2024-2028 Conservation & Demand Management Plan

Hôpital Montfort

June 23, 2023

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1 Introduction

1.1 Background

Envari was selected by Hôpital Montfort to develop a Conservation and Demand Management (CDM) Plan that would fulfil the requirements of Ontario Regulation 507/18 for the years 2024 to 2028.

The regulation requires the Hôpital Montfort to:

- Publish its annual energy consumption and greenhouse gas emissions for its operations.
- Outline the hospital's goals and objectives for conserving and reducing energy and managing its demand for energy.
- Describe previous, current and future measures for conserving energy and forecast expected results for current and future energy conserving measures.
- Determine savings estimates for proposed measures.
- Describe any renewable technologies if applicable.
- Estimate the length of time that the energy savings measures will be in place.
- Provide confirmation that the CDM Plan has been approved by the hospital's senior management.
- Report actual results achieved.

1.2 Facility Background

The Hôpital Montfort, located at 713 Montréal Rd, Ottawa, ON K1K 0T2, was opened in 1953 and consists of 5 wings, 301 beds, and a total of 725,000 ft^2 of floor space.

The Hôpital Montfort has an affiliated complementary care clinic, the Aline-Chrétien Health Hub (ACHH). This 90,000 ft^2 clinic is located at 2225 Mer-Bleue Rd, Orléans, ON and provides a range of services including foot care, intensive family support, MRI, and cardiovascular/pulmonary rehabilitation.

The details about each of the Hôpital Montfort's 5 wings are taken from the previous Conservation and Demand Management Plan and are outlined below:

- **A-wing**, which was built in 1992 and has 129,824 ft^2 of floor space spread amongst its 4 stories, provides space for operating rooms, sterilization, emergency services, a pharmacy, and patient care rooms. This wing includes 10 AHUs, with accompanying equipment, located in its two mechanical rooms. One mechanical room is located on the lower level and the other is on the third floor. There are 10 AHUs which provide conditioned ventilation air to the building. Perimeter heater and terminal units provide for the heating needs of this wing.

- **B-wing**, which was built in 2008 and has 181,221 ft^2 of floor space spread amongst its 3 stories, provides space for services such as intensive care rooms, diagnostic imaging, and nuclear medicine. It has three penthouse mechanical rooms, with conditioned ventilation air for this wing being provided by AHUs located in these mechanical rooms. B-wing’s second mechanical room is located in the basement and houses steam/water heat exchangers, which supply hot water to the perimeter zone heaters and terminal units.
- **C-wing**, which has 200,435 ft^2 of floor space spread amongst its 6 stories, and is the original hospital built in 1953, provides space for services such as administration, orthopedics, therapeutic services, and pre-admission. The lower level mechanical room houses 1 AHU, with 2 more AHUs located on the third floor, and an additional 4 AHUs located on the roof of the building. Together, these 7 AHUs provide ventilation air for this wing. Heating for C-wing is provided by heating coils in the AHUs, terminal units, and radiant heaters.
- **D-wing**, which was built in 2006 and has 181,803 ft^2 of floor space spread amongst its 6 stories, provides space for services such as administration, clinics, dentistry, and therapeutic services. The main occupant of this building is the Department of National Defense. Required heating is provided by steam/water heat exchangers located in the building's two mechanical rooms, which supply hot water for terminal units, perimeter zones, and AHUs. One mechanical room is located in the building’s basement, and the second mechanical room is located in the penthouse. The upper floors are provided with conditioned ventilation air by large rooftop units.
- **E-wing**, which was built in 1954 and has 31,717 ft^2 of floor space spread amongst its 2 stories, provides space for general administration for the hospital and the University of Ottawa, as well as a central heating and cooling plant. The central heating and cooling plant houses 3 centrifugal chillers, 2 air-cooled chillers, and 4 natural gas fired steam boilers, which provide chilled water and steam for the whole hospital. The boilers are the only natural gas load on site.

2 Utility Analysis

2.1 Utility Consumption

Hôpital Montfort is supplied with electricity by Hydro Ottawa and natural gas by Enbridge Gas Distribution. For electricity, the site falls under Hydro Ottawa's Class A Rate Structure, while for natural gas, it is billed under Enbridge's 110 rate structure.

The utility rates used to calculate the cost savings for each measure are outlined in Table 1 below. The electricity rate is based on Envari's previous experience and is representative of an average electricity cost over a year in $/kWh. The natural gas rate is based on the most recent Enbridge rate 110 structure.

Table 1: *Utility rates for yearly comparisons*

Utility	Unit Cost
Electricity	$0.150 per kWh
Natural Gas	$0.458 per m^3

Figure 1 shows the average breakdown in energy consumption for the facility in both 2016 and 2022. For comparison purposes, the natural gas and electricity have been converted to common units of energy (ekWh). The conversion for cubic metres of natural gas to equivalent kWh is:

- 1 m^3 = 10.5 ekWh

Over 60% of the energy consumed at the hospital is from natural gas as shown in *Figure 1*. Total energy use at the hospital dropped significantly from 2016 to 2022, however this decrease has been partially offset by the addition of the ACHH site.

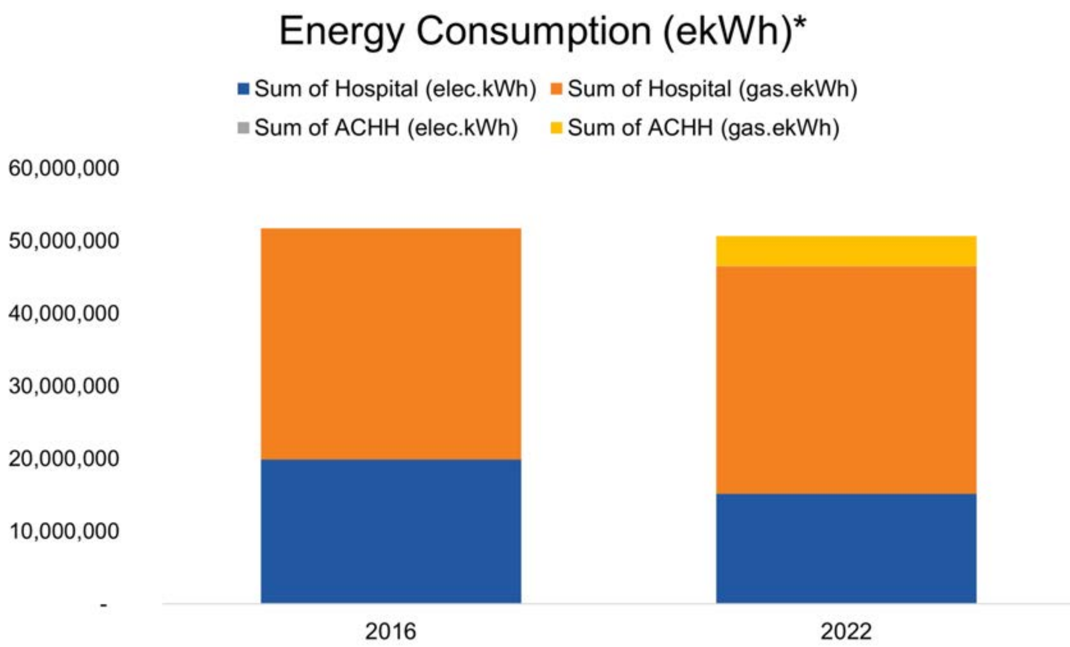

Figure 1: *Energy Consumption in 2016 and 2022*

*Aline-Chrétien Health Hub hydro data has been provided only from December 2021 on, and ACHH gas data has been provided only from February 2022 on.

Table 2: *Energy consumption of Hôpital Montfort and Aline-Chrétien Clinic*

Utility	2016		2022	
	Hospital	ACHH	Hospital	ACHH
Electricity (kWh)	19,899,505	N/A	15,149,476	62,790
Natural Gas (ekWh)	31,821,438	N/A	31,337,836	4,147,965
Total	**51,710,943**		**46,487,312**	**4,210,755**

2.2 Weather-Adjusted Consumption Analysis

In order to visualize the progress in utility consumption for the Hôpital Montfort[1] between 2016 and 2022, a weather-adjusted baseline was created for the monthly energy usage in the building. The energy savings were calculated using the following information:

- The *Baseline* is the forecasted energy consumption for the month if there had not been any energy efficiency measures implemented or changes to building operation. The baseline is determined by identifying the relationship between electricity and natural gas and the weather in the *Base Year*. The relationship between energy consumption and weather is determined using linear regression (also known as *line of best fit*). The present day weather is entered into this relationship to forecast what the electricity and natural gas consumption would have been if nothing in the building had changed since the base year.
- 2016 was selected as the base year
- The *Actual* energy consumption is the metered electricity and natural gas consumption data provided by Hôpital Montfort staff
- The *Savings* is the *Baseline* predicted consumption subtracted by the *Actual* consumption.

