UNION WATER SUPPLY SYSTEM

Energy Conservation and Demand Management Plan

2020-2024

June 19, 2019

Union Water Supply System

Table of Revisions

Revision #	Date	Description of Revision	Revised by
0	June 16, 2015	Initial Issue	UWSS and OCWA
1	June 26, 2019	5-Year Revision	UWSS and OCWA

June 30, 2019

Ministry of Energy, Northern Development and Mines
159 Cedar Street
Sudbury, ON P3E 6A5

Dear Sir/Madam:

RE: Union Water Supply System
Conservation and Demand Management Plan 5-Year Update
Electricity Act - Ontario Regulation 507/18

The attached Updated Conservation and Demand Management Plan (CDM Plan) has been prepared by the Ontario Clean Water Agency on behalf of the Union Water Supply System (UWSS). The attached CDM Plan is the UWSS' 5-year update to the initial plan submitted in accordance with the since-revoked Green Energy Act, as required by Ontario Regulation 507/18. The Plan outlines the UWSS' annual energy consumption along with the goals, objectives and proposed measures with respect to energy conservation and demand management. It also outlines the energy reductions achieved from 2014-2018.

The UWSS is committed to implementing the energy conservation and demand management measures as outlined in this Plan, which has been approved by senior management. This Plan is constantly evolving and may be revised to reflect the most current information and circumstances.

I trust the information contained in the Plan is self-explanatory. If you have any questions or require more information, please do not hesitate to call me.

Sincerely,

Rodney R. Bouchard,
General Manager
Union Water Supply System

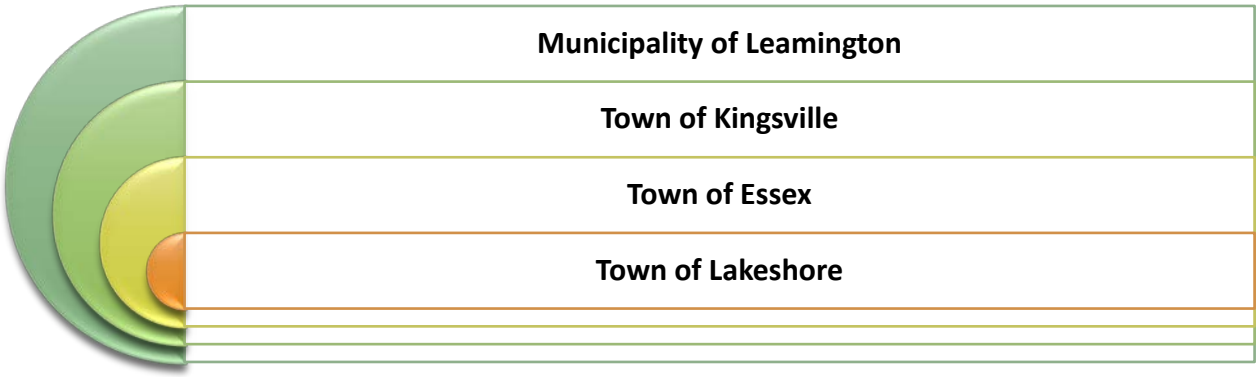
Table of Contents

Disclaimer: This document has been prepared by the Ontario Clean Water Agency on behalf of the Union Water Supply System in accordance with Ontario Regulation 507/18 under the Electricity Act, 1998 for submission to the Ministry of Energy, Northern Development and Mines. This Plan is constantly evolving and may be revised to reflect the most current information and circumstances. The Union Water Supply System, its Management Board, shareholders or representatives do not accept any liability whatsoever by reason of, or in connection with, any information in this document or any actual or purported reliance on it by any person. The Union Water Supply System may update any information in this document at any time.

Executive Summary

In 2014, the Union Water Supply System (UWSS) developed a comprehensive Five Year Conservation and Demand Management (CDM) Plan for the system in compliance with the requirements of *Ontario Regulation 397/11* under the *Green Energy Act, 2009* with the support of the Ontario Clean Water Agency (OCWA). This regulation was replaced with *Ontario Regulation 507/18* under the *Electricity Act, 1998* in 2018.

UWSS is overseen by a Management Board comprised of individuals from ***four municipalities***:



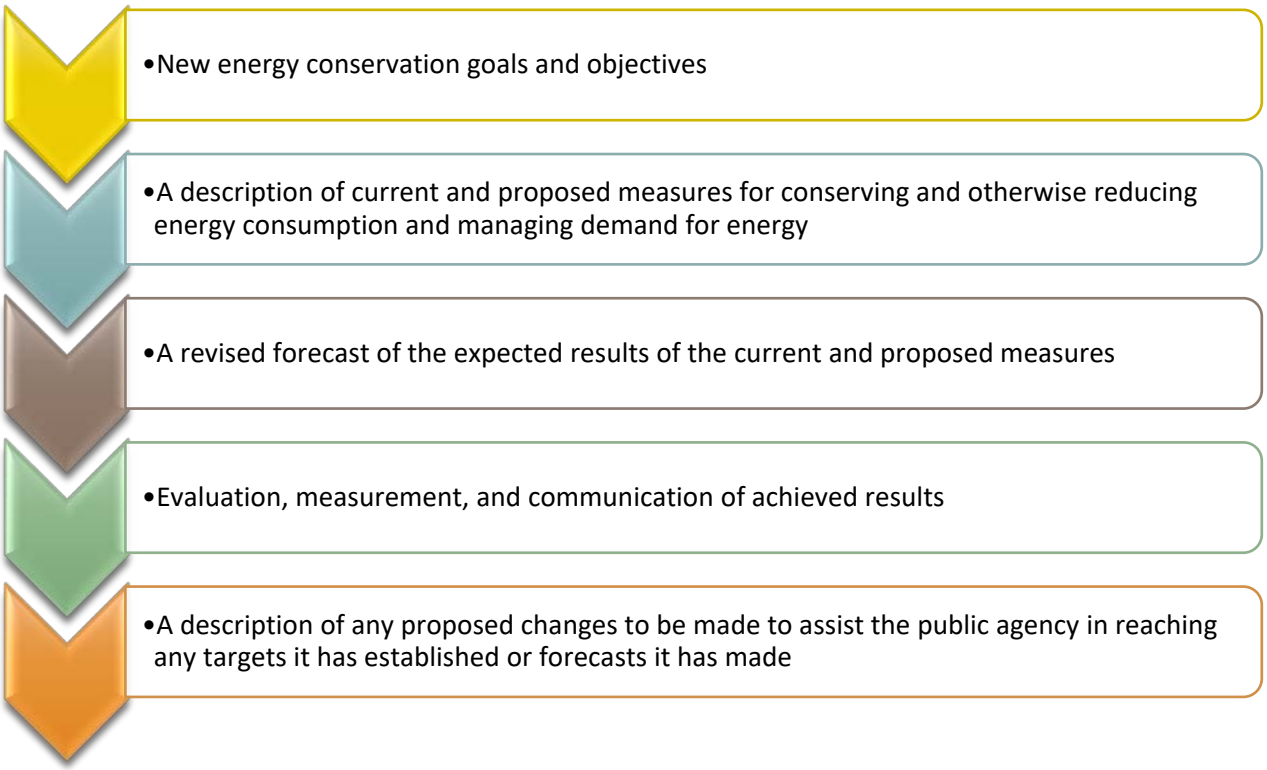
UWSS provides treated drinking water to the above mentioned municipalities through a distribution system network and components (pumping stations and water towers). These municipalities are provided with wholesale water rates and the municipalities then distribute the drinking water to their customers. The water system is operated and maintained by the OCWA under contract to the Management Board.

The UWSS retained OCWA to build on the system's first CDM Plan originally developed in 2014 incorporating the experiences gained in energy conservation over the last five years. This updated CDM plan was developed as per the regulation and guidelines provided by Ministry of Energy, Northern Development and Mines and covers the period from 2020 to 2024. The plan was presented to the Management Board and approved on June 19, 2019.

There are significant advantages to developing and implementing a CDM Plan. The lowest cost options for meeting energy demands could be to implement energy efficiency and the wise use of energy. Simple actions of turning off lights and appliances, shutting off heaters in the summer and establishing efficient usage times, efficient production requirement, and many other ***actions can result in energy savings, while providing many other environmental, economic and social benefits, including reducing GHG emissions***. Reducing energy consumption translates to reducing costs to municipalities and the savings could be directed to more important works in the municipalities.

The intent of the CDM Plan is to guide the UWSS in the development of an energy management foundation and energy program. It is a living document that will evolve as the UWSS' energy needs are revealed and better understood. This plan is designed to meet the current energy conservation needs of the UWSS.

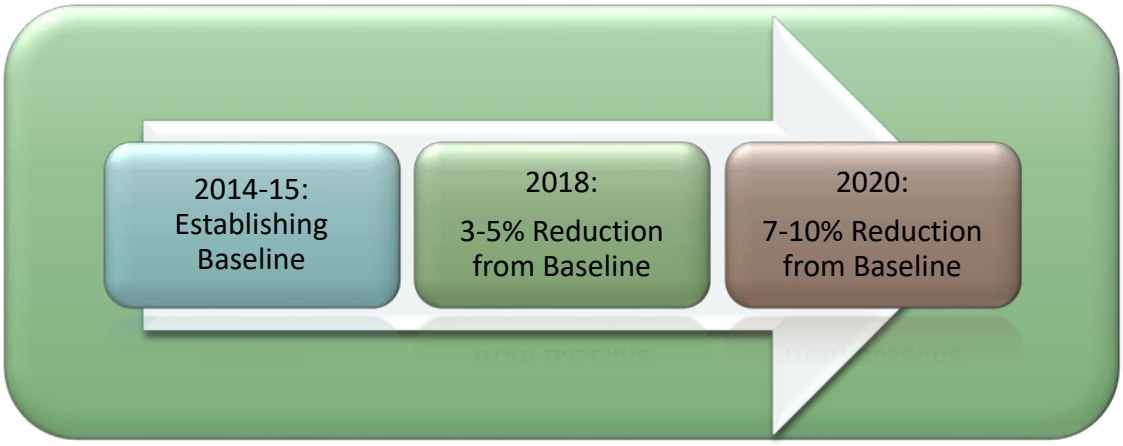
The CDM Plan should be consistent with other existing planning documents that relate to energy conservation. This plan should also document all energy conservation initiates that the UWSS has completed, currently have and plan to implement. The updated CDM Plan will outline the following:



The UWSS is committed to the promotion of responsible energy management through the implementation of economically viable energy efficiencies and environmental care throughout all facilities, plants and equipment. The UWSS will take reasonable efforts to minimize impacts to the environment when allocating resources, while recognizing the needs of our residents and visitors.
The UWSS will exercise stewardship in the use of finite resources to demonstrate leadership, optimize our delivery of services, and enhance the overall quality of life in the community. We will strive to continually reduce our total energy consumption and associated carbon footprint through wise and efficient use of energy and resources.

It was not expected that there would be substantial energy usage reductions from the 2014 baseline year's rate of energy consumption. However, there are always opportunities for improvement and the UWSS is committed to continuously monitor energy consumption and implement energy efficient practices where applicable.

As a target for the last five year CDM Plan, the UWSS vowed to strive to reduce energy (electricity and natural gas) consumption in each building by 7-10% by the end of 2019 from the 2014 baseline.



UWSS has always been proactive towards energy conservation and has initiative various activities that would assist towards efficient use of energy. Overall electricity and natural gas consumption per megalitre of water treated and pumped decreased by 8.7% and 9.2% respectively by 2018 compared to the 2014 baseline consumption levels. UWSS is committeed to continuous implementation of new ECMs and decrese energy consumption, cost and the negative impact of fossil fuels on the environment have raised interest in sustainability and predictable energy rates.

Though total annual electricity and natural gas consumption may have increased at some of the facilities over the years, ***the quantity of electricity and natural gas consumed per unit of flow (energy intensity) demonstrate that the facilities' energy intensities (kWh per ML) have been reduced by over 10% since 2014. That said, the 2020 Energy Reduction Target has been surpassed.***

Please see Schedule 1 for a detailed analysis of the UWSS' energy consumption and intensities from 2011 to 2018.

The UWSS is continuously working to recognize and implement measures to ensure energy savings continue to grow and that new conservation measures are identified and acted upon. Concerns over ever-increasing energy prices and the negative impact of fossil fuels on the environment have raised interest in sustainability and predictable energy rates.

