June 2024

Centre for Addiction and Mental Health 2024-2029 Energy Conservation and Demand Management Plan

Management sign-off

I confirm that the Centre for Addiction and Mental Health's senior management has reviewed and approved this 2024-2029 Energy Conservation and Demand Management Plan.

Signature: 

Name: Douglas Weaver **Date:** 28 June 2024

Title: Senior Project Director

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 the Centre for Addiction and Mental Health

The Centre for Addiction and Mental Health (CAMH) is Canada's largest mental health teaching hospital and one of the world's leading research centres in its field. With a dedicated staff of more than 5,000 physicians, clinicians, researchers, educators and support staff, CAMH offers outstanding clinical care to more than 38,000 patients each year. CAMH operates multiple facilities that span up to 1,873,354 ft^2 which have been undergoing a multi-year and phase redevelopment.

This Energy Conservation and Demand Management (ECDM) plan addresses the primary facilities making up CAMH: Queen Street Site, Queen Street Site - Phase 1B, Queen Street Site – Phase 1C, 250 College Street and White Squirrel Way.

Table 1 CAMH sites

Site	Address	Building Area (ft^2)	Description
Queen Site	1001 Queen Street West Toronto ON M6J 1H4	378,810	Mental health facility
Queen Street Site – Phase 1B	100 Stokes Street Toronto ON M6J 1H4	385,500	Mental health facility
Queen Street Site – Phase 1C	101 Stokes Street Toronto ON M6J 1H4	747,107	Mental health facility
250 College Street	250 College Street Toronto, ON M5T 1R8	273,197	Research facility
White Squirrel Way	30, 40, 50, 60 White Squirrel Way Toronto, ON M6J 1H4	88,740	Mental health facility

2. Planning horizon and scope

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

3. Leadership in sustainability

CAMH is committed to run integrated, sustainable and highly energy efficient healthcare facilities in support of a sustainable future. CAMH aims to be a leader in energy efficiency and corporate sustainability among peers. It continues to collaborate with other hospitals and work towards increasing the level of environmental sustainability across the healthcare sector. As part of its commitment to sustainability and energy efficiency, all new buildings on the main Queen Street

campus have been designed and built with several energy and environmental initiatives to achieve LEED Gold certification for construction, at minimum. The current Phase 1D Forensics Project and Phase 1D Research Building form part of the last phases of redevelopment at CAMH and are scheduled to achieve respectively LEED Gold and LEED Platinum certification upon their completion in 2028 and 2027.

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

1. Energy and water progress compared to targets

In the previously approved ECDM plan posted in 2019, CAMH set an objective to operate the existing buildings in the most energy efficient and cost-effective way, while ensuring that the new buildings meet the required standard of energy performance excellence. Furthermore, to improve energy awareness and education to nurture an environmentally sustainable culture.

1.1 Queen Site

The 2019 ECDM plan targeted an overall GHG reduction of 1,123 tonnes eCO_2 for all CAMH sites. Table 2 presents the actual, weather-normalized performance results from the 2023 calendar year compared to the 2018 baseline for the Queen Site and Phase 1B and a 2021 baseline for Phase 1C, which resulted in net utility cost savings of $296,013.

Table 2 Queen Site: Energy savings vs 2018 baseline

	2019 Plan Target savings		Actual savings (2023 vs 2018 baseline)[1]					
Site(s)	**$**	**GHG (tonnes eCO_2)**	**Site(s)**	**Utility**	**Units**	**%**	**$**	**GHG (tonnes eCO_2)**
All CAMH sites	$514,748	1,123	**Queen Site**	Electricity (kWh)	4,340,284	53.0%	$694,445	130
			Phase 1B		306,598	3.8%	$49,056	9
			Phase 1C[2]		683,359	6.1%	$109,337	21
			Queen Site, 1B, 1C	Natural Gas (m^3)	-1,687,349	-84.2%	-$556,825	-3,233
				Total Energy (ekWh)	**-12,133,819**	**-25.3%**	**$296,013**	**-3,073**

Monthly savings graphs help identify the periods of recorded savings or increases. On the graphs in Figure 1 through Figure 9, 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.

[1] Using 2024 utility rates: Electricity $0.16/kWh, gas $0.33/$m^3$, water $4.30/$m^3$.
[2] Phase 1C used a 2021 electricity baseline, as the facility only opened in 2020.

The Queen Site electricity consumption trend over the last 5 years in Figure 1 demonstrates savings in each of the 5 years, with the savings increasing significantly starting in 2021. This may be attributed to the change in operations around building demolition. The 5-year cumulative savings were 13,442,150 kWh valued at $2,150,744.

