UNIVERSITY of GUELPH

Conservation & Demand Management Plan University of Guelph

July 2015

Contents

1.1 INTRODUCTION

Context

This report is in response to the University of Guelph's requirements under Ontario Regulation 397/11 – to submit an Energy Conservation and Demand Management Plan.

Data reporting, also required under Ontario Regulation 397/11, is submitted through the Ministry of Energy (MOE) portal.

Intent

The intent of this Conservation and Demand Management Plan is to promote good stewardship of the Energy and Water resources consumed at the University of Guelph.

1.2 BACKGROUND

On January 1st, 2012 the Ontario Regulation 397/11 came into effect. Its goal is to allow organizations and agencies within the Broader Public Sector to better understand how and where their energy is used, as well as to provide public access to the usage and plans.

Starting in July 2013, organizations and agencies within the Broader Public Sector were required to prepare and publish a summary of their 2011 energy consumption and greenhouse gas emissions. The regulation further requires the organizations and agencies to report their energy usage and Greenhouse Gas (GHG) emissions on an annual basis and to also develop a Five Year Energy Conservation and Demand Management (CDM) Plan by July 1, 2014 and every five years thereafter.

The University of Guelph is a public research university established in 1964. The Campus consists of 136 buildings covering an area of approximately 6 million square feet with a central utility plant that provides chilled water and steam across the Campus. Academic facilities represent 47% of the total area, followed by Residences at 26%, Administration at 6%, Multi-Use at 5%, Libraries and Athletics at 4% each and other building usage types at 8%. Currently, the metering on the Campus is tracked by Utility revenue meters and limited sub-metering on a building level; as such, specific energy and water footprints by building or by building type or operation is not possible.

A first step in developing a CDM Plan is to establish baselines. As required by regulation 397/11, the initial baseline consists of 2011 energy consumption as reported on last year. ***Table 1*** contains a summary of the University of Guelph's electricity and natural gas

consumption. The noted GHG emissions and energy intensity are calculated based on the upload of the 2013 energy use figures to the Ministry of Energy reporting portal.

Table 1

Reporting Year	Electricity kWh's	Gas m3	kgs of eCO2	ekWh/ft2
2013	107,384,000	19,997,110	45,969,548	50.76

A full description of Energy and Water usage trends is provided in ***Appendix A***.

Ongoing Commitment

Since 2004/2005 the University, through its Energy Conservation Fund (student funded and University matched investment), initiated a wide range of energy conservation measures. Cumulative savings since their implementation totals over $12 million dollars and over 22,000 tonnes of eCO_2 as reported upon annually in the University's Community Energy Plan. These include the following initiatives:

- Capital projects that included building renovations to improve energy efficiency, a more efficient 2,400 ton chiller and more efficient boiler at the Central Utilities Plant
- Renewable energy options through small scale wind energy system, rooftop garden and solar panels
- Lighting and lighting controls upgrades
- Mechanical upgrades ranging from the installation of variable air volume air-handling units to variable speed motor controls
- Chiller optimization which ensures that they run at or near 100% capacity
- Central Utilities Building switching over to well water for cooling tower and boiler makeup purposes decreasing city water usage
- Switch to more efficient low flow water fixtures (toilets and showers)
- The Green Gryphon Initiative

The Sustainability Office continues to promote a number of programs and incentives to encourage energy efficiency and behavioral opportunities. These include:

- Residence challenge
- Sustainability website
- Enviro Rep program in residence
- Energy Conservation Week
- Green computing committees
- Zero Footprint Calculator
- Greening of orientation week

Hyperlink to location of University of Guelph Community Energy Plan Reports:

The University of Guelph Community Energy Plan

1.3 ENERGY MANAGEMENT PLAN

Planning Horizon and Scope

The Energy Management Plan for the University of Guelph is a five-year plan covering the period July 1, 2014 to June 30, 2019. The EMP is intended to provide the framework for all energy management activities at the University, including:

- Support of ongoing initiatives to improve the conservation and strategic management of Energy, Demand and Water resources.
- Implementation of the Comprehensive Energy Retrofit Program, with the opportunity to reduce the Energy, Demand and Water costs by a further 10%. The opportunity is further defined in ***Appendix B***.

APPENDIX A – BASELINE ENERGY USAGEUTILITY OVERVIEW

The energy consumption, demand and costs of the CY 2013 are summarized below in *Table A.1*. Electricity represents 51.6% of the overall baseline costs while gas represents 41.0% and water the remaining 7.2%.

