
2019 - 2023 ENERGY CONSERVATION AND DEMAND MANAGEMENT PLAN

NORTHUMBERLAND HILLS HOSPITAL

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NORTHUMBERLAND HILLS HOSPITAL

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1 INTRODUCTION

This is Northumberland Hills Hospital's 2019 to 2023 energy conservation and demand management (ECDM) plan for the Northumberland Hills Hospital located at 1000 DePalma Drive in Cobourg, Ontario. The Northumberland Hills Hospital is depicted in Figure 1.



Figure 1: Northumberland Hills Hospital

ECDM plans are mandated by Ontario Regulation 507/18 under the Electricity Act. This regulation requires public agencies, such as municipalities, education facilities and hospitals to report energy consumption and greenhouse gas (GHG) emissions annually beginning in 2013, and to develop, implement and regularly update ECDM plans.

Ontario Regulation 507/18 specifies that ECDM plans are comprised of the following components.

- A summary of annual energy consumption and GHG emissions.
- A description of previous (implemented), current (implementation in 2019) and proposed energy conservation measures (ECMs), including a forecast of expected results of current and proposed ECMs.

Accordingly, the objectives of this ECDM plan are as follows.

- Baseline performance: document previous and current energy and GHG performance.
- Energy conservation measures (ECMs): document previous, current and proposed ECMs.
- Energy and greenhouse gas (GHG) plan: establish 5-year energy and GHG performance targets and develop a roadmap to achieve those targets.

2 BASELINE ENERGY AND GREENHOUSE GAS (GHG) PERFORMANCE

The following is a summary of Northumberland Hills Hospital's baseline energy performance.

2.1 Previous energy and GHG performance

Northumberland Hills Hospital's 2014 ECDM plan focused on implementing general principles and policies for improving energy efficiency, rather than achieving objective energy performance targets. The following observations were noted with respect to Northumberland Hills Hospital's annual energy performance data between 2014 and 2018.

- Electricity: Annual electricity consumption was observed to decrease and consistently between 2014 through 2018.
- Natural gas: Annual natural gas consumption was observed to increase slightly and consistently between 2014 and 2018.
- GHG: Annual GHG emissions were observed to increase slightly between 2014 and 2018. This is because natural gas combustion tends to emit a greater quantity of GHGs per unit energy than Ontario grid electricity.

Electricity

Figure 2 summarizes previous electricity performance for the years 2014 through 2018.