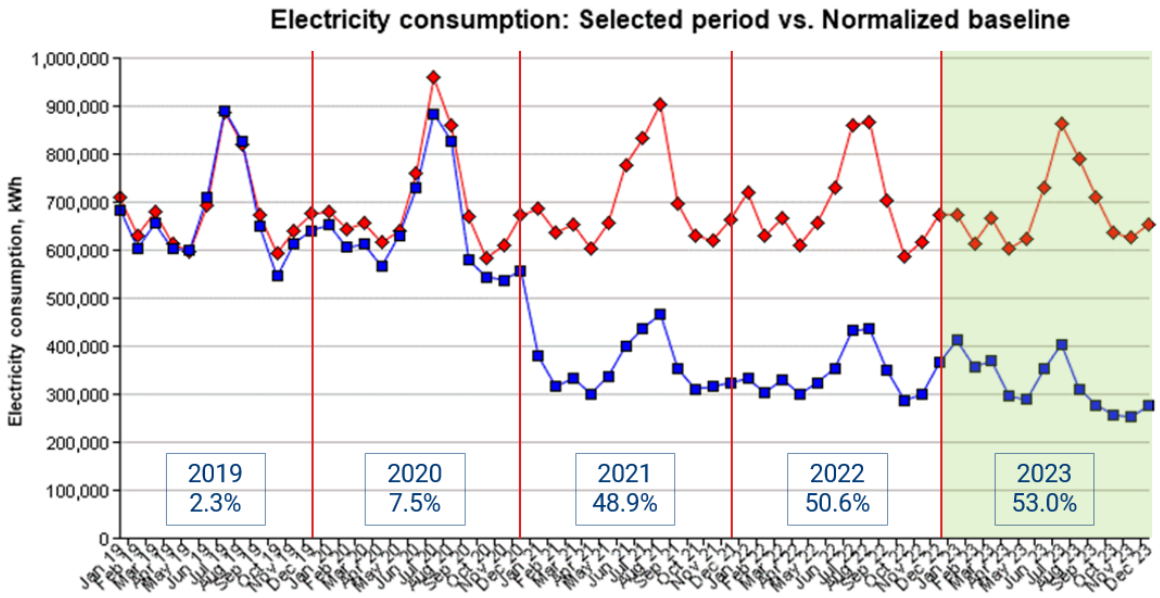


Figure 1 Queen Site: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

The electricity consumption trend at the Phase 1B location for the past 5 years is shown in Figure 2. The trend demonstrates minimal savings in each of the 5 years, with the exception of 2020, which showed an increase. The 5-year cumulative savings were 157,005 kWh valued at $25,121.

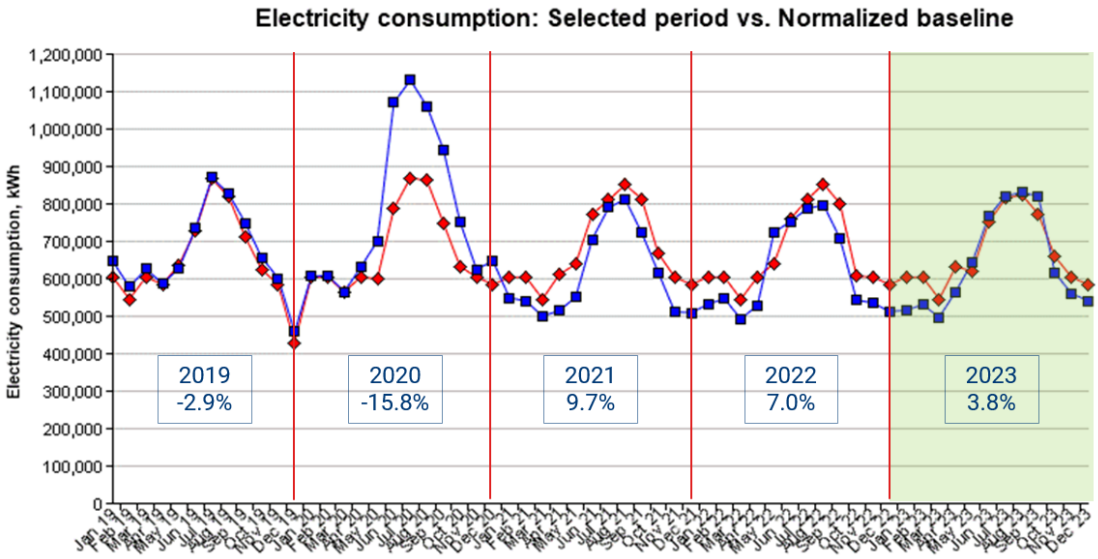


Figure 2 Phase 1B: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

Figure 3 shows the electricity consumption trend at the Phase 1C location over the past 2 years. While the consumption in 2022 was closely aligned to the baseline, there were some savings achieved in 2023. The 2-year cumulative savings were 752,176 kWh valued at $120,348.

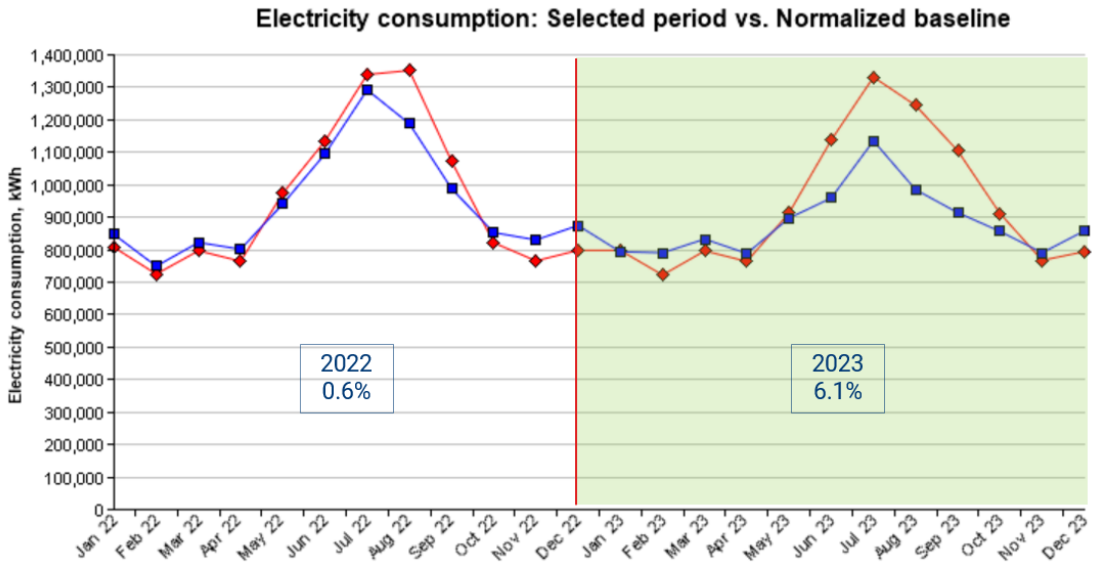


Figure 3 Phase 1C: Electricity consumption (kWh) in 2022-2023 vs 2021 baseline

The natural gas trend in Figure 4 is for the Queen Site, Phase 1B and Phase 1C combined. The sub-metered data is under investigation and hence thermal energy use per phase is not reported. The consumption shows substantial increases throughout each of the five previous years. The 5-year cumulative increase was 5,301,964 m³ valued at $1,749,648.

