



To: General Purposes Committee

Date: May 26, 2017

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

File: 10-6125-05-01/2017-
Vol 01




Re: 2017 Corporate Energy Management Program Update

Staff Recommendation

That the staff report titled “2017 Corporate Energy Management Program Update” from the Director, Engineering, dated May 26, 2017, 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 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.*

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

Background

Through the implementation of a variety of projects and initiatives, as well as working collaboratively within the City, the EMP supports continued improvement in corporate energy efficiency and embedding energy use best practices in corporate operations. In addition, the City's EMP is integral to the long term goal of maintaining carbon neutral operations through delivering corporate projects that reduce natural gas use. The continuing support and enhancement of corporate energy efficiency and reduction initiatives is essential to maintaining the City's Climate Action Charter and sustainability commitments.

The City's EMP has continued to be successful in increasing energy efficiency 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 EMP, innovative corporate and community energy efficiency projects are consistently being developed and implemented, and energy efficiency is becoming more embedded within the City's corporate culture.

The City was recognized in February 2017 by BC Hydro through a letter to Mayor and Council for having achieved the highest reported electricity savings over the last three years of any municipality in the region. The City continues to partner with BC Hydro on various corporate and community policy initiatives, as well as on specific projects, such as Phase 1 of the City's Street Lighting Replacement Plan. Besides BC Hydro, staff are also actively engaged with other external stakeholders to bring forward reduction initiatives in a collaborative way and maximize partnerships opportunities.

As part of the 2016-2017 EMP funding agreement with BC Hydro, the City committed to an electricity reduction target of 2.1% or 854,000 kilowatt hour (kWh) by April 2017 (from 2015 levels), which is equal to the energy used by approximately 20 single-family homes in Richmond per year. This target and continued collaboration with BC Hydro maximizes the overall incentive funding the City receives, and allows for the continued delivery of energy management projects.

Analysis

EMP Achievements – 2008-2015 EMP Highlights

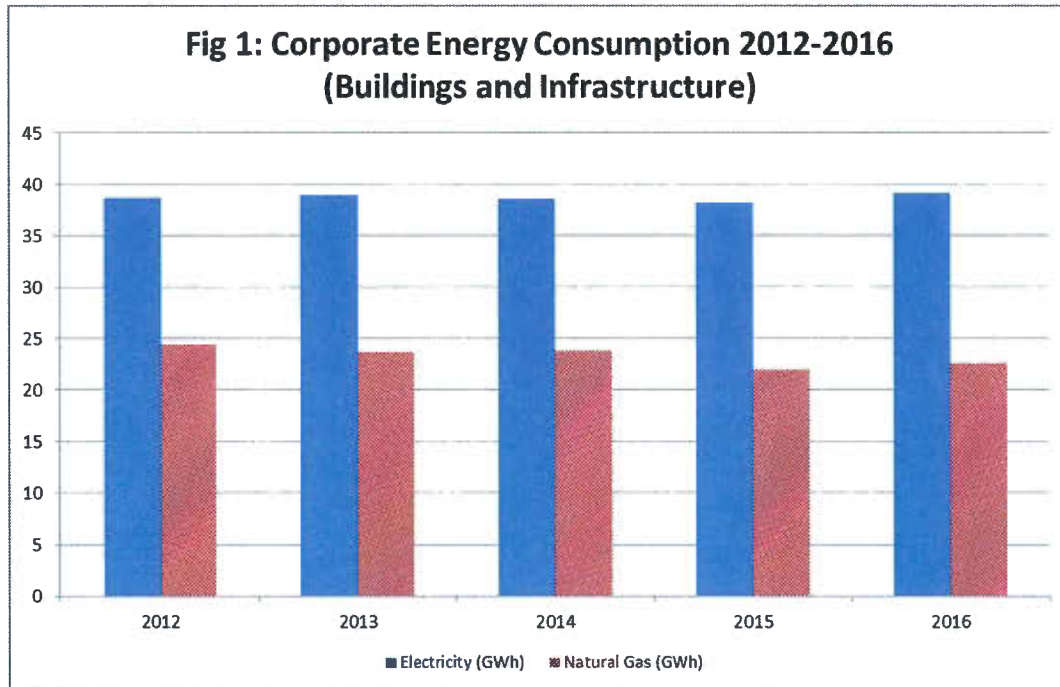
Energy conservation work at the City has cumulatively saved over 58.0 gigawatt hours (GWh) of energy since 2008 (equal to the energy consumption in 1,400 Richmond single-family homes per year). In this same period, the City has cumulatively avoided approximately \$3,000,000 in operational costs and over 8,000 tonnes of greenhouse gas emissions (CO₂e) (equal to emissions from 2,500 Richmond cars). Since 2008, the City has received over \$1,800,000 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. The City's use of this type of funding mechanism is a leading best practice of interest to other cities.