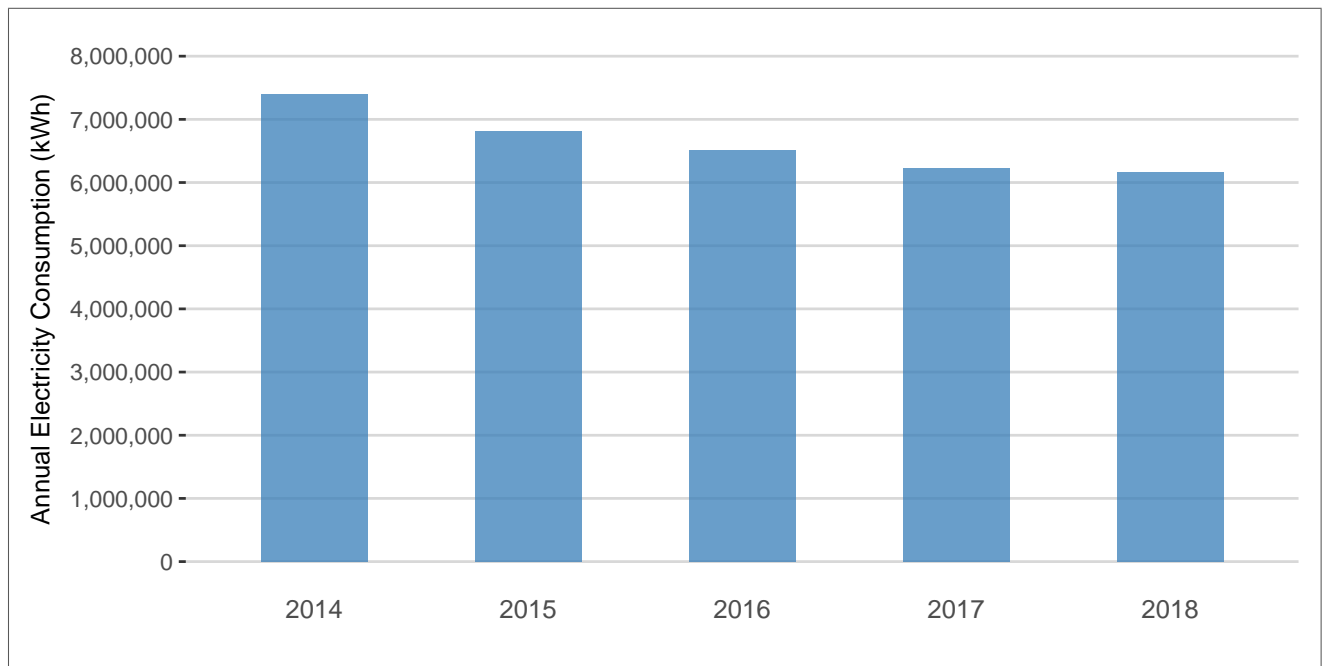


Figure 2: Annual Electricity Consumption

Natural gas

Figure 3 summarizes previous natural gas performance for the years 2014 through 2018.

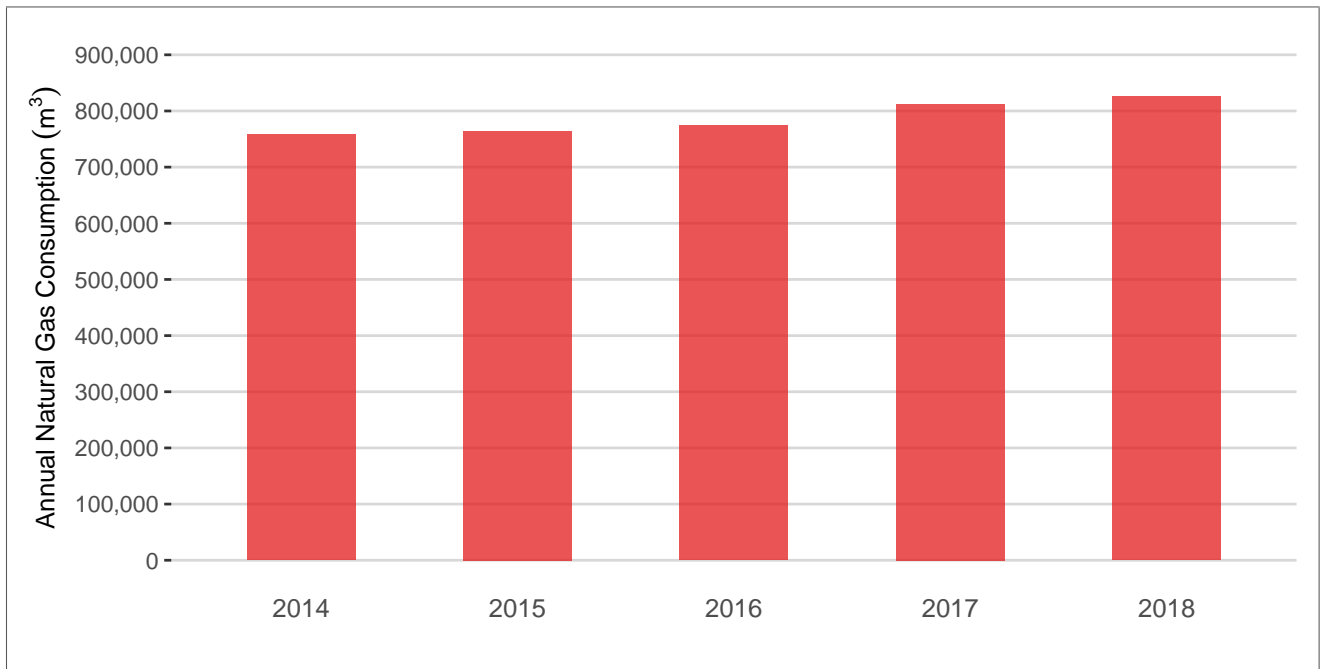


Figure 3: Annual Natural Gas Consumption

GHG

Figure 4 summarizes previous GHG performance for the years 2014 through 2018.

