



June 2024

Halton Healthcare Services
2024-2029 Energy Conservation and
Demand Management Plan

Management sign-off

On behalf of Halton Healthcare's Senior Management team, I confirm the 2024-2029 Energy Conservation and Demand Management Plan has been reviewed and approved.

Signature: 

Name: Al Coady

Date: June 27th, 2024

Title: Senior Vice President, Redevelopment, Facilities and Retail Operations

Under Ontario Regulation 25/23, Ontario's broader public sector organizations are required to develop and publish an Energy Conservation and Demand Management (ECDM) Plan by July 1, 2024. Technical advice and analysis for this ECDM Plan were provided by [Enerlife Consulting Inc.](#)

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Part 1: Introduction

1. About Halton Healthcare Services

Halton Healthcare Services (Halton Healthcare) is an award-winning healthcare organization comprised of three community hospitals and community-based services serving Halton Hills, Milton and Oakville. Our hospitals - Georgetown Hospital, Milton District Hospital and Oakville Trafalgar Memorial Hospital - have a long-standing tradition of providing quality care to our communities.

We are committed to a sustainable future making considerable effort to reduce the environmental impact of our hospitals, while ensuring patient and staff comfort and delivering high quality healthcare services. We have undertaken projects aimed at lowering energy use and improving facility operations. Hospital staff work diligently to operate and maintain building systems as efficiently as possible with the available resources.

This Energy Conservation and Demand Management (ECDM) plan addresses Oakville Trafalgar Memorial Hospital, Georgetown Hospital, and Milton District Hospital which together form Halton Healthcare.

Table 1 Halton Healthcare sites

Site	Address	Building Area (ft ²)	Description
Oakville Trafalgar Memorial Hospital	3001 Hospital Gate Oakville, ON L6M 0L8	1,526,580	Acute care facility
Georgetown Hospital	1 Princes Anne Drive Georgetown, ON L7G 2B8	155,924	Acute care facility
Milton District Hospital - Central & South Block	725 Bronte Street South Milton, ON L9T 9K1	330,000	Acute care facility
Milton District Hospital – North Block		155,701	

2. Planning horizon and scope

The horizon for this plan is the 5-year period from 2024 to 2029, prioritizing projects and organizational improvements which are manageable within this period.

3. Leadership in sustainability

Halton Healthcare has been recognized for leadership in sustainability with multiple awards for our hospitals including BOMA Best Gold certification in 2022 and BOMA Toronto Earth Award in 2021 for Milton District Hospital. In 2021, we received the National Earth Award - Health Care Facility for Oakville Trafalgar Hospital. Halton also received Leadership in Energy and Environmental Design Gold for building design in 2018 and 2010 for the Milton Hospital expansion and Oakville Trafalgar Hospital, respectively.

In 2011, Halton 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. Milton Hospital received two 5% Greening Health Care Energy Savings awards in 2020 and 2019, recognizing the steady improvements in efficiency at the site.

Part 2: Results from the past 5 years (2019-2023)

1. Energy and water progress compared to targets

In the previous ECDM plan posted July 1, 2019, Halton Healthcare aimed to reduce energy consumption, energy demand, operating costs and greenhouse gas emissions. It outlined lighting retrofits, recommissioning and optimization projects, and a few capital retrofits.

Each of the four sites showed total energy savings over the past 5 years with further details of the utility consumption trends in the following sections.

1.1 Oakville Trafalgar Memorial Hospital (OTMH)

Table 2 presents both the original target savings put forward in the 2019 ECDM plan and actual, weather-normalized performance results from the 2023 calendar year as compared to the 2018 baseline, which resulted in net utility cost savings of \$462,918.

Table 2 OTMH: Energy and water savings vs 2018 baseline

	2019 Plan Target savings				Actual savings (2023 vs 2018 baseline) ¹			
	Units	%	\$	GHG (tonnes eCO ₂)	Units	%	\$	GHG (tonnes eCO ₂)
Electricity (kWh)	2,847,445	7.0%	-	117	441,894	1.1%	\$70,703	13
Natural gas (m ³)	4,407,272	60.6%	-	8,330	1,101,251	16.0%	\$363,413	2,110
Total Energy	48,462,710	41.7%	-	8,446	11,839,839	10.7%	\$434,116	2,123
Water (m ³)	-	-	-	-	6,698	2.9%	\$28,802	1
Total							\$462,918	2,124

Monthly savings graphs help identify the periods of recorded savings or increases. On the graphs in Figure 1 through Figure 10, the blue points are actual monthly energy use, and the red points are the comparative, weather-normalized 2018 baselines. Blue dots below red represent real savings.

The electricity consumption trend over the last 5 years in Figure 1 demonstrates savings in 2019, 2020 and 2023, while 2021 and 2022 show minimal increases. The 5-year cumulative savings were 3,549,487 kWh valued at \$567,918.

¹ Using 2024 utility rates: Electricity \$0.16/kWh, gas \$0.33/m³, water \$4.30/m³.

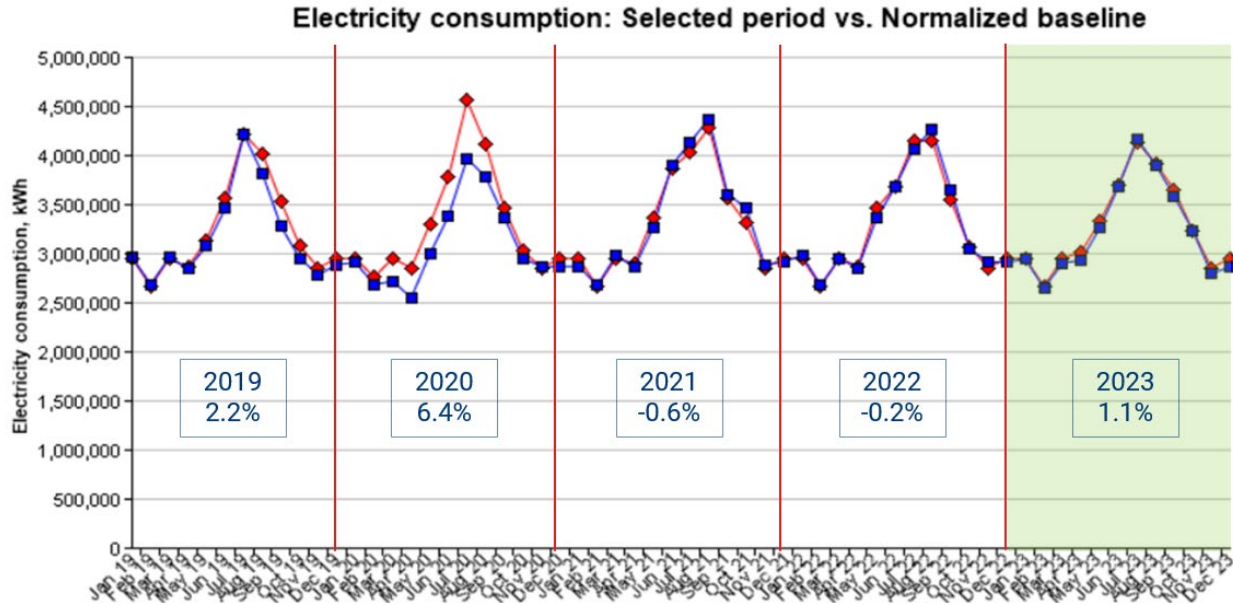


Figure 1 OTMH: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

The gas use trend in Figure 2 indicates savings through each of the five previous years. The 5-year cumulative savings were 2,551,667 m³ valued at \$842,050.

