



2019-2023 Corporate Energy Plan Summary Report

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Executive Summary

The City of Richmond Hill operates and maintains 61 facilities and over 16,000 street, parks and parking lot lights. City operations consume a significant amount of electricity and natural gas, with energy costs in the range of \$6.6M annually. As Richmond Hill's population continues to grow, so do City services and infrastructure, which will increase energy consumption. Richmond Hill remains committed to managing and reducing energy consumption, costs and greenhouse gas emissions from its buildings and operations.

Ontario Reg. 507/18 under the *Electricity Act* requires municipalities to report energy consumption and greenhouse gas (GHG) emissions annually. It further requires municipalities to develop and publish energy conservation and demand management plans (Corporate Energy Plans), and to update these plans every five years.

Richmond Hill developed its first Corporate Energy Plan in 2014. The primary objective of the City's Corporate Energy Plan is to manage and reduce municipal energy consumption, related costs and GHG emissions, through energy conservation initiatives and renewable energy systems. The 2014 Corporate Energy Plan resulted in approximately 4,300,000 ekWh/year in energy savings, equivalent to roughly \$660,000/year in cost avoidance and a reduction in GHG emissions of 370 tonnes/year.

This report, the **2019-2023 Corporate Energy Plan Summary**, outlines the results of the 2014-2018 Corporate Energy Plan and the measures the City will undertake over the next five years to reduce energy consumption, costs and greenhouse gas emissions. A comprehensive planning process was used to develop the 2019-2023 Corporate Energy Plan, which included energy audits, an in-depth analysis of energy consumption, trends and benchmarking to identify energy saving opportunities. The resulting five year implementation plan identifies projects that, once implemented, are expected to result in 8,400,000 ekWh/year in energy savings, \$725,000/year in cost avoidance and approximately 860 tCO₂-eq/year in GHG emissions reduction. In addition, the plan outlines measures that will promote a culture of energy conservation for staff and residents using City facilities.

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1. Introduction

The City of Richmond Hill operates and maintains 61 facilities, 45 of which consume energy in meaningful amounts and have been included in this report. These include community centers, pools, ice rink arenas, libraries and administrative buildings. In addition, the City operates and maintains an outdoor lighting network comprised of over 16,000 street, parks and parking lot lights. These facilities and outdoor lights consume a significant amount of energy (electricity and natural gas) costing \$6.6 million in 2017. As Richmond Hill's population continues to increase, the number of facilities and outdoor lights will continue to grow and require more energy to operate.

To manage energy consumption, related costs and greenhouse gas (GHG) emissions, Richmond Hill, in 2014, developed its first five-year (2014-2018) Corporate Energy Plan.

This report, the **2019-2023 Corporate Energy Plan Summary**, outlines the implementation results of the first five-year plan and the measures the City will undertake over the next five-years to continue to reduce energy consumption, related costs and GHG emissions. The full version of the 2019-2023 Corporate Energy Plan, which contains a more in-depth analysis of energy consumption as well as the details of the projects implemented as part of the 2014-2018 Corporate Energy Plan, is available upon request.

1.1 Legislative Requirements: Green Energy Act and the Electricity Act

The *Green Energy Act*, 2009, O. Reg. 397/11 required all public agencies, including municipalities, to report their energy use and GHG emissions annually, and to prepare and publish energy conservation and demand management plans (Corporate Energy Plans). The plans required senior management approval and must be updated every five years.

In 2018, the *Green Energy Act*, O. Reg. 397/11 was repealed, however, all the requirements for public agencies in regards to annual energy reporting and preparing the corporate energy plans were re-enacted under the *Electricity Act*, O. Reg. 507/18.

1.2 City's Commitment to Energy Conservation and Past Achievements

The City of Richmond Hill understands that energy is a valuable resource and that the efficient use of energy will help manage costs and reduce GHG emissions. The City has made commitments to energy conservation and efficiency in its Strategic Plan, Official Plan and Environment Strategy. Richmond Hill's ISO 14001 certified, Environmental Management System (EMS), also identifies energy consumption as a significant environmental aspect of municipal operations and has set an objective to reduce energy use through continuous improvement of operational practices. Corporately, Richmond Hill requires that all new municipal buildings with a floor area over 500 square meters be constructed to meet LEED¹ Silver (or alternative equivalent) certification.

¹ Leadership in Energy and Environmental Design (LEED) is the most widely used green building rating system in the world.

