Prepared By:

Recreation, Cultural and Facility Services
City of Ottawa

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1.0 Overview

The City of Ottawa is committed to improving energy management and has made it a key component of its operations; becoming a leader in energy conservation and the reduction of greenhouse gas emissions (GHG). The City understands the social, environmental and financial implications of energy management and is continuously striving to deliver improvements and efficiencies in a responsible way.

This report presents a summary of the City's utility consumption, as well as a review of the measures and contributions identified within the first CDMP, highlighting the positive impacts of energy conservation efforts across the corporation between 2014 and 2018. In addition, and as required by the provincial Electricity Act, 1998, this document will outline the City's Energy Conservation and Demand Management Plan (CDMP) for 2019-2022.

Since implementation of the first CDMP, the City's total energy use has been reduced by 6.7%. as a direct result of its active pursuit of energy conservation initiatives, including:

- Investment of more than $1 million dollars per year over the last four years on energy conservation projects
- Implementation of a largescale street lighting LED conversion project
- Improving the energy efficiency of facilities while exploring demand peak saving opportunities
- Continued use of the Leadership in Energy and Environmental Design (LEED) standards which emphasize creating sustainable and environmentally conscious facilities
- Council approval of an Air Quality and Climate Change Management Plan (AQCCMP), that targets the reduction of GHG emissions in Ottawa by 80% by 2050 from 2012 values
- A City partnership with Envari, a subsidiary of Hydro Ottawa, on 99 energy conservation projects, at 92 different locations
- Over $1 million received in incentives from Hydro Ottawa, Hydro One, and Enbridge to expand and increase energy reduction initiatives

This 2019 to 2022 CDMP will serve as a guide and provide the basis for the City to responsibly implement improvements to its infrastructure and facilities to optimize energy use and reduce its environmental footprint.

2.0 Utility Consumption Data

As required by the Province, this section summarizes consumption over the course of the first CDMP (2014-2018) for electricity, natural gas, and water. This data is reported in the context that since 2014, the number and size of City managed facilities has grown by 5% to meet population growth and the demand for municipal services. Many of the new buildings include large surface areas and energy intensive operations such as swimming pools and arenas. Some of the new or expanded facilities include the Richcraft Recreation Centre, Minto Barrhaven Recreation Complex, Francois Dupuis Recreation Centre, OCTranspo Facilities Management Operation Centre, Arts Court and the Iber Road Works Yard.

2.1 Electricity

At the start of the first CDMP in 2014, the total amount of electricity consumed by the City was 307 GWh per year. By 2018, this consumption level had decreased to 285 GWh per year, a reduction of 22 GWh or 7.2%. The corresponding reduction in greenhouse gas emissions equates to 923 tonnes per year.

Project Examples:

Street Light LED Conversion

The City has initiated a large-scale street lighting LED conversion project over the last four years. As of the end of 2018, 35,700 of the City's 58,000 street lights have been converted to LED. This project accounts for a cumulative energy avoidance of approximately 21,700,000 kWh since its inception in 2014. Currently, this is producing an energy savings of 64%, with expected annual energy reduction between 50 and 65 percent by the end of the project.

Solar Photovoltaic Panels

12 Solar Photovoltaic Systems have been installed atop City facilities generating over 2,500 kW of clean energy for the province. Eight rooftops have been leased out to third parties for the installation and management of the solar panels.

Facility LED Lighting Conversions

Several LED lighting conversion projects were completed at Administration, Recreation, and Operational buildings across the City.

An example of the program's success is at the St. Laurent Recreation Complex. The site assessment identified several LED conversion opportunities beyond linear fluorescents. By converting to LED, this facility now demonstrates over 140,000 kWh of annual consumption savings, or 9% of the facility's total electrical use.

At Water and Wastewater facilities an Ontario Save on Energy incentive of $100,000 was leveraged to convert lighting to LED. The overall cost of the project totaled $2 million and is expected to result in an estimated annual energy savings of 2 million kWh.

The City is also working on lighting conversions at the Britannia and Lemieux Water Purification Plants. The project will cost approximately $500,000 and will also leverage incentive funds of $30,000 from Ontario Save on Energy. The projected outcome is an estimated combined annual savings of almost 400,000 kWh.