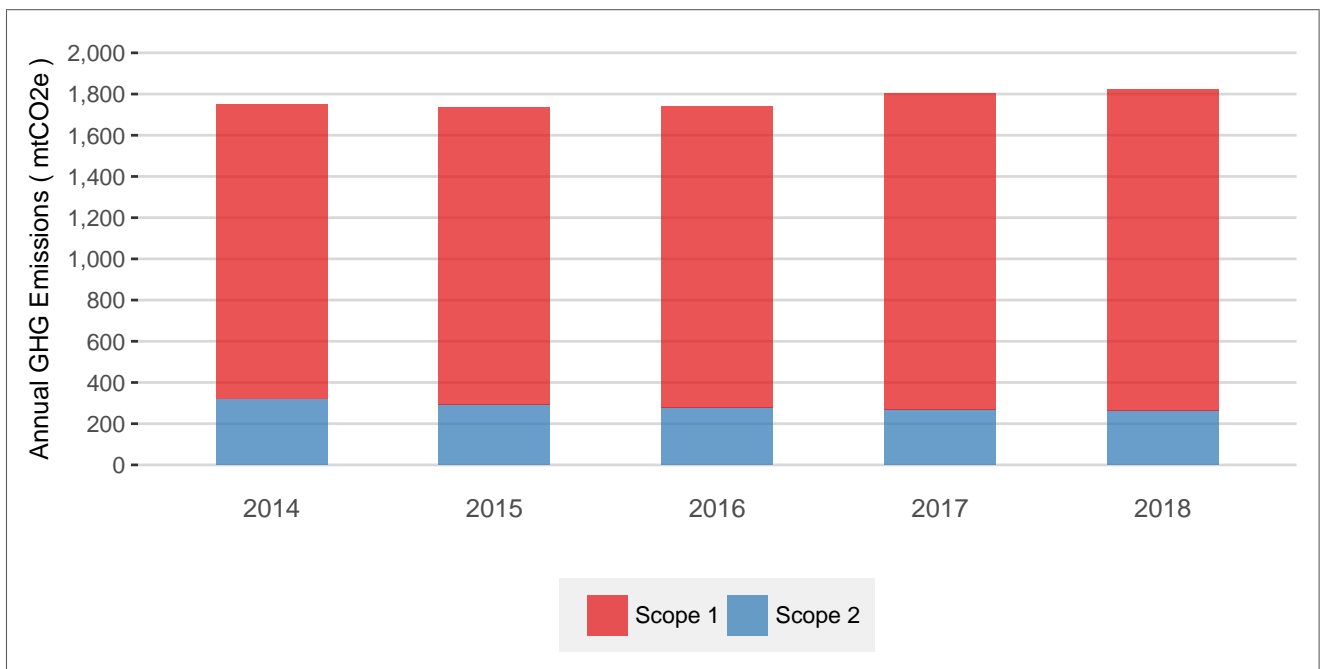


Figure 4: Annual GHG Emissions

- Scope 1 emissions: direct GHG emissions from owned or controlled sources (e.g. due to on-site natural gas combustion).
- Scope 2 emissions: indirect GHG emissions from the generation of purchased energy (e.g. due to grid electricity generated by a combustion turbine).

2.2 Current energy and GHG performance

Table 1 summarizes the current energy and GHG performance for the 2018 baseline year.

