LAWSS
Lambton Area Water Supply System

Energy Conservation and Demand Management Plan

2020-2024

July 1, 2019

Lambton Area Water Supply System

Table of Revisions

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

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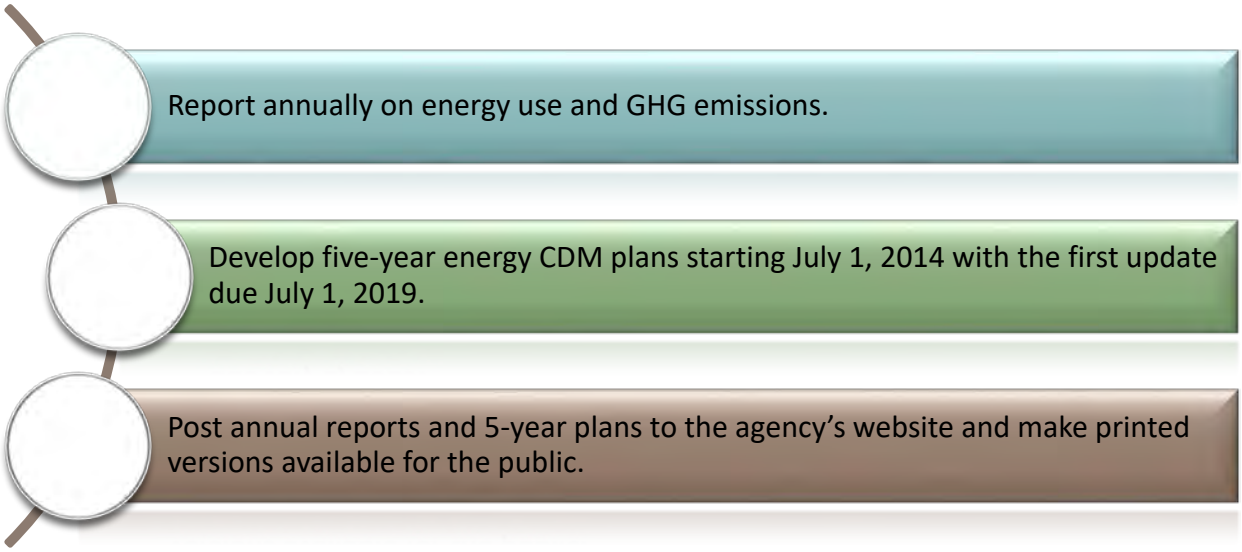
Disclaimer: This document has been prepared by the Ontario Clean Water Agency on behalf of the Lambton Area Water Supply System in accordance with Ontario Regulation 507/18 under the Electricity Act, 1998 for submission to the Ministry of Energy, Northern Development and Mines. This Plan is constantly evolving and may be revised to reflect the most current information and circumstances. The Lambton Area 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 Lambton Area Water Supply System may update any information in this document at any time.

Executive Summary

In 2014, the Lambton Area Water Supply System (LAWSS) developed a 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. This regulation was replaced with Ontario Regulation 507/18 under the Electricity Act, 1998 in 2018.

Ontario Regulation 507/18 requires public agencies to:

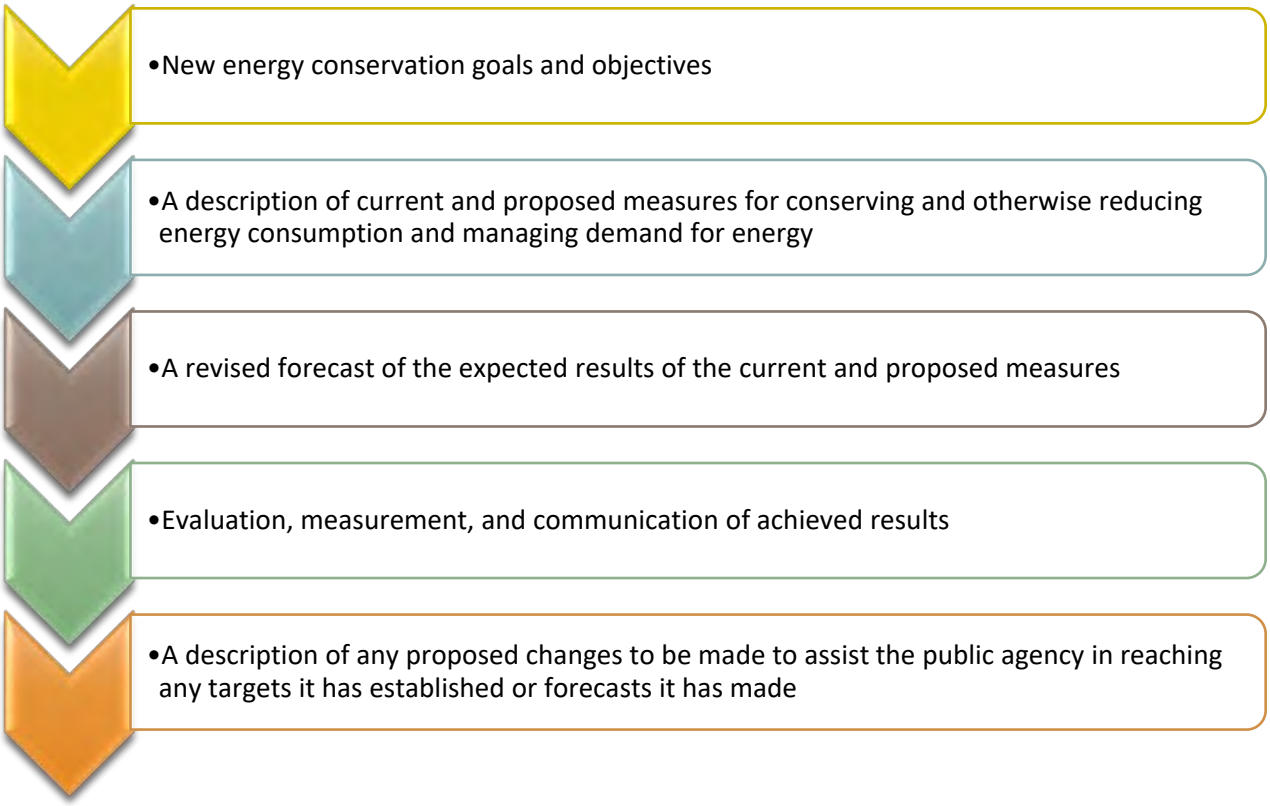


LAWSS is a municipal water supply system that is jointly owned by the Ontario municipalities of the City of Sarnia, Township of St. Clair, Town of Plympton-Wyoming, Township of Warwick, Village of Point Edward and Municipality of Lambton Shores. The LAWSS is governed by a joint board of management that consists of board members from each of the owner municipalities. The system is operated under contract by the Ontario Clean Water Agency (OCWA).

The LAWSS 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 27, 2019.

The intent of the CDM Plan is to provide a basis for the LAWSS to implement improvements to its infrastructure and operations that reduce energy use, their associated costs, as well as environmental effects of the system's activities. It is a living document that will evolve with the system's energy needs. This plan is designed to meet the current energy conservation needs of the LAWSS.

