Energy Conservation and Demand Management Plan Update

2025-2029

June 11, 2024

Municipality of North Middlesex

Table of Revisions

Revision #	Date	Description of Revision	Revised by
0	June 26, 2024	Initial Issue	OCWA

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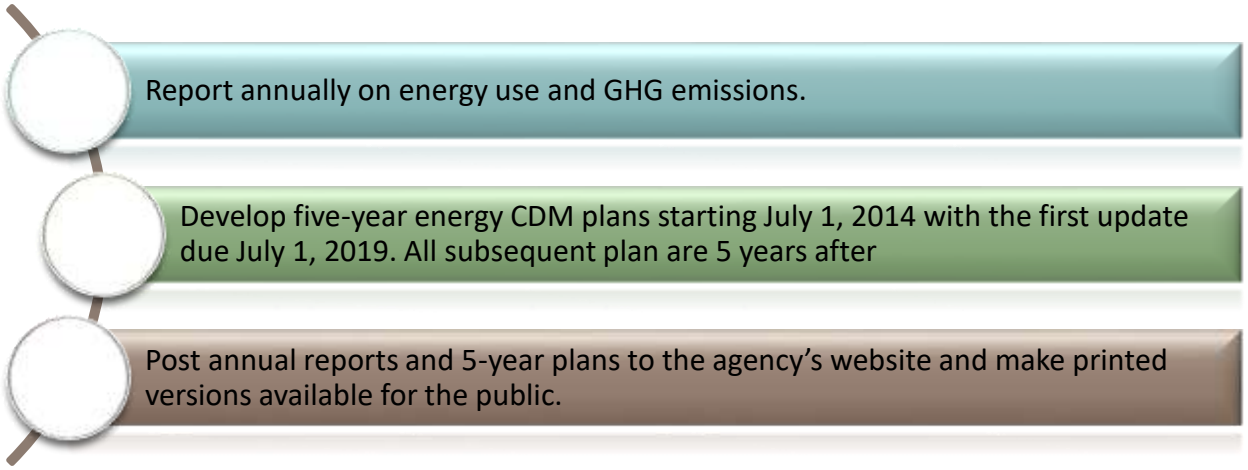
Executive Summary

In 2019, the Municipality of North Middlesex (NMS) 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. The Regulation 507/18 was replaced with O. Regulation 25/23 in 2023.

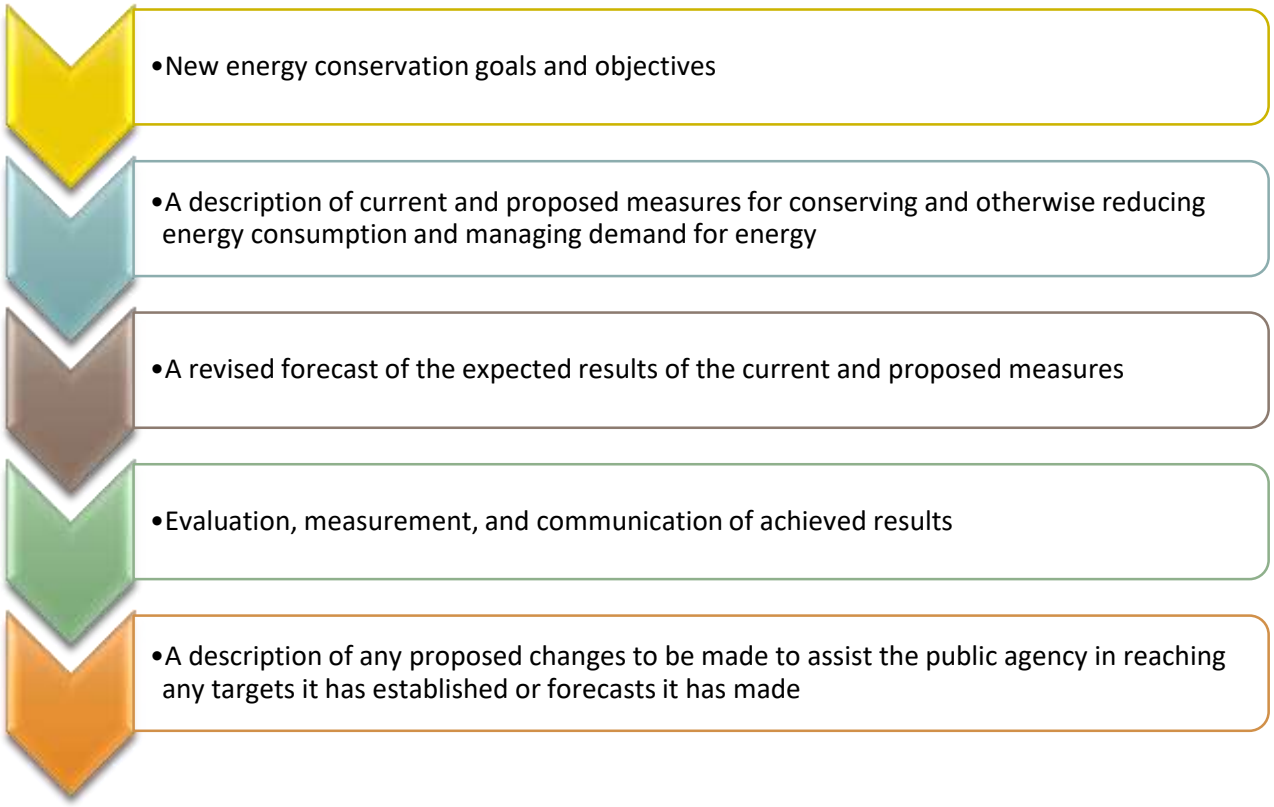
Ontario Regulation 25/23 requires public agencies to:



The NMS developed the first CDM Plan originally in June of 2014 with a subsequent update in the year 2019. 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 2025 to 2029. The plan was presented to the Council and approved on June 19, 2024.