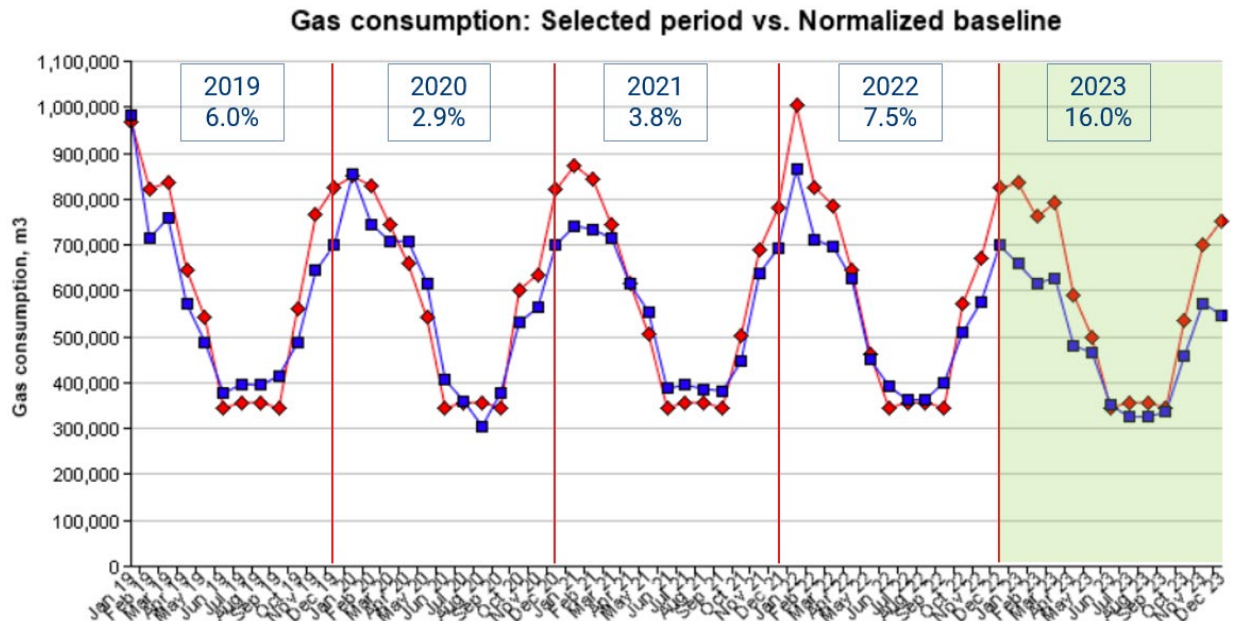


Figure 2 OTMH: Natural gas consumption (m³) in 2019-2023 vs 2018 baseline

The water use trend in Figure 3 shows increases in all five years. The 5-year cumulative increase was 18,536 m³ valued at \$79,705. Note that water consumption data variations are likely due to estimated and adjusted meter readings.

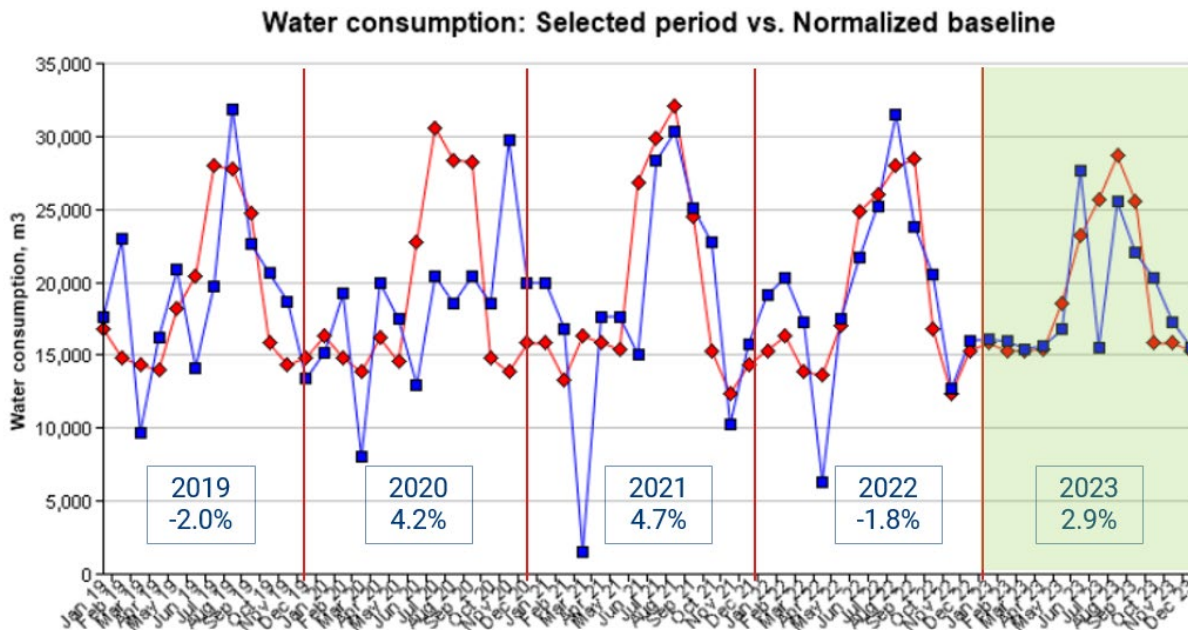


Figure 3 OTMH: Water consumption (m³) in 2019-2023 vs 2018 baseline

1.2 Georgetown Hospital

Table 3 presents the energy savings targeted in the 2019 ECDM report and Georgetown Hospital energy savings in the 2023 calendar year compared to the 2018 baseline, which resulted in net utility cost savings of \$18,085.

Table 3 Georgetown Hospital: Energy and water savings vs 2018 baseline

	2019 Plan Target savings				Actual savings (2023 vs 2018 baseline) ²			
	Units	%	\$	GHG (tonnes eCO ₂)	Units	%	\$	GHG (tonnes eCO ₂)
Electricity (kWh)	647,067	15.4%	-	27	52,800	1.3%	\$8,448	2
Natural Gas (m ³)	91,307	14.2%	-	173	29,202	4.9%	\$9,637	56
Total Energy (ekWh)	-	14.6%	-	199	-	3.5%	\$18,085	58
Water (m ³)	-	-	-	-	-	-	-	-
Total			-	199			\$18,085	58

² Using 2024 utility rates: Electricity \$0.16/kWh, gas \$0.33/m³, water \$4.30/m³.

As shown in Figure 4 electricity consumption between 2019 to 2023 showed savings in 2019, 2020 and 2023, while minor increases in consumption in 2021 and 2022 offset some of those savings. The 5-year cumulative savings were 384,205 kWh worth \$61,473.

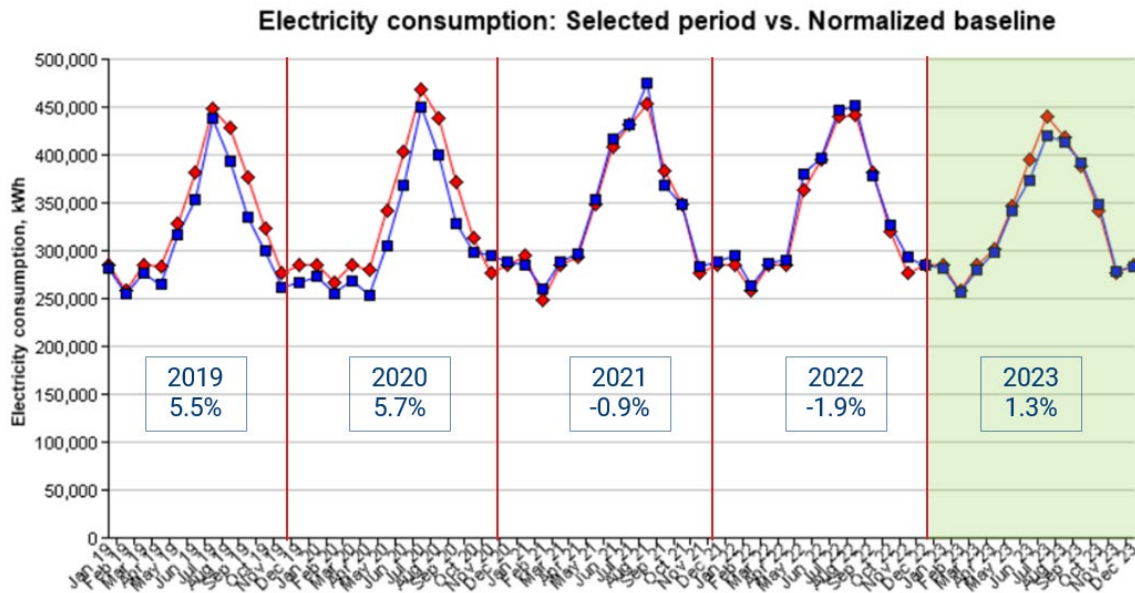


Figure 4 Georgetown Hospital: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

Figure 5 presents natural gas consumption and shows significant savings throughout the 5-year period. The 5-year cumulative savings were 121,811 m³ valued at \$40,198.