The CDM Plan should be consistent with other existing planning documents that relate to energy conservation. The updated CDM Plan will outline the following:

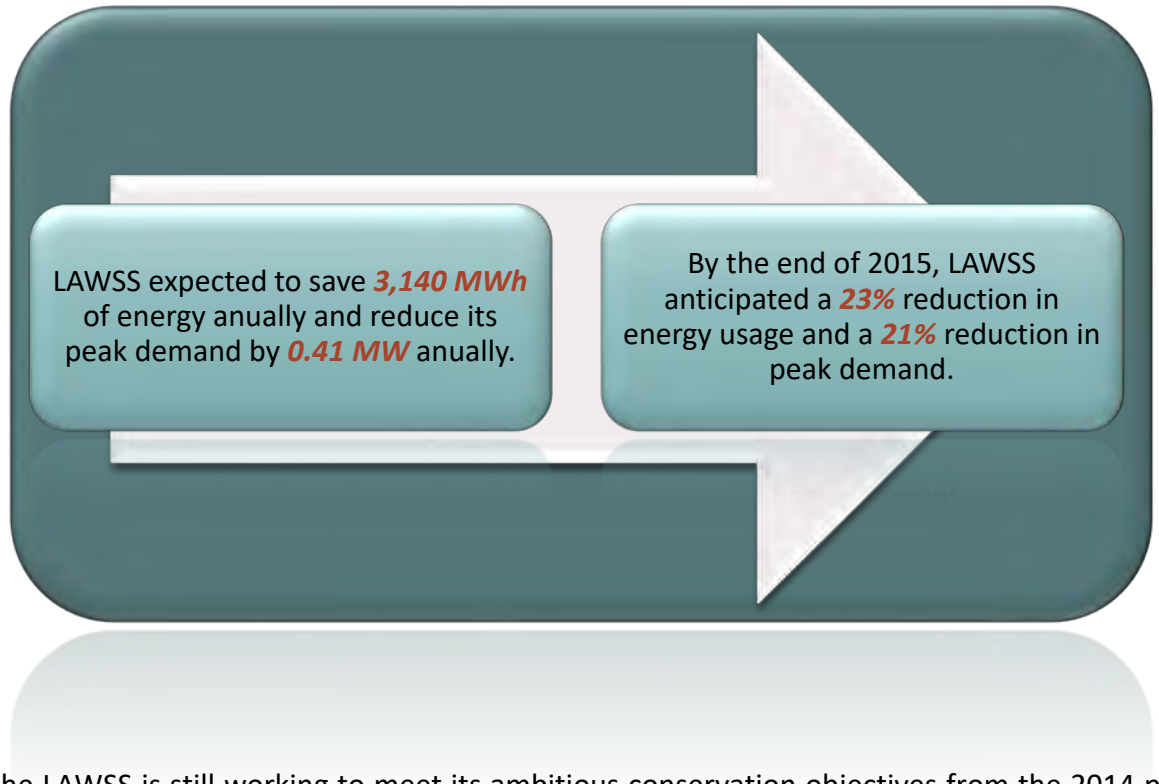


The LAWSS is committed to the promotion of responsible energy management through the implementation of economically viable energy efficiencies and environmental care throughout all facilities, plants and equipment. The LAWSS will take reasonable efforts to minimize impacts to the environment when allocating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

The LAWSS 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.

LAWSS has always been very proactive towards energy conservation and Greenhouse Gas (GHG) reduction. It has engaged with various stakeholders and carried out innovative studies and pilot projects towards this direction. LAWSS has made energy benchmarking an utmost priority and is in process of establishing its energy baseline for all facilities. It has plans to explore renewable sources of energy opportunities and installation of new technologies along with operational and behavioral changes. LAWSS is focused in three key areas namely; people, process and technology to achieve its energy efficiency goals.

The original 2014 CDM Plan set very ambitious energy conservation targets for the LAWSS.

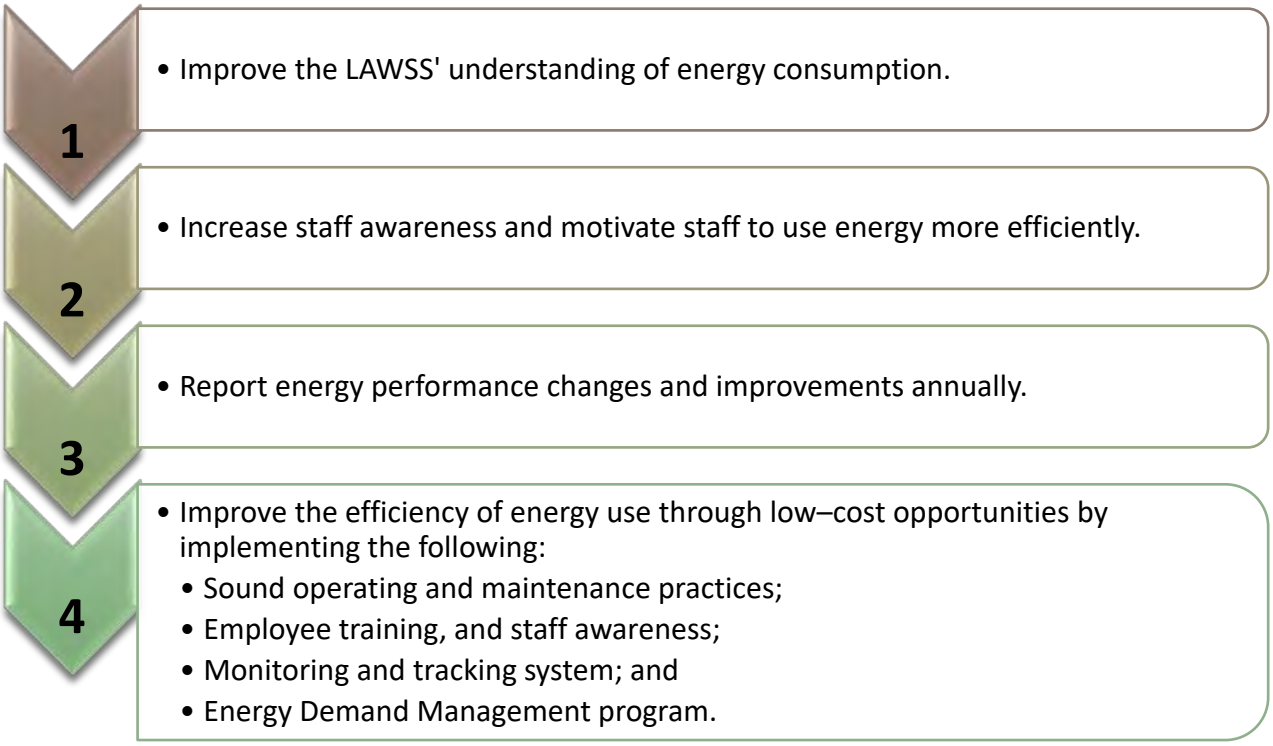


Though the LAWSS is still working to meet its ambitious conservation objectives from the 2014 plan, the achieved energy reductions within the system are significant. ***In total, overall energy consumption across all LAWSS' buildings reported on was reduced by 12% by 2018 compared to the 2014 baseline levels.***

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.

The LAWSS will 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 LAWSS.

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



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

Introduction and Background

In 2014, the Lambton Area Water Supply System (LAWSS) developed a 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. 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.

Ontario 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 LAWSS 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 27, 2019.