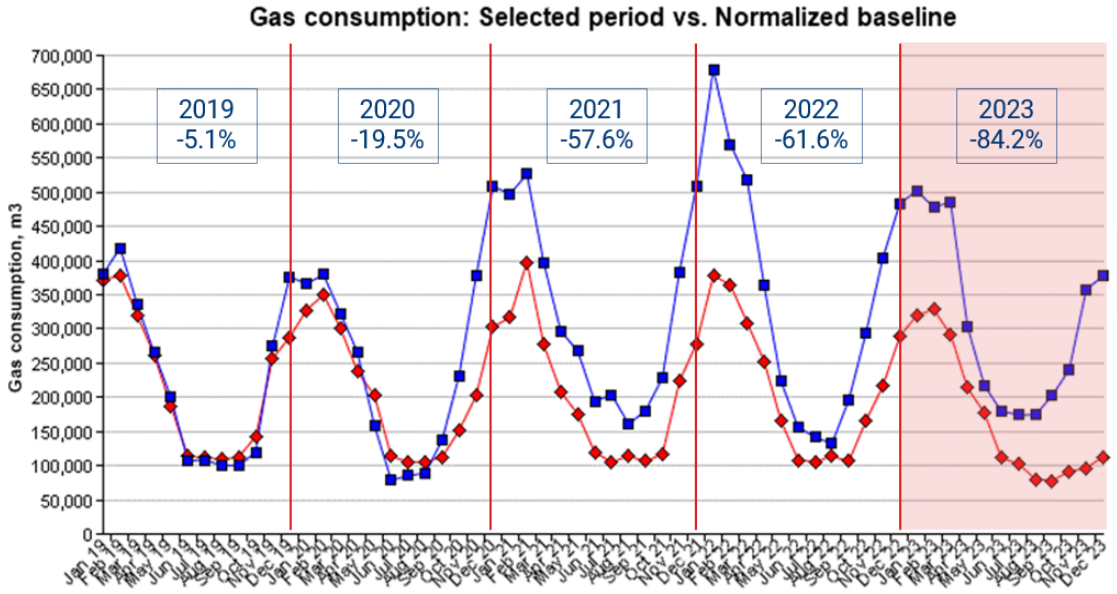


Figure 4 Combined natural gas consumption (m^3) in 2019-2023 vs 2018 baseline for Queen Site, Phase 1B & Phase 1C

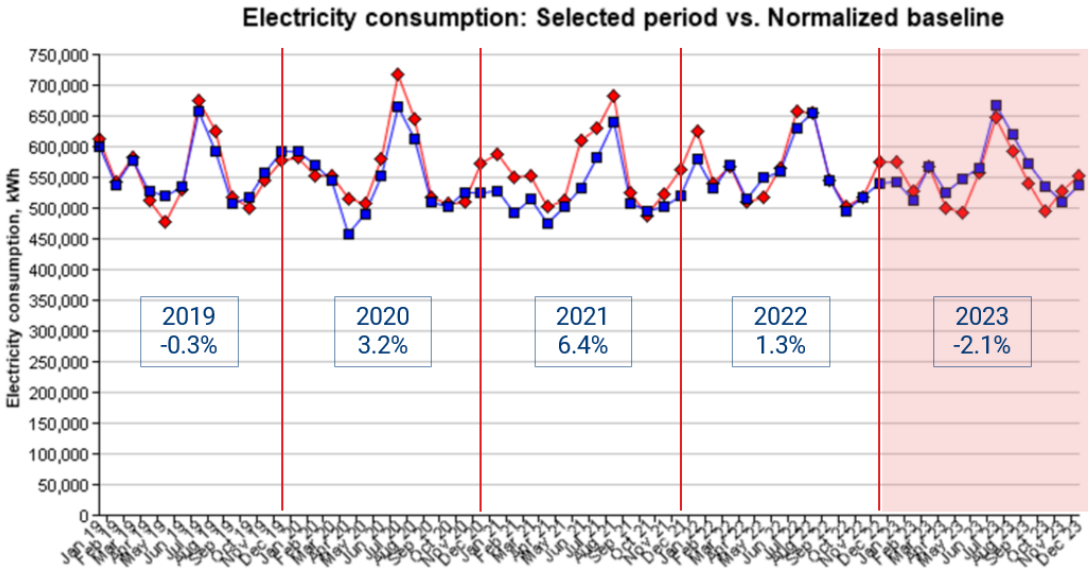
1.2 250 College Street

Overall, 250 College Street showed total energy savings of 2.1%, primarily due to the natural gas savings. The site also showed substantial water savings. Table 3 outlines 250 College Street's energy savings in the 2023 calendar year, as compared to the 2018 baseline, which resulted in net utility cost savings of $38,036.

Table 3 250 College Street: Energy and water savings vs 2018 baseline

	2019 Plan Target savings		Actual savings (2023 vs 2018 baseline)[3]					
Site(s)	**$**	**GHG (tonnes eCO_2)**	**Site(s)**	**Utility**	**Units**	**%**	**$**	**GHG (tonnes eCO_2)**
All CAMH sites	$514,748	1,123	**250 College Street**	Electricity (kWh)	-135,398	-2.1%	-$21,664	-4
				Natural Gas (m^3)	39,021	6.4%	$12,877	75
				Total Energy (ekWh)	**268,475**	**2.1%**	**-$8,787**	**71**
				Water (m^3)	10,889	28.9%	$46,822	1
				Total	**-**	**-**	**$38,036**	**72**

As shown in Figure 5, there were savings in electricity consumption between 2020 and 2022. However, the savings were partially negated by increases in 2019 and 2023. The 5-year cumulative savings were 578,302 kWh worth $92,528.



[3] Using 2024 utility rates: Electricity $0.16/kWh, gas $0.33/$m^3$, water $4.30/$m^3$.

Figure 5 250 College Street: Electricity consumption (kWh) in 2019-2023 vs 2018 baseline

Natural gas savings occurred in each of the five years as presented in Figure 6. The 5-year cumulative savings were 161,499 m³ valued at $53,295.

