



# Centre for Addiction and Mental Health Queen Street Campus Energy Conservation and Demand Management Plan

## **In Transition to Sustainable Infrastructure**

The Centre for Addiction and Mental Health is in the midst of massive redevelopment of its Queen Street West campus, which is transforming its facilities into green, sustainable infrastructure. This plan presents the current energy performance of existing facilities, and sets out how they will be selectively improved for immediate efficiency gains and longer-term integration with the new buildings. With capital investment focused on the new buildings, the emphasis is on smart operations and prudent maintenance expenditures for the existing buildings.

JUNE 5, 2014

The Government of Ontario enacted the Green Energy Act Regulation 397/11 on January 1, 2012. This legislation requires broader public sector organizations to develop and publish a five-year Energy Conservation and Demand Management (ECDM) plan by July 1, 2014.

This document was prepared in accordance with Ontario Regulation 397/11 for the Centre for Addiction and Mental Health by Enerlife Consulting.

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## Summary

This Energy Conservation and Demand Management (ECDM) plan, prepared in accordance with Ontario's Green Energy Act Regulation 397/11, addresses the Queen Street campus of the Centre for Addiction and Mental Health (CAMH). CAMH is currently at the beginning of Phase 1C of multi-year redevelopment of its Queen St campus, with several new buildings recently completed, more planned for construction, and several planned for demolition by 2019. Currently, the Queen St campus comprises four Treatment Unit buildings, Maintenance Building, Community Centre, West Wing, as well as four buildings completed in 2008 under Phase 1A (30, 40, 50 and 60 White Squirrel Way) and four buildings completed in 2012 under Phase 1B (Intergenerational Wellness Centre, a non-CAMH building, Bell Gateway Building, and Utilities & Parking). New development phase 1B buildings are separately metered and are not included in this plan. Within the plan, the four Phase 1A (White Squirrel Way) buildings are discussed separately as appropriate; otherwise they are included when "Queen Street campus" is referred to.

The existing CAMH Queen Street campus (not including the four Phase 1B buildings) is already energy efficient relative to comparable Ontario hospitals. The facilities are well maintained, and investments in plant and system renewal have been made over time. About 40% of the existing building area, including the central steam plant, will be demolished as part of the next phase of redevelopment in 2019. The remaining buildings served by the existing plant are to be reconnected to the new heating plant located in the new Phase 1B building at 101 Stokes Street (Bell Gateway Building).

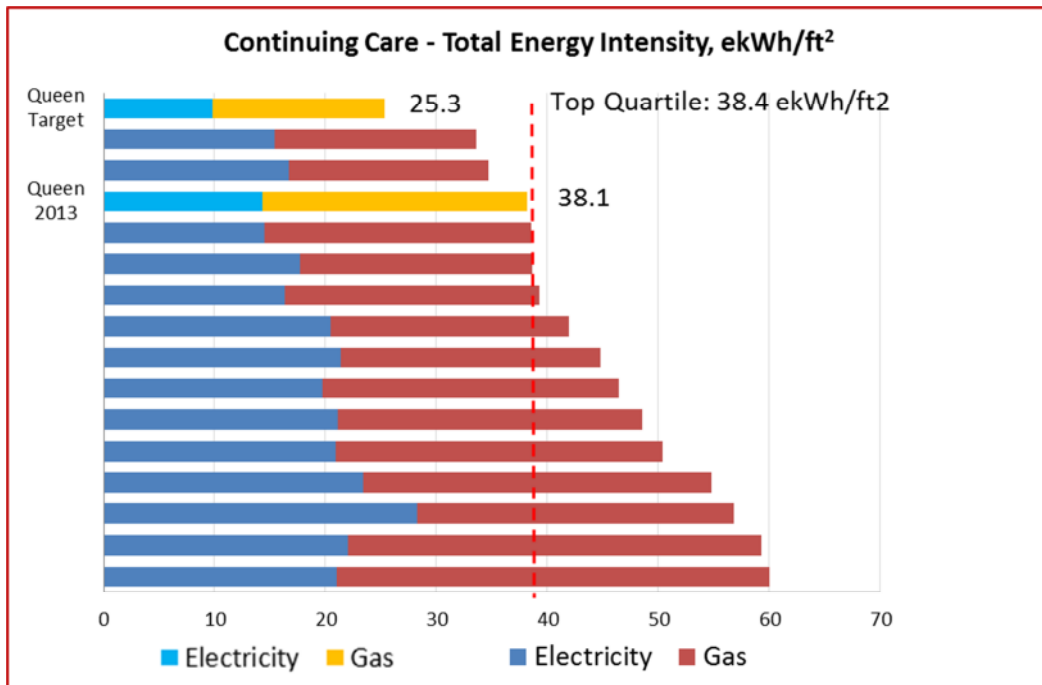
Therefore, the focus of this ECDM plan is on improving the energy efficiency of the existing buildings which are to remain in service ready for integration into the new campus. Energy conservation measures with preliminary budget costs and projected savings are presented in Section 3. The plan also provides some guidance for consideration by the designers of the new buildings to support effective integration and energy efficiency of the campus as a whole.