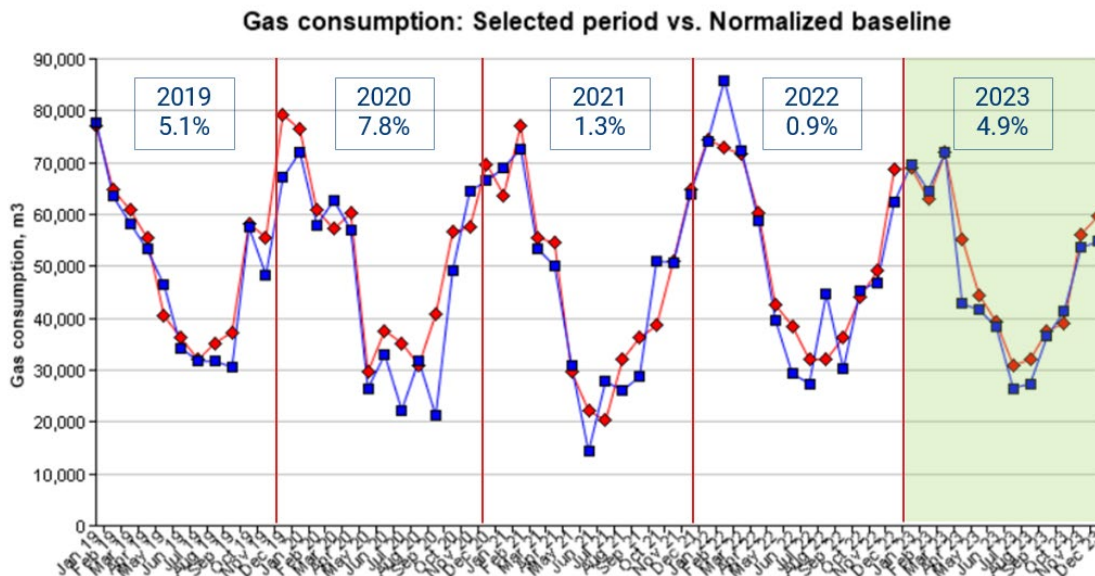


Figure 5 Georgetown Hospital: Natural gas consumption (m³) in 2019-2023 vs 2018 baseline

1.3 Milton District Hospital – Central and South Block

Table 4 presents the energy targets from the 2019 ECDM plan and lists Milton District Hospital – Central and South Block’s (MDH Central and South Block) energy savings in the 2023 calendar year compared to the 2018 baseline, which resulted in net utility cost savings of \$199,537.

Table 4 MDH Central and South Block: Energy and water savings vs 2018 baseline

	2019 Plan Target savings				Actual savings (2023 vs 2018 baseline) ³			
	Units	%	\$	GHG (tonnes eCO ₂)	Units	%	\$	GHG (tonnes eCO ₂)
Electricity (kWh)	665,257	5.4%	-	27	-119,985	-1.3%	-\$19,198	-4
Natural Gas (m ³)	371,339	18.7%	-	702	535,834	44.3%	\$176,825	1,027
Total Energy (ekWh)	4,508,616	13.7%	-	729	5,425,896	25.2%	\$157,628	1,023
Water (m ³)	-	-	-	-	9,746	12.9%	\$41,909	1
Total							\$199,537	1,024

In Figure 6 the electricity consumption increases in 2019, 2021 and 2022 were not fully offset by the savings in 2020 and 2023, but positive savings in 2023 shows improved operations. The 5-year cumulative increase was 530,751 kWh worth \$175,148.

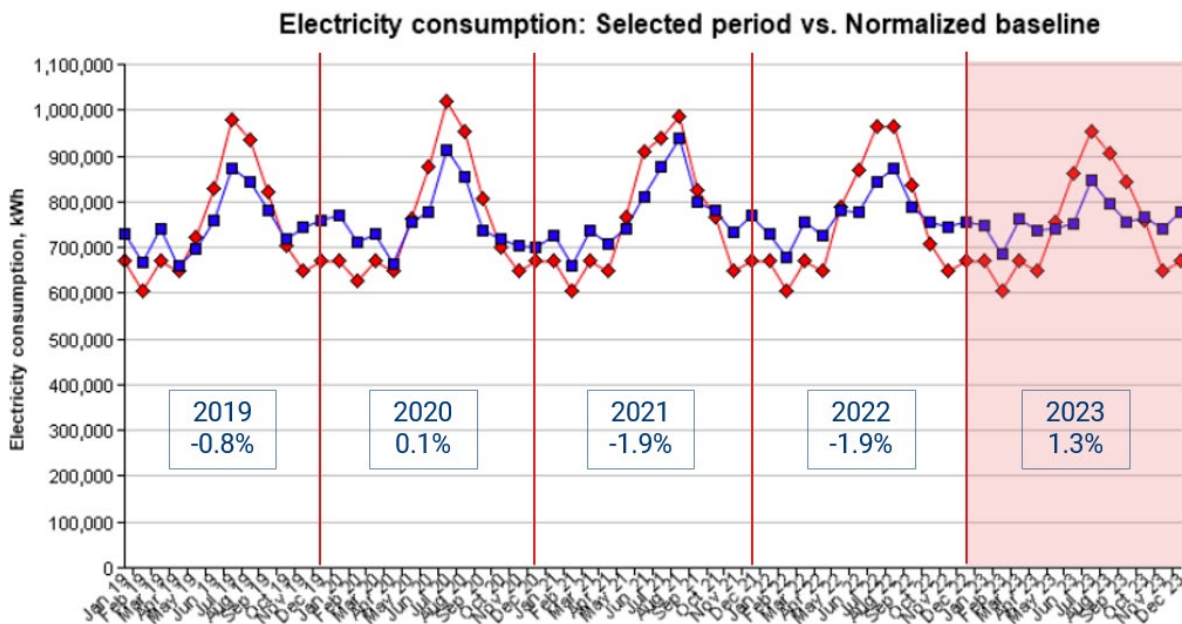


Figure 6 MDH Central and South Block: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

³ Using 2024 utility rates: Electricity \$0.16/kWh, gas \$0.33/m³, water \$4.30/m³.

Natural gas consumption presented in Figure 7 shows significant savings across all 5 years. The 5-year cumulative savings were 2,542,845 m³ valued at \$839,139.

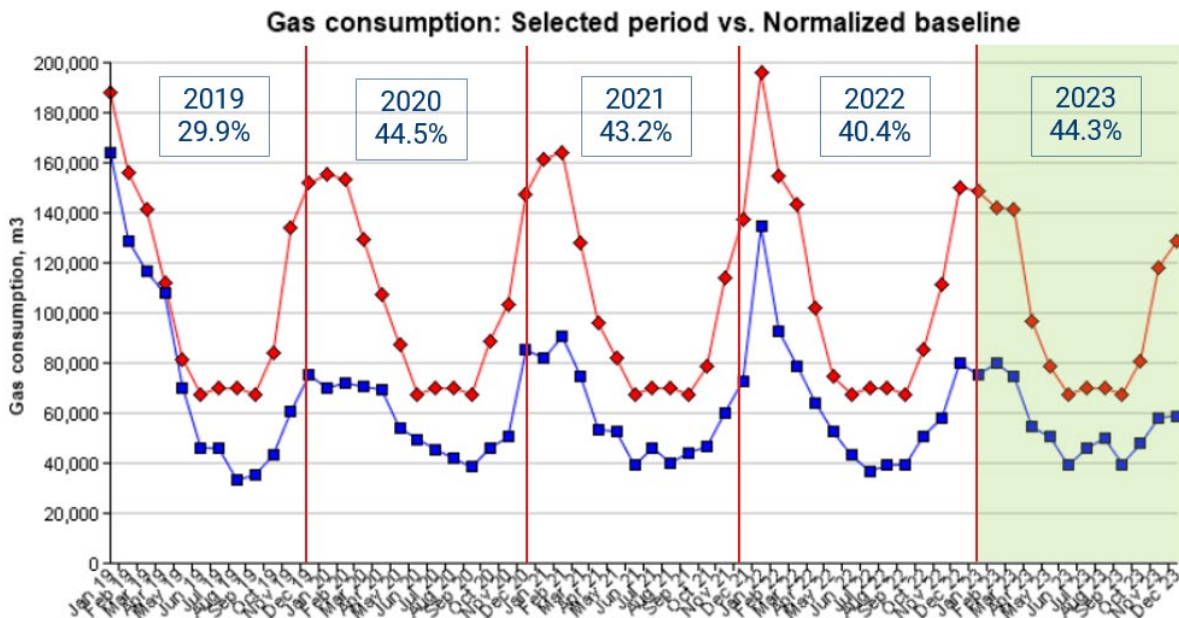


Figure 7 MDH Central and South Block: Natural gas consumption (m³) in 2019-2023 vs 2018 baseline