Corporate Energy Use Overview - 2016

In 2016, City assets, not including the fuel used by the City's fleet, consumed approximately \$5.3 million dollars of conventional energy¹ (electricity and natural gas), which equals 63.5 GWh (equivalent to the amount of energy used on average each year by approximately 1,600 homes in Richmond). This energy use resulted in corporate emissions of approximately 4,400 tonnes of CO₂e.

As shown in Figure 1 below, the total electricity use for City buildings and infrastructure has remained fairly stable since 2012. This is a positive result over that time period, given that the City has added infrastructure (namely the Community Safety Building and City Centre Community Centre) and has been consistently switching building energy use from natural gas to cleaner electricity where feasible. Given the City's continued focus on GHG emissions reductions, natural gas use has been steadily decreasing, with an approximate reduction of 10% since 2012. Since 2007, corporate natural gas use has been reduced by approximately 25%.

¹ 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.

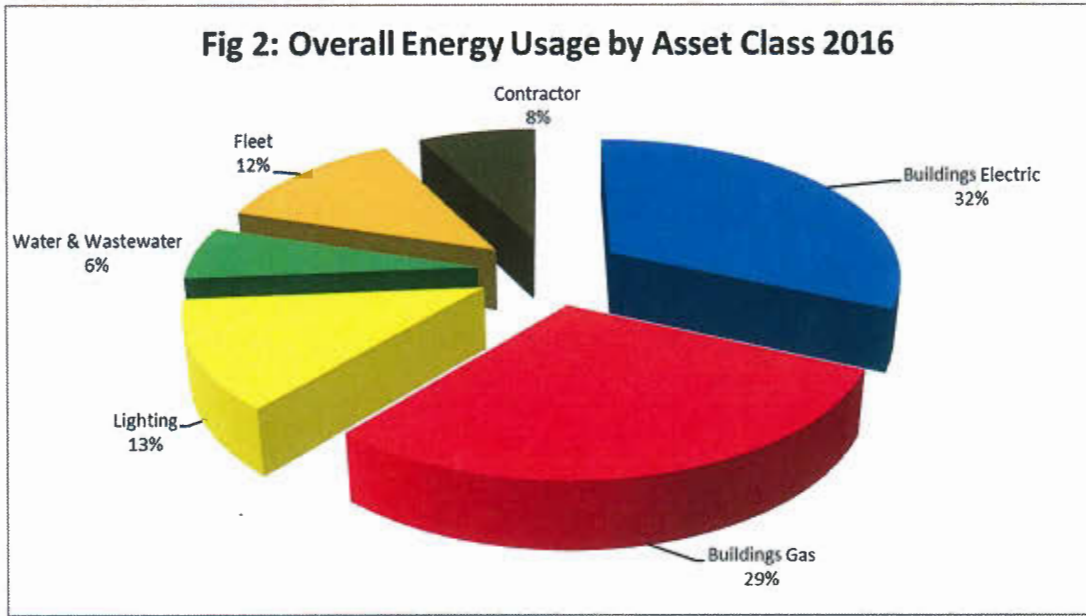


With Council’s 2016 endorsement of an emissions reduction target of 65% for corporate buildings by 2020 (from 2007 levels), there remains natural gas reduction work to be done. Replacement of the Minoru Aquatic Centre and the Minoru Seniors Centre with the Minoru Centre for Active Living (MCAC) will help to further the City’s progress towards its reduction target. Since the new MCAC will rely heavily on electricity powered heat recovery to redistribute heat throughout the building, the new facility is anticipated to greatly reduce natural gas use compared to existing buildings. It is expected that corporate natural gas use will be reduced by 15% once the new facility is operational.