The 2013 energy performance for the Queen Street campus is shown in Figure 1, along with the projected benchmark energy intensity positioning following attainment of the target energy use presented in Section 3.3 of the plan. Together with other facilities presented in this chart, the energy performance of CAMH is tracked in the Greening Health Care database<sup>1</sup>.

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<sup>1</sup> Greening Health Care program, founded in 2003, helps hospitals to work together to lower their energy costs and raise their environmental performance. Members use a powerful online system to manage data, assess their performance and track savings. Program includes workshops and webinars to help plan, implement and verify improvements, and to share best practices. Greening Health Care is managed by Toronto and Region Conservation.

Figure 1: CAMH Queen Street Campus 2013 Total Energy Intensity



## 1 Site Redevelopment

Figure 2 shows the Queen Street campus site plan. The following notes serve to put this ECDM plan into the context of the ongoing redevelopment.

- 80 Workman Way (Intergenerational Wellness Centre), 100 Lower Ossington (non-CAMH building), 100 Stokes St (Bell Gateway Building) and 101 Stokes St (Utilities & Parking) make up the new development Phase 1B, opened in 2012, and are not included in this plan.
- 30, 40, 50 and 60 White Squirrel Way make up the new development Phase 1A, opened in 2008, and are included in this plan.
- Units 1 and 3 and the Community Centre will remain in service, and will be integrated into the new campus in 2019 as part of new development Phase 1C.
- Units 2 and 4, along with the Maintenance Building (which houses the existing central heating plant), will be demolished by 2019 as part of new development Phase 1C.
- West Wing is largely vacant and will be repurposed as part of new development Phase 1C, beginning in 2020.

Therefore, this plan addresses energy efficiency improvements to the aging Units 1 and 3, and to the new buildings on White Squirrel Way, as well as measures for the other buildings which can yield positive financial returns within 5 years.

