Energy Conservation & Demand Management (ECDM) Plan 2024

Holland Bloorview
Kids Rehabilitation Hospital

Contents

1. Glossary of Terms

Word	Abbreviation	Meaning
Baseline year		A baseline is a benchmark that is used as a foundation for measuring or comparing current and past values.
Building automation system	BAS	Building automation is the automatic centralized control of a building's heating, ventilation and air conditioning, lighting and other systems through a building management system or building automation system (BAS)
Carbon dioxide	CO_2	Carbon dioxide is a commonly referred to greenhouse gas that results, in part, from the combustion of fossil fuels.
Energy usage intensity	EUI	Energy usage intensity means the amount of energy relative to a building's physical size typically measured in square feet.
Equivalent carbon dioxide	CO_2e	CO_2e provides a common means of measurement when comparing different greenhouse gases.
Equivalent kilowatt hours	ekWh	1 $kWh_{Electricity}$ = 1 ekWh, 1 $m^3_{Natural\ Gas}$ = 10.56 ekWh
Greenhouse gas	GHG	Greenhouse gas means a gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., carbon dioxide and chlorofluorocarbons.
Metric tonnes	T	Metric tonnes are a unit of measurement. 1 metric tonne = 1,000 kilograms
Net zero		A net-zero energy building, has zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site.
Greening Healthcare median - EUI		The median EUI was provided by Greening Healthcare based on participating healthcare providers. Greening Health Care is a network of leading hospitals, healthcare groups and other organizations across North America working together to achieve deep energy and greenhouse gas emissions reductions in healthcare facilities.
Scope 1 emissions		Direct emissions from sources owned or controlled by the school, such as natural gas
Scope 2 emissions		Indirect emissions from the consumption of purchased energy generated upstream
Scope 3 emissions		Indirect emissions (not included in Scope 2) that occur in the value chain of the hospital include both upstream and downstream emissions, like waste, transport, food, and procurement. Scope 3 is not included in this plan.
Variable frequency drive	VFD	A variable frequency drive is a device that allows for the modulation of an electrical or mechanical piece of equipment and facilitates greater efficiency.

2. Regulatory Summary

Every broader public sector (BPS) organization, including hospitals, shall prepare, publish, make available to the public and implement energy conservation and demand management (ECDM) plans in accordance with O. Reg. 25/23. These plans will report on historical consumption to date, corresponding greenhouse gas (GHG) emissions, potential reductions measures/opportunities, and a 5-year forecast. The ECDM Plan is to be updated every 5 years. A history of the regulation is provided below.

- O. Reg. 397/11: Conservation and Demand Management Plans was introduced in 2013. Under this regulation, public agencies were required to report on energy consumption and greenhouse gas emissions and develop conservation and demand management (CDM) plans the following year.
- Until recently, O. Reg. 397/11 was housed under the Green Energy Act, 2009 (GEA). On December 7, 2018, the Ontario government passed Bill 34, Green Energy Repeal Act, 2018. The Bill repealed the GEA and all its underlying Regulations, including O. Reg. 397/11. However, it re-enacted various provisions of the GEA under the Electricity Act, 1998.
- As a result, the conservation and energy efficiency initiatives, namely CDM plans and broader public sector energy reporting, were re-introduced as amendments to the Electricity Act. As of January 1, 2019, O. Reg. 397/11 was replaced by O. Reg. 507/18 and BPS reporting and ECDM plans were under the Electricity Act, 1998 rather than the Green Energy Act, 2009.
- As of February 23, 2023, O. Reg. 507/18 was replaced by *O. Reg. 25/23, and BPS Reporting and ECDM* plans are now under the Electricity Act, 1998 rather than the Green Energy Act, 2009.

The net result of all of these regulatory changes is that every broader public sector (BPS) organization, including hospitals, prepare, publish, make available to the public and implement energy conservation and demand management (ECDM) plans. The plans must be updated every 5 years. Holland Bloorview's last plan was published in 2019. Now, in 2024, Holland Bloorview is publishing this substantial update in accordance with the regulations while also taking the opportunity to reflect and built upon its plans for a more sustainable future.

3. Executive Summary

The purpose of Holland Bloorview Kids Rehabilitation Hospital's energy conservation and demand management (ECDM) plan is to outline specific actions and measures that will promote good stewardship of our environment and community resources in the years to come. The plan will accomplish this, in part, by looking at future projections of energy consumption and reviewing past conservation measures.

In keeping with our goals for efficiency and fiscal responsibility, our energy management program will support the reduction of operating costs while enabling high-quality, safe care for children with disabilities and medical complexity.

Holland Bloorview as it exists now at 150 Kilgour Avenue in Toronto, opened its doors in February 2006. The building itself is recognized by the International Academy for Design and Health for its modern design excellence. Today it includes many "green" features including:

- 52kW solar panel installation for on-site green energy production
- 114,000 liter collection system to collect roof rainwater and re-use it for irrigation
- Energy efficient windows
- Variable speed drives for all fans and pumps that increase energy efficiency
- Low voltage lighting control system
- Energy efficient LED lighting upgrades in some high-access areas and installation in all newly built additions to the building

Holland Bloorview Kids Rehabilitation Hospital will continue to invest capital funding into the newest proven technology to drive energy savings and a lower carbon footprint. Government funding, including rebates has been, and will continue to be integral to our planning.

Our goal is to obtain full value from energy management activities that consider the federal government's net zero targets. Holland Bloorview will take a strategic approach to fully integrate energy management into its business decision-making, policies, and operating procedures. This active management of energy-related costs and risks will provide a significant economic return and will support other key organizational objectives.

We are considering a number of measures described in the report that will target our emissions and natural gas and electricity consumption. Where possible, we will implement measures that best align with net zero targets by 2050. The list of measures in the report is only a beginning. With a strong commitment embedded in our Holland Bloorview 2030 strategic plan and rapidly changing technology, we will both investigate and be open to other approaches that will help drive impact.

In terms of baseline measures, Holland Bloorview ranks in the top quartile performers compared to other hospitals:

- Energy Use Index (EUI) was 42.7 ekWh/sq.ft
- Energy-related emissions equaled 2,240 tCO_2e

With current planned initiatives, Holland Bloorview has the potential to achieve the following targets by 2029, compared to its 2023 utility profile:

- 20 per cent reduction in electricity consumption
- 8 per cent reduction in natural gas consumption
- 14 per cent reduction in GHG emissions

Our team is dedicated to this effort and will continue to engage internal and external stakeholders to map a strategy that aligns or improves upon these targets.

Holland Bloorview Kids Rehabilitation Hospital's Energy Performance & Path Forward

The results and the progress of the ECDM activities implemented over the past five years, and the projected impact of the new ECDM plan is presented in the graph below. Please note natural gas has been converted to ekWh (1 $kWh_{Electricity}$ = 1 ekWh, 1 $m^3_{Natural\ Gas}$ = 10.56 ekWh).