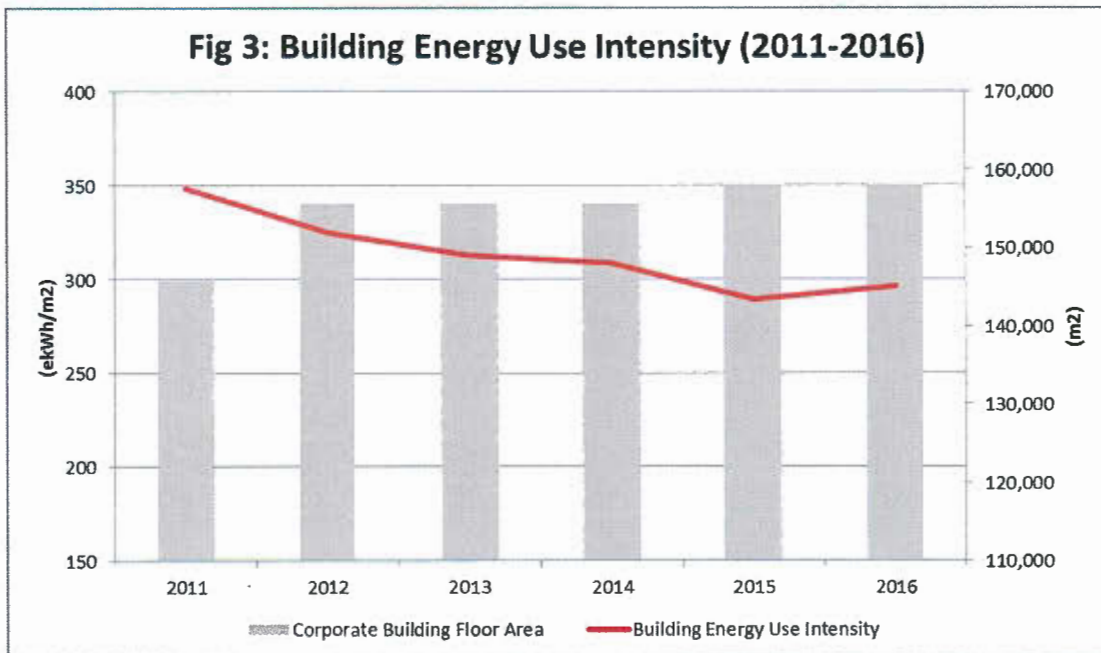
Switching from mostly natural gas use to electricity use at the MCAC is expected to increase corporate electricity use by approximately 10%. Overall, it is expected that energy use at the MCAC will be approximately equal to the facilities it is replacing, with the new facility providing approximately 50% more floor space.

Since energy use in civic buildings accounts for a majority (approximately 61%) of total reported corporate energy use in 2016, a continued focus of the City’s EMP has been on increasing the energy efficiency at City facilities (see Figure 2 below – Overall Energy Usage by Asset Class).

One tool to help focus energy efficiency resources that the City is exploring using more widely is benchmarking. City staff have finished entering energy use data for specific buildings into the benchmarking tool Energy Star Portfolio Manager, which allows for the comparison of energy performance of office type buildings. As an example, in 2016, City Hall received an Energy Star score of 69 through the benchmarking tool, which indicates that it is in the 69th percentile of office type buildings in North America for energy efficiency. Portfolio Manager is not as effective for benchmarking of other corporate building types such as ice rinks and aquatic centres, since it does not currently have this comparison capability. Staff are exploring other benchmarking options to compare the energy performance of other corporate building types to similar buildings in the region and country.



As shown in Figure 3, civic building energy use intensity has decreased from approximately 348 kWh/m² in 2011 to 296 kWh/m² in 2016. The reduction in energy use intensity is a strong indication that the City’s EMP along with the timely replacement and renewal of energy using infrastructure 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, Fire Hall No.3, and the Minoru Aquatic Centre and Older Adults Centre have been completed in 2017/2018.



Although the City’s EMP focuses significantly on facilitating energy use reduction and optimization initiatives, other corporate and community benefits are also pursued in conjunction with energy projects (e.g. improved lighting/safety, increased client comfort, and improved operator control). Energy projects are conducted in collaboration with multiple stakeholders, to ensure that the largest

number of project benefits is achieved. This collaborative pursuit of multiple benefits helps to ensure that City staff are aware that energy management best practices is everyone's responsibility, and to encourage everyone to play an active role in identifying energy efficiency and reduction opportunities whenever possible.

