



Muskoka Algonquin Healthcare 2019-2023 Energy Conservation and Demand Management (ECDM) Plan

JUNE 28, 2019

Under Ontario Regulation 507/18, Ontario's broader public sector organizations are required to develop and publish an Energy Conservation and Demand Management (ECDM) Plan by July 1, 2019. Technical advice and analysis for this ECDM Plan were provided by [Enerlife Consulting Inc.](#)

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Executive summary

Muskoka Algonquin Healthcare (MAHC) has prepared this 2019-2023 Energy Conservation and Demand Management (ECDM) plan that is intended to reduce energy consumption and greenhouse gas (GHG) emissions, lower utility costs, upgrade building systems and provide a positive economic return on investment. The Plan presents energy savings achieved and lessons learned from 2014-2018, and lays out the goals, strategy and business case for the Hospital's energy efficiency investments over the next five years. We are committed to improving our energy efficiency, while maintaining occupant comfort and meeting the expectation of the general public and the Ministry of Health to efficiently deliver the highest quality healthcare services to our community.

The Plan presents the actual energy and water performance of the existing hospital since the previous plan was posted in 2014, discussing actions taken, savings achieved, and lessons learned. More efficient lighting, a new building automation system and ventilation system improvements were implemented in both South Muskoka Memorial Hospital and Huntsville Memorial Hospital that resulted in \$621,350 in utility cost savings over the 5 years while lowering greenhouse gas emissions by 401 tonnes CO₂e.

Project success and lessons learned from this experience inform the strategy and management practice recommendations in this Plan, with particular reference to training staff and leveraging the capabilities of the new building automation system. We are aiming to further lower energy use at the hospitals in this plan.

Table 1 presents actual, weather-normalized energy and water savings achieved in 2018 compared to a 2013 baseline. Further details on the measures implemented can be found in Part 3 of the Plan.

Table 1 2018 energy and GHG emissions savings vs 2013 baseline

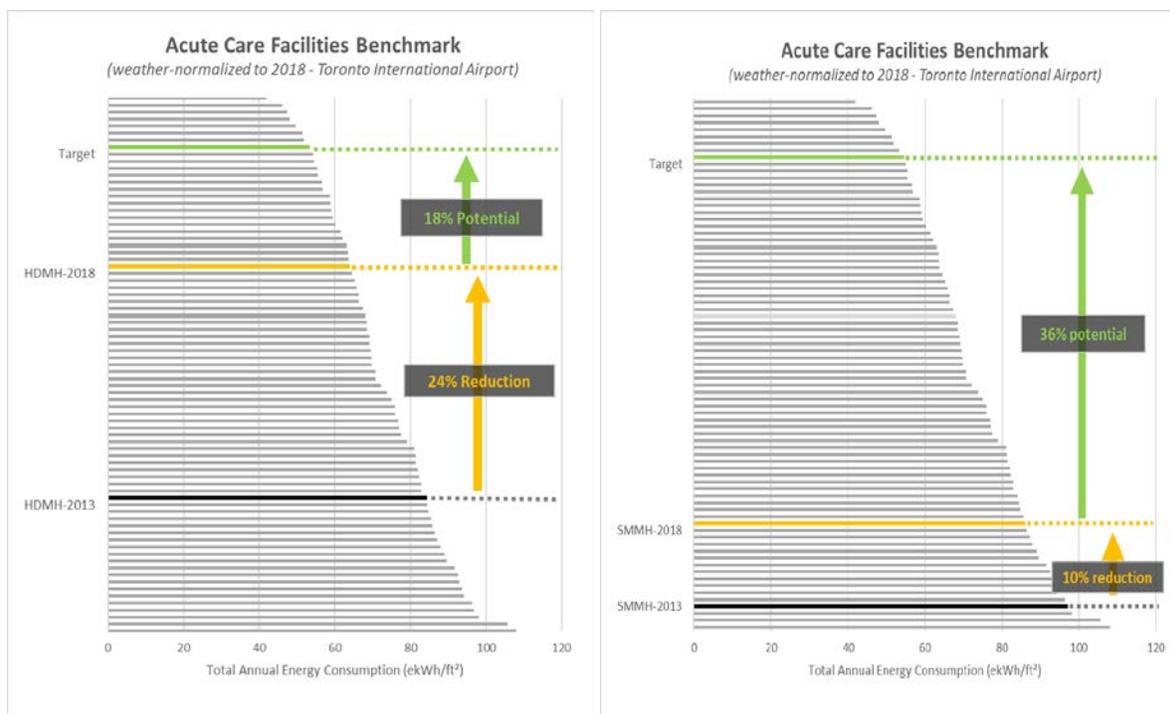
	South Muskoka	2018 actual savings	Huntsville	2018 actual savings
	%	Units	%	units
Electricity Reduction (kWh)	527,368	13%	325,290	11%
Natural Gas Reduction (m ³)	70,566	8%	222,370	29%
Water Reduction (m ³)	8,724	28%	1,595	7%
Total Energy Reduction (ekWh)	1,257,727	10%	2,626,816	24%
Total Cost Reduction (\$)	\$85,004	10%	\$82,489	13%
GHG Reduction (tonnes CO ₂ e)	117	6%	284	17%