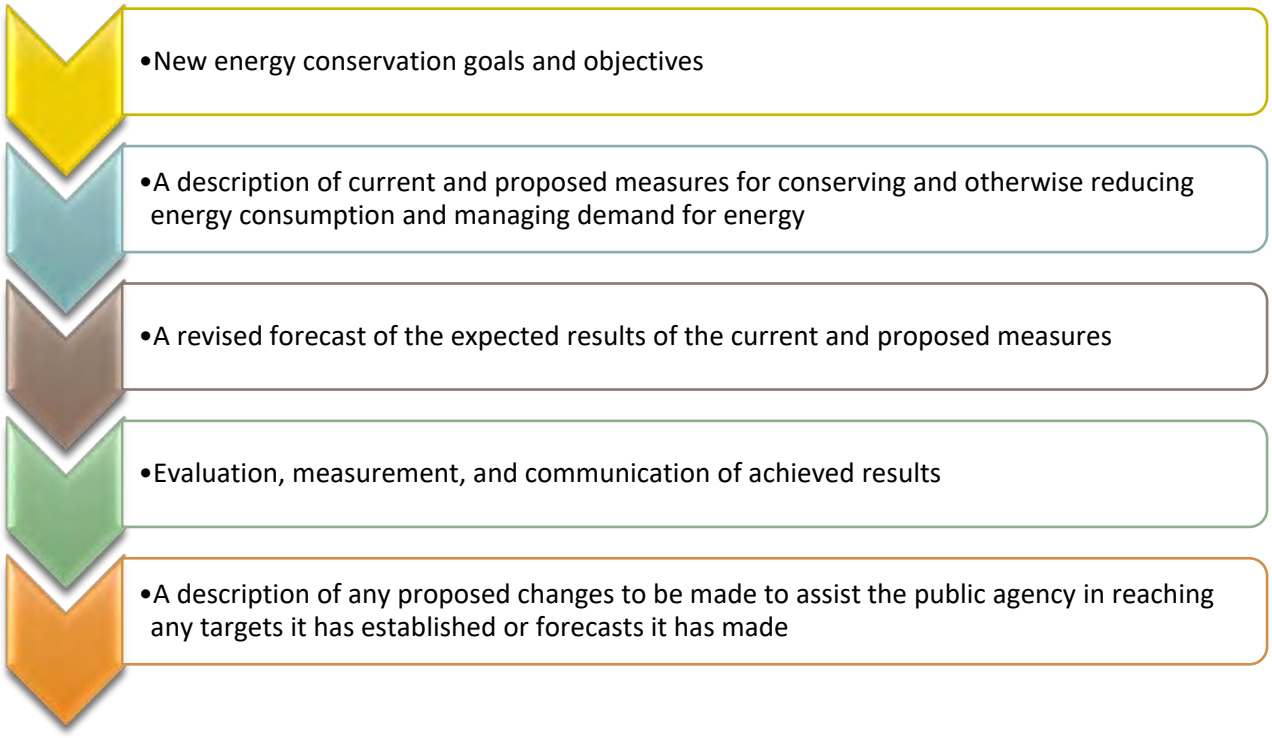
Overview

Municipalities are under a huge pressure to increase water rates to maintain their water systems and increasing energy cost 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 simple energy efficiency measures. 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.

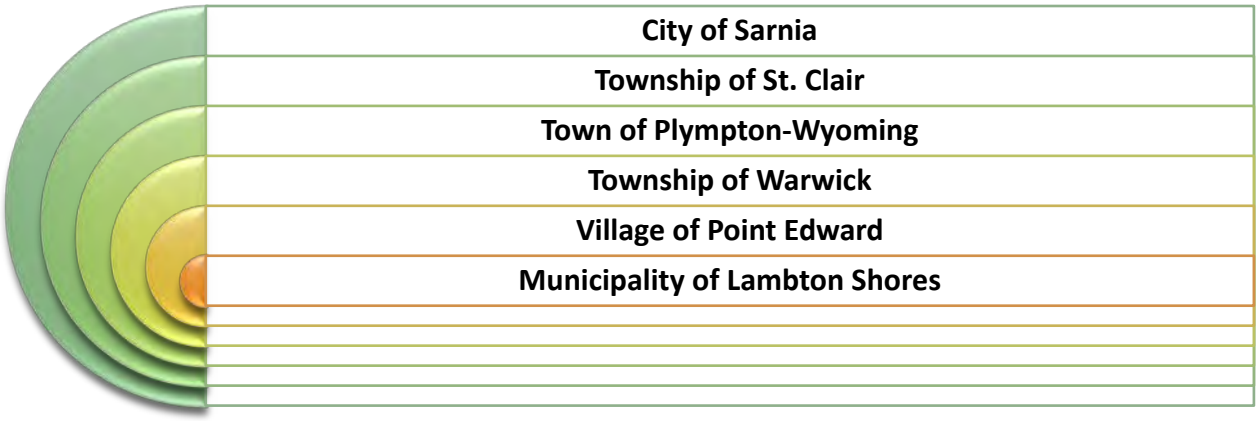
The intent of the CDM Plan is to provide a basis for the LAWSS to implement improvements to its infrastructure and operations that reduce energy use, their associated costs, as well as environmental effects of the system's activities. It is a living document that will evolve with the system's energy needs. This plan is designed to meet the current energy conservation needs of the LAWSS.

The CDM Plan should be consistent with other existing planning documents that relate to energy conservation. The updated CDM Plan will outline the following:



Lambton Water Supply System

LAWSS is overseen by a Management Board comprised of individuals from ***six municipalities***:



The LAWSS was transferred to its municipal owners under a transfer order issued from the Ministry of the Environment, Conservation and Parks (MECP) under the Municipal Water and Sewage Transfer Act, 1997. The system was transferred jointly to the municipalities on July 3, 2003.

LAWSS includes a direct filtration water treatment plant (WTP) with a maximum rated capacity of 181,844 m^3/d. The WTP uses chemically assisted filtration with disinfection and supplies water to approximately 100,000 users in Lambton County. LAWSS has about 250 km of water main of various sizes and materials, three standpipes, one elevated tower and two booster stations. The East and West Lambton Booster Stations (ELBS and WLBS) have 9,000 m^3 and 90,000 m^3 of water storage, respectively, and both have the ability to re-chlorinate the water prior to being re-pumped into the distribution system. LAWSS' sites have a combined peak energy usage of 2 MW.

Energy Demand and Costs

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.

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.

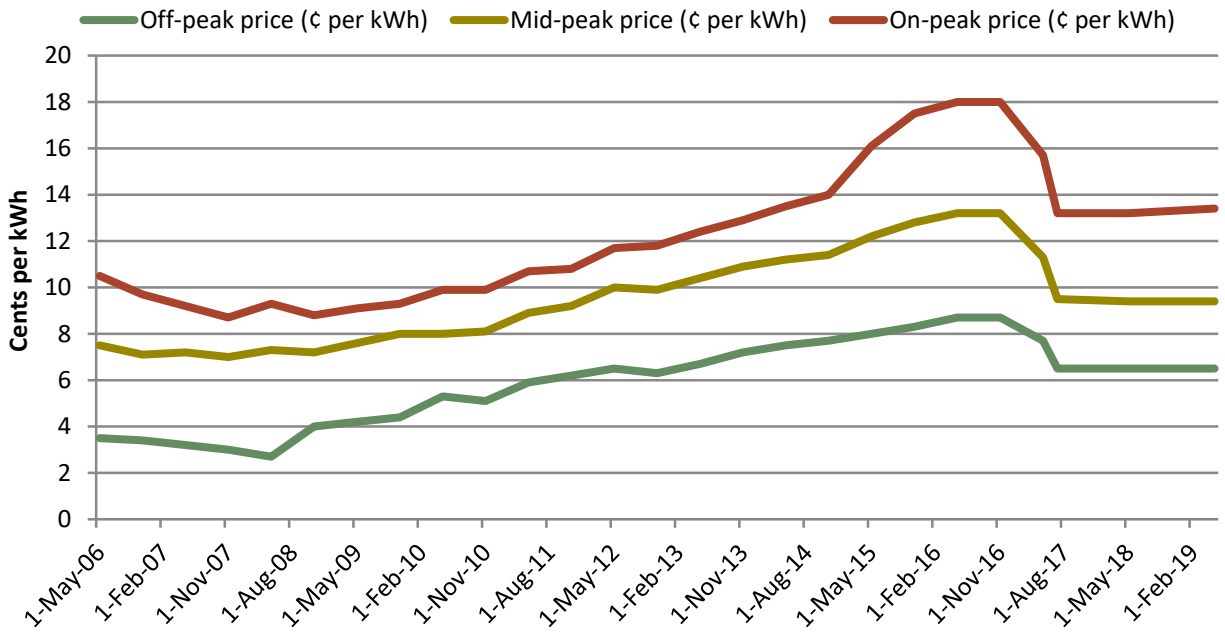


Figure 1: Historical TOU Electricity Rates[1]

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 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]