The relationship between energy and weather in the *Base Year* (2016) was calculated using the form:

Baseline Use = (Baseload + HDD x Use/HDD + CDD x Use/CDD)

Heating degree-days (HDD) and cooling degree-days (CDD) are a measure of the severity of the heating and cooling season, e.g. the more HDD there were in a month, the colder it was in that month. Degree-day information is available from Environment Canada.

The coefficient of determination (R^2) is a measure of the precision of the linear regression, or the strength of the relationship between the energy consumption and the variable (HDD or CDD). The value of R^2 ranges from 0 (no relationship at all) to 1 (perfect relationship where the equation predicts energy use exactly).

[1] This analysis does not include data for the Aline-Chrétien Health Hub.

2.2.1 Electricity Consumption Reduction

The base year for the regression between electricity consumption and the weather was the year 2016 to avoid the variances in consumption caused by the energy retrofits undertaken by Ameresco. The electricity consumption of the building has a strong relationship with CDD. The building consumes 1,847 kWh for every CDD and has a base usage of 51,504 kWh per day. The building does not correlate with HDD, indicating that there is no significant operational change for the winter months (e.g electric heating).

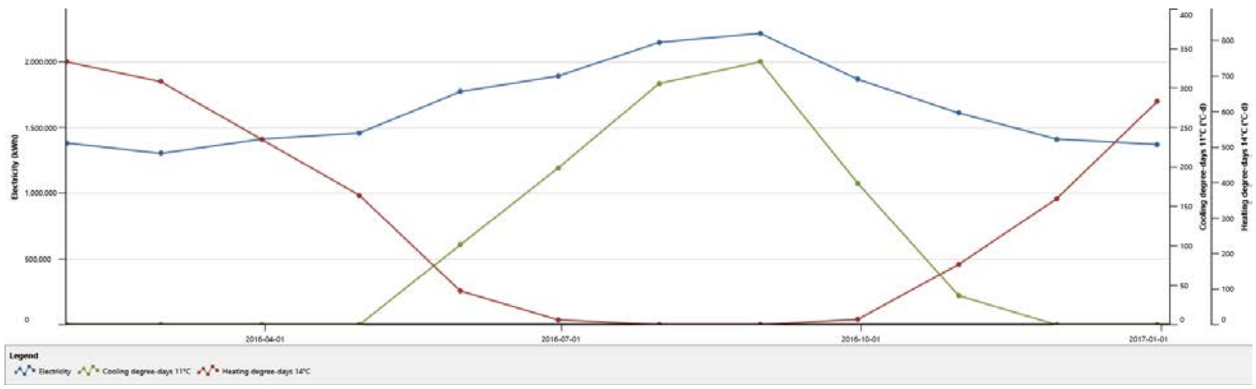

Figure 2: *Electricity consumption regression with HDD and CDD*

$$Baseline\ Electricity\ Consumption\left[\frac{kWh}{day}\right] = 51,503.55 - 302.95\ x\ HDD[°C\ x\ days] + 1,847.49\ x\ CDD[°C\ x\ days]$$

$$R^2 = 0.9961$$

Entering the HDD/CDD for 2022 into the baseline equation and comparing it to the metered electricity consumption shows that the actual consumption of electricity has decreased significantly since 2016. This is expected given the retrofits that have been done in the facility since 2016. As indicated in Table 3, the building has reduced its electricity consumption by 23% since 2016, which equates to over 4,500,000 kWh and an estimated $570,954 in avoided electricity costs per year by 2022.

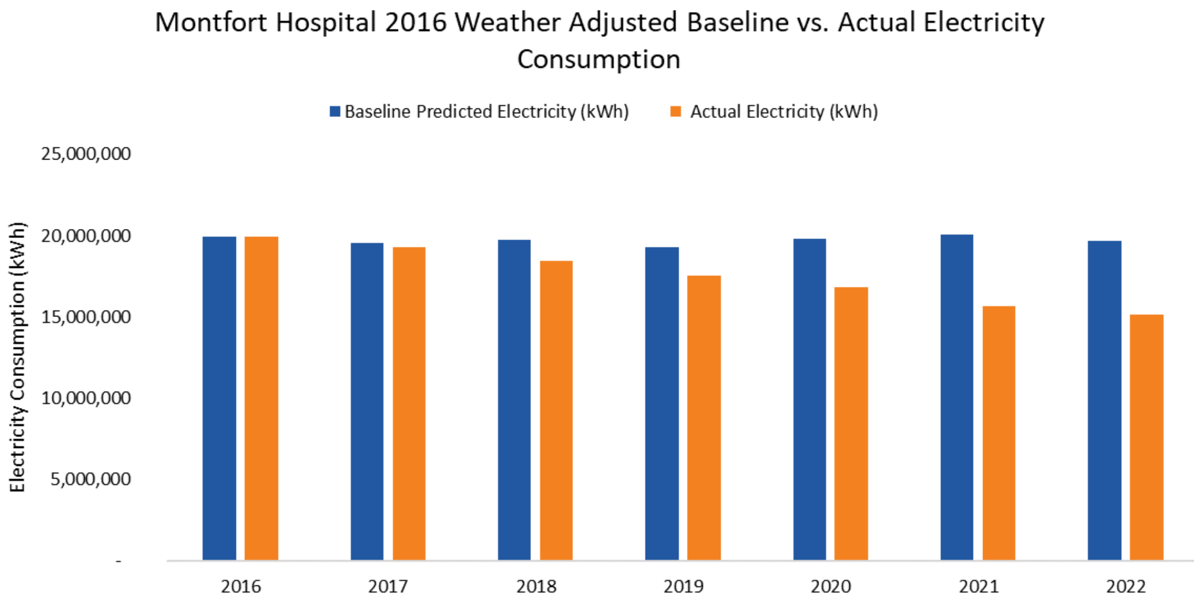

Figure 3: *Electricity consumption from 2016-2022 compared with 2016 weather-adjusted consumption*

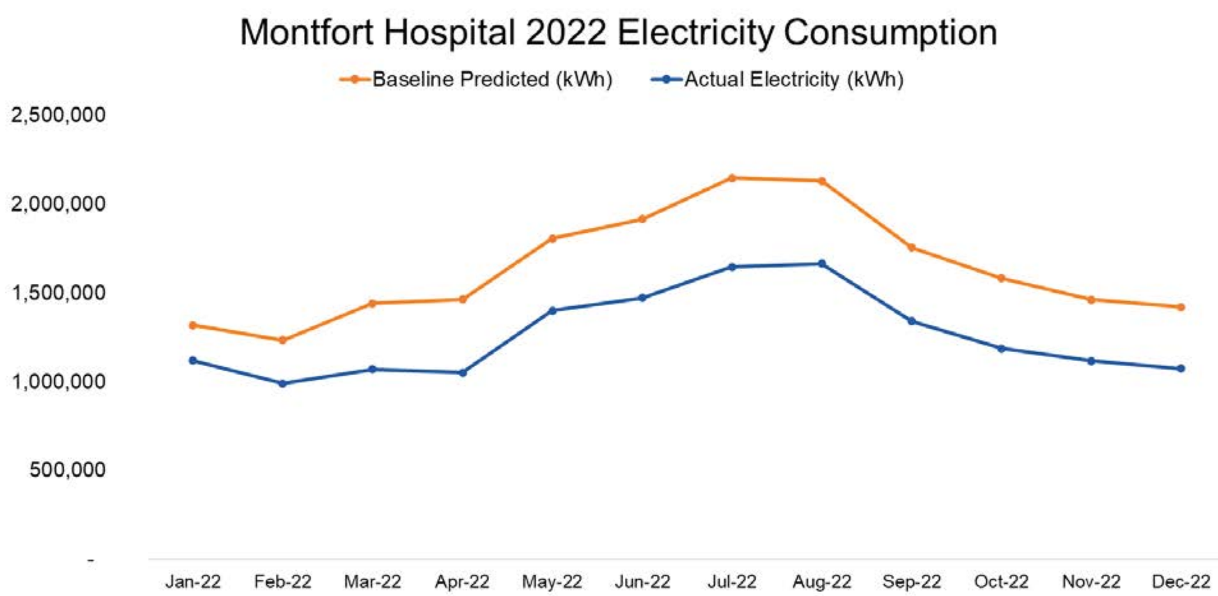

Figure 4: *2022 yearly profile electricity consumption compared with 2016 weather-adjusted consumption*

The consistent decrease in monthly electricity use shown in Figure 4 indicates that the majority of the savings come from retrofits that were relatively independent of weather such as lighting and air-handling unit replacements. Upgrades of the automation system also allowed equipment to operate more efficiently at all times of the year.