Water consumption presented in Figure 8 shows increases between 2019 to 2021. However, the annual consumption in 2022 was aligned with the baseline followed by significant savings in 2023. The 5-year cumulative savings were 17,267 m³ valued at \$74,248.

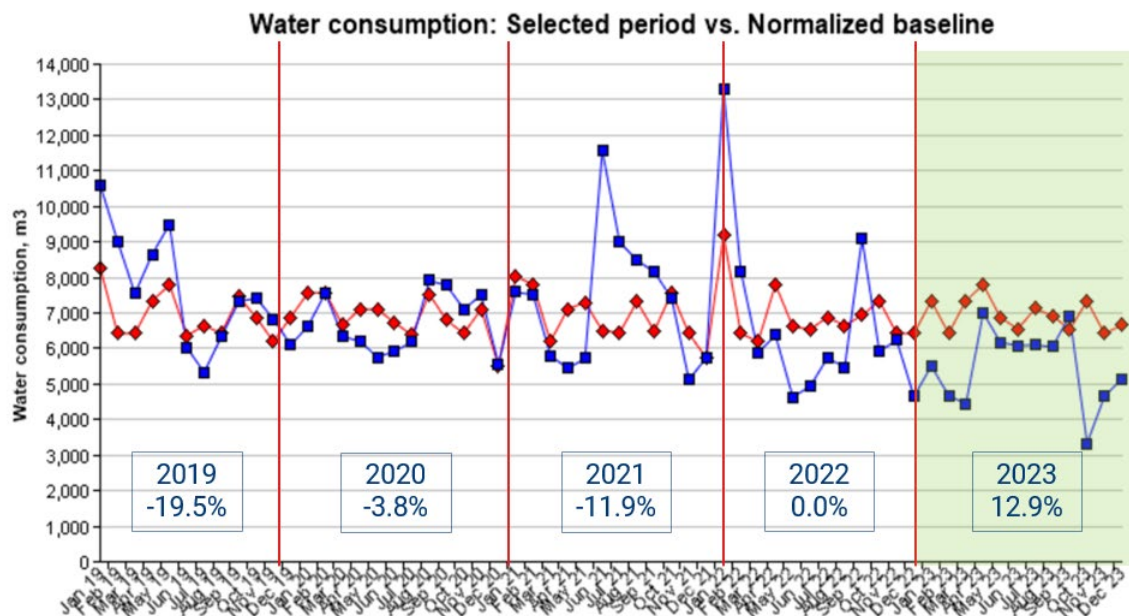


Figure 8 MDH Central and South Block: Water consumption (m³) in 2019-2023 vs 2018 baseline

1.4 Milton District Hospital – North Block

Table 5 presents the energy targets from the 2019 ECDM plan and lists Milton District Hospital – North Block’s (MDH North Block) energy savings in the 2023 calendar year compared to the 2018 baseline, which resulted in net utility cost savings of \$118,325.

Table 5 MDH North Block: Energy and water savings vs 2018 baseline

	2019 Plan Target savings				Actual savings (2023 vs 2018 baseline) ⁴			
	Units	%	\$	GHG (tonnes eCO ₂)	Units	%	\$	GHG (tonnes eCO ₂)
Electricity (kWh)	1,016,444	8.2%	-	42	293,912	9.2%	\$47,026	9
Natural Gas (m ³)	179,992	9.1%	-	340	216,056	39.5%	\$71,299	414
Total Energy (ekWh)	2,879,361	8.7%	-	382	2,530,094	28.6%	\$118,325	423
Water (m ³)	-	-	-	-	-	-	-	-
Total							\$118,325	423

Electricity consumption shown in Figure 9 displays consumption savings in each of the 5 years. The 5-year cumulative savings were 1,325,120 kWh worth \$212,019.

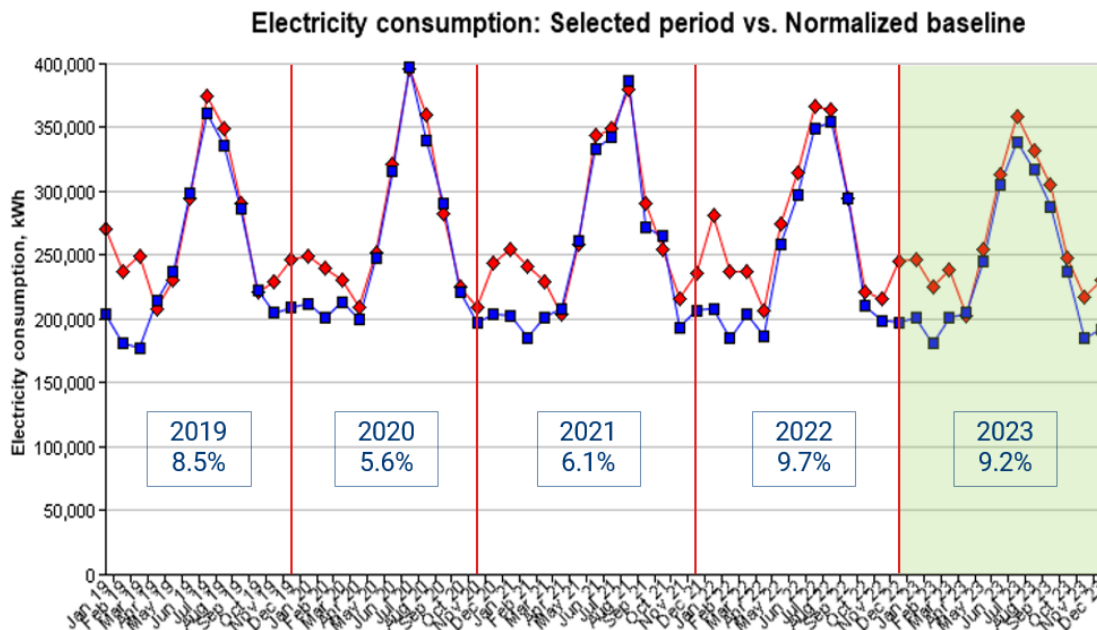


Figure 9 MDH North Block: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

⁴ Using 2024 utility rates: Electricity \$0.16/kWh, gas \$0.33/m³, water \$4.30/m³.

Natural gas consumption presented in Figure 10 shows a minor increase in 2019 followed by significant savings between 2020 and 2023. The 5-year cumulative savings were 454,649 m³ valued at \$150,034.