Table 1: Current energy and GHG performance (for year 2018)

Category	Source	Description	Unit	Value
Energy	Electricity	Annual consumption	[kWh]	6,157,542
		Annual consumption	[GJ]	22,167
		EUI ¹	[GJ/m ²]	0.096
	Natural gas	Annual consumption	[m ³]	825,972
		Annual consumption	[GJ]	30,561
		EUI	[GJ/m ²]	0.13
Combined	Annual consumption	[GJ]	52,728	
	EUI	[GJ/m ²]	0.23	
GHG	Electricity (scope 2)	Annual emissions	[mtCO ₂ e]	265
		GHGI ²	[mtCO ₂ e/m ²]	0.0011
	Natural gas (scope 1)	Annual emissions	[mtCO ₂ e]	1,559
		GHGI	[mtCO ₂ e/m ²]	0.0067
	Combined	Annual emissions	[mtCO ₂ e]	1,824
		GHGI	[mtCO ₂ e/m ²]	0.0079

¹ EUI = Energy use intensity.

² GHGI = GHG intensity.

3 ENERGY CONSERVATION MEASURES (ECMS)

3.1 Previous ECMs

Previously implemented ECMs are summarized in Table 2. Previously implemented ECMs were determined based on information provided by Northumberland Hills Hospital and the 2014 ECDM plan.

Table 2: Previously implemented ECM summary

ECM description	Implementation year
[-]	[yyyy]
General energy efficiency initiative ¹	2014
Staff energy efficiency training ²	2014-2018
Air distribution controls upgrade ³	2015-2016
LED lighting upgrades ⁴	2016
Steam distribution insulation upgrades ⁵	2018

1. An organization-wide initiative was taken to consider energy efficiency when purchasing new equipment.
2. Staff were educated regarding energy efficiency.
3. Variable frequency drives (VFDs) were implemented on all air handling units (AHUs) and variable air volume (VAV) boxes were implemented.

4. Signage lighting and approximately 860 lighting fixtures were upgraded to LED.
5. Thermal insulation improvements were implemented on steam distribution piping system valves and traps.

3.2 Current ECMs

ECMs currently being implemented in the year 2019 are summarized in Table 3. Currently implemented ECMs were determined based on information provided by Northumberland Hills Hospital. Energy and GHG savings associated with the combined heat and power (CHP) system were estimated based on a detailed engineering study that was previously completed concerning the CHP system.

Table 3: Currently implemented ECM summary

ECM description	Electricity savings	Natural gas savings	GHG savings	Utility cost savings	Capital cost	Simple payback
[-]	[kWh/yr]	[m ³ /yr]	[mtCO ₂ e/yr]	[\$/yr]	[\$]	[yr]
Combined heat and power	2,366,852	-317,863	-498	163,546 ¹	1,143,179 ²	4.8

¹ Includes \$75,000 annual operating cost increase for CHP system maintenance.

² Does not include funding incentive.

From Table 3, it can be seen that the combined heat and power (CHP) system currently being implemented is expected to significantly impact annual energy and GHG performance. A graphical rendering of the system can be seen in Figure 5.