Building on this achievement, lessons learned over the past 5 years can help us do even better in future and have been incorporated into the Plan. There is strong organizational support for energy efficiency and sustainability. As well, we have a powerful building automation technology platform at the hospitals and knowledgeable and engaged facility operations teams.

Our goal for MAHC over the next five years (2019 to 2023) is to reduce energy cost by up to 21.5% measured against the new 2018 baselines. The planned improvements will move us towards the top

quartile of the Greening Health Care¹ benchmark chart of acute care hospitals (adjusted for reheat minimization) as shown in Figure 1.

Figure 1 MAHC sites energy benchmark for 2013, 2018, and 2023 target



Energy and water efficiency improvements included in the scope of the Plan are summarized in Part 3, Section 3. Manageable work packages will be prioritized and scheduled over the first few years over the 5-year period based on capital availability. The targeted measures, when implemented, are projected to bring in approximately \$207,000 of utility company incentives and yield electricity and natural gas savings worth over \$326,000 per year at current utility rates. The associated GHG emissions reduction would be 30% or 761 tonnes CO₂e per year.

Achieving any of the targeted savings highlighted under the Energy and water efficiency improvements (Tables 6/7) will be contingent upon development of the business case and securing funds to address each of the projects in a prioritized fashion. There will be a strong reliance on Health Infrastructure Renewal Fund (HIRF) to support these energy-based projects.

¹ Founded in 2004, Greening Health Care is the largest and longest serving program of its kind in North America, helping hospitals work together to lower their energy costs, raise their environmental performance and contribute to the health and well-being of their communities.

Part 1: Introduction

1 About Muskoka Algonquin Healthcare

This ECDM plan addresses Huntsville District Memorial Hospital (HDMH) and South Muskoka Memorial Hospital (SMMH), which together form Muskoka Algonquin Healthcare (MAHC).

MAHC is committed to a sustainable future and has made significant efforts towards reducing the impact of its hospitals on the environment. Since the mid-2000s and more recently, MAHC has undertaken retrofit projects aimed at lowering energy use and improving facility operations. Significant strides have been made in improving energy efficiency in both sites. As well, hospital staff work diligently to operate and maintain building systems as efficiently as possible with the available resources.

In 2010, MAHC joined Greening Health Care, a program that helps hospitals work together to lower energy costs, raise their environmental performance and contribute to health and well-being of communities.

MAHC received a Silver Seal Award through the Ontario Hospital Association's Green Hospital Scorecard for our environmental performance in 2017, 2016 and in 2015. It also received a 2013 Bronze Seal Award through the Ontario Hospital Association's inaugural Green Hospital Scorecard for their performance in 2012. The Green Hospital Scorecard is a benchmarking and recognition program that evaluates environmental performance in five areas: energy, waste, water, pollution prevention, and corporate leadership, planning and management.

Table 2 MAHC sites

Site	Building Area (ft ²)
South Muskoka Memorial Hospital	127,800
Huntsville District Memorial Hospital	121,400

MAHC's commitment to sustainability is grounded in the culture and values of management and staff, with support and direction from the Board of Directors. Energy Efficiency goals, initiatives and performance are featured on the hospital's website, and Sustainable Future is one of the five pillars of its strategic plan which includes "Develop a Master Program and Master Plan that provides a future vision for the facilities, along with an understanding of the clinical services appropriate for the facilities." This statement provides the foundation for this Energy Conservation and Demand Management plan.

Part 2: Results from the past 5 years (2014-2018)

1 Energy and water progress compared to targets

In the previously approved ECDM plan posted July 1, 2014, MAHC set a goal to put into effect an integrated multi-year energy, management, financial and operational plan which will use all available resources to rationalize and renew the facilities and deliver significant long-term cost savings. The objectives for the duration of the 2014 plan were to implement smart improvements which will provide immediate savings, and to develop the longer-term vision and strategy for rationalizing and renewing the facilities.

1.1 Huntsville District Memorial Hospital

Table 3 lists the energy savings in the 2018 calendar year compared to the 2013 baseline, which resulted in net utility cost savings of \$90,037.