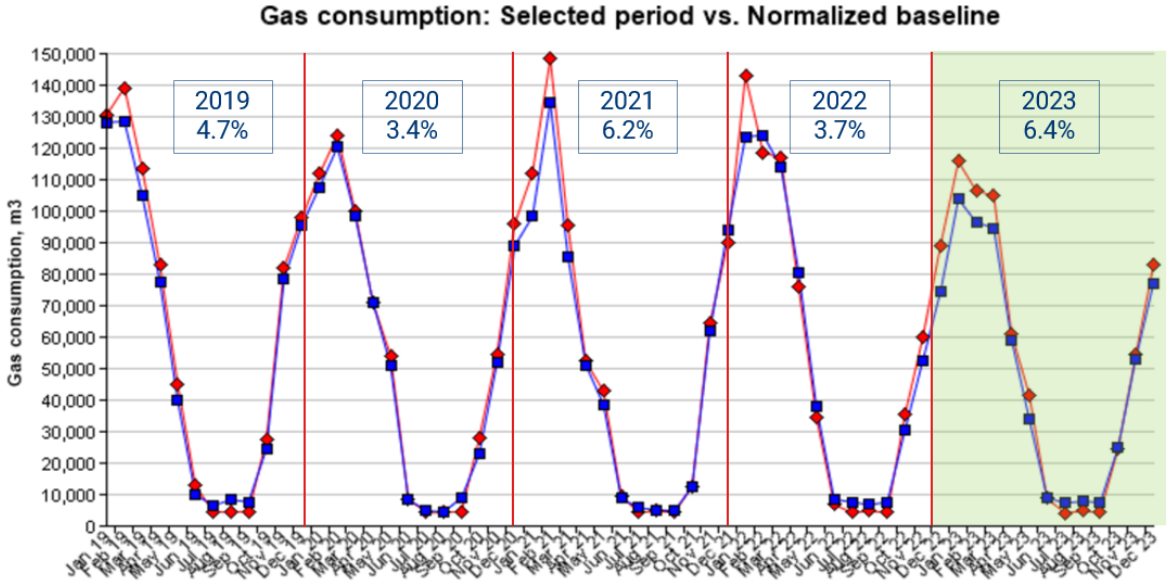


Figure 6 250 College Street: Natural gas consumption (m³) in 2019-2023 vs 2018 baseline

Water use in Figure 7 illustrates a small increase in 2019, followed by considerable savings between 2020 and 2023. The 5-year cumulative improvement was 47,886 m³ valued at $205,910.

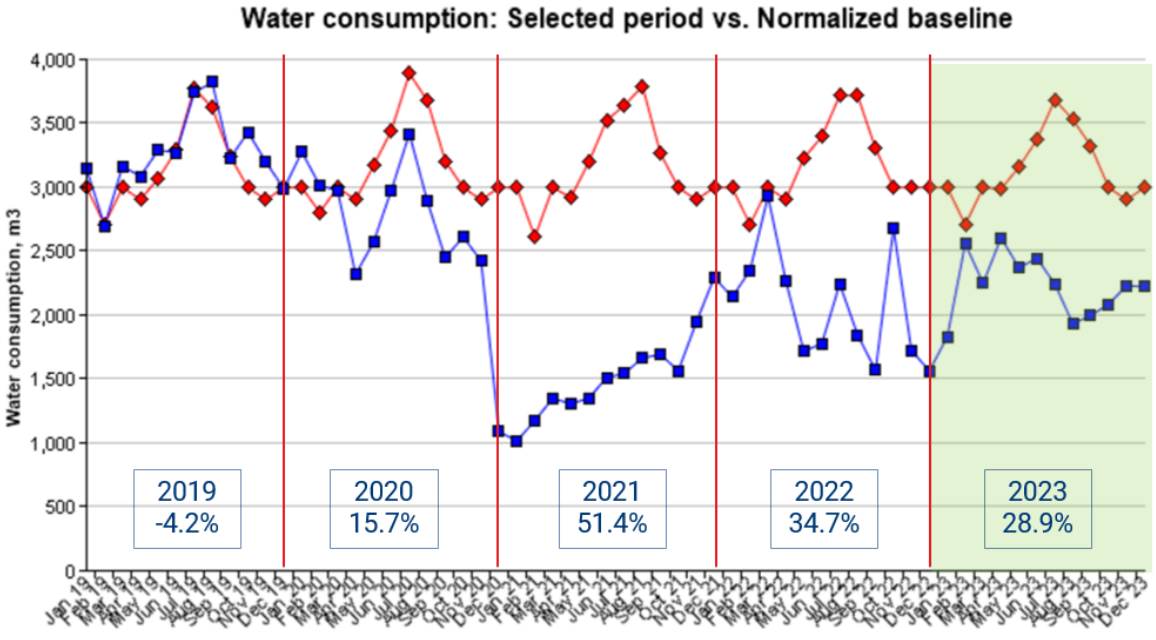


Figure 7 250 College Street: Water consumption (m³) in 2019-2023 vs 2018 baseline

1.3 White Squirrel Way

To track energy savings, we compared 2023 to a 2018 baseline. In that time, as can be seen in Table 4, there were net utility cost savings of $17,428.

Table 4 White Squirrel Way: Energy and water savings vs 2018 baseline

	2019 Plan Target savings		Actual savings (2023 vs 2018 baseline)[4]					
Site(s)	**$**	**GHG (tonnes eCO_2)**	**Site(s)**	**Utility**	**Units**	**%**	**$**	**GHG (tonnes eCO_2)**
All CAMH sites	$514,748	1,123	**White Squirrel Way**	Electricity (kWh)	107,708	8.4%	$17,233	3
				Natural Gas (m^3)	590	0.6%	$195	1
				Total Energy (ekWh)	**113,815**	**4.9%**	**$17,428**	**4**
				Water (m^3)	-	-	-	-
				Total	**-**	**-**	**$17,428**	**4**

As shown in Figure 8,Figure 5 electricity an increase in 2019 followed by savings in each of the next four years. The 5-year cumulative savings were 184,962 kWh worth $29,594.