Table A.1: Summary of Utility Consumption, Demand and Costs

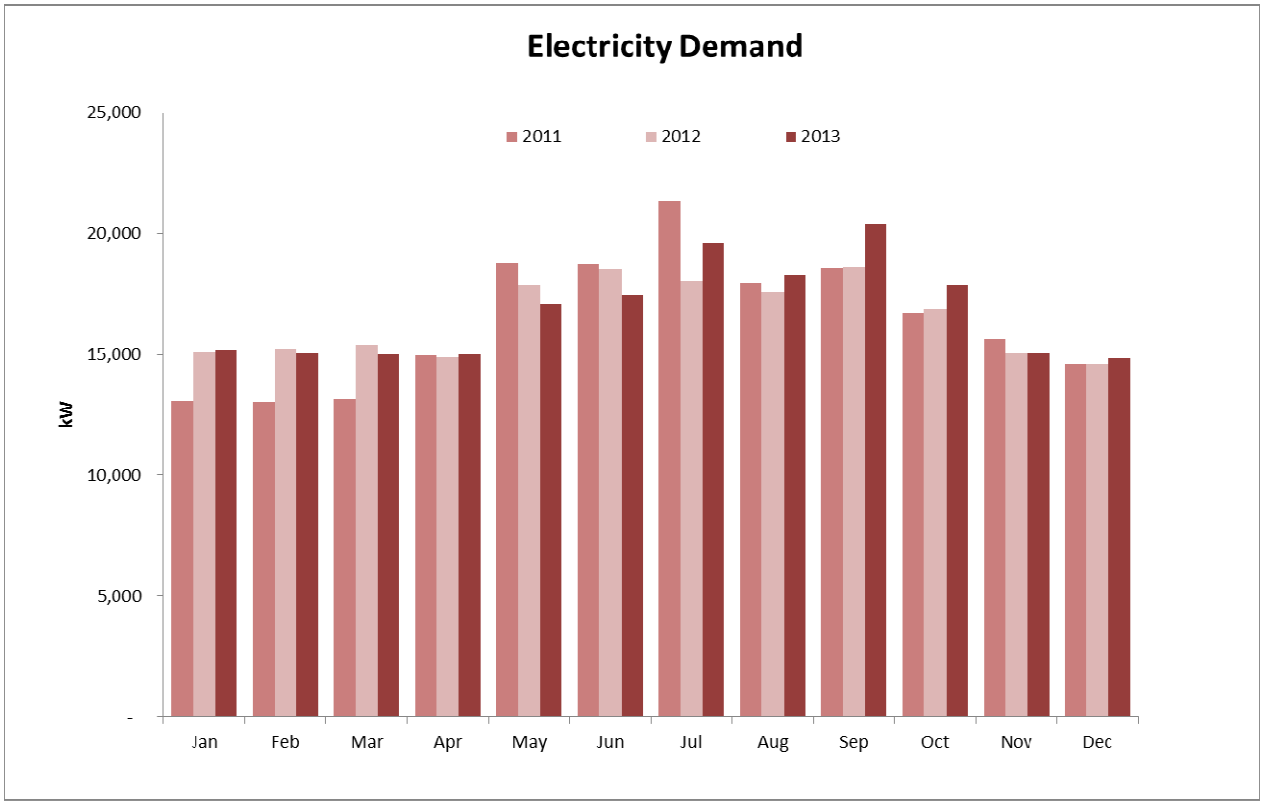
Utility	Annual Usage	% of Energy	Annual Cost	% of Cost
Electricity Consumption	107,384,025 kWh	34.2%	$2,819,022	12.7%
Electrical Demand	219,052 kW (annual)		$2,889,114	13.0%
Electrical Global Adjustment			$5,754,304	25.9%
Natural Gas	19,997,112 m^3	65.8%	$9,100,911	41.0%
Water	555,010 m^3		$1,615,125	7.2%
Total	313,954,192 ekWh		$22,188,476	

ELECTRICITY

The University of Guelph is classified as a Large Electricity Account (demand peaks over 5 MW), and is in the Group A Consumer Group.

Electrical Demand

Electrical demand trends (as seen in ***Figure A.1***) over the last three years show variability due to cooling related loading school term trends.



