OWWA 2020 AWARDS
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Ontario Water Works Association

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Name of Organization:	Markham Stouffville Hospital
Title of Submission:	Water Conservation and Efficiency
Submission Category:	Public Sector
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I hereby certify the accuracy and validity of the information provided in the attached report and agree that this report may be shared and posted on the OWWA website:

Maria Pavone

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Authorized Person name
Director, Facilities and Corporate Services
Markham Stouffville Hospital

Date: __April 16, 2020_____

MARKHAM STOUFFVILLE HOSPITAL
WATER EFFICIENCY PROGRAM

Who are we?

Markham Stouffville Hospital (MSH) is one of Ontario's leading community hospital. The organization has made a concerted commitment to sustainability by implementing a number of initiatives designed to decrease our environmental impact, use energy more efficiently, reduce water and resource consumption, and increase recycling. We are determined to reduce our environmental footprint even further as we continue to grow.

Executive Summary

Across our two sites (Markham and Uxbridge) and the Reactivation Care Centre (RCC), the hospital has 329 beds and provides high quality, patient-centred care to more than 402,000 patients each year. We offer diagnostic and emergency services and delivers clinical programs in acute care medicine and surgery, addictions and mental health, and childbirth and children's services. In order to best serve our patients and community, MSH is always looking for opportunities to make our organization more environmentally friendly. The partnership with Markham District Energy is a great example of working with leaders in the industry to use energy and water more efficiently. The Regional Municipality of York (York Region)'s Industrial, Commercial, and Institutional (ICI) Capacity Incentive program (the "Program") was another perfect fit for our commitment to the environment.

Through the ICI Capacity Buyback Incentive Program York Region offers a water audit at no cost to Industrial, Commercial, and Institutional (ICI) high water users in York Region. The purpose of this Program is to identify long-term water-saving measures. If facilities choose to implement the opportunities identified in the water audit, York Region's representative will then return to the facility to verify the water savings and recommend an incentive amount based on the volume of water saved per day.

In 2017, when our Markham site participated in the Program the water use assessment revealed opportunities for long-term water savings. MSH completed the implementation in February 2019 which resulted in a large amount of water savings. Through the Program, MSH reduced over 20 per cent of its total water consumption. By disconnecting the potable water use equipment from the domestic cold water supply and connecting them to the Markham District Energy (MDE) cooling loop— MSH has been able to reduce its annual water consumption by more than 31,000 m^3, which equates to a savings of $138,000 and has had additional savings of over $35,000 annually from a reduction in electricity cost.

Project Background

In MSH, the main water consuming processes are: Markham District Energy (MDE), domestic usage, and the open loop cooling system; i.e. walk-in freezer and fridge compressors, autoclaves, and air conditioners.

In 2019 MSH initiated a water conservation project which included replacing domestic fixtures with low-flow fixtures. This retrofit project achieved an overall 40 per cent reduction in water use. Furthering the commitment to sustainability, MSH participated in York Region's ICI Capacity Buyback Incentive Program. In 2017 York Region's representative conducted a water audit to determine the water consuming processes in the facility. The results were summarized into a water audit report and included the process water balance, water saving opportunities, estimated investment required, gross savings, payback period, and eligible incentive amount from York Region.

The water audit report identified high potential water savings opportunities which required the plumbing work and sufficient process load. Subsequently, MSH decided to retain their own consultant to conduct a feasibility study of the existing chilled water system (MDE cooling loop) serving building A, and to identify the year-round cooling requirements. The scope of the study was to review the existing chilled water system connected to these process loads, and to optimize energy usage when the system is running in the non-cooling season. The study also identified equipment which was using domestic water for once-through process cooling and proposed a retrofit solution.

Through the feasibility study, it was recommended that MSH decouple the process cooling loads from the main chilled water system, to reduce energy usage, resulting in two chilled water loops: 1) primary chilled water loop and 2) secondary 24/7 chilled water loop. The primary chilled water loop serves the air handling unit cooling coils and fan coil units, running only during the summer season. A new secondary chilled water loop now serves the 24/7 cooling loads throughout the facility and will run full-time during the year. The 24/7 chilled water loop is tied into the Markham District Energy heat exchangers for chilled water supply and return. This process change led to significant water and energy savings.