The intent of the CDM Plan is to provide a basis for the NMS 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 NMS.

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 Municipality 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 NMS will take reasonable efforts to minimize impacts to the environment when allocating resources, while recognizing the needs of the community.

The NMS 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.

NMS 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 – especially at its largest energy consuming facility Ailsa Craig Wastewater Treatment Plant. NMS 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. NMS is focused in three key areas namely; people, process and technology to achieve its energy efficiency goals.
The original 2019 CDM Plan set very ambitious energy conservation targets for the NMS.

Though the NMS is still working to meet its conservation objectives from the 2019 plan, the achieved energy reductions within the system are close to the target. ***In total, overall electricity consumption was reduced by 4.5%, natural gas consumption was reduced by 13%, and propane usage had increased by 43% by 2022 across all NMS' buildings reported on compared to the 2017 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.

Though the NMS is still working to meet its conservation objectives from the 2019 plan, the achieved energy reductions within the system are significant. ***In total, overall electricity consumption was reduced by 4.5%, natural gas consumption was reduced by 13%, and propane usage had increased by 43% by 2022 across all NMS' buildings reported on compared to the 2017 baseline levels.***

The NMS commits to the following objectives for the 2025-2029 period:

1. • Improve the NMS' 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 2019, the North Middlesex (NMS) 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. The Regulation 507/18 was replaced with O. Regulation 25/23 in 2023.

Under Ontario Regulation 25/23, the requirements for broader public sector energy planning and reporting are identical to those under the former Ontario Regulations 507/18 & 397/11.

Under Ontario Regulation 25/23, all Broader Public Service 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 25/23 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. All subsequent plan are 5 years after
- Post annual reports and 5-year plans to the agency's website and make printed versions available for the public.

The NMS had originally developed in 2019, using 2017 as the baseline year. This 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 original plan was presented to and approved by NMS Council on June 27, 2019.

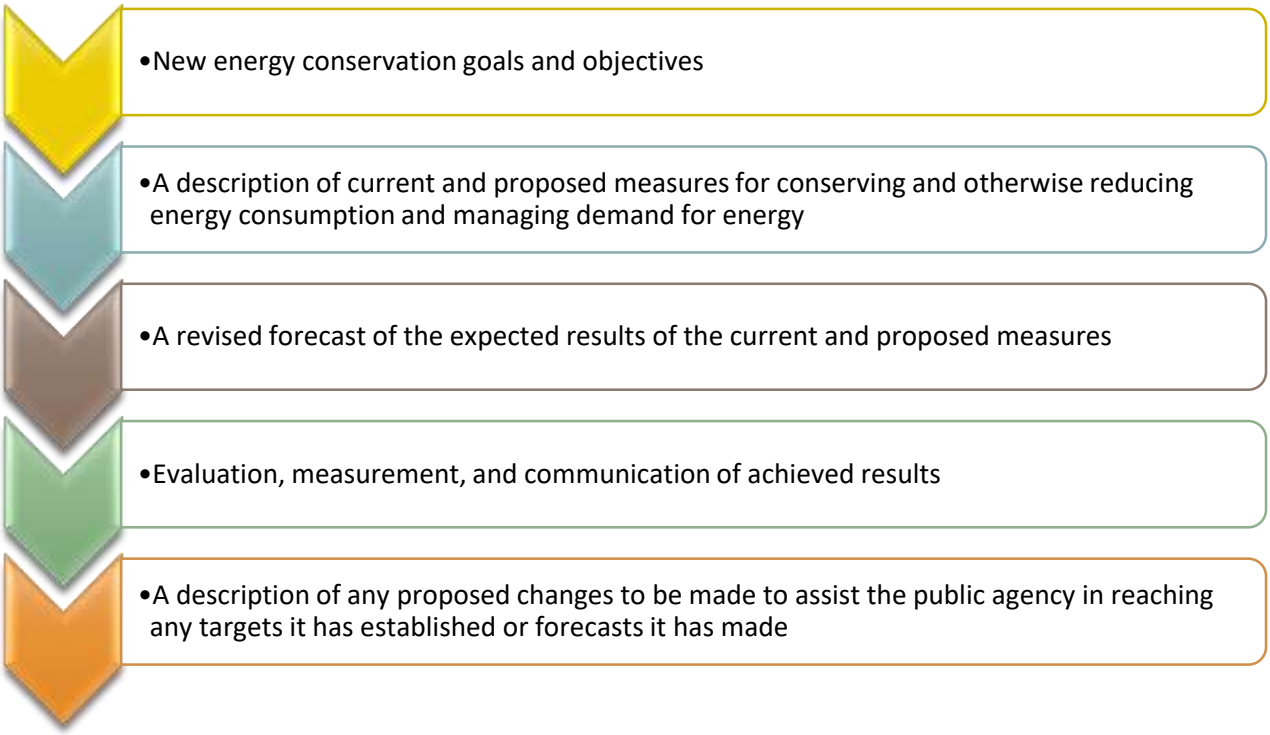
Overview

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 NMS 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 NMS.