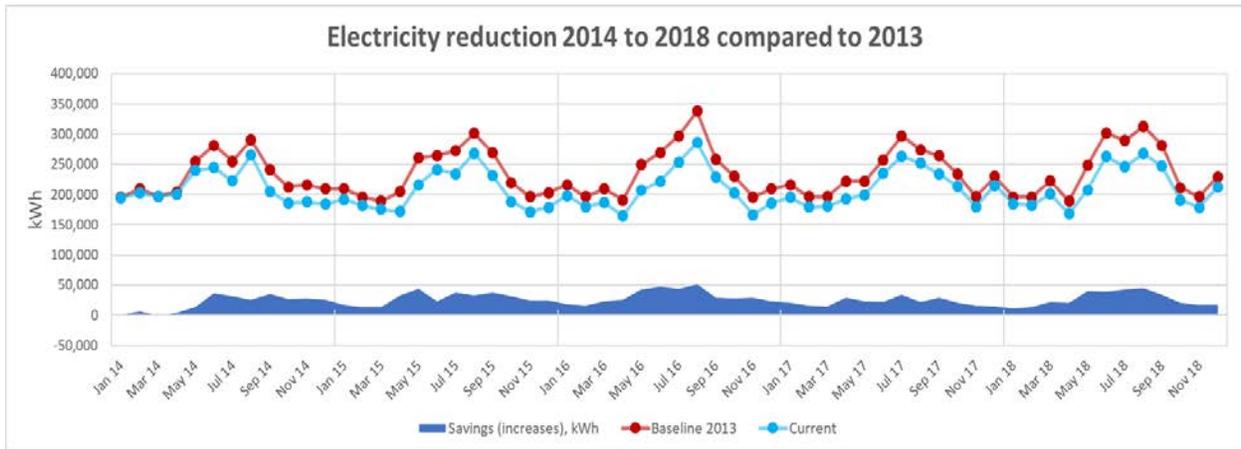
Table 3 HDMH: Energy and water savings in 2018 vs 2013 weather-normalized baseline

Energy Type	Savings in 2018 vs 2013	Units	%	Cost savings
Electricity Reduction	325,290	kWh	11%	\$45,541
Natural Gas Reduction	222,370	m ³	8%	\$36,949
Water Reduction	1,595	m ³	28%	\$7,547
Total Energy Reduction	2,626,816	ekWh	10%	\$90,037
GHG reduction	284	Tonnes CO ₂ e	17%	

Monthly savings graphs help identify the periods of recorded savings or increases. The blue dots represent monthly consumption from the actual bills, and the red dots represent the 2013 consumption weather normalized to the weather conditions during the period in the actual bill. Blue dots below red represent real savings.

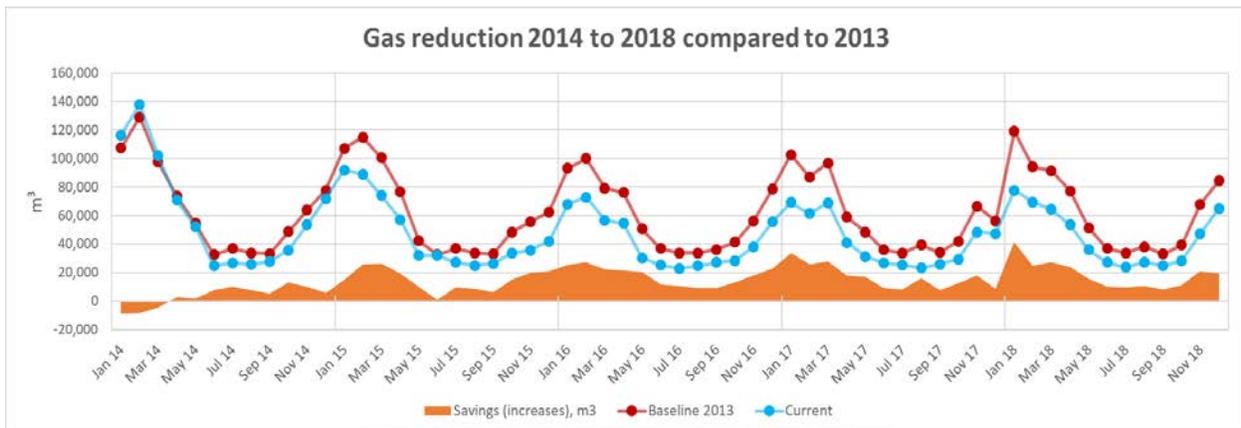
The electricity consumption trend over the last 5 years in Figure 2 demonstrates improvement in 2015 and 2016 resulting from measures arising from the 2014 ECDM Plan. In 2017 and 2018, there has been a slight reduction of the savings achieved in the 2 previous years. The 5-year cumulative improvement: 1,537,860 kWh - \$180,377.