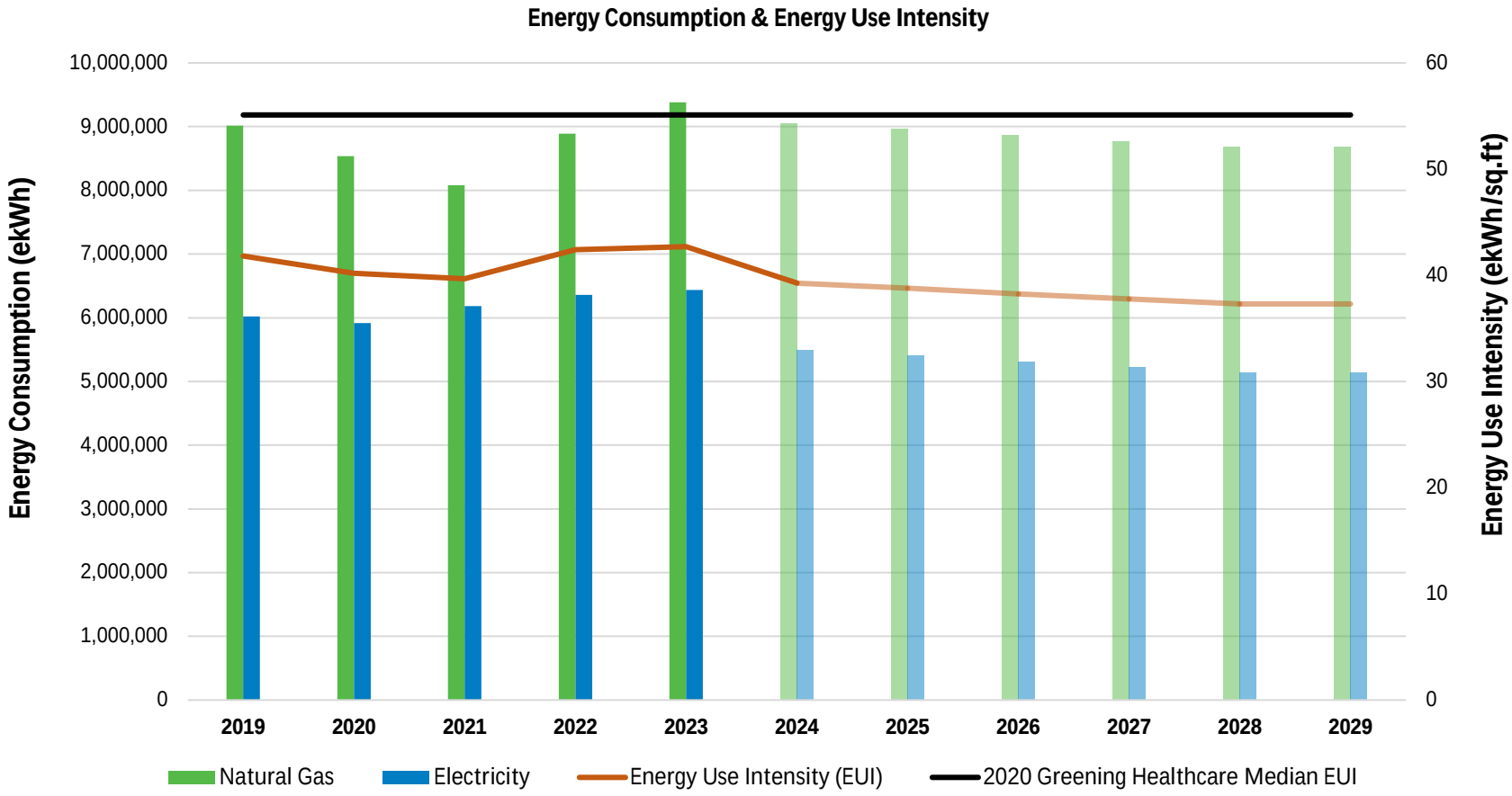


***Figure 1**. Energy Consumption Trends & Projections*

4. About Holland Bloorview Kids Rehabilitation Hospital

Figure 2. *Holland Bloorview Kids Rehabilitation Hospital*

Holland Bloorview Kids Rehabilitation Hospital creates a world of possibility by supporting children and youth living with disabilities, medical complexity, illness and injury. Holland Bloorview is a top 40 Canadian research hospital that is fully affiliated with the University of Toronto and serves over 9,500 families annually. Providing both inpatient and outpatient services, Holland Bloorview is renowned for its expertise in partnering with clients and families to provide exceptional care. Holland Bloorview is the only organization to ever achieve 100 per cent in three successive quality surveys by Accreditation Canada.

Facility Information	
Facility Name	**Holland Bloorview Kids Rehabilitation Hospital**
Type of Facility	Healthcare Facility
Address	150 Kilgour Rd, East York, ON M4G 1R8
Gross Area (Sq. Ft)	365,000
Average Operational Hours in a Week	168
Number of Beds	75
Number of Floors	7

Table 1. *Holland Bloorview Kids Rehabilitation Hospital Facility Information*

In order to obtain full value from energy management activities, and to strengthen our conservation initiatives, a strategic approach must be taken. Our organization will strive to fully integrate energy management into our practices by considering indoor environmental quality, operational efficiency and sustainably sourced resources when making financial decisions.

Our Vision

The most meaningful and healthy futures for all children, youth and families.

Our Mission

In unparalleled partnership with children, youth and families, we deliver outstanding personalized, inter-professional care; maximize function through cutting-edge treatment and technology; co-create groundbreaking research, innovation and teaching; connect the system; and drive social justice for children and youth with disabilities.

Our Values

- Courage and Resilience
- Compassion
- Excellence
- Equity
- Innovation

Our Holland Bloorview 2030 Strategy

Figure 3. *Holland Bloorview Kids Rehabilitation Hospital Strategy Graphic*

4.1 Previous Sustainability and Reduction Efforts

Holland Bloorview's existing home is now 18 years old, built relatively recently in 2006. Active management of energy related costs and risks continues to provide a significant economic return to the organization and will support other key organizational objectives. Planning for upgrades with energy management in mind began in 2009.

During the last 5 years, led by the facility management team, Holland Bloorview has partnered with Toronto Hydro, Enbridge, Johnson Controls and George Brown College on a number of projects including:

- Various LED lighting retrofits including the parking lot, conference rooms and elevators
- Conversion of selected air handling units from constant air volume (CAV) to variable air volume (VAV), creating greater energy efficiency
- Conducting a steam trap energy efficiency analysis and subsequent upgrade of steam traps
- Adding variable frequency drives (VFD) to pumps and motors to increase electricity savings
- Redirecting rainwater to an underground tank that has a capacity of 114,000 litres. The water is pumped into the facility's underground irrigation system for use in the perennial beds and turf areas. The system drives cost savings on water/sewer charges, reduces water usage and keeps our common client/family/staff areas lush and green.
- A solar panel array that generates approximately $40,000 per year in revenue via rebates from our Toronto Hydro. Estimated kWh of production is between 57,000 and 60,000 annually. Holland Bloorview's contract to receive its solar rebate from Toronto Hydro is in place until March 2028.

5. Historical Site Analysis

5.1 Historical Energy Intensity

Energy Utilization Index is a measure of how much energy a facility uses per square foot. By breaking down a facility's energy consumption on a per-square-foot-basis, we can compare facilities of different sizes with ease. In this case, we are comparing our facility to the median from *Greening Health Care*, a network of leading hospitals, healthcare groups and other organizations across North America working together to achieve deep energy and greenhouse gas emissions reductions in healthcare facilities*. The energy use intensity median amongst the healthcare providers in the network was found to be 55.1 ekWh/sq. ft while Holland Bloorview' EUI stands between 39.7 and 42.7 ekWh/sq. ft over the last 5 years.