Table 3: *Baseline predicted electricity consumption vs. actual*

Year	2016 Weather Adj. Baseline (kWh)	Metered Usage (kWh)	Savings (kWh)	Savings (%)	Average Historical Energy Price ($/kWh)*	Savings ($)
2016	19,899,505	19,899,505	0	N/A	N/A	N/A
2017	19,573,406	19,306,241	264,165	1%	$0.12	$33,024
2018	19,752,233	18,443,786	1,308,447	7%	$0.10	$130,373
2019	19,297,607	17,545,861	1,751,747	9%	$0.11	$196,674
2020	19,773,266	16,805,197	2,968,069	15%	$0.16	$464,944
2021	20,057,263	15,641,958	4,415,305	22%	$0.14	$629,140
2022	19,697,024	15,149,476	4,547,548	23%	$0.13	$570,954
Total						$2,025,109

* This price is based on the actual amount per month that Hôpital Montfort paid for its electricity divided by the actual amount of electricity (kWh) consumed.

2.2.2 Electricity Demand Reduction

The base year for the regression between electricity demand (the maximum power draw by the facility in a month) and the weather was 2016 to avoid the variances in demand caused by the energy retrofits undertaken by Ameresco. The demand value is the highest coincident peak of all six meters feeding the campus. The building demand increases by 31.5 kW for each CDD. The building does not correlate with HDD, indicating that there are no significant operational changes for the winter months (e.g electric heating).

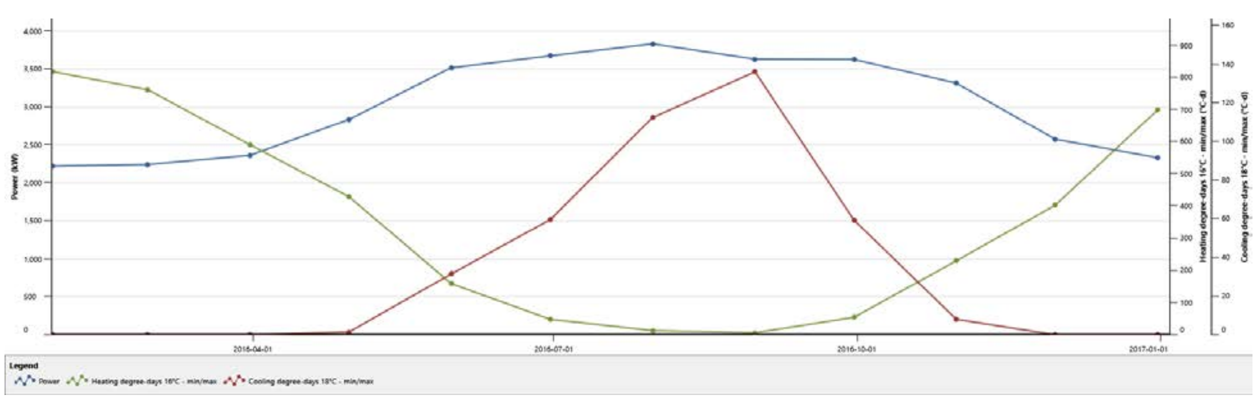

Figure 5: *Electrical demand regression with HDD and CDD*

$$Baseline\ Electricity\ Demand\left[\frac{kW}{day}\right] = 3,652.5 - 58.2\ x\ HDD[°C\ x\ days] + 31.5\ x\ CDD[°C\ x\ days]$$

$$R^2 = 0.9555$$

Entering the HDD/CDD for 2022 into the baseline equation and comparing it to the metered electrical demand shows that the demand has decreased significantly since 2016. This is expected given the retrofits that have been done in the facility since 2016. Table 4 shows the demand savings from month-to-month for 2022 versus the baseline. Table 5 provides a summary for total peak demand saved throughout the year for the previous years shown in Figure 6. All cost savings associated with reduced demand have been captured in the electricity cost savings shown in *Table 3 Baseline predicted electricity consumption vs. actual*.

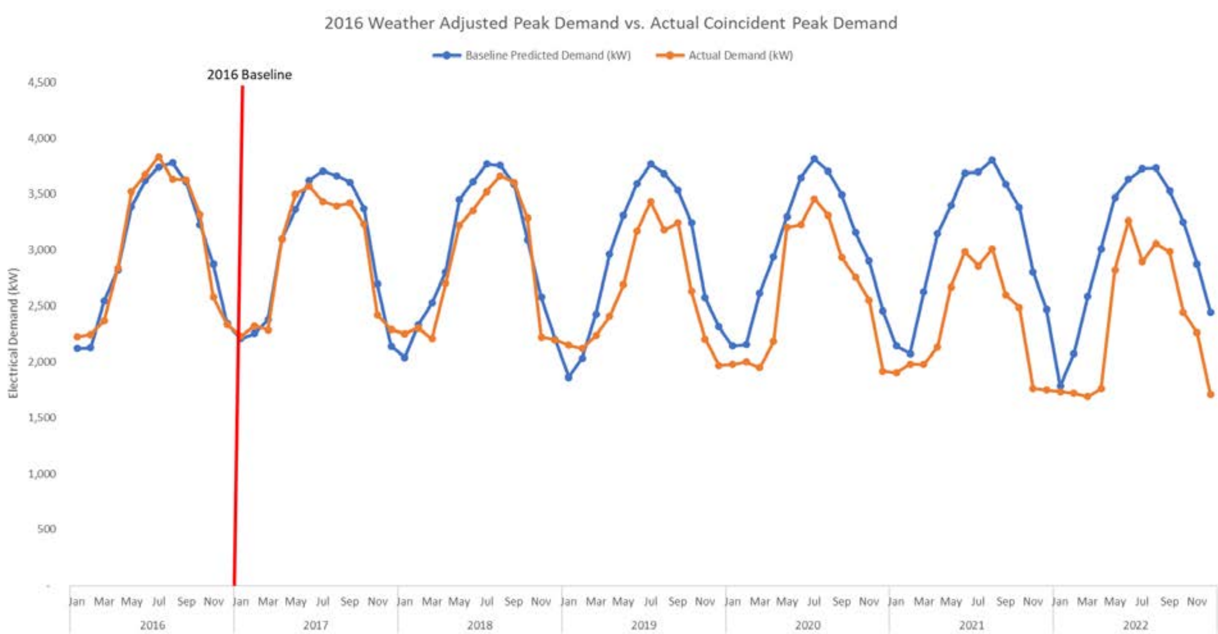

Figure 6: *Yearly profile electricity demand compared with 2016 weather-adjusted consumption*

Table 4: *Baseline predicted electricity demand vs. actual 2022 demand*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2016 Weather Adjusted Baseline (kW)	1,784	2,075	2,586	3,011	3,473	3,634	3,728	3,732	3,532	3,253	2,876	2,446	36,131
2022 Actual Demand (kW)	1,733	1,717	1,689	1,760	2,823	3,264	2,898	3,058	2,987	2,446	2,259	1,709	28,341
Savings (kW)	52	358	897	1,251	650	370	830	674	545	807	617	737	7,789
Savings %	3%	17%	35%	42%	19%	10%	22%	18%	15%	25%	21%	30%	N/A

Table 5: *Baseline predicted electricity demand vs. actual*

Year	Yearly Peak Demand Savings (kW)
2016	N/A
2017	911
2018	1,215
2019	3,876
2020	4,857
2021	8,711
2022	7,789

2.2.3 Natural Gas Reduction

The base year for the regression between natural gas and the weather was 2016 to avoid potential variances due to the energy efficiency retrofits implemented by Ameresco. The natural gas consumption of the building has a good relationship with the HDD, which is expected due to the heating requirements of the building as the weather gets colder. The building consumes 266 m^3 of natural gas per HDD and has a base usage of 6,278 m^3 per day.

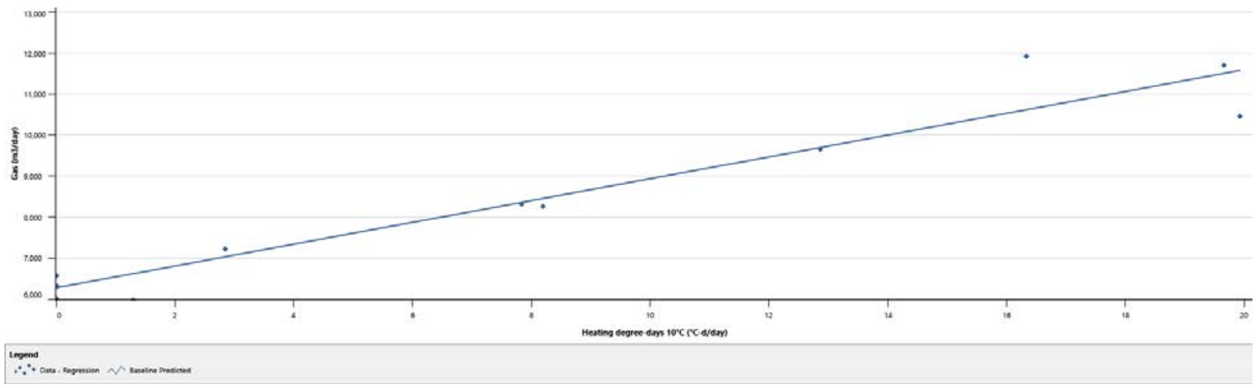

Figure 7: *Natural gas regression with HDD*

$$Baseline\ Natural\ Gas\ Consumption\left[\frac{m^3}{day}\right] = 6,277.54 + 265.93\ x\ HDD[°C\ x\ days]$$

$$R^2 = 0.9292$$

Entering the HDD for the following years into the baseline equation and comparing it to the metered natural gas consumption shows that the actual consumption of natural gas has remained relatively consistent since 2016, the difference between 2016 and 2022 being only 45,839 m^3. This indicates that the energy savings measures identified in Table 10 have not significantly impacted natural gas consumption in the facility.

