



City of Richmond

Report to Committee




To: Public Works and Transportation Committee **Date:** May 25, 2018
From: Peter Russell **File:** 10-6125-05-01/2018-
Senior Manager, Sustainability and District Energy Vol 01
Re: **2018 Corporate Energy Management Program Update**

Staff Recommendation

That the staff report titled "2018 Corporate Energy Management Program Update" from the Senior Manager of Sustainability and District Energy, dated May 25, 2018, be received for information.

Peter Russell
Senior Manager, Sustainability and District Energy
(604-276-4130)

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:

Continue advancement of the City's sustainability framework and initiatives to improve the short and long term livability of our City, and that maintain Richmond's position as a leader in sustainable programs, practices and innovations.

4.1 *Continued implementation of the Sustainability Framework.*

4.2. *Innovative projects and initiatives to advance sustainability.*

#5 Partnerships and Collaboration:

Continue development and utilization of collaborative approaches and partnerships with intergovernmental and other agencies to help meet the needs of the Richmond community.

5.1 *Advancement of City priorities through strong intergovernmental relationships.*

5.2. *Strengthened strategic partnerships that help advance City priorities*

#6 Quality Infrastructure Networks:

Continue diligence towards the development of infrastructure networks that are safe, sustainable, and address the challenges associated with aging systems, population growth, and environmental impact.

6.1 *Safe and sustainable infrastructure.*

The "Energy Update Report – Summary 2017" (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 improvements in corporate energy use and efficiency. The City's EMP is integral to the long term goal of maintaining carbon neutral operations through projects that reduce and optimize natural gas use.

To help accomplish the City's sustainability commitments the EMP focuses 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)

The City continues to develop innovative corporate energy efficiency projects as part of the capital submission process, as well as work on policy related initiatives. More recently a majority of the focus of the EMP has been on ways to reduce natural gas use and associated greenhouse gas (GHG) emissions, to help achieve the City's ambitious building reduction target. Staff remain focused on reducing natural gas use in an effort to achieve a reduction of 65% in GHG emissions by 2020 from 2007 levels.

At the same time, the City remains committed to electricity use optimization and reduction in partnership with BC Hydro. Staff also actively engage with other external stakeholders to bring forward reduction initiatives in a collaborative way and maximize partnership 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 896,000 kilowatt hours (kWh) by April 2018 (from 2016 levels). The agreed target was exceeded, as actual electricity reduction from projects completed in the last year was over 2.8% or 1,200,000 kWh. This target maximizes the overall incentive funding the City receives, and allows for the continued delivery of energy management projects.