Year	2019	2020	2021	2022	2023
Total	41.8	40.2	39.7	42.4	42.7

***Table 2**. Historic Energy Use Intensity*

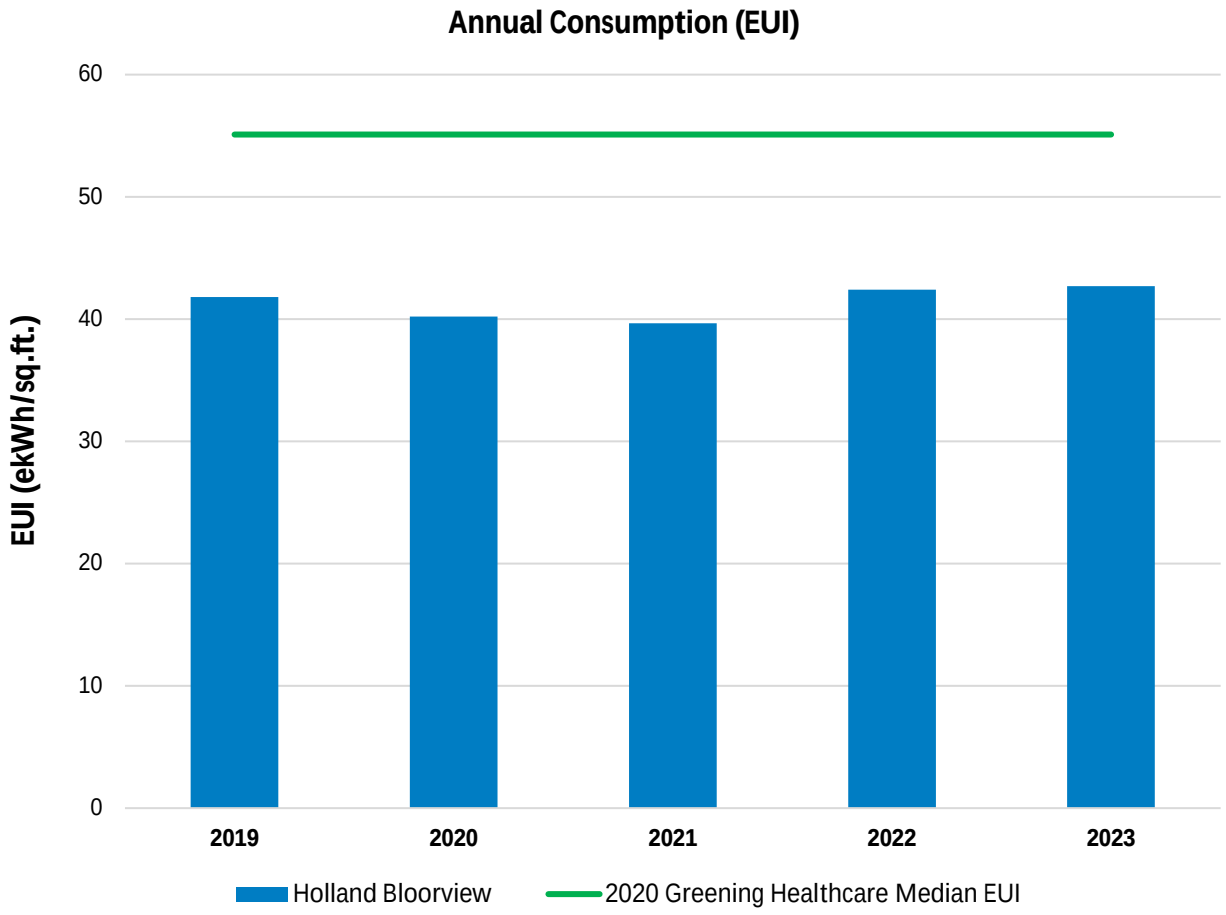


***Figure 4.** Historic Annual Energy Utilization Indices*

**Greening Health Care: https://greeninghc.com/*

5.2 Historical Utility Consumption Analysis

Utilities to the site are electricity and natural gas. Table 3 below shows natural gas and electricity consumption as well as power generated onsite via solar panels. Holland Bloorview has a few solar panel systems – a 39-kW capacity system on the east roof, a 13-kW capacity system on the west roof, and a 5-kW solar array in operation on an exterior storage building (this smaller array creates power that is used on-site).

Both natural gas and electricity consumption follow historical weather trends. A colder year will lead to a higher consumption of natural gas through heating and a hotter summer will lead to a higher consumption of electricity through cooling. More information on the correlation between weather patterns and fuel consumption can be found in *Appendix 1*. Weather aside, the spike in consumption for both electricity and natural gas in 2023 can be attributed to the 11,000 square-foot facility expansion that happened that year.

Year	2019	2020	2021	2022	2023
Natural gas consumption (m^3)	853,751	808,350	765,162	841,807	888,573
Electricity consumption (kWh)	6,070,696	5,970,303	6,235,321	6,382,725	6,486,095
Solar power generation (kWh)	50,423	53,494	52,903	21,554	48,216