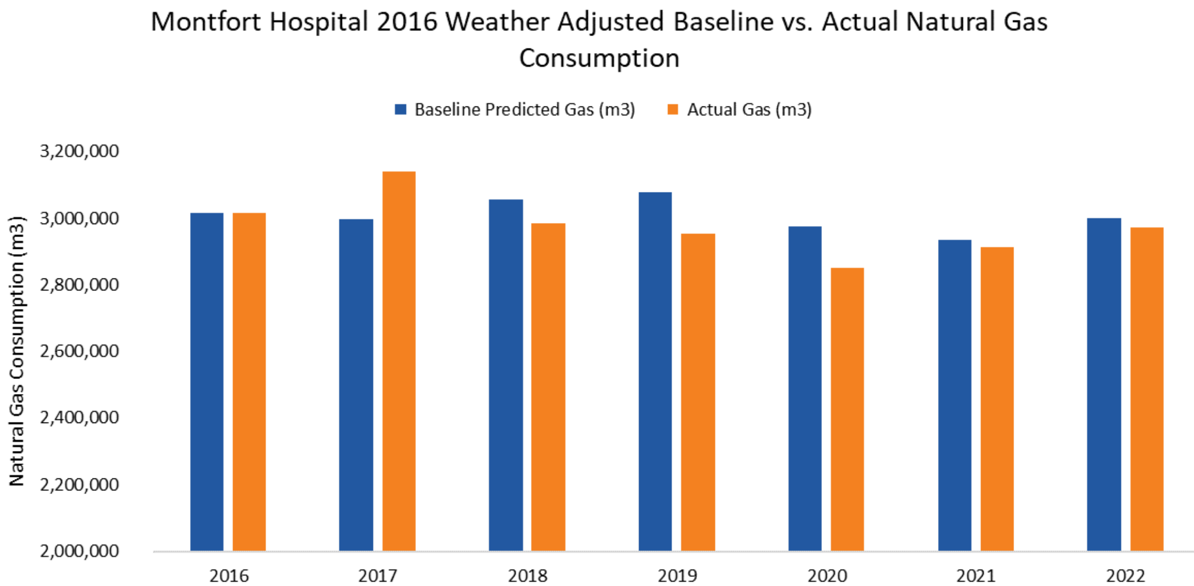

Figure 8: *Natural gas consumption from 2016-2022 compared with 2016 weather-adjusted consumption*

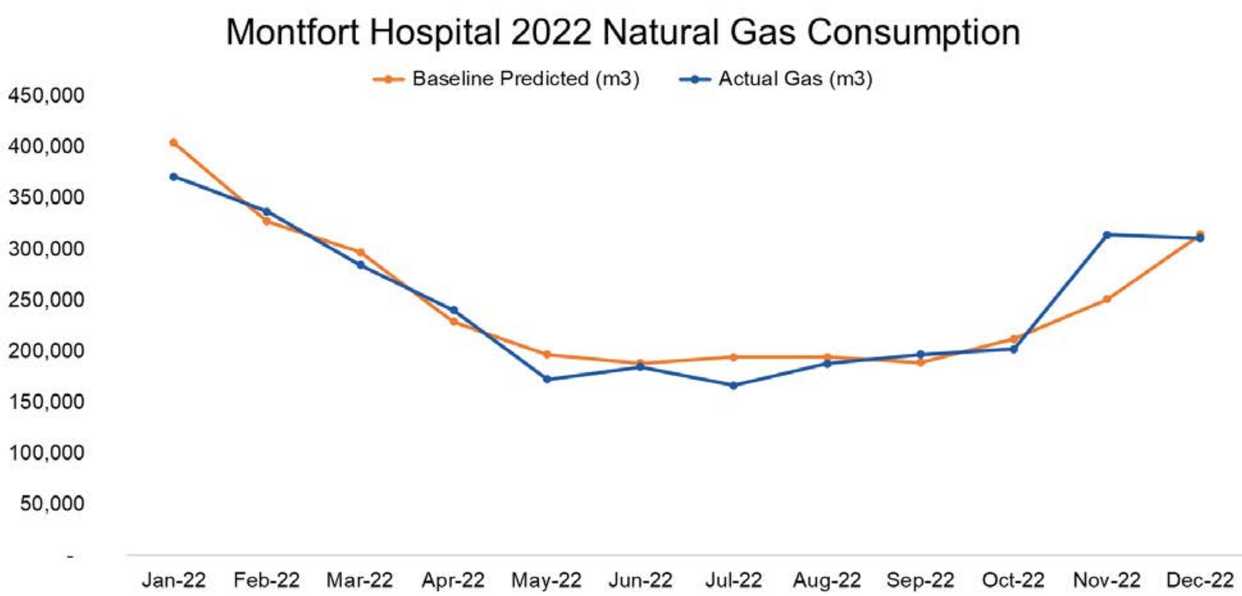

Figure 9: *2022 monthly profile natural gas consumption compared with 2016 weather-adjusted consumption*

Table 6: *Baseline predicted natural gas consumption vs. actual*

Year	2016 Weather-Adj. Baseline (m^3)	Metered Usage (m^3)	Savings (m^3)	Savings (%)	Average Historical Gas Price ($/m^3)*	Savings ($)
2016	3,016,250	3,016,250	N/A	N/A	N/A	N/A
2017	2,997,657	3,138,600	(140,943)	(4%)	0.07	$(9,209)
2018	3,054,914	2,983,569	71,345	2%	0.06	$4,525
2019	3,077,134	2,955,446	121,688	4%	0.06	$ 7,383
2020	2,973,588	2,849,486	124,102	4%	0.11	$13,356
2021	2,935,811	2,912,241	23,570	1%	0.11	$ 2,635
2022	2,999,474	2,970,411	29,063	1%	0.14	$4,033
Total						$22,724

* This price is based on the actual amount Hôpital Montfort paid for its natural gas divided by the actual amount of natural gas (m3) consumed.

2.3 Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions are often classified into three different types. Scope 1 results from the direct combustion on site of fuels that emit GHGs. Scope 2 are emissions that come from the consumption of purchased energy (most commonly electricity) that creates GHGs at the source of generation (e.g. power plant). Scope 3 comes from the organization's operations including waste generation, supply chain, and employee business travel. For the purposes of this plan, Scope 1 and Scope 2 emissions will be the only considered emissions. The following emission factors have been applied to examine the current GHG emissions of the building and the potential savings for each measure.

The emission factors given below are sourced from RETScreen, a federal government database. The burning of natural gas will yield a constant emission factor. Emission factors for electricity in Ontario are dependent on how many fossil fuel sources were needed to meet demand throughout the year and therefore it changes.

Table 7: *Emission factors for each utility*

Year	Natural Gas Emission Factors (tCO_2/m^3)	Electricity Emission Factors (tCO_2/kWh)
2016	0.00196	0.0000370
2017	0.00196	0.0000170
2018	0.00196	0.0000270
2019	0.00196	0.0000260
2020	0.00196	0.0000250
2021	0.00196	0.0000250
2022	0.00196	0.0000319[2]

Natural gas is a significant portion of the utility consumption at the Hôpital Montfort. Since natural gas emits significantly more than electricity and Section 2.2.2 indicates natural gas has remained consistent, emissions on the campus have remained consistent since 2016. Including the emission portfolio of the Aline-Chretien clinic, emissions in 2022 exceeded the 2016 emissions of the Hôpital Montfort campus.