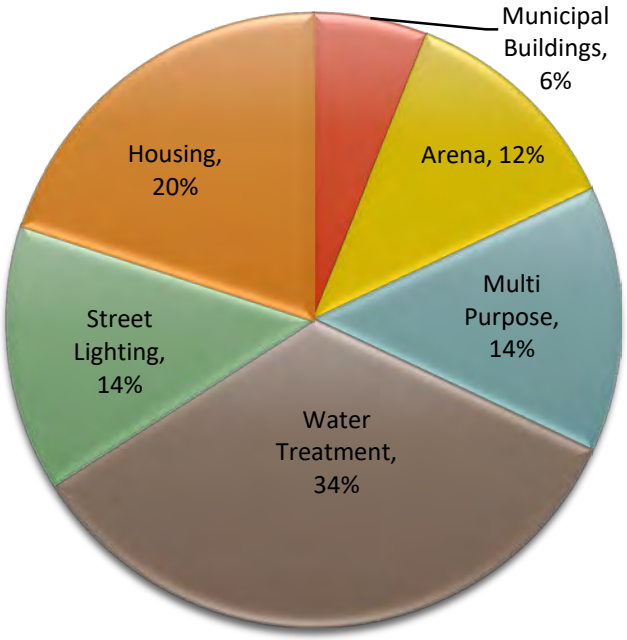
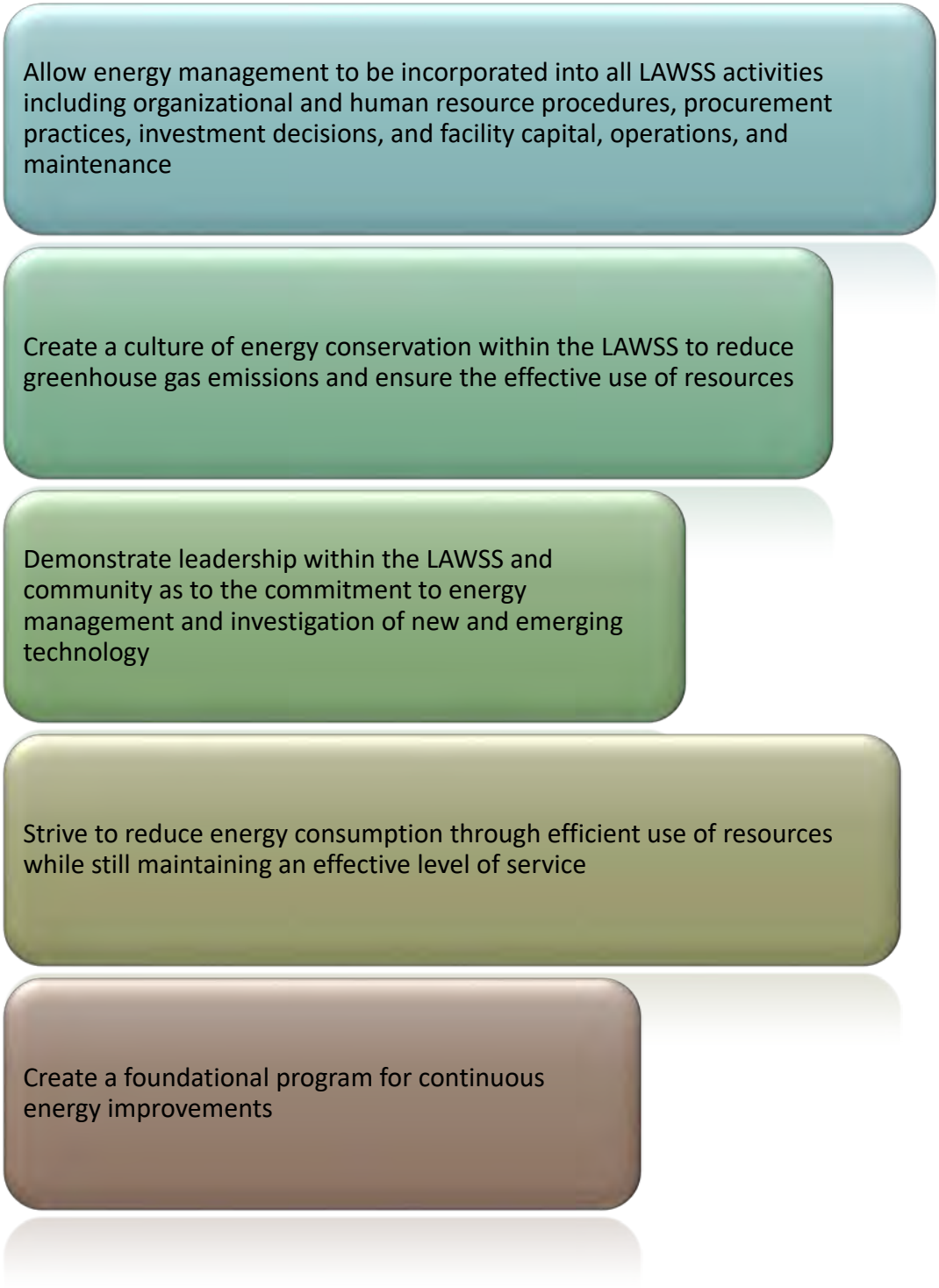


Figure 2: Municipal Energy Use by Sector in Ontario[3]

[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.
[3] Every Drop Counts, ECO, 2017

Goals and Objectives

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



Commitment

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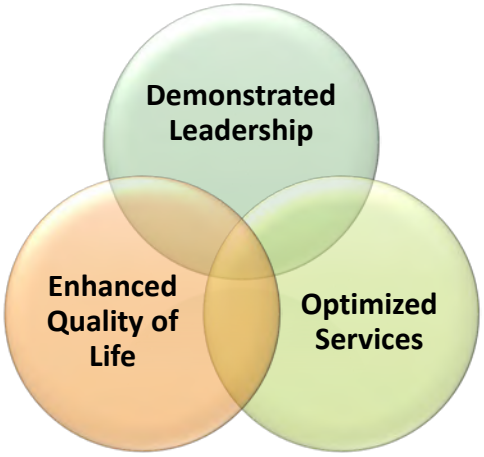
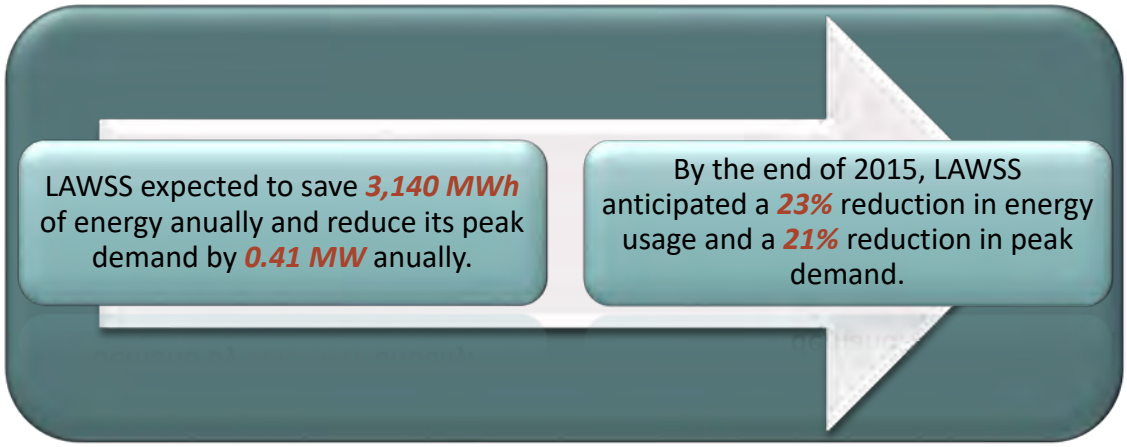


Vision

The LAWSS 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.

2014-2019 CDM Plan Reduction Targets

The original 2014 CDM Plan set very ambitious energy conservation targets for the LAWSS. That said, 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 LAWSS is committed to continuously monitor energy consumption and implement energy efficient practices where applicable.



The preferred state of energy usage in the LAWSS is to continue to seek improvement to its energy conservation and management practices where applicable.

Energy Conservation Initiatives

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

- **Energy efficiency saves 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 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 LAWSS 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, LAWSS does have multiple water meters throughout the distribution system to determine each municipality's water system usage.

LAWSS 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: 2014-2019

LAWSS has always been proactive towards energy conservation and has initiative various activities that would assist towards efficient use of energy. LAWSS has been working with the Ontario Power Authority since 2012 to implement projects to reduce the energy consumption at LAWSS. Lighting, HVAC, and variable frequency drive studies have been undertaken at LAWSS.