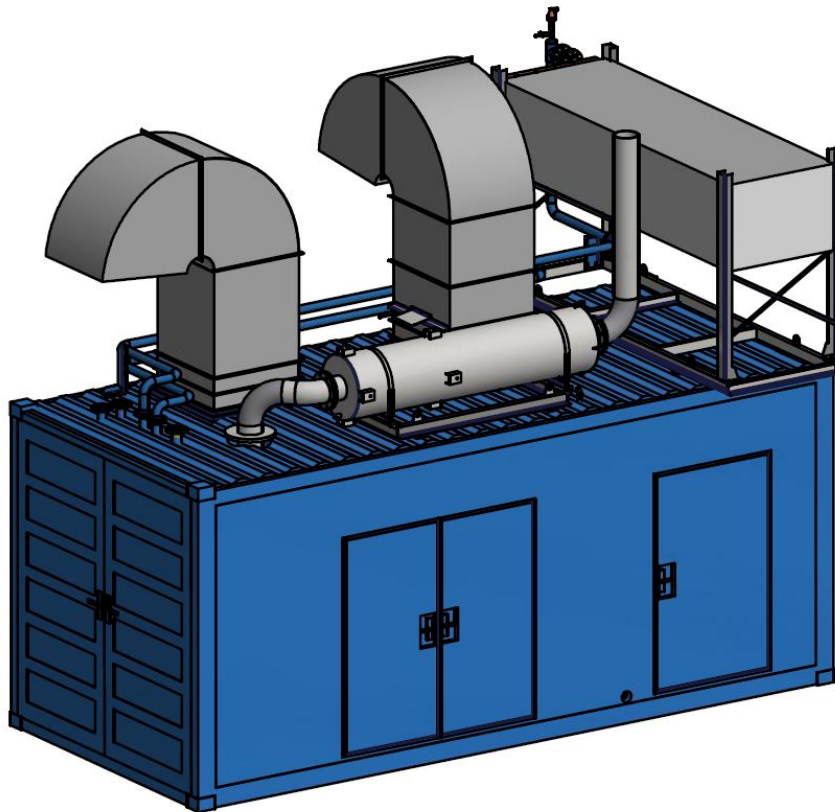


Figure 5: Combined heat and power system

3.3 Proposed ECMs

Proposed ECMs are summarized in Table 4. Proposed ECMs and associated energy and GHG savings were determined based on ECMs recommended in a detailed feasibility study that was previously completed concerning the proposed ECMs.

Table 4: Proposed ECM summary

ECM description	Electricity savings	Natural gas savings	GHG savings ¹	Utility cost savings	Capital cost ²	Simple payback
[-]	[kWh/yr]	[m ³ /yr]	[mtCO ₂ e/yr]	[\$/yr]	[\$]	[yr]
Recommissioning	34,444	6,441	14	6,621	38,783	5.9
Lighting upgrades	426,667	-7,542	4	95,995 ³	604,091	6.3
Demand control ventilation	292,778	42,755	93	52,700	508,218	9.6
Hot water pump conversion	47,500	0	2	5,232	56,942	10.9
Water conservation measures	0	5,234	10	24,549	270,161	11.0
Chiller plant control upgrade	160,833	0	7	22,190	248,613	11.2
Building envelope seal	5,556	5,502	11	2,357	38,412	16.3
Totals	967,779	52,390	141	209,644	1,765,220	8.4

¹ GHG savings estimated assuming 0.000043 mtCO₂/kWh for electricity (scope 2) and 0.001888 mtCO₂/m³ for natural gas (scope 1).

² Does not include funding incentive.

³ Includes \$35,500 annual operating cost savings.

Northumberland Hills Hospital intends to explore options for achieving similar energy and GHG performance results at reduced capital costs than those indicated in Table 4. To achieve this, the following options will be considered.

- **Energy policy enhancement.** Between 2014 and 2018, Northumberland Hills Hospital implemented energy policies described in its 2014 ECDM plan, which included financial, purchasing, design and construction practices that incorporate energy efficiency considerations. Consideration will be given to enhancing (making more advanced and detailed) and extending (applying to additional business areas) its energy policies.
- **Energy training and awareness program enhancement.** The change of human behaviour through energy education and awareness is often a cost and resource-efficient approach to improving energy efficiency. Effective programs typically involve increasing the awareness (conscious focus), education (technical competency), and empowerment (authority, encouragement and reward) of staff to make changes that improve energy efficiency. Consideration will be given to the more advanced energy training and empowerment of hospital staff to improve energy efficiency.
- **Additional energy audits.** Between 2014 and 2018, Northumberland Hills Hospital hired external consultants to perform various energy studies focused on identifying and/or exploring ECMs. Consideration will be given to performing additional energy audits focused on identifying and exploring lower-cost ECMs.
- **Energy monitoring and targeting program.** A systematic approach to measuring and regularly reviewing energy performance data can lead to significant energy performance improvements through the identification and root cause analysis of data anomalies. It also typically results in improved equipment condition and longevity. Consideration will be given to the implementation of such a program, including the potential installation of supplemental energy metering equipment.

3.4 Renewable energy

Additional consideration was given to renewable energy at Northumberland Hills Hospital. A solar photovoltaic (PV) electricity generation system was considered, based on an analysis that was previously completed concerning a potential solar PV system. Figure 6 depicts an image of the potential solar PV system considered.