Energy conservation has been an on-going process in all buildings. As per the Capital Budgeting Plans of the UWSS, new developments and redevelopments including replacement/retrofit works are encouraged to be built and sustained in a manner that minimizes energy consumption. Electrical equipment replacement works over the years have been evaluated against energy efficiencies criteria, and the most cost-effective option at that time was chosen.

The UWSS will thus strive to ***reduce our energy consumption (electricity and natural gas) by 13-15% by the end of 2024 from the 2014 baseline***. This Energy Reduction Target will apply to all facilities owned by the UWSS.

The UWSS commits to the following objectives for the 2020-2024 period:

1. • Improve the UWSS' understanding of energy consumption.
2. • Increase staff awareness and motivate staff to use energy more efficiently.
3. • Report energy performance changes and improvements annually.
4. • Improve the efficiency of energy use through low–cost opportunities by implementing the following:
   - Sound operating and maintenance practices;
   - Employee training, and staff awareness;
   - Monitoring and tracking system; and
   - Energy Demand Management program.

Included herein are the measures that will be undertaken to support the achievement of these objectives and goals.

Introduction and Background

In 2014, the Union Water Supply System (UWSS) developed a comprehensive Five Year Conservation and Demand Management (CDM) Plan for the system in compliance with the requirements of *Ontario Regulation 397/11* under the *Green Energy Act, 2009* with the support of the Ontario Clean Water Agency (OCWA). This regulation was replaced with *Ontario Regulation 507/18* under the *Electricity Act, 1998* in 2018.

Under *Ontario Regulation 507/18,* the requirements for broader public sector energy planning and reporting are identical to those under the former *Ontario Regulation 397/11*.

Under *Ontario Regulation 507/18*, all BPS organizations, including municipalities, service boards and townships, are required to report annually on energy use and greenhouse gas (GHG) emissions. The organizations are also required to develop a CDM plan and update it every five years, with this first update due July 1, 2019.

Regulation 507/18 requires public agencies to:

- Report annually on energy use and GHG emissions.
- Develop five-year energy CDM plans starting July 1, 2014 with the first update due July 1, 2019.
- Post annual reports and 5-year plans to the agency's website and make printed versions available for the public.

The UWSS retained OCWA to build on the system's first CDM Plan originally developed in 2014 incorporating the experiences gained in energy conservation over the last five years. This updated CDM plan was developed as per the regulation and guidelines provided by Ministry of Energy, Northern Development and Mines and covers the period from 2020 to 2024. The 2019 CDM plan update was endorsed by the UWSS Board meeting on June 19, 2019.

Plan Purpose

Municipalities are under a huge pressure to increase water rates to maintain their water systems and to address increasing energy costs to operate these plants.

There are significant advantages to developing and implementing a CDM Plan. The lowest cost options for meeting energy demands could be to implement energy efficiency and the wise use of energy. Simple actions of turning off lights and appliances, shutting off heaters in the summer and establishing efficient usage times, efficient production requirement, and many other ***actions can result in energy savings, while providing many other environmental, economic and social benefits, including reducing GHG emissions***. Reducing energy consumption translates to reducing costs to municipalities and the savings could be directed to more important works in the municipalities.

The intent of the CDM Plan is to guide the UWSS in the development of an energy management foundation and energy program. It is a living document that will evolve as the UWSS' energy needs are revealed and better understood. This plan is designed to meet the current energy conservation needs of the UWSS.

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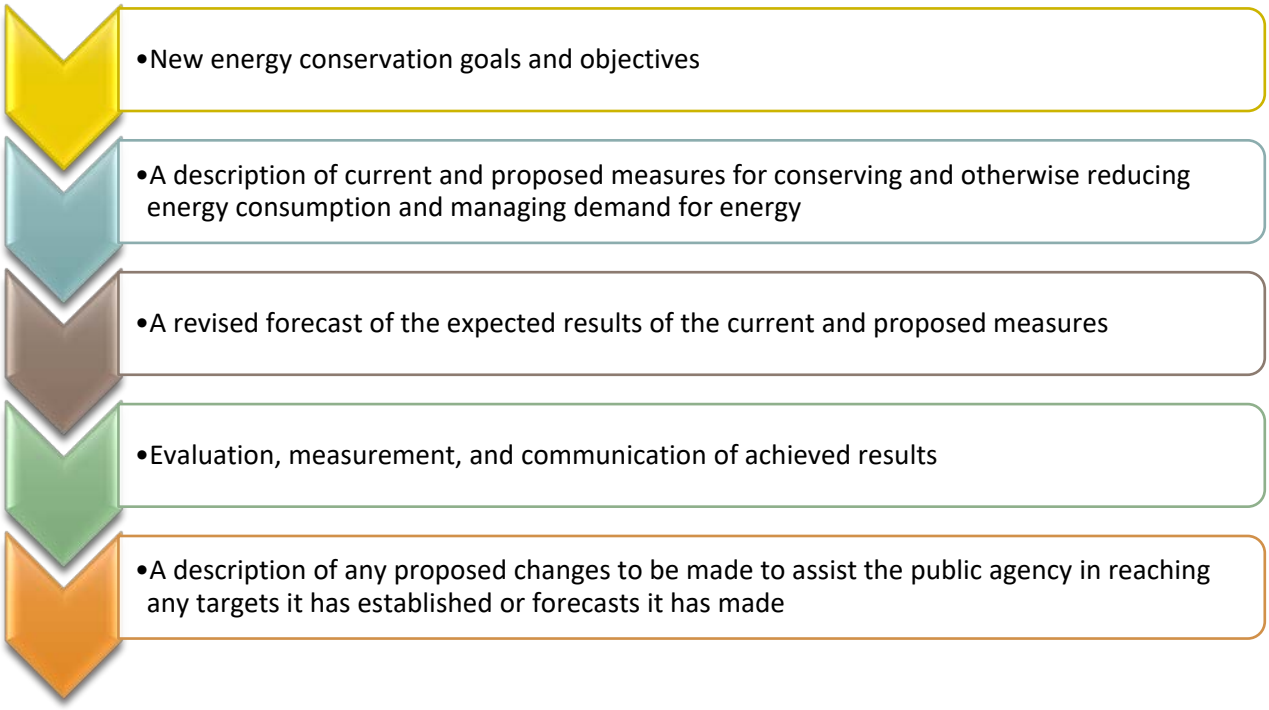

Union Water Supply System

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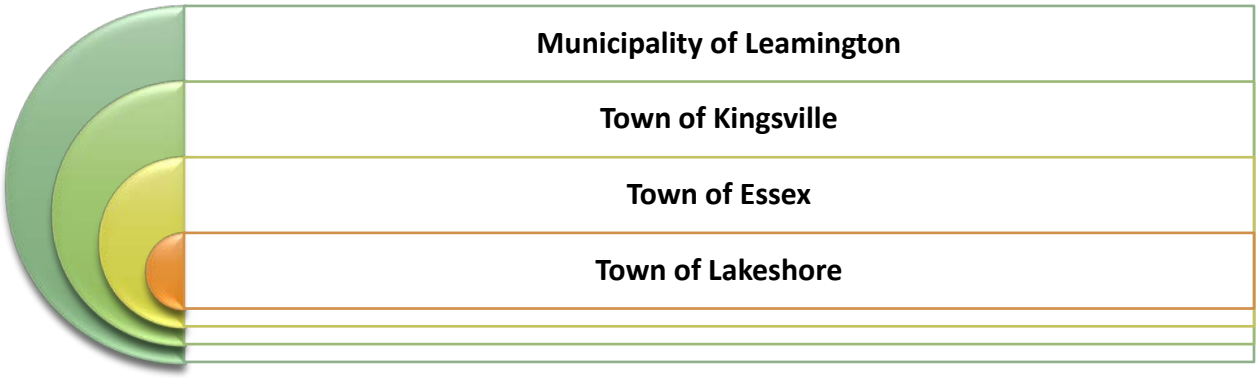


UWSS provides treated drinking water to the above mentioned municipalities through a distribution system network and components (pumping stations and water towers). These municipalities are provided with wholesale water rates and the municipalities then distribute the drinking water to their customers. The water system is operated and maintained by the OCWA under contract to the Management Board.

The UWSS was originally built in the 1960s and is classified as a Class 4 Water Distribution and Class 4 Water Treatment System. The RWTP has a capacity of 124,560 m^3/day. The three intake system has a design capacity of 218,208 m^3/day and has zebra mussel control systems for intake 1 and 2. Intake 3 is an emergency intake. Water is drawn from the lake through the three intake system to the low lift pump station and pumped to the Ruthven Water Treatment Plant (RWTP), where the water is treated. The water storage and transmission system includes two reservoirs at the RWTP, four elevated storage tanks (Albuna Water Tower, Leamington Water Tower, Kingsville Water Tower and Essex Water Tower), one booster pumping station with reservoir (Cottam Booster Station) and approximately 120 km of “transmission” water mains.

The Low Lift (LL) building consists of two inlet chambers, screening facilities (two bar screens and three travelling screens), two low lift pump wells, seven vertical turbine pumps, chemical storage and feed facilities, two surge tanks, and 600 kW diesel generator. The two surge tanks interconnected to the low pump discharge header. The main floor area of the building is approximately 407 m^2.

The RWTP has a main floor area of approximately 2,580 m^2, which houses filters, chemical storage and feed equipment, high lift pumps, standby diesel generators, offices, laboratory, control room and workshop.

The Cottam Reservoir and Booster Pumping Station (CBS) is located in the Hamlet of Cottam within the Town of Kingsville. It consists of a two compartment in-ground concrete storage reservoir, a reservoir contact chamber, four vertical turbine pumps, two hydro-pneumatic surge suppression tanks, disinfection system (one sodium hypochlorite tank, two chemical metering pumps and one sample pump), two chlorine residual analyzers, one wastewater holding tank and one 400 kW diesel generator. It also contains an office and washroom.

The Leamington Water Tower is located in the Municipality of Leamington. Its useable volume is 1,514 m^3. The Kingsville Water Tower is located in the Town of Kingsville. Its useable volume is 1,137 m^3. The Essex Water Tower is located in the Town of Essex. Its useable volume is 1,137 m^3. The Albuna Water Tower is located in the Town of Kingsville adjacent the western municipal boundary of the Town of Leamington. Its useable volume is 6,820 m^3.

Capital Plan of the UWSS

Energy conservation and management is part of the process when determining the UWSS Capital Planning Budget. Development of the Capital Plan encourages the implementation of energy conservation practices for new developments and redevelopments in the UWSS. UWSS has been very proactive in including a number of energy related projects in its capital plan for 2015-2020.

Some energy conservation objectives that were approved, included in capital plans, and completed from 2015-2018 are listed below:

- Growing Smart Water Communities – UWSS and University of Windsor initiated a water demand/water usage study.
- Low Lift Lighting Upgrades (LED) – Multi-year funding allocated to install LED lighting in all UWSS facilities including Low Lift, Treatment plant, Cottam Booster and exterior areas Installation of VFDs for various pumps including Main Wash #1 pump, carbon pumps, chemical pumps, etc.
- Installation of VFDs for various pumps including Main Wash #1 pump, carbon pumps, chemical pumps, etc.
- Master Meter Replacements – There is a yearly allocation to replace the all the meters in the distribution system until completion.
- Window replacements for Ruthven Water Treatment Plant completed over a 3-year period from 2015-2018.
- Various High Lift, Low Lift, Booster and other pumps replacement
- Replacement of roof at maintenance shop, pole barn, and chlorine building to prevent leakage and improve R values

UWSS also completed a Monitoring and Targeting (M&T) project for its Low Lift Pumping Station that will track energy consumption by LLPs on real time basis in 2018. It is currently implementing M&T project in Water Treatment Plant that will bring energy consumption for HLPs in the system. ***These data will be used to identify and assess ECMs for both pumping systems***

The 2019 approved capital plan for the UWSS includes:

- The installation of power meters and upgrade of hight lift process pumps
- The rehabilitation of the carbon recirculation pump
- Power factor capacitor upgrades at the low lift and high lift pumps
- An energy monitoring and management system at the high lift pump

This CDM Plan complements the Capital Planning Budget in defining practical objectives in order to realize the goal to create an energy efficient and comfortable environment in the UWSS.

UWSS Energy Background

Population

The UWSS provides drinking water to a few municipalities, which are the Municipality of Leamington, the Town of Kingsville, the Town of Essex, and the Town of Lakeshore. The area is experiencing population growth due to the relatively low cost of living.

UWSS provides water to all of the population in the Town of Kingsville and Municipality of Leamington, 18% of the population in the Town of Lakeshore and about 50% of the population in the Town of Essex. In total, the UWSS provides water to approximately 65,000 residents along with numerous commercial, industrial. The UWSS also provides treated water to a large greenhouse industry that is concentrated in the Leamington and Kingsville area.