Analysis

Past EMP Achievements – 2008 to 2016 EMP Highlights

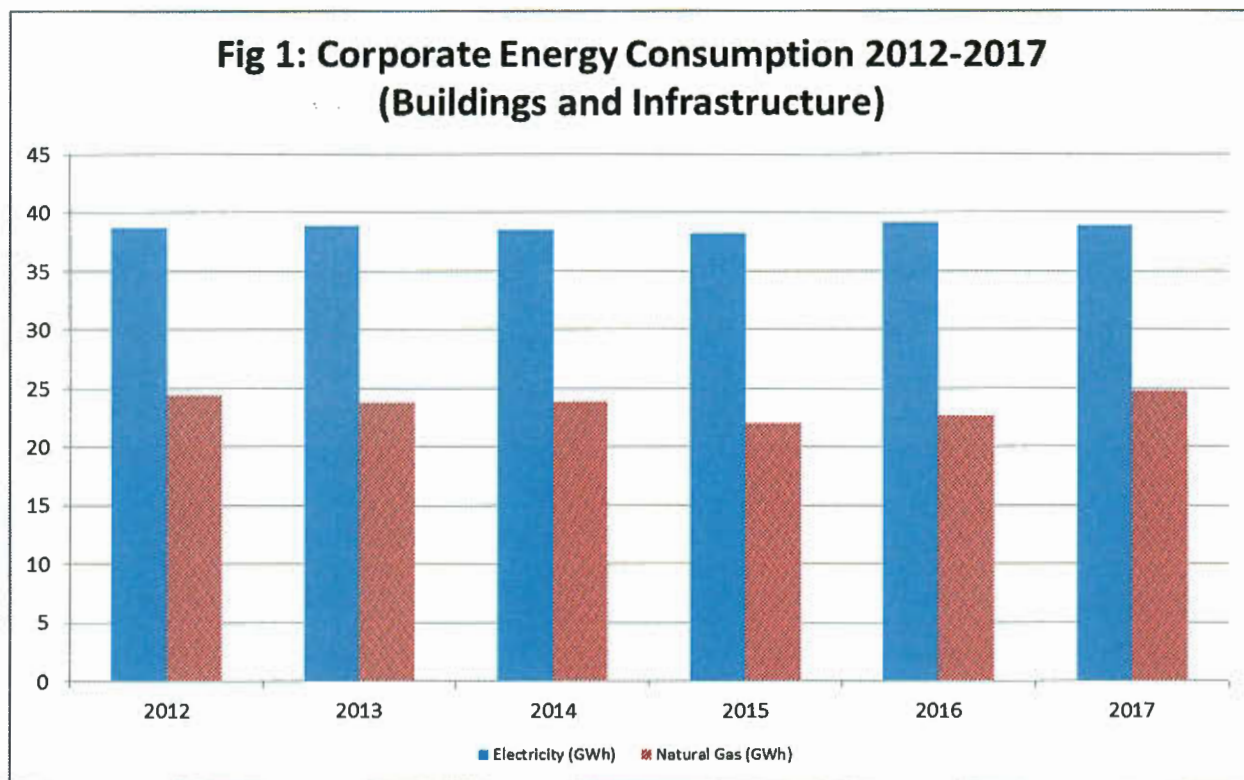
Energy conservation work at the City has cumulatively saved over 69.0 gigawatt hours (GWh) of energy since 2008 (which is equal to enough conventional energy to power the City's corporate operations for an entire year). Other key metrics associated with these cumulative savings since that time include;

- Avoided approximately \$3,500,000 in energy related operational costs,
- Over 9,000 tonnes of greenhouse gas emissions (CO₂e) avoided, which is equal to the annual emissions from 2,800 Richmond cars.
- Execution of external partnerships and agreements that included over \$2,000,000 in funding to support EMP associated projects and programs

Corporate Energy Use Overview - 2017

City assets, not including the fuel used by the City's fleet, consumed approximately \$5.5 million dollars of electricity and natural gas, or a total of 63.6 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 4,800 tonnes of CO₂e.