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



Municipality of North Middlesex Facilities

NMS is overseen by a Council in charge of 26 facilities:

Street Lights	
Clandeboye Streetlights	1 Concession Lot 20
Elginfield Rd Streetlight	0 Elginfield Rd.
McLeod Street Ball Diamonds	225 McLeod St.
Parkhill Street Lights	Parkhill Street
Water & Wastewater	
Ailsa Craig Sewage Treatment Plant	4381 Elginfield Rd.
Bear Creek Pumping Station	11105 Petty Rd.
Kerwood Rd. Water Pumping Station	32217 Kerwoord Rd.
Lieury Rd. Mt. Caramel Pump	35085 Lieury Rd.
New Ontario Rd. Pumping Station	19 Concession Lot 25
Parkhill Water Reservoir	320 Parkhill Main
Victoria Street Sewage Pumping Station	395 Victoria St.
Water Tower	4688 West Corners
Civil Administration, Recreation & Wellness	
Ailsa Craig Library	147 Ailsa Craig Main
Ailsa Craig Recreation Centre	155 Annie Ada Shipley
Municipal Office	229 Parkhill
North Middlesex Arena	256 McLeod St.
North Middlesex Community Centre	224 McLeod St.
Parkhill Library (Carnegie Hall)	233 Parkhill Main
Parkhill Medical Centre	268 Parkhill Main
West Williams community Centre	32217 Kerwood West.
Public Works	
Ailsa Craig Works Shop	135 Mill St.
Lieury Shop	147 Ailsa Craig Main
McGillivray Public Works Department	34665 Creamery Rd.
Parkhill Public Works Shop	249 Station Parkhill
Fire	
Ailsa Craig Fire Station	159 William St.
Parkhill Fire Station	194 Parkhill Main.

NMS owes a total of 26 facilities on record, consisting of wastewater treatment, recreation, public service, and other municipal facilities that fall within the scope of the CDM plan updated.

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 figures below shows the significant increase in electricity costs over the last decade, taxing municipal reserves.

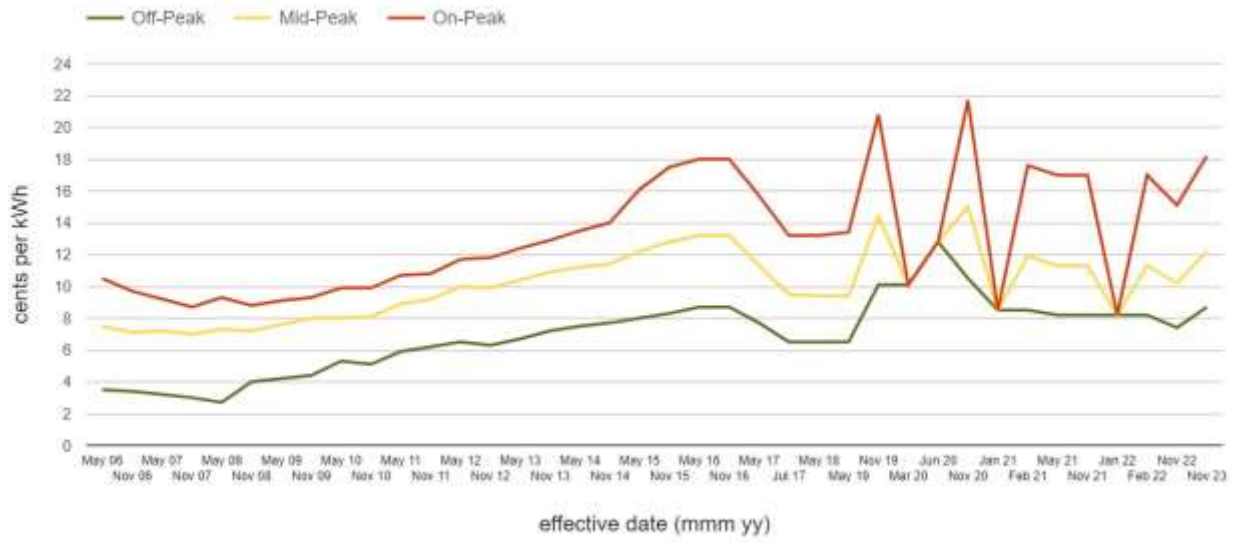


Figure 1 Historical TOU Electricity Rates[1]

The Time of Use (TOU) prices are primarily for users with utilization rates under 50kW of average demand such as small pumping station, small commercial and residential locations.

[1] Ontario Energy Board, 2024

Figure 2 Historical Tiered Prices[2]

Tiered is primarily for the medium size facilities, where some of the larger NMS facilities fall under this category. However, for the purposes of highlighting the rise in the electricity prices over the years both of the above figures display a comparable trend.

