



2014 Strategic Energy Conservation and Demand Management Plan

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Vision

Windsor Utilities Commission (WUC) strives to be the lowest energy user per megalitre of water treated within the benchmark reporting communities across Canada. WUC is committed to continuing its progress in reducing energy usage through innovative and proven methods while providing a safe and reliable water supply to Windsor, Lasalle and Tecumseh. The organization is continuously increasing awareness of its energy reduction initiatives and energy management processes. Energy is a major part of the developed master plan and capital reinvestment plan. WUC is committed at all levels within the organization to ensure the fulfillment of the action plan in order to reduce energy consumption.

Overview

WUC has many areas where improvements can be implemented to change old or inefficient equipment or processes to newer more energy efficient models. Currently we are developing priority lists of ways to optimize the organization's energy usage. Many initiatives are of little cost to the organization and as simple as turning lights off when they are not required, turning down heaters in warmer temperatures, reviewing production requirements to improve efficiency just to list a few. It has become the production department's responsibility to review, document, report and inform the staff on energy usage and how everyone can contribute to the goals and objectives of reducing our energy footprint.

Currently we report on energy usage and initiatives taken to reduce the amount of energy used in those areas. WUC strives to keep the capital reinvestment plan on target with energy conservation and management goals that are integrated into the business culture.

Prior to this plan WUC enlisted the services and guidance of an external consultant company (360 Energy) to assist in our initiation planning process and provided the organization with the initial necessary skills to undergo the changes necessary to achieve our goal. Moreover, the organization utilized the University of Windsor to perform an energy assessment of our infrastructure to provide a jumpstart to our energy reduction plan. These actions provided WUC with the necessary building blocks in which to begin our path to being a leader in energy utilization.

Executive Summary

Scorecard Results

WUC performed a self-assessment on the WUC energy and demand management efforts. As a result we have targeted a variety of actions in the five main focus areas, and will position the organization in a way to attain optimal results. Through the evaluation, many areas of opportunity for improvement were revealed, however WUC does have areas that are of strength to the energy management efforts thus far. These in particular are as follows:

- **Energy Data Management:** WUC has designed a comprehensive program for collecting and analyzing monthly energy billing information, which will ensure all energy information, is available to all employees. This effort has produced a database of the facilities usage and cost information that is available for use in monitoring excessive variations, targeting facility follow-up evaluations, and generating areas that could be held for improvement opportunities. A monthly energy report card is incorporated into monthly production reports. Quarterly production reports which include energy metrics are reported to the Commission and EnWin Board. Once this report is received, it is disseminated to all employees within the facility to bring usage variations to attention and review improvements made. WUC continues to track and monitor specific aspects of our overall operations that would help enable us to better understand the bottom line impact on our energy efficiency activities.
- **Energy Supply Management:** WUC is currently on the most effective rates offered by the utility suppliers *ENWIN* and Union Gas. Our monthly billing analysis enables us to identify and recover any billing errors, or usage that should be brought to attention. Any changes that are made to the organizations use/operational procedures will prompt a re-evaluation of energy use.
- **Energy use in Facilities:** WUC has various controls in place for all major energy systems to allow for the verification and analysis of usage and costs of energy. All employees follow procedures to ensure that we are energy efficient in order to make them aware of how the day to day activities affect the energy usage. We have conducted walkthroughs and reviewed specific areas of the facility to target energy improvement activities. WUC also benchmarks its results against itself and the National and Provincial Benchmarking Communities.
- **Equipment Efficiency:** Energy efficiency design guidelines are established for various processes and equipment. When selecting equipment energy efficiency is considered along with maintainability and durability. Presently, WUC is planning a variety of other energy efficiency projects that will be continue to reduce the overall energy use at the production facilities.
- **Organizational integration:** Individuals are trained in the day-to-day responsibilities associated with energy and demand management. Some elements are facility wide and

others are simple energy awareness programs which have been implemented. The main areas that use and cost will be identified and documented with respect to the different ways each functional area can contribute to reducing energy use.

Baseline Energy Use

WUC's energy mix of the total energy use for 2012 year is approximately 97% electricity and 3% natural gas. A breakdown of energy use and cost for the WUC has been prepared, and is used to identify the large departmental users which highlight where improvements could be made. Total energy consumed in 2012 (including natural gas and electricity) was 16775014 kWh.

Due to continual increasing cost of energy and the production schedule, it is important that WUC reduces its overall cost and energy consumption. The water treatment plant plans to reduce the energy consumption by 8% of the 2012 baseline. Using 2012 as a starting point WUC will introduce new programs and changes to the facility, which will help to decrease the energy consumption.