Figure 2 HDMH: Electricity consumption in 2014-2018 vs 2013 weather-normalized baseline



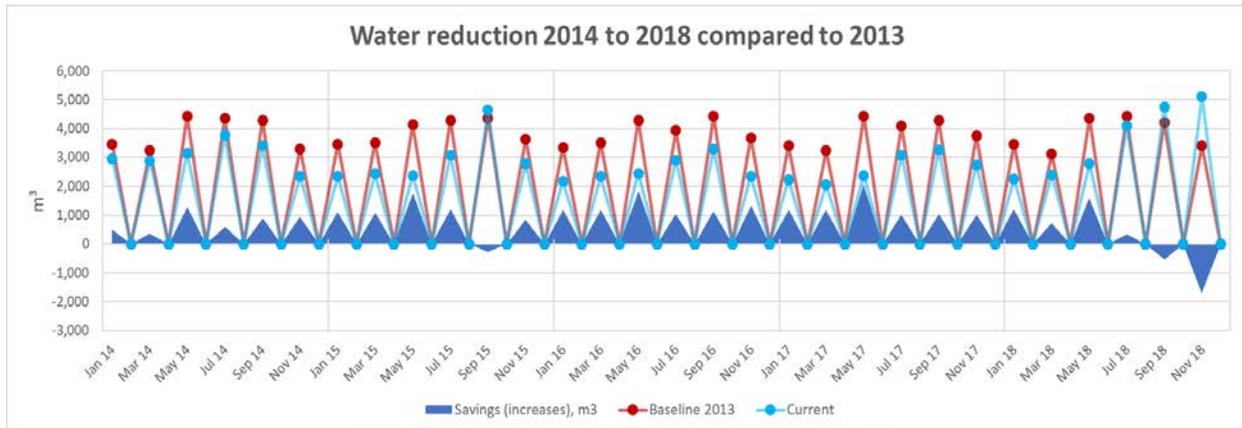
The natural gas trend in Figure 3 indicates improvements in both winter and summer months with a slight reduction in gas savings in the fall of 2017 and 2018 relative to 2016. The 5-year cumulative improvement was 859,094 m³ valued at \$164,742.

Figure 3 HDMH: Natural gas consumption in 2014-2018 vs 2013 weather-normalized baseline



The water use trend in Figure 4 shows reductions from 2015 to 2018 with the exception of September 2015 and most recently September 2018 and November 2018. The usage in November/December 2018 was almost double the usual monthly water usage. At the end of March and beginning of April 2019, a water device that had failed was identified and repaired and the water usage has now reduced to typical consumption. The 5-year cumulative improvement was 114,898 m³ valued at \$27,073.

Figure 4 HDMH: Water consumption in 2014-2018 vs 2013 weather-normalized baseline



1.2 South Muskoka Memorial Hospital

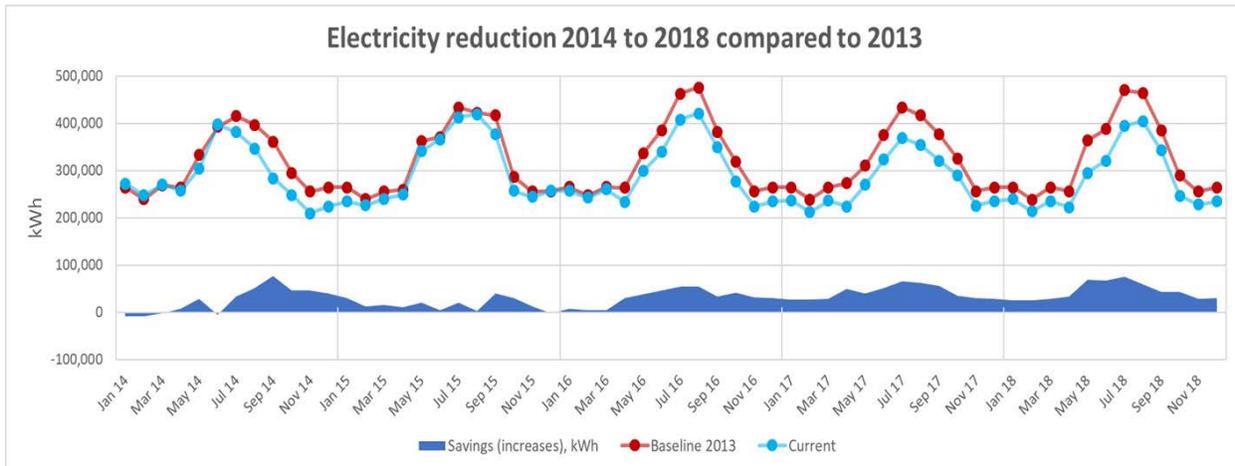
Table 4 lists South Muskoka energy savings in the 2018 calendar year compared to the 2013 baseline, which resulted in net utility cost savings of \$125,403.