EMP Achievements - 2016 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 help the City avoid approximately 1,100,000 kWh in future electricity and natural gas use (equal to the power used in 25 homes in Richmond in a year) and avoid over \$80,000 in operational costs. This total energy savings represents a reduction of approximately 1.8% in overall City energy use. As part of the previous 2016-2017 EMP funding agreement with BC Hydro, the City committed to reduce electricity use by 2.1% or 854,000 kWh by April 2017 from 2015 levels. The City was able to exceed that target by over 200,000 kWh this past year through various electricity reduction initiatives.

A detailed overview of EMP project highlights in 2016 is provided in Attachment 2. General highlights include:

- External Funding: \$180,000 of external funding was leveraged to support the City and the Corporate Energy Management Program in 2016.
- Showcase projects:
 - Completed lighting and building control upgrades to City Hall to reduce lighting energy use and optimize equipment operation and scheduling.
 - Completed lighting retrofits at three Fire Halls, No.4, No.5 and No.6, to reduce energy use and improve lighting quality
 - Completed Phase 1 of the City's Street Lighting Replacement Plan, by replacing over 1,000 inefficient light fixtures in West Richmond with more efficient LED fixtures.
 - Completed the upgrades and replacement of the building automation system at the Library Cultural Centre
- Policy Implementation:
 - Implemented a corporate building GHG emissions reduction target of 65% reduction from 2007 levels by 2020, which will help the City achieve an overall target of 33% reduction by 2020.
 - As a result of the implementation of the goals and targets of the High Performance Building Policy, the replacement of Fire Hall No.1 with a new facility will result in approximately 50% less energy use overall while providing 35% more floor area.
 - The Energy Statement Initiative was implemented to increase corporate energy use engagement and awareness, which provides pertinent quarterly energy performance information to City staff operating and managing buildings.

- Operational Improvements:
 - Staff began development of an online dashboard tool to allow for the quick review and interpretation of energy use information, as well as build in the capacity to view and manage building systems. This tool will also allow for a dynamic electronic information board to be established at key facilities to increase public awareness of the City's Energy Management Program.
 - Staff began development of an optimization procedure plan and process for buildings to ensure that they are systematically assessed and optimized on an on-going basis, and that changes in scheduling and system operation are tracked effectively. This procedure plan and process will support energy efficiency improvements while not impacting occupant comfort.

EMP Goals for 2017 and Upcoming Projects

The following main focus areas are in place for the EMP for 2017:

- Increase energy use awareness within the organization
- 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
- Develop and incorporate a more systematic approach to building energy use performance analysis in civic facilities, and implement a system to allow for the continued improvement of facilities, and the extension of their useful life
- 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 2017:

- Complete major hot water equipment upgrades at the Richmond Ice Centre
- Complete heating plant and mechanical improvements at Watermania Aquatic Centre
- Complete building automation system upgrades and improved energy monitoring capabilities at Fire Hall No.4 and No.5, and at the Community Safety Building.
- Complete Phase 2 of the City's street lighting upgrade plan.
- Complete the installation and commissioning of the City's first solar photovoltaic system at Fire Hall No.1

Financial Impact

None.

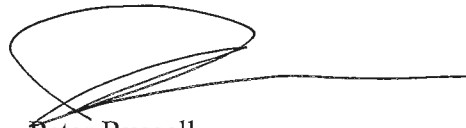
Conclusion

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 best energy management practices into corporate processes, and maximize external funding support to help develop and deliver more projects and results. The EMP has been successful at delivering energy reduction projects and tracking other corporate energy efficiency results. Without Council's continued support of investment and improvements in corporate energy efficiency, it is estimated that the City's energy use would have increased by approximately 15% since 2012, or by approximately 10 GWh.

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 and implemented, along with natural gas reduction projects, so that overall corporate energy reduction can be achieved.