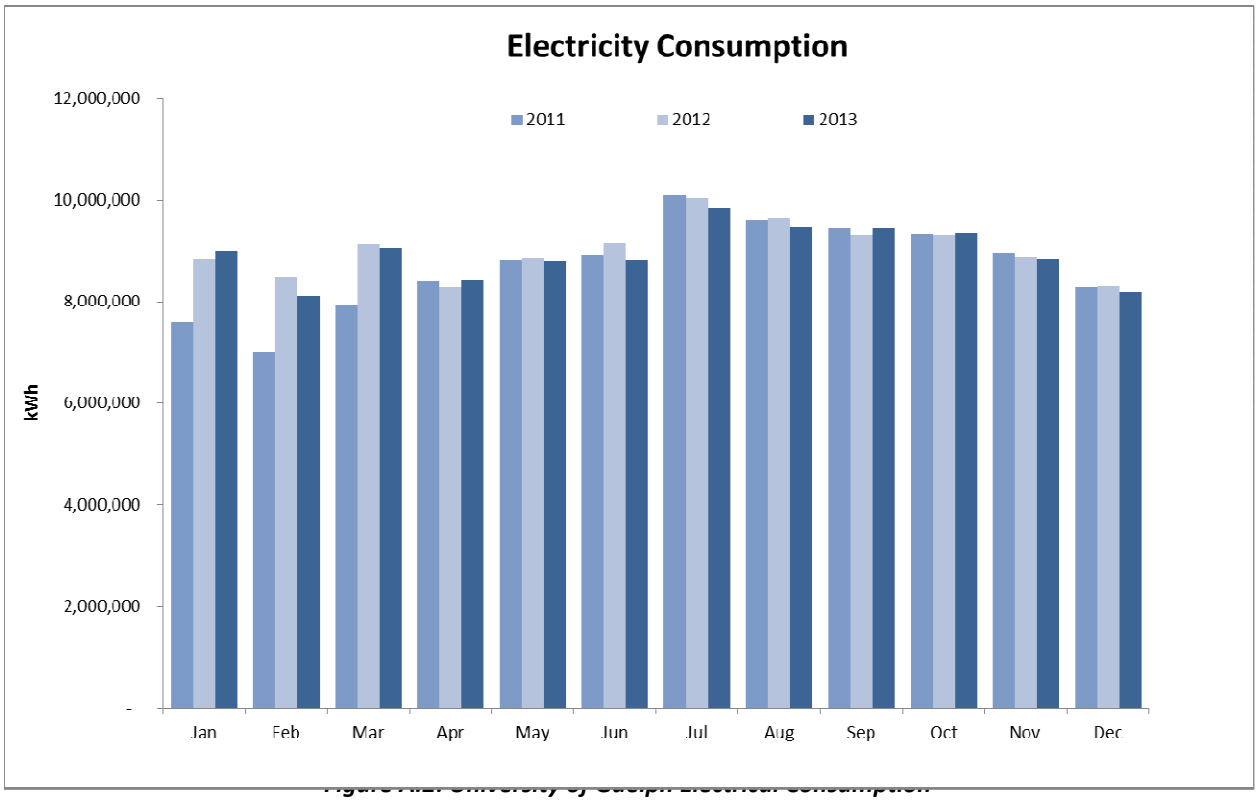
A linear regression of the monthly demand was undertaken comparing it to the outside air temperature and the summary of its results are detailed in ***Table A.2***.

Table A.2: Summary of kW Demand

Load Type	Demand	% Load
Base Load	177,925 kW	81.2%
Cooling Extra	41,127 kW	18.8%

Electrical Consumption

Electrical consumption trends over the last three years are shown in ***Figure A.2***, demonstrating variability due to additional cooling related consumption and school term trends.



A linear regression of the monthly consumption was undertaken comparing it to the outside air temperature and the summary of its results are detailed in ***Table A.3***.

Table A.3: Summary of kWh Electricity Consumption

Load Type	Consumption	% Load
Base Load	107,384,025 kWhs	100.0%

NATURAL GAS

Natural Gas Consumption

Gas consumption trends over the last three years clearly are shown in ***Figure A.4***, demonstrating typical natural gas usage weather dependency.

