University of Waterloo - Energy Conservation and Demand Management Plan 2024

June 2019

Introduction

The University of Waterloo is a large and growing research intensive post-secondary institution. With facilities for approximately 42,000 faculty, students and staff, encompassing multiple campuses, the annual cost of energy is a major concern.

Under Ontario Regulation 507/18, the Ontario Government requires all BPS organizations to update their 2014 energy conservation and demand management plans. The Act has two main focuses. The first is to have organizations formalize their energy plans; the second is to encourage organizations to install renewable energy generation.

Energy Consumption

For the operating year May 2013 to April 2014, the University of Waterloo used a total of 1,114,824 GJ of energy; 62.7% was from natural gas, the balance was electricity. With a total building area of 647,485 m^2, the energy intensity was 1.72 GJ/m^2.

UW is currently developing a Climate and Energy Action Plan which will guide development towards a carbon neutral campus by 2050. This document has been created with that goal in mind. While being carbon neutral does not demand energy efficiency, it is much easier to achieve with low energy use buildings.

This updated plan will use calendar year (rather than fiscal year) to better align with other Provincial and Federal reporting requirements.

Goals and Objectives

1) Minimize energy consumption and environmental impact while ensuring the needs of the university community are met.
2) Support a culture of efficiency and sustainability by converting theory into practical, cost-effective actions.
3) Ensure that everyone on campus is aware of the need and does their part to conserve energy.

Organizational Energy Measures

1) Net-Zero ready for new construction. Based on detailed design analysis, some new buildings will be selected as candidates to be constructed as "net-zero" ready. The target will be 100 kWh/m^2 per year or less (2018/2019 average is 436 kWh/m^2 per year). Passive house design criteria could aid in the fundamental development of new buildings.
   Cost: 15% above base project cost. Annual Savings: 75% annual operating utility costs. Lifespan: indefinite.

2) Develop a lighting control plan. The University operates virtually 24 hours a day. There are no formal policies or methodologies relating to the operation of interior lights. This measure will encompass a

detailed campus audit to develop a plan to address this situation. The resulting plan should include both a technical measure (lighting automation) as well as a behavioural measure.
Cost: Internal. Annual Savings: None directly. Lifespan: indefinite.

3) Exterior lighting conversion. This is an ongoing measure. Currently, about 60% of the exterior lights have been upgraded to a modern energy efficient style. As opportunities and capital are available, work will continue. Note that as new bulb and fixture technologies become available, the design and implementation will change.
Cost: Varies. Annual Savings: Variable. Lifespan: 15 years.

4) Building lighting conversion. This is an ongoing measure. There are still large areas of building spaces containing fluorescent T12 bulbs and incandescent bulbs. As opportunities and capital become available, work will continue. An $875,000 project to convert to LED bulbs is currently underway.
Cost: Varies. Annual Savings: Variable. Lifespan: 10 years.

5) Develop a policy for stringent mechanical and electrical designs with respect to new building/renovations. It is common for lab spaces to be over engineered with regards to estimated heat loads, electrical loads, and cooling loads. Oversizing HVAC equipment leads to short cycling and poor overall equipment performance as well as high electrical demand spikes. Ensuring the optimum sizing of equipment and infrastructure leads to a better overall performance of the space as well as more satisfied occupants. This organizational measure requires enhanced communication between the space occupant, designer and operator.
Cost: Internal. Annual Savings: unknown. Lifespan: indefinite.

6) Fume hood design. The industry standard for fume hood design is 100 fpm face velocity. Makeup air for fume hood needs is a large energy use for buildings with labs. This organizational measure is to develop a set of design criteria for all new fume hoods. Recent research into containment velocities will be used as well as evaluating the cost benefit of monitored demand based fumes hoods.
Cost: Completed in-house. Annual Savings: TBD. Lifespan: 20 years.

7) Improved marketing of energy conservation at student residences and on campus with attention to plug loads. This will be a broad based behavioural measure. Occupants have a good basic understanding of energy conservation. A detailed plan will be developed to leverage the existing knowledge with more detailed UW specific information. The plan will include methods to develop concrete actions with the campus community.
Cost: Internal. Annual Savings: unknown. Lifespan: 5 years.

Technical Energy Measures

8) Chilled water booster pumps. The main campus has a large multi-loop chilled water distribution system. During low load times, chillers must operate to meet flow needs rather than cooling load. By installing strategically located booster pumps, the chillers themselves could be left off.
   Cost: $100,000. Annual Savings: $25,000. Lifespan: 20 years.

9) VAV systems replacing constant volume. Many of the older buildings have constant volume air handling systems with terminal reheat. This kind of system is inefficient and requires summer heat. Refurbishing the systems for variable air volume will reduce energy demands.
   Cost: Varies. Annual Savings: Varies. Lifespan: 20 years.

10) Ron Eydt Village Heating system upgrade. As conventional boilers are replaced, condensing boilers are being installed in their place. Further, system changes allow the heating systems to drop into the condensing temperature range, thus improving the overall system efficiency.
    Cost: 5% above base project. Annual Savings: 10% fuel costs. Lifespan: 15 years.

11) Re-commission building mechanical systems. Develop and implement a systematic, documented process for optimizing existing system performance. Systems will be compared to the original design intent and improved where cost effective changes can be made.
    Cost: Internal. Savings: 2-3% of operating cost of building. Lifespan: 7 years. 2-3% savings are likely if a building is re-commissioned every 7 years.

Renewable Energy Sources

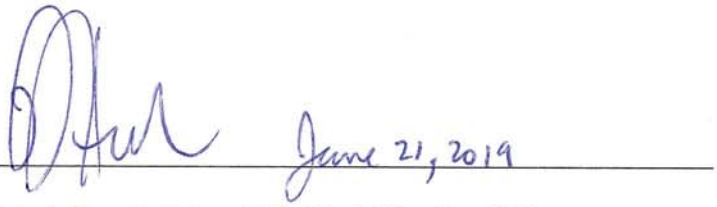
60 kW solar collector EV3 – Refurbished in 2019.

June 2019

Summary

The physical growth of the University continues to drive our absolute energy consumption. The University's strategic plan will result in additional growth over the next 5 years. With improved technology and construction methods, our energy intensity can be reduced.

Approval



Signed and dated: Dennis Huber, V.P. Administration & Finance

Appendix A – Energy calculations

All information is based on fiscal year (May-April). Future versions may switch to calendar year to align with other government submissions. 2013/2014 is the base year for reference. 0.0036 GJ/kWh; 0.0389 GJ/m^3.

Year	Gross Area (m^2)	Hydro ('000 kWh)	Gas ('000 m^3)	Total Energy (GJ)	Energy Intensity (GJ/m^2)
2002/2003					1.44
2003/2004					1.32
2004/2005					1.27
2005/2006					1.39
2006/2007					1.45
2007/2008					1.43
2008/2009					1.41
2009/2010					1.36
2010/2011					1.49
2011/2012					1.34
2012/2013					1.64
2013/2014	647,485	115,465	17,973	1,114,824	1.72
2014/2015	661,371	116,077	18,940	1,154,643	1.75
2015/2016	681,754	121,360	16,325	1,071,939	1.57
2016/2017	694,555	130,149	17,366	1,144,074	1.65
2017/2018	712,478	132,421	19,113	1,220,211	1.71
2018/2019	773,557	137,025	18,496	1,212,795	1.57
2019					
2020					
2021					
2022					
2023					
2024					

Appendix B – Final Summary of the CDM 2014-2019

The final summary of the previous plan has been published as a separate document for clarity.