuing to retrofit existing buildings for improved energy performance.
- Continue to increase energy use awareness within the organization and community.

2014 Action items:

- Major refrigeration plant and mechanical improvements at Richmond Ice Centre
- Completion of building automation system upgrades and improved energy monitoring capabilities at several civic facilities, including City Hall
- Lighting retrofits at various facilities, including Richmond Courthouse and the Minoru Park tennis courts
- Solar thermal pool heating system optimization at Steveston and South Arm facilities
- Launching of two community engagement programs to support energy efficiency and GHG emissions, entitled the Richmond Energy Challenge and Richmond Carbon Marketplace.



South Arm Pool Solar Thermal Water System

City Energy Management Program – 2013 Key Initiatives

	2013 Key Initiatives
Plan	<p><i>Energy Strategic Planning:</i></p> <ul style="list-style-type: none"> • Secured over \$100,000 in external funding for a variety of projects completed in 2013 • Secured over \$175,000 in external funding in 2013 to support the infrastructure upgrades and replacements at Richmond Ice Centre in 2014 including; <ul style="list-style-type: none"> ◦ Complete chiller replacement to more efficient refrigeration plant technology ◦ Installation of heat recovery unit, to pre-heat ice resurfacing hot water ◦ Replacing two hot water boilers to more efficient condensing units • Updated the Corporate High Performance Building Policy, which retained LEED as a sustainable building/space construction measurement tool and included the following strategic revisions; <ul style="list-style-type: none"> ◦ Acknowledged that a “sustainable” building needs to ensure that occupant comfort and functionality ◦ Established new energy performance targets for new and existing buildings ◦ Referenced the need for sustainable operation and maintenance best practices to be followed ◦ Included long term stretch goals of building net zero energy and carbon neutral buildings by 2030 • In collaboration with the Project Development Unit, currently undergoing a review of the energy production and delivery options for the new facilities in Minoru Park to ensure that these facilities are able to optimize energy use and incorporate renewable energy technologies where feasible.
Do	<p><i>Building Capacity</i></p> <ul style="list-style-type: none"> • Workplace conservation Awareness program Year 3 completed in 2013 (initiatives included What’s Watt online challenge, lighting information workshop and a turn down the heat campaign). • Greater alignment of capital submissions for yearly building improvement and energy management related requests, to ensure that projects are delivered seamlessly (e.g. Coordinated Richmond Ice Centre mechanical upgrade planning to optimize the performance of the new system and maximize external funding support). <p><i>Reducing Energy Use or Displacing conventional energy sources</i></p> <ul style="list-style-type: none"> • Building controls upgrade and operational efficiency improvements at the Works Yard • Lighting retrofits and re-lamps at various facilities (e.g. Community Safety Building and City Hall) • Completion of natural gas use reduction projects at Gateway Theatre that included a major boiler and coupling replacement. • Building envelopment improvement and sealing at various facilities <p><i>Increasing Financial Security & Stability</i></p> <ul style="list-style-type: none"> • Over \$80,000 in energy and maintenance cost avoidance savings

	2013 Key Initiatives
Monitor & Report	<p><i>Improving Energy Monitoring System</i></p> <ul style="list-style-type: none"> • Building automation system upgrades have been completed at West Richmond and South Arm Community Centres, which will allow increased operational and energy use detail to enable greater energy system optimization. • 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) <p><i>Reporting Performance</i></p> <ul style="list-style-type: none"> • Annual Corporate-wide Energy update report to Council • Semi-Annual reporting to Senior Management, on Energy Management Program status and work plan • Quarterly reporting to BC Hydro
Innovate & Improve	<p><i>Exploring New Approaches and Technologies</i></p> <ul style="list-style-type: none"> • The following projects and feasibility of further evaluation will be assessed in the coming months <ul style="list-style-type: none"> ○ Steveston Community Centre and Richmond Courthouse energy upgrades ○ Further implementation of building automation system upgrades and energy monitoring improvements ○ Street lighting replacement plan and efficiency improvement <p><i>Energy Management System Evaluation</i></p> <ul style="list-style-type: none"> • BC Hydro energy management system assessment to be conducted in June 2014 will review current corporate practices and determine five action items/areas that the City's EMP should focus on to ensure continually improvement in corporate energy efficiency is maintained <p><i>Improved Building Operational Guidelines</i></p> <ul style="list-style-type: none"> • In collaboration with the Facilities Department, currently developing Sustainable Operation and Maintenance Guidelines for buildings that aim to include City Lighting standards and Building Automation System Integration Guidelines