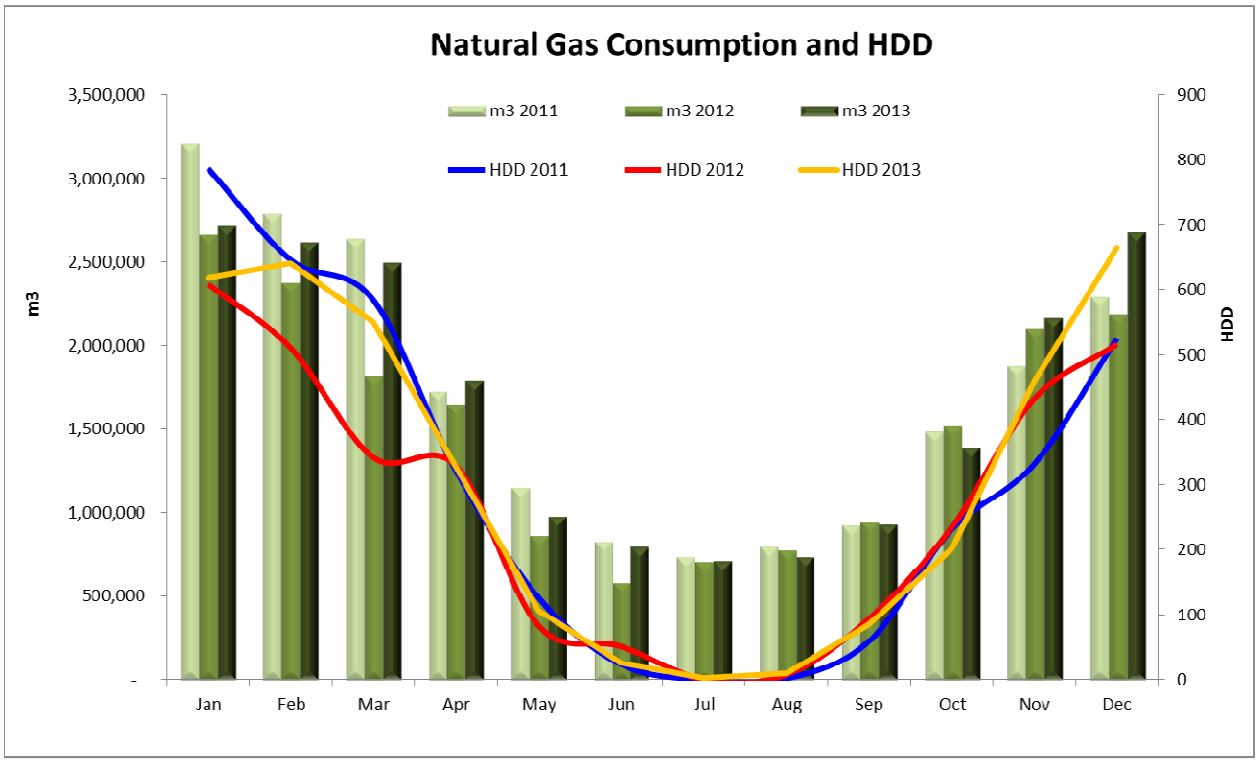


Figure A.4: University of Guelph Natural Gas Consumption

A linear regression of the monthly consumption was undertaken comparing it to the outside air temperature and the summary of results are detailed in ***Table A.4***.

Table A.4: Summary of m^3 Gas Consumption

Load Type	Consumption	% Load
Base Load	8,458,693 m^3	42.3%
Heating Extra	11,538,420 m^3	57.7%

WATER AND WASTEWATER

Water Consumption

Water consumption trends over the last three years are shown in ***Figure A.5***, demonstrating variability month over month due to school term trends.