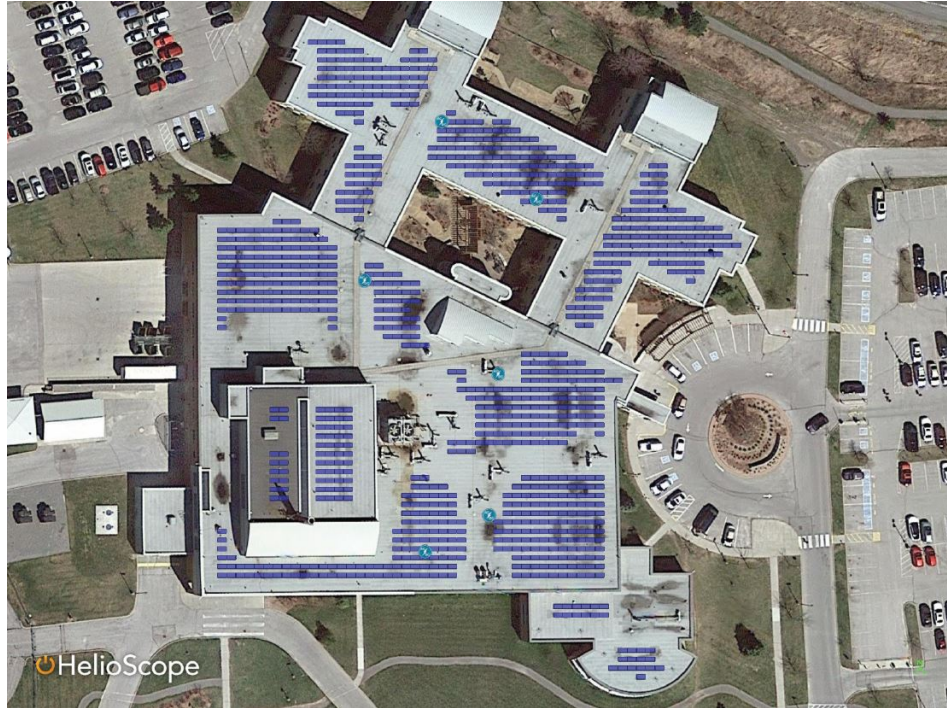


Figure 6: Solar PV electricity generation system

The following notes were made based on the previously completed solar PV system analysis.

- Electricity generating capacity: 300 kW (AC).
- Expected annual electricity generation: 430,000 kWh.

The following assumptions were applied to the above information to obtain the results presented in Table 5.

- Electricity utility cost rate (blended): 0.15 \$/kWh.
- Capital cost rate of solar PV system (installed): 4 \$/W.
- Funding incentive for solar PV system (based on annual electricity savings): 0.10 \$/kWh.

Table 5: Solar PV system ECM summary

ECM description	Electricity savings	Natural gas savings	GHG savings	Utility cost savings	Capital cost	Simple payback
[-]	[kWh/yr]	[m ³ /yr]	[mtCO ₂ e/yr]	[\$/yr]	[\$]	[yr]
Solar PV system	430,000	0	18	64,500	1,157,000	17.9

While it was considered, the implementation of solar PV electricity generation is not planned between the years 2019 and 2023.

4 ENERGY AND GHG PLAN

4.1 Energy and GHG targets

The energy and GHG targets were determined based on the energy and GHG performance that is estimated to result by implementing all current and proposed ECMs by 2023. The targets and are summarized in Table 6.

Table 6: Energy and GHG targets

Category	Description	Metric ¹	Units	2018 baseline performance	2023 target performance
Energy	Electricity consumption	Absolute	[kWh]	6,157,542	2,822,911
		Relative	[%]	100	46
	Natural gas consumption	Absolute	[m ³]	825,972	1,091,445
		Relative	[%]	100	132
GHG	GHG emissions	Absolute	[mtCO ₂ e]	1,824	2,182
		Relative	[%]	100	120

¹ Relative metrics are defined with respect to the 2018 baseline performance values.

To paraphrase Table 6, the 2023 energy and GHG targets are as follows.

- Electricity: To limit annual electricity consumption to 2,822,911 kWh.
- Natural gas: To limit annual natural gas consumption to 1,091,445 m³.
- GHG emissions: To limit annual GHG emissions to 2,182 mtCO₂e.