Centrifuge Upgrades

Between 2014 and 2016, 13 centrifuges were upgraded at the City's waste water plant to improve motor reliability and reduce maintenance costs. The project received approximately $90,000 in funding from Ontario Save on Energy. By implementing the latest technology, regenerative variable frequency drives and alternating-current motors, the new system reduces the equipment energy requirement by 110 kW.

2.2 Natural Gas

In Ontario, natural gas is a more cost-effective source of energy when compared to electricity or propane. In 2018, natural gas cost less than 20% per unit of energy compared to electricity. Given this lower cost, the City converted many facilities to use high-efficiency natural gas for heating. These conversions, along with the addition of new facilities heating with gas, contributed to a 4.5% (from 353 to 369) increase in the number of gas accounts. Although the number of accounts has increased, the total consumption of natural gas decreased over the same period due to the integration of high-efficiency technology. The amount of natural gas used in 2018 was 21.3 million m^3, compared to 22.7 million m^3 in 2014. Representing a consumption decrease of 1.4 million m^3 or 6.3%, and a reduction of 2713.4 tonnes of GHGs.

2.3 Water

The City recognizes the value and importance of fresh water as a resource and has taken measures to reduce water consumption throughout its facilities. High-efficiency toilets and urinals have been replacing traditional units, and nozzles designed to reduce water flow have been installed on at the City's busiest splash pads.

Over the last four years, 64 water accounts have been added, many of which are for splash pads. Water use consumption peaked in 2015 with 2.2 million m^3. Since then, the City has reduced water consumption by 2% to 2 million m^3 in 2018 through various conservation initiatives.

Project Example:

Playground Splash Pad Optimization

The Splash Pad Optimization Project took place between May 2016 and May 2017. To conserve water, $50,000 was invested into 25 splash pads with the highest water consumption levels. Nozzles designed to reduce water flow were installed, re-commissioning work such as repairing leaks was completed, and re-programming was done to ensure water did not run for an excessive amount of time. As a result, water consumption levels decreased by 37,000 m^3 or 22% with some splash pads reducing water use by over 50%. This project yielded an annual savings of $147,000 without compromising play value.

3.0 Results of the first CDMP 2014-2018

The various initiatives implemented through the 2014-2018 CDMP have made a significant impact on energy conservation and demand management. The Energy Management Program outlined reduction targets for electricity, natural gas and water.

The table below outlines the annual targets and provides the estimated savings achieved by the end of 2018.[1]

[1] The Playground Splash Pad Optimization Project accounts for an additional savings of 36,985 m^3 of water in 2017

	Annual Savings Targets	Estimated Savings 2015	Estimated Savings 2016	Estimated Savings 2017	Estimated Savings 2018	Total Estimated Savings
Electricity	250,000 kWh	1.5M kWh	1.6M kWh	1.2M kWh	1.6M kWh	5.9M kWh
Natural Gas	125,000 m^3	32,837 m^3	75,833 m^3	83,333 m^3	105,906 m^3	297,909 m^3
Water	15,000 m^3	7,504 m^3	2,593 m^3	1,511 m^3	37,054 m^3	48,662 m^3

Utility price fluctuations, combined with the evolving affordability of technologies such as LED, had a significant influence on the selection the of electricity conservation projects undertaken. Significant improvements were also made through the reduction of greenhouse gas emission (GHG) projects, as well as water conservation.

3.1 Building Energy Performance Index 2014-2018

Each year, staff evaluates the performance of its energy reduction measures for electricity and natural gas. City facilities with a minimum area of 100 square meters are included in the calculation of the overall building energy use coefficient. In 2018, there were 336 facilities in this category.

The building energy use coefficient describes how effectively a facility, or group of facilities, is using its electrical and natural gas energy. Dividing the total energy used by the total area produces the average energy intensity coefficient, otherwise known as the Building Energy Performance Index, or the BEPI. The various energy conservation programs implemented have contributed to the steady decline in the BEPI for City facilities.