[2] Estimated value for 2022. The factor has not yet been published as of June 2023

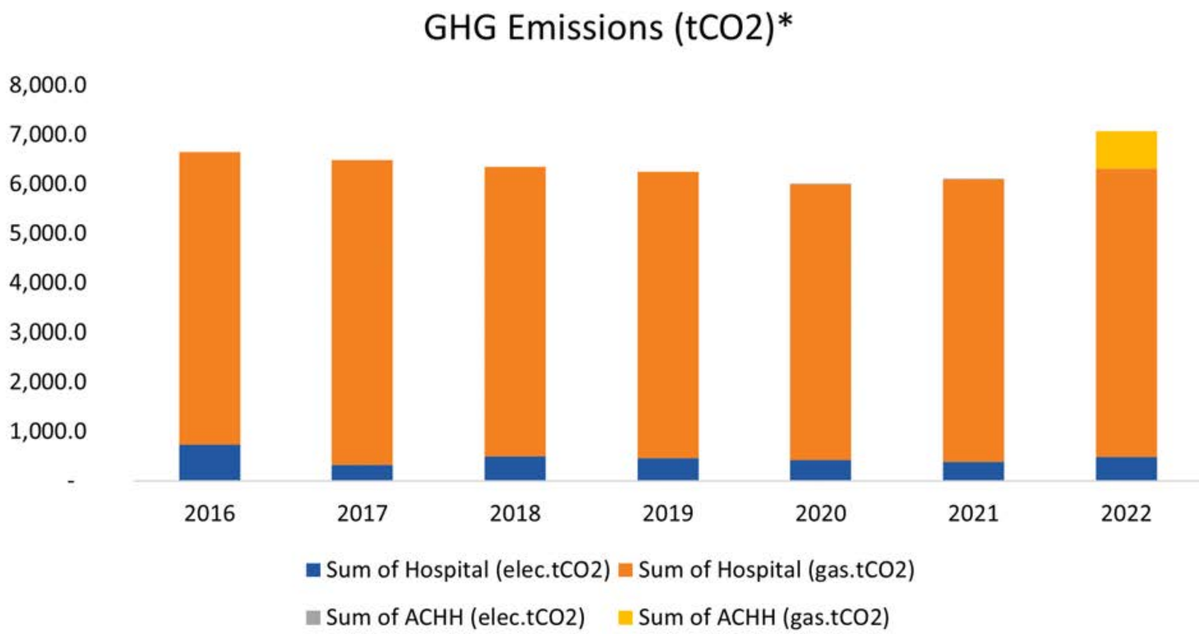

Figure 10: *Yearly GHG emissions by facility/utility*

Note: Aline-Chrétien Health Hub hydro data has been provided only from December 2021 onwards, and ACHH gas data has been provided only from February 2022 on.

Table 8: *GHG Emissions since 2016*

	Hospital (elec.tCO2)	Hospital (gas.tCO2)	ACHH (elec.tCO2)	ACHH (gas.tCO2)
2016	736.3	5,911.9	N/A	N/A
2017	328.3	6,151.7	N/A	N/A
2018	497.0	5,847.8	N/A	N/A
2019	456.2	5,791.4	N/A	N/A
2020	420.1	5,585.0	0.05	N/A
2021	391.0	5,711.0	1.3	N/A
2022	483.3	5,822.0	2.0	770.6

2.4 Energy Benchmarking[3]

"Energy Intensity" is the total annual energy consumption per square foot for a facility. This accounts for electricity and natural gas, after converting to common units. Based on a floor area of approximately 725,000 ft^2, the energy intensity for the Hôpital Montfort is 65 $ekWh/ft^2$ for the 2019 calendar year. Comparing this building's energy intensity to other hospitals in Ontario and other hospitals in the Ottawa region, the Hôpital Montfort energy intensity is in the approximate middle of the group. Also of note is that the energy intensity for the Hôpital Montfort does not include data from the Aline-Chrétien Health Hub. Figures 11 and 12, shown below, illustrate the comparison between the energy intensities of 305 hospitals in Ontario as well as between 15 hospitals in the Ottawa region.

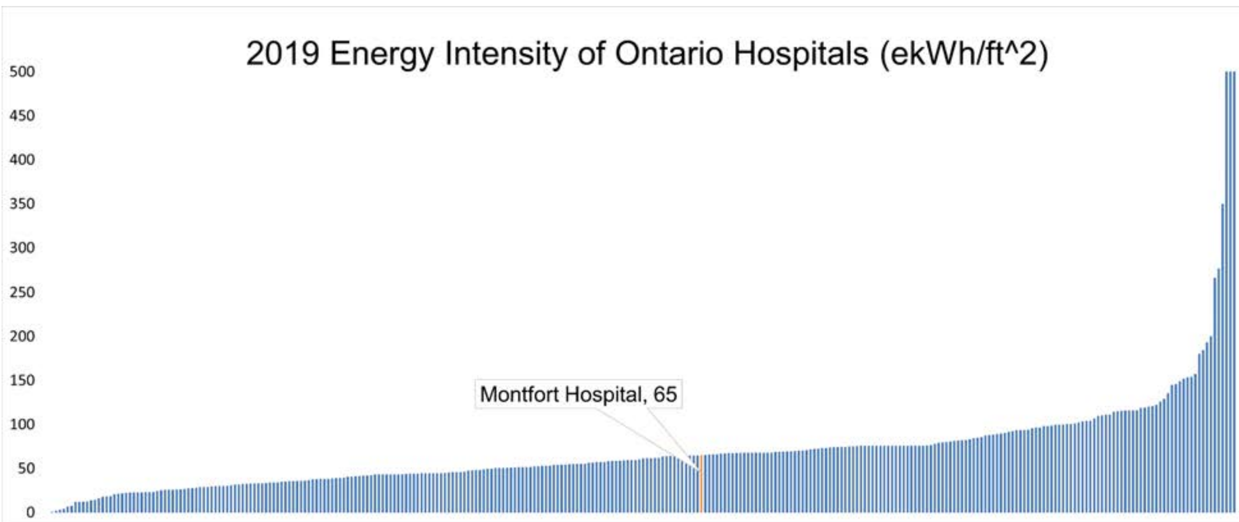

Figure 11: *2019 energy intensity compared to other Ontario hospitals.*[4]

[3] The raw data used in this section was sourced from https://data.ontario.ca/, Energy use and greenhouse gas emissions for the Broader Public Sector.
[4] Note, the top three highest ranked Ontario hospitals exceed the vertical range of this graph.

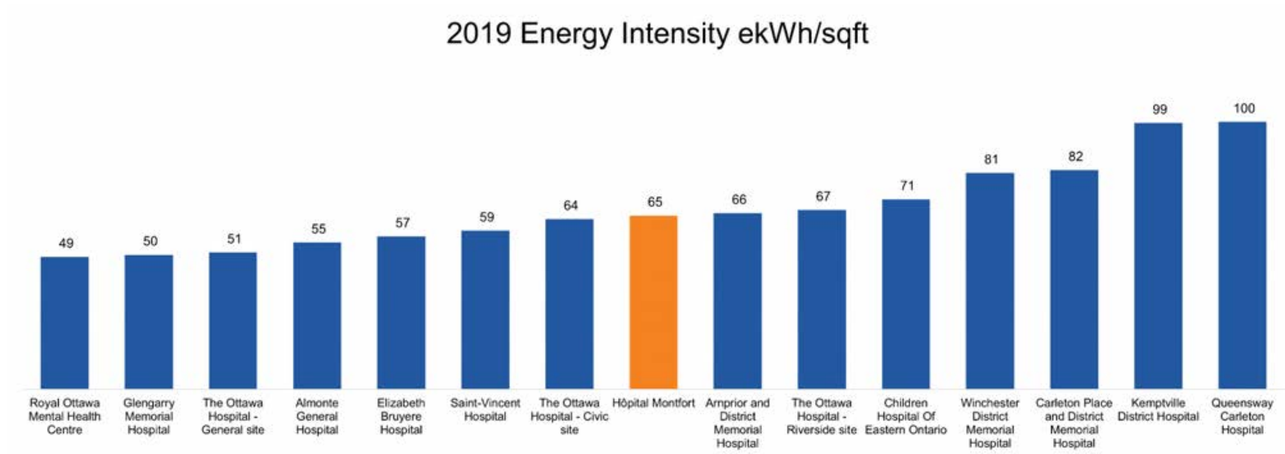

Figure 12: *2019 energy intensity compared to Ottawa area hospitals.*

Table 9 shows the Hôpital Montfort's energy intensity Ontario-wide ranking between 2016 and 2020.

Table 9: *Hôpital Montfort's yearly Ontario-wide energy intensity ranking*

Year	Ranking	Total # of Hospitals	Energy Intensity (ekWh/ft^2)
2016	239	360	72
2017	222	331	72
2018	183	286	70
2019	168	305	65
2020	173	301	65

3 Energy Conservation Measures

3.1 Implemented Measures (2019-2023)

The Hôpital Montfort planned and implemented numerous energy efficient retrofits, which are summarized in Table 10. The details for these projects were taken from a June 15, 2021 presentation prepared by Ron Drummond, facility manager at the Hôpital Montfort - energy savings data was not available for all the measures. The expected annual savings from these retrofits was 4,172,527 kWh (21.6 %) of electricity and 642,223 m^3 (20.6 %) of natural gas. The utility analysis in Section 2 of this report shows that the annual electricity consumption has actually decreased by over 4,500,000 kWh or 23% as a result of these implemented measures, while the natural gas consumption has remained approximately consistent.