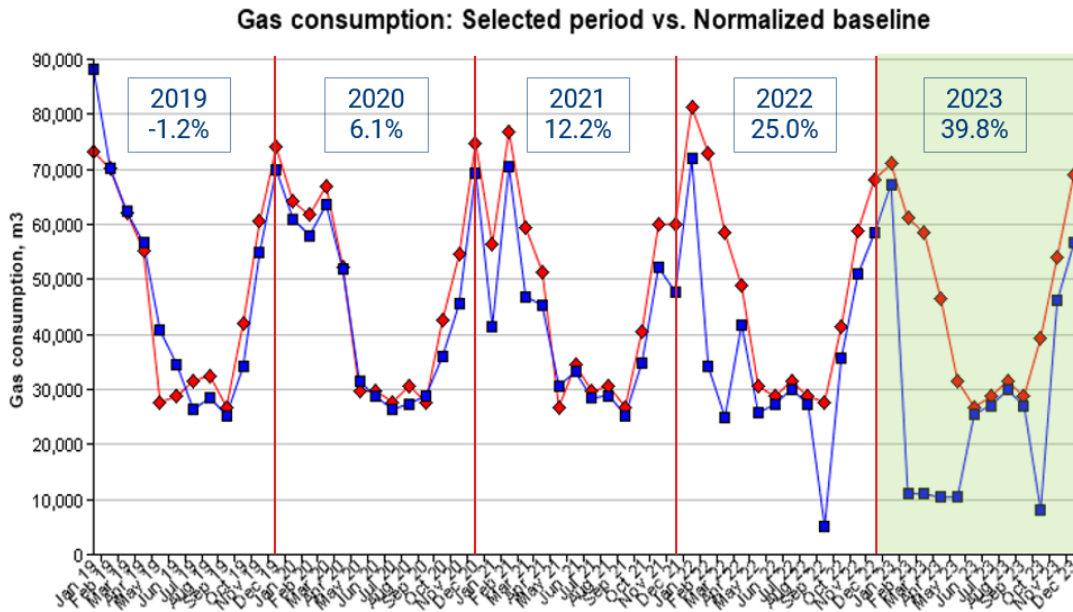


Figure 10 MDH North Block: Natural gas consumption (m³) in 2019-2023 vs 2018 baseline

2. Measures implemented in 2019-2023

A number of measures were proposed for the sites in the 2019 ECDM plan, as follows:

Oakville Trafalgar Memorial Hospital:

- Operating room fresh air reduction (100% to 30%)
- Heat recovery from blowdown and deaerator bleed to atmosphere incorporating a boiler blowdown study and a condensate return/water makeup study
- Hot glycol/hot water heating systems (snow melt system)
- Reduce hot water boiler temperature from 90°C to 81°C and operate with $\Delta T = 10^\circ\text{C}$
- Combustion efficiency testing & tuning
- Produce hot water from Heat Exchangers in Summer
- Flushing of reheat coils at VAV boxes
- Sequence hot water boilers and exchangers to maximize efficiency, improve Honeywell Building Automation System logic
- Isolate steam injection at AHUs in Summer, i.e., prevent summer humidification
- Heat recovery chiller optimization
- Tenant hood exhaust makeup
- Install chiller to serve cooling loads in MRI and CT Operations
- Demand response programming for Building Automation System (savings are on rates charged)
- Hospital education engagement
- Submetering maintenance
- Camfil Dura filter retrofit central & west air handling units
- Cloud based control system for air handling units (shift energy)
- Improved occupancy sensor in meeting rooms and offices
- Hot water & glycol unit heaters
- Solar PV (611 kW)

Georgetown Hospital:

- Air handling unit scheduling
- Heating, ventilation & air conditioning system recommissioning
- Energy awareness
- LED lighting retrofit

Milton District Hospital – Central & South Block:

- Whole building - energy awareness
- Install solar PV system (253 kW)
- Air handling unit scheduling work
- Operating room air handling unit scheduling
- Air handling unit steam jackets control and humidification control
- Hydronic pump optimization
- Enhanced heat recovery chiller usage
- Continuous commissioning of set-points

Milton District Hospital – North Block:

- Air handling unit scheduling
- Heating, ventilation & air conditioning recommissioning
- Enthalpy wheel control
- Direct digital controls upgrade
- LED lighting retrofit

The planned energy efficiency improvements that were implemented from 2019 to 2023, are as follows:

Oakville Trafalgar Memorial Hospital:

- Heat recovery from blowdown and deaerator bleed to atmosphere
- Reduce hot water boiler temperature. This was reduced in the summer.
- Combustion efficiency testing & tuning
- Flushing of reheat coils at variable air volume boxes

- Sequence hot water boilers and exchangers
- Isolate steam injection at air handling units in summer
- Heat recovery chiller optimization
- Demand response programming for building automation system was implemented for lighting controls but might be some additional opportunity with fans.
- Submetering maintenance
- Camfil Dura filters changed to high efficiency vinyl filters to withstand high humidity

Milton District Hospital – Central & South Block:

- Air handling unit scheduling work: 75% of this work has been completed. There is still some opportunity for fine tuning.
- Fully implemented work includes:
 - Air handling unit steam jackets control and humidification control: This work has been fully implemented.
 - Hydronic pump optimization.
 - Enhanced heat recovery chiller usage.
 - Continuous commissioning of set-points

3. Project successes and lessons learned

Over the past five years, there have been successes, along with lessons learned, which will help make future progress and have informed the Plan.

Some of the lessons learned include:

- Overall, each of the hospital sites saved total energy with some saving more than expected and other less.
- COVID-19 affected prioritization of energy efficiency projects, impacting operations and implementation of projects.
- Engagement of staff and Project Co. will be crucial to ensure success.
- Scheduling and operational changes are a lower cost, low impact way to reduce energy and emissions.

Part 3: The plan for the next 5 years (2024-2029)

Halton Healthcare has the potential to significantly improve the energy efficiency of its hospitals and we are working towards top-quartile positioning in the Greening Health Care energy efficiency benchmark charts. The targeted energy use reduction is 11%, 18%, 16% and 30%, for Oakville Trafalgar, Georgetown Hospital, MDH Central and South Block and MDH North Block respectively, by 2029 compared with the 2023 baseline. The projects and organizational measures described below are designed to achieve this goal along with utility cost savings worth approximately \$1,173,406/year at 2024 rates and GHG emissions reduction of 2,633 tonnes eCO₂/year.

1. 2023 energy and water use

Table 6 below presents the 2023 baseline energy and water use, costs, and emissions for all four of Halton Healthcare's facilities.

Table 6 Halton Healthcare's 2023 energy and water use

Site	Energy Type	2023 Use	2023 Costs (\$)	Greenhouse Gas Emissions (tonnes eCO ₂)
Oakville Trafalgar Memorial Hospital	Electricity	38,773,915 kWh	\$5,816,087	2,536
	Thermal	5,912,179 m ³	\$1,952,904	11,356
	Water	221,929 l/ft ²	\$998,682	3
Georgetown Hospital	Electricity	3,944,724 kWh	\$591,709	258
	Thermal	588,655 m ³	\$194,444	1,131
	Water	-	-	-
Milton District Hospital – Central and South Block	Electricity	9,144,300 kWh	\$1,371,645	598
	Thermal	680,386 m ³	\$224,527	1,307
	Water	43,279 l/ft ²	\$186,099	1
Milton District Hospital – North Block	Electricity	2,910,052 kWh	\$436,508	190
	Thermal	483,485 m ³	\$159,550	929
	Water	20,420 l/ft ²	\$87,806	0
Total	Electricity	54,772,990 kWh	\$8,215,949	3,582
	Thermal	7,664,705 m³	\$2,531,425	14,723
	Water	285,628 l/ft²	\$1,272,587	4

2. Energy and water intensity benchmarks and targets

Greening Health Care sets energy and water intensity targets for its 69 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. Top-quartile is considered good practice, requiring no special technology, just consistent application of good design and operational practices which are already in wide use. Figure 11 through Figure 14 shows the relative energy intensity of the four Halton Healthcare sites in 2018, 2023 and at the target 2029 performance level which is the goal for the Plan.