The following illustration demonstrates the decline in the BEPI over the 2014-2018 period:

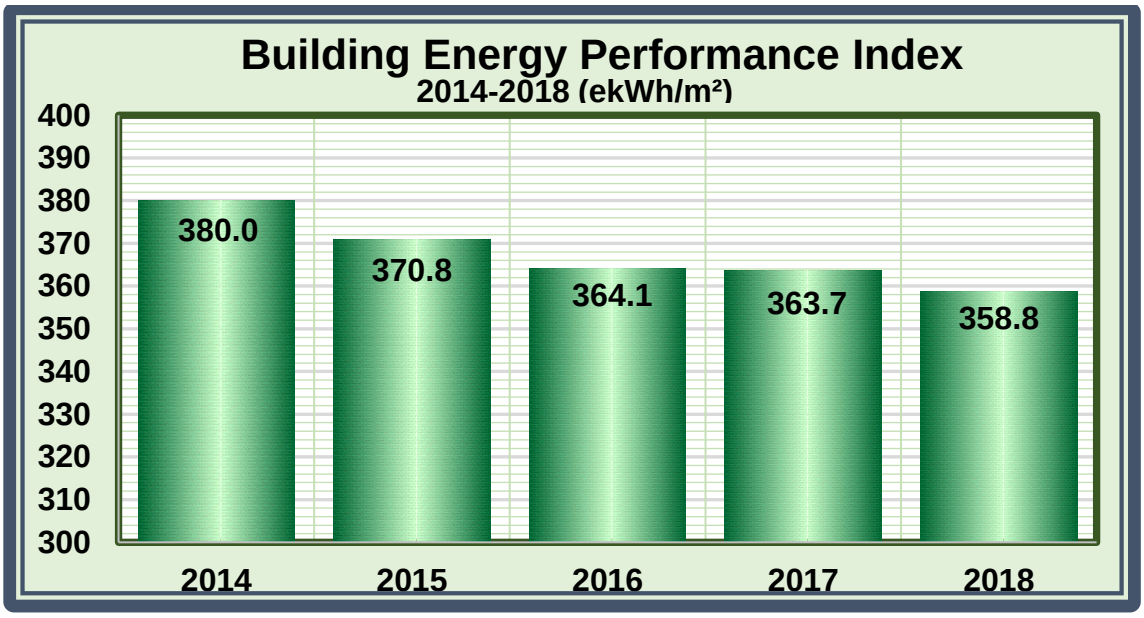

Figure 1. Building Energy Performance Index for the years 2014 – 2018

The steady decline in the BEPI over this time-period indicates a significant reduction in the energy intensity of the 336 largest facilities, resulting in an annual savings of $844,000, and a total reduction of 545 tonnes of GHG emissions.

3.2 Building Automation System Integration

Building Automation System (BAS) Integration was a key component of the first CDMP. It is the automatic centralized control of a building's heating, ventilation, air conditioning, lighting, and other systems through a building automation system. BAS integration allows for much more effective optimization of both energy use and comfort in facilities, as well as enabling central support for site staff.

The City developed a platform that allowed technology from 35 different vendors, including 15 different control companies, to be accessed by staff at 122 sites through one universal portal. This portal may be accessed remotely by any computer on the City network or approved mobile device; allowing staff to monitor and adjust building equipment set-points and schedules as needed from any location.

This unique platform has been studied internationally and emulated by other municipalities throughout the province.

Heating and ventilation improvements have also been completed at Britannia and Lemieux Water Purification Plants. The cost of the work was approximately $1.9 million. The integration of the building's automation system with unit heaters and exhaust fans,

along with improved air handling, will result in a combined estimated annual electricity savings of almost 35,000 kWh.

3.3 Energy Evolution - Phase One

Energy Evolution is a renewable energy strategy, developed by City in collaboration with the community, designed to manage energy consumption, promote the use of renewable energy and advance local economic development opportunities in Ottawa.

In 2015, Council directed staff to develop a municipal renewable energy strategy. Work on the strategy began in 2016 with the creation of a community Sounding Board comprised of over 100 individuals representing 50 local organizations. Over the course of 2016 and 2017, staff worked with members of the Sounding Board as well as targeted stakeholders in the energy sector to establish an overarching vision for the strategy, assess renewable energy generation and energy reduction opportunities, and identify a series of actions to implement between 2018 and 2020.

Phase One of the strategy, approved by Council on December 13, 2017, delivered a baseline inventory and analysis of Ottawa's current energy consumption and assessed opportunities primarily related to renewable energy generation (e.g., solar power, heat pumps, biogas, etc.). It also included a short-term action plan comprised of over 30 initiatives to be implemented by the City and its community partners by 2020.