Table 4 South Muskoka: Energy and water savings in 2018 vs 2013 weather-normalized baseline

Energy Type	Savings in 2018 vs 2013	Units	%	Cost savings
Electricity Reduction	527,368	kWh	13%	\$73,832
Natural Gas Reduction	70,566	m ³	8%	\$11,173
Water Reduction	8,724	m ³	28%	\$40,399
Total Energy Reduction	1,257,727	ekWh	10%	\$125,403
GHG reduction	117	Tonnes CO2e	6%	

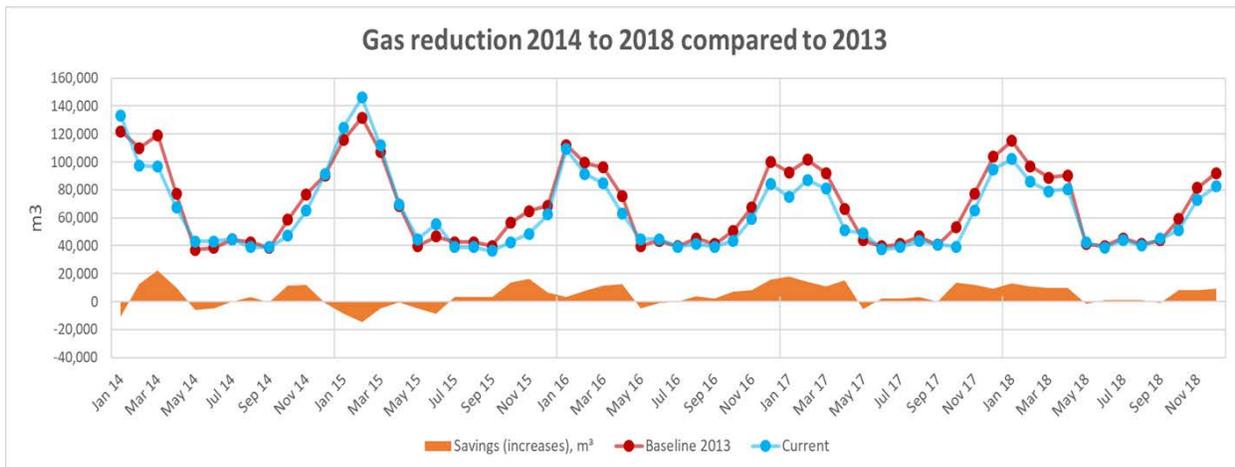
Electricity consumption showed significant savings since March 2016 as shown in Figure 5. The 5-year cumulative improvement was 1,911,303 kWh worth \$227,565.

Figure 5 South Muskoka: Electricity consumption in 2014- 2018 vs 2013 weather-normalized baseline



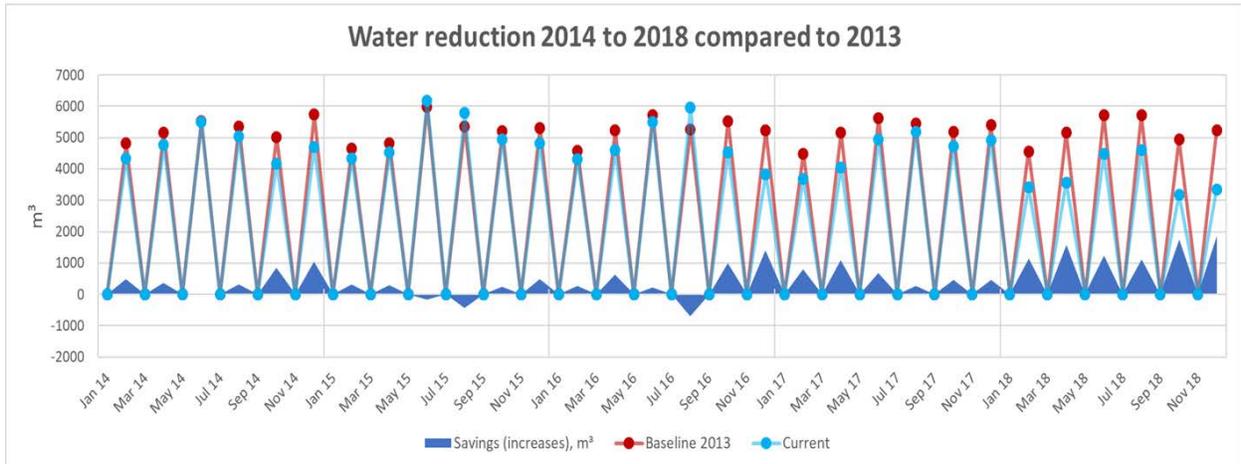
Gas consumption presented in Figure 6 shows an increase January and February of 2015 relative to the 2013 baseline but generally has shown gas savings in the winters that followed. The summers showed marginal savings but the most recent summer shows gas usage back to the 2013 baseline. The 5-year cumulative improvement was 284,103 m³ valued at \$48,672.