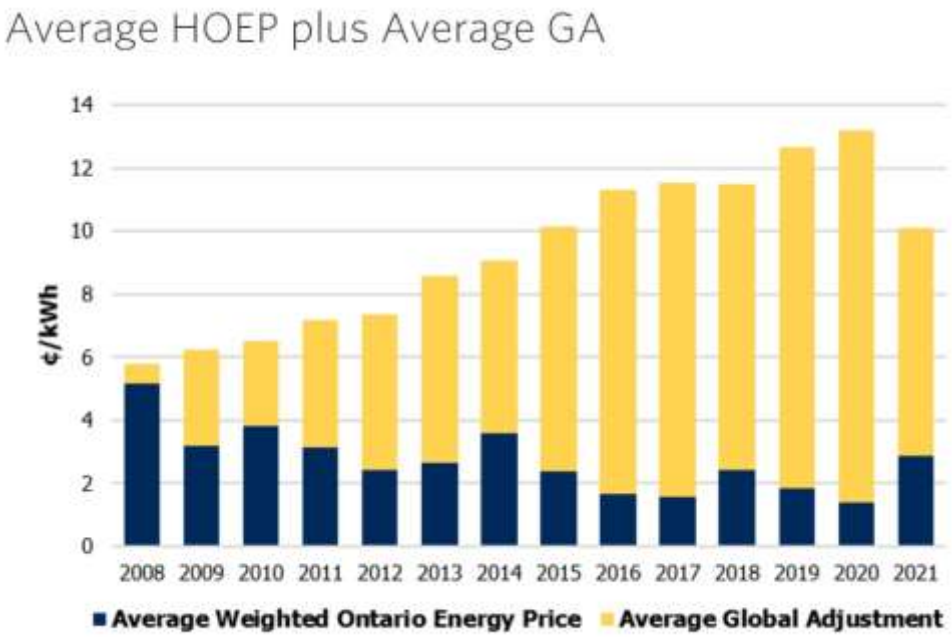


Figure 3 Historic HOEP and GA Blended Cost[3]

The Hourly Ontario Energy Price (HOEP) in combination with Global Adjustment (GA Class B) is used for determining the bulk of the typical invoice from the Local Distribution company (LDC).

[2] Ontario Energy Board, 2024
[3] IESO, 2024

Unlike the figures before, total cost is steadily rising, however NMS has taken significant measures to mitigate the global adjustment portion of the electricity bill through reduction in electrical consumption (for class B customers reducing electrical consumption is the only way to reduce GA costs unlike the Class A – based on electrical demand).

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.[5]

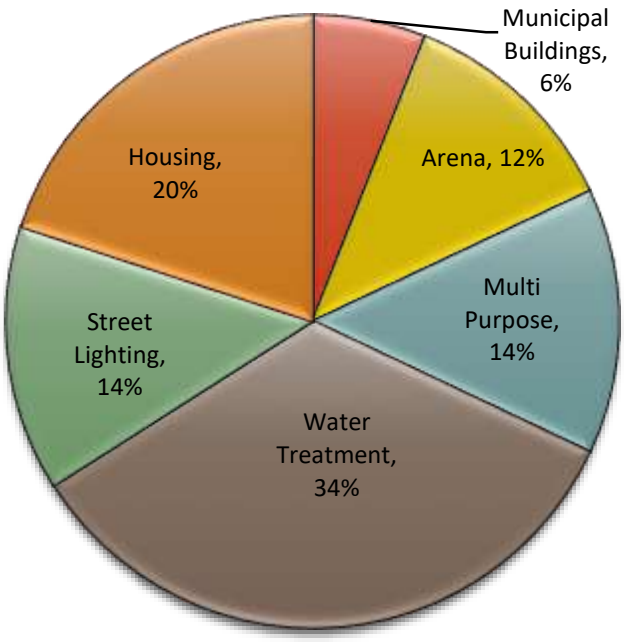
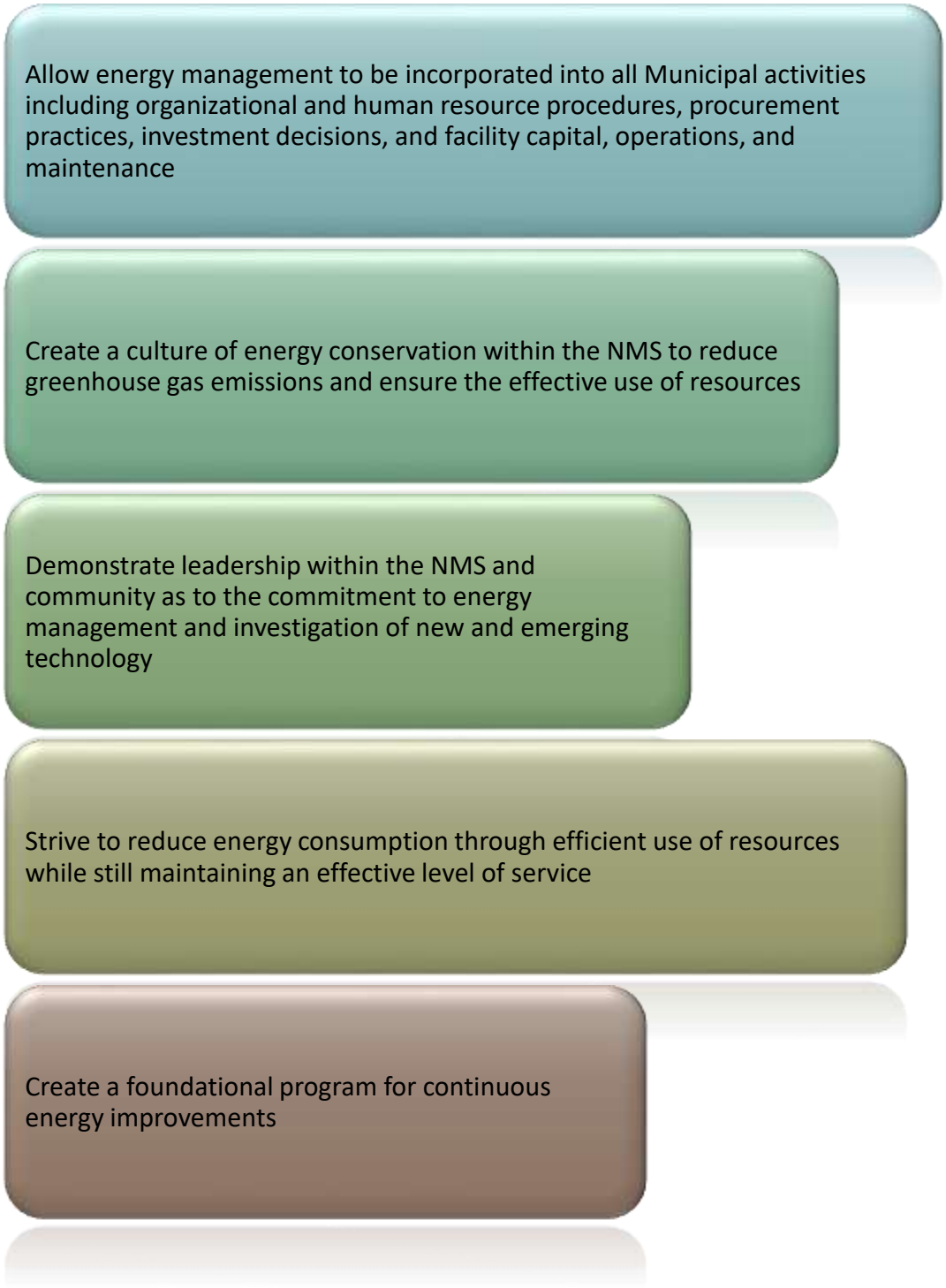