4.2 Energy and GHG roadmap

To achieve the energy and GHG targets, a roadmap was developed as follows.

1. ECMs from Tables Tables 3 and 4 were prioritized in order of ascending simple payback period.
2. ECMs were assumed to be implemented between 2019 and 2023 according to the timeline indicated in Figure 7. Note that the timeline indicates the year by which implementation was assumed to be completed.
3. Changes in electricity and natural gas consumption associated with each ECM were taken from Tables 3 and 4 and projected according to the same implementation timeline. Results were plotted in Figure 7.
4. Changes in GHG emissions associated with each ECM were taken from Tables 3 and 4 and projected according to the same implementation timeline. Results were plotted in Figure 7.

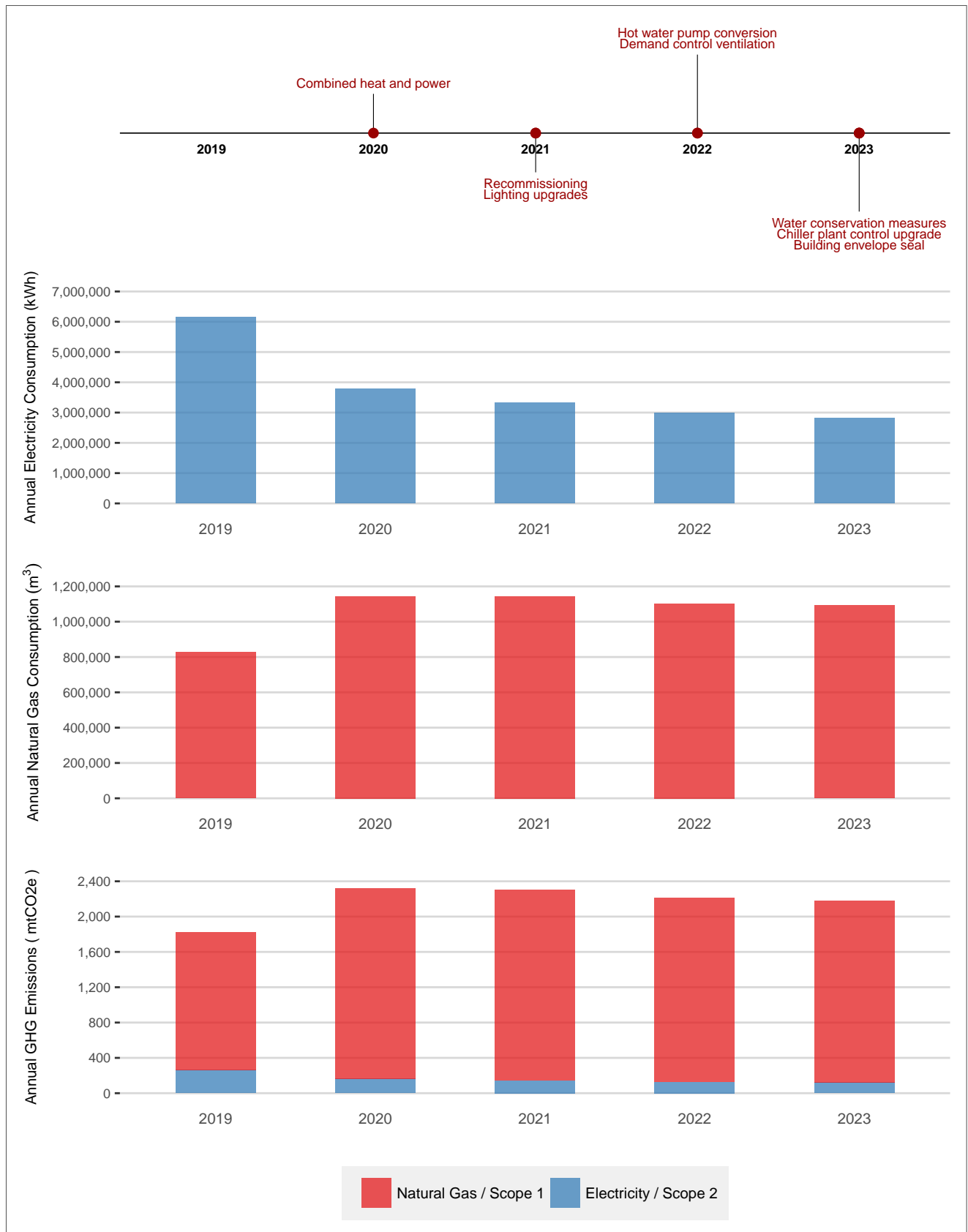


Figure 7: Energy and GHG Roadmap

5 SUMMARY

This document summarizes Northumberland Hills Hospital's 2019 to 2023 ECMD plan for the Northumberland Hills Hospital facility, located at 1000 DePalma Drive in Cobourg, Ontario, as required by Ontario Regulation 507/18 under the Electricity Act. The following steps were taken.

1. Baseline energy and GHG performance and documented.
2. ECMs were documented, including those previously implemented, those currently being implemented in the year 2019, and those proposed for future implementation. Results are summarized in Table 7.
3. Based on the above, and a review of the 2014 ECMD plan, an energy and GHG plan extending from 2019 to 2023 was developed, consisting of targets and a roadmap for achieving those targets. Results are summarized in Table 8.

Table 7: Summary of current and proposed ECMs considered

ECM category	ECM description	Electricity savings	Natural gas savings	GHG savings ¹	Utility cost savings	Capital cost ²	Simple payback
[-]	[-]	[kWh/yr]	[m ³ /yr]	[mtCO ₂ e/yr]	[\$/yr]	[\$]	[yr]
Current	Combined heat and power	2,366,852	-317,863	-498	238,546 ³	712,207	4.4
Proposed	Recommissioning	34,444	6,441	14	6,621	38,783	5.9
	Lighting upgrades	426,667	-7,542	4	95,995 ⁴	604,091	6.3