3.4 Leadership in Energy and Environmental Design (LEED)

Ottawa continues to demonstrate a strong commitment to sustainable environmental practices. Green building practices show responsible management and good business sense. These practices reduce the impact of construction and building operation on the environment as well as resources, while reducing the cost of maintaining and operating a building over its life cycle.

Since the adoption of the Green Building Policy in 2005, the City has made a concentrated effort to increase the number of LEED certified buildings. Over this period, 27 buildings have earned LEED certification. Five have achieved Gold certification, 12 have achieved Silver and 10 have achieved LEED Certified rating. There are currently six buildings undergoing the LEED certification process. The Lansdowne Redevelopment project, completed in 2014, has been recognized as an innovative example of the City's sustainable building practices, as the first project in Canada to receive full LEED for Neighbourhood Development Stage 3 built Project Silver certification from the US Green Building council.

3.5 Backup Generator Investigation

The 2014-2018 CDMP suggested that the large backup generator at the Britannia Water Purification Plant be used to assist in managing the demand of energy during peak times. An investigation into this possible opportunity was undertake but it was determined that this generator cannot be made available for any other purpose other than in an emergency, as indicated in Schedule B, Section 5.3 of the City of Ottawa's Drinking Water Works Permit 008-202, Issue 5.

3.6 Clean Water and Wastewater Fund Projects

The City received over $69 million in funding as part of the Clean Water and Wastewater fund (CWWF). This funding was part of a short-term Canada-wide program for investment of $2 billion to support rehabilitation of both water treatment and distribution infrastructure and existing wastewater and storm water treatment systems; collection and conveyance infrastructure; and initiatives that improve asset management, system optimization, and planning for future upgrades to water and wastewater systems.

In October 2016, Council approved the proposed projects for submission (ACS2016-PIE-GEN-0001) and in 2018, Council received an update on the projects.

3.6 Raw Sewage Pumping Station (RSPS)

The Raw Sewage Pumping Station (RSPS) heating, ventilation and air conditioning upgrade project replaced the existing RSPS chillers and installed a new dry-cooler system. The project received approximately $8,000 in funding from Ontario Save on Energy and will reduce the equipment energy requirements by 10 kW.

4.0 Changes to CDMP for Future Initiatives

Historically, energy reduction programs have concentrated on reducing energy use and supplying a relatively aggressive return on investment. Moving into the future, the City will place additional emphasis on also initiating projects with a greater impact on GHG reductions.

In the first CDMP, investments concentrated primarily on projects with a 5.5-year payback. For the 2019-2022 plan it is proposed to include projects with a payback of up to 8 years. Notably, the utility costs avoided for these projects will equal the investment made within eight years. The extended payback period, coupled with the increased

investments, will allow for additional capital to be contributed towards more comprehensive upgrade opportunities that have a more direct impact on reducing GHG emissions.

4.1 Greenhouse Gas Emission Reduction

In 2019, Council allocated $3 million annually for energy, water and greenhouse gas reduction measures for City buildings, subject to annual budget consideration. The increased funding allows the City to expand the CDMP and better target the reduction of greenhouse gas emissions, while allowing for more comprehensive building upgrades.

4.2 District Energy

Over the last two years, the City and Public Services and Procurement Canada have pursued discussions on the merits and challenges of connecting the federal district heating and cooling system to Ottawa City Hall as the primary source of heating and cooling for the building. More recently, discussions have also extended to considering the inclusion of the City's new Main Library building. Through detailed discussions, both parties have explored the implications on the City's GHG emissions, upfront capital costs of connecting to district energy, and the ongoing cost implications to the City. These discussions are ongoing.

5.0 CDMP 2019-2022 - Current and Proposed Energy Conservation

The sections below outline the initiatives, measures, and projects planned under the 2019-2022 CDMP.

5.1 LED Conversion Program

The City has initiated lighting surveys of its facilities. Based on results, old lighting technology is being upgraded to high efficiency LED's. As many bulbs as possible will be replaced, as well as ballasts. The program targets 18,000 four-foot linear fluorescent bulbs and ballasts throughout all facilities. Identified lighting fixture replacement opportunities, such as in pools, arenas, and parking lots will also be considered.