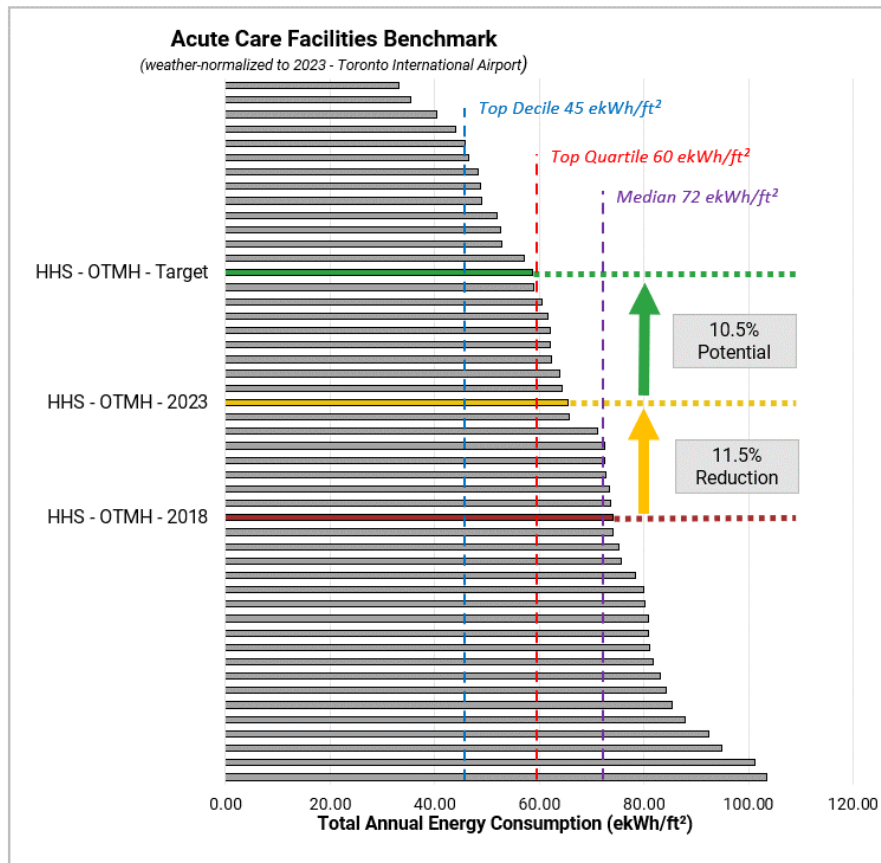


Figure 11 Annual energy intensity benchmarks for 2018, 2023, and 2029 target for OTMH

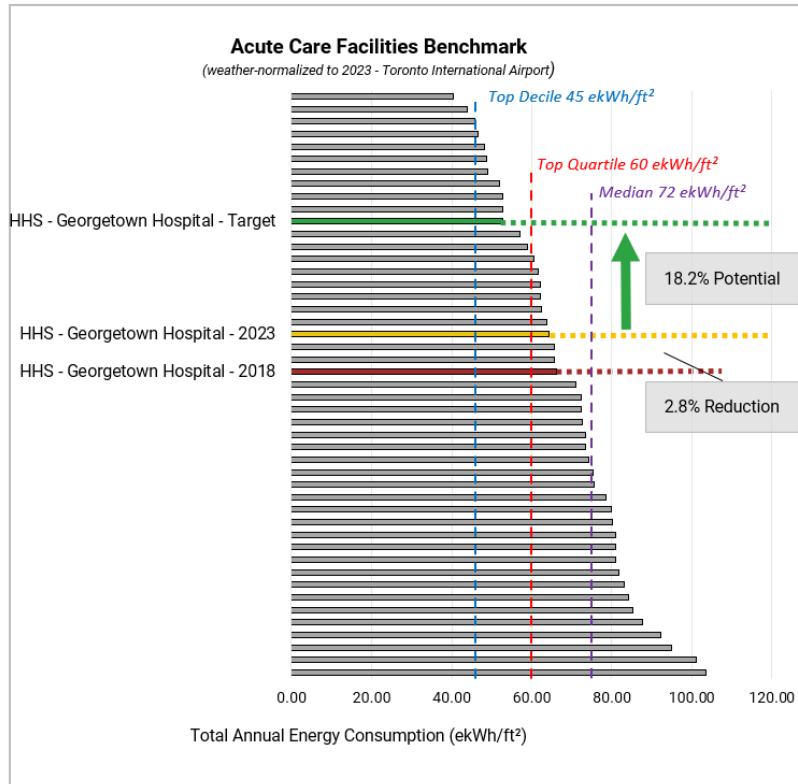


Figure 12 Annual energy intensity benchmarks for 2018, 2023, and 2029 target for Georgetown Hospital

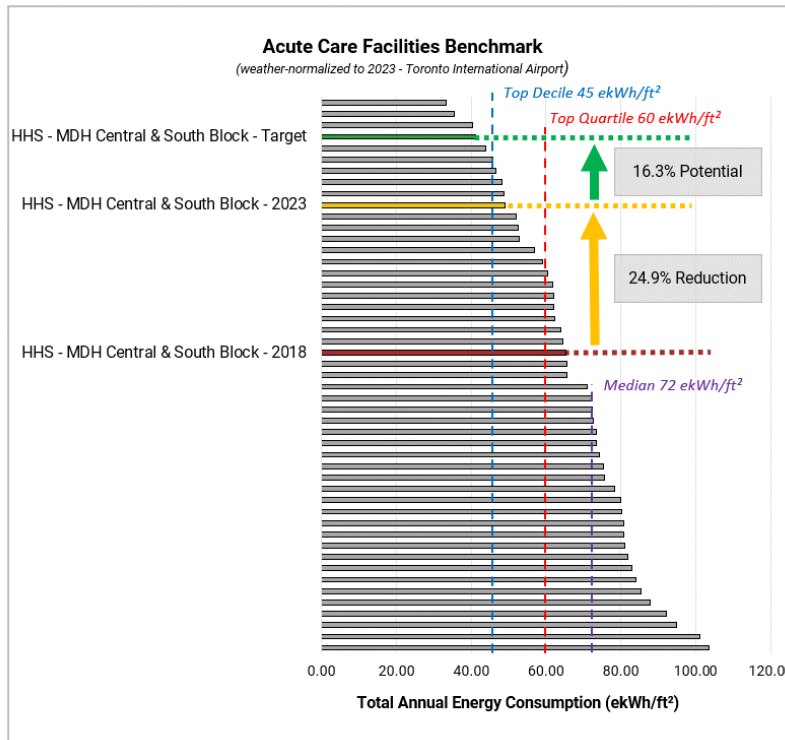


Figure 13 Annual energy intensity benchmarks for 2018, 2023, and 2029 target for MDH Central and South Block

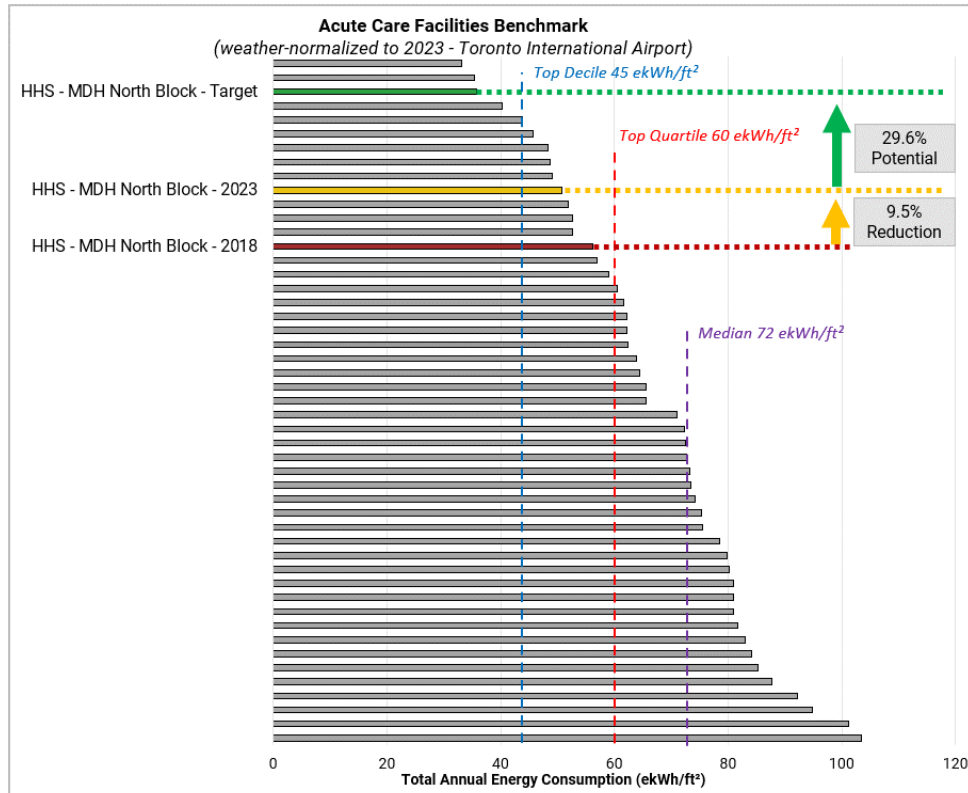


Figure 14 Annual energy intensity benchmarks for 2018, 2023, and 2029 target for MDH North Block