Table 3. *Historic Annual Utility Consumption*

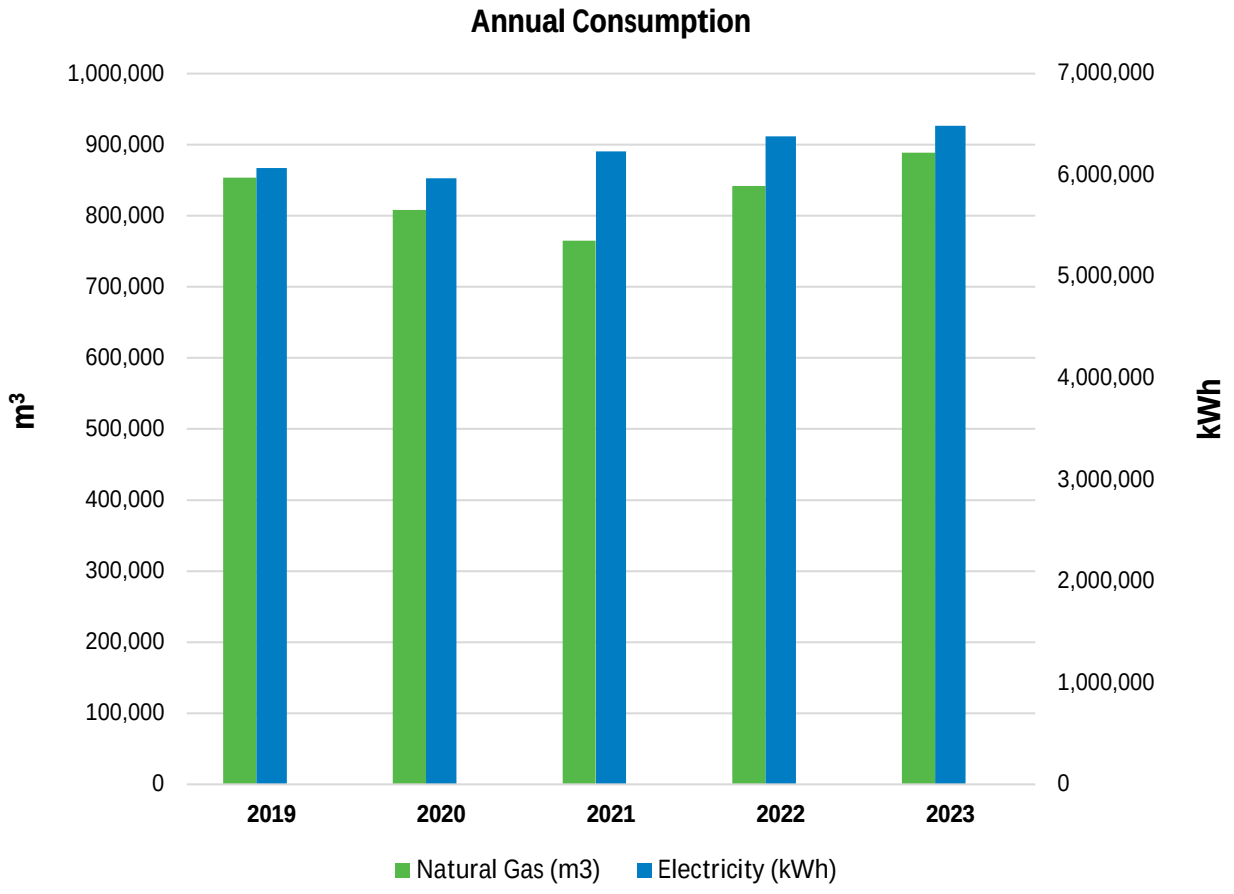


Figure 5. *Historic Annual Utility Consumption*

Figure 6 below shows the historical solar generation through the years from existing solar panels. The panels' expected output is around 50,000 kWh of electricity annually as depicted. Due to some inverter issues in 2022, the panels were unable to operate as expected for six (6) months which provoked a dip in production that year. The generated electricity is injected into the grid to supply the Ontario grid with green electrons. While solar-generated electricity is not used directly on-site, it reduces Holland Bloorview's annual GHG emissions. Effectively, the electrons generated by the solar panels will offset Holland Bloorview's consumption by being injected back into the grid for others to use. This cancels out ~50,000 kWh worth of grid emissions.

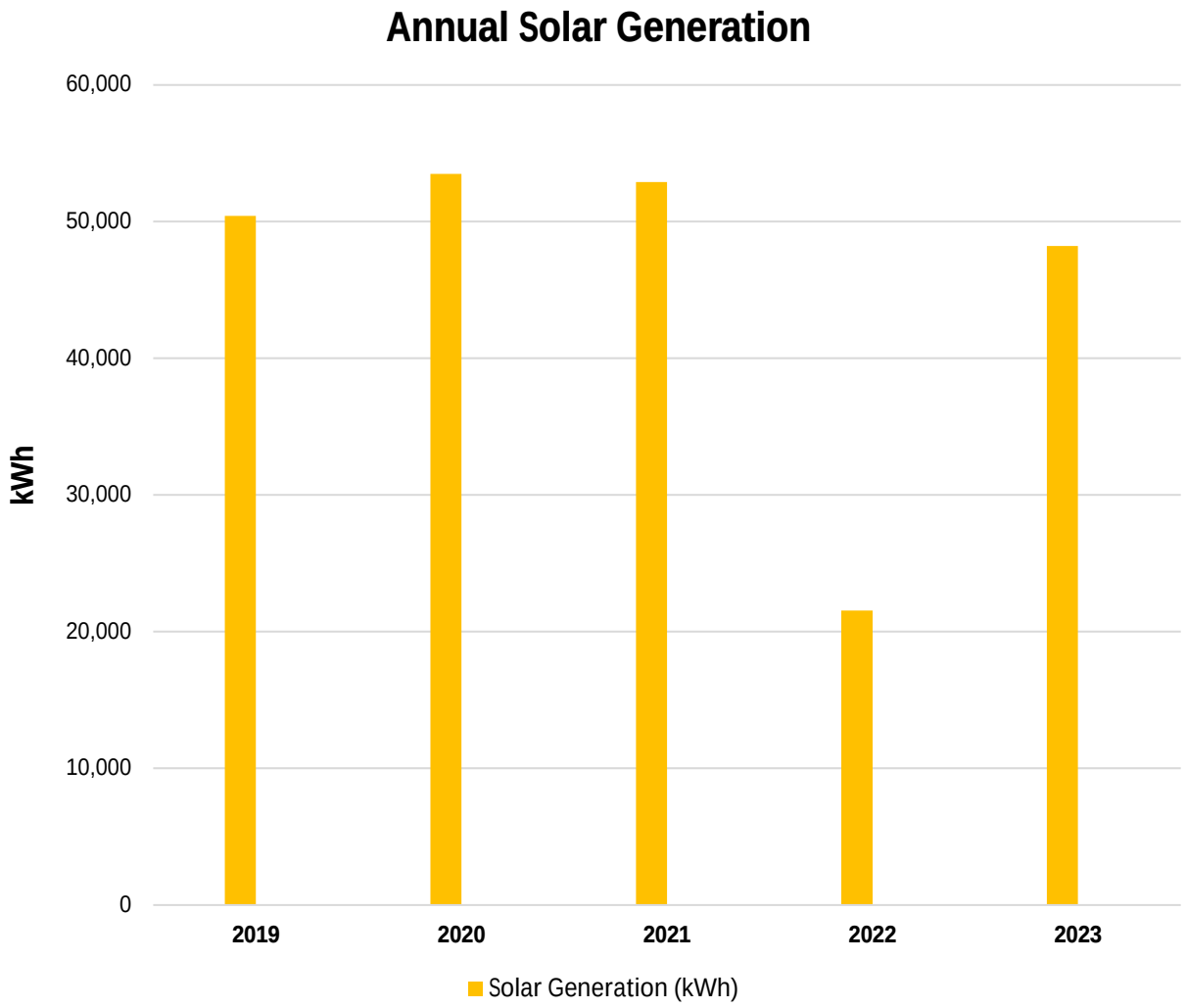


Figure 6. *Historic Annual Solar Generation*

5.3 Historical GHG Emissions

Greenhouse gas (GHG) emissions are expressed in terms of equivalent tonnes of Carbon Dioxide (tCO_2e). The GHG emissions associated with a facility are dependent on the fuel source — for example, hydroelectricity produces fewer greenhouse gases than coal-fired plants, and light fuel oil produces fewer GHGs than heavy oil.

Electricity from the grid in Ontario is relatively "clean", as the majority is derived from low-GHG nuclear power and hydroelectricity, and coal-fired plants have been phased out. Scope 1 (such as natural gas directly used in facilities) and scope 2 (such as purchased electricity) consumptions have been converted to their equivalent tonnes of greenhouse gas emissions in the table below. Scope 1 represents the direct emissions from sources owned or controlled by the institution, and Scope 2 consists of indirect emissions from the consumption of purchased energy generated upstream from the institution.