Lighting conversions are also underway at more than 50 of the City's drinking water and wastewater pumping stations. The cost of this work is approximately $350,000 and the City is anticipating receiving $10,000 in Ontario Save on Energy incentives. The estimated total annual energy savings are over 70,000 kWh.

In 2019, it is anticipated that the City will spend up to $1.7 million on lighting upgrades, excluding any third-party incentives that may be received. Over the next three years, the City will be targeting City Hall, fire stations, Central Archives, its indoor ice pads, indoor pools, parking lots, as well as linear and pot light fluorescents for LED retrofits.

5.2 Building Automation System Integration Program

The BAS Integration Program has been in place since 2010. The project will continue to onboard facilities with network access to the BAS Integrator. With improved monitoring in mind, the BAS Integration Program expansion will continue to be a high priority. In 2019, approximately $1 million is planned to be spent on optimizing controls and expanding the program.

5.3 Mechanical Retrofits

In 2019 the City intends to make investments of approximately $300,000 on mechanical retrofits. Many of the mechanical efficiency upgrades will be done in conjunction with the replacement of mechanics that have reached end of life cycle. These may include boiler replacement with condensing, or the replacement of rooftop ventilation units, among others.

There are plans to retrofit portions of the HVAC system at the City's waste water plant. These initiatives include heat recovery and have the potential to reduce energy demands by up to 40%.

5.4 Pilot Projects

With increased funding comes the opportunity to explore new and emerging technologies, along with innovative uses of existing technologies. The following are projects currently being examined:

Electric Boiler Usage

This pilot program involves the innovative use of electric boilers at Walter Baker Sports Centre. With an incentive from the Federation of Canadian Municipalities, this program proposes using an electric boiler, as the facility's heating source when the cost of electricity is less than that of natural gas. Walter Baker is one of a limited number of large electrical users that are listed as a Class A hydro account. The rate per kWh for these accounts reflects the actual cost for electricity from the Province which varies dramatically over the day, month, and year. It is anticipated that the cost of electricity will be less than that of natural gas 50% of the time at this Class A facility.

Envelope Upgrade Demonstration

Building envelope demonstration projects are currently underway using next generation envelope components at the Glebe Community Centre. The building envelope consists of anything on the outside of a building, protecting it from the elements; this includes windows, siding, doors, etc. The goal of this project is to demonstrate to the surrounding community how improving components of a heritage building envelope can enhance both the occupant comfort and the energy effectiveness of the overall envelope, while still maintaining the style or character of the building.

There are eleven windows in the community centre that have been identified, within this project, as candidates for replacement. The proposed innovative windows are estimated to have an R-Value of R11 with a predicted lifespan of 60 years, as opposed to traditionally energy efficient windows with a R3 or R4 value which typically only lasts 15-20 years. The new windows will reduce heat loss by 90% and improve energy intensity.

The existing uninsulated steel door is also proposed to be replaced. In its current state, this component of the building envelope is highly energy intensive and is causing a condensation problem. A fiberglass reinforced polyester (FRP) door will be the recommended replacement. The FRP door is almost 65% less energy intensive than traditional steel doors and it will not dent, scratch, or rust.

5.5 Retro-Commissioning

Retro-commissioning is a process to improve the efficiency of an existing building's equipment or systems. As equipment ages, or building usage changes, building mechanical controls and envelope systems may be repaired over time with different generations of parts that can make the technology or equipment, less energy efficient. This leads to opportunities of retro-commissioning which Natural Resources Canada has indicated can yield energy savings of up to 16% with attractive payback periods. The City will review select facilities and identify retro-commissioning opportunities.

5.6 Incentives

The City has an aggressive plan to investigate and pursue all energy conservation incentive funding from external sources and to apply all secured funding back into additional projects to further the reduction of energy usage and greenhouse gas emissions.

5.7 Electrical Master Plan Study

An Electrical Master Plan study for the City's waste water plant is expected to be completed by the end of 2019. This study will address life-cycle replacements, risk assessments associated with aged equipment, capacity, growth, and service level expectations. The key objective of this work is to increase the facility's electrical reliability, including the ability to operate independent of the electrical grid using the power produced on-site by the Co-generation Facility. The study will provide a framework of projects needed to meet the plan's objectives.