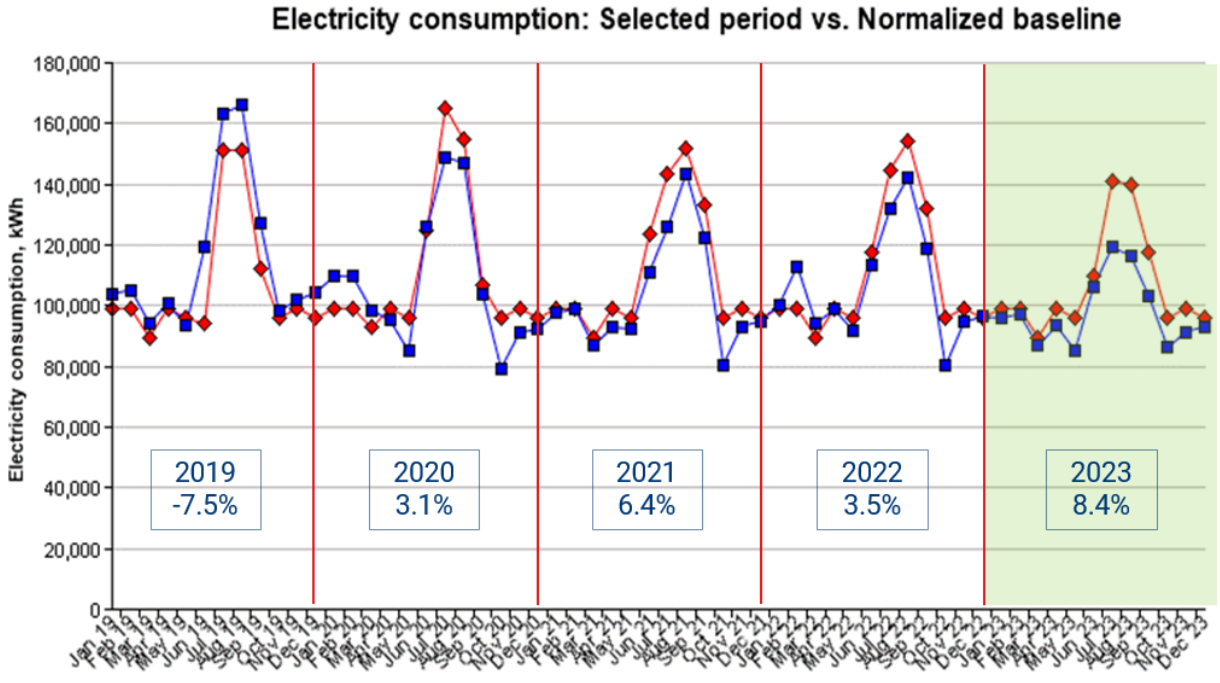


Figure 8 White Squirrel Way: Electricity consumption (kWh) in 2023 vs 2018 baseline

[4] Using 2024 utility rates: Electricity $0.16/kWh, gas $0.33/$m^3$, water $4.30/$m^3$.

Gas consumption presented in Figure 9 shows a significant increase in 2019. However, there were savings seen in each year between 2020 and 2023. The 5-year cumulative savings were 17,851 m³ valued at $5,891.

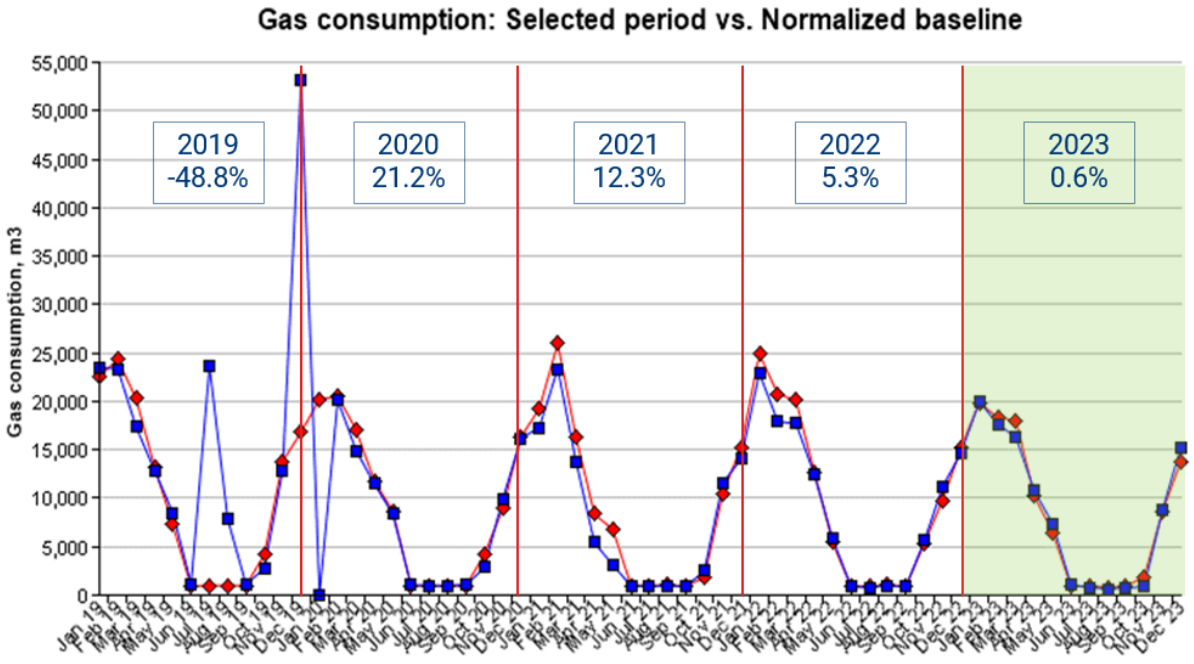


Figure 9 White Squirrel Way: Natural gas consumption (m³) in 2023 vs 2018 baseline

2. Measures implemented in 2019-2023

The 2019 ECDM report proposed the following measures for CAMH's various sites:

Queen Site

- Unit 3 – HVAC upgrades
- Solar Energy Feasibility Study
- Steam Traps Audit and Repair
- Plant Operational Review and Optimization

Phase 1A - WSW

- Energy Performance Audit
- Lighting System Improvements

Phase 1B

- Lighting System Improvements
- Heating Plant Upgrades
- Plant Operational Review and Optimization

College

- HVAC Rationalization
- Washrooms Renovation
- Plant Operational Review and Optimization

Russell

- Plant Operational Review and Optimization

All Sites

- Staff training + engagement

Of these projects, the following were completed:

Queen Site

- Unit 3 heating, ventilation and air conditioning upgrades of air handling units

Phase 1A and 1B

- Lighting system improvements with LED upgrades

College Site

- Washroom renovations

In addition, CAMH has completed the following three capital renewal projects:

- 250 CS - Induction unit replacements
- 33 UFS - Cooling tower replacement
- Unit 1 - HVAC Upgrades – Replacement of air handling units currently underway

3. Project successes and lessons learned

CAMH has been undergoing a redevelopment of its main site on Queen Street which has been the hospital's primary focus in terms of facilities. Key lessons learned, as we balance the redevelopment with other efficiency projects are:

1. Submetering energy loads will provide insight needed to optimize systems.
2. Any proposed efficiency projects have to be implemented with current contracts and staff.
3. Staff engagement on the details of the alterations is key.