Population in the municipalities that are supplied drinking water by the UWSS is projected to continue rising in the foreseeable future. As population grows, more water shall be consumed. Further, the greenhouse industry is currently in a growth phase that is anticipated to continue for the next few years. Subsequently, the demand for energy usage for UWSS will likely rise.

The water demand for the area varies greatly depending on the industry in the area. There are many greenhouses, food processors, and other industries in the area that greatly influence the

water demand. The greenhouses, food processors, and other industries water demand requirement is difficult to determine as their water demand requirements change depending on the crop, time of year and varying meteorological conditions. Additionally, UWSS does not have control over the building of new greenhouses, as this is up the municipalities. It is extremely difficult to figure out this water demand for the area as the number of operating greenhouses can change significantly in a short period of time.

Energy Costs

Energy consumption and costs are relatively high in Ontario. The figure below shows the significant increase in electricity costs over the last decade, taxing municipal reserves.

The UWSS obtains electrical energy and natural gas from the Local Authority Services (LAS). LAS has approximately 160 participating organizations in the program. Its rates are lower than Enbridge and Union Gas rates.

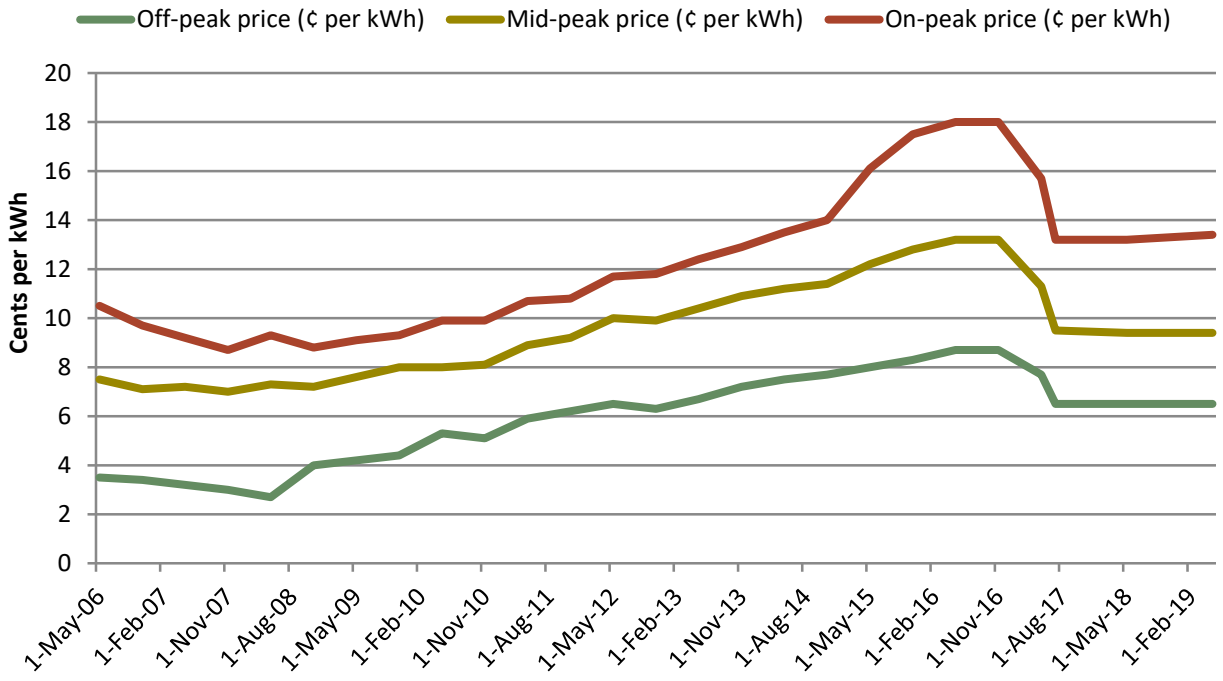


Figure 1: Historical TOU Electricity Rates[1]

The Ontario water and wastewater treatment sectors are the largest municipal electricity consumers, representing more than a third of annual electricity consumption. In 2011, water

[1] Ontario Energy Board, 2019

[2] Study Report: Market Characterization & Conservation Potential for Ontario's Drinking Water & Wastewater Treatment Plants (Dec. 2018), IESO, Posterity Group, 113.

and wastewater systems used about 1,815 gigawatt-hours (GWh) of electricity (enough to power about 200,000 homes) and 40 million m^3 of natural gas (enough to heat approximately 15,000 homes). This energy use may rise due to ever-more stringent treatment requirements, but these systems also have many opportunities to become more energy efficient, and even to generate renewable energy.[3]

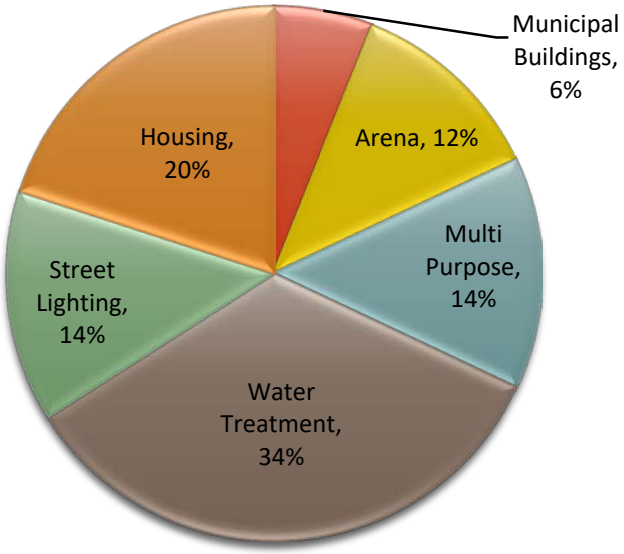


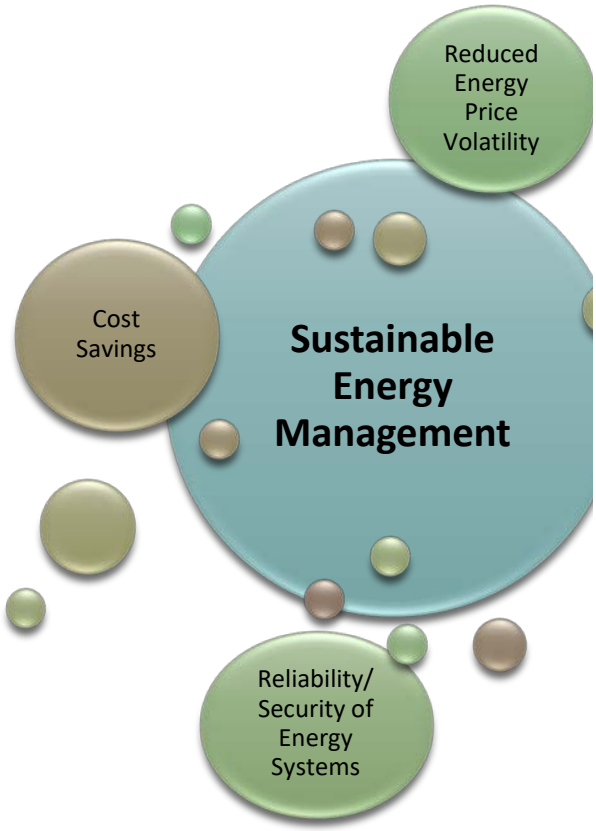
Figure 2: Municipal Energy Use by Sector in Ontario[3]

Managing municipal energy consumption efficiently means providing the same services with less energy. Energy conservation measures are often the lowest cost options for providing many other environmental, economic and social benefits. This also results in cost savings, lower environmental load by avoiding GHG and local air, water and land emissions associated with energy production and consumption, local economic development opportunities and associated new jobs, enhanced reliability of energy systems, and reduced price volatility, and improved energy supply security.

Commitment

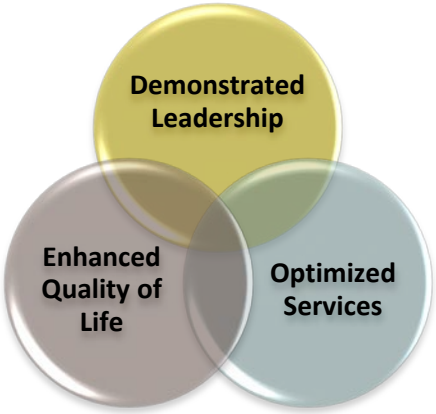
The UWSS is committed to the promotion of responsible energy management through the implementation of economically viable energy efficiencies and environmental care throughout all facilities, plants and equipment. The UWSS will take reasonable efforts to minimize impacts to the environment when allocating resources, while recognizing the needs of our residents and visitors.

[3] Every Drop Counts, ECO, 2017



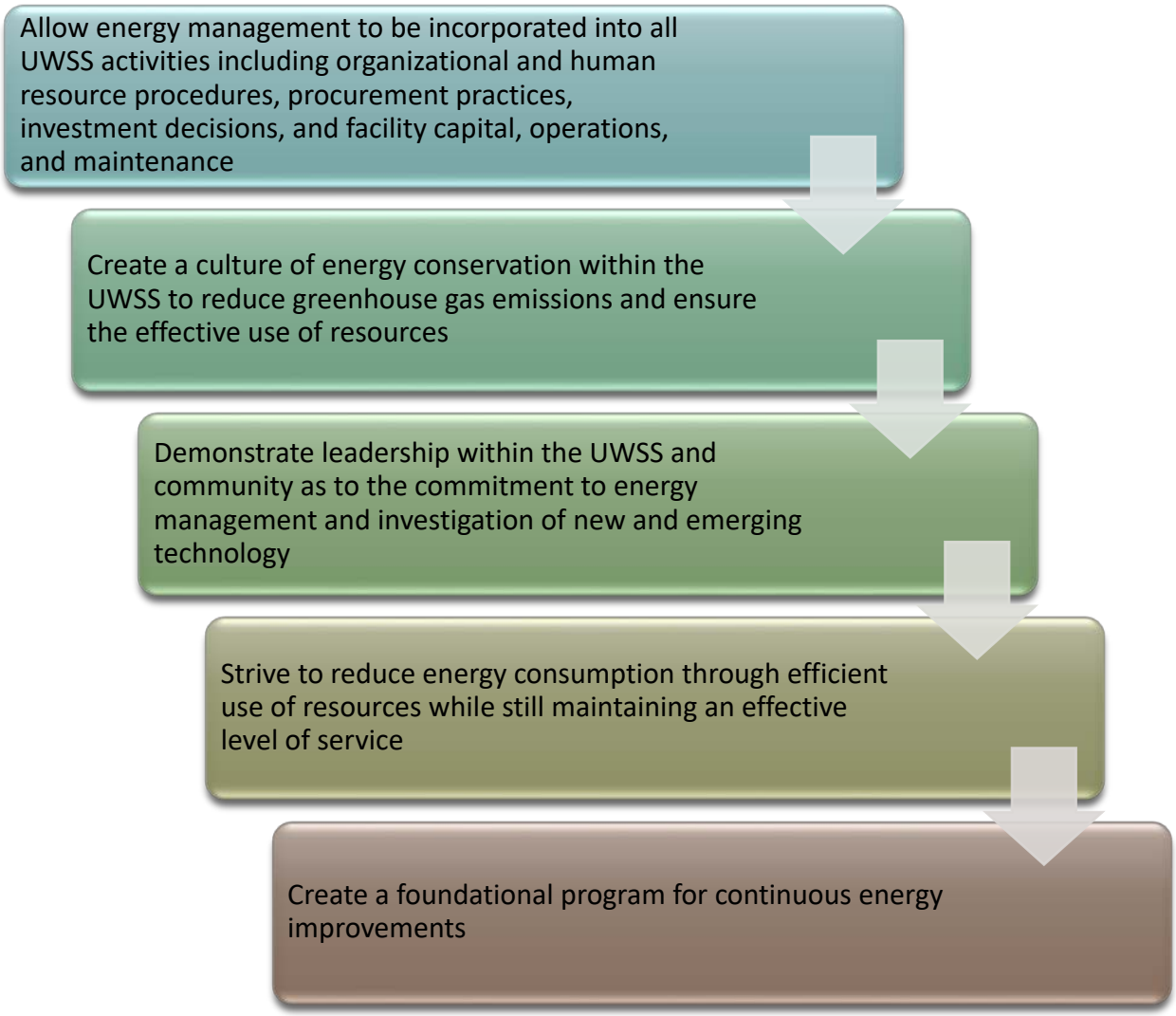
Vision

The UWSS will exercise stewardship in the use of finite resources to demonstrate leadership, optimize our delivery of services, and enhance the overall quality of life in the community. We will strive to continually reduce our total energy consumption and associated carbon footprint through wise and efficient use of energy and resources.