Figure 2: Municipal Energy Use by Sector in Ontario[3]

[4] Study Report: Market Characterization & Conservation Potential for Ontario's Drinking Water & Wastewater Treatment Plants (Dec. 2018), IESO, Posterity Group, 113.
[5] Every Drop Counts, ECO, 2017

Goals and Objectives

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



Commitment

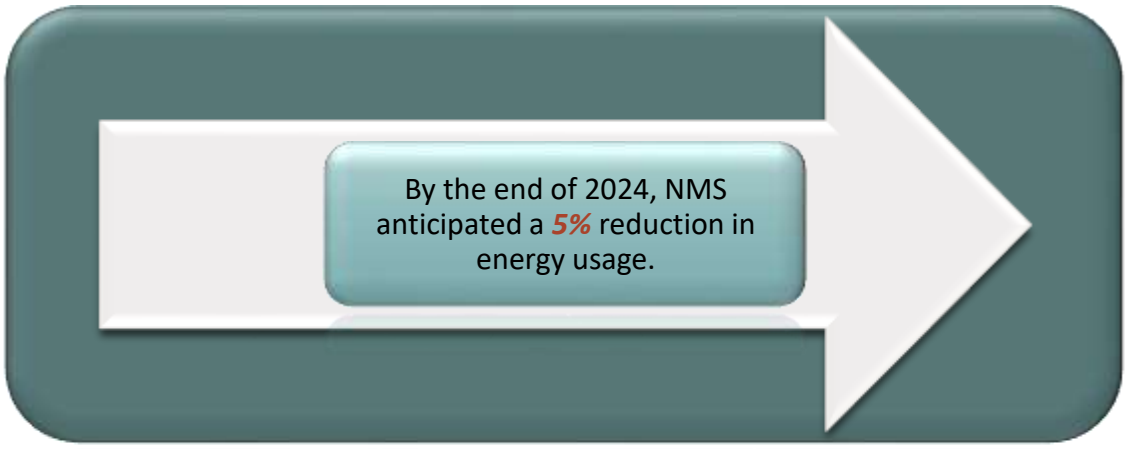
The NMS is committed to the promotion of responsible energy management through the implementation of economically viable energy efficiencies and environmental care throughout all facilities, plants and equipment. The NMS will take reasonable efforts to minimize impacts to the environment when allocating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

Vision

The NMS 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.

2020-2024 CDM Plan Reduction Targets

The original 2019 CDM Plan set ambitious energy conservation targets for the NMS. That said, it was not expected that there would be substantial energy usage reductions from the 2017 baseline year's rate of energy consumption. However, there are always opportunities for improvement and the NMS is committed to continuously monitor energy consumption and implement energy efficient practices where applicable.



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

Energy Conservation Initiatives

The NMS is aware that energy conservation and management is imperative to creating a sustainable environment and reducing on-going operations/energy costs. NMS 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 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 NMS purchases water, it is up to municipality to determine whether their customers are metered. All of the municipal water users are metered, which allows municipality to effectively manage the water resources.

NMS could encourage 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 purchased 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.

Decrease energy consumption of Water Systems

Water systems are costly to operate. The pumping of water is energy intensive. Reducing output from these systems directly decreases energy costs.

Projects Implemented: 2014-2023

Municipality of North Middlesex has always been proactive towards energy conservation and has initiative various activities that would assist towards efficient use of energy. NMS has historically worked with various government agencies such as Ontario Power Authority, currently know as IESO, implementing various projects to improve the energy efficiency of its facilities. Projects types included Lighting, HVAC, and variable frequency drive studies have been undertaken at NMS.