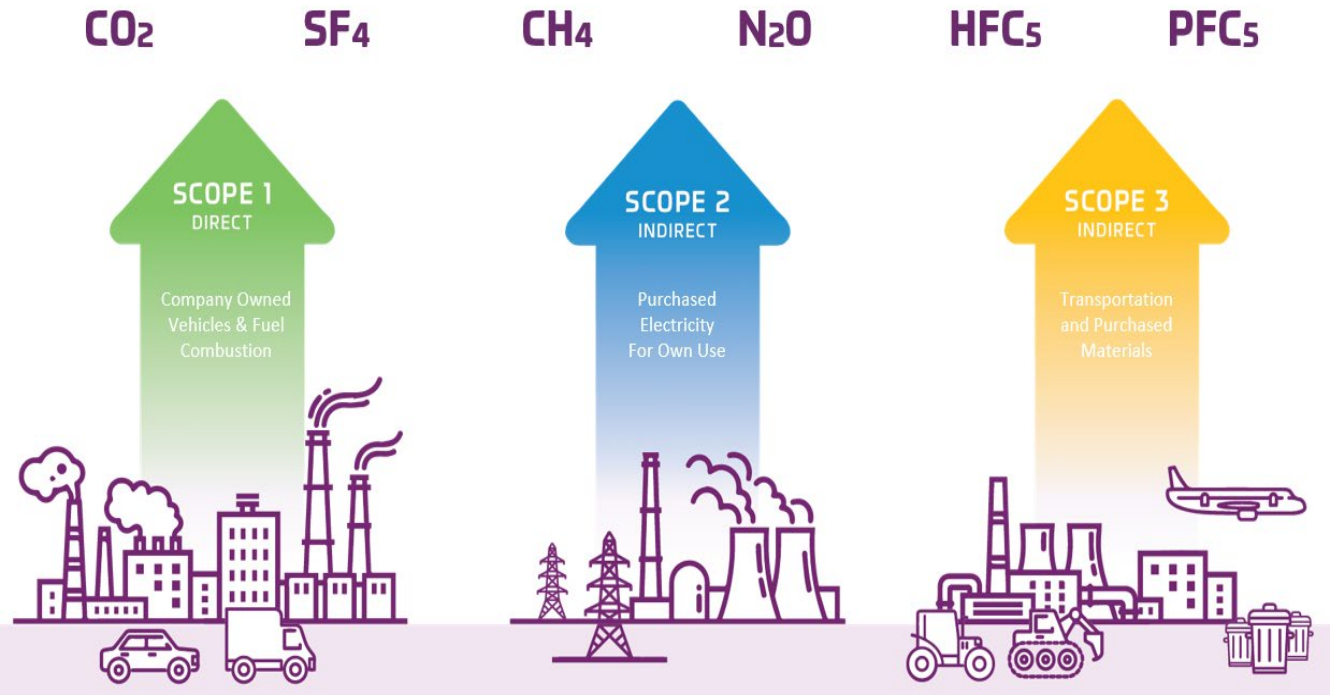


Figure 7. *Examples of Scope 1 and 2*

In order to determine the emissions from each scope, emission factors need to be calculated and used. An emission factor is a coefficient that describes the potency at which a given activity releases greenhouse gases into the atmosphere. They are also referred to as conversion factors, emission intensity and carbon intensity. The emission factors used in this plan come from *Canada Infrastructure Bank* and can be found in the table below. It is important to note the significant increase between 2021 and 2022 is due to nuclear generators coming offline to be refurbished in Ontario. While these nuclear plants are being renovated, the demand is picked up by natural gas plant which renders the grid electricity more carbon intensive.

Table 4 below shows the GHG emission factors used to calculate Holland Bloorview's total emissions from scopes 1 and 2.

Fuel (Units)	Scope	2019	2020	2021	2022	2023
Natural Gas (gCO_2e/m^3)	1	1,921	1,921	1,921	1,921	1,921
Electricity (gCO_2e/kWh)	2	25	26	26	71	83

Table 4. *GHG Emissions Factors*

The greenhouse gas emissions for Holland Bloorview Kids Rehabilitation Hospital have been tabulated using the emission factors and are represented in the table and graph below. As noted above both natural gas and electricity consumption are impacted by weather trends. A colder year will lead to a higher consumption of natural gas through heating and a hotter summer will lead to a higher consumption of electricity through cooling. As well, in 2023, Holland Bloorview completed an 11,000 square foot expansion of its research institute.

GHG Emissions (tCO_2e)	2019	2020	2021	2022	2023
Natural Gas (Scope 1)	1,640	1,553	1,470	1,617	1,707
Electricity (Scope 2)	151	153	162	449	533
Total Scope 1 & 2 Emissions	**1,791**	**1,705**	**1,632**	**2,066**	**2,240**

Table 5. *Historic Greenhouse Gas Emissions*

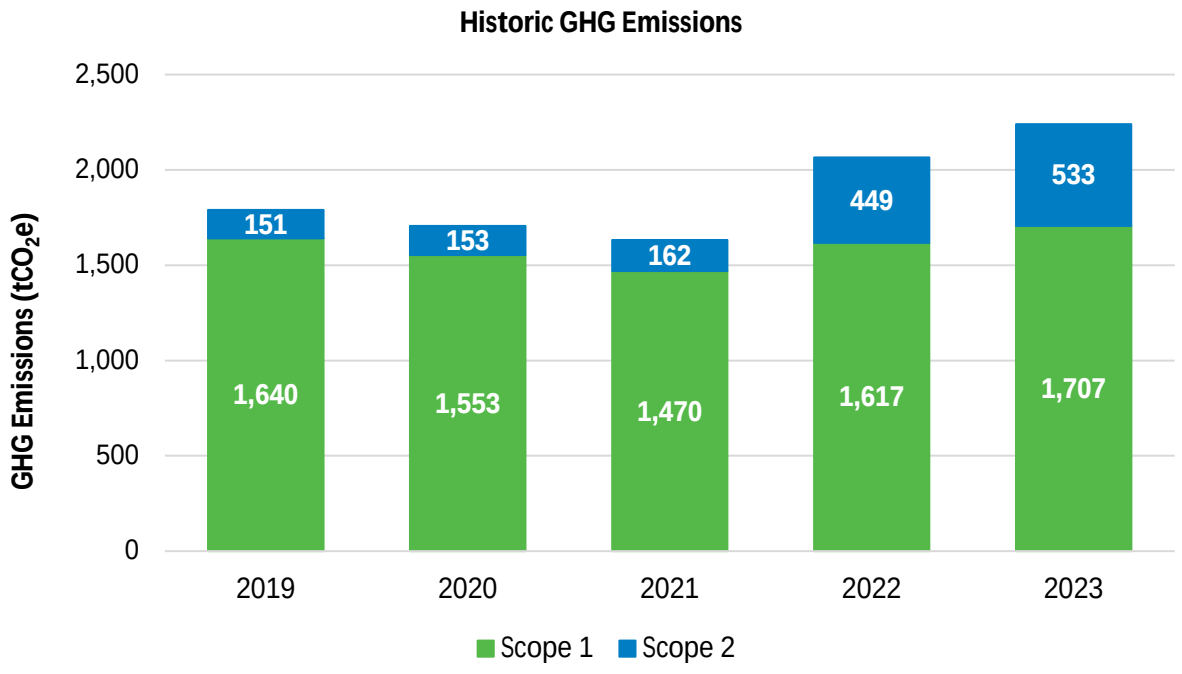


Figure 8. *Historical GHG Emissions*

6. Proposed Energy Conservation & GHG Reduction Measures

Several conservation and GHG reduction strategies are planned over the next five years. They are summarized below outlining savings potential of the targeted utilities and estimated project costs as well as planned project timelines. Note that for simplicity and due to still-to-be-confirmed timing of project completion, we are showing a linear progression of the annual savings shown in section 7 of the report. This means that, in 2024, 1/5 of the savings will affect the forecasted consumption, in 2025, 2/5 and so on.