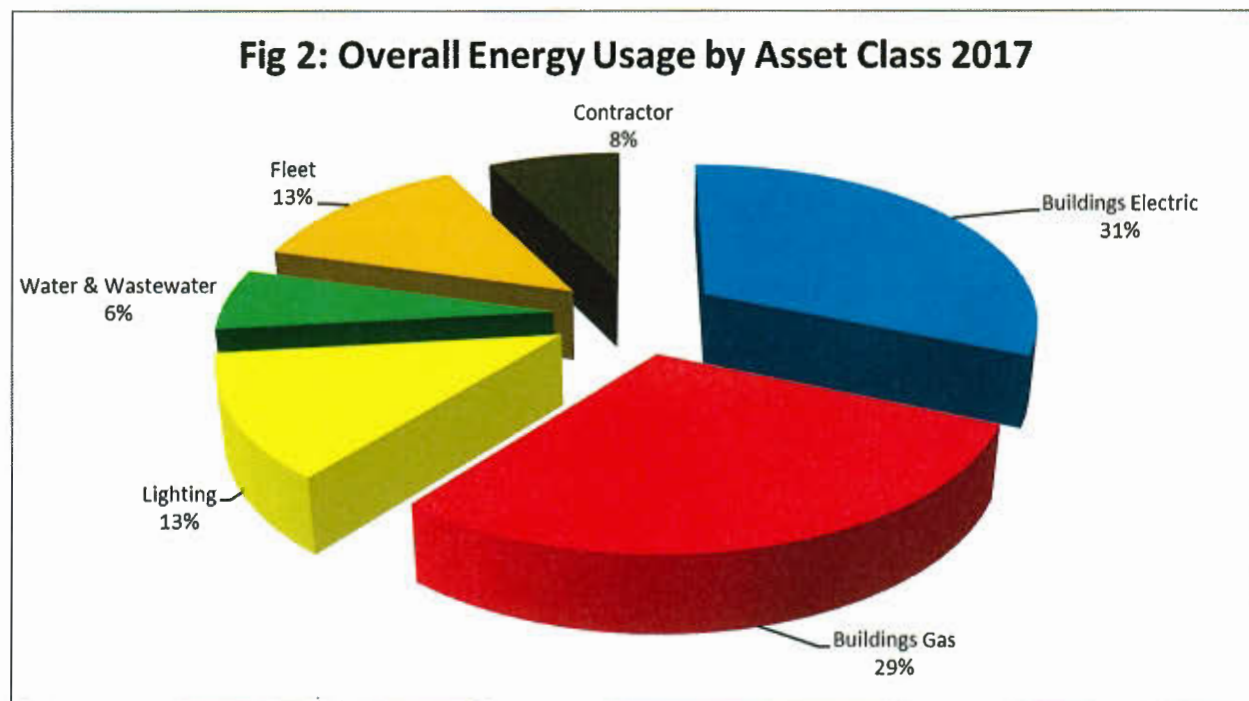
As shown in Figure 1 below, the total electricity use for City buildings and infrastructure has remained fairly stable since 2012. This is a positive result over that time period, given that the City has added infrastructure (i.e. the Community Safety Building, the City Centre Community Centre, and Fire Hall No.3) and has been regularly switching building energy use from natural gas to cleaner electricity where feasible.



It is noted that over the previous two years corporate natural gas use has increased as compared to 2015, which is mostly due to increased use during an unusually cold weather period between December 2016 and March 2017. During this time the heating requirements for buildings were 17% higher than the previous 5 year average. Over this past winter heating requirements were more in line with past averages, and it is anticipated that natural gas use at corporate buildings will be lower in 2018 than in 2017. As compared to 2007, overall natural gas usage has decreased by approximately 18%.

Replacement of the Minoru Aquatic Centre and the Minoru Place Seniors Centre with the Minoru Centre for Active Living (MCAL) will help to further the City's progress towards its 65% corporate buildings GHG emissions reduction target by 2020 from 2007 levels. Remaining planned projects that will be instrumental in helping the City achieve its reductions target include equipment upgrades and renewable energy project at the Cultural Centre, and the gas equipment replacement plan at smaller City facilities.

Since energy use in civic buildings accounts for a majority (approximately 60%) of total reported corporate energy use in 2017, 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).



Comprehensive benchmarking could help the City focus investment and identify key opportunities for improved energy efficiency in buildings. In conjunction with other municipalities, staff are exploring the implementation of a regional building energy use benchmarking initiative that would enable the comparison of the energy performance of similar municipal building types. The City has led the development of the initiative over the past six months, and is hopeful that an agreement on sharing data and costs can be completed shortly.

Civic building energy use intensity has decreased from approximately 348 kWh/m² in 2011 to 301 kWh/m² in 2017. Similar to the increase in natural gas use over the past two years, building energy use intensity increased in 2016 and 2017, mostly due to the unusually cold weather period in the winter of 2017. Further reduction in building energy use intensity is expected to be achieved in the coming years once the replacements of Fire Hall No.1 and the Minoru Aquatic Centre and Minoru Place Senior's Centre have been completed. The overall reduction in building energy use intensity since 2011 is due to the continued investments by Council in corporate energy efficiency, through the City's EMP and replacement of aging infrastructure. It is estimated that the City's annual energy use would have been approximately 25% higher in 2017 without these past investments in corporate buildings.