***Table 10:** List of measures proposed at the Hôpital Montfort for the period 2019-2023*

Measure	Anticipated Annual Electricity Savings (kWh)	Anticipated Annual Natural Gas Savings (m^3)	Progress
Building Automation System Upgrades			
A-Wing Controls Optimization	76,151	28,889	Complete
B-Wing Controls Optimization	215,412	54,871	Complete
C-Wing Controls Optimization	81,224	53,740	Complete
D-Wing Controls Optimization	375,184	127,079	Complete
E-Wing New Controls			Complete
A-Wing 4th Floor VAV and Controls			Complete
C-Wing Convert Remaining Floors			Complete
C-Wing Replace Siemens Controls			Complete
Subtotal	747,971	264,579	
Lighting Upgrades			
Replace A-Wing Lighting with	164,039		Complete

LED			
Replace B-Wing Lighting with LED	200,066		Complete
Replace C-Wing Lighting with LED	181,917		Complete
Replace D-Wing Lighting with LED	239,077		Complete
Replace E-Wing Lighting with LED			Complete
Replace Parking Garage Lighting with LED	343,396		Complete
Replace Exterior Parking Lot Lighting with LED	106,155		Complete
Replacement of Exterior Wall Lighting with LED	34,057		Complete
Subtotal	1,268,707		
Air Handling Unit Upgrades			
A-Wing: Replacement of AHU 1	57,714	19,292	Complete
A-Wing: Replacement of AHU 2	16,739	60,618	Complete
A-Wing: Replacement of AHU 3 and 6	86,089	19,384	Complete
A-Wing: Replacement of AHU 4	65,239	28,937	Complete
A-Wing: Replacement of AHU 5	27,351	4,886	Complete
C-Wing: Replacement of AHU 15, 16, 17	810,497	158,241	Complete
A-Wing: Operating Room VAV and Pressurization Control	54,000		Complete
Subtotal	1,117,629	291,358	
Cooling Plant Upgrades			

Chiller Replacement			Complete
Upgrade Free Cooling			Complete
Subtotal	761,844		Complete
Total	3,896,151	555,937	

3.1.1 Measure Impact

As is illustrated in Table 11, Meter A shows the largest contribution to the total savings between 2016 and 2022. Meter D on the other hand shows the smallest contribution to the total savings. This indicates that consumption saving measures implemented in the Meter A service area were successful in reducing consumption, while there either were few significant measures implemented in Meter D's service area, or they were mostly unsuccessful in reducing consumption. The other four meters fall somewhere between these two extremes.

Table 11: *Comparison of 2016 and 2022 Consumption for individual meters*

Year	Meter A	Meter B	Meter C	Meter D	Meter E	Meter F	Total
2016 (kWh)	4,248,629	2,837,060	4,170,034	1,767,458	2,161,150	4,626,357	19,810,687
2022 (kWh)	2,296,940	1,970,265	3,636,112	1,563,329	1,675,390	4,007,442	15,149,479
Savings (kWh)	1,951,689	866,795	533,922	204,128	485,759	618,914	4,661,208
Contribution to Total Savings[5]	42%	19%	11%	4%	10%	13%	100%

Shown in Figure 13 below, are graphs of monthly electricity consumption for the individual meters for 2016 versus 2022.

[5] Note that due to averaging, the individual percentages may not directly sum to 100%.

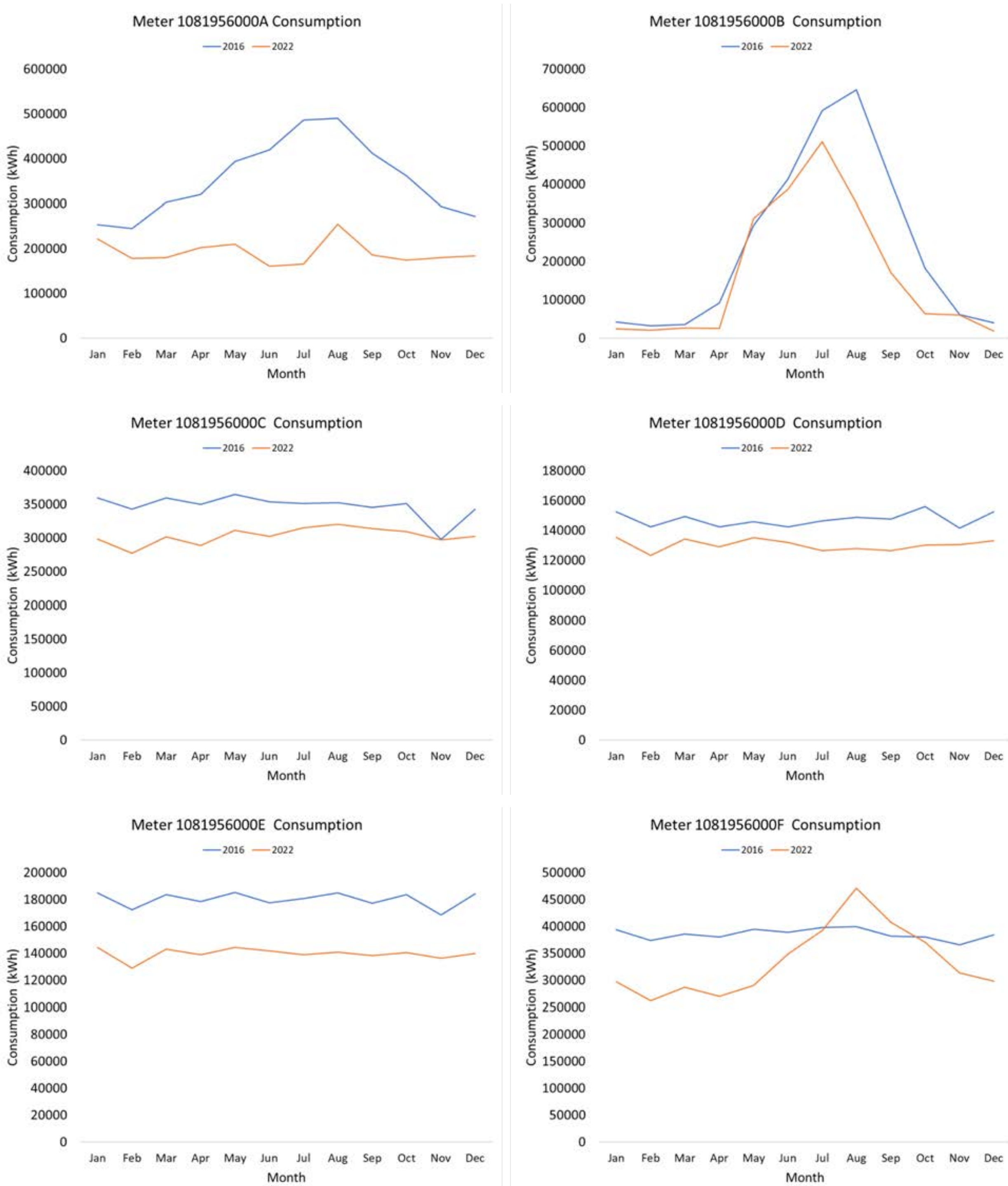

Figure 13: *2016 and 2022 individual meter yearly consumption profiles*

Figure 13 shows that the measures implemented between 2016 and 2022 at Hôpital Montfort have resulted in overall electricity consumption savings on all meters. More specifically, the summer consumption peak for Meter A has mostly been eliminated. This reduction may be due to the cooling plant upgrades. Meter B also shows a reduction in summer electricity use.

Lighting, BAS, and AHU upgrades are likely responsible for the non-weather related reduction in electricity consumption shown across the other meters.