Key Actions

Using the results of the energy assessment, WUC has identified the following actions, which, if taken, can reduce the facilities energy consumption and ensure that we meet our targets. The following categories will help in addressing the areas of improvement:

Process Improvement:

- Utility Bill review and comparison
- Incentives update
- Review of Shutdown procedures
- Corporate established KPI's
- Manage heating and cooling loads during summer and winter months
- Implement new pumping strategy to lower pumping requirements

Program Implementation:

- Expand Facility-wide energy and demand management programs
- Initiate energy efficiency improvement projects
- Continue the traffic light energy management program
- Review application of Solar Energy at the production facility
- Continue Demand Response program through Rodan (Program sponsored through the Ontario Power Authority to reduce overall peak demand in the province)

Projects:

- Install new LED light fixtures that are energy efficient and brighter.
- Install lighting controls to maintain light levels as required in the workplace.
- Install soft starters and variable frequency drives to improve energy required to pump treated water
- Replace aging HVAC equipment as required with new energy efficient models.
- Replace aging steam boiler with a new energy efficient boiler.
- Rebuild pumps to original specification to improve efficiency.

- Replace Ozone system diffuser injection method with Mazzei injection to reduce ozone generation electrical requirements.
- Diversion of the wastewater process to sanitary sewer
- Rebuild of Natural Gas Generators to maintain efficiency

Savings Estimate Evaluation

- The estimated energy reduction is 8% of 2012 baseline data
- 3% savings from process improvements
- 1% savings from program implementation
- 4% savings from projects

Goals & Measures

The overall goal of WUC is to increase the energy efficiency throughout both facilities by reducing the usage and setting a target of 8% decrease in the kWh/ML treated. The timeline set for the target is a 5 years.

Progress will be tracked by:

- Monthly KPI reviews
- Energy tracking
- Established awareness of energy conservation

The Energy Plan

1. Baseline Energy Use

Due to the fact that WUC operates on a 24-hour schedule in order to supply drinking water to the residents of Windsor, Lasalle and Tecumseh proves difficult when trying to reduce the overall utilities cost. This operating and demand pattern does not lend itself to shifting operating patterns to be the most efficient as it almost always conflicts with customer demand. However, with the current and future plans WUC should see consumption levels and variables decreasing as more and more actions are completed. The costs that are being saved through the reduced energy initiatives are known as avoided costs, which is the difference between the utilities costs at current usage per unit produced versus utility costs at reduced usage per unit produce.

Areas where there are exceptionally high energy consumption rates are the pump stations. Additionally, the control room uses above average consumption due to the fact that the room has computers running 24/7. Areas of low consumption are mainly offices and washrooms since they are used when needed and have little to no equipment.

Projects and initiatives are prioritized based on the cost to implement vs the expected savings (Return on Investment or ROI). If the ROI is acceptable then the project is placed into the capital project list for the upcoming year(s).

Natural gas is basically used for comfort heating during the winter months. Natural gas consumption during the summer months is minimal.

2. Savings Opportunity Assessment

WUC has implemented several energy saving initiatives since the original campaign began in 2010. These projects included:

- 1) SCADA Conversion - This project upgraded the management operating environment, or SCADA system (System Control And Data Acquisition), implement double redundancy (2n) on critical system controllers and improve management reporting capability for productivity improvements and Ministry of the Environment (MOE) compliance.
- 2) Medium/Low Voltage switchgear replacement - This project upgraded all electrical facility distribution components at the A.J. Brian pumping station and J.F. Cook Reservoir and booster station. The system conforms to all current electrical safety standards and provides redundancy thereby ensuring operation of the critical high and low lift pumping stations. These components are the lifeline to ensure the provision of safe and reliable drinking water within the City of Windsor and surrounding municipalities.
- 3) Distribution pressure control - WUC was one of five municipalities which participated in an Ontario Power Authority Conservation Fund program for subsidized pump efficiency testing in Ontario. With the support of the OPA Conservation Fund, municipalities had the opportunity to have their pumps tested at a subsidized rate and for the results to be compiled with those from other participating municipalities in order to advance the awareness of energy conservation in Ontario water supply systems. One of the recommendations highlighted the #3 high lift pump at our AJ Brian facility as a candidate for a rebuild due to its lack of efficiency while in operation. As a result WUC rebuilt the pump and also applied a coating to the interior of the pump which increases its efficiency and operating range. The second phase of this project involves the utilization of our networked distribution pressure stations. By using real time pressure data we are able to select which pumps should be operating in order to maximize high lift pump efficiency. This is made possible through Rockwell Pavillion software which employs predictive control to ensure that we are achieving our distribution setpoint within 1 psi while actively managing our high lift operations.
- 4) Generator Controls Upgrade – The generator building houses four natural gas electrical generators for the main purpose of emergency power for water production and high/low lift pumping. The controls which operate the generators are at the end of their cycle and require replacement in order to ensure a reliable emergency power source. Without these generators WUC would not be able to start high lift pumping or its production facility resulting in water loss to the entire city of Windsor, Lasalle and Tecumseh. This project included the replacement of all major control hardware and associated software. The newly installed controls have been integrated with the recently

installed SCADA infrastructure allowing for improved control and monitoring of the generators.