In 2016 and 2017, Richmond Hill City Hall received the 'Living City Energy Efficiency Leadership Award (Gold)' from the Toronto Region Conservation Authority's (TRCA) Mayors' Megawatt Challenge (MMC) Program for surpassing the energy reduction target set by the program under its 'Town Hall Challenge Program'. In 2011, the City earned the fifth and final milestone of the 'Federation of Canadian Municipalities FCM)'s 'Partners for Climate Protection (PCP) program' for exceeding the corporate GHG emissions reduction target. These achievements demonstrate the City's commitment and leadership in energy conservation.

2. Energy Conservation Goals, Objectives and Reduction Target

The goal of the City's Corporate Energy Plan is to make Richmond Hill one of the leaders in sustainable energy use. The primary objectives of the plan is to manage municipal energy consumption, related costs and greenhouse gas emissions, through the implementation of energy conservation initiatives and renewable energy systems.

Corporate Energy Reduction Target

The corporate energy reduction target for the 2019-2023 Corporate Energy Plan is to maintain the average energy use intensity (EUI) below 41 ekWh/ft² by 2023 (i.e. 5% below past five years' average EUI of 43 ekWh/ft²).

Corporate GHG Reduction Target

The City will investigate establishing a corporate GHG emissions reduction target upon completion of the Community Energy and Emissions Plan (CEEP), which is currently underway. The CEEP will establish a community GHG emissions reduction target, and staff envision alignment between this measure and any corporate GHG emissions reduction target selected. The GHG emission reduction potential from energy projects proposed in the 2019-2023 Corporate Energy Plan is 860 tonnes of CO₂-eq/year.

3. 2014- 2018 Corporate Energy Plan Results

3.1 Approach

The 2014-2018 Corporate Energy Plan laid the foundation for energy management in City facilities. A working group, with representatives from various City departments, assisted in developing the plan.

Staff conducted walkthrough energy audits for top energy-consuming facilities and identified a number of energy conservation opportunities (energy projects). Staff also identified a number of opportunities to improve energy efficiency through routine projects, such as planned lifecycle replacement of equipment. Projects with the best return on investment were selected and formed the basis of the 2014-2018 implementation plan.

3.2 Projects Implemented and Results

Capital Energy Projects Implemented

A total of 89 capital energy conservation projects were implemented which resulted in 4,300,000 ekWh/year in energy savings and approximately \$660,000/year in cost avoidance, as well as 370 tonnes/year in GHG emissions reduction. More than half of the energy savings came from lifecycle replacement projects where end-of-life equipment was replaced with new, more energy efficient options. Examples include the replacement of boilers, chillers and compressors. The remainder of the savings came from the implementation of proactive energy projects such as indoor lighting replacements with LED lights. Provincial incentive funding programs made available through the local energy distribution companies (Alectra and Enbridge), assisted in offsetting \$330,000 of the capital costs.

Operational Energy Projects Implemented

In addition to capital energy projects, several operational energy projects were implemented over the 2014-2018 Corporate Energy Plan period. These include:

- The creation of the cross-functional Corporate Energy Conservation Team
- Providing energy efficiency training to facility operators, supervisors and managers.
- Providing monthly energy consumption reports to facility managers and supervisors to facilitate analysis of energy consumption and to identify and correct abnormalities in consumption or in billing in a timely manner.

3.3 Energy Consumption and Costs Analysis - City Facilities

City facilities consume roughly equal amounts of electricity and natural gas. However, electricity accounts for approximately 85% of total energy cost, whereas natural gas accounts for approximately 85% of GHG emission. Therefore, it is important to prioritize energy conservation

projects based on both cost savings potential and the potential to reduce GHG emissions, to meet the objectives of the Corporate Energy Plan.

In 2017, 14 City facilities accounted for approximately 80% of the total energy consumed. The 2019 – 2023 Corporate Energy Plan focuses energy conservation measures on these 14 facilities, which have the greatest reduction potential.

Energy Consumption Trends - City Facilities

Figure 1 shows the energy consumption and cost of City facilities from 2012 to 2018. Total consumption has decreased by 5% in 2018 when compared to 2014, which is mainly attributed to savings from energy conservation projects implemented by the City. A slight increase in consumption in 2017 and 2018 is due to the addition of two new facilities (Richmond Green Sports Dome in 2016 and David Dunlop Observatory in 2017). Although energy consumption has decreased since 2014, energy cost continued to increase mainly due to a significant increase in electricity rates from 2014 to 2016. Energy rates stabilized in 2017 and 2018, which kept the energy cost the same during this time period.