Figure 6 South Muskoka: Gas consumption in 2014-2018 vs 2013 weather-normalized baseline



Water use shown in Figure 7 was somewhat irregular between 2014 and 2016 but has stabilized and shows savings in each month in 2017, and material savings in 2018. The 5-year cumulative improvement was 86,232 m³ valued at \$19,191.

Figure 7 South Muskoka: Water consumption in 2014-2018 vs 2013 weather-normalized baseline



2 Measures implemented in 2014-2018

With support from the North Simcoe Muskoka Local Health Integration Network (LHIN), in 2010 MAHC began a joint energy initiative project with three other hospitals in North Simcoe Muskoka to assess their facilities from an energy savings perspective. Benchmarking revealed that by upgrading building systems, MAHC can achieve annual utility consumption savings in excess of 20% at both sites.

In February 2013, the Board of Directors approved an energy retrofit initiative that was intended to create a more comfortable environment for patients and staff and reduce MAHC carbon footprint by making their facilities more energy efficient. MAHC has since implemented many of the measures identified in the energy initiative. The measures implemented by hospital are listed below:

Huntsville

- Lighting Measures
 - Mainly replaced 1'x4', 2'x4', 2lamp, 3lamp and 4lamp T8 & T12 lamp luminaires, with new 1'x4' 1lamp T8 lamp luminaires or with 1'x4' 2lamp T8 luminaires.
 - Replaced incandescent downlights with CFL and LED equivalents.
 - Replaced toggle switches with occupancy sensors.
 - A staff education campaign was conducted reminding staff to power down lights and equipment when not in use.
- New BAS with efficient sequences of operation.
- Ventilation improvement through extensive system testing, removing and correcting restrictions, and adjusting fan speeds and air balancing accordingly.

South Muskoka Memorial Hospital

- Lighting Measures
 - Replaced 1'x4', 2'x4', 2lamp, 3lamp and 4lamp T8 lamp luminaires, with new 1'x4' 1lamp T8 lamp luminaires.
 - Replaced incandescent and CFL downlights with LED equivalents.
 - Replaced toggle switches with occupancy sensors.
 - A staff education campaign was conducted reminding staff to power down lights and equipment when not in use.
- New BAS with efficient sequences of operation optimization.
- Ventilation improvement through extensive system testing, removing and correcting restrictions, and adjusting fan speeds and air balancing accordingly.

3 Project successes and lessons learned

There have been many successes over this period, along with lessons learned which will help us make further progress in future. Project successes are summarized as follows:

1. The implementation of a new properly commissioned Building Automation System (BAS) proved to be considerably helpful with energy performance, addressing occupant comfort issues, providing instant feedback, and provided excellent overall building control.
2. The existing BAS service provider provides ongoing support and troubleshooting expertise and guidance, beyond initial implementation, further encourages and engages operators to use the new BAS.
3. An increase in energy awareness in all staff, which encouraged staff to consider consumption and reduction in all operations of the hospital, including areas outside of the scope of the ECDM plan.

Some of the key lessons learned are as follows:

1. Any proposed ventilation system alterations need to be proved to comply with the latest CSA regulations regarding air flows and pressurization before implementing them.
2. Leverage new proven technologies that allow more flexibility with the mechanical and electrical systems.
3. Staff engagement on the details of the alterations is key.

Part 3: The plan for the next 5 years (2019-2023)

MAHC has the potential to be among the most energy efficient acute care hospitals in Canada and is working towards top-quartile positioning in the Greening Health Care energy efficiency benchmark charts. The targeted energy use reduction is 18% and 36%, for HDMH and SMMH respectively, by 2023 compared with the 2018 baseline. The projects and management/organizational measures described below are together designed to achieve this goal along with utility cost savings worth approximately \$326,000/year at 2018 rates and GHG emissions reduction of 761 tonnes CO₂e/year.