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

CAMH's facilities have the potential to be among the most energy efficient continuing care hospitals in Canada. The targeted energy use reduction by 2029, compared with the 2023 baseline, is 11.2%, 3.3%, and 7.5% for the combined Queen Site, 250 College Street and White Squirrel Way respectively. The projects and organizational measures described below are designed to achieve this goal along with utility cost savings worth approximately $555,418/year at 2024 rates and GHG emissions reduction of 1,150 tonnes eCO_2/year.

1. 2023 energy and water use

Table 5 below presents the 2023 baseline energy and water use, costs, and emissions for all of CAMH's facilities.

Table 5 CAMH's 2023 energy and water use

Site	Energy Type	2023 Use	2023 Costs ($)	Greenhouse Gas Emissions (tonnes eCO_2)
Queen Site	Electricity	3,908,367 kWh	$586,255	256
Phase 1B		7,743,752 kWh	$1,161,563	506
Phase 1C		10,630,169 kWh	$1,594,525	695
Queen Site, Phase 1B and Phase 1C	Natural Gas	3,647,869 m³	$1,104,738	6,424
250 College Street	Electricity	6,767,805 kWh	$1,015,171	443
	Natural Gas	535,864 m³	$177,006	1,029
	Water	26,935 l/ft²	$121,206	0
White Squirrel Way	Electricity	1,162,494 kWh	$174,374	76
	Natural Gas	1,052,456 m³	$347,311	69
Total	**Electricity**	**30,212,587 kWh**	**$4,531,888**	**1,976**
	Natural Gas	**5,236,189 m³**	**$1,629,055**	**7,522**
	Water	**26,935 l/ft²**	**$121,206**	**0**

Note: Total water use, cost and emissions are only for 250 College Street site.

2. Energy targets

Table 6 below presents CAMH'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.

We will work towards achieving those targets over the next five years.

Table 6 CAMH sites energy targets

Site	Energy Component	Energy Usage Intensity (ekWh/ft^2)		Annual Savings Potential	
		Actual	Target	%	$
Queen Site	Base Electricity	8.9	7.7	13.6%	$73,712
	Electric Cooling	1.4	1.2	13.5%	$11,371
Phase 1B	Base Electricity	16.6	15.4	7.1%	$72,654
	Electric Cooling	3.5	2.9	15.4%	$33,016
Phase 1C	Base Electricity	12.9	12.1	6.5%	$100,388
	Electric Cooling	1.3	1.2	10.2%	$15,847
Queen Site, Phase 1B, and Phase 1C	Base Thermal	15.5	12.5	19.3%	$144,327
	Heating Thermal	9.5	8.8	7.5%	$34,457
	Total Energy	**69.6**	**61.8**	**11.2%**	**$485,772**
250 College Street	Base Electricity	23.5	23.1	1.7%	$17,500
	Electric Cooling	1.2	1.1	7.8%	$4,228
	Base Thermal	3.4	3.4	0.0%	$0
	Heating Thermal	16.9	15.9	5.9%	$8,661

	Total Energy	**45.1**	**43.6**	**3.3%**	**$30,389**
	Water (liters/ft^2)	99	99	0.0%	$0
	Total	**-**	**-**	**-**	**$30,389**
White Squirrel Way	Base Electricity	12.4	11.4	8.2%	$14,482
	Electric Cooling	0.7	0.7	0.0%	$0
	Base Thermal	2.36	2.3	1.9%	$1,347
	Heating Thermal	9.5	8.7	8.4%	$23,427
	Total Energy	**25.0**	**23.1**	**7.5%**	**$39,257**

3. Energy efficiency measures

CAMH has been focused on maintaining an efficient and operational environment that is supportive of clinical and research requirements and adapt to changes in patient needs or volumes and evolution in research practices. CAMH will prioritize no cost-low cost energy conservation measures in the short term as most of the opportunities rest in continuous HVAC improvements and optimization in the most recently completed buildings, working in close collaboration with CAMH FM service providers. Subsequently CAMH will consider implementing more capital intensive energy efficiency measures by prioritizing them based on business case, funding availability, incentives and resource availability. The approved projects will be designed, tendered and monitored to ensure efficiency gains are realized.

Table 7 through Table 11 summarize the proposed energy efficiency measures ("ECMs") for each site together with their estimated costs, savings, and payback. The measures are described in more detail in the following section.

Table 7 Energy efficiency projects summary – Queen Site

Measures	Investment	Savings			Incentives	Payback (with incentives)	GHG emissions reductions (tonnes eCO_2/year)
Ventilation							
Schedule air handling units	$293,000	227,471 kWh	109,824 m³	$72,637	$50,203	3.3	226
Canadian Standards Association's air change rates validation							
Testing and Re-balancing							
Percentage of outdoor air control and optimization							
Optimize control sequence of operations							
Lighting							
System Upgrade/Expansion	$35,000	37,940 kWh	0 m³	$6,070	$3,794	5.1	3
Heating plant							
Convert induction, reheat, radiation secondary loops to tertiary loops and reset water temperature based on outside air temperature	$270,500	126,001 kWh	89,714 m³	$49,766	$35,029	4.7	181

Perform pump testing, balancing, field investigation on differential pressure setpoints and confirm pump sizing							
Install new variable frequency drives on pumps, add differential pressure sensors and modulate pump flow for P5, P7and P10							
Install DP sensor on P5/P6, pump optimization, review size for summer operation and install small summer pump							
Triple-duty valve optimization- P1/2 and glycol pumps							
Heating Boilers sequence review, optimization, and steam shutdown in summer							
Cooling Plant							
UNIT 1: Install variable frequency drive on condenser pump and triple-duty valve optimization							
UNIT 1: Install variable frequency drive on chilled water pump, triple-duty valve optimization and differential pressure sensor install and optimization							
UNIT 1: Chiller plant sequence of operation review and optimization	$117,000	140,355 kWh	0 m³	$22,457	$14,036	4.6	9
UNIT 3: Triple-duty valve optimization- Chiller and condenser pumps							
UNIT 3: Install differential pressure sensor, field test and optimize operation							
UNIT 3: Chiller plant sequence of operation review and optimization							
Total	**$715,500**	**531,767 kWh**	**199,538 m³**	**$150,930**	**$103,061**	**4.1**	**418**

Note that Units 1 and 3 are scheduled to be unoccupied but retained for backup/contingency, upon the construction of the Phase 1D Research.