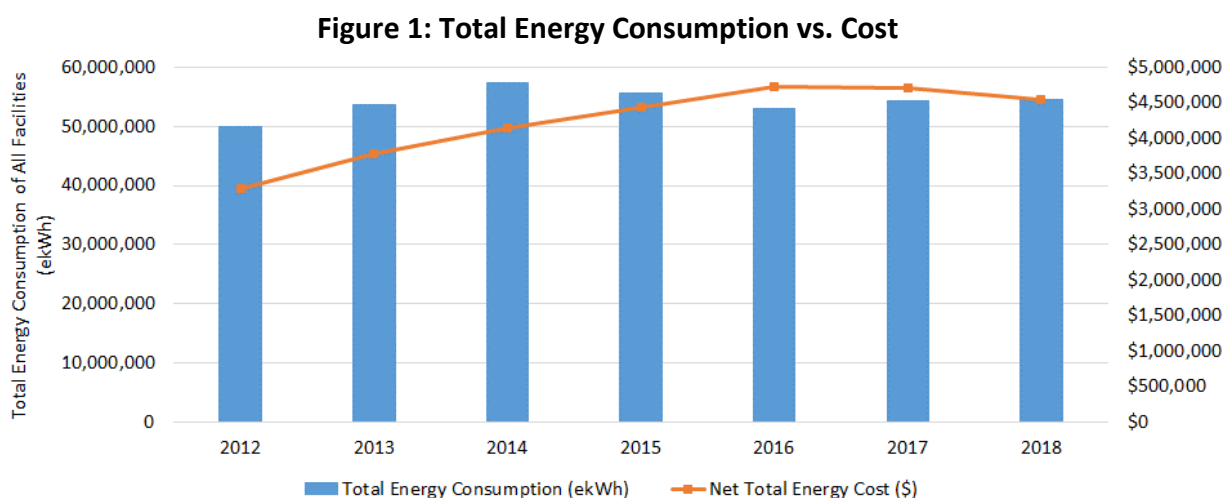
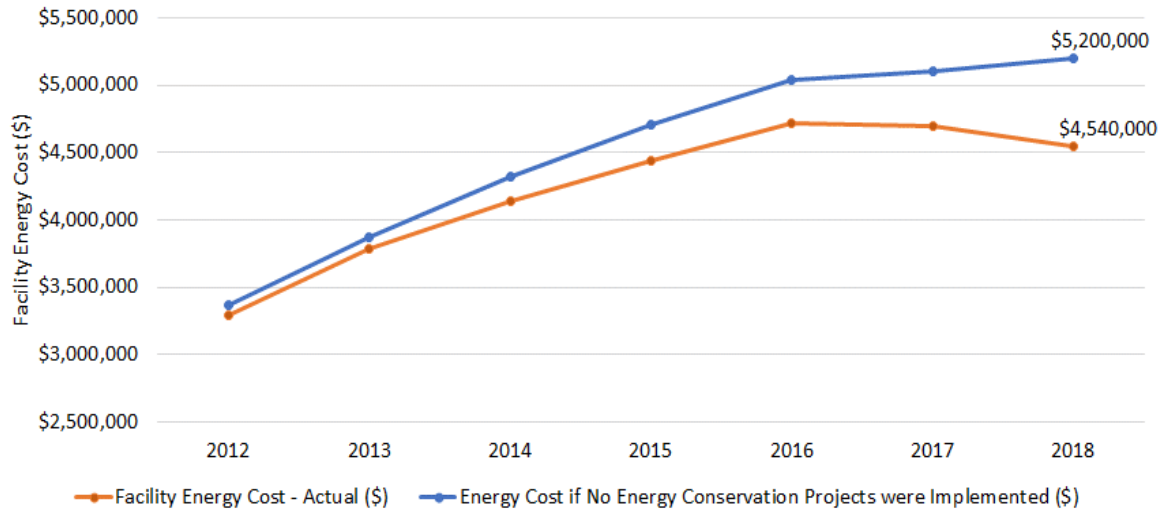