1 2018 energy and water use

Table 5 below presents the 2018 baseline energy and water use, costs, and emissions for HDMH and South Muskoka.

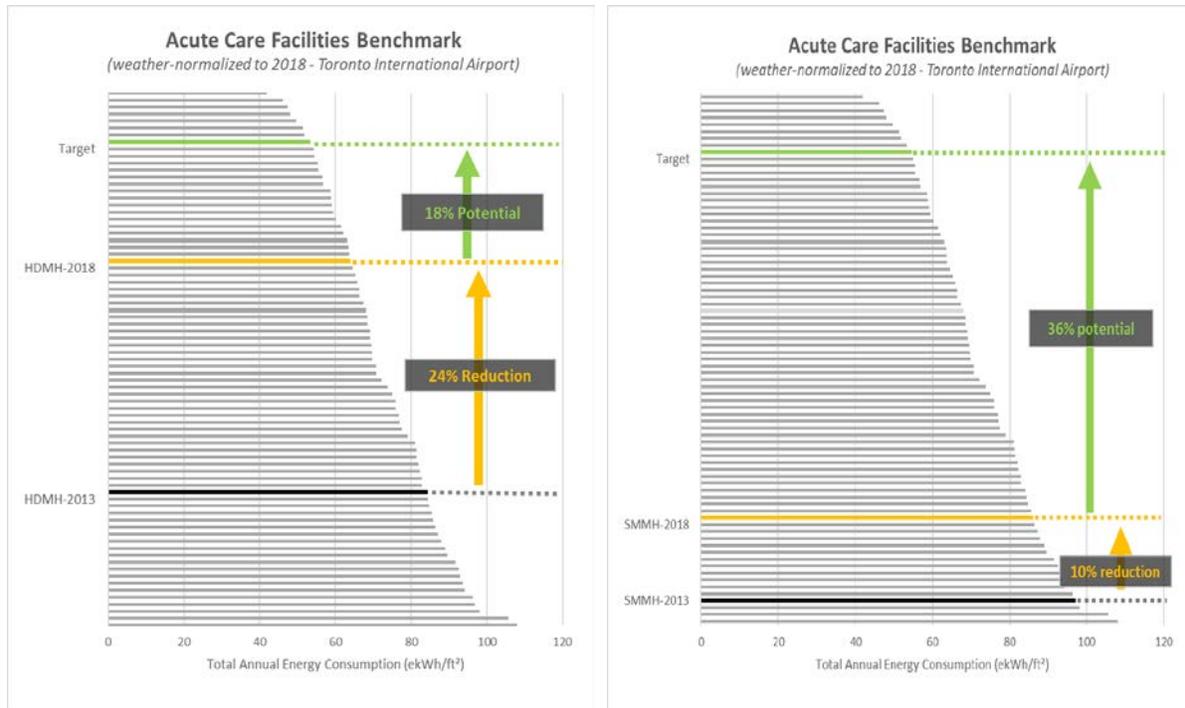
Table 5 MAHC energy and water use and expenditure

Site	Energy Type	2018 Use	Units	2018 Costs (\$)	Greenhouse Gas Emissions (tonnes CO ₂ e)
Huntsville					
	Electricity	2,647,601	kWh	\$397,140	106
	Natural Gas	487,341	m ³	\$160,823	933
	Water	22,129	m ³	\$99,580	1
South Muskoka					
	Electricity	3,489,781	kWh	\$523,467	140
	Natural Gas	712,306	m ³	\$235,061	1364
	Water	23,157	m ³	\$104,206	1
Total					
	Electricity	6,137,383	kWh	\$920,607	245
	Natural Gas	1,199,648	m ³	\$395,884	2297
	Water	45,286	m ³	\$203,785	2

2 Benchmark positioning and targets

Greening Health Care sets good practice energy and water targets for its 65 member hospitals based on the average of top-quartile performance of comparable buildings in the Greening Health Care database and adjusted for weather and material site specific variables. Figure 8 shows the positioning of the two MAHC sites in 2013, 2018 and at the 2023 performance level which is the goal for the Plan.

Figure 8 MAHC sites energy benchmark for 2013, 2018, and 2023 target



3 Energy and water efficiency improvements for consideration pending future approval and funding

Table 6 and Table 7 summarize the proposed energy and water efficiency measures for each site together with their estimated costs, savings, and payback. The measures are described in more detail in the following section.