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 - 2017 EMP Highlights

Numerous energy efficiency projects were completed over the past year that will provide benefit to the City including avoided energy use, cost, and GHG emissions. The following are the key metrics that the City achieved with the completed projects in 2017;

- Will avoid over \$70,000 in energy utility operational costs
- Over 2,000,000 kWh in future electricity and natural gas use reduction (equal to the power used in 45 homes in Richmond in a year), and
- More than 200 tonnes of GHG emissions avoidance (equal to the emissions from over 60 Richmond cars).

The largest component of these anticipated energy and cost savings is from the completion of an equipment replacement and optimization project at Watermania. The total energy savings represents approximately 3.0% of the overall City energy use.

As part of the previous 2017-2018 EMP funding agreement with BC Hydro, the City committed to reduce electricity use by 2.1% or 896,000 kWh by April 2017 from 2016 levels. The City was able to exceed that target by over 300,000 kWh this past year through various electricity reduction initiatives.

A detailed overview of EMP project highlights in 2017 is provided in Attachment 2. General highlights include:

- External Funding: \$110,000 of external funding was leveraged to support the City and the Corporate Energy Management Program in 2017.
- Showcase projects:
 - Boiler replacement and heating systems and controls optimization at Watermania Aquatic Centre.
 - Completed Phase 2 of the Street Lighting Fixture replacement plan, replacing over 1,400 inefficient fixtures in the West Richmond area with more efficient LED fixtures.
 - Replaced and upgraded corporate parking lot and exterior lighting at numerous City sites and facilities.
 - Completed lighting and control upgrades at Fire Hall No.6 and Ironwood Library
- Policy Implementation:
 - Expanded the Energy Statement Initiative to include infrastructure areas of street lighting, drainage stations, and sanitary stations. The energy statements aim to engage staff and increase corporate energy use and cost awareness.

Summary of Key Financial Achievements:

Through a variety of external partnerships agreements with energy utilities and governmental organizations since 2008, the City has been able to leverage its corporate energy efficiency investments and has received over \$2,000,000 in support funding for its EMP and capital projects. Some of this additional support funding has been used to accelerate the repayment of capital funding to the corporate Enterprise Fund, which is an internal fund that many EMP projects are funded through, with energy utility savings used to repay the fund. This type of funding mechanism for energy efficiency best management practice projects is a leading best practice of interest to other cities.

The City has also benefitted from its continued investment in the EMP with energy cost avoidance savings. Since 2008 it is estimated that the City has cumulatively saved over \$3.5 million dollars in energy utility operational cost, which has been used to fund other Council and City priorities, once repayment to the Enterprise Fund has been completed.

EMP Goals for 2018 and Upcoming Projects

The following main focus areas are in place for the EMP for 2018:

- Develop projects and policies that help to reduce corporate energy resource use and promote greater corporate energy use awareness
- Ensure planned corporate projects maximize the potential benefit of external funding and partnerships with outside agencies
- Improve the usability of energy use data at key facilities
- Continue to work with other departments to ensure continuity of building improvement and energy management related projects, so that they are delivered as seamlessly as possible

The following key energy initiatives are in various stages of implementation, and are scheduled to be completed in 2018:

- Complete the major equipment replacement and upgrade at Thompson Community Centre, including the revitalization of the geo-exchange field on-site.
- Complete building automation system upgrades and improved energy monitoring capabilities at Thompson Community Centre, Fire Hall No.4 and No.5, and at the Community Safety Building.
- Complete the commissioning of the City's first solar photovoltaic system at Fire Hall No.1

Financial Impact

None.

Conclusion

The main action areas of the City's Energy Management Program is to facilitate energy reduction initiatives, embed best energy management practices into corporate processes, and maximize external funding support. With Council and senior management support, the EMP has been successful at delivering energy reduction projects and tracking other corporate energy efficiency results over the past decade. Without past investments and improvements to corporate energy efficiency, it is estimated that the City's energy use would have been approximately 25% higher in 2017, equal to an increase of 11 GWh.