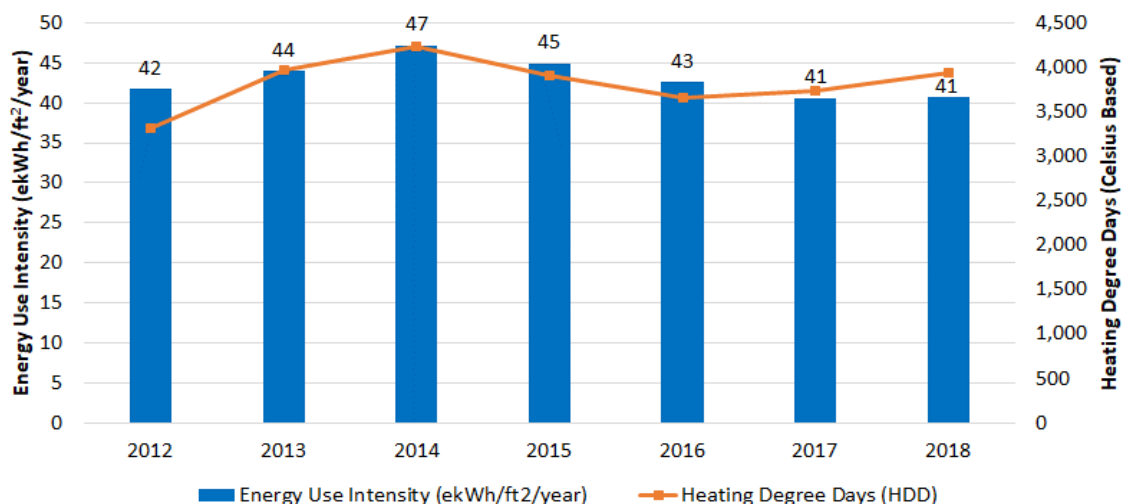
Figure 2 below illustrates the actual energy cost of all City facilities contrasted with what the cost would have been if no energy conservation projects were implemented. The difference is attributed to the cost avoidance achieved from the energy conservation projects implemented by the City.

Figure 2: Energy Cost with and without Energy Conservation Projects (2014-2018)



Another important measurement of progress, as noted in Figure 3, is Energy Use Intensity (EUI), which measures energy consumption per square foot of building space. EUI allows for comparison between buildings of different size and normalizes increases in total consumption resulting from the addition of new facilities. Figure 3 below, shows the EUI of City facilities from 2012 to 2018 (blue bars) and the heating degree-days (HDD) for each year (orange line). Heating degree-days are an indicator of how cold a winter is. The higher the heating degree-days the more space heating is required to keep buildings comfortable for occupants and therefore the more energy consumed. The chart shows that a strong correlation exists between energy consumption and HDD (i.e. winter weather). The EUI of City facilities shows a consistent decreasing trend since 2014 (see Figure 3). In fact, EUI decreased by 14% between 2014 and 2018. This is due to the energy conservation projects implemented by the City and slightly milder winter weather in 2018 as compared to 2014.

Figure 3: Energy Use Intensity Trend



4. 2019-2023 Corporate Energy Plan Summary

4.1 Approach

The 2019-2023 Corporate Energy Plan was developed in adherence to the Ministry of Energy's requirements. The plan takes a proactive approach to reducing corporate energy consumption over the next five years. The scope of the Corporate Energy Plan has been expanded to include the energy consumption of municipal street, parks and parking lot luminaires, in addition to energy consumption of City facilities.

A comprehensive planning process was used to develop the plan, which included an in-depth analysis of energy consumption, trend analysis and benchmarking to identify energy saving opportunities. In addition, the City conducted detailed energy audits of the top 13 energy-consuming facilities and the recommendations from these audits informed the implementation plan.

The Corporate Energy Conservation Team actively participated and contributed during the entire plan development process including prioritization and selection of energy conservation opportunities for implementation over the next five years.

4.2 Implementation Plan

The 2019-2023 Corporate Energy Plan proposes to implement a number of capital, operational and organizational energy conservation projects as described below. A summary of the Implementation Plan can be found in Appendix A of this report.

Proposed Capital Energy Projects

The 2019 – 2023 Corporate Energy Plan includes 62 proposed capital energy conservation projects, batched into 12 projects types that were recommended by the 2017 detailed energy audits. Examples include:

- Installation of variable frequency drive (VFD) on pool filter pumps to optimize/reduce the pump speed to meet demand;
- Installation of a low-e ceiling in ice rink arenas to reduce the UV ray penetration and radiant heat from arena ceiling to the ice surface;
- Lighting retrofit to LED technology;
- Building recommissioning to ensure building equipment and systems are operating optimally;
- Installation of occupancy sensors to optimize the operation of lights and heating/cooling systems based on occupancy; and
- Installation of demand control ventilation to optimize the amount of fresh air that needs to be conditioned.