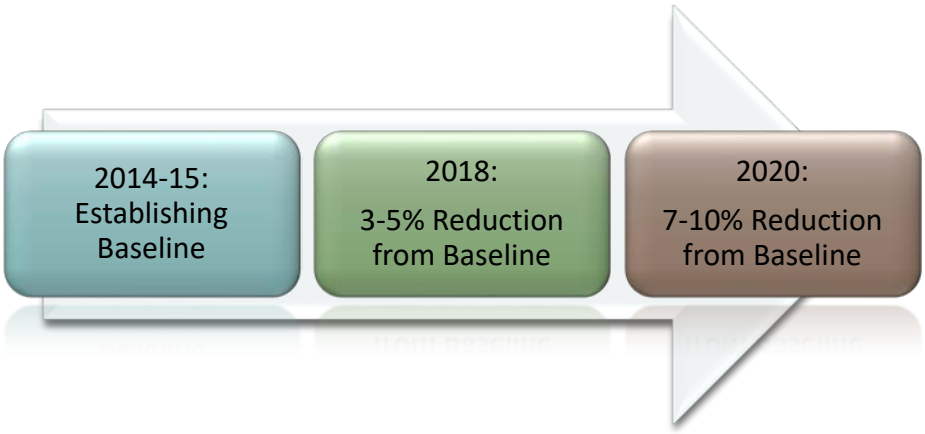
Goals and Objectives

The UWSS' Energy Conservation and Demand Management Plan was completed to help achieve the following objectives:



2014-2019 CDM Plan Reduction Targets

Due to the increase in water demand, increase in energy usage was anticipated from the 2014 baseline year's rate of energy consumption. However, based on the index of energy used per unit of treated water, there appeared to be a substantial decrease in energy consumption in that time period. UWSS is committed to identification, assessment and implementation of new ECMs and continuously monitor energy consumption where applicable.



As a target for the last five year CDM Plan, the UWSS vowed to strive to reduce energy (electricity and natural gas) consumption in each building by 7-10% by the end of 2019 from the 2014 baseline.

As a short term target, a 3-5% reduction by the end of 2018 in energy consumption from the 2014-15 baseline was established.

It should be noted that overall energy consumption during the 2014-2018 period increased; this is mainly due to the increased water demand over that period (approximately 13%). However, the energy used per megalitre of water treated and pumped during that period decreased by approximately 10-12%. This is due to the result of ECMs that were implemented from 2014-2018. The preferred state of energy usage in the UWSS is to continue to comply with the guidelines as set out in its Capital Budget and to always seek improvement to its energy conservation and management practices where applicable.

Energy Conservation Initiatives

The UWSS is aware that energy conservation and management is imperative to creating a sustainable environment and reducing on-going operations/energy costs. UWSS is working towards reducing energy in its facilities, as energy conservation benefits include:

- Energy efficiency save money – Energy savings can be achieved by improving energy efficiency, which means using less energy to provide the same level of service and water quality.
- Energy efficiency extends the life of existing infrastructure – By monitoring equipment for energy efficiency, water systems are more attuned to the overall state of their infrastructure and can proactively take steps to ensure equipment is operating efficiently, thus reducing equipment strain and lowering operation and maintenance requirements.

- Energy efficiency reduces greenhouse gas (GHG) emissions – Reducing energy consumption has a direct impact on reducing GHG emissions.
- Energy efficiency enhances customer relations – Customer expectations and concern for water are increasing, thus energy providers are encouraging energy conservation and energy efficiency in consumer purchases. Effectively communicating energy management efforts an successes to customers and other stakeholders is an opportunity for a water system to establish itself as an environmental steward in the community.

Water Conservation

Energy conservation and management does not only include electricity usage reduction in buildings. Water conservation also play a direct role in the overall target for efficient energy management. The lower the amount of water and waste produced the less energy required for treatment and disposal.

Water efficiency efforts will result in energy savings, as the less water required the less energy consumed to treat, pump and distribute the water through the water system. Savings can be realized through supply side water efficiency efforts and through demand side water conservation efforts. Some supply side water efficiency efforts would be water accounting, water loss control, or leak detection and repair. Some demand side water conservation efforts would include public outreach and education program to reduce water consumption, free water audits for large volume customers, retrofit programs for residential customer, water price, and water use regulations.

One way to encourage water conservation is to ***ensure all users are metered***. As UWSS supplies water to the municipalities who then sell the water to customers, it is up to each municipality to determine whether their customers are metered. The majority of the municipal water users are metered. Additionally, UWSS does have multiple water meters throughout the distribution system to determine each municipality's water system usage.

UWSS could encourage the municipalities to install water meters for all customers, as the installation of water meters have **multiple benefits**:

Immediate water usage reduction

Historical statistics have shown that buildings reduce water consumption immediately following the installation of water meters.

Ability to detect water loss/leaks

The summation of all water meter readings over a period of time can be compared to the amount of water output at the WTP over the same period of time to see how much of the treated water actually gets consumed. This verification check could provide an indication of water loss or watermain leaks should the consumption be much lower than the water output.

These two parameters should be compared on an annual basis for a meaningful analysis. Should the gap between them increases, it is likely that watermain leaks are worsening and an investigation may be warranted.

Increase capacity of Water Systems

All water systems have a rated capacity or maximum output that they can produce. Should output be near the rated capacity (~80% of rated capacity) as demand increases, studies should be initiated to increase the capacity which would typically involve major upgrades to the systems.

Reducing water consumption has a direct effect on reducing output of the water systems and could avoid costly capital upgrades.

This is in turn beneficial from the municipal planning perspective as there would be capacity to accommodate new housing or commercial/industrial developments.

Decrease energy consumption of Water Systems

Water systems are costly to operate. The treatment and pumping of water are very energy and chemically intensive. Reducing output from these systems directly decreases energy and chemical costs.

Projects Implemented: 2012-2018

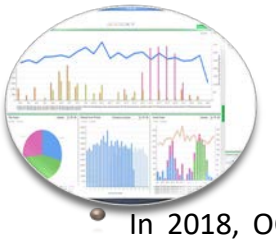
UWSS has always been proactive towards energy conservation and has initiative various activities that would assist towards efficient use of energy. Some of the projects that UWSS has implemented in the last seven years are shown in the following table:

Date	Scope of Work
2012	Replacement of some of the lights in the RWTP with LEDs.
2013	Replacement of distribution water meters with new more energy efficient meters.

2013	Compressor retrofit for CBS
2013	Pump Upgrades (High Lift Pump, Booster Pump and Low Lift Pump)
2014	High Lift Compressor replacement
2014	Continued replacement of water meters with new more energy efficient meters.
2014	Continued replacement of lights in the RWTP with LEDs.
2015	Conducted energy walkthrough to assess energy conservation opportunities
2015	Building Envelope improvements: Improve windows, doors and roofs to increase R values for insulation
2015	Robotic switch gear for main plant electrical service
2015	New main wash flow meter to monitor backwash water flows
2015	Main wash pump #1 VFD install
2015	Filters #2 and #4 HMI and air blower upgrade
2015	LED Lighting Low lift and Cottam Booster
2015	New LED lights on exterior of building and pole Barn
2015	Carbon System upgrades and installation of new carbon pumps with VFD's
2015	Fire separation walls around MCC room and Fire alarm install
2015	Smart Water Meter Project
2015	Plant window replacements
2015	New inlet valves for filters #1 and #3 to address leaky inlet valves

2015	Low lift pump #2 rebuild
2015	High Lift pump #8 rebuild
2015	Replacement of High lift pump #1
2016	Low Lift Pump #1 rebuild
2016	Filter Meter Upgrades to improve flow monitoring and for leak detection
2016	Treatment Plant Valve upgrades to replace old leaky valves
2016	Turbidity Meter Upgrades
2016	Chlorine Analyzer Replacements
2016	High Lift Pump #3 Rebuild
2016	High Lift Reservoir Repairs to address possible leaks.
2016	Lighting Upgrades – Exterior facilities
2016	Continued Window Replacements-Treatment Plant
2016	New Roof for Pole Bard
2016	Cottam Booster Pump #1 Rebuild
2016	SCADA System Upgrade/Maintenance
2016	Distribution System Valves and Components upgrades
2016	Continued Master Meter Replacements/Upgrades
2017	Low Lift Pump #5 Rebuild

2017	Continued Filter Meter Replacements
2017	Continued Turbidity Meter Replacements
2017	Continued Chlorine Analyzer Replacements
2017	High Lift Pump #4 Replacement
2017	High Lift Compressor #1 Replacement
2017	Continued Window Replacements - Treatment Plant
2017	Full SCADA System Upgrade (2-year project)
2017	Essex Water Tower Rehabilitation (interior and exterior)
2018	CO2 Raw Water pH Adjustment System Install
2018	Turbidity Meters for Filter Backwash optimization
2018	Low Lift Pump #1 Rebuild
2018	Maintenance Shop Roof replacement
2018	Continuted Lighting Upgrades to LED in various UWSS facilities
2018	Power meter monitoring (M&T) installation at the Low Lift Station
2018	New Soft start for HL pump #8



UWSS M&T Project

In 2018, OCWA undertook the installation of energy power meters with eight metering points at the Union Low Lift Station. This project combines process flow data and energy consumption data to populate energy and GHG intensity (KPIs: kWh per m^3,) for analysis and trending. A dashboard was developed with currenty and historical flows for LLPs and is displayed in real time in the control room. The system has reporting features

Currently the project is being expanded to Water Treatment Plant.

Innovation and Pilot Initiatives

The UWSS has been participating in some innovative projects to enhance the efficiency of the water system. A few of these projects will be described below, which include Growing Smart Water Communities (currently ongoing), Climate Risk Assessment (completed 2013), and Application of the Optimal Industrial Load Management Model to the Ontario Clean Water Agency Water Pumping Station (completed 2013).

Growing Smart Water Communities

UWSS is participating in the Growing Smart Water Communities with the University of Windsor, Crozier Bard Engineers, and BDK Engineering Inc. This multi-year program is to develop a comprehensive planning and operations model of the UWSS water distribution network in order to most efficiently provide for its current and future customers. The first phase of the project is to inventory the actual water usage against the current design allocations. The water model will then be reviewed for capability assessment and physical validation. Smart water meters will be installed at strategic demand sites (specifically greenhouses). Additional physical inputs including pressure and flow sensors will also be installed at key network locations to feed the model validation process. The next phase would be to determine the demand-forecasting capabilities and incorporated into the comprehensive distribution model through integration of established climate and client usage pattern models. The final phase will consider the potential for the implementation of smart water micro grids in the Essex Region. Such new grid architectures could consider novel networks that could see large water consumers that have alternative supplies acting as distributors of water to other consumers in their region. This smart approach to water sourcing and distribution will enhance water availability, security, and system efficiency.

Climate Risk Assessment

Genivar completed a Climate Risk Assessment for the UWSS in May of 2013. UWSS, Engineers Canada and the Ministry of the Environment, Conservation and Parks worked together to assess the engineering vulnerability of the UWSS infrastructure to the potential impacts of the current and future climate. The project assesses the national engineering vulnerability of public infrastructure to climate change based on the Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol Version 10 BETA (October 2011). The PIEVC Protocol was started in 2007 and has been refined and improved over the years in adoption of best practices at the national level. The two (2) main aspects of the climate analysis and projections were:

- Establish a set of climate parameters describing climatic and meteorological phenomena relevant to the geographic areas of the UWSS
- Establish a general probability for the occurrence of each phenomenon, both historically and in the future

The conclusion from the project resulted in the UWSS being noted as resilient to potential climate change, specifically when comparing existing conditions to those anticipated in the 2050s.

Application of the **Optimal Industrial Load Management Model** to the Ontario Clean Water Agency Water Pumping Station.

UWSS worked with the University of Waterloo to complete an water model on the pumping capabilities in the water system. The water model used was the Optimal Industrial Load Managment (OILM) model. The objective of the project was minimize energy consumption and/or the peak power load for the RWTP, which is based on the set of water pumps that have the most important loads in the facility (high lift pumps). Individual water discharge and power consumption were estimated based on measurement of active power, water discharge, and operation pump times. The estmimations were used to develop polynomial function models for the pumps to include in the OILM model that optimally dispatches the pumps considering 15 minute time intervals. The three (3) high consumption days in September 2012 are used to demonstrate and test the application of the OILM model. The resulting simulations showed that considerable savings may be obtained as a result of the optimal dispatch of the pumps.