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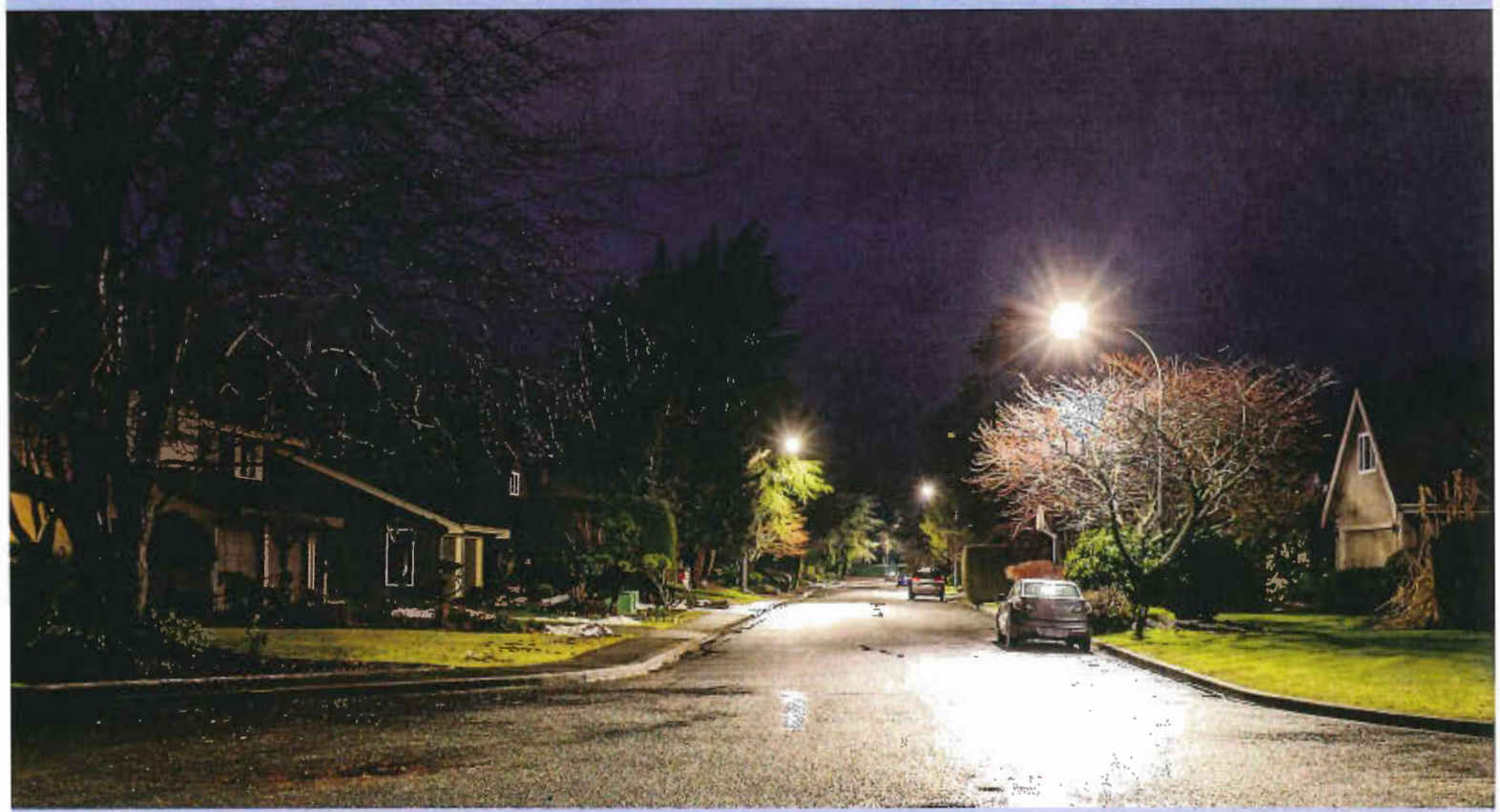