Table 7 below presents Halton Healthcare’s current and target energy intensities once the measures included in this Plan are implemented. The energy intensities are broken down by energy components, which indicates where the greatest savings are to be found and helps direct efforts to the building systems with the biggest opportunities. The energy components and associated potential opportunities for savings are as follows:

- Base electricity systems consist of fans, pumps, equipment, and lighting. The savings potential lies mostly in fans and pumps.
- Electric cooling is air conditioning plant and equipment, with significant further savings potential in how the equipment is controlled.
- Base thermal energy is primarily used for reheat in ventilation systems, along with domestic hot water and kitchens and heating distribution losses. Isolating the radiation loop and other optimization measures will help reduce base thermal energy use.
- Heating thermal systems are space and ventilation heating and humidification, with further targeted savings potential through improved control of ventilation and scheduling optimization.

Table 7 Energy and water targets for Halton Healthcare’s sites

Site	Energy Component	Energy Usage Intensity (ekWh/ft ²)		Annual Savings Potential	
		Actual	Target	%	\$
Oakville Trafalgar Memorial Hospital	Base Electricity	22.6	21.5	4.6%	\$255,624
	Electric Cooling	2.8	2.6	6.2%	\$42,351
	Base Thermal	27.2	21.6	20.4%	\$269,201
	Heating Thermal	13.0	12.8	1.1%	\$7,038
	Total Energy	65.5	58.6	10.5%	-
	Water (liters/ft ²)	145.4	145.4	0%	\$0
	Total				\$574,214
Georgetown Hospital	Base Electricity	21.4	18.7	12.6%	\$67,079
	Electric Cooling	3.9	2.3	42.2%	\$40,946
	Base Thermal	25.2	19.0	24.5%	\$30,581
	Heating Thermal	14.0	12.7	8.8%	\$6,087
	Total Energy	64.4	52.7	18.2%	-
	Water (liters/ft ²)	-	-	-	-
	Total				\$144,693
Milton District Hospital – Central and South Block	Base Electricity	26.7	22.0	17.8%	\$251,082
	Electric Cooling	1.0	1.0	0.0%	\$0
	Base Thermal	15.3	12.2	20.3%	\$32,628
	Heating Thermal	6.1	6.0	2.0%	\$1,282
	Total Energy	49.1	41.1	16.3%	-
	Water (liters/ft ²)	131.1	131.1	0%	\$0
	Total				\$284,992
Milton District Hospital – North Block	Base Electricity	15.1	12.2	19.5%	\$73,130
	Electric Cooling	3.6	1.8	50.6%	\$45,406
	Base Thermal	22.0	13.8	37.3%	\$40,668
	Heating Thermal	10.2	8.1	20.4%	\$10,303
	Total Energy	50.9	35.8	29.6%	-
	Water (liters/ft ²)	131.1	131.1	0%	\$0
	Total				\$169,507

3. Energy efficiency measures

Table 8 through Table 11 summarize the proposed energy efficiency measures for each site together with their estimated costs, savings, and payback. No water efficiency measures are recommended at this time, as the sites have seen water savings and are meeting the water target. The energy efficiency measures are described in more detail in the following section. Measures outlined below will be subject to a detailed engineering study and payback review before they are approved for implementation.

Table 8 Energy efficiency projects summary – Oakville Trafalgar Memorial Hospital

Identified Energy Savings Measures	Rough Order of Magnitude Costs		Potential Energy Savings (per year)			Incentives	Preliminary Payback (with incentives)	GHG emissions reductions (tonnes eCO ₂ /year)
			Electricity	Gas	\$			
Ventilation								
Schedule air handling units	\$135,000	\$420,000	695,170 kWh	333,413 m ³	\$221,253	\$152,870	1.2	686
Testing, rebalancing, and Canadian Standards Association's air change rate validations	\$120,000							
Reheat control and optimization	\$165,000							
Heating plant								
Steam boilers summer operation & optimization	\$14,000	\$535,500	163,539 kWh	258,946 m ³	\$111,618	\$81,090	4.1	508
Steam pressure reset	\$19,000							
Convert reheat loops to tertiary loops & reset hot water supply temperature based on outside air temperature	\$360,000							
Heating pump optimization: differential pressure sensor	\$67,500							
Pump triple-duty valve testing & optimization	\$75,000							
Cooling plant								
Heat recovery chiller investigation & optimization	\$80,000	\$363,000	324,318 kWh	244,728 m ³	\$132,651	\$93,614	2.0	491
Cooling tower winterization in design & optimization	\$45,000							
Pump triple-duty valve testing & optimization	\$80,000							

Pump differential pressure sensor testing & optimization	\$88,000							
Cooling plant standard operating procedure review & optimization	\$70,000							
Lighting								
Retrofit to LED lighting	\$375,000							
Optimize lighting schedules, including light levels, during operation hours.	\$35,000	\$429,000	679,317 kWh	0 m ³	\$108,691	\$67,932	3.3	44
Investigate emergency fixture design & optimize fixtures lighting levels.	\$7,000							
Reduce occupancy sensors time period.	\$12,000							
Total								

Table 9 Energy efficiency projects summary – Georgetown Hospital

Identified Energy Savings Measures	Rough Order of Magnitude Costs		Potential Energy Savings (per year)			Incentives	Preliminary Payback (with incentives)	GHG emissions reductions (tonnes eCO ₂ /year)
			Electricity	Gas	\$			
Ventilation								
Install variable frequency drives and associated controls	\$144,000	\$407,000	405,092 kWh	45,267 m ³	\$79,753	\$51,826	4.5	113
Schedule air handling units	\$39,000							
Canadian Standards Association's air change rates validation	\$63,000							
Testing and re-balancing	\$42,000							
Outside air % control and optimization	\$56,000							
Optimize control sequence of operations	\$63,000							
Building Automation								
Trend log storage expansion	\$35,000		21,180 kWh	5,658 m ³	\$5,256	\$3,533	6.0	12
Heating Plant								
Steam plant optimization	\$28,000	\$150,000	41,924 kWh	60,192 m ³	\$26,571	\$19,241	4.9	118
Investigate perimeter and reheat heating operation in summer and shut off systems	\$28,000							
Testing and replacement of isolation valves	\$42,000							
Add variable frequency drive on steam boiler blower motor and feedwater pump	\$38,000							
Pumps operation optimization	\$14,000							
Cooling Plant								
Investigate, test and optimize chiller plant operations	\$35,000		131,493 kWh	0 m ³	\$21,039	\$13,149	1.0	9
Lighting								
Continue to upgrade remaining lighting fixtures to LED	\$85,000		75,464 kWh	0 m ³	\$12,074	\$7,546	6.4	5
Total	\$712,000		675,153 kWh	111,118 m³	\$144,693	\$95,295	4.3	258