2014-2019 Energy Consumption Summary

Tracking Energy Consumption and Savings

In addition to including the UWSS' 2017 annual energy report as required under the regulation, we have also included and considered our 2018 annual energy consumption information, which helped us to report on our achievements and inform the development of new measures (see

Schedule 1). Our previous years' annual energy reports, along with the 2014 energy conservation and demand management plan can be found on our website.

Overall electricity and natural gas consumption across all municipal buildings reported on experienced slight increases of 2.9% and 2.4% respectively by 2018 compared to the 2014 baseline consumption levels; this is mainly due to the increased water demand over that period (approximately 13%). However, the energy used per megalitre of water treated and pumped during that period decreased by approximately 8-9%. This indicates that the energy conservation measures that were implemented from 2014-2018 were quite successful.

Though total annual electricity and natural gas consumption have increased at some of the facilities over the years, ***the quantity of electricity and natural gas consumed per unit of flow (energy intensity) prove that the facilities' energy intensities have in fact been reduced by over 10% since 2014. That said, the 2020 Energy Reduction Target has been surpassed.***

In addition to the municipalities benefitting from reducing its energy use, residents and local businesses also benefit from more efficient use of tax payer dollars and better maintained/operated public buildings and facilities.

Please see Schedule 1 for a detailed analysis of the UWSS' energy consumption from 2011 to 2018.

From 2014 to 2018, the greatest reductions achieved at the UWSS were:

15% reduction in natural gas consumption per megalitre of water pumped at the at the Cottam Booster Station from 2014 to 2018

15% reduction reduction in electricity consumption per megalitre of water pumped at the at Low Lift Pumping Plant from 2014 to 2018

Looking forward: 2020-2024

UWSS recognizes that measures can take place to ensure energy savings continue to grow and that new conservation measures are identified and acted upon. Concerns over ever-increasing energy prices and the negative impact of fossil fuels on the environment have raised interest in sustainability and predictable energy rates..

Energy conservation has been an on-going process in all buildings. As per the Capital Budgeting Plans of the UWSS, new developments and redevelopments including replacement/retrofit works are encouraged to be built and sustained in a manner that minimizes energy consumption. Electrical equipment replacement works over the years have been evaluated against energy efficiencies criteria, and the most cost-effective option at that time was chosen.

The UWSS will thus strive to ***reduce our energy consumption (electricity and natural gas) by 13-15% by the end of 2024 from the 2014 baseline***. This Energy Reduction Target will apply to all departments and facilities owned by the UWSS.

The UWSS commits to the following objectives for the 2020-2024 period:

1. • Improve the UWSS' understanding of energy consumption.
2. • Increase staff awareness and motivate staff to use energy more efficiently.
3. • Report energy performance changes and improvements annually.
4. • Improve the efficiency of energy use through low–cost opportunities by implementing the following:
   - Sound operating and maintenance practices;
   - Employee training, and staff awareness;
   - Monitoring and Targeting system; and
   - Energy Demand Management program.

Proposed Energy Conservation Measures

Energy conservation projects can be categorized as technical (switching street lighting from high pressure sodium to LED), organizational (establishing a green team), or behavioral (running a daylight harvesting campaign, where lights are turned off on sunny days).

Potential energy conservation projects were identified by comparing building-level energy benchmarks to the median energy benchmark for that building type.

Building equipment tend to lose their efficiency as they approach the end of their useful life. A plan should be developed to replace the equipment by evaluating the life cycle cost of the replacement options.

As discussed previously, the UWSS has been continuously improving equipment and their energy efficiency. The creation of this Plan confirms that UWSS already conforms with the steps for an energy improvement program. UWSS has already implemented many ECMs.

Based on the steps for the energy improvement plan described in the Implementation section below, UWSS has proposed the following conservation measures for implementation in the next 5 years:

Technical Measures

Efficiency Measure	Status
Power meter installation on hight lift process pumps	To be completed 2019
Chlorine system upgrades and chlorine building improvements including LED lights	To be completed 2019
CO_2 system installation for raw water pH adjustment to optimize coagulation process	To be completed 2019
Continuation of full SCADA System Upgrade	To be completed 2019
Low lift transformer and switch gear replacement	To be completed 2019
New control valve for VC9	To be completed 2019

Low lift surge tank compressor replacement	To be completed 2019
Flow meters for raw water #1 and #3	To be completed 2019
New Clarifier Turbidimeters (SWAN)	To be completed 2019
The addition of a new 5000 igpm energy efficient vertical turbine pump with VFD	To be completed 2020
Treatment Plant Building renovation including an elevator roof upgrades and new energy efficient cooling units	To be completed 2021
The addition of a three million imperial gallon reservoir to increase storage and optimize pumping schedule	To be completed 2023

Organizational Measures

Efficiency Measure	Status
Create an energy management team	To be completed 2020

Behavioural Measures

Efficiency Measure	Status
Place poster near kitchen/bathroom sinks reminding users to limit water usage where appropriate	To be completed 2020
Place poster/sticker near light switch in rooms reminding users to turn off lights when no one is in the room	To be completed 2020
Continue to ensure the temperature of facilities meets the needs of the users	To be completed 2020
Harvest day light where possible by opening blinds instead of using electric lighting	To be completed 2020
Close windows when air conditioning is in operation	To be completed 2020
Energy Efficiency Awareness Training for Operators	To be completed 2020

Renewable Energy Projects

Efficiency Measure	Status
Conduct assessment for renewable sources of energy (solar and energy storage)	To be investigated 2021

Best Practices

Best practices for implementing energy savings by reducing energy consumption or implementing other measures are described below for different methods for water systems and buildings.

Water Systems

Water systems consume a lot of energy in the production and distribution of drinking water. There are substantial opportunities to reduce energy costs by implementing operational changes, adding VFDs, using properly sized equipment, etc. Installing renewable energy will also assist in reducing energy costs. Best practices for these items are discussed in more details below.

Variable Frequency Drives

Normally, pumping represent the largest port of energy consumption at a drinking water system. Improving pump and motor efficiency should be the focus of a system's energy management program, thus correcting for inappropriate pump sizing, upgrading standard efficiency motors with premium efficiency motors to installing variable frequency drives (VFDs). VFDs are electronic control devices that modulates the amount of power being delivered to a motor to allow for continuous matching of motor speed to load requirement for the pump. VFDs accommodate fluctuating flow demands, avoiding losses from throttled valves and bypass lines (unless it is a static head system), allow "soft starts" (reduces wear and tear on the motor) and provide more precise control of the process. Normally, savings of 10 – 50 % can result when VFDs are installed to increase motor and pump efficiency in drinking water systems. Although, VFDs will not save energy for systems without variability and will only yield benefits when properly operated.

Motor Efficiency

An effective way for drinking water systems to improve their energy performance is to replace the inefficient motors with higher efficiency models. By maintaining ventilation and temperature control to the optimal operating conditions provided by the motor manufacture will can result in motor efficiency at the operations level with very little capital expenditure.

Operational Changes

Changing normal operational settings can result in energy cost savings. Energy savings can be realized by increasing the difference between the high and low set points for water towers and reservoirs. Energy savings are achieved as the pumps will not turn on as frequent and should also decrease pump run times (increase in useful life for equipment). Some operational settings could be changed to allow energy usage during the off peak energy times to decrease the electricity costs for the system. Some energy providers offer incentives and rebates for consultations with them, as agreements may be negotiated about load shifting opportunities.

Proper Equipment Sizing

Water systems are often designed for future demand purposes, and are therefore oversized for the current usage. Proper equipment sizing involves matching pumps to their intended duty and flow rate, as oversized pumps add to system operating cost in terms of energy and maintenance requirements. Some corrective actions to address oversized pumps are to replace the pump/motor with a downsized version; replace the impeller with a smaller one; install VFDs to match variable speed to load requirements for the pumps, and add a small pump to reduce the intermittent operation of the existing pump.

Renewable Energy

Renewable energy projects can be built to reduce the dependence on the energy grid. Renewable energy projects could include solar, wind, or geothermal system to generate power. Renewable energy projects combined with energy storage projects can be leveraged to reduce the peak demand for the facilties and will reduce significant energy cost to UWSS.

Buildings

Nearly all buildings have lighting and heating, ventilation and air conditioning (HVAC) components, and they typically account for nearly all of the energy consumption in non-industrial buildings. Lighting and HVAC along with the building envelope upgrades are the major works that could lead to energy savings. Best practice measures of the three components are provided below; however, this does not mean all buildings should implement the measures below as each project is different and various factors (i.e. life cycle cost, long term use of the equipment/building, etc.) need to be considered.

Lighting Retrofits

There have been significant improvements in the area of lighting technology in recent years. Energy savings can be achieved by replacing older incandescent, T12 fluorescent, and metal halide lamps with T8 fluorescent, T5 fluorescent, compact fluorescent (CFL), and LED (light-emitting diode) lamps. Newer technology can produce the same amount of light for half or less

of the input power, thereby reducing half or more energy consumption. At the same time, lighting levels should be optimized to meet needs - if a 100W and a 80W light bulb both can produce sufficient lighting level for the location, consider installing the 80W light bulb.

Lighting motion sensors could be a beneficial add-on for areas of infrequent occupancy, as most people do not turn off lights when they leave the area. This would ensure the light is automatically turned off when the area is not occupied.

Heating, Ventilation and Air Conditioning (HVAC) System Upgrades

HVAC system improvements offer the greatest potential for energy savings in most buildings. The first step for reducing HVAC operating costs in large buildings is to reduce HVAC loads. "Greening" an existing building may also include replacing equipment with more efficient models, improving controls and operating procedures, and retrofitting existing equipment to operate more efficiently. It must be realized, however, that HVAC systems contain many interrelated components, and upgrading them takes careful planning, professional engineering design, and careful implementation. Properly designed, installed and maintained HVAC systems are efficient, provide comfort to the occupants, and inhibit the growth of moulds and fungi.

Buildings usually operate under less than full-load heating and cooling conditions. Therefore, the greatest overall efficiency improvements will result from giving special consideration to part-load conditions and selecting equipment accordingly. Chiller manufacturers now provide a standard ratings for part-load efficiency, reflecting the fact that chillers operate at less than full load 99% of the time. Staging multiple chillers or boilers to meet varying demand also greatly improves efficiencies at low and moderate building loads. Pairing different-sized chillers or boilers in parallel offers greater flexibility. Units should be staged with microprocessor controls to optimize system performance.

The fan motors in packaged units typically run at constant speeds. Variable frequency drives (VFDs) can be installed on the motors to match the fan output to the required airflow. Energy savings vary depending on the specific system characteristics, but in certain cases can be 50% or higher.

Programmable thermostats should be utilized where possible. It can be used to specify an automatic reduction in temperature overnight. Typical savings are 2% of the heating bill for every 1°C that the temperature is reduced overnight.

Natural gas heating should be utilized instead of electric heaters where feasible as the cost of electricity heating is two to three times the cost of natural gas heating.

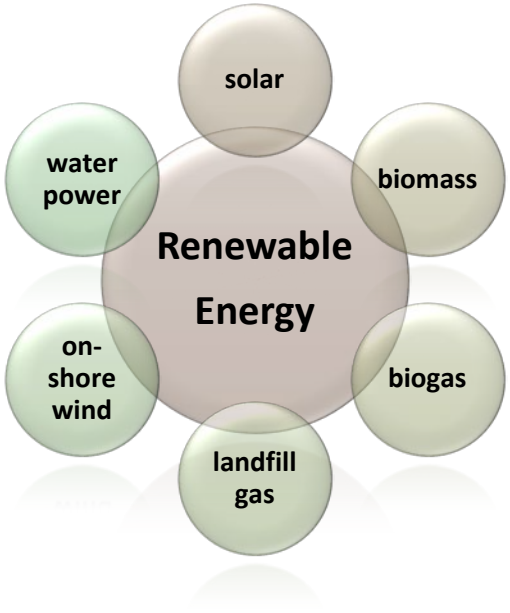
Building Envelope Upgrades

Reducing a building's energy consumption often revolves around changes to its mechanical and electrical operations or system. However, a building's roof and walls may also provide significant energy savings.

Adding/improving insulation to the roof and walls reduces the amount of heat lost to the environment in the winter and also reduces the heat coming into the building in the summer. By implementing this measure, studies have shown a building could reduce the heating and cooling load substantially. This is generally a high cost measure for existing buildings since the roof and walls essentially need to be rebuilt. The most effective strategy is to coordinate the work with a roof or wall replacement.