Some of the projects that LAWSS has implemented are shown in the following table:

Year	Scope of Work	Status
2012	completed lighting audit	Completed
	completed administrative HVAC Energy audit	Completed
2013	lighting retrofit for WTP and ELBS	Completed
	complete power monitoring integration of high and low lift pumps	Completed
	complete preliminary design for VFDs at WTP	Completed
2014	install new HVAC system for administrative area	Outstanding, 2019
	detailed design for VFDs for WTP	Completed
	retrofit plant HVAC system	Outstanding, 2020-2025
	complete pumping optimization study following the installation of VFDs at WTP and WLBS	Completed
	look into replacing or improving inefficient pumps or motors through retrofit, repair or right sizing	Ongoing
	investigate use of energy storage battery to reduce the peak demand at the WTP by about 15%	Completed
2015	install VFD at WTP or purchase a new right sized pump	Completed
	investigate options for enrolling in a peak shaving program such as EMBALA	Completed
2016	replace inefficient louver system in generator room at WLBS to reduce heat loss during the winter months	Outstanding, 2019
2017	replace the WTP's 4, 1 MW generators and switchgear	Outstanding, 2019
	investigate demand response opportunities with new generator	Outstanding, 2019

	filter backwash study and optimization = 1 million Kw saved plus reduced filter effluent sent to the residual management system	Completed
2018	PES for the east and west booster stations as well as the waterplant – propose VFD for pump East booster, new pumping strategy for highlift	Completed
	GA assessment for the Water plant – suggestion = go to Class A	Completed
2019	Water Plant M&V verification for the duty high lift pump - verified that retrofit project achieved more than 80% of estimated savings	Completed

Summary of Estimated Energy Savings and Cost for Completed and Planned Projects at LAWSS:

Project	Estimated Yearly Energy Savings (MWh)	Estimated Demand Savings (MW)	Estimated Capital Cost ($)	Estimated Simple Payback Period (years)*	Project Forecasted completion date
Lighting Retrofit-Water Treatment Plant	64	0.018	$27,000	6	April, 2013 (Completed)
Lighting Retrofit-East Lambton Booster Station	1.2	0.0023	$5,000	35	April, 2013 (Completed)
Operating Changes for Main Plant HVAC Fans	307	0.07	$0	Anticipated save $36,840/ year – actual results not as anticipated	June, 2013 (Completed)
Administration HVAC Replacement	40	0.025	$180,000	38	Project Cancelled

VFD at West Lambton Booster Station	492	0.08	$450,000	8	June, 2014
Main Plant HVAC Replacement (this will be offset by operating changes already implemented)	1200	0.13	$500,000	3.5	Project Pending
VFD at WTP	1000	0.08	$1,000,000	8	December, 2015
Total	**3140**	**0.41**	**$2,162,000**	-	-

***assuming $0.12/kWh and not including any OPA incentives**

High Lift Pump Optimization

In discussions with OCWA regarding the operation and repair of High Lift pump 3 in 2017, a solution was developed to reduce the energy wasted on the pump and get it to operate at a better spot on its curve as well as well as eliminate the Ross valve throttling.

M&V Report for High Lift Pump VFDs

This 2017 project consisted of the removal of the throttling valve at HLP6 pump discharge and the installation of a variable frequency drive (VFD) to adjust the speed of the Pump to vary the flow and meet the pressure requirements of the System while reducing energy consumption.

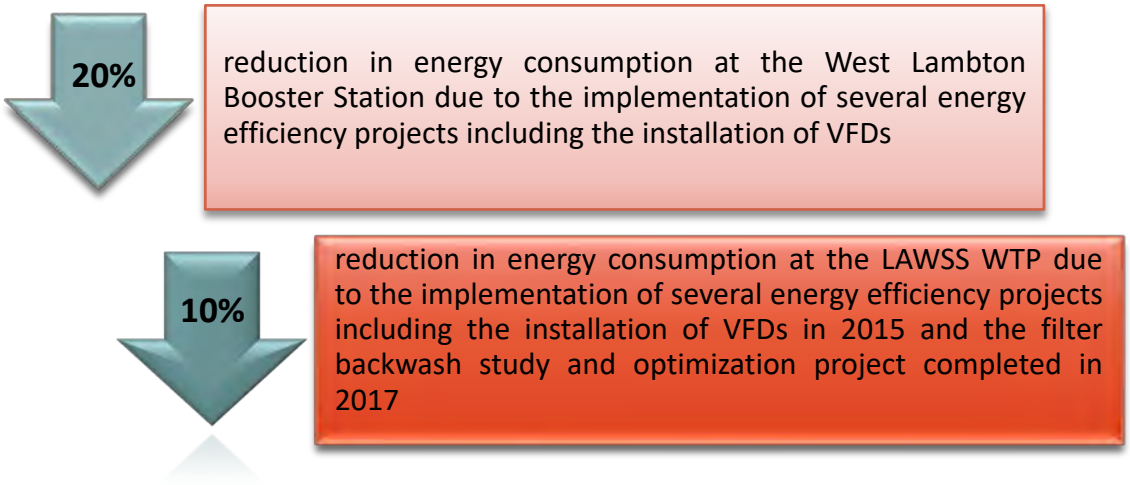
2014-2019 Energy Consumption Summary

Tracking Energy Consumption and Savings

Annual energy reporting is required under the regulation and allows the LAWSS to understand how energy is used in our buildings, identify potential energy conservation opportunities and track progress on energy conservation efforts. In addition to including the LAWSS' 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.

Though the LAWSS is still working to meet its ambitious conservation objectives from the 2014 plan, the achieved energy reductions within the system are significant. ***In total, overall energy consumption across all LAWSS' buildings reported on was reduced by 12% by 2018 compared to the 2014 baseline levels.***

From 2014 to 2019, the greatest reductions achieved at the LAWSS were:



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 LAWSS' energy consumption from 2011 to 2018.

Looking forward: 2020-2024

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.

The LAWSS will 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 LAWSS.

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

1. • Improve the LAWSS' 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.

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 LAWSS has been continuously improving equipment and their energy efficiency. The creation of this Plan confirms that LAWSS already conforms with the steps for an energy improvement program. LAWSS has already implemented many ECMs.
Based on the steps for the energy improvement plan described in the Implementation section below, LAWSS has proposed the following conservation measures for implementation in the next 5 years:

Technical Measures

Efficiency Measure	Status
Improving Electricity Conservation in Small-Medium Water Distribution Systems Project with CUI	To be completed 2020
Off-season process shut of two 50 hp motor mixers	To be completed 2020
Battery storage peak shaving study	To be completed 2020
Backwash Pump VFD or Soft start control modification	To be completed 2021
Power Factor correction study	To be completed 2021
Opportunity to look into a turbine insertion at a location within the plant	To be completed 2021
Equipment right sizing to match actual demand system curve	To be completed after 2025

Electricity Conservation with CUI

CUI developed water-energy performance tools that quantify and visualize embedded energy throughout municipal water distribution systems. Using hydraulic models as the input, the technology calculates energy use of different system components from pressure and flow, and then summarizes results in summary tables and maps. The technology also evaluates the effectiveness of energy efficiency strategies by estimating the resulting energy savings.

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

Renewable Energy Projects

Efficiency Measure	Status
Investigate options for solar at the WTP	To be completed 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 represents the largest portion 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.

Motor Efficiency

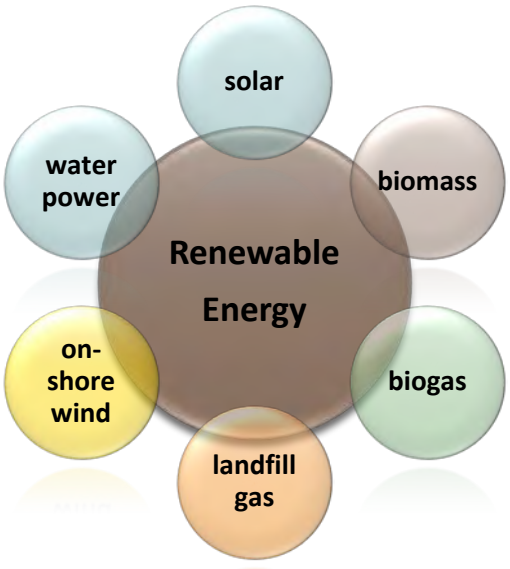
An effective way for drinking water systems to improve their energy performance is to replace the inefficient motors with higher efficiency models. By maintaining ventilation and temperature control to the optimal operating conditions provided by the motor manufacture will can result in motor efficiency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

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.

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.

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.

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.

Plan Implementation

Ontario Regulation 507/18 requires increased municipal energy management and engagement. 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 LAWSS is maintaining and developing current and planned services that continue to be affordable to taxpayers.