If all of the capital energy projects proposed by the 2019-2023 Corporate Energy Plan are implemented, energy consumption is expected to drop by 8,400,000 ekWh/year, which represents approximately 15.7% of total energy consumed in 2017. This equates to an estimated energy cost avoidance of \$725,000/year, and 860 tonnes/year in GHG emission reduction.

Proposed Operational Energy Projects

In addition to capital energy projects, staff identified several operational energy conservation projects that involve improving existing operating practices, and increasing staff awareness and commitment to energy conservation. Examples of operational energy projects proposed in the 2019-2023 Corporate Energy Plan include:

- Provide energy efficiency training to facility operators every other year;
- Continue providing monthly energy reports to facility managers/supervisors/operators;
- Ensure that pools are operated within the following water temperature ranges²:
 - Pleasure/Recreational swimming: 80°F to 85°F
 - Competitive swimming: 78°F to 80°F
- Ensure that ice rinks are operated within the following ice surface temperatures³:
 - Ice Hockey: 22°F-24°F
 - Figure Skating: 24°F-26°F
- Explore opportunities to optimize the facility's energy consumption and costs during the unoccupied/idle periods;
- Continue to work with operators to ensure operating schedules are customized and updated based on planned building use;
- Monitor equipment operation and electricity consumption through the deployment of wireless sensors and optimize operations based on this data;
- Work with Alectra to move to billing based on actual consumption for outdoor lights; and
- Develop a dimming strategy for outdoor lights and obtain approval from senior management.

Proposed Organizational Energy Projects

Having the appropriate organizational policies in place also ensure that decisions are made in consideration of energy conservation. Examples of organizational energy projects included in the 2019-2023 Corporate Energy Plan are:

- Conduct detailed energy audits of the top energy consuming facilities every 5 years.
- Conduct walkthrough energy audits of City facilities other than the top 10 energy-consuming facilities.
- Continue working with external agencies such as local utility companies to secure incentive funding for energy conservation opportunities.

² Recommended by ASHRAE (http://smartenergy-form.arch.illinois.edu/pdf/EST_Pools.pdf, Table 2)

³ Ontario Recreation Facilities Association Inc. (ORFA): (<http://www.rfabc.com/Assets/RFABC+Digital+Assets/pdf/icetemps.pdf>)

- Develop energy efficiency design guidelines and targets for new City facilities and major retrofit projects.
- Explore opportunity to upgrade building automation system (BAS) for City facilities.

5. Renewable Energy Systems

The City has implemented a total of 12 renewable energy projects, including the installation of solar thermal and photovoltaic (PV) systems as well as ground source heat pumps. The list and description of renewable energy systems installed by the City is detailed in the 2019 – 2023 Corporate Energy Plan Report.

The installed renewable energy systems demonstrate the City's commitment to become a leader in sustainable energy use. Through the installed renewable energy systems, the City is able to offset the energy purchased from utility companies. This helps reduce the City's corporate energy cost, move towards resilience, and reduce greenhouse gas emissions.

6. Corporate Energy Plan Approval

O. Reg. 507/18 under the *Electricity Act* requires the five-year Corporate Energy Plan be approved by the public agency's senior management. Richmond Hill's 2019-2023 Corporate Energy Plan was presented to the City's Executive Leadership Team (ELT) for review and approval.

7. Conclusion

The City of Richmond Hill operates and maintains 61 facilities and over 16,000 street, parks and parking lot lights. City operations consume a significant amount of electricity and natural gas, with energy costs in the range of \$6.6M annually. As Richmond Hill's population continues to grow, so do City services, infrastructure and energy needs. Richmond Hill remains committed to managing and reducing energy consumption, costs and greenhouse gas emissions from its buildings and operations.

The City has prepared a 2019-2023 Corporate Energy Plan as required by Ontario Regulation 507/18, under the *Electricity Act*. The primary objectives of the Corporate Energy Plan are to manage municipal energy consumption, cost and greenhouse gas emissions. The City will achieve this through a series of recommended energy-reducing capital projects together with improved operational practices and organizational measures.

The recommended energy projects are estimated to reduce energy consumption by 8,400,000 kWh/year, which is approximately 15.7% of the total energy consumption in 2017. This equates in a cost avoidance of \$725,000/year and a reduction in GHG emissions of 860 tonnes/year.