Renewable Energy

The UWSS has not currently applied for any renewable energy projects. They are looking into the options for a few different projects. UWSS may apply for funding program to explore adoption of energy efficient technologies for any new building.



UWSS is exploring solar PV project, as there are about three acres available on the RWTP grounds to install solar panels.

UWSS may also install solar panels for some of their larger district water meters. The Meter #27 site will be reviewed for a solar panel installation. If it is successfully installed, UWSS may install solar panels for other water meter sites.

New Construction/Redevelopment

Energy efficiency measures should be implemented during the construction phase for maximum potential benefit when the measures have been evaluated, planned and designed.

The UWSS will consider employing sustainable/energy efficient building principles for new or redevelopment of their buildings through the pursuit of LEED (Leadership In Energy and Environmental Design) certification.

LEED is a set of rating systems for the design, construction, operation, and maintenance of green buildings. Developed by the United States Green Building Council (USGBC) and adopted by Canada Green Building Council (CaGBC), LEED is intended to help building owners and operators be environmentally responsible and use resources efficiently.

Under LEED (2009), there are 100 possible base points distributed across six credit categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation in Design. Up to 10 additional points may be earned: 4 additional points may be received for Regional Priority Credits, and 6 additional points for Innovation in Design.

Buildings can qualify for ***four levels*** of LEED certification:

Certified: 40 - 49 points

Silver: 50 - 59 points

Gold: 60 - 79 points

Platinum: >80 points

Buildings with LEED certification means they have employed sustainable and energy efficient practices into their design and construction. Canada stands as the largest international market for LEED green buildings and boasts more area of LEED-certified space than any other nation outside the United States, according to a report released by the USGBC in June 2014.

UWSS is planning for a new maintenance shop building in 2021. UWSS is committed to exceed energy efficiency requirements as per Ontario Building Code for any new buildings. UWSS also intend to apply for High Performance New Construction (HPNC) incentive programs for any new building to secure incentives on energy savings.

Operational and Behavioural Changes

To help meet the increasing demand for energy, as outlined with Ontario's Long Term Energy Plan, conservation has become an integral part of the future to help meet the ever increasing demand for energy.

Studies have stressed the importance of engaging the people working within the facility along with technological changes to achieve meaningful and lasting energy consumption savings. This

has been shown to result in much higher energy savings than just implementing energy technology or engaging people alone.

The chart below presents some behavioral measures that the UWSS could implement without major cost or effort. There is no cost to adjusting behaviors on day-to-day activities so the payback is immediate.

Behavioral Measures	Year of Implementation
Place poster near kitchen/bathroom sinks reminding users to limit water usage where appropriate	2015 - 2016
Place poster/sticker near light switch in rooms reminding users to turn off lights when no one is in the room	
Place poster in office rooms with computers reminding users to turn off computers at the end of the day	
Continue to ensure the temperature of facilities meets the needs of the users	On-going
Install programmable thermostats and implement programmed setback temperatures where appropriate	
Harvest day light where possible by opening blinds instead of using electric lighting	

Plan Implementation

Ontario Regulation 507/18 requires increased municipal energy management and engagement. Development of an energy conservation strategy as part of an overall sustainability plan is a complex process. The main driver for a local municipality or service board to change the way energy is used relates to fiscal benefits and financial incentives. Energy is a manageable input to the business process, much like any other resource cost. The UWSS is maintaining and developing current and planned services that continue to be affordable to taxpayers.

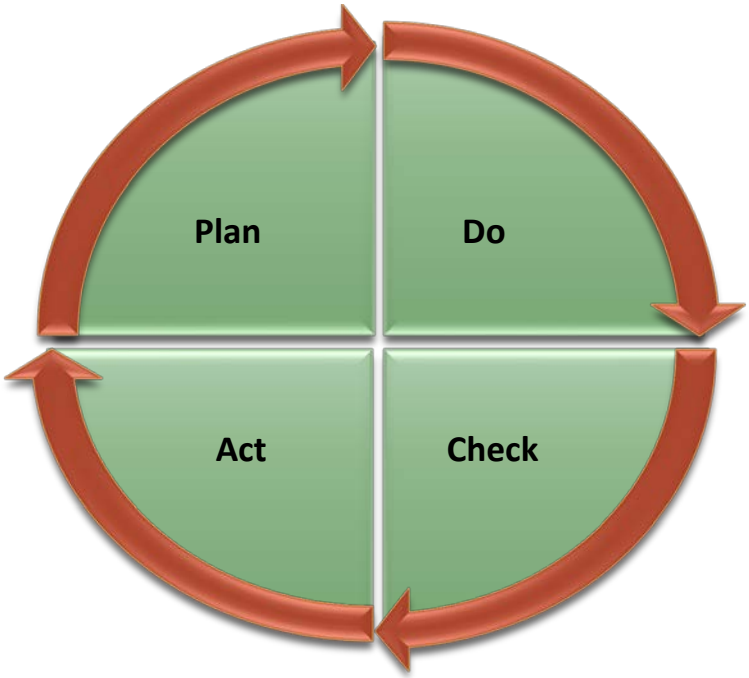
This CDM Plan provides the "big picture" view as an ongoing framework for optimizing overall energy use and achieving success.

Current practices must be enhanced and new approaches must be developed. To meet these needs, the UWSS will consider designing a comprehensive program for collecting and analyzing

monthly energy billing information, and ensuring that staff is informed about energy consumption. The resulting energy costs and consumption database will be used to monitor excessive variations, target facility follow-up assessments, and determe areas that could be candidates for improved conservation. These monitoring enhancements will improve the UWSS's understanding of the bottom line impact of energy management.

In order to establish a baseline for managing energy costs, the UWSS has captured information critical to energy management planning. This formalizes the process involved in understanding the relative magnitude of energy costs, the possible ways to reduce energy use, energy targets that are likely to be achievable, and other associated activities that need to occur.

CDM Planning is intended to be a process of "continuous improvement." The UWSS follows *NRCAN, ISO 50001*'s four step plan–do–check–act management methodology, used in business for the control and continuous improvement of processes.



PLAN

Establish the energy conservation objectives and processes necessary to deliver results in accordance with the expected outputs: the energy conservation targets or goals. Start on a small scale to test possible effects and financial feasibility. Develop an Energy Conservation Demand Management Plan prioritizing budgets, resources, and timelines.

DO

Implement the plan and collect data for analysis in the following "CHECK" and "ACT" steps. Develop projects' design and execution, preparing status reports, and implementing the communication strategy.

CHECK

Study the actual results (measured and collected in "DO" above) and compare against the expected results (targets or goals from the "PLAN") to ascertain any differences. Evaluate any deviations in implementation from the plan and also evaluate the appropriateness and completeness of the plan to enable the execution, i.e., "Do".

ACT

Recommend improvements and adjustments to the initial plan; determine the course of corrections and modifications to the plan.

The UWSS implements tools to maintain and continually improve energy conservation and demand management. Benchmarking is the process that the UWSS has implemented for collecting, analyzing and relating energy performance data of comparable activities to evaluate and comparing performance between or within entities.

Four Pillars for a Successful Energy Management Program

Top Management Support

Top Management shall make a commitment to allocate manpower and funds to achieve continuous improvement. To establish the energy management program, the UWSS should:

- ✓ Obtain Management Board endorsement
- ✓ Assign energy management responsibility
- ✓ Institute an energy policy

Strategy Plan

Assess Energy Performance

Understanding current and past energy use helps the UWSS identify opportunities to improve energy performance and gain financial benefit.

- ✓ Data Collection, Management, Analysis and Evaluation
- ✓ Establish Baselines and Benchmarks
- ✓ Conduct Technical Assessments & Audits

Set Goals

Performance goals drive energy management activities and promote continuous improvement. Setting clear and measurable goals is critical for understanding intended results, developing effective strategies, and reaping financial gains.

- ✓ Determine Scope and Goals
- ✓ Estimate Potential Improvement

Create and Implement Action Plan

Once past performance has been assessed and the goals set, an Action Plan can be created. A detailed action plan is used to ensure a systematic process to implement energy performance measures. Unlike the policy, the action plan is regularly updated, most often on an annual basis, to reflect achievements, changes in performance, and shifting priorities.

- ✓ Define Technical Steps and Targets
- ✓ Determine Roles and Resources

Technical Ability

Investments must be made in training and systems. Staff must have adequate technical ability for analyzing and implementing energy saving options.

- ✓ Industry Seminars & Conferences
- ✓ Certified Director of Public Works
- ✓ Other Energy related training

Monitoring Systems

Evaluate Progress

Evaluating progress includes formal review of both energy use data and the activities carried out as part of the action plan as compared to your performance.

- ✓ Measure results and Benchmark
- ✓ Review action plan

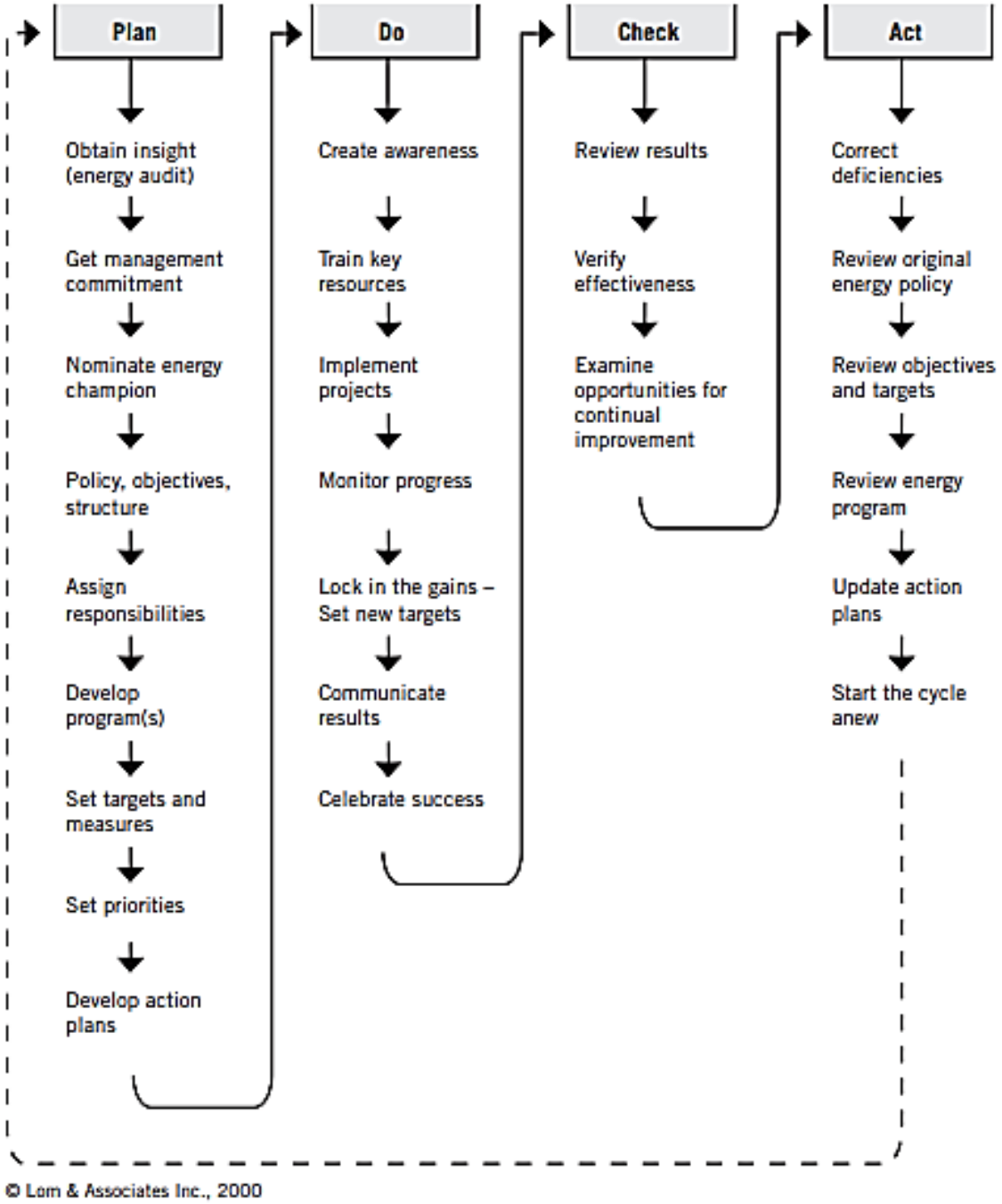
Recognize Achievements

Providing and seeking recognition for energy management achievements is a proven step for sustaining momentum and support for your program.