Table 10 Energy efficiency projects summary – MDH Central and South Block

Identified Energy Savings Measures	Rough Order of Magnitude Costs		Potentials Energy Savings (per year)			Incentives	Preliminary Payback (with incentives)	GHG emissions reductions (tonnes eCO ₂ /year)
			Electricity	Natural Gas	\$			
Ventilation								
Schedule air handling units	\$30,000	\$293,750	523,088 kWh	78,041 m ³	\$109,447	\$71,819	2.0	184
Canadian Standards Association’s air change rates validation	\$31,250							
Testing and re-balancing	\$37,500							
Outdoor air % control and optimization	\$67,500							
Optimize control sequence of operations - thermal wheel operations	\$127,500							
Heating plant								
Steam plant optimization	\$42,000	\$77,500	104,618 kWh	24,718 m ³	\$24,896	\$16,641	2.4	54
Steam pressure reset	\$10,500							
Glycol pumps operation optimization	\$25,000							
Cooling plant								
Testing & optimize pump operations	\$42,000	\$78,000	209,235 kWh	0 m ³	\$33,478	\$20,924	1.7	14
Investigate on chilled water plant and implement new optimized sequences	\$36,000							
Lighting								
Optimize lighting schedules, including light levels, during operation hours.	\$105,000	\$162,000	732,323 kWh	0 m ³	\$117,172	\$73,232	0.8	48
Investigate emergency fixture design & optimize fixtures lighting levels.	\$21,000							
Reduce occupancy sensors time period.	\$36,000							
Total	\$611,250		1,569,263 kWh	102,759 m³	\$284,992	\$182,616	1.5	300

Table 11 Energy efficiency projects summary – MDH North Block

Identified Energy Savings Measures	Rough Order of Magnitude Costs		Potential Energy Savings (per year)			Incentives	Preliminary Payback (with incentives)	GHG emissions reductions (tonnes eCO ₂ /year)
			Electricity	Gas	\$			
Ventilation								
Install variable frequency drives and associated controls	\$175,000	\$405,500	422,217 kWh	71,888 m ³	\$91,278	\$60,194	3.8	166
Schedule air handling units	\$30,000							
Canadian Standards Association's air change rates validation	\$62,500							
Testing and re-balancing	\$42,000							
Outdoor air % control and optimization	\$48,000							
Optimize control sequence of operations	\$48,000							
Building Automation System								
System upgrade/expansion	\$30,000	\$55,000	40,749 kWh	7,805 m ³	\$9,096	\$6,026	5.4	18
Re-programming	\$25,000							
Heating plant								
Heating plant optimization - turn off steam plant in summer, reset supply water temperature based on outside air temperature	\$66,000	\$122,000	72,167 kWh	74,763 m ³	\$36,219	\$25,908	2.7	148
Investigate and isolate radiation and air handling unit heating in summer	\$20,000							
Glycol & heating pumps operation optimization & triple-duty valve investigation	\$36,000							
Cooling plant								
Testing & optimize pump operations	\$42,000	\$82,000	205,715 kWh	0 m ³	\$32,914	\$20,572	1.9	13
Investigate chilled water plant sequences and implement new optimized sequences	\$40,000							
Total		\$664,500	740,849 kWh	154,457 m³	\$169,507	\$112,699	3.3	345

3.1 Ventilation system

- All sites
 - Optimize air handling unit (AHU) scheduling to align operating hours with departmental hours. For AHUs serving 24/7 zones, schedule variable air volume boxes in unoccupied zones to match space occupancy and adjust the AHU fan based on static pressure sensor feedback. Ensure AHU variable frequency drive (VFD) speed aligns with expected unoccupied turn-down levels during off-hours.
 - Test space air change rates to ensure compliance with Canadian Standards Association's (CSA) recommended levels. Reduce air change rates in areas where over-ventilation is identified.
 - Test and rebalance air handling unit airflows, refurbishing ductwork and dampers as necessary to enhance system performance and resiliency.
- Oakville Trafalgar
 - Reheat control and optimization: test all reheat valves for operations, validate space airflow, optimize supply air temp and implement optimized zone control sequence of operations
- Georgetown Hospital and MDH North Block
 - Install new variable frequency drives complete with static pressure sensor and connect to building automation system.
 - Test AHU outside air percentages, comparing them against CSA Z317.2 requirements. Then, adjust damper positions and/or balance return and supply air to ensure airflow aligns with CSA Z317.2 recommendations.
 - Optimize control sequence of operations.
- MDH Central and South Block
 - Test AHU outside air percentages, comparing them against CSA Z317.2 requirements. Then, adjust damper positions and/or balance return and supply air to ensure airflow aligns with CSA Z317.2 recommendations.
 - Optimize control sequence of operations – thermal wheels operations and outside air control. Confirm each system is set up for correct amount of outdoor air percentages and that the thermal wheels pre-heat setpoint matches with the manufacturer recommendations.

3.2 Building Automation System

- Georgetown Hospital
 - Trend log storage expansion
- MDH North Block
 - System upgrade/expansion – retrofit control devices including actuators, control valves and sensors as needed to achieve savings.

- Re-programming – update building automation system programming to implement new optimized sequences of operations.

3.3 Heating Plant

- Oakville Trafalgar
 - Steam boilers summer operation and optimization. Steam and boiler plant optimization. Review sequence of operations, test boilers and optimize sequence to reduce plant cycling.
 - Steam pressure reset
 - Convert reheat loops to tertiary loops and reset hot water supply temperature based on outside air temperature.
 - Heating pump optimization – differential pressure sensor
 - Pump triple duty valve investigation, testing and optimization: open triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed.
- Georgetown Hospital
 - Steam plant optimization. Review sequence of operations, test boilers and optimize sequence to reduce plant cycling.
 - Investigate perimeter and reheat heating operation in summer and shut off systems.
 - Testing and replacement of isolation valves
 - Add VFD on steam boiler blower motor and feedwater pump.
 - Pump operation optimization
- MDH Central and South Block
 - Steam plant optimization
 - Steam pressure reset
 - Glycol pumps operation optimization
- MDH North Block
 - Heating plant optimization – turn off steam plant in summer, reset supply water temperature based on outside air temperature.

3.4 Cooling Plant

- Oakville Trafalgar
 - Heat recovery chiller investigation and optimization.
 - Cooling tower winterization in design and optimization
 - Pump triple duty valve investigation, testing and optimization: open triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed.

- Pump differential pressure sensor testing and optimization.
- Cooling plant sequence of operation review and optimization
- Georgetown
 - Investigate, test and optimize chiller plant operations.
- MDH Central and South Block
 - Testing and optimize pump operations
 - Investigate on chilled water plant and implement new optimized sequences.
- MDH North Block
 - Testing and optimizing pump operations
 - Investigate chilled water plant sequences and implement new optimized sequences

3.5 Lighting

- Oakville Trafalgar and MDH Central and South Block
 - Optimize lighting schedules, including light levels during operation hours
 - Investigate emergency fixture design and optimize fixtures lighting levels
 - Reduce occupancy sensor time period
- Oakville Trafalgar and Georgetown Hospital
 - Retrofit to LED lighting
- Georgetown
 - Continue to upgrade remaining lighting fixtures to LED

3.6 Capital Measures

The following capital measures are being considered for implementation during the 2024-2029 ECDM cycle. However, they are subject to further investigation, study, and business validation. Final determination will be made once feasibility studies are complete.

- Oakville Trafalgar
 - Adiabatic humidification
 - *Description:* Retrofit existing air handling unit natural gas humidifiers with adiabatic humidifiers
 - *Estimate Cost:* \$4,500,000
 - *Estimated Gas Savings:* 21% of total facility gas consumption
 - Condensing Economizer
 - *Description:* Install condensing economizers on the boiler flues
 - *Estimated Cost:* \$1,816,184
 - *Estimate Gas Savings:* 8% of total facility gas consumption

- Georgetown Hospital
 - Replace air handling unit MZ with hot water heating
 - *Description:* Install new coil and connect it plant hot water loop
 - *Cost:* To be determined
 - *Savings:* To be determined
- MDH Central and South Block
 - Install new summer steam boiler
 - *Description:* Install new small summer steam boiler to correctly match boiler capacity to the facility summer load
 - *Estimate Cost:* To be determined
 - *Savings:* 15% of total 2023 gas use

4 Organization role and impact

Halton Healthcare has been focused on improving the energy and emissions performance of its hospitals. Success to date has required the integrated support of the Board, senior management, facility and capital staff as well as the project consortiums managing the hospitals. Building on achievable results, this plan concentrates on operational improvements and straightforward retrofits that can be accomplished with current staff and resources to meet short and long terms goals. We expect broader organizational awareness and involvement in environmental initiatives over the next five years with the establishment of the new Halton Healthcare Sustainability Committee.