The recommended opportunities were implemented and completed in February 2019. This upgrade is saving MSH approximately 30,946 m^3 of water per year ($138,267), approximately 20 per cent of the total annual water consumption in 2018 (154,010 m^3) and has had additional savings of over $38,000 annually from a reduction in energy.

Demonstrating leadership in environmental sustainability, MSH is continuing to explore additional water conservation opportunities. Currently there are three autoclaves and one bench autoclave which use once-

through domestic water to create steam for the sterilization process. To reduce water waste, this process will be investigated to see if it can be plumbed into the 24/7 chilled water loop.

Program Description and Results

MSH, York Region and a third party consultant worked together under York Region's ICI Capacity Buyback Incentive program to conserve water at the facility. The project started off with a kick-off meeting in May 2017 to discuss the water use equipment and included an onsite visit. From the kick-off meeting major water- consuming processes and the main water supply location were identified, the consultant then returned to the facility to complete the pre-audit.

Water Balance

The water balance was prepared based on water meter readings, direct flow measurements using an ultrasonic flow meter, observation, and information provided by MSH. Figure 1 shows the three largest water-consuming processes identified in the facility during the pre-audit; MDE (37.3%), domestic (13.6%), and water-cooled fridge and freezer compressors (12.5%). Figure 2 shows the three largest water-consuming processes identified in the facility during the post-audit; MDE (46.7%), domestic (17%), and autoclaves (9.6%). After implementation, no water was required for the water-cooled fridge and freezer compressors and air conditioning units.

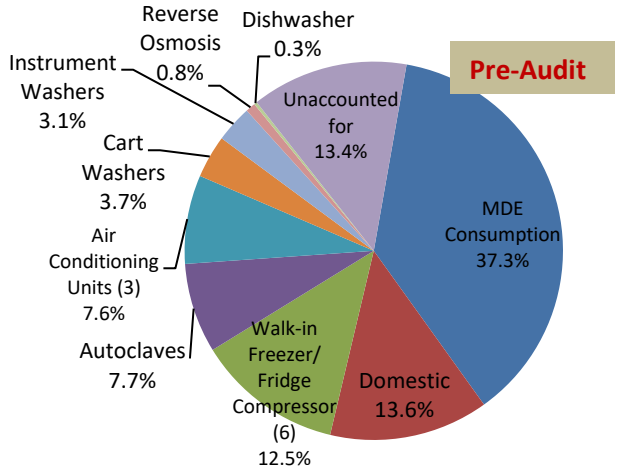


Figure 1: Pre-Audit Water Consuming Processes

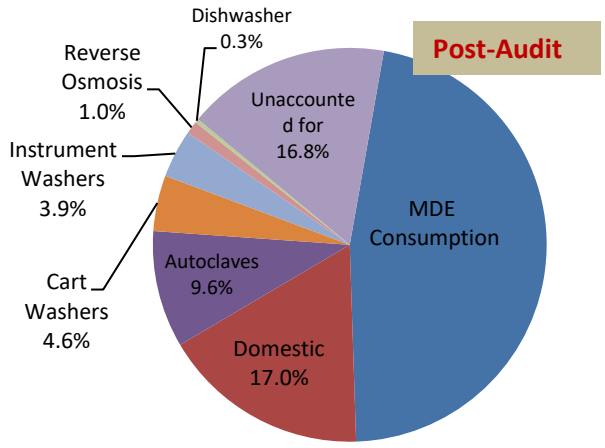


Figure 2: Post-Audit Water Consuming Processes

Water Conservation Opportunities

After the consultant conducted the pre-audit, the results and recommendations for water saving opportunities were provided to MSH. One recommendation from the audit to install second district cooling loop and connect Air Conditions and Fridge Compressor to this process cooling loop, which was estimated

to save approximate30, 000 m^3 was implemented and completed by March, 2019. A verification audit was performed to inspect the installation and confirm the water savings.

The connection of Air Conditions and Fridge Compressor; including three air conditioners, five fridge compressors and one biohazardous fridge compressor to the Markham District Energy System were verified. Additional supporting documentation including project invoices, drawings and specifications, and the Certification of Substantial Performance of Contract were collected to confirm project completion. The total savings are presented in Table 1. The details of each conservation opportunity are subsequently listed below.