- ✓ Internal Recognition
- ✓ Determine recognition type and action
- ✓ External Recognition

The detailed energy conservation project planning process is visually illustrated on the following page.

Energy Conservation Project Planning Process[4]



A planning framework acts as an overall guideline to ensuring energy conservation will be realized. Three planning measures are identified: ***structure planning, resource planning, and procurement planning***.

[4] Energy Efficiency Planning and Management Guide, CIPEC, 2002

Structure Planning

Consideration of Energy Efficiency for All Projects: incorporate life cycle cost analysis into the design procedures for all capital projects as well as procurement decisions for equipment and other UWSS assets. Life cycle cost analysis is a technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave. It can avoid a narrow outlook on environmental concerns by: 1) compiling an inventory of relevant energy and material inputs and environmental releases; 2) evaluating the potential impacts associated with identified inputs and releases; 3) interpreting the results to help make a more informed decision.

Energy Skills Training: provide skills training for operators and employees that have hands-on involvement with energy consuming systems to enhance their capacity to achieve energy efficiency improvements. Training will help lower operating costs, reduce greenhouse gas emissions, increase operational efficiency, and create a better work environment.

Procurement Planning

Energy Purchasing: investigate utilizing purchasing groups and/or cooperatives to procure diesel, gas, natural gas, and electricity. The investigation will include the analysis of cost considerations, available energy services, energy quality, and other performance factors. The goal is to obtain the optimal rates while achieving an appropriate level of cost certainty.

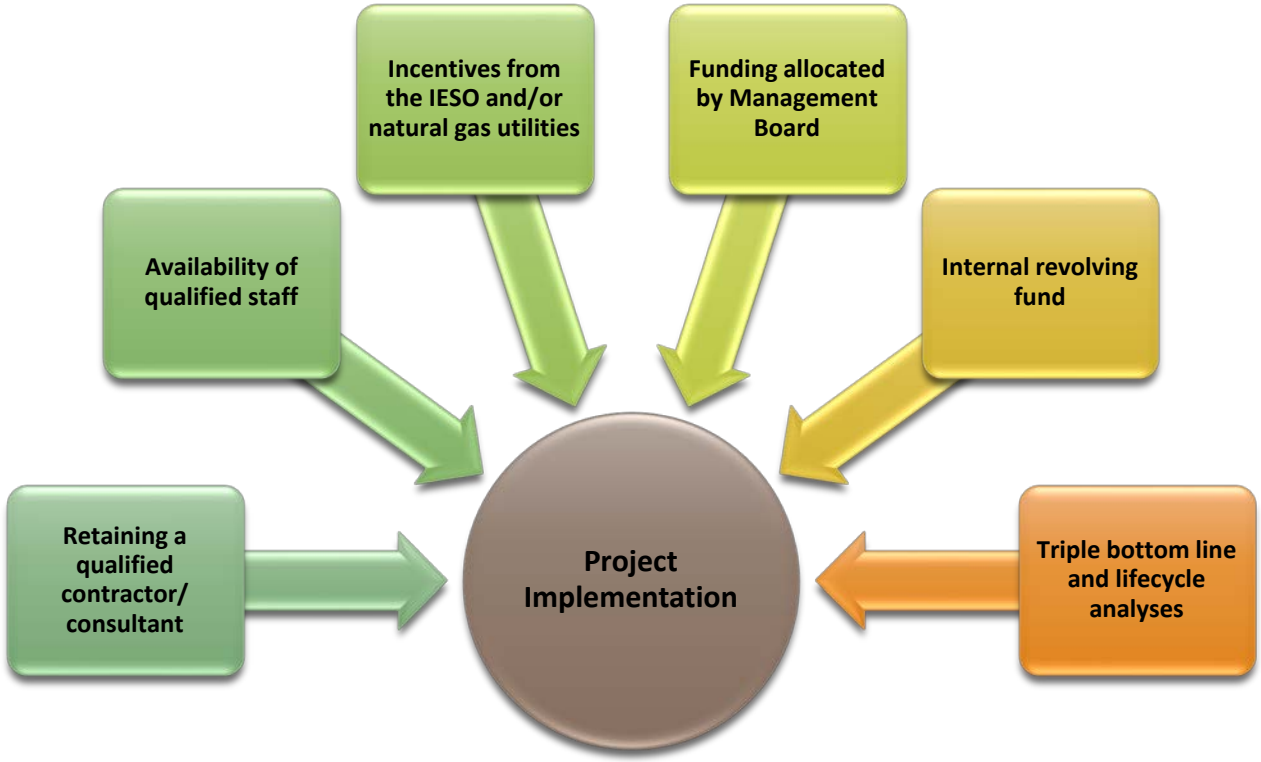
Consideration of Energy Efficiency of Acquired Equipment: incorporate energy efficiency and life cycle costing into the criteria for selection and evaluation of materials and equipment.

Evaluation Metric Development

Energy conservation projects will be evaluated using an internal rate of return (the rate of interest the project could generate), along with simple payback (the number of years it would take to pay off the project from the savings). Hydro cost savings and life cycle analysis will be used to derive these parameters. In addition, more costly conservation projects will be bundled with more cost-effective ones to ensure their successful implementation.

Robust Measurement and Verification (M&V) procedure will be adopted with the help of UWSS operating authority to quantify the energy savings as a result of EE projects and will be added to the project completion report.

Implementation of the proposed projects depends on:



Timelines

Timelines are assigned based on measures/facility prioritization. These timelines allow for flexibility during implementation, and will be dependent upon the costs/incentives and business decisions driven by the UWSS. We will carry out the required development of business procedures and communication programs and implement them methodically according to the planned timelines within the resources constraints that apply.

2020 & Beyond

The Energy Conservation and Demand Management Plan is intended to be a living document and flexible roadmap that will provide guidance and encourage the UWSS to incorporate energy management into their daily and future decisions. As capacity building and development of the foundation for successful energy management practices will be the primary focus for the initial implementation of the CDM Plan, future years will allow staff to apply their knowledge to investigate energy efficiency initiatives that will emerge as the energy management field continues to thrive and evolve.

Responsibilities

Energy Management Team

All UWSS staff and its Board have a responsibility to contribute to overall municipal energy management objectives. Technology alone will not achieve energy conservation and demand management objectives. UWSS will benefit when staff realizes how everyday actions can reduce energy waste and decrease operating costs. Simple actions such as turning off lights, computers and printers, ensuring that filters on heating and cooling coils are clean and dust-free, etc., all contribute to reduced energy use and energy costs in UWSS buildings.

The UWSS will implement an Energy Management Team to create and maintain a methodical focus on energy costs. This Team will provide a vehicle for key staff from critical departments to track energy budgets, update energy related projects and develop accountability for achieving energy reduction targets. The Team will have the lead responsibility and accountability for monitoring and achieving energy reduction targets.

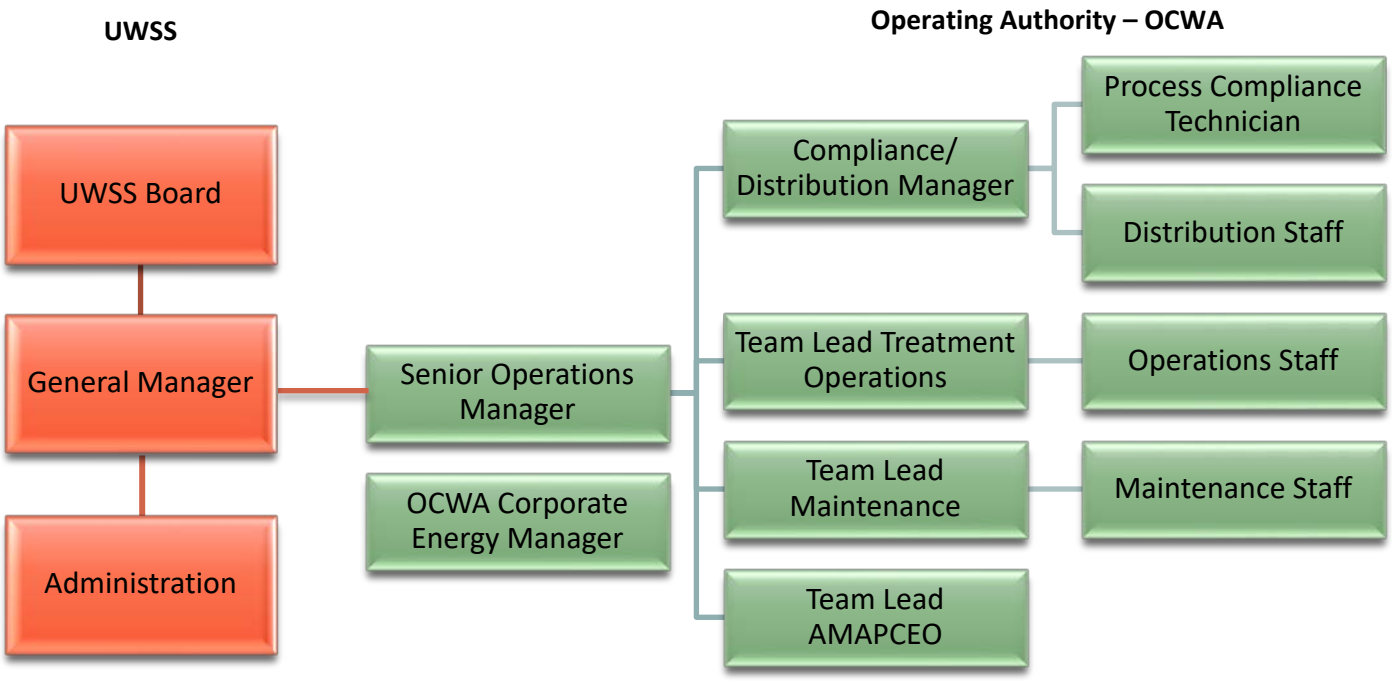
The role of monitoring progress will fall upon an Energy Management Team to be appointed by the Management Board. The Team will ensure that both the capital projects and behavioural changes outlined in this Plan are maintained on a continuing basis seeing as ***managing energy consumption is important to both environmental and financial good stewardship.***

The specific mandate for the proposed Team shall be established by the Management Board and the Terms of Reference created by the Team (and approved by the Management Board) upon creation and shall be based generally on the following:

- Track energy spending by department
- Identify, analyze, and prioritize potential projects for consideration by the Management Board on an annual basis
- Consider a corporate strategy for back-up generators
- Create an energy awareness strategy for UWSS staff
- Report and track all utility incentives

Participation and education will be solicited from utility partners, both electrical and gas supplier (if applicable), to ensure up to date information on incentive programs, energy rates and other available assistance. Active participation from these partners will make the Energy Management Team that much more effective.

Structure of the Energy Management Team



Monitoring and Evaluation

We will review and evaluate our energy plan, revising and updating it as necessary, on an annual basis within our corporate planning process.

To ensure the UWSS meets its goals in energy consumption reduction, it is critical that there is regular monitoring and evaluation of its progress. Progress on projects will be monitored using the annual energy reports prepared under the regulation. A separate summary for each project will be prepared and archived.

Short Term Goal

As a minimum, there will be an evaluation at the end of 2021. As stated, a short term target of 10-13% energy reduction by the end of 2021 from the 2014 baseline is established. Energy usage of each facility for the year 2021 will be compiled and compared to the baseline energy usage in 2014. The comparison would provide the UWSS an idea where it stands in meeting the short term goal and the long term goals.