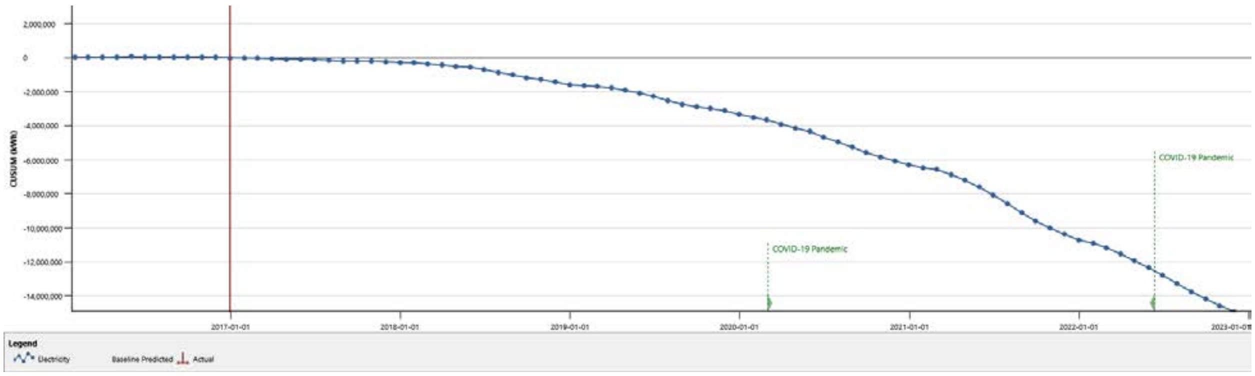

Figure 14: *Electricity CUSUM chart*

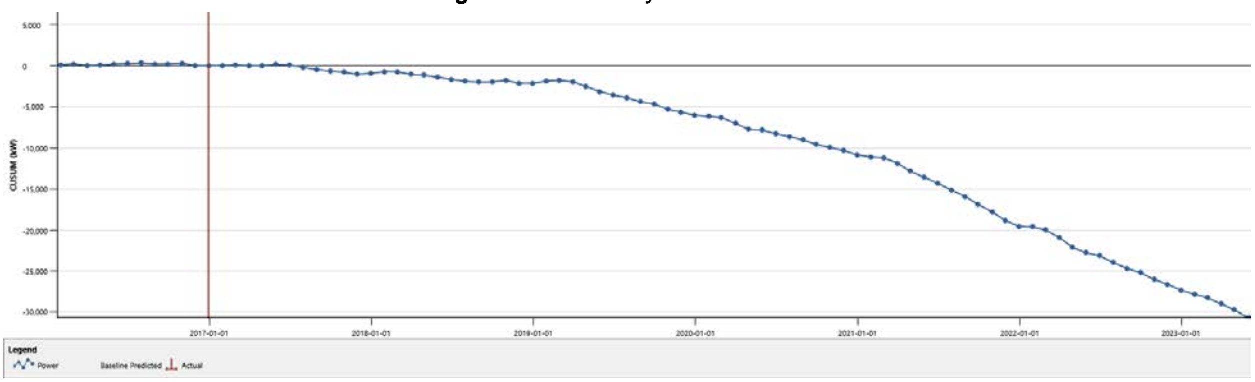

Figure 15: *Electrical Demand CUSUM chart*

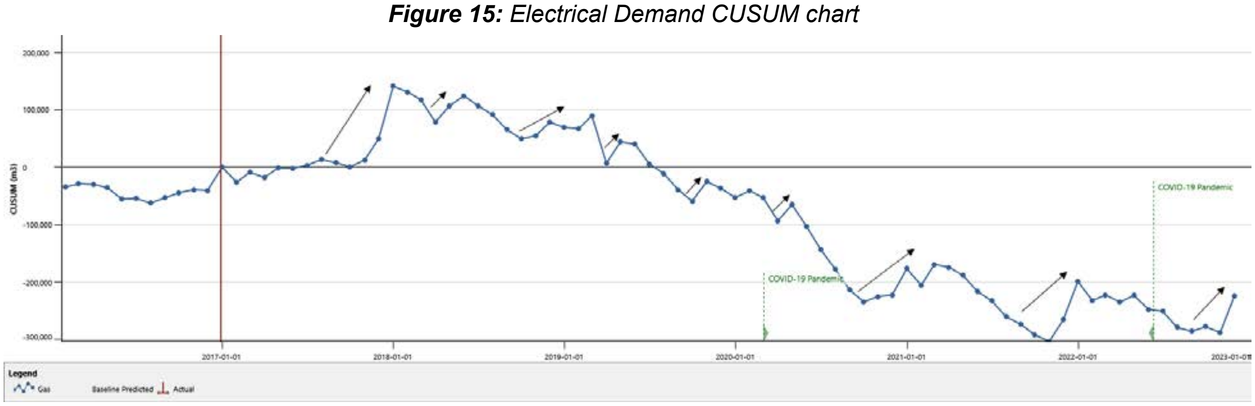

Figure 16: *Natural Gas CUSUM chart*

The Cumulative Sum (CUSUM) charts in Figures 14 to 16 above indicate the cumulative sum of the differences between the actual and weather-adjusted baseline. The electricity consumption and demand CUSUM, shown in Figures 14 and 15 respectively, indicate a steady decrease in electricity use beginning in 2018. This decrease is likely due to the retrofit projects completed through this time period. The natural gas CUSUM indicates a small reduction in gas use that coincides with the COVID-19 pandemic.

3.2 Proposed Measures (2024-2028)

Envari proposes a number of energy efficiency retrofits for the Hôpital Montfort to consider. The projects would reduce energy consumption of the hospital, with a particular focus on reducing natural gas consumption. The only gas load in the campus is the central natural gas fired boiler plant and reduction of steam use from the boiler plant demand would significantly reduce the campus GHG emissions. Further engineering study must be conducted prior to implementing any of the measures in Table 12 below. Envari can provide support by conducting the feasibility studies, engineering design, and implementation of these measures.

Table 12: *List of measures proposed for 2024-2028*

Measure	Electricity Savings (kWh/yr)	Natural Gas Savings (m^3/yr)	Avoided GHG (tonnes/yr)
Wing B & D: Perimeter Heat on BAS VAV boxes have been tied into the BAS but perimeter heating is still pneumatic. Convert perimeter heating to BAS digital control for better control of heating and cooling delivered to space, better occupant comfort, and improved troubleshooting of issues.	15,200	16,700	33.2
4th Floor Wing A: VAVs from Pneumatic to DDC Convert VAVs and perimeter heating to digital control from BAS for better control of heating and cooling delivered to space, better occupant comfort, and improved troubleshooting of issues.	1,100	1,200	2.4
Reinstate Water-side Free Cooling A fluid cooler tied to the central chiller plant has not been operational for a couple years requiring that a 150-ton air-cooled chiller operate all winter. The estimated winter cooling load is 80 tons. Replacing the fluid cooler will allow chilled water to be generated using cold outdoor air in winter, avoiding electricity use by the chiller, and improving chiller life by reducing run time.	168,000	-	5.4
Demand Control Kitchen Ventilation (DCKV) A small make-up air unit with a duct heater provides fresh air to offset exhaust from the cafeteria kitchen hood. A DCKV system slows down the amount of air exhausted and made up during periods of no cooking activity.	5,700	-	0.2

Economizer for Boiler 4 An economizer is an air-to-water heat exchanger located in the boiler stack to recover heat from the flue gases to preheat domestic cold water feeding the boiler plant and reducing energy required to convert this water to steam. The economizer on boiler 4 failed several years ago. Replacing the economizer will result in natural gas savings - typically 4% to 7% of the boiler's natural gas use.	-	34,300	67
Wing A & C: Exhaust Air Heat Recovery Advances in heat pump technology allow heat pumps to produce much higher grade heat (over 160ºF) than in the past. There are three rooftop exhaust fans in C wing exhausting approx 35,000 cfm of air. The exhaust fans in the A Wing air-handlers exhaust another 7,000 cfm approximately. Air-to-water heat pumps installed on these exhaust fans are estimated to generate 3.5 MMBH of glycol hot enough to use in the AHU coils and displace the steam load and reduce natural gas use. The recovered heat may need to be pumped to the central plant to reduce natural gas all year round.	(920,000) *Increased elec use to heat pump operation	870,000	1,676
Central Plant: Heat Recovery Chiller There is a base heating load of approx 8 MMBH all year round that is met by the steam boiler plant. Install a heat recovery chiller to provide chilled water in the cooling season and reject waste heat to the boiler plant feedwater and glycol heating loops in some buildings. Savings are based on a heat recovery chiller that produces 5 MMBH of waste heat.	(195,000) *Increased elec use running heat pump chiller vs standard chiller	565,000	1,100
Wing A: Window Film on South Facing Windows The south elevation of Wing A has a significant amount of glazing that faces southeast. Applying a window film to these windows will reduce the solar heat gain in summer, reduce the cooling load on the air-handling unit serving the space, and improve occupant comfort. If this pilot installation is effective, it can be applied to other windows with southern exposure.	3,300	-	0.1
Wing A Entrance Lobby: Daylight Harvesting The atrium at the entrance to Wing A has a significant amount of glazing that provides plenty of natural light on clear days. Install sensors to automatically dim the light fixtures and reduce electricity consumption when	2,200	-	0.1

the sun can maintain appropriate light levels in the space. A low voltage signal from the sensor or the BAS will set the dimming level for each light (or bank of lights) The savings are based on the lighting operating 24/7. If the installation is effective, it can be replicated to other areas of the building with a significant amount of glazing and natural light.			
Solar PV: Portion of A and B Wing Roofs Based on the available roof area on A and B Wings, these roofs can accommodate solar arrays totalling approximately 80 kW. The power generated can be used in the building's electricity distribution system to displace electricity purchased from the grid. This measure should be installed as part of a new roof installation or on a roof that is less than 5 years old.	96,000	-	3
Grand Total:	**(823,500)**	**1,487,200**	**2,888**

In addition to these energy savings measures, Envari recommends some good practices that will further optimize the functionality of the existing equipment:

Update and maintain a CMMS

- Ensure that the CMMS (Computerized Maintenance Management System) of the building is up to date and tasks are completed on time. Poor maintenance of HVAC equipment can lead to increased energy use as well as poor equipment performance. An up to date CMMS will avoid energy penalties due to dirty filters, loose fan belts, stuck dampers, disconnected actuators, etc.