2.1 Process Improvements

On a general level these initiatives are quicker and more straightforward to implement with lower costs. Typically they can be expected to generate savings on the order of 1-2% of the annual expenditures. WUC has identified areas for improvement under the key levels of energy data management, energy supply management, energy use in facilities, equipment efficiency, organizational integration in relation to process improvement opportunities. Such areas need to be considered for improvements in order to reach a high level of energy performance.

- Discuss energy savings initiatives at monthly plant meetings to discuss progress and collect thoughts on new projects.
- Standard monthly summary reports of the energy and natural gas usage are shared, discussed and distributed with production staff. The numbers are to be compared with various activity levels and variances are highlighted and discussed.
- Continue to review benchmarking targets and KPI of similar comparators.
- Establish written procedures to ensure control with equipment, systems etc to optimize usage and write up shut down and start up procedures for all non-essential items.
- Continue to develop a comprehensive corrective maintenance program to ensure optimal equipment performance.

3. Energy Plan:

3.1 Utility Bill Review and Comparison

Groups involved:	<ul style="list-style-type: none"> • Water Production • EnWin • Union Gas
Review:	<ul style="list-style-type: none"> • Quarterly with team
Objective:	<ul style="list-style-type: none"> • Understanding how utility costs are determined and how frequent
Measurement of success:	<ul style="list-style-type: none"> • Identification of billing costs that can be controlled (ex. Gas – transportation Elec. Peak demand). • Identifying where the utility can help. • Identifying anomalies in consumption.
Expected savings:	<ul style="list-style-type: none"> • Can range from 1% to as high as 5% of cost (intermittently). Corrections can be made immediately.

3.2 Incentives update

- | | |
|-------------------------|--|
| Groups involved: | <ul style="list-style-type: none"> • Water Production • EnWin • Union Gas |
| Review: | <ul style="list-style-type: none"> • Quarterly with team |
| Objective: | <ul style="list-style-type: none"> • Understand where funding can become available to assist with payback for small or large scale projects |
| Measurement of success: | <ul style="list-style-type: none"> • Attend conferences and industry tradeshow |
| Expected savings: | <ul style="list-style-type: none"> • Less than 1% |

3.3 Review of Shutdown procedures

- | | |
|-------------------------|--|
| Groups involved: | <ul style="list-style-type: none"> • Engineering • Maintenance • Production |
| Review: | <ul style="list-style-type: none"> • Daily |
| Measurement of success: | <ul style="list-style-type: none"> • Ensure all non critical loads are turned off |
| Expected savings: | <ul style="list-style-type: none"> • Less than 1% |

3.4 Corporate Established KPI's

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|-------------------------|--|
| Groups involved: | <ul style="list-style-type: none"> • Entire energy team |
| Review: | <ul style="list-style-type: none"> • Quarterly |
| Measurement of success: | <ul style="list-style-type: none"> • Improve KPI |
| Expected savings: | <ul style="list-style-type: none"> • 8% |

4. Long Term Projects

In general, programs take longer to implement with moderate costs. Typically they can be expected to generate savings on the order of 5-10% of the annual expenditures. The initiatives identified areas for improvement under the key levels of energy data management, energy supply management, energy use in facilities, equipment efficiency, and organizational integration in relation to additional program implementation opportunities. Such areas need to be considered for improvements in order to reach a high level of energy performance.

- Establish daily load profiles for evaluation on energy use and cost
- Changing Variable Speed drive to a more efficient drives
- Shutdown or decommission unused areas in the plant
- Installation of solar power in rooftops of the WUC buildings.