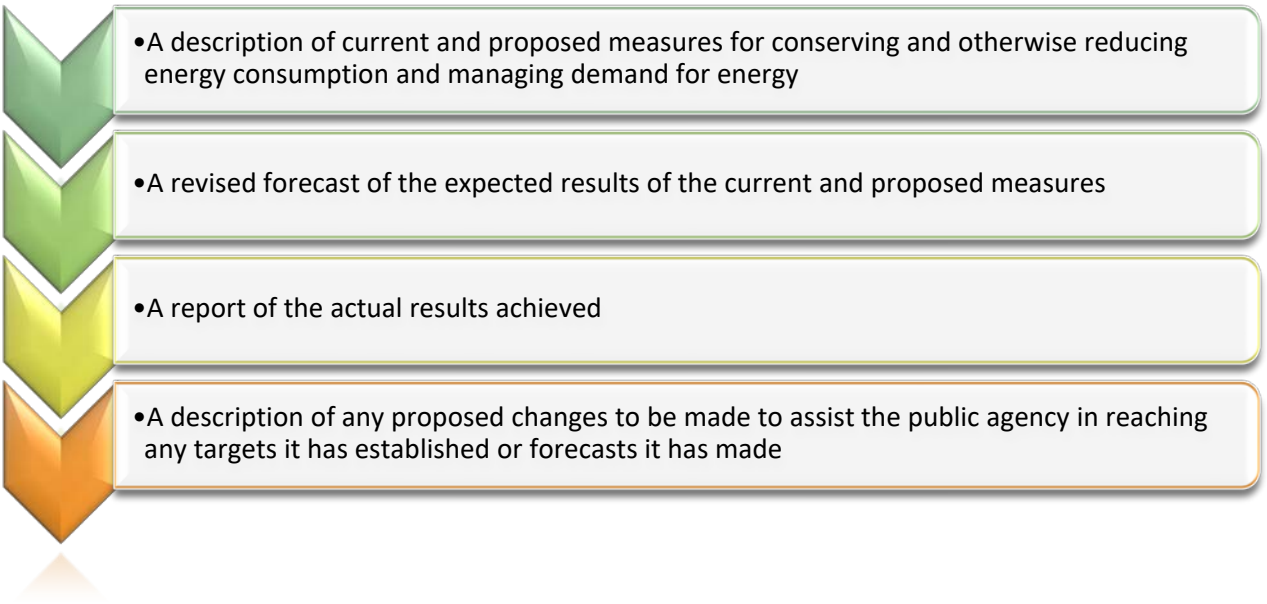
This also provides an opportunity to examine measures implemented and their effectiveness in reducing energy consumption at mid-term. A plan could be developed to further implement the successful measures for other facilities.

Long Term Goal & CDM Plan Update

The UWSS will strive to reduce total system-wide energy consumption by 13-15% by the end of 2024 from the 2014 baseline.

The Energy Consumption and Greenhouse Gas (GHG) Emission template that is required to be submitted in 2026 will document the 2024 energy usage results. This template will show if the energy reduction target was achieved or not.

As with this plan update, the updated CDM Plan in 2024 will include the following items:



Annual Energy and GHG Emissions Reporting and Five-Year Plan Update

Ontario Regulation 507/18 requires that the UWSS report on the results of the CDM Plan at the end of the five-year planning period. As in this update, in the next update due in 2024, the UWSS will provide an update to include any revisions to the 2020-2024 CDM Plan. The UWSS has submitted and published all of its annual Energy and Greenhouse Emission Reports and will continue to do so annually until July 1, 2024. At that time, the revised Plan will provide:

- A description of current and proposed measures for conserving and otherwise reducing energy consumption and managing its demand for energy;
- A revised forecast of the expected results of the current and proposed measures;
- A report of the actual results achieved;
- A description of any proposed changes to be made to assist the public agency in reaching any targets it has established or forecasts it has made; and
- Any additional initiatives geared at achieving or establishing new targets.

Incentive Funding

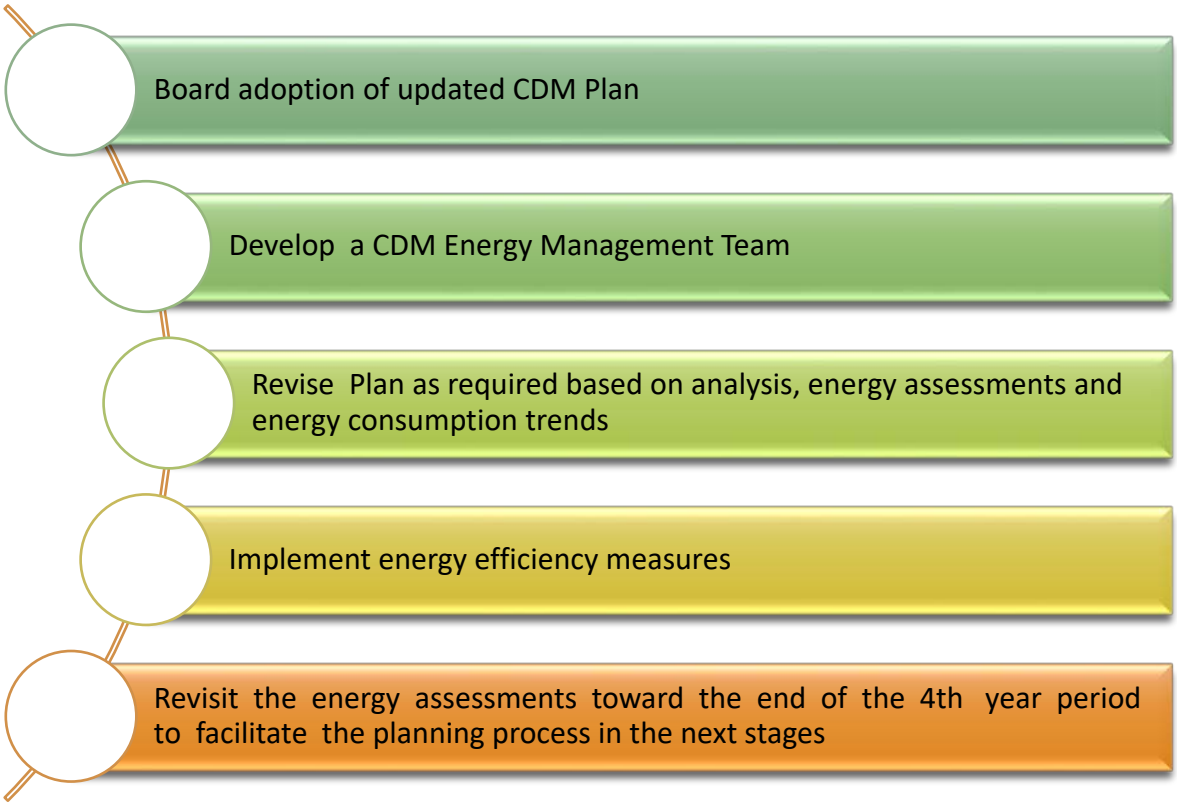
To ensure that the UWSS will take advantage of all funding and grant opportunities related to energy efficient projects, the UWSS will liaise with representatives from municioallities and local utility providers. UWSS staff and utility representatives are in a unique position to review current and future process improvements, program implementations and projects that can meet future funding requirements. As funding opportunities arise that are suitable for specific energy conservation projects, UWSS Staff will report to the Management Board and clearly outline the cost savings associated with a successful application.

Conclusions and Recommendations

Conclusions

- ✓ The UWSS is on its way to the implementation of a structured Conservation Program
- ✓ The UWSS plans to further investigate investment decisions in technologies to reduce electricity and natural gas expenditures and revise the current plan where appropriate
- ✓ Reasonable reductions must be targeted based on analysis through facility assessments
- ✓ A structured implementation framework will be followed to ensure the success of the CDM initiative

Recommendations



Schedule 1:
Actual 2011-2018 Energy Consumption and Energy Intensities

Energy Consumption Profile and Variance

The following tables show the change in electricity and natural gas consumption and intensities at all of the UWSS' facilities over the last eight years. A lot of changes have occurred to the UWSS' facilities over the last five years, many of which resulted in energy efficiencies and consumption reductions. That said, even though a facility may have experienced an increase in energy consumption, the change in annual flow must be accounted for when evaluating energy consumption at the facilities. As you can see in the tables below, total annual electricity and natural gas consumption may have increased at some of the facilities over the years, however, when analyzing the quantity of electricity and natural gas consumed per unit of flow (energy intensity), it is evident that the facilities' energy efficiencies have in fact improved since 2014.

Table S-1: Electricity Consumption per Megalitres of Water Pumped (2011-2018)

Total Annual Electricity Consumption per Megalitres (kWh per ML)				
Facility	**2011**	**2014**	**2018**	**2014-2018 Variance**
Ruthven WTP	313	285	272	**-4.3%**
Low Lift Pump Station	136	145	124	**-14.2%**
Cottam Booster Station	266	213	191	**-10.4%**
Total Average	**226**	**215**	**196**	**-8.7%**

Table S-3: Natural Gas Consumption per Megalitres of Water Pumped (2011-2018)

Total Annual Natural Gas Consumption per Megalitres(m^3 per ML)				
Facility	**2011**	**2014**	**2018**	**2014-2018 Natural Gas Consumption Variance**
Ruthven WTP	7.78	7.87	7.45	**-5.2%**
Low Lift Pump Station	0.73	0.74	0.69	**-7.0%**
Cottam Booster Station	6.05	7.19	6.08	**-15.4%**
Total Avergae	**4.3**	**4.45**	**4.04**	**-9.2%**

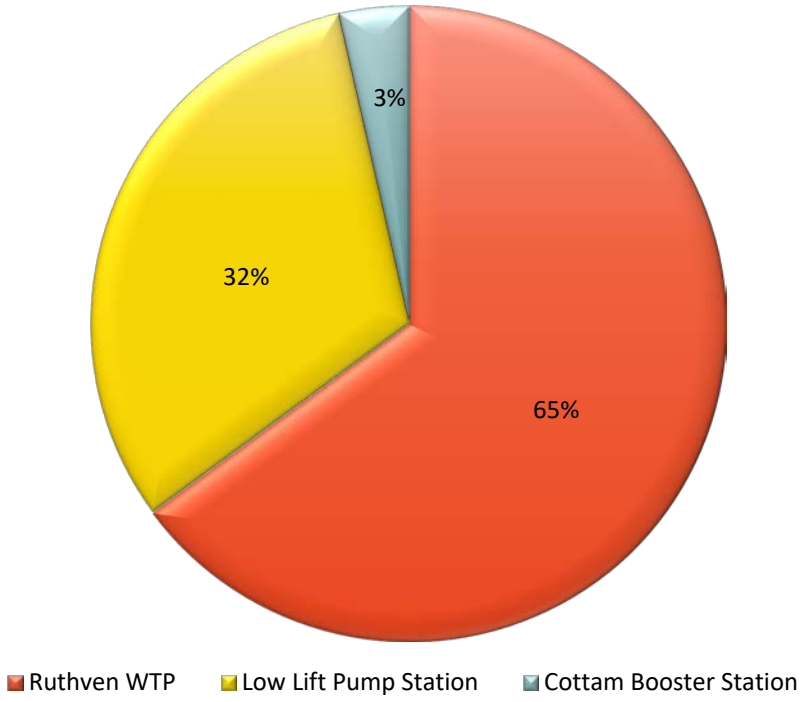


Figure S-1: 2018 UWSS ELECTRICITY Consumption Profile

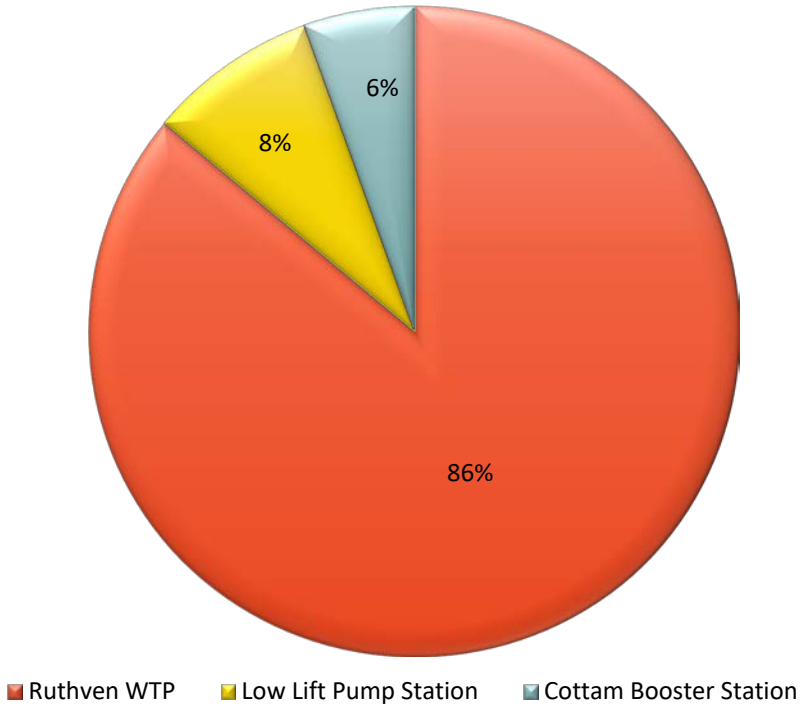


Figure S-2: 2018 UWSS NATURAL GAS Consumption Profile

Schedule 2:
Board Resolution Adopting 2019 CDM Plan Update