The EMP remains committed to focusing on reducing corporate GHG emissions and achieving the ambitious 2020 corporate building reduction target. This includes bringing forward innovative projects and initiatives that achieve multiple benefits for the City, such as reduced operational costs and improved occupant comfort. Some of the initiatives may include further fuel switching from natural gas to cleaner electricity. In conjunction, it remains imperative that projects aimed at electricity use reduction continue to be developed and implemented, so that overall corporate energy reduction can be achieved long term. As the City grows, greater levels of service and infrastructure will be needed to keep up with demand. Reducing resource use in existing buildings and infrastructure helps the City incorporate expanded services without increasing its overall environmental footprint.



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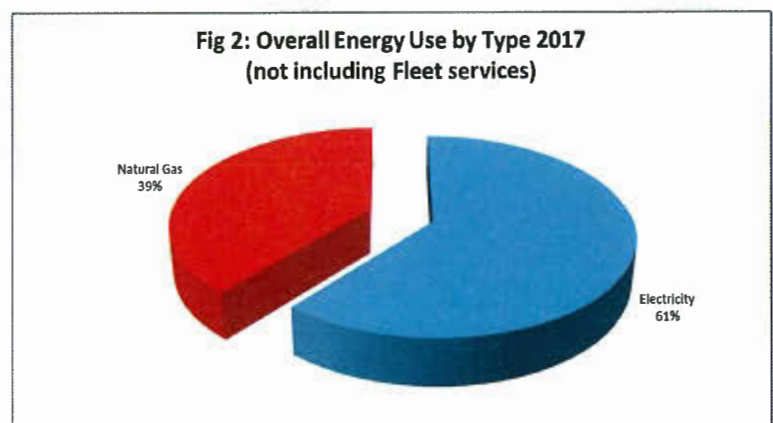
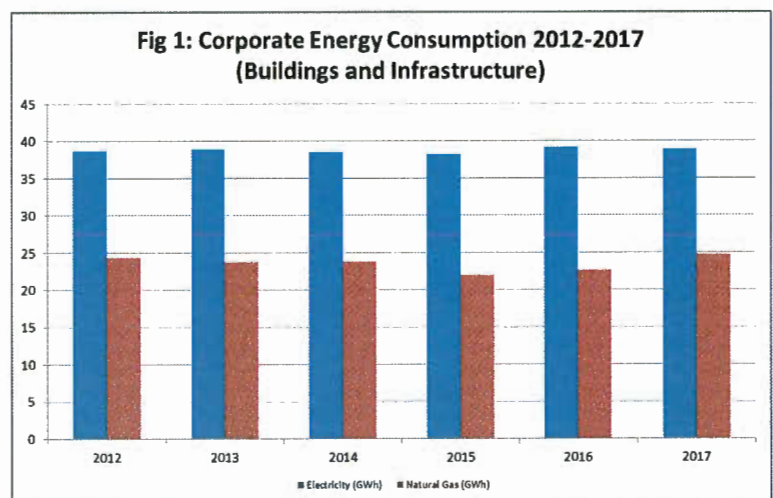
- Att. 1 Energy Update Report – Summary 2017
- Att. 2 City Energy Management Program – 2017 Key Initiatives