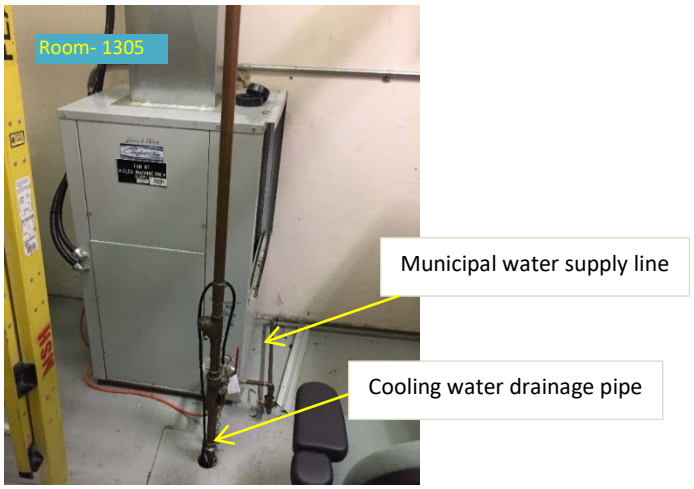
Table 1: Total Savings and Incentives

Item	Units	Quantity
Total water savings from the implementation	(m^3/year)	30,946
Total cost saving from water saved	($/year)	$138,267
Estimated percentage of water saved from total consumption	(%)	20%
Total cost saving from reduction in electricity cost	($/year)	$35,864
Cost of measures	($)	212,154
Recommended York Region incentive	($)	50,000
Estimated payback period	(years)	0.93
Estimated greenhouse gas saving	(tCO_2eq)	13.26*

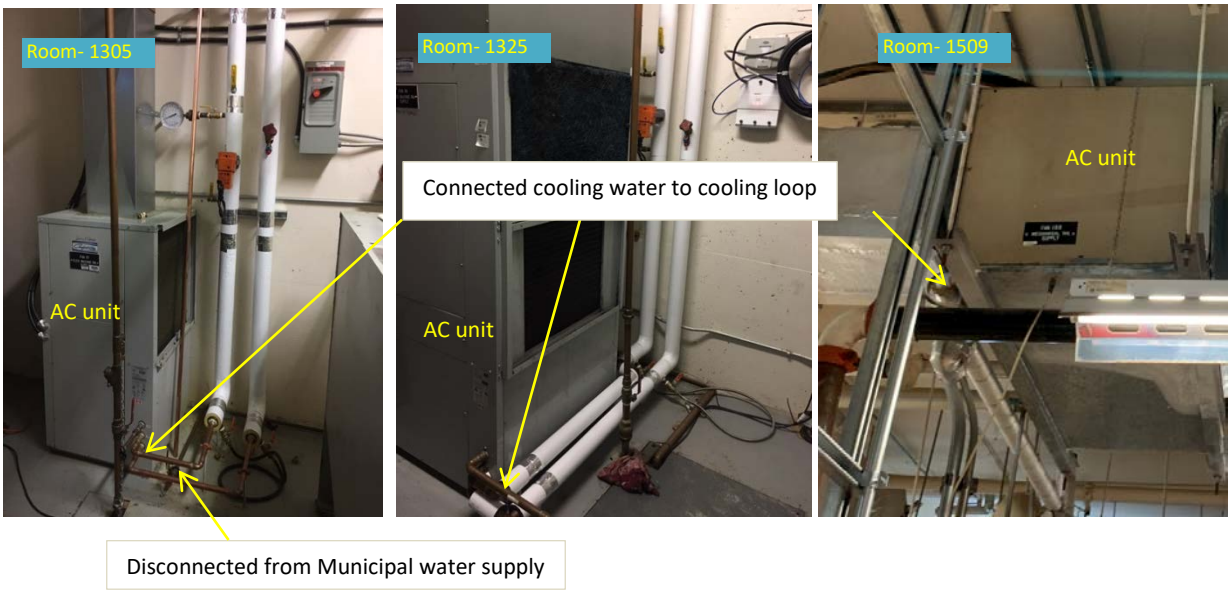
*GHG saving is combined from water saving (1.49 tCO_2eq) and electricity saving (11.78 tCO_2eq)

Opportunity 1: Installation and Connection of Air Conditioners to the District Cooling Loop

Previously, the compressors in elevator machine rooms A-1305, 1325 and mechanical room 1509 were cooled by once-through water that drained directly to the sanitary sewer. The compressors were estimated to use 11,673 m^3 of water per year. MSH disconnected the municipal water inlet pipe and connected the compressors to the Markham District Cooling Loop. Now, with the new connection the cooling water is recirculated and no municipal water is being used for cooling the compressors.