4.1 **Expand Facility-wide energy awareness programs**

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|-------------------------|--|
| Groups involved: | <ul style="list-style-type: none"> • Director of Water Production • EnWin |
| Review: | <ul style="list-style-type: none"> • Quarterly |
| Measurement of success: | <ul style="list-style-type: none"> • Demonstration of conservation targets achieved and showed to rest of the facility. |
| Expected savings: | <ul style="list-style-type: none"> • 1 – 2% |

4.2 **Internal facility walkthrough**

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|-------------------------|---|
| Groups involved: | <ul style="list-style-type: none"> • Engineers • Maintenance |
| Review: | <ul style="list-style-type: none"> • Yearly |
| Measurement of success: | <ul style="list-style-type: none"> • Identifying motors, devices, or other items left on that can be turned off. |
| Expected savings: | <ul style="list-style-type: none"> • 1 – 2% |

4.3 **Review Solar Energy application at the Production facilities**

- | | |
|-------------------------|--|
| Groups involved: | <ul style="list-style-type: none"> • Engineers |
| Review: | <ul style="list-style-type: none"> • Ensure everyone at the site understand who's on the energy team. Each person's responsibility will allow for implementation of programs to be efficient. |
| Measurement of success: | <ul style="list-style-type: none"> • Timelines met • Improved efficiency |
| Expected savings: | <ul style="list-style-type: none"> • 5-10% |

5. **Capital Projects**

In general, capital projects to upgrade equipment and facilities are the most costly to implement and entail detailed planning. However, such projects can be expected to generate the largest savings, typically of the order of 10-20% of the annual expenditures. Improvements have been identified under the key levels of energy data management, energy supply management, energy use in facilities, equipment efficiency, organizational integration in relation to projects. Such areas need to be considered for improvements in order to reach a high level of energy performance.

All areas relating to projects in the 5 key levels need to be investigated and a plan of action to improve all aspects needs to be developed. This level is in most need of attention for achieving a higher level on energy performance.

5.1 LED and Lighting Controls replacement

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|-------------------------|---|
| Groups involved: | <ul style="list-style-type: none"> • Director of Production • EnWin • Maintenance • Engineering |
| Review: | <ul style="list-style-type: none"> • Monthly |
| Measurement of success: | <ul style="list-style-type: none"> • Installation by 2016 • Incentives received • Conservation success verified • Improved efficiency |
| Expected savings: | <ul style="list-style-type: none"> • 5% or \$190K |

5.2 Installation of soft starters and VFD's to reduce peak demand and usage

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|-------------------------|---|
| Groups involved: | <ul style="list-style-type: none"> • Director of Production • Engineering |
| Review: | <ul style="list-style-type: none"> • to ensure expectations of reduced peak demand were met. |
| Measurement of success: | <ul style="list-style-type: none"> • Projections met |
| Expected savings: | <ul style="list-style-type: none"> • 1% reduction in demand |

5.3 Solar energy

- | | |
|-------------------------|---|
| Groups involved: | <ul style="list-style-type: none"> • Director of Production • EnWin |
| Review: | <ul style="list-style-type: none"> • 2014 |
| Measurement of success: | <ul style="list-style-type: none"> • Implementation within 5 years • Payback within 15 years. |
| Expected savings: | <ul style="list-style-type: none"> • 0.5% annually |

5.4 Replacing of aging HVAC Equipment

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|-------------------------|---|
| Groups involved: | <ul style="list-style-type: none"> • Engineering • Site Maintenance • EnWin • Union Gas |
| Review: | <ul style="list-style-type: none"> • Ongoing |
| Measurement of success: | <ul style="list-style-type: none"> • Replace with new energy efficient units |
| Expected savings: | <ul style="list-style-type: none"> • Less than 1% |

5.5 Rebuild pumps to original specification

- | | |
|------------------|---|
| Groups involved: | <ul style="list-style-type: none"> • Director of Production • Maintenance |
|------------------|---|

- Review:
 - Various Contractors
 - 2016
- Measurement of success:
 - Improved pumping based on initial OPA audit conducted in 2012
- Expected savings:
 - Less than 1% annually

5.6 Diversion of the Wastewater to the Sanitary Sewer

- Groups involved:
 - Maintenance
 - Production
 - Director of Production
 - City of Windsor
 - EnWin
- Review:
 - 2016
- Measurement of success:
 - Complete implementation and savings measured.
- Expected savings:
 - than 1% annually

5.7 Rebuild of Natural Gas Generators

- Groups involved:
 - Maintenance
 - Production
 - External Contractor
- Review:
 - 2018
- Measurement of success:
 - Improved reliability of generators
 -
- Expected savings:
 - Least than 1% annually