Energy Update Report

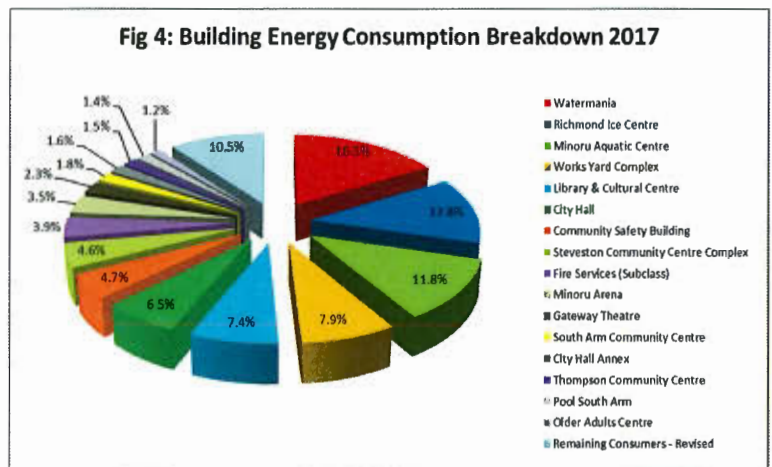
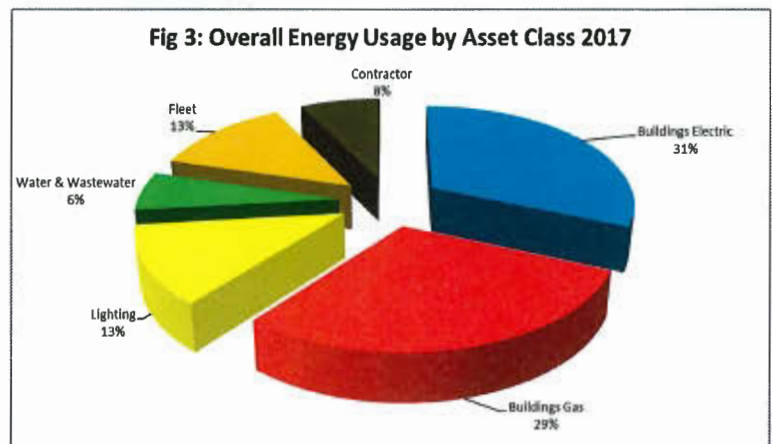
Summary 2017



- Cost of energy in 2017 for City of Richmond buildings, lighting, water and wastewater services = **\$5.5 million dollars or 63.6 GWh** (this is equal to the average power consumed in ~1,500 homes in Richmond in 1 year).
- This energy use resulted in approximately 4,800 tonnes of greenhouse gas (GHG) emissions.
- The total electricity 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 **69.0 GWh** in conventional energy use (equal to the energy consumption in ~1,650 Richmond homes annually), and over **9,000 tonnes** of greenhouse gas emissions (equal to emissions from ~2,800 Richmond cars).
- Due to an unusually cold weather period between December 2016 and March 2017, natural gas use in 2017 was similar to 2012 after three straight years of reduction. Over this past winter heating requirements were more in line with past averages. As compared to 2007, overall natural gas usage has decreased by approximately 18%.



- In 2017, the majority of corporate energy use was by **buildings-60%**, followed by **lighting-13%** and **fleet services-13%** (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 over 50% in 2017 (see Fig. 5, on next page).
- 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 Management

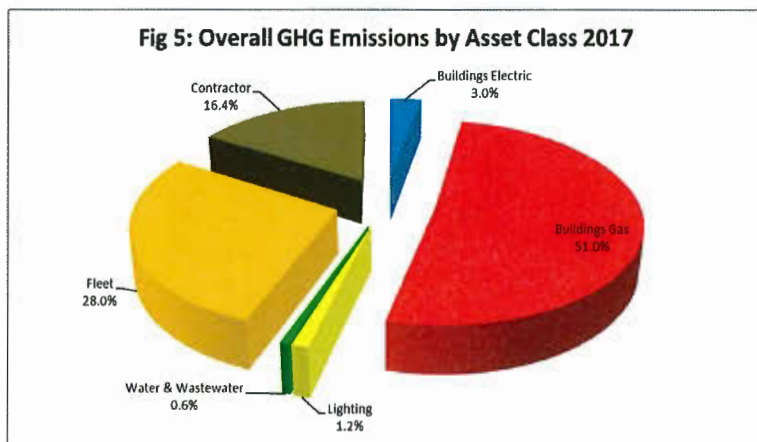
Program Highlights 2017

2017 Highlights:

- Maintained the City's **Carbon Neutral** status for corporate operations.
- Secured over **\$110,000** of external funding to support the Energy Management Program.
- Avoided over **1,000,000 kWh** in electrical and natural gas use and over **25 tonnes** of GHG emissions from a variety of 2016 completed projects.
- This energy reduction represents approximately **1.35%** of the City's current corporate annual energy use.
- This energy reduction will result in over **\$80,000** in operational cost avoidance savings.
- Anticipate achieving over 2.0 GWh in electrical and natural gas savings in 2018 from projects completed in 2017.