Table 8 Energy efficiency projects summary – Phase 1B

Measures	Investment	Savings			Incentives	Payback (with incentives)	GHG emissions reductions (tonnes eCO_2/year)
Ventilation							
Schedule air handling units	$292,000	341,989 kWh	109,824 m³	$90,960	$61,655	2.5	233
Canadian Standards Association's air change rates validation							
Testing and re-balancing							
Percentage of outdoor air control and optimization							
Optimize control sequence of operations							
Building Automation and Lighting Controls							
System upgrade/expansion	$45,000	47,799 kWh	0 m³	$7,648	$4,780	5.3	3
Re-programming							
Heating plant							
Pump testing and upgrades	$110,000	143,396 kWh	33,643 m³	$34,045	$22,750	2.6	74
Pump sequence of operation review and optimization							
Boiler plant sequence optimization and controls, supply water temperature, outside air temperature reset							
Cooling Plant							
Cooling plant sequence optimization and controls	$93,000	127,255 kWh	0 m³	$20,361	$12,726	3.9	8
Install variable frequency drive on condenser pumps and triple-duty valve optimization							
Total	**$540,000**	**660,439 kWh**	**143,467 m³**	**$153,014**	**$101,911**	**2.9**	**319**

Further ECMs are currently under way, including but not limited to the following:

- Reduction of HVAC run times to minimum
- Identify occupant areas that require HVAC after 5pm and target VAV control to minimize AHU load
- Identify and provide supplementary cooling for small loads driving large HVAC equipment operation
- Perform audit and replace steam pipe insulation where missing or insufficient
- Review steam boiler sequencing control and optimize
- Review AHU sequence of operation and optimize
- Provide energy flow diagram for CAMH to review high energy intensity uses

Additional Energy conservation initiatives requiring feasibility study include:-

- Provide additional metering to localize end user loads
- Replace steam distribution system with local humidification systems and kitchen dishwasher system to enable central plant shut down
- Review outside air code requirement and identify outside air content reduction
- Investigate recovery of steam condensate currently dumped to drain
- Review outside air content Vs occupancy to identify opportunities for reducing outside air makeup
- Identify ROI by adding VFD and controls to condenser pump

Table 9 Energy efficiency projects summary – Phase 1C

Measures	Investment	Savings			Incentives	Payback (with incentives)	GHG emissions reductions (tonnes eCO_2/year)
Ventilation							
Schedule air handling units	$314,500	369,936 kWh	126,259 m³	$100,855	$68,558	2.4	267
Canadian Standards Association's air change rates validation							
Testing and re-balancing							

Percentage of outdoor air control and optimization							
Optimize control sequence of operations							
Enthalpy wheel optimization							
Building Automation and Lighting Controls							
System upgrade/expansion	$90,000	100,965 kWh	0 m³	$16,154	$10,097	4.9	7
Re-programming							
Heating plant							
Pump testing and upgrades	$128,000	158,659 kWh	33,643 m³	$36,488	$24,277	2.8	75
Pump sequence of operation review and optimization							
Boiler plant sequence optimization and controls							
Cooling Plant							
Pump testing, balancing and triple-duty valve optimization	$98,750	96,908 kWh	33,643 m³	$26,607	$18,101	3.0	71
Heat recovery chiller review and optimization							
Cooling plant sequence optimization and controls							
Total	**$631,250**	**726,468 kWh**	**193,544 m³**	**$180,105**	**$121,033**	**2.8**	**419**

Further ECMs will be assessed, including but not limited to the following:

- Steam reduction through the deployment of an electronic monitoring system on all steam traps (2024- Q4)
- Water conservation plan (2025 – Q1)
- Secondary glycol loop and storage system
- Condensing heat recovery exchanger on flue gas (2026 – Q2)
- Ongoing commissioning

Table 10 Energy efficiency projects summary – 250 College Street

Measures	Investment	Savings			Incentives	Payback (with incentives)	GHG emissions reductions (tonnes eCO_2/year)
Ventilation							
Optimize control sequence of operations	$17,500	57,566 kWh	16,151 m³	$14,540	$9,794	0.5	35
Heating plant							
Pump testing and upgrades	$21,500	28,783 kWh	10,094 m³	$7,936	$5,402	2.0	21
Boiler plant sequence optimization and controls							
Cooling Plant							
Cooling plant sequence optimization and controls	$30,000	49,453 kWh	0 m³	$7,912	$4,945	3.2	3
Total	**$69,000**	**135,801 kWh**	**26,246 m³**	**$30,389**	**$20,142**	**1.6**	**59**

Table 11 Energy efficiency projects summary – White Squirrel Way

Measures	Investment	Savings			Incentives	Payback (with incentives)	GHG emissions reductions (tonnes eCO_2/year)
Ventilation							
Schedule rooftop unit	$113,000	90,515 kWh	39,578 m³	$27,543	$18,946	3.4	82
Install variable frequency drives where unit cannot be scheduled							
Outside air % control and optimization for makeup air units							
Heating plant							
Perform non-destructive testing to confirm remaining life of boilers	$55,000	0 kWh	35,496 m³	$11,714	$8,874	3.9	68
Boiler plant sequence optimization and controls							
Total	**$168,000**	**90,515 kWh**	**75,074 m³**	**$39,257**	**$27,820**	**3.6**	**150**