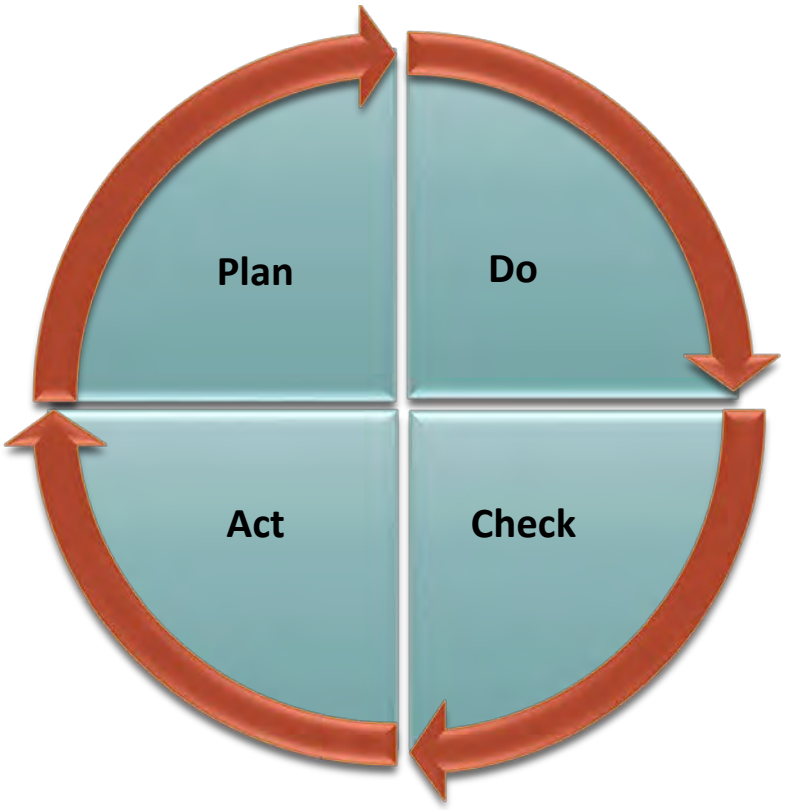
This CDM Plan provides the "big picture" view as an ongoing framework for optimizing overall energy use and achieving success.

Current practices must be enhanced and new approaches must be developed. To meet these needs, the LAWSS 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 LAWSS' understanding of the bottom line impact of energy management.

In order to establish a baseline for managing energy costs, the LAWSS 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 LAWSS 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".

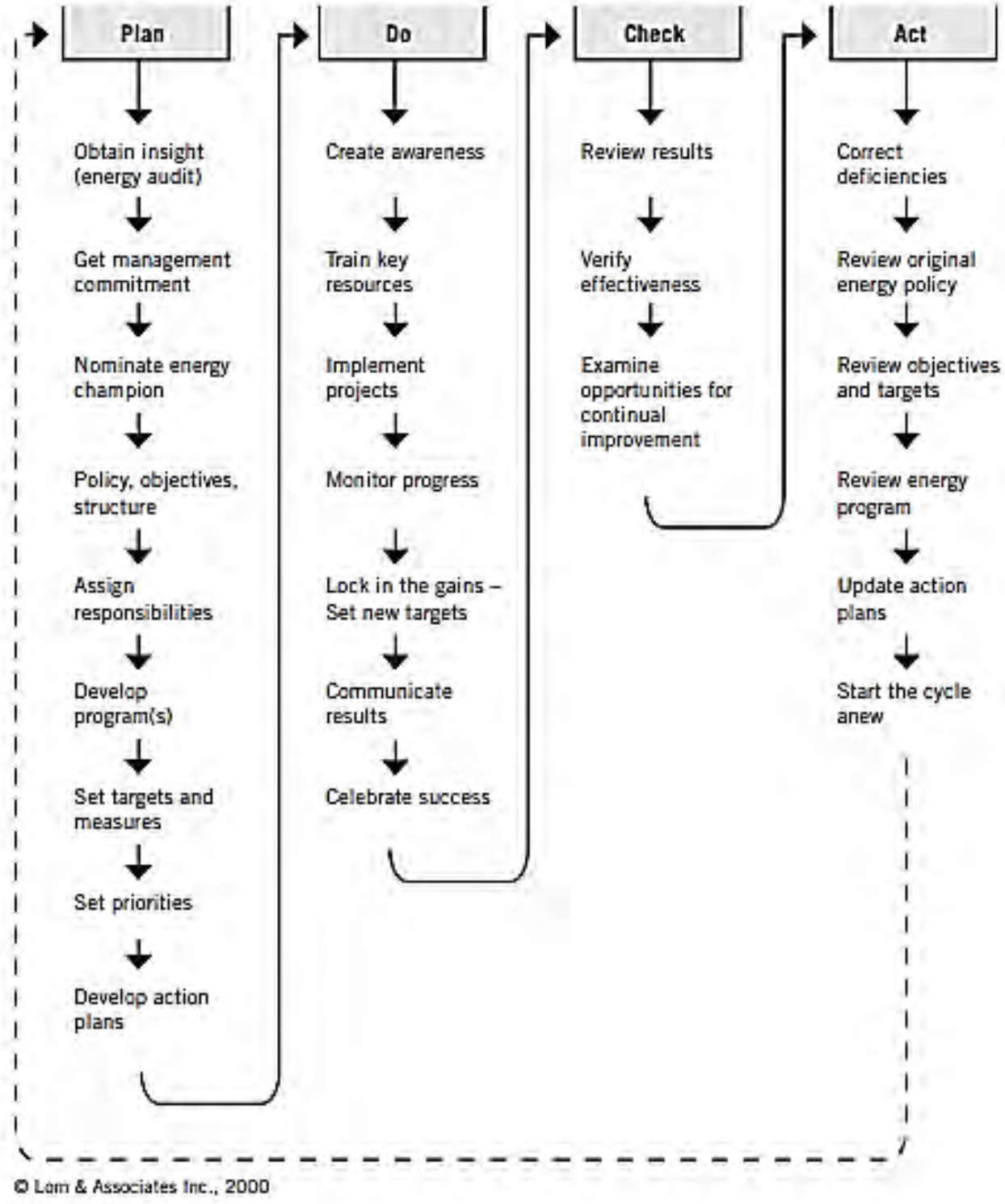
ACT

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

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

The detailed energy conservation project planning process is visually illustrated below.

Energy Conservation Project Planning Process[4]