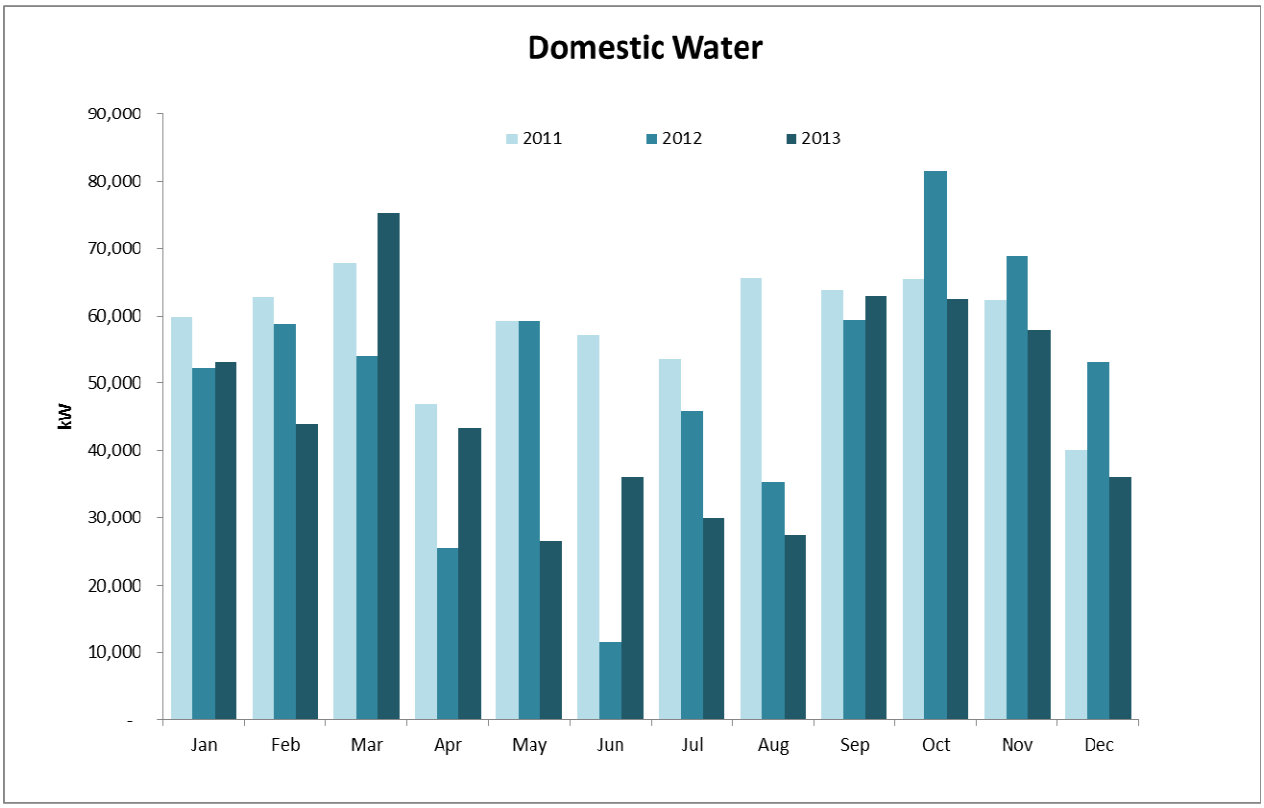


Figure A.5: University of Guelph Water Consumption

A linear regression of the monthly consumption was undertaken comparing it to the outside air temperature and the summary of its results are detailed in ***Table A.5***.

Table A.5: Summary of m^3 Water Consumption

Load Type	Consumption	% Load
Base Load	555,010 m^3	100.0%

APPENDIX B – ENERGY SAVINGS PROJECT SUMMARY

OVERVIEW

This Summary pertains to the Energy Project initiated by the University of Guelph in 2012. As of June 2014 the Energy Project has received Board of Governors approval and is scheduled for implementation to start in the Summer/Fall of 2014.

In 2012/2013 the University campus underwent a comprehensive energy audit. The recommendations proposed in the Audit concentrate on electricity consumption and demand, gas and water consumption, which when implemented will allow the University to benefit from a Comprehensive Energy Retrofit Program.

SUMMARY

The results of the feasibility assessment suggest the potential for energy improvements that include but are not limited to the following:

- Lighting Systems – Retrofit fluorescent lamps and ballasts to high-efficiency lamps and electronic ballasts, replace incandescent with compact fluorescent or LED replacement lamps, and replace incandescent or compact fluorescent exit signs with new LED exit signs.
- Central Utilities Plant – Optimize boiler and chilled water systems, including installation of a chilled water storage system to shift chiller electrical demand to off-peak hours.
- Mechanical Modifications – Conversion of variable inlet vane (VIV) air handling units and multi-zone and large single zone constant air volume air handling units to variable air volume (VAV) systems.

- Building Automation Controls – Scheduling systems for on/off and setback controls strategies.
- Water Conservation – Replacement of existing plumbing fixtures to high-efficiency low-flow technology.

The proposed efficiency measures, once implemented, would reduce energy costs by an estimated **$2.24 million** per year. This represents a financial savings of **10%** per year as compared to the CY 2013 energy costs.

The program has the benefit of reducing the energy intensity of the University to **1.80 GJ/m^2**, from the current level of **1.93 GJ/m^2**. The resulting GHG emission reductions are estimated at **4.7 million kilograms** of eCO_2 per year (varying yearly based on the changing provincial electricity generation GHG emission factor).