Figure 2: CAMH Queen Street Campus Site Plan



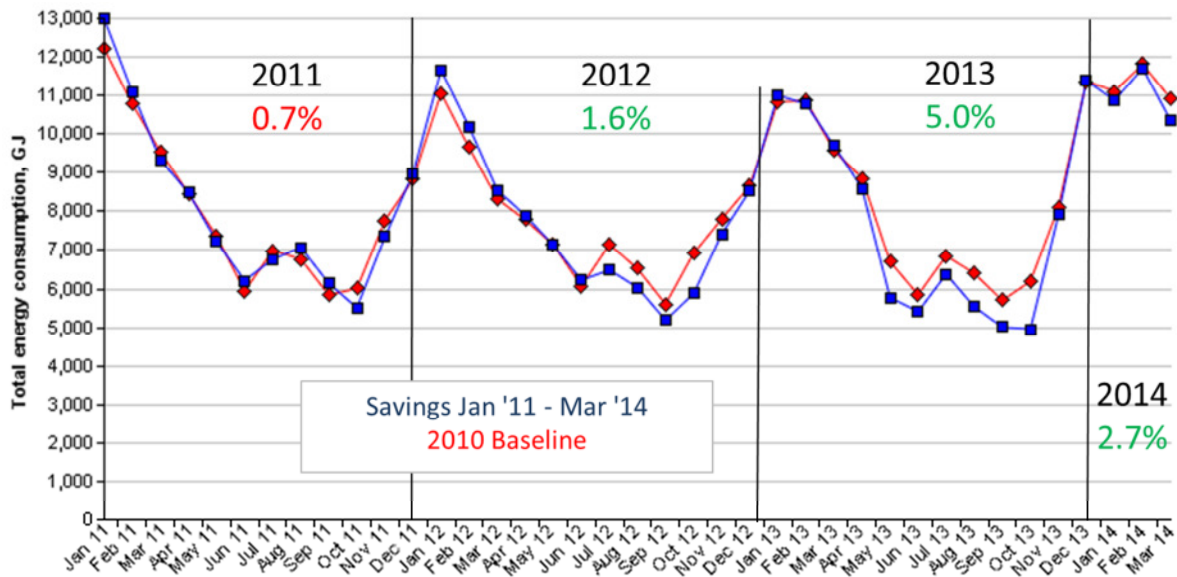
## 2 A History of Energy Efficiency

### 2.1 Previous Energy Initiatives

With the organization's resources focused on the campus redevelopment, energy efficiency efforts for the past several years have been in effective operations and maintenance of existing plant and systems, with replacement only as required for health and safety as well as end-of-life situations. Within these constraints, new heating boilers were installed in 2009, with two new summer boilers added in 2014 to raise plant efficiency during light load operation. A new, more efficient chiller, cooling tower and pumps with variable frequency drives were installed in Unit 3 in 2014. A lighting audit has been performed for Unit 1, and is being implemented over time using in-house labour and as existing lamps and ballasts wear out.

The monthly performance chart in Figure 3 shows the weather-normalized changes in energy use (electricity and gas combined) in the older Queen Street Site buildings since 2010. The most notable feature is the reduction of electricity use in 2012 when the kitchen was relocated from the old campus to the new buildings. Otherwise staff has done a good job of maintaining good energy performance despite aging infrastructure.

Figure 3: Queen Street Site 2010-2013 Total Energy Savings



## 2.2 Current Initiatives

CAMH staff is visibly committed to energy conservation action, tracking performance, responding to variances and operating and maintaining their aging facilities as well as possible. The ongoing lighting retrofit of Unit 1 continues, along with elimination of old T12 lighting technology in all buildings as lamps and ballasts wear out.

## 2.3 Organizational Commitment

CAMH's commitment to sustainability is grounded in the culture and values of its staff, which are reflected in management and operations, and in inter-departmental initiatives. Facilities, housekeeping and security staff are actively involved in conservation and environmental efforts. Inter-departmental challenges and regular communications maintain awareness and participation in stewardship, supported by CAMY, their own environmental mascot. In-house champions take responsibility for new conservation ideas. The focus on monitoring energy and water use, as well as systems and operations, can be seen in the good energy performance relative to comparable facilities.

## 3 Building on Success – The 5-Year Plan (2014-2019)

### 3.1 Goals and Objectives

CAMH's overarching goal for the Queen Street campus is to achieve an integrated, sustainable and highly energy efficient campus which reflects its leadership role and values in 21<sup>st</sup> century healthcare service delivery, and its contribution to the renaissance of our city and the economic health of the Queen Street West community.

The objectives for the duration of this plan are to operate the existing buildings as energy and cost efficiently as possible, while ensuring that the new buildings meet the required standard of energy performance excellence.

### 3.2 2013 Energy and Water Performance

2013 energy use by the CAMH Queen Street campus placed it at the top quartile of the Greening Health Care database of continuing care facilities, as previously shown in Figure 1. The older Queen Street Site buildings together used almost 9.5 million kWh of electricity and over 1.5 million m<sup>3</sup> of gas, spending more than \$2,157,000 (including water). The four new White Squirrel Way buildings together used over 1.3 million kWh of electricity, more than 138 thousand m<sup>3</sup> of gas, and spent about \$210,000 (including water).

2013 energy use and cost breakdowns are presented below. Natural gas accounts for the largest share of energy use and greenhouse gas (GHG) emissions. The relatively low current price of gas is responsible for electricity’s larger share of utility costs. Electricity, natural gas and water prices are forecast to rise faster than the rate of inflation for the foreseeable future, further improving economic returns on investment in energy efficiency.