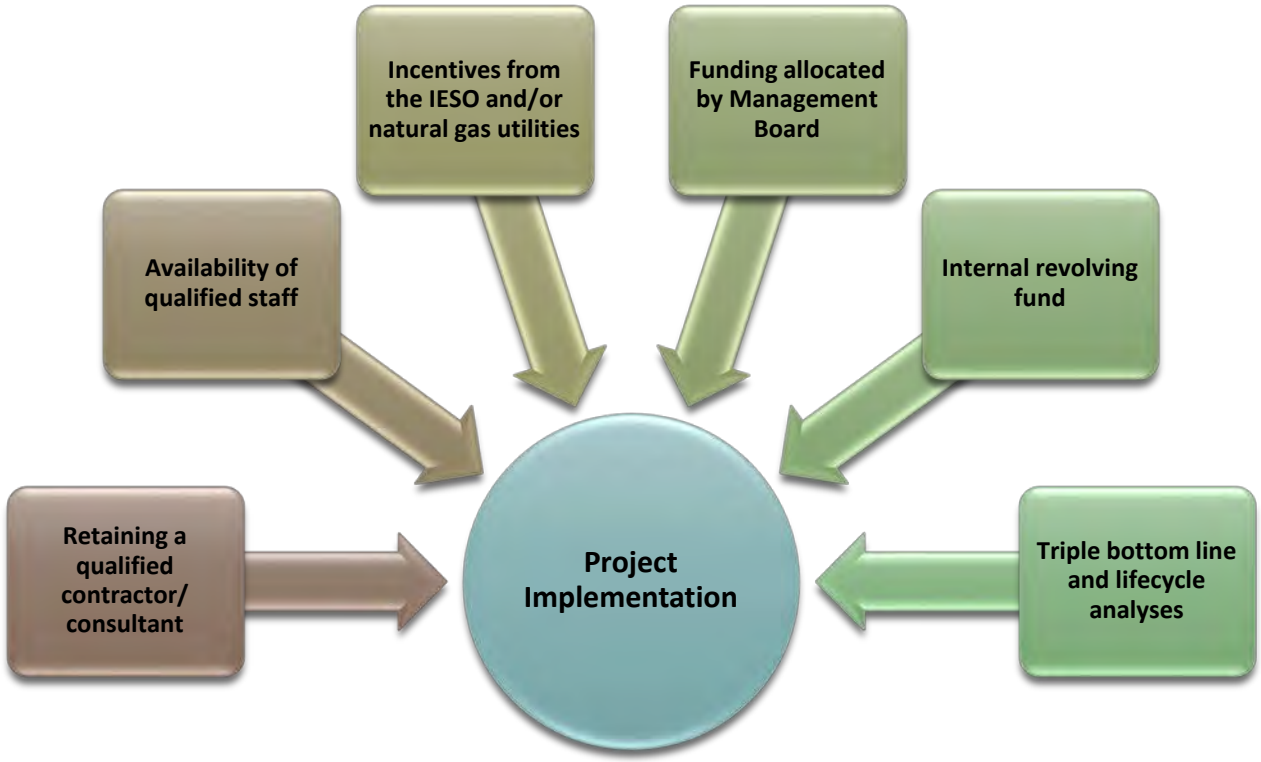


[4] Energy Efficiency Planning and Management Guide, CIPEC, 2002

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.

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 LAWSS. 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 LAWSS 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

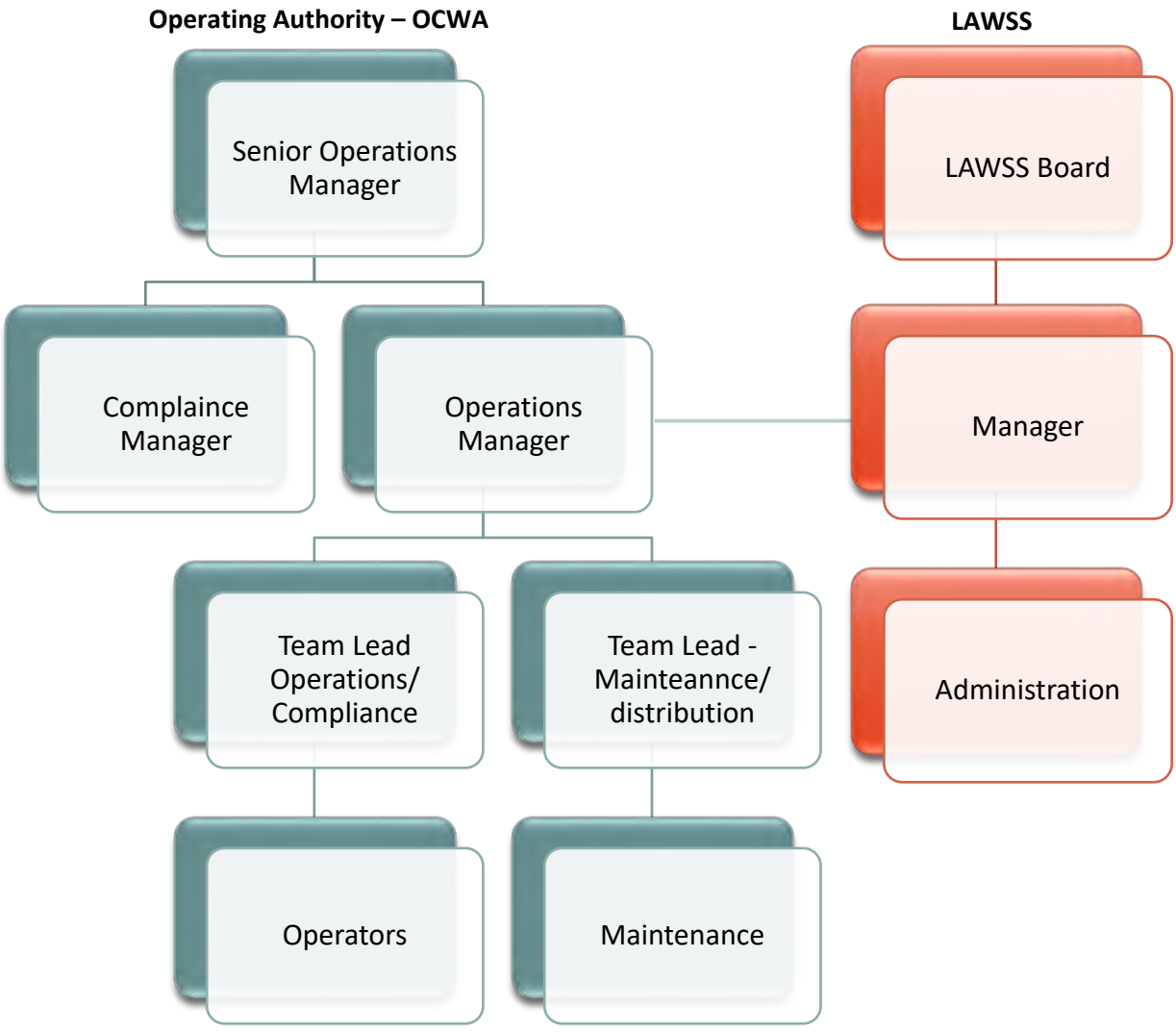
initial implementation of the CDM Plan, future years will allow staff to apply their knowledge to investigate energy efficiency initiatives that will emerge as the energy management field continues to thrive and evolve.

Responsibilities

Energy Management Team

All LAWSS staff and its Board should have a responsibility to contribute to overall municipal energy management objectives. Technology alone will not achieve energy conservation and demand management objectives. LAWSS 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 LAWSS buildings. The LAWSS will thus create an energy management team incorporating the system operator, OCWA

Structure of the Energy Management Team



The LAWSS 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
- Analyze and prioritize projects for consideration by the Management Board on an annual basis
- Identify potential projects to consider in the future
- Consider a corporate strategy for back-up generators
- Create an energy awareness strategy for LAWSS 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.

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 LAWSS 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 LAWSS an idea where it stands in meeting the short term goal and the long term goals.

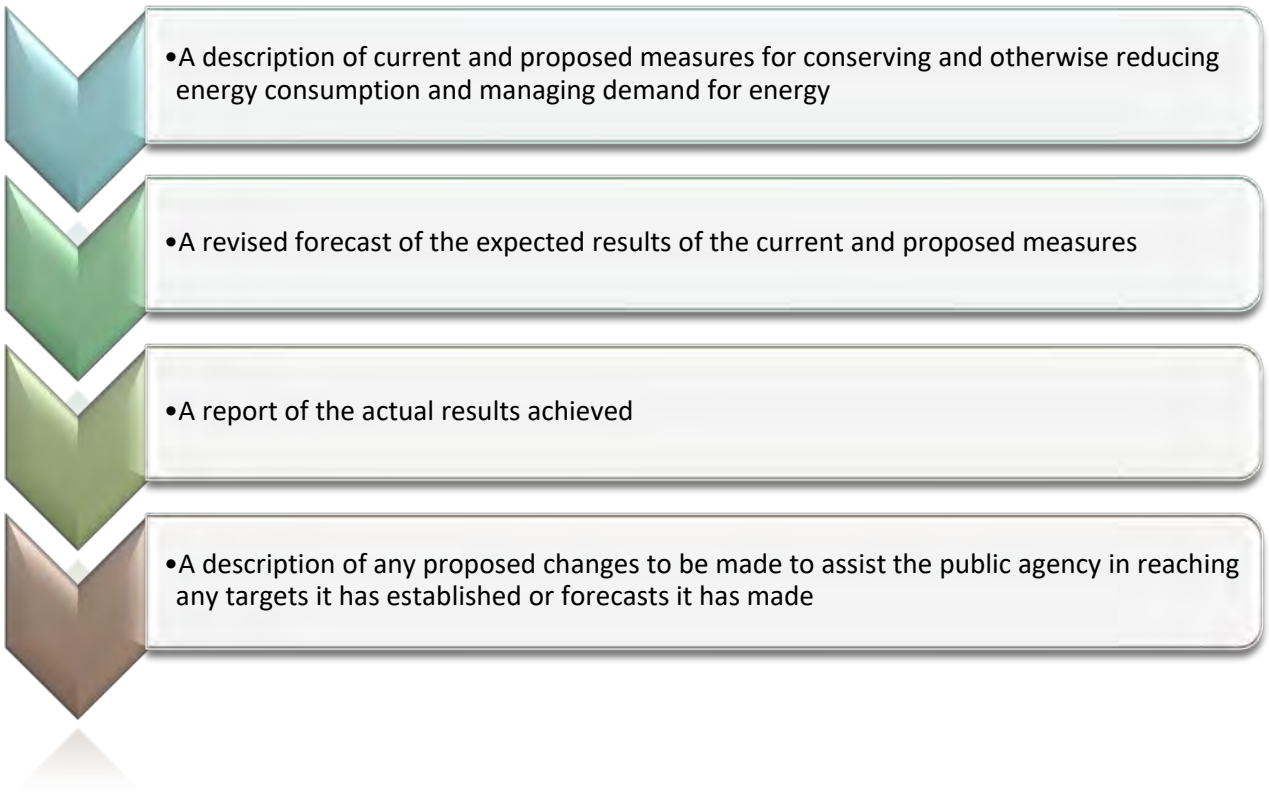
This also provides an opportunity to examine measures implemented and their effectiveness in reducing energy consumption at mid-term. A plan could be developed to further implement the successful measures for other facilities.