Holland Bloorview is committed to continuing its work over the next 5-years to explore additional opportunities to drive utility consumption down and reduce GHGs.

Measure	Estimated Annual Savings			Project Cost	Simple Payback (Years)	Project Timelines
	Electricity (kWh)	Natural Gas (m^3)	Savings ($)			
Building automation upgrade including chiller plant optimization; increases efficiency of building-wide cooling	403,552	44,429	$70,370	$500,000	7.1	2024 - 2028
Burner retrofit on the hot water boilers; increases efficiency of heating water	0	26,657	$93,300	$300,000	3.2	2024
Adding variable frequency drives to pumps; increases energy efficiency for heat, ventilation and cooling systems	518,888	0	$72,644	$500,000	6.9	2024
Upgrades to legacy light fixtures to LED; reduces electricity use	346,359	-4,416	$46,966	$500,000	10.6	2025 - 2028
Adding to solar panel array; decreases electrical energy use	26,250	0	$3,675	$75,000	20.4	2025- 2028
Total	**1,295,049**	**66,670**	**$286,955**	**$1,875,000**	**9.7**	**-**

Table 6. *Proposed Measures*

7. Holland Bloorview Kids Rehabilitation Hospital Outlook

a. Utility Consumption Forecast

By implementing the recommended measures stated in the previous section, Holland Bloorview projects electricity and natural gas utility consumption as tabulated below. The percentage of change is based on the data from the baseline year of 2023.

Utility	2023 (baseline)	2024		2025		2026		2027		2028		2029	
		Units	% Change	Units	% Change	Units	% Change	Units	% Change	Units	% Change	Units	% Change
Natural Gas (m^3)	888,573	857,446	4%	848,560	5%	839,674	6%	830,788	7%	821,903	8%	821,903	8%
Electricity (kWh)	6,437,880	5,491,922	15%	5,411,212	16%	5,304,252	18%	5,223,541	19%	5,142,831	20%	5,142,831	20%