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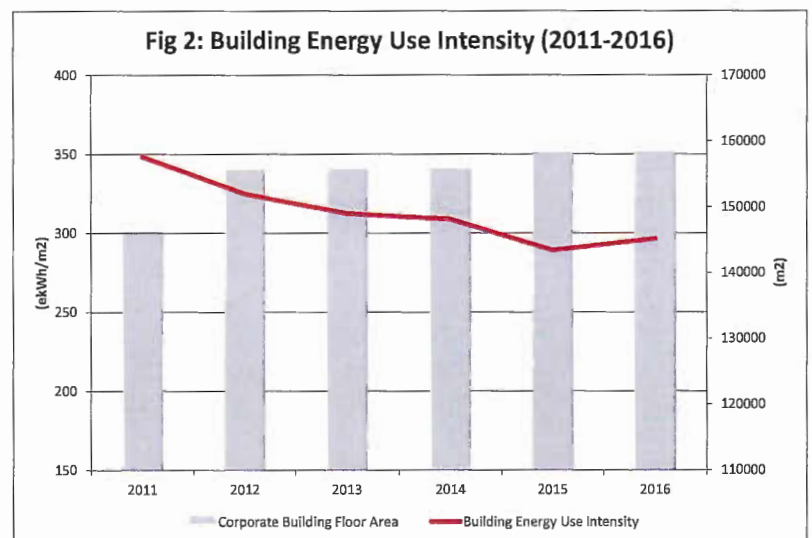
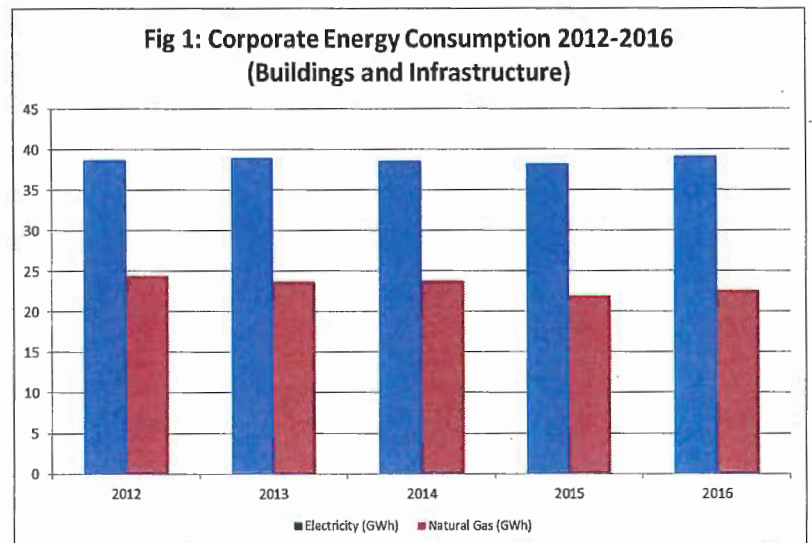
- Att. 1 Energy Update Report – Summary 2016
- Att. 2 City Energy Management Program – 2016 Key Initiatives

Energy Update Report

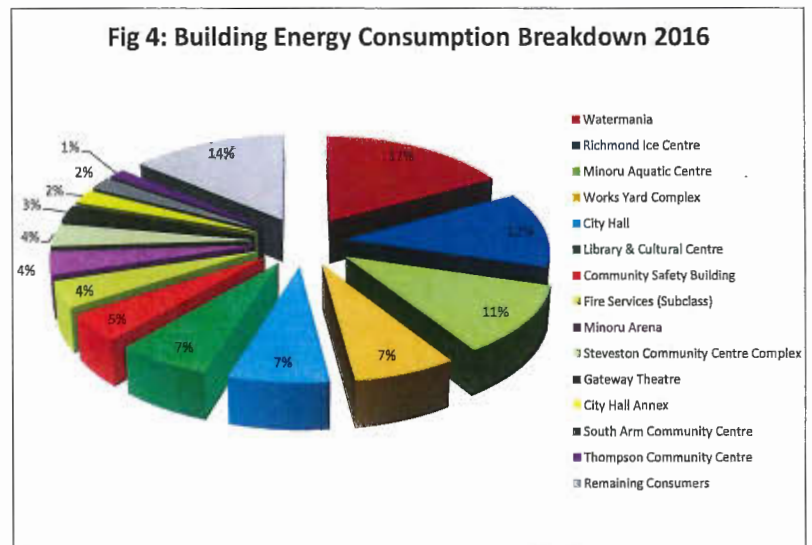
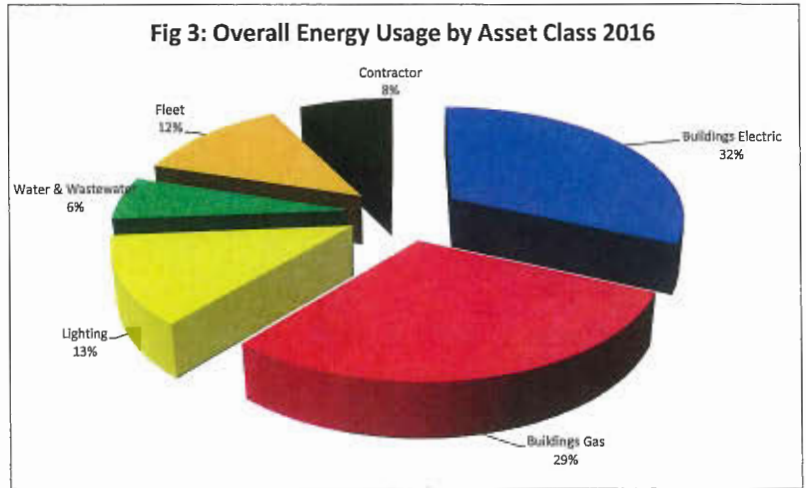
Summary 2016