Long Term Goal & CDM Plan Update

The LAWSS 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 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 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 LAWSS 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 LAWSS will provide an update to include any revisions to the 2020-2024 CDM Plan. The LAWSS has submitted and published all of its annual Energy and GHG 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

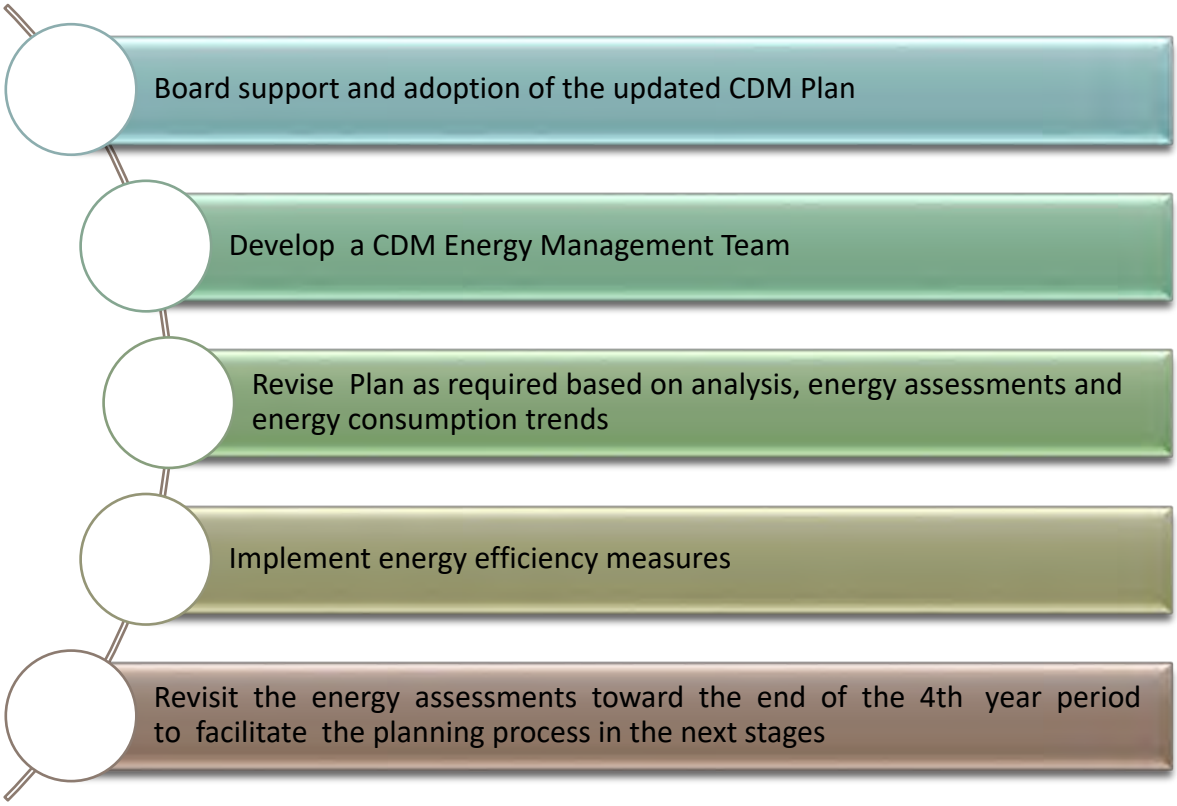
To ensure that the LAWSS will take advantage of all funding and grant opportunities related to energy efficient projects, the LAWSS will liaise with representatives from municioallities and local utility providers. LAWSS staff and utility representatives are in a unique position to review current and 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, LAWSS Staff will report to the Management Board and clearly outline the cost savings associated with a successful application.

Conclusions and Recommendations

Conclusions

- ✓ The LAWSS is on its way to the implementation of a structured Conservation Program
- ✓ The LAWSS 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

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2011-2018 Municipal Energy Consumption

A lot of changes have occurred to the LAWSS' facilities over the last five years, many of which resulted in energy efficiencies and consumption reductions. The table below shows the change in electricity consumption at LAWSS' three facilities reported on from 2011 to 2018.

Table S-1: Change in Electricity Consumption (2011-2018)

Total Annual Electricity Consumption (kWh)				
Facility	**2011**	**2014**	**2018**	**2014-2018 Electricity Consumption Variance**
East Lambton BS	985,459.00	1,153,518.00	946,586.00	**-18%**
LAWSS WTP	10,746,101.88	10,366,100.00	9,318,988.04	**-10%**
West Lambton BS	1,917,569.00	1,247,393.00	999,600.00	**-20%**
LAWSS TOTAL	**13,649,129.88**	**12,767,011.00**	**11,265,174.04**	**-12%**

The following figure shows the distribution of electricity consumption amongst the LAWSS' three facilities in 2018.

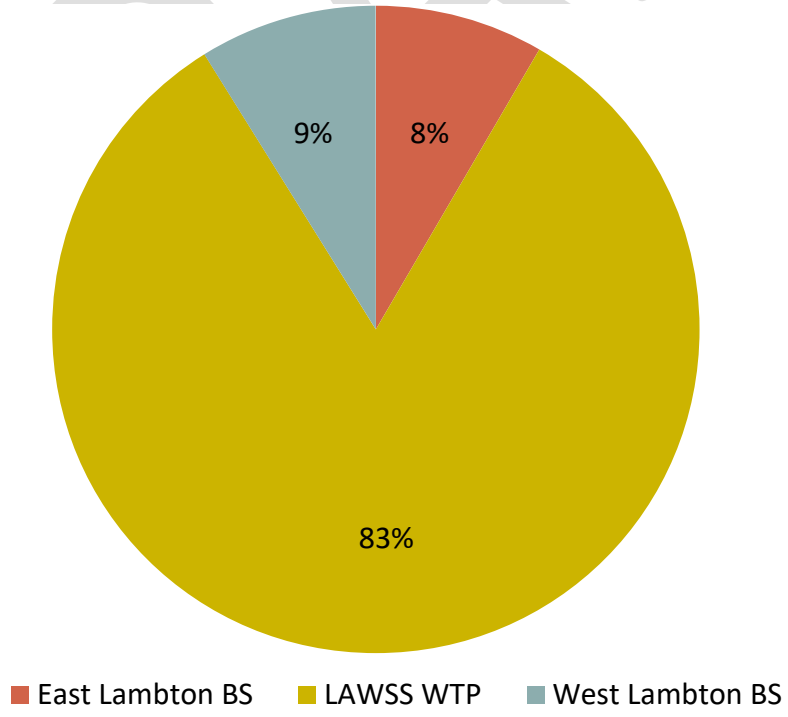

Figure S-1: 2018 LAWSS Electricity Consumption Profile