5.8 Street Lighting

The City continues to execute the street lighting conversion project laid out in the previous CDMP. As of the end of 2018, an estimated 22,300 street lights remain to be converted to LED. The anticipated project completion date is July 2020, with a target annual energy reduction of 18,626,000 kWh.

5.9 Leadership in Energy and Environmental Design

The updated 2018 Green Building Policy report maintains the requirement that all newly constructed municipal buildings with a footprint greater than 500 square meters (5,400 square feet) be designed, delivered and certified by the Canada Green Building Council (CaGBC) as being Leadership in Energy and Environmental Design (LEED®) Certified at minimum. The current practice for retrofit and renovation projects is to apply sustainable design principles.

Noted in the 2018 Green Building Policy report, the CaGBC has made significant changes to its rating system, updating from LEED 2009 to LEED v4. Many of the changes in LEED v 4 are focused on a project's continued performance, rather than just its initial design. This is important to ensure reduced energy requirements and lower lifecycle costs for buildings. The City is reviewing and familiarizing itself with the new LEED v4 requirements and implications and is committed to working with the CaGBC to evaluate and assess the new certification system.

5.10 Climate Change and Resiliency Group

The City's Climate Change and Resiliency Group, established in 2018, focuses on climate change adaptation, resiliency and mitigation. Their mandate is to undertake actions to adapt to impacts of climate change on the City, as well as initiate actions that will facilitate the overall reduction of greenhouse gases in the community. This includes

legislation, policy, incentives, studies, etc. They also monitor emissions for the municipality. The City is currently on target to reduce community-wide emissions by 12% below 2012 levels by 2024.

5.11 Energy Evolution – Phase 2

The Energy Evolution Plan – Phase 1, outlined the City's target of a community wide GHG emission reduction of 80% by 2050. Phase 2 of the Energy Evolution Plan is expected to be completed in Q4 2019. It is anticipated that the report will suggest building energy conservation to be a key component of the plan to achieve the targeted emissions reduction. This could include deep building retrofits of municipal buildings which are typically beyond the scope of a CDMP, however, critical to achieve large GHG reductions.

5.12 City of Ottawa Official Plan

The official plan is currently under review and is expected to be completed and presented to Council by 2021. The plan is expected to include a section on energy. To date, an energy discussion paper has been produced and it has gone through an initial public consultation process.

6.0 Demand Management

Demand management is an approach to control peak electrical use in a facility. Projects addressing demand management are listed below.

6.1 Co-Generation Facility at ROPEC

Since 1997, the co-generation facility has used methane, a by-product of the wastewater treatment process, to produce heat and electricity. This reduces the amount of electricity and natural gas required from utility suppliers, which also reduces the City's greenhouse gas emissions.

In 2018, the facility reduced its need to purchase energy from the grid by generating almost 17 million kW-hours of electrical energy Staff are preparing a report for Committee and Council's consideration to increase the climate resiliency of ROPEC, including the use of co-generation and other plant upgrades to increase the plant's electrical reliability, provide financial savings, and GHG reductions.

6.2 Energy Demand Peak Management at Waste Water Plant

During forecasted provincial peak demand events, the City's Waste Water Plant Operations reduces its demand on the Ontario power grid. This is done by reducing raw sewage pumping through the storage collection system, as well as reducing air conditioning loads in the site buildings, and reducing equipment loads that do not affect short term process quality. Additionally, co-generation engine maintenance is scheduled to ensure the units are operational during forecasted peak demand events. These activities do not reduce the amount of energy consumed but rather shift it outside of peak demand events. This demand management initiative reduced the plant's hydro costs by approximately $498,000 annually.

6.3 Electric Boiler at Walter Baker Sports Centre

The City has developed a pilot program to install electric boilers at select Class A facilities. This is planned for the Walter Baker Sports Centre. During periods when electricity is less expensive than natural gas, the electric boiler will be used for space and process heating while consuming some of the surplus electricity from the Ontario grid.

7.0 Conclusion

The City of Ottawa is committed to taking a leadership role in environmental sustainability. With a proven record of accomplishment and a focus on the future, the City continues to improve on energy conservation and demand management, while tackling climate change through GHG emission reduction initiatives. The goal of reducing greenhouse gas emissions by 80% from 2012 levels by 2050, will require the City to continue to focus on reducing energy use and emissions in the coming years.