**BC CLIMATE ACTION
COMMUNITY 2016**



Sanitary pump replacement



Watermania

Energy Management

Program Highlights 2017

Showcase Projects:

- Boiler replacement and heating systems and controls optimization at Watermania Aquatic Centre.
- Completed Phase 2 of the Street Lighting Fixture replacement plan, replacing over 1,400 inefficient fixtures in the West Richmond area with more efficient LED fixtures.
- Replaced and upgraded corporate parking lot and exterior lighting at numerous City sites and facilities.
- Completed lighting and control upgrades at Fire Hall No. 6 and Ironwood Library.

Policy Implementation:

- Expanded the Energy Statement Initiative to include infrastructure areas of street lighting, drainage stations, and sanitary stations. The energy statements aim to engage staff and increase corporate energy use and cost awareness.



2018 Vision and Goals

The following main focus areas are in place for the EMP for 2018:

- Develop projects and policies that help to reduce corporate energy resource use and promote greater corporate energy use awareness.
- Ensure planned corporate projects maximize the potential benefit of external funding and partnerships with outside agencies.
- Improve the usability of energy use data at key facilities.
- Continue to work with other departments to ensure continuity of building improvement and energy management related projects, so that they are delivered as seamlessly as possible.

2018 Action items:

- Complete the major equipment replacement and upgrade at Thompson Community Centre, including the revitalization of the geo-exchange field on-site.
- Complete building automation system upgrades and improved energy monitoring capabilities at Thompson Community Centre, Fire Hall No. 4 and No. 5, and at the Community Safety Building.
- Complete the commissioning of the City's first solar photovoltaic system at Fire Hall No. 1.



Solar thermal system at Thompson Community Centre



Thompson Community Centre

City Energy Management Program – 2017 Key Initiatives

	2017 Key Initiatives
Plan	<p><i>Energy Strategic Planning:</i></p> <ul style="list-style-type: none"> Received \$110,000 in external funding to support City energy efficiency related projects and the Corporate Energy Management Program in general. Completed a project development assessment for the planned lighting infrastructure upgrade and replacement project at South Arm Park. Completed a natural gas using equipment replacement and upgrade plan, which will be used to develop a 2019 capital submission for Council consideration. The implementation of this plan would help the City achieve its building emissions targets. Applied for Federation of Canadian Municipality funding to support a comprehensive energy retrofit and equipment replacement project at the Library Cultural Centre. Continued working closely with Project Development and Facilities to ensure that planned infrastructure and equipment improvement projects achieve the highest energy efficiency results as possible, and qualify for available external incentives.
Do	<p><i>Building Capacity</i></p> <ul style="list-style-type: none"> Continued providing the Energy Statements to pertinent staff and areas. Expanded the initiative to include infrastructure areas of street lighting, drainage stations, and sanitary stations. The energy statements aim to engage staff and increase corporate energy use and cost awareness. Continued to work together with other departments to align capital submissions for yearly building improvement and energy management related requests, so that building related projects are delivered as seamlessly as possible. <p><i>Reducing Energy Use or Displacing conventional energy sources</i></p> <ul style="list-style-type: none"> Completed lighting and control upgrades at Fire Hall No.6 and Ironwood Library Completed mechanical equipment and HVAC related control upgrades at South Arm Community Centre. Replaced one boiler and optimized the heating systems and controls at Watermania Aquatic Centre. Completed Phase 2 of the Street Lighting Fixture replacement plan, replacing over 1,400 inefficient fixtures in the West Richmond area with more efficient LED fixtures. Replaced and upgraded corporate parking lot and exterior lighting at numerous City sites and facilities. <p><i>Increasing Financial Security & Stability</i></p> <ul style="list-style-type: none"> Over \$65,000 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 Thompson Community Centre 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 • 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 2019 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 continuing the development of 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 planned 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 continuing the development of an optimization procedure plan and process for buildings, to ensure that buildings 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.