Some of the projects that NMS has implemented (new are underlined) are shown in the following table:

Year	Scope of Work	Status
2015	North Middlesex Arena - Installed LED lighting in arena	Completed
2016	North Middlesex Arena - Install LED lighting throughout facility	Completed
2017	North Middlesex Arena - New Condensor	Completed
2016	Ai Isa Craig Recreation Centre - Instal led LED I lighting throughout the facility	Completed
2015	Ai Isa Craig Recreation Centre - Installed new HVAC system	Completed
2015	Ai Isa Craig Recreation Centre - Upgraded refrigerators	Completed
2016	North Middlesex Community Centre - Installed LED I lighting throughout the facility	Completed
2015	North Middlesex Community Centre - Installed new HVAC system	Completed
2015	North Middlesex Community Centre - Upgraded refrigerators	Completed
2016	Library - Installed LED lighting throughout the facility	Completed
2019	Bear Creek – control issue identified (both duty pumps running simultaneously instead of alternating) with duty selection of pumps, issue resolved after PLC replacement April-May 2019	Completed
	Reducing the flood water temperature by 30 degrees farenheit at Arena	Completed
2020	Install Glycol cooling loop - Arena	Posponed until 2026
	Install smart thermostats - Arena	Completed
	Install LED Lights to replace Metal Halides – Parkhill Sports Fields (currently looking for grant or sponsorship to offset ROI beyond projected lifecycle)	Postponed
	Install LED Lights to replace Metal Halides – Ailsa Craig Community Park (currently looking for grant or sponsorship to offset ROI beyond projected lifecycle)	Postponed
	Install Smart Thermostat – Ailsa Craig Recreation Centre	Complete

	Install Waterless Urinals – Ailsa Craig Recreational Centre	Postponed
	Install LED Lights to replace Metal Halides – Lieury Ball Diamond (currently looking for grant or sponsorship to offset ROI beyond projected lifecycle)	Postponed
	Install Smart Thermostat – North Middlesex Community Centre	Complete
2021	Install Waterless urinals - North Middlesex Community Centre	Postponed
	Install floating head pressure in compressor room – Arena	Completed
	Install waterless urinals - Arena	Postponed
	Replace 2 compressors 50hp V6 and 30 HP V6 in arena with 1 high efficiency mycom n2m 50hp compressor at Arena	Completed
	Energy Audit – Ailsa Craig Wastewater Treatment Plant	Completed
2022	Replace the control unit on the HVAC unit RTU-2 at Ailsa Craig WPCP	Completed
	Installed a new motor to digester blower #2 at Ailsa Craig WPCP	Completed
	Installed a new 20 hp motor to the #2 aeration blower to the digester at Ailsa Craig WPCP.	Completed
	Mechanical aerator installed in the head works as part of an energy conservation pilot project at Ailsa Craig WPCP	Completed

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

Project	Estimated Yearly Energy Savings (kWh)	Estimated Demand Savings (kW)	Estimated Capital Cost ($)	Estimated Simple Payback Period (years)*	Project Forecasted completion date
Ailsa Craig WPCP – Aeration System Upgrade + HVAC VFDs on supply & exhaust (PROPOSED)	30+% of facility total consumption	TBD	$200,000	4	TBD
Ailsa Craig WPCP Pilot – IPEX aerator (ONGOING)	14,000	5	$0	N/A	2025
Total					

***assuming $0.12/kWh and not including any IESO or other types of incentives**

Double Vortex Force Aerator

In 2022, OCWA and NMS have begun trial of the a mechanical aerator at the Ailsa Craig Waste Water Treatment Plant. The unit has no moving parts and does not consume electricity, but provides additional dissolved oxygen at the headworks of the facility, reducing the amount of oxygen needed to be delivered by aeration positive displacement blowers

Municipal Office Upgrades

Municipal office had undergone significant upgrades when it comes to heating systems and behavior change of occupants resulting in substantial natural gas use reduction.

2019-2022 Energy Consumption Summary

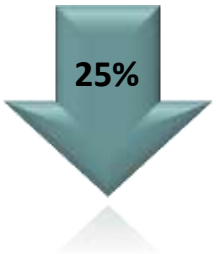
Tracking Energy Consumption and Savings

Annual energy reporting is required under the regulation and allows the NMS 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 NMS' 2022 annual energy report as required under the regulation, we have also included and considered our 2023 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 2019 energy conservation and demand management plan can be found on Municipal website: http://www.northmiddlesex.on.ca/

From 2019 to 2022, the greatest reductions achieved at the NMS were:

Though the NMS is still working to meet its conservation objectives from the 2019 plan, the achieved energy reductions within the system are significant. ***In total, overall electricity consumption was reduced by 4.5%, natural gas consumption was reduced by 13%, and propane usage had increased by 43% by 2022 across all NMS' buildings reported on compared to the 2017 baseline levels.***

The plant has undergone multiple changes across its processes including technical projects and operational optimization efforts, including exploration of innovative aeration systems that offset the dissolved oxygen requirements (second biggest consumer after HVAC at the plant as per most recent energy audit).



Municipal office saw reduction of 25% in its natural gas usage, which can be attributed to the implementation of various behavioural changes, as well as equipment upgrades over the years.

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 NMS' energy consumption from 2017 to 2022.

Looking forward: 2025-2029

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 NMS will strive to ***reduce our energy consumption (electricity and natural gas) by 5% by the end of 2029 from the 2017 baseline***. This Energy Reduction Target will apply to all departments and facilities owned by the NMS.

The NMS commits to the following objectives for the 2025-2029 period:

1. • Improve the NMS' 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 additional street lighting from high pressure sodium to LED), organizational (establishing a green/energy 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 NMS has been continuously improving equipment and their energy efficiency. The creation of this Plan confirms that NMS already conforms with the steps for an energy improvement program. NMS has already implemented many ECMs.