As per the requirements of the *Electricity Act*, the 2019-2023 Corporate Energy Plan Summary will be posted on the City's website. Staff will be submitting the 2017 corporate energy consumption and GHG emissions report to the Ministry of Energy by July 1, 2019. The full version of the 2019-2023 Corporate Energy Plan will be made available upon request.

Appendices

Appendix A: Implementation Plan Summary (2019-2023)

| # | Energy Conservation Projects (Capital) | Description |
|---|--|---|
| 1 | Filter Pump VFD | Installation of variable frequency drives (VFDs) on pool filter pumps allows the speed of pumps to be reduced to the required levels rather than running at full speed. This significantly reduces the electricity consumed by these pumps. |
| 2 | Arena Low-e Ceiling | To reduce radiant energy emitted from an arena ceiling onto the ice surface, a low emissivity ceiling will be installed. The low-e ceiling reduces the amount of heat the ice plant has to remove from the ice which in turn reduces the ice plant's electricity consumption and cost. |
| 3 | Interior Lighting Retrofit | Retrofits of interior lights with energy efficient lighting (i.e. LED lights). |
| 4 | Facility Re-commissioning | Re-commissioning is the process of analyzing building system operations and returning them to their design or optimum specifications and settings based on current facility needs. Re-commissioning these facilities will lead to energy savings, improved system operations, and improved occupant comfort. |
| 5 | Low-flow Aerators | Low-flow aerators installed on washroom faucets reduce the water flow rate which reduces overall water consumption. This saves energy by reducing the amount of hot water consumed. |
| 6 | Optimum Start Stop | A building optimum start/stop program could be integrated with the Building Automation System (BAS) to determine the optimal start/stop times for the heating, ventilation and air conditioning (HVAC) system based on the occupancy and event schedules set in the BAS. This will save energy by only having the units operate when required; minimizing the time they are active when not needed. |
| 7 | Occupancy Sensors | Many of the spaces in the facilities experience varying occupancy levels throughout the day, in particular the program and meeting rooms. Installing occupancy sensors that are tied into the heating, cooling and lighting systems will enable temperature setbacks and turning off of lights when the areas are not in use. |
| 8 | VFDs for RTUs, AHU, AC Units | This project involves equipping rooftop units (RTU), air handling units (AHU) and air conditioners (AC) with variable frequency drives (VFD) to allow fans to run at reduced speeds when the heating or cooling needs are beneath maximum capacity. Reducing the speed of the fan motors will result in energy savings. |
| 9 | Glycol Pump VFD | Installation of variable frequency drives (VFDs) on the glycol pump will allow for the flow and speed of the pump to be reduced when heating and cooling needs are being adequately met. This significantly reduces the electricity consumed by these pumps. |

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| 10 | Demand Control Ventilation | This system utilizes CO ₂ sensors located in the air return ducts to control the amount of fresh air brought into the facility to maintain an acceptable level of indoor air quality. This control strategy will save energy by reducing the amount of fresh air that needs to be conditioned. |
| 11 | Arena Water Deaerator | A water deaeration system removes air bubbles from the ice resurfacing water. Removing the air from water allows for a reduction in the temperature of the water used for ice resurfacing resulting in reduced refrigeration load. In addition, the use of deaerated water makes harder ice, which will reduce the frequency of ice resurfacing. All of the above will result in energy savings. |
| 12 | Arena Water Reverse Osmosis (RO) | A reverse osmosis system removes impurities from the ice resurfacing water. Removing impurities from water allows for a reduction in the temperature of the water used for ice resurfacing resulting in reduced refrigeration load. In addition, the use of RO water makes harder ice, which will reduce the frequency of ice resurfacing. |

The estimated capital cost for the implementation of these capital energy conservation projects is \$2.0 Million. If all proposed projects are implemented, the energy savings is estimated at 6,800,000 ekWh/year which represents a cost avoidance of \$580,000/year.

In addition, life-cycle replacement projects with energy saving potential that the City is planning to implement over the 2019-2023 Corporate Energy Plan period are expected to provide an additional energy savings of 1,600,000 ekWh/year which represents \$145,000/year in cost avoidance.

The combined total energy savings and cost avoidance from the proposed capital energy projects is estimated to be:

- **Energy savings: 8,400,000 ekWh/year**
- **Cost avoidance: \$725,000/year**