- Cost of energy in 2016 for City of Richmond buildings, lighting, water and wastewater services = **\$5.3 million dollars or 61.7 GWh** (this is equal to the average power consumed in ~1,500 homes in Richmond in 1 year).
- This energy use resulted in approximately 4,600 tonnes of greenhouse gas (GHG) emissions.
- The total energy use for City infrastructure has remained fairly stable over the last five years, even with new facilities and increased services coming online over that time period.
- Given the investments that the City has made in infrastructure renewal and energy efficiency since 2008, the City has cumulatively avoided over **58.0 GWh** in conventional energy use (equal to the energy consumption in ~1,400 Richmond homes annually), and over **8,000 tonnes** of greenhouse gas emissions (equal to emissions from ~2,500 Richmond cars).
- As compared to 2012, corporate natural gas use in 2016 was 10% lower, even with this year's winter spike. With the upcoming replacement of Minoru Aquatic Centre, further corporate natural gas reduction is expected in the coming years.

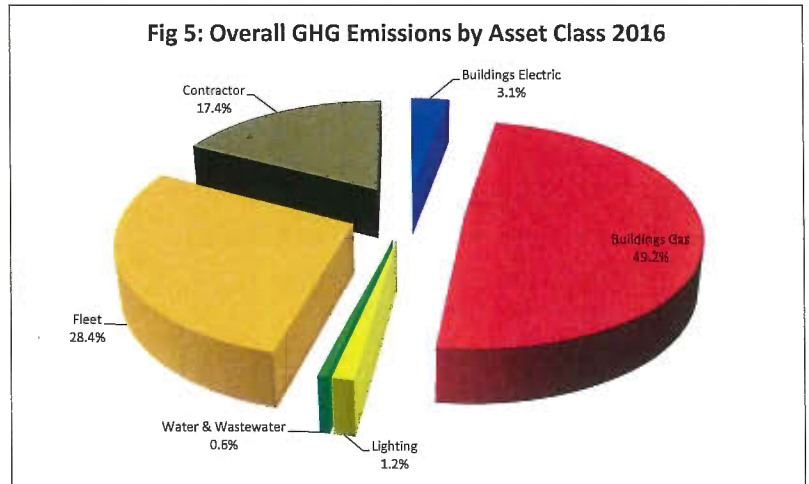


- In 2016, the majority of corporate energy use was by **buildings-61%**, followed by **lighting-13%** and **fleet services-12%** (see Fig. 3).
- For corporate buildings, three recreational buildings accounted for 40% of building energy use—Watermania, Richmond Ice Centre, and Minoru Aquatic Centre (see Fig. 4).
- For corporate GHG emissions, natural gas usage in buildings is responsible for a majority of the City’s annual emissions—accounting for approximately 50% in 2016 (see Fig. 5, on next page).
- Continued focus and work is on-going in City facilities to reduce and/or displace natural gas use, which will reduce corporate GHG emissions. This includes reviewing fuel switching options from natural gas to electricity.



2016 Highlights:

- Maintained the City's **Carbon Neutral** status for corporate operations.
- Secured over **\$180,000** of external funding to support the Energy Management Program.
- Avoided an estimated **800,000 kWh** in electrical and natural gas use and approximately **95 tonnes** of GHG emissions from a variety of 2015 completed projects.
- This energy reduction represents approximately **1.3%** of the City's current corporate annual energy use.
- This energy reduction will result in over **\$50,000** in operational cost avoidance savings.
- Anticipate achieving over 1.1 GWh in electrical and natural gas savings in 2017 from projects completed in 2016.



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Showcase Projects:

- Completed lighting and building control upgrades at City Hall to reduce lighting energy use and optimize equipment operation and scheduling.
- Completed lighting retrofits at three Fire Halls, No. 4, No. 5 and No. 6, to reduce energy use and improve lighting performance
- Completed Phase 1 of the City's Street Lighting Replacement Plan, replacing over 1,000 inefficient light fixtures in West Richmond with more efficient fixtures.



Policy Implementation:

- Implemented a corporate building GHG emissions reduction target of 65% reduction from 2007 levels by 2020, which will help the City achieve an overall target of 33% reduction by 2020.
- As a result of the implementation of the goals and targets of the High Performance Building Policy, the replacement of Fire Hall No.1 with a new facility will result in approximately 50% less energy use overall while providing 35% more floor area.