6. Objectives and Goals

6.1 WUC has established the following goals:

6.1.1 A 8% decrease in the kWh/ML treated by 2018.

6.2 Milestones and Accountability Assignment

- a. AJ Brian LED Conversion – December 2014
- b. Old Treatment Plant Boiler replacement – December 2014
- c. Install new Ozone injection system – March 2015
- d. George and JF Cook LED Conversion – April 2015
- e. Install VFD at George Pump Station – May 2015
- f. Diversion of wastewater treatment process to sanitary sewer – August 2015
- g. Rebuild Natural Gas Generator #1 – December 2015
- h. AH Weeks LED Conversion – December 2015
- i. OTP LED Conversion – August 2016
- j. Rebuild Natural Gas Generators #2– December 2016
- k. Rebuild Natural Gas Generators #3– December 2017
- l. Rebuild Natural Gas Generators #4– December 2018

6.3 Progress Measurements:

WUC must adopt specific energy use and cost metrics and utilize comparison and benchmarking to set performance targets for each process line. As well, establish a process and schedule where managers regularly review the Energy report cards with their employees and initiate action when and where it is needed. The managers are to report feedback on the status of the actions taken. As a progress report, there will be monthly updates that will track Energy consumption and all the ongoing and near-future projects being implemented.

7. Planned Actions and Projects

The goals and objectives along with the monthly plant meetings revealed processes, programs and projects that should be undertaken to drive the organization's energy management performance to the next higher level. These actions, encompassing each other the five focus areas: energy information, energy supply, facilities operations, systems and equipment, and business integration. These can be grouped into the following three categories.

7.1 Process Improvement:

- Establish readily available monthly billing information conveyed in understandable formats
- Develop methods of benchmarking targets and KPI of energy users
- Establish usage/cost reports, for regular review on energy performance results
- Identified proper methods for data reviewing
- Identify high/med/low users, marking best rates, performing changes when necessary
- Develop proper communicating techniques for those responsible for purchasing
- Schedule and commit to a facility walk through monthly/quarterly
- Build upon written procedures to ensure control with equipment, systems etc to optimize usage
- Build upon the current comprehensive corrective maintenance program to ensure key energy-using
- Build upon established appropriate controls for systems when operating load is reduced to reduce energy use and cost

7.2 Program Implementation:

- Review established daily load profiles for evaluation on energy use and costs

- Review established proper supply purchasing set up, with emphasis on forward prices and monitoring
- Identify those responsible for purchasing energy saving opportunities
- Identify potential alternate fuels for use in key energy using equipments

7.3 Projects:

All areas relating to projects in the 5 key levels corresponding to the SEP scorecard need to be investigated and a plan of action to improve all aspects needs to be developed. This level is in most need of attention for achieving a higher level on energy performance.

8. Financial Assessment

The cost and saving estimations for the proposed process improvements, program implementation and projects is broken down as follows.

8.1 Operating Budget

<u>Process Improvements</u>	<u>Cost Savings</u>	<u>Cost</u>
• Facility Walk Through	\$ 300	\$ -
• Energy Usage/Cost Reporting	\$ 1,000	\$ -

<u>Project Implementation</u>	<u>Cost Savings</u>	<u>Capital Cost</u>
• LED Conversion	\$ 190K	\$350K
• OTP Boiler Replacement	\$ 5K	\$ 95K
• New Ozone Injection system	\$ 25K	\$ 1.2M
• Install new VFD at George Pump Station	\$ 20K	\$ 350K
• Diversion of wastewater to sanitary sewer	\$ 50K	\$ 350K
• Rebuild Natural Gas Generators	\$ 5K	\$ 480K

The prioritization of projects that are to be initiated in WUC facilities are based on the financial assessment results, where the top priorities go to the projects that have the lowest life cycle cost and highest rate of return.

9. Budget

9.1 Program Implementation Costs

The committee has formulized an operating budget that will determine what funds are needed for the new projects and what is needed for the ongoing projects.

9.2 Project Implementation Costs

The committee has formulized a capital budget that is needed for funding of the proposed projects. The funding is available when a project is approved.

9.3 Outside Funding

Outside funding will be considered when the internal capital is insufficient to support any new and ongoing projects. Different methods of outside funding is a performance contract with the company supplying either new equipment, replacing old equipment with more energy efficient models and in place of paying for the construction, the supplier will receive the cost savings from the equipment till the equipment is paid for.

10. Energy Mandate

WUC feels that it is of critical importance to improve energy use and cost management and must be done without any adverse impact on the operation and routine of the workplace or its customers. Energy conservation is recognized by the majority as a controllable operating expense and if compliance, cooperation and foot-forward efforts are engaged. Every member of WUC has an important role and responsibility to play in the success of the energy management program. An Energy Mandate for WUC has been developed and is proposed as an integral part of the Sustainable Energy Plan.