Table 7. *Forecast of Annual Utility Consumption from 2024 to 2029*

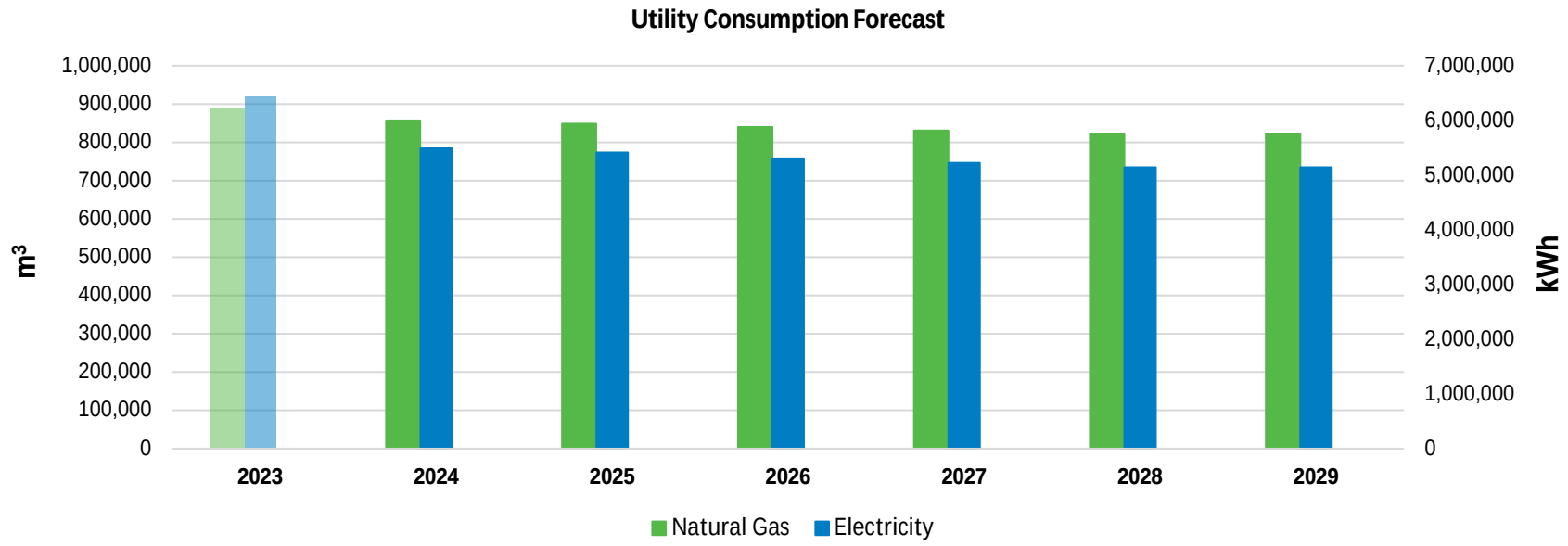


Figure 9. *Forecast of Annual Energy Consumption*

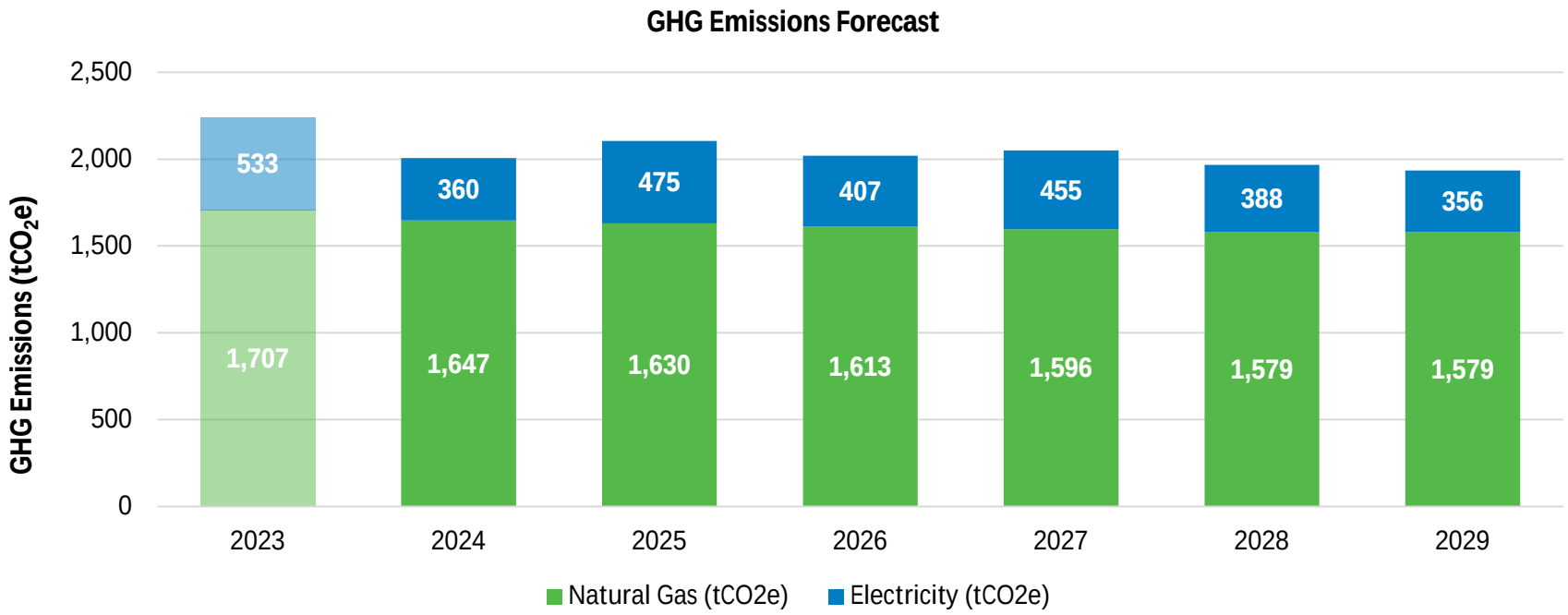
b. GHG Emissions Forecast

The organizational GHG emissions for Holland Bloorview Kids Rehabilitation Hospital are calculated based on the forecasted site-wide energy consumption data analyzed in the previous section and are tabulated in the following table. The percent of reduction is based on the baseline year of 2023.

Utility Source (tCO_2e)	2023 (baseline)	2024	2025	2026	2027	2028	2029
Natural Gas (scope 1)	1,707	1,647	1,630	1,613	1,596	1,579	1,579
Electricity (scope 2)	533	360	475	407	455	388	356
Totals	**2,240**	**2,007**	**2,105**	**2,020**	**2,051**	**1,967**	**1,935**
Reduction from Baseline Year		**10%**	**6%**	**10%**	**8%**	**12%**	**14%**

Table 8. *Forecast of Annual Greenhouse Gas Emissions from 2024 to 2029*

Figure 10. *Forecast of Annual Greenhouse Gas Emissions*



8. Closing Comments

Thank you to all who contributed to Holland Bloorview Kids Rehabilitation Hospital's energy conservation and demand management plan. We strive to operate a sustainable and efficient facility so we can effectively maximize our ability to provide the highest quality of health care services possible. We commit to building upon this plan and demonstrating impactful progress along the way.

On behalf of the executive leadership team at Holland Bloorview Kids Rehabilitation Hospital, I approve this energy conservation & demand management plan.

X 

Stewart Wong

Vice president, communications, strategy and sustainability

This ECDM plan was created through a collaborative effort between Holland Bloorview Kids Rehabilitation Hospital and Blackstone Energy Services.

9. Appendix 1 – Heating & Cooling Degree Days

9.1 Background

For the purpose of the analysis found in this plan, an introduction to heating and cooling degree days is being provided below. This will allow for better understanding of weather impacts on the facilities. The reason degree days are measured is to allow a comparison between energy consumption relative to weather. By doing this, we can determine whether any fluctuations in energy consumption are a direct result of weather. If not, then we can quickly recognize this and isolate any efficiency issues to eliminate energy waste.

"**Heating Degree Days**", or "**HDD**", are a measure of how much (in degrees), and for how long (in days), outside air temperature was lower than a specific "base temperature". They are used for calculations relating to the energy consumption required to heat buildings.

"**Cooling Degree Days**", or "**CDD**", are a measure of how much (in degrees), and for how long (in days), outside air temperature was higher than a specific base temperature. They are used for calculations relating to the energy consumption required to cool buildings.

For the auditing period for the facility in 2023, HDD and CDD were collected from Natural Resources Canada (Toronto weather station) and is summarized in the table below.

Month	Heating Degree Days (13°C or less)	Cooling Degree Days (14°C or more)
January	394	0
February	364	0
March	349	0
April	188	6
May	73	38
June	0	145
July	0	273
August	0	221
September	0	171
October	43	54
November	232	0
December	293	0
Totals	**1,937**	**909**

Table 9. *HDD & CDD January to December 2023*

Figure 10 below shows the relationship between cooling degree days and electricity consumption on an annual basis. A clear correlation between the two variables can be observed, as the cooling degree days increase or decrease through the years, the electricity consumption follows suit.

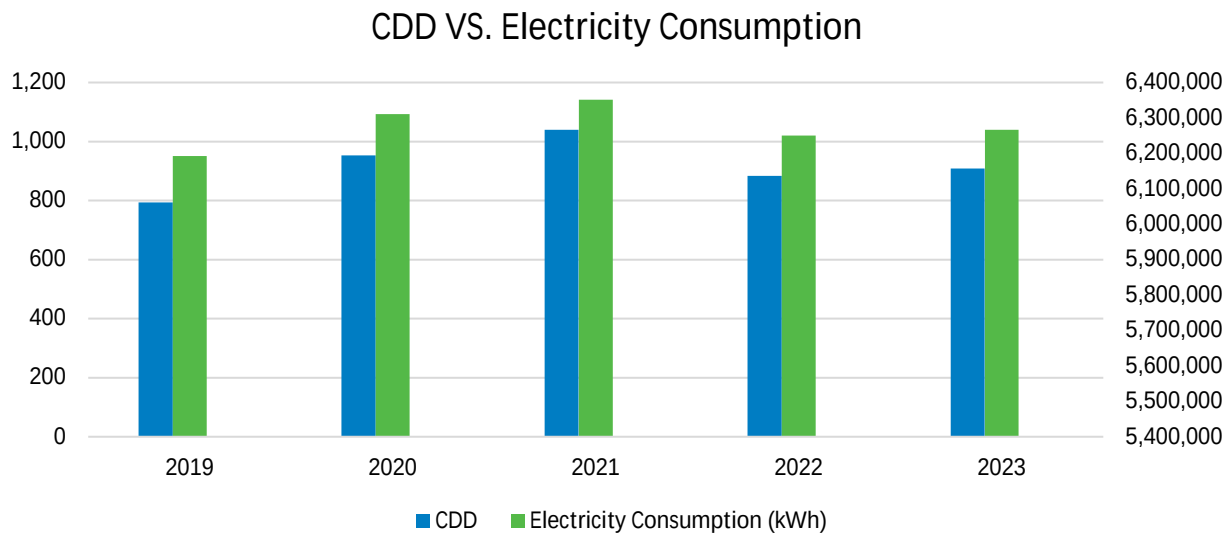


Figure 11. *CDD VS. Electricity Consumption*

In the same way as Figure 10, Figure 11 below depicts the relationship between heating degree days and natural gas consumption between 2019 and 2023. The chart shows a strong correlation between the two variables for the first four (4) years. In the fifth year, the natural gas consumption spikes while the heating degree days are at their lowest. This can be due to a change in facility operations (such as Holland Bloorview's 11,000 square foot addition that opened in 2023), or an addition of process loads, such as imaging equipment, which are not weather sensitive.