Figure 4: CAMH Queen Street Site 2013 Energy Use and Cost Breakdown

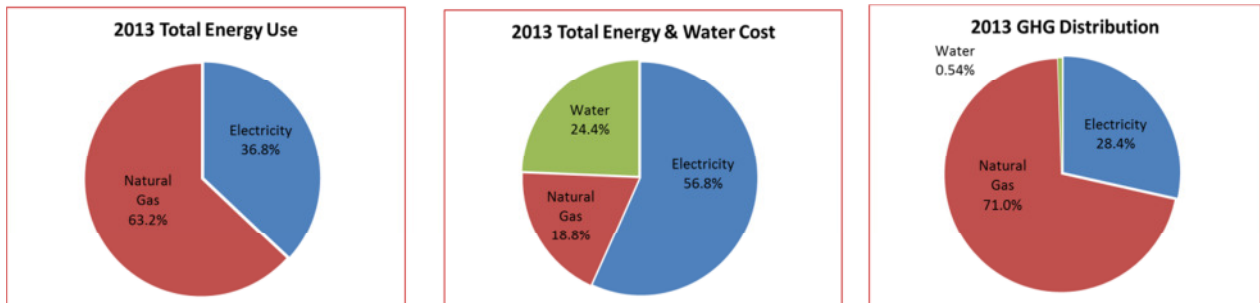
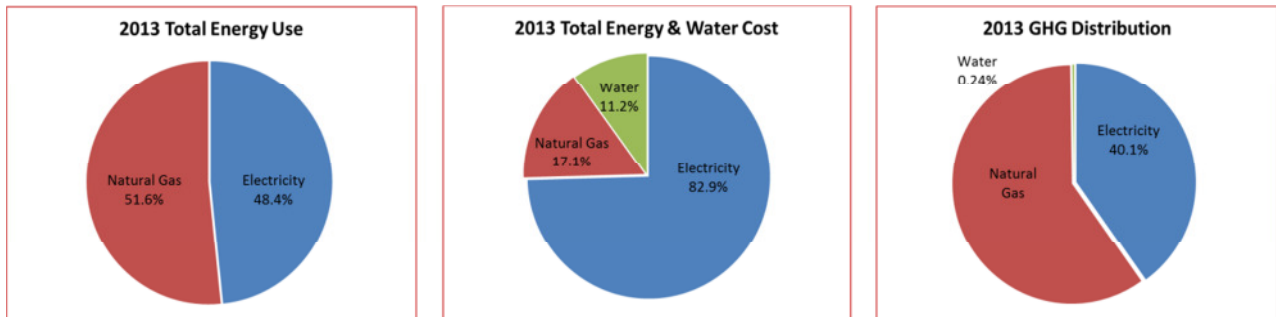


Figure 5: CAMH White Squirrel Way Site 2013 Energy Use and Cost Breakdown





### 3.3 Energy Targets

The energy targets presented in Table 1 for the main campus, and in Table 2 for the four new Phase 1A buildings on White Squirrel Way, are based on good performance standards from comparable healthcare facilities. The component targets identify the current areas of inefficiency which this ECDM plan addresses, and the dollar savings potential if the existing buildings included in the ECDM plan were operating at this level of efficiency in 2013.

**Table 1: Queen Street Site Component Energy Target Performance**

Component	Target Performance		Areas for Attention
	Percent	\$/year	
Electrical Base	28%	\$177,481	Fan power, operation of lights and equipment
Thermal Base	64%	\$119,597	Boiler plant & heating system controls
Electric Cooling	24%	\$16,614	Cooling plant and ventilation system controls
Thermal Heating	11%	\$23,578	Ventilation system operation and controls
<b>TOTAL</b>		<b>\$337,270</b>	

**Table 2: White Squirrel Way Site Component Energy Target Performance**

Component	Target Performance		Areas for Attention
	Percent	\$/year	
Electrical Base	18%	\$25,795	Fan power, operation of lights and equipment
Thermal Base	0%	\$0	Boiler plant & heating system controls
Electric Cooling	56%	\$15,344	Cooling plant and ventilation system controls
Thermal Heating	19%	\$6,167	Ventilation system operation and controls
<b>TOTAL</b>		<b>\$47,306</b>	

### 3.4 Energy Efficiency Improvements

Given the objectives for this plan outlined in Section 3.1, the target performance levels in Tables 1 and 2 will not be reached during the term of this plan. The actual energy conservation measures along with associated energy savings and preliminary budget costs are summarized in Table 3 and described more fully below. The focus of the work in the older Queen Street Site buildings is on Units 1 and 3 which will remain in service, with targeted improvements to other buildings where short paybacks can be achieved. Measures for the newer Phase 1A buildings on White Squirrel Way (WSW) are shown and described separately.

**Table 3: Queen Street Campus Proposed Energy Efficiency Measures**

#	Site	Description	Budget Implementation Cost \$	Annual Savings \$/year	Estimated Incentives \$	Simple Payback years
1	Queen	Ventilation Refurbishment and Re-Balancing	\$241,775	\$37,911	\$15,473	5.97
2	Queen	Cooling Plant Modifications	\$82,625	\$15,544	\$4,262	5.04

#	Site	Description	Budget Implementation Cost \$	Annual Savings \$/year	Estimated Incentives \$	Simple Payback years
3	Queen	Heating Plant and System Controls	\$39,880	\$20,399	\$6,900	1.62
4	Queen	Lighting	\$97,470	\$37,236	\$15,181	2.21
5	WSW	HVAC Optimization	\$184,675	\$37,152	\$26,380	4.26
6	WSW	Lighting	\$58,810	\$8,169	\$6,284	6.43
7		Project Direction	\$71,520			
		<b>TOTALS</b>	<b>\$776,755</b>	<b>\$156,410</b>	<b>\$74,480</b>	<b>4.49</b>

### 3.4.1 Queen Street Site Ventilation Refurbishment and Re-Balancing

The most recent testing of the air handling systems in the older Queen Street Site buildings indicates some imbalances between supply, return and exhaust airflows, as well as unusually high static pressures in a number of systems. Relatively high use of base electricity (fans), heating gas and cooling electricity indicates potential for savings through modifications and better control of ventilation systems.