3.1 Ventilation system

- Queen Site, Phase 1B and Phase 1C
    - 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 air AHU variable frequency drive (VFD) speed aligns with expected unoccupied turn-down levels during off-hours.
    - Canadian Standards Association (CSA) air change rates validation. Test space air change rates to ensure compliance with CSA recommended levels. Reduce air change rates in areas where over-ventilation is identified.
    - Test and rebalance AHU airflows, refurbishing ductwork and dampers as necessary to enhance system performance and resiliency.
    - Test AHU outside air percentages, comparing them against CSA's Z317.2 requirements. Then, adjust damper positions and/or balance return and supply air to ensure airflow aligns with CSA's Z317.2 recommendations.
    - Investigate economizer, supply air temperature, mixed air temperature control and implement new sequences to optimize operations.
- Queen Site only
    - Optimize the enthalpy wheel operation by testing and confirming that airflows are balanced. Review sequence to confirm pre-heat setpoint and that wheel sequence is optimized for maximizing energy savings.
- 250 College Street
    - Investigate economizer, supply air temperature, mixed air temperature control and implement new sequences to optimize operations.
- White Squirrel Way
    - Optimize rooftop units scheduling to align operating hours with departmental hours.
    - Install VFDs where unit cannot be scheduled off and modulate the speed during unoccupied period.
    - Test AHU outside air percentages, comparing them against CSA's Z317.2 requirements. Then, adjust damper positions and/or balance return and supply air to ensure airflow aligns with CSA's Z317.2 recommendations.

3.2 Building Automation System

- Queen Site, Phase 1B and Phase 1C

- System upgrade/expansion opportunities include retrofitting 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

- Queen Site:
  - Convert induction, reheat, radiation secondary loops to tertiary loops and reset water temperature based on outside air temperature.
  - Perform pump testing, balancing, field investigation on differential pressure setpoints and confirm pump sizing.
  - Install new VFDs on pumps, add differential pressure sensors and modulate pump flow for P5, P7and P10.
  - Install DP sensor on P5/P6, pump optimization, review size for summer operation and install small summer pump.
  - Triple-duty valve optimization- P1/2 and glycol pumps.
  - Heating boilers sequence review, optimization, and steam shutdown in summer.
- Phase 1B, Phase 1C and 250 College Street
  - Pump testing and upgrades. Test pumps, open triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed. Field test differential pressure sensors setpoints to avoid any excessive pipe pressure losses resulting from over pumping. Reset differential pressure sensor setpoint to match with field investigation.
  - Boiler plant sequence optimization and controls. Test boiler efficiencies and confirm that the boilers are not cycling during low load conditions in the summer. Implement new sequences of operations to improve overall efficiency and performance.
- Phase 1B and Phase 1C
  - Pump sequence of operation review and optimization
- White Squirrel Way
  - Perform non-destructive testing to confirm the remaining life of boilers and options for extending life, as required.
  - Boiler plant sequence optimization and controls. Test boiler efficiencies and confirm that the boilers are not cycling during low load conditions in the summer. Implement new sequences of operations to improve overall efficiency and performance.

3.4 Cooling Plant

- Queen Site
    - UNIT 1
        - Install VFD on condenser pump and triple-duty valve optimization. Install new VFD and open triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed.
        - Install VFD on chilled water pump, triple-duty valve optimization and differential pressure sensor install and optimization: Install new VFD and open triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed.
        - Chiller plant sequence of operation review and optimization: Test the chillers, pumps, and cooling towers, then implement a new smart sequence of operations to optimize the cooling plant controls. This will enhance the efficiency and performance of the cooling system, ensuring optimal operation and energy savings.
    - UNIT 3
        - Triple-duty valve optimization for chiller and condenser pumps. Open the triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed.
        - Install differential pressure sensor, field test and optimize pump operations. Field test differential pressure sensors setpoints to avoid any excessive pipe pressure losses resulting from over pumping. Reset differential pressure sensor setpoint to match with field investigation.
        - Chiller plant sequence of operation review and optimization.
- Phase 1B, Phase 1C and 250 College Street
    - Cooling plant sequence optimization and controls: Test the chillers, pumps, and cooling towers, then implement a new smart sequence of operations to optimize the cooling plant controls. This will enhance the efficiency and performance of the cooling system, ensuring optimal operation and energy savings.
- Phase 1B
    - Install VFD on condenser pump and triple-duty valve optimization: Install new VFD and open triple duty balancing valves completely and rebalance by modulating the variable frequency drive speed.
- Phase 1C
    - Pump testing, balancing and triple-duty valve optimization.

- Heat recovery chiller review and optimization. Test heat recovery chiller operation and piping connections. Review sequence of operations and implement new sequence to optimize heat recovery chiller operations and control.

3.5 Building Envelope

- All sites:
  - Thermographic analysis: Technical review of the thermographic analysis of roof and exterior walls.
  - Air sealing, re-insulation: Implement local air sealing and re-insulation, as needed.

4 Organization role and impact

With multiple sites and different phases of redevelopment, overall management and oversight of the facilities is a challenging task. CAMH has a range of planned improvements for the full range of buildings: new, existing, and those slated for redevelopment. Internal and external resources will be required for implementation and achieving the targets. Developing a strategy for building capacity, implementation and monitoring and measuring results is the first step in plan implementation and is under way.

Team collaboration between CAMH, Phase 1B, Phase 1C FM service providers will continue over the next 5 years in the form of quarterly utility subcommittee meetings and monthly energy meetings. While Phase 1B and Phase 1C report on their monthly energy usage as part of their contractual obligations, CAMH will monitor in parallel the ongoing energy performance and savings through the Greening Healthcare online energy management system to:

a) Identify and rectify any anomalies

b) Ensure improvements are realized

CAMH in collaboration with their FM service providers will provide staff education and awareness sessions to assist in the implementation of CAMH overall energy reduction strategies including:-

- Ensuring windows are closed during heat and cooling seasons
- Limiting lighting to task lighting during periods of low occupancy
- Limiting lighting during cleaning activity
- Turning off monitors , computers and other devices when not in use
- Consolidating work spaces for individuals that work outside normal hours to limit equipment run time