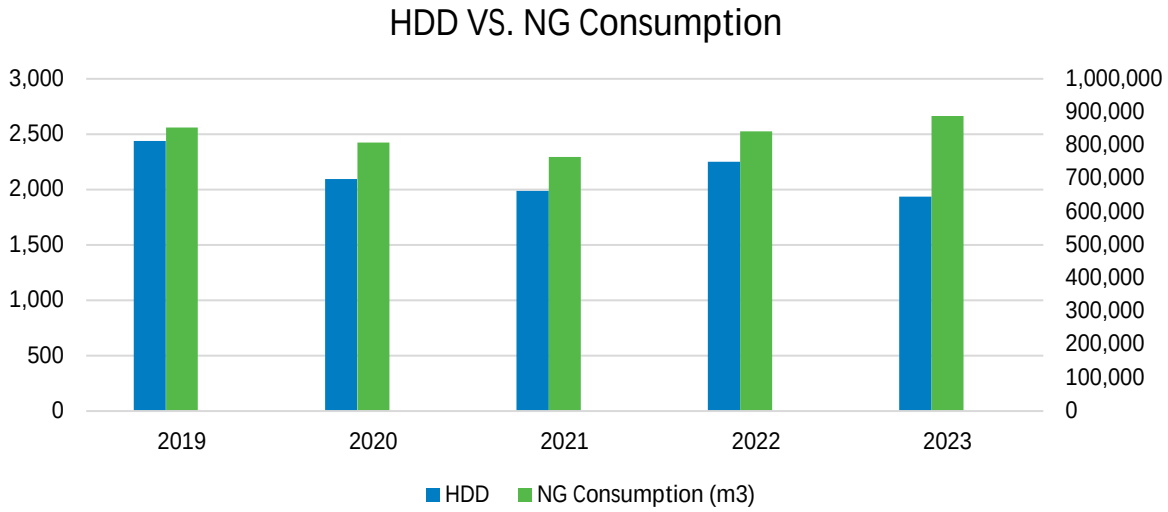


Figure 12. *HDD VS. NG Consumption*

a. Electricity Analysis

The figure below displays a breakdown of electricity consumed by month for the consumption period analyzed. This consumption is also compared against local weather effects and demonstrates that electricity consumption has a strong correlation with the weather.

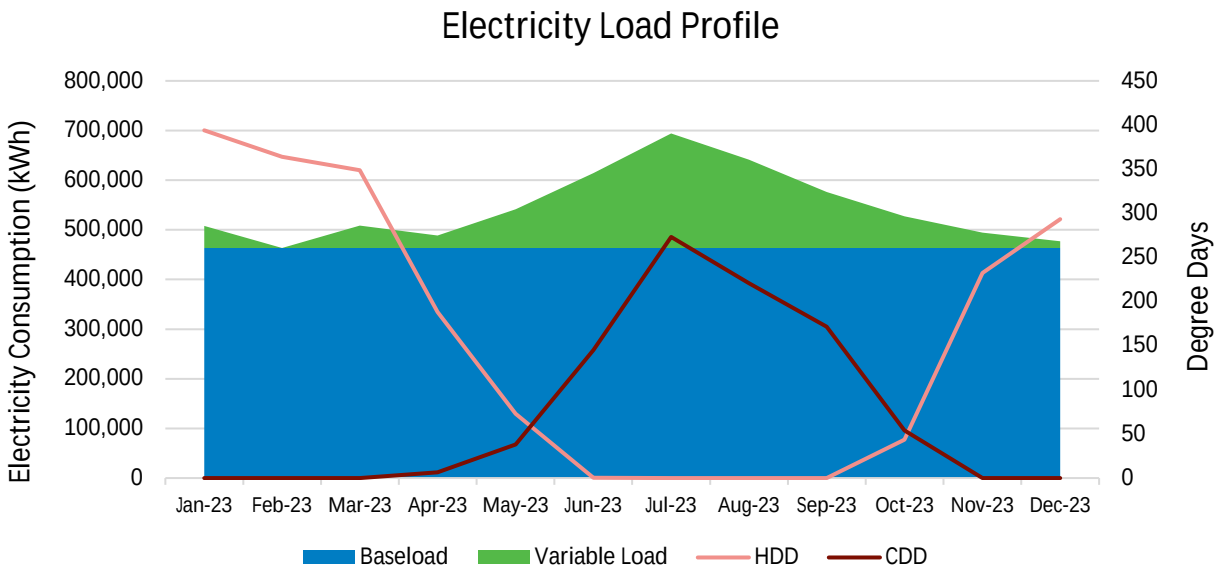


Figure 13. *Electricity Load Profile*

After performing a regression analysis, it was confirmed that the facility's electricity consumption profile was highly dependent on weather conditions with a coefficient of determination of 0.94 (R^2 = 0.94). While the facility's baseload is responsible for the majority of its consumption, cooling needs will determine the facility's peaks.

b. Natural Gas Analysis

The graphic below demonstrates that natural gas consumption is strongly correlated with heating load. Consumption increases commensurately with HDD, as demand for heating increases.

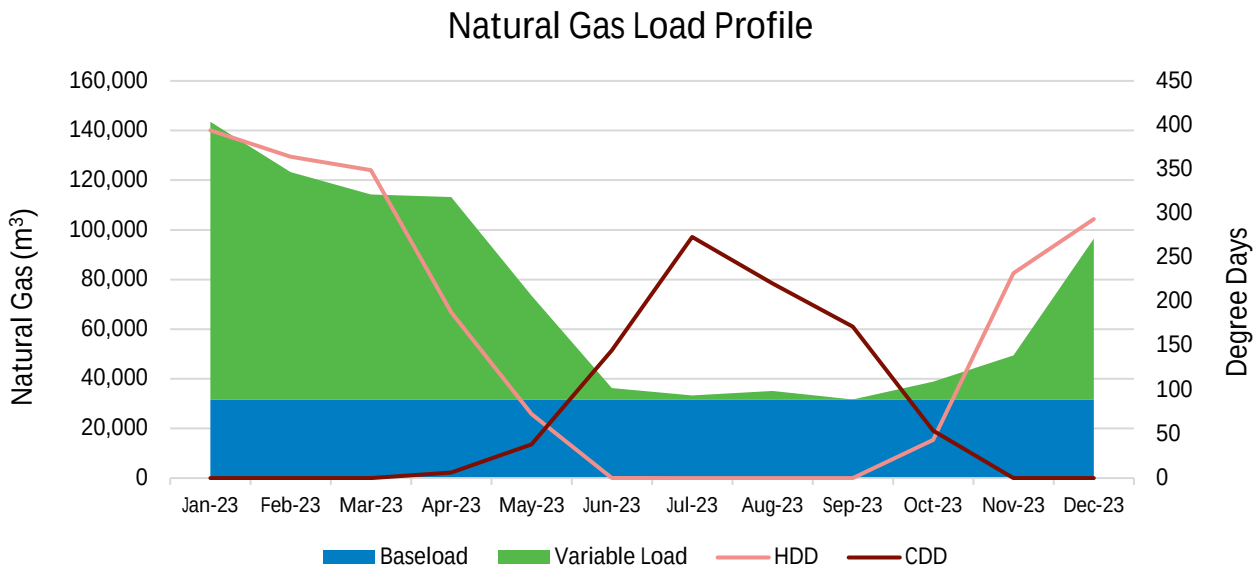


Figure 14. *Natural Gas Load Profile*

Following a regression analysis to confirm the correlation between natural gas consumption and weather, it was determined that there was a significant correlation between the two. Although not as important as the relationship between electricity consumption and cooling degree days, the coefficient of determination regarding natural gas consumption and heating degree days remains fair at 0.82 (R^2 = 0.82).

10. Appendix 2 – List of Tables & Figures

Tables

Figures