Table 6 Energy and water efficiency projects summary - SMMH

Measure	Description	Payback (Years)	Project Cost (\$)	Total Savings (\$/year)	Total Incentives (\$)	GHG Emissions Reduction (tonnes CO2e)
Ventilation scheduling, rebalancing and upgrades	Test and re-balance ventilation systems, install VFDs, correct high static pressure components, scheduling (including zone separation and block damper installation)	3.7	\$202,702	\$46,915	\$27,693	101
Ventilation systems BAS optimization	Optimize sequence and setpoints on the BAS	3.7	\$22,522	\$5,213	\$3,077	11
Lighting retrofit and controls	Interior lights - LED retrofit	3.4	\$137,574	\$34,210	\$22,806	9
Heating system optimization	Optimize Steam plant. Optimize heating plant sequence of operation and install VFDs on pumps, test system flow and optimize pump operation.	1.3	\$121,387	\$63,388	\$39,557	264
Cooling system optimization	Install VFDs on pumps, test system flow and optimize pump operation.	1.4	\$117,533	\$58,201	\$37,237	158
TOTAL			\$601,718	\$207,926	\$130,370	544

Projects for Future Consideration

Lighting retrofit and controls	Exterior lights - Wall and Pole mounting lighting retrofit	12.0	\$48,180	\$3,792	\$2,528	1
Water conservation	Retrofit faucets and toilets	8.0	\$155,500	\$19,384	\$862	0.1

Table 7 Energy and water efficiency projects summary – HDMH

Measure	Description	Payback (Years)	Project Cost (\$)	Total Savings (\$/year)	Total Incentives (\$)	GHG Emissions Reduction (tonnes CO2e)
Ventilation scheduling, rebalancing and upgrades	Test and re-balance ventilation systems, install VFDs, correct high static pressure components, scheduling (including zone separation and block damper installation)	5.6	\$169,370	\$27,207	\$17,181	55
Ventilation systems BAS optimization	Optimize sequence and setpoints on the BAS	5.6	\$18,819	\$3,023	\$1,909	6
Lighting retrofit and controls	Interior lights	4.7	\$123,506	\$23,017	\$15,345	6
Lighting retrofit and controls	Exterior lights retrofit to LED	5.1	\$21,438	\$3,734	\$2,489	1
Heating system optimization	Optimize Steam plant. Optimize heating plant sequence of operation and install VFDs on pumps, test system flow and optimize pump operation.	3.7	\$101,778	\$23,670	\$14,695	105
Cooling system optimization	Optimize sequence of operation. Install VFDs on pumps, test system flow and optimize pump operation.	3.6	\$60,796	\$14,407	\$9,245	37
TOTAL			\$495,707	\$95,059	\$60,864	210

Projects for Future Consideration

Water conservation	Retrofit faucets and toilets. Test and clean main unit and terminal elements to reduce static pressure drop, and seal air leakages.	5.0	\$95,850	\$19,017	\$845	0
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3.1 Lighting System

- Opportunity to take advantage of the better reflector
- Choose LED lamps with wider view range

3.2 Ventilation system

- Extensive system testing.
- Review of humidifier system
- New CSA / ASHRAE total air flow and outside air calculations
 - *Adjust %OA and minimum damper position as well as supply air volume*
- Review air flow during unoccupied hours
 - *Install & Integrate VFDs to BAS*

3.3 HVAC Controls and Building Automation System

- Review sequence of operation
 - *OA air amounts*
 - *Heat & Cooling fighting*
 - *Min OA air damper position*
- Review air handling unit schedules
 - *Fan schedule*
 - *Ventilation schedule*
- Review department schedule
 - *Opportunities for zone dampers*

3.4 Heating Plant and System Upgrades and Study

- Add BAS to control the steam plant rather than just monitor the equipment.
- Review hot water boilers return water temperature setpoint
 - *Base setpoint on space feedback*

3.5 Cooling Plant and Systems

- Optimize chiller plant operation
 - *Consider Installing VFDs on chilled and condenser pumps*
- Cooling tower
 - *Consider Installing VFDs on cooling tower fans*
- Resetting chilled and condenser water temperature setpoints according to actual cooling loads, limiting chiller demand

3.6 Water Conservation

- For future consideration, review the logistics and economics of replacing toilets and installing moderators on sink faucets.

3.7 Building Operator Staff Training

- Training will be provided as required to ensure the building operators are knowledgeable with the new equipment and operational changes that result from the implementation of the measures.

3.8 Ongoing Monitoring, Reporting and Corrective Action

- Regular ongoing review of savings results and flagging by email of anomalies for corrective action.
- Formal quarterly review of results by webinar to follow up on corrective actions.
- Documentation and follow-up by phone and email of actions and next steps.

Management sign-off

I confirm that Muskoka Algonquin Healthcare's senior management has reviewed and approved this 2019-2023 Energy and Conservation and Demand Management Plan.

Signature: _____

Name: _____

Date: _____

Title: _____