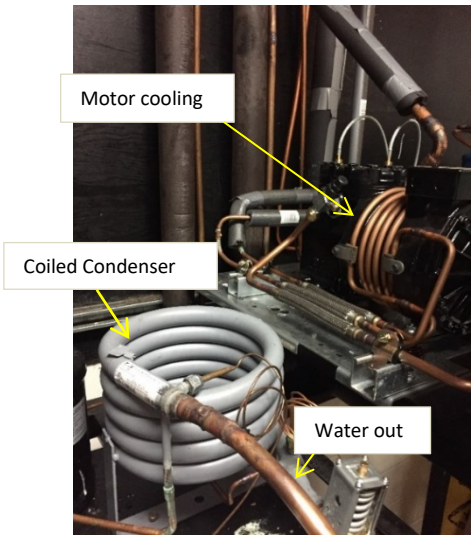
(a) Once-Through Cooled Air Conditioner (Before)



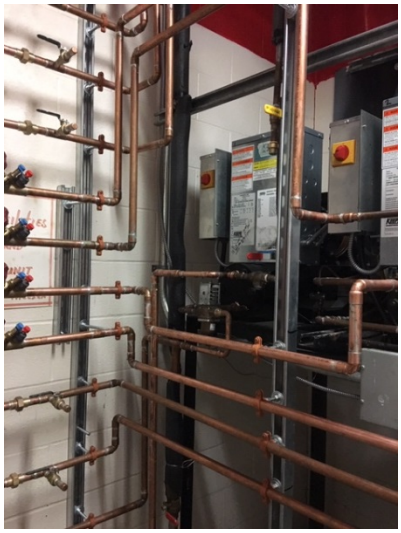
(b) Connection of the Fridge/Freezer Compressors to the District Cooling Loop (After)

Opportunity 2: Installation and Connection of Fridge and Freezer Compressors to the District Cooling Loop

Previously, five fridge/freezer compressors serving the kitchen that are in Room 1564 were connected to domestic cold water for once-through cooling that drained directly to sanitary sewer. The fridge and freezer compressors were estimated to use 18,805 m^3 of water per year. MSH disconnected the municipal water inlet pipe and connected all five compressors to the Markham District Cooling Loop. Now, with the new connection the cooling water is recirculated and no municipal water is being used for cooling the compressors.



(a) Water-Cooled Condensing Unit (b) old water-cooled pipeline from 5 compressors

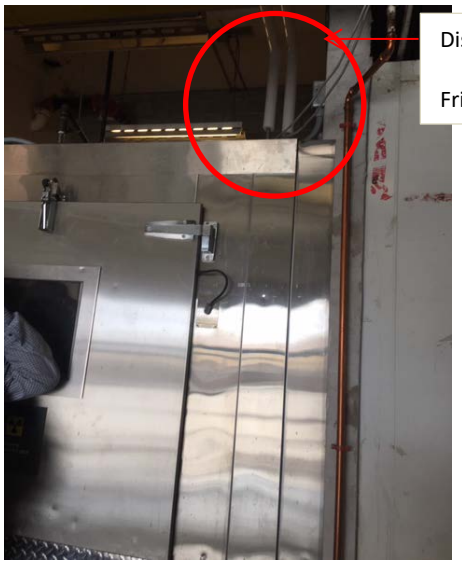


(a) new pipelines connection from condensers to cooling loop (b) new pipelines before insulation