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

Technical Measures

Efficiency Measure	Status
New Ontario SPS – Pump replacement one each year	To be completed 2026-2027
Ailsa Craig WPCP – RTU replacement with potential for inclusion for heat pump as part of the unit	To be completed 2025-2026
Ailsa Craig WPCP – replacement of one of the primary aeration PD blowers with a turbo blower at the end of life	To be completed 2025-2027
Ailsa Craig WPCP – addition of the VFDs to the intake and exhaust fans of the HVAC system for the facility	To be completed 2025-2027
Victoria Street SPS – HVAC upgrade	To be completed 2027
Ailsa Craig WPCP – roof replacement (building envelope)	To be completed 2024
Explore electric ice-resurfacer when replacement is scheduled	To be completed 2029
Install Smart thermostat systems for hot water heaters to lower temperature during low demand period	To be completed 2028

Ailsa Craig Aeration and HVAC Upgrade

NMS is exploring the option to implement a small scale turbo blower for the Ailsa Craig WPCP primary aeration. The turboblowers were typically cost prohibitive for any size smaller than 50 hp in the past, but with the advent of the new vendors on the market, NMS is considering replacement of one of the exising PD blowers with a turbo blower. In addiiton the project is slated to receive significant grant when bundled with HVAC upgrade from the Green Municipal Fund (GMF). Lastly, the project is also eligible for further incentives from the SOE by the IESO, where NMS will work closely with OCWA to ensure the success of the project. The expected energy savings are to meet total facility electricity consumption reduction of no less than 30%

Organizational Measures

Efficiency Measure	Status
Create an Energy Management Team	To be completed 2025

Behavioural Measures

Efficiency Measure	Status
Continue to upgrade the remaining water taps with motion sensors to reduce the water use across the municipal facilities.	To be completed 2026
Place poster/sticker near light switch in rooms reminding users to turn off lights when no one is in the room (for the systems without the motion sensors)	To be completed 2024
Continue to ensure the temperature of facilities meets the needs of the users	To be completed 2024

Renewable Energy Projects

Efficiency Measure	Status
Investigate the existing solar system at the Ailsa Craig WPCP for potential expansion upgrade. Investigate potential revenue sources such as the Demand Response program participation (100 kW minimum reduction for lengths of up to 4 hours 10-12 times a year as the target)	To be completed 2026

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.

Waste Water Systems

Waste Water systems consume a lot of energy in the treatment and collection of sewage. 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 wastewater 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

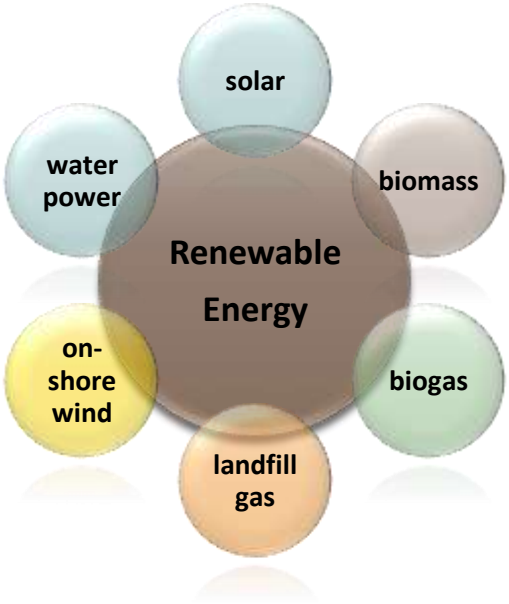
An effective way for drinking water systems to improve their energy performance is to replace the inefficient motors with higher efficiency models. By maintaining ventilation and temperature control to the optimal operating conditions provided by the motor manufacture will can result in motor efficiency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

wastewater 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. The renewable power options can be utilized to offset the energy consumption of the loacal facility such as the wastewater plant, or offload the excess to the electrical grid of Ontario.

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. This one is of particular importance for Ailsa Craig WPCP as the discussion on the replacement of RTU are ongoing while also considering modifications to the main roof of the plant.

Plan Implementation

Ontario Regulation 25/23 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 NMS is maintaining and developing current and planned services that continue to be affordable to taxpayers.

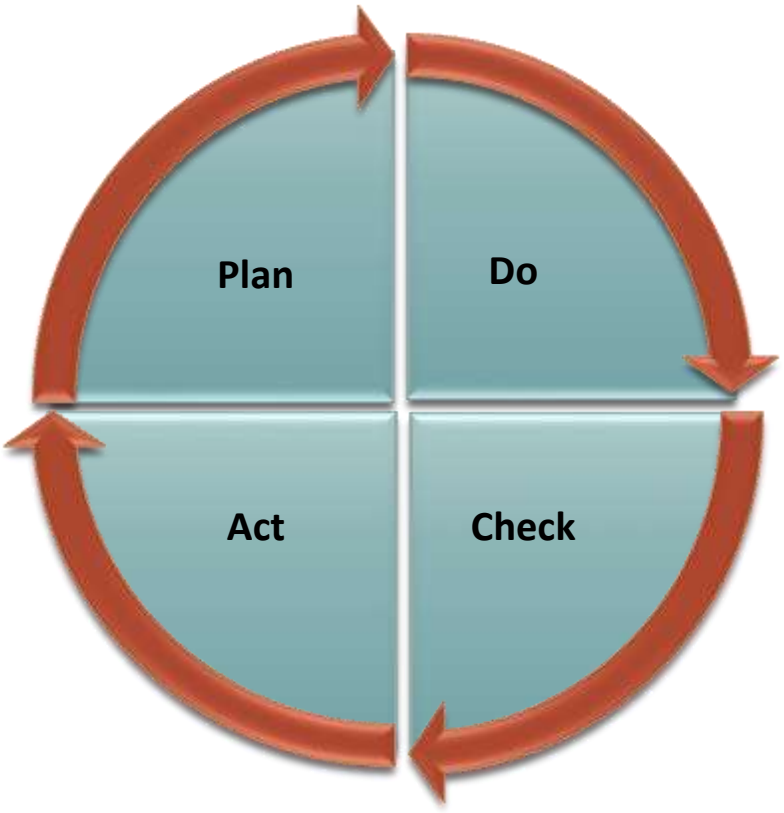
This CDM Plan provides the "big picture" view as an ongoing framework for optimizing overall energy use and achieving success.