2016 Vision and Goals

The following main focus areas remain in place for the EMP for 2017:

- 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.



2017 Action items:

- Complete major energy using equipment upgrades at the Library and Cultural Centre
- Complete building automation system upgrades and improved energy monitoring capabilities at Fire Hall No. 4 and No. 5, and at the Community Safety Building.
- Complete Phase 2 of the City's street lighting upgrade plan.
- Complete heating system and lighting optimization at various corporate facilities.



City Energy Management Program – 2016 Key Initiatives

	2016 Key Initiatives
Plan	<p><i>Energy Strategic Planning:</i></p> <ul style="list-style-type: none"> • Received \$180,000 of external funding to support the City and the Corporate Energy Management Program in 2016 • In the process of securing external project funding agreements to support some lighting infrastructure upgrades and replacements in 2017; <ul style="list-style-type: none"> ◦ Lighting upgrades at corporate parking lots ◦ Lighting retrofits and improvements at various outdoor recreational facilities, including Brighthouse Park, South Arm Park, Steveston Park and Hugh Boyd Park • In the process of completing a natural gas using equipment replacement and upgrade plan, to allow for a 2018 capital submission. The implementation of this plan would help the City achieve its building emissions targets. • Working with the Project Development Unit, to identify 2017 building/infrastructure improvement projects that could qualify for incentives, to maximize the City's external funding opportunities
Do	<p><i>Building Capacity</i></p> <ul style="list-style-type: none"> • Implemented the Corporate Energy Statement Initiative, which aims to engage staff and increase corporate energy use and cost awareness, as well as facilitate increased dialogue between programmers and facility managers through the sharing of energy use and cost information for select facilities • Alignment of capital submissions for yearly building improvement and energy management related requests, to ensure that projects are delivered seamlessly (e.g. reviewing and supporting the lighting and energy improvements at South Arm Community Centre) <p><i>Reducing Energy Use or Displacing conventional energy sources</i></p> <ul style="list-style-type: none"> • Lighting and control upgrades at City Hall • Completed lighting retrofits and re-lamping at various recreational facilities and at Fire Halls No.4, No.5, and No.6. • Optimized heating systems and controls at South Arm Community Hall and the Japanese Cultural Centre. • Completed the upgrades and replacement of the building automation system at the Library Cultural Centre • Completed Phase 1 of the Street Lighting Fixture replacement plan, replacing over 1,000 inefficient fixtures in the West Richmond area with more efficient LED fixtures. <p><i>Increasing Financial Security & Stability</i></p> <ul style="list-style-type: none"> • Over \$80,000 in expected energy and maintenance cost avoidance savings • Continued work on developing and completing external project funding agreements with stakeholders, helping to reduce the capital cost of projects and provide funding for future project development

2016 Key Initiatives	
Monitor & Report	<p><i>Improving Energy Monitoring System</i></p> <ul style="list-style-type: none"> • Building automation system upgrades are planned for Fire Hall No.4 and No.5, and the Community Safety Building – Direct Digital Control Replacement Plan Phase 3 • Continued to utilize the corporate energy use database to inform internal departments of corporate energy use metrics and to help to facilitate public reporting needs <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"> • Through the completion of feasibility studies and energy savings assessments, the following potential projects are planned to be assessed in the coming months for possible inclusion in the 2018 capital submission process; <ul style="list-style-type: none"> ○ Natural gas major equipment upgrade at various facilities ○ Renewable energy system installation at Library Cultural Centre ○ Street lighting LED and replacement plan development – Phase 3 <p><i>Energy Management System Evaluation</i></p> <ul style="list-style-type: none"> • The City is in the process of developing an online dashboard tool to allow both Facilities Management and Energy Management to quickly review and interpret energy use information, as well as view and manage building system anomalies. This tool will also allow for a dynamic public display electronic information board to be established at key facilities to increase public awareness of the City’s Energy and Facilities Management Program. <p><i>Development of Internal Building Optimization Procedures</i></p> <ul style="list-style-type: none"> • The City’s is in the process of developing an optimization procedure plan and process for buildings, to ensure that they are systematically assessed and optimized on an on-going basis, and that changes in scheduling and system operation are tracked effectively. This procedure plan and process will support both energy efficiency improvements as well as look to improve occupant comfort where possible.