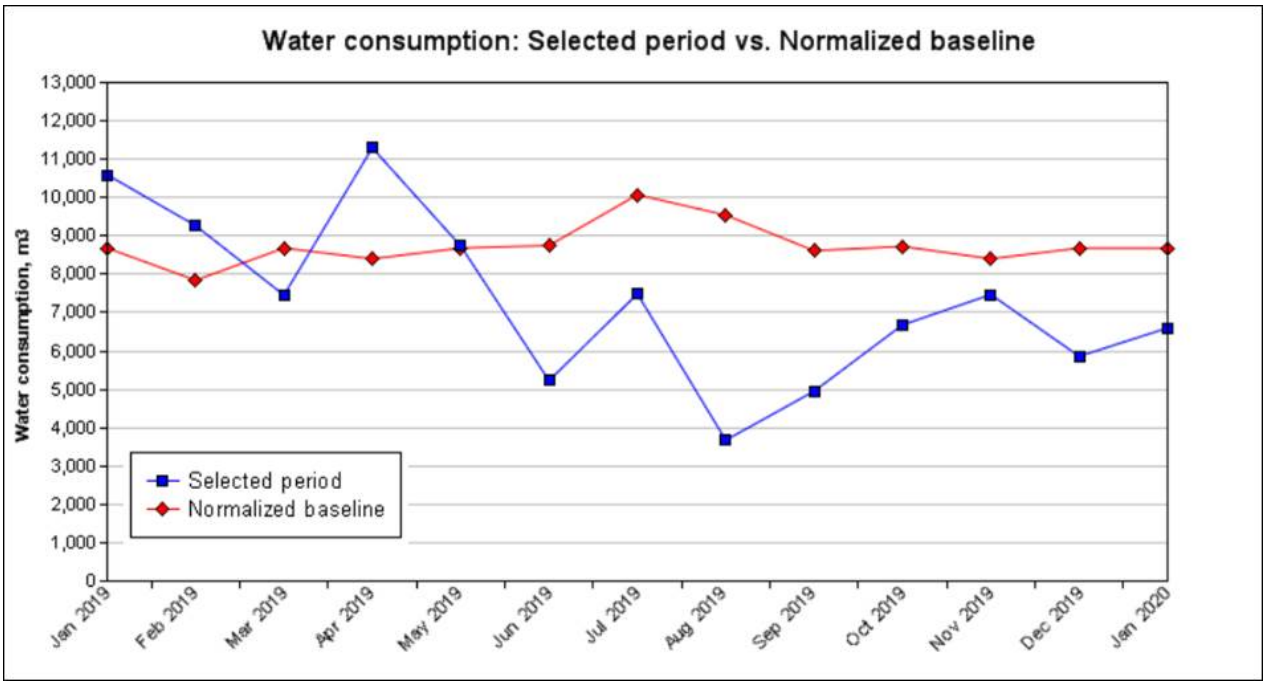
Opportunity 3: Installation and Connection of Biohazardous Fridge Compressor to the District Cooling Loop

Previously, the biomedical waste fridge compressor located at the loading dock was cooled by once-through water that drained directly to the sanitary sewer. The compressor was estimated to use 468 m^3 of water per year. MSH disconnected the municipal water inlet pipe and connected the compressor to the Markham District Cooling Loop. Now, with the new connection the cooling water is recirculated and no municipal water is being used for cooling the compressors.

(a) Once-Through Cooled Bio-Hazardous Fridge Compressor (Before)



(b) Connection of Bio-hazardous Fridge Compressor to the District Cooling Loop (After)



From June/19 there are 32.9% savings total over the 8 months. Roughly 35 k m3 over a full year, and at $4.47 per m3 is around $160,000 annual savings.

MSH believes that the high quality patient care, services and programs we provide need not come at the expense of the environment. To the contrary, MSH embraces the concept that environmental sustainability and ecological responsibility promotes overall wellness and this in turn is one of the very best ways to serve our communities. Motivated by this holistic model of healthcare, which unites environmental stewardship with exceptional patient care, MSH's 2014-2020 strategic plan states MSH endeavors to "be exemplary stewards of our resources [and] create systems of great governance". This is further underscored by the MSH's mission and beliefs which emphasizes our role in delivering safe, high quality care and maximizing health while ensuring that we remain accountable. Our Vision is to deliver care beyond our walls and all our energy initiatives speaks to our commitment to serve the community.