Current practices must be enhanced and new approaches must be developed. To meet these needs, the NMS 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 determine areas that could be candidates for improved conservation. These monitoring enhancements will improve the NMS' understanding of the bottom line impact of energy management.

In order to establish a baseline for managing energy costs, the NMS 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 NMS has expressed intent to begin following *NRCAN, ISO 50001*'s four step plan–do–check–act management methodology in relation to Conservation Demand Management. The process described below is typically used in business for the control and continuous improvement of processes, but is also applicable to energy management and conservation.



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".

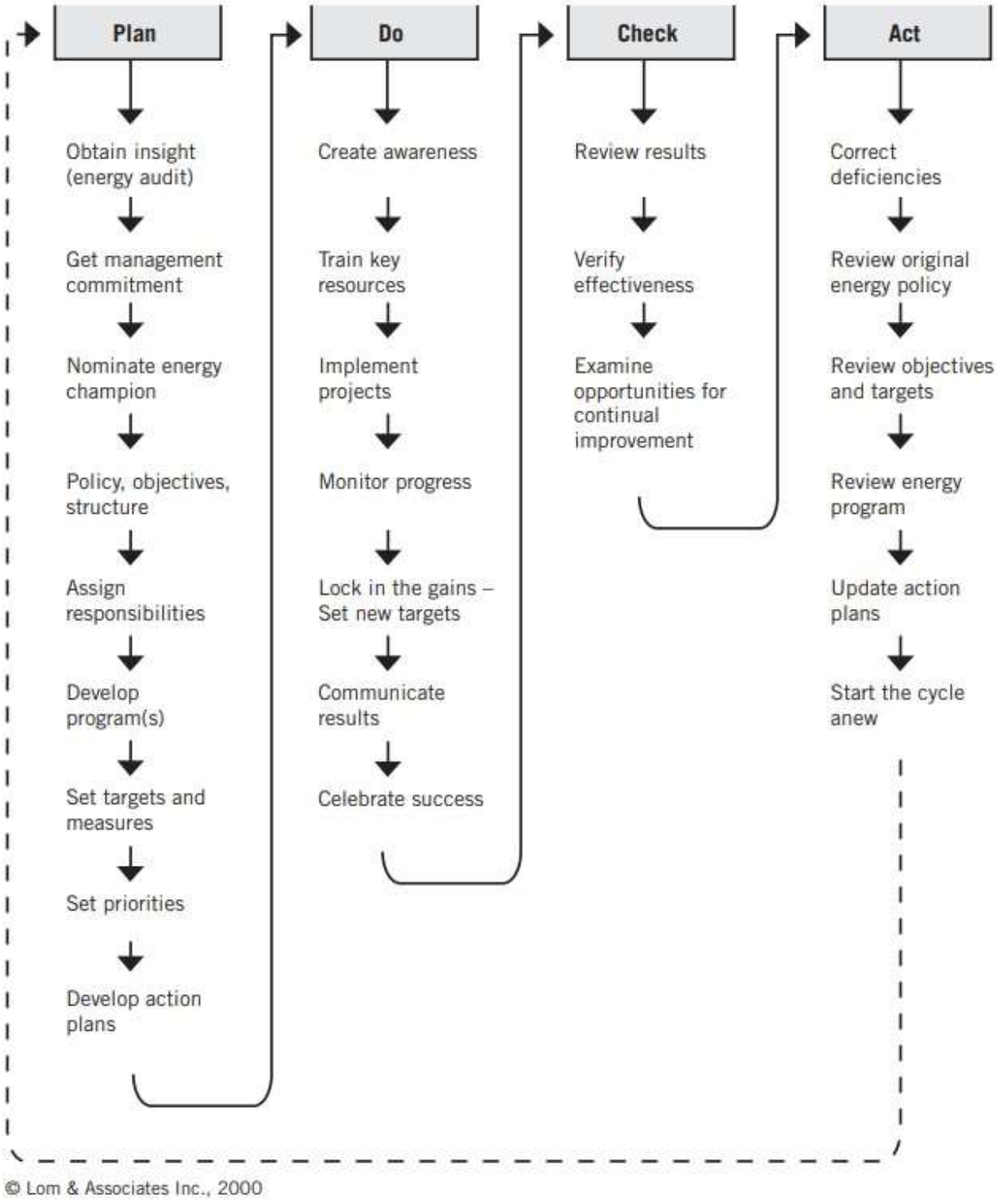
ACT

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

The NMS implements tools to maintain and continually improve energy conservation and demand management. Benchmarking is the process that the NMS 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[6]