This measure will identify and correct significant airflow imbalances and restrictions, as well as faulty dampers and control valves. Operating sequences programmed into the building automation system will be assessed and upgraded as necessary. More in-depth system testing, along with trend logs of actual control performance, will isolate the issues and identify corrective actions which typically obtain good energy savings and incentive payments and short payback periods.

Measure Life: This measure should remain effective for 5 years, at which time systems should be retested to see if adjustments are required. Monitoring of the building automation system, along with electricity and gas use will identify any significant efficiency losses during this period.

### 3.4.2 Queen Street Site Cooling Plant Modifications

Relatively high cooling electricity use indicates plant inefficiencies. Ensuring proper chilled and condenser water flow rates, cooling tower performance, and control of plant enable/disable and supply water temperature will result in energy savings. Control strategies include resetting chilled and condenser water temperatures according to actual cooling loads, limiting chiller demand, and optimizing cooling tower fan operation. Testing of the chilled and condenser water pumps and cooling tower performance will identify corrections to be made to flow rates and plant operation to maximize efficiency. Trend logs from the building automation system will confirm actual control operation, and help identify and verify control improvements.

Measure Life: This measure will remain effective for 5 years at which time equipment retesting should be performed.

### 3.4.3 Queen Street Site Heating Plant and System Controls

The most exceptional aspect of 2013 energy performance is the high base gas consumption. Summer gas use is far greater than should be necessary for domestic water and pool heating. The difference is

attributed to losses in the central heating plant and the extensive steam and hot water distribution systems.

Most of these losses should be eliminated when the existing plant and distribution are decommissioned as part of the Phase 1C redevelopment in 2019. The energy target presented in Table 1 reflects the anticipated new system with highly efficient plant and minimal distribution losses. The measure included in Table 3 will minimize losses for the next few years through:

- Operation and control of the new summer boilers
- Optimized control of the primary heating loop supply temperature, the pool heater and the domestic hot water systems

Measure Life: This measure will remain effective for 5 years, subject to periodic monitoring.

#### **3.4.4 Queen Street Site Lighting**

The lighting retrofit program in Unit 1 will be completed using in-house labour. As well, remaining T12 lighting will be phased out through replacement with T8 technology as ballasts and lamps burn out.

Measure Life: This measure will last for ten years or more, subject to future changes in standards or available technology.

#### **3.4.5 White Squirrel Way Site HVAC Optimization**

The most recently tested fan power density at 0.9 W/ft<sup>2</sup> is 30% higher than a good standard for these buildings, while electric cooling energy use of 2.4 kWh/ft<sup>2</sup> is double what would be expected. These metrics indicate potential energy savings in the HVAC systems. This measure will retest specific ventilation systems, as well as chilled and condenser water pump flow rates, to identify issues for correction. Trend logs will be set up to identify actual controls operation and opportunities for improvements.

Measure Life: This measure should remain effective for 5 years, at which time systems should be retested to see if adjustments are required. Monitoring of the building automation system, along with electricity and gas use will identify any significant efficiency losses during this period.

#### **3.4.6 White Squirrel Way Site Lighting**

Some areas of the buildings were observed to have higher installed lighting power densities than current good practice. This measure will identify specific opportunities and implement appropriate fixture, lamp or ballast changes.

Measure Life: This measure will last for ten years or more, subject to future changes in standards or available technology.

### **3.5 Renewable and Geothermal Energy**

There is no renewable or geothermal installation at CAMH Queen Street campus, and none is planned for the term of this ECDM Plan.

## **4 Implementation**

Most of the measures described in Section 3 are planned for implementation over the duration of this plan, as funds become available and in order to realize the economic and operational benefits. The next stage of the work involves targeted, in-depth measurement and testing of existing systems to fully define the individual measures, and firm up the preliminary budget costs and savings potential. Approved projects will then be designed and tendered, and monitored to ensure the efficiency gains are realized. The implementation budget includes project management and coordination, measurement and verification of savings, and reporting on results. CAMH will continue to closely monitor ongoing energy performance and savings through the Greening Health Care online energy management system.

Where practical, electricity conservation measures for implementation in 2015 will be identified by the end of 2014 so that applications can be submitted for Toronto Hydro incentives.