	Demand control ventilation	292,778	42,755	93	52,700	508,218	9.6
	Hot water pump conversion	47,500	0	2	5,232	56,942	10.9
	Water conservation measures	0	5,234	10	24,549	270,161	11.0
	Chiller plant control upgrade	160,833	0	7	22,190	248,613	11.2
	Building envelope seal	5,556	5,502	11	2,357	38,412	16.3
Combined	Totals	3,334,631	-265,473	-357	448,190	2,477,427	5.5

¹ GHG savings estimated assuming 0.000043 mtCO₂/kWh for electricity (scope 2) and 0.001888 mtCO₂/m³ for natural gas (scope 1).

² Northumberland Hills Hospital intends to explore options for achieving similar energy and GHG performance results at reduced capital costs.

³ Includes \$75,000 annual operating cost increase, based on detailed engineering study.

⁴ Includes \$35,500 annual operating cost savings, based on detailed feasibility study.

Table 8: Annual energy and GHG performance summary

Category	Source	Description	Unit	2018 baseline	2023 target	Savings
Energy	Electricity	Absolute consumption	[kWh]	6,157,542	2,822,911	3,334,631
		Relative consumption ¹	[%]	100	46	54
	Natural gas	Absolute consumption	[m ³]	825,972	1,091,445	-265,473
		Relative consumption	[%]	100	132	-32
	Combined	Absolute consumption	[GJ]	52,728	50,546	2,182
		Relative consumption	[%]	100	96	4.1
GHG	Electricity (scope 2)	Absolute emissions	[mtCO ₂ e]	265	121	143
		Relative emissions	[%]	100	46	54
	Natural gas (scope 1)	Absolute emissions	[mtCO ₂ e]	1,559	2,061	-501
		Relative emissions	[%]	100	132	-32
	Combined	Absolute emissions	[mtCO ₂ e]	1,824	2,182	-358
		Relative emissions	[%]	100	120	-20

¹ Relative metrics are defined with respect to the 2018 baseline performance values.

The 2023 target results are significantly influenced by the expected impact of the combined heat and power (CHP) system currently being implemented. While a decrease in energy consumption of 4.1% is expected at the Northumberland Hills Hospital, a greater decrease in global energy consumption is expected because waste heat is not typically recovered in grid electricity generation processes.