BAS Continuous Commissioning:

- The building automation system is integral in ensuring that the building is operating as efficiently as possible. Regular maintenance and review of its functionality should be conducted in parallel with HVAC maintenance managed by the CMMS. Continuous commissioning involves a regularly scheduled review of trend data to ensure the desired sequence of operations is being followed, checking end devices for calibration, and modifying sequences of operations to account for changes in space use.

Conduct Steam Trap Audits:

- A steam trap audit should be conducted in order to identify and remedy any failed steam traps and minimize losses in the steam distribution system. In systems with adequate preventative maintenance, steam trap losses should be minimal. According to the US Department of Energy, in steam systems that have not been maintained for 3 to 5 years, up to 30% of steam traps may have failed[6].

[6] U.S Department of Energy

3.3 Summary of Proposed Measures

The Hôpital Montfort has steadily reduced its electricity consumption since the last plan was created. The next five years are focused on reducing natural gas consumption and associated GHG emissions through heat recovery and electrification projects. If the proposed measures in Section 3.2 are all feasible, the Hôpital Montfort is estimated to reduce natural gas consumption by 50%, increase electricity consumption by 5% and and reduce GHG emissions by 46%. These results are summarized in Table 13 below. It should be noted that this study is a high level overview of potential retrofits. Further investigation and design is required to confirm the technical feasibility of each retrofit, refine the potential savings, and identify which measures impact the savings/performance of other measures.

Table 13: *Estimated savings from proposed measures for 2024-2028*

	2022 Baseline	2028 Anticipated Consumption	Reduction (%)
Electricity (kWh)	15,149,476	15,972,976	-5%
Natural Gas (m^3)	2,970,411	1,483,211	50%
GHG (tonnes/year) [7]	6,305	3,417	46%

Figure 17 shows the potential effect these proposed measures would have on the Hôpital Montfort's Ontario hospital ranking. These measures would cause the Hôpital Montfort's energy intensity to decrease from 65 ekWh/ft^2 in 2019 to approximately 44 ekWh/ft^2 in 2028 and bring Hôpital Montfort's Ontario hospital ranking down from 169th to 93rd.

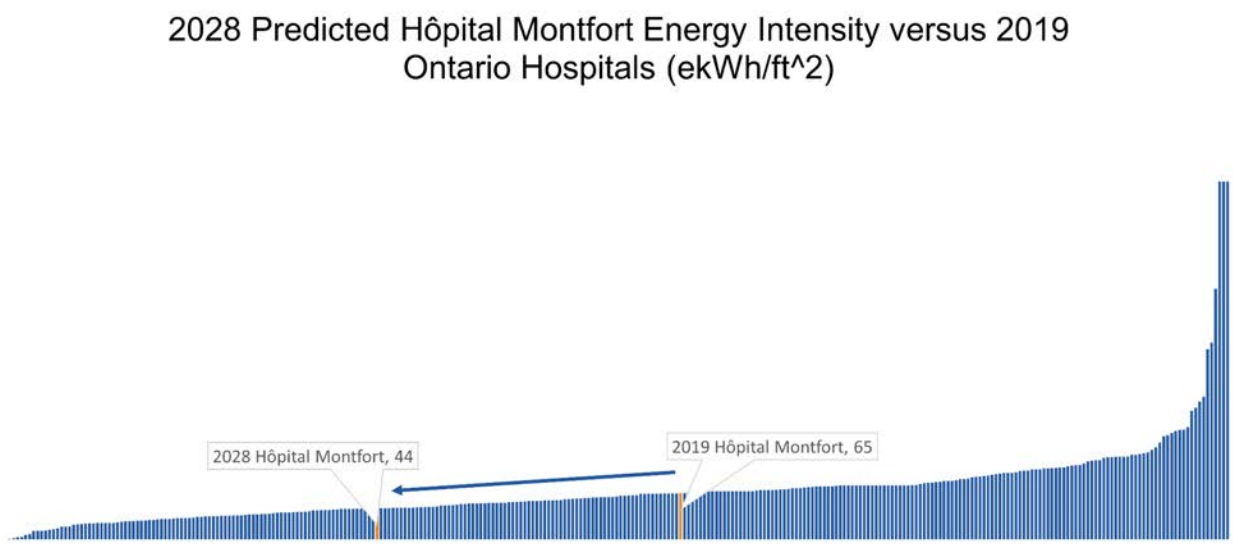

Figure 17: *Predicted energy intensity ranking in 2028 compared to 2019 based on proposed measures.*

[7] Estimated GHG reductions are based on 2023 emissions factors.

4 Conservation and Demand Management Plan Summary

4.1 Summary of 2019-2023 Goals and Results

Hôpital Montfort's goal by the end of the 2019-2023 phase of their Energy Conservation and Demand Management Plan was to reduce electricity consumption by 21% and natural gas consumption by 20% compared to 2016 consumption. Table 14 shows that by the end of 2022 the goal to reduce electricity consumption by 21% has been achieved, but that the goal to reduce natural gas consumption by 20% has not been achieved.

Table 14: *Summary of 2019-2023 Conservation and Demand Management goals and results achieved*

	2016 Baseline	2022 Actual Consumption	Reduction (%)
Electricity Consumption (kWh)	19,899,505	15,149,476	24%
Natural Gas Consumption (m^3)	3,016,250	2,970,411	1.5%

4.2 Summary of 2024-2028 Proposed Goals and Estimated Savings

Since significant progress has been made in reducing electricity consumption, Envari recommends focusing on reducing natural gas consumption in the 2024-2028 Conservation and Demand Management Plan. The target for this Plan is to reduce natural gas consumption by 20%, while maintaining electricity consumption at current levels which would result in a 19% reduction in GHG emissions. These results are summarized in Table 15.

Table 15: *Estimated savings from proposed measures for 2024-2028*

	2022 Baseline	2028 Target	Reduction (%)
Electricity (kWh)	15,149,476	15,149,476	0%
Natural Gas (m^3)	2,970,411	2,376,329	20%
GHG (tonnes/year) [8]	6,305	5,141	19%

This energy reduction target would result in a decrease in Hôpital Montfort's energy intensity by 15% from 65 ekWh/ft^2 in 2019 to approximately 55 ekWh/ft^2 in 2028 resulting in Hôpital Montfort's Ontario hospital ranking decreasing from 169th to 138th (based on 2022 rankings).

[8] Estimated GHG reductions are based on 2023 emissions factors.

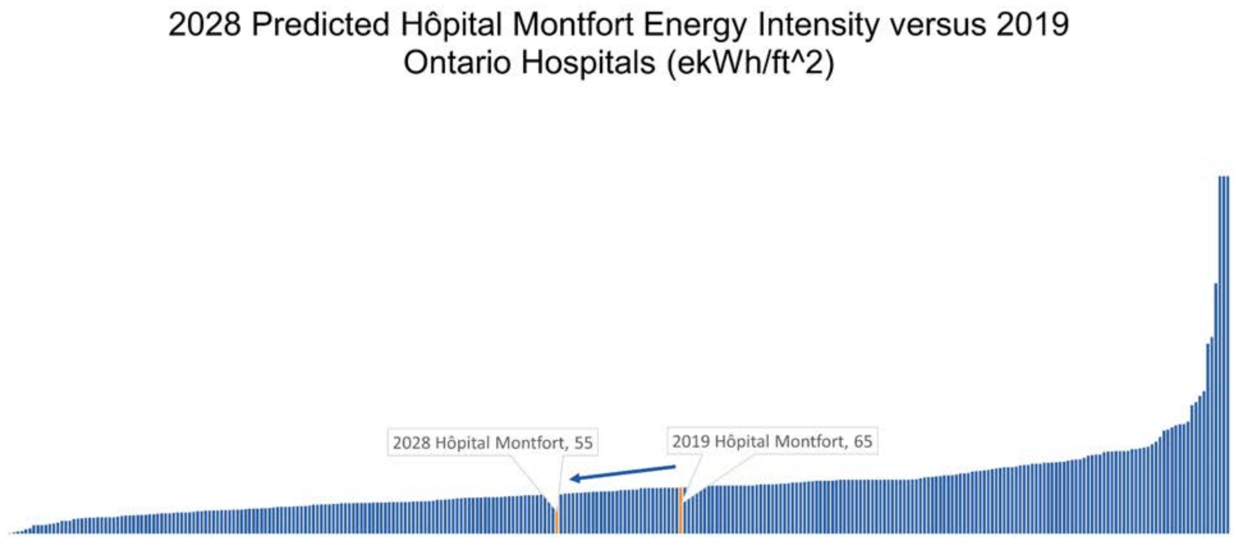

Figure 18: *Predicted energy intensity ranking in 2028 compared to 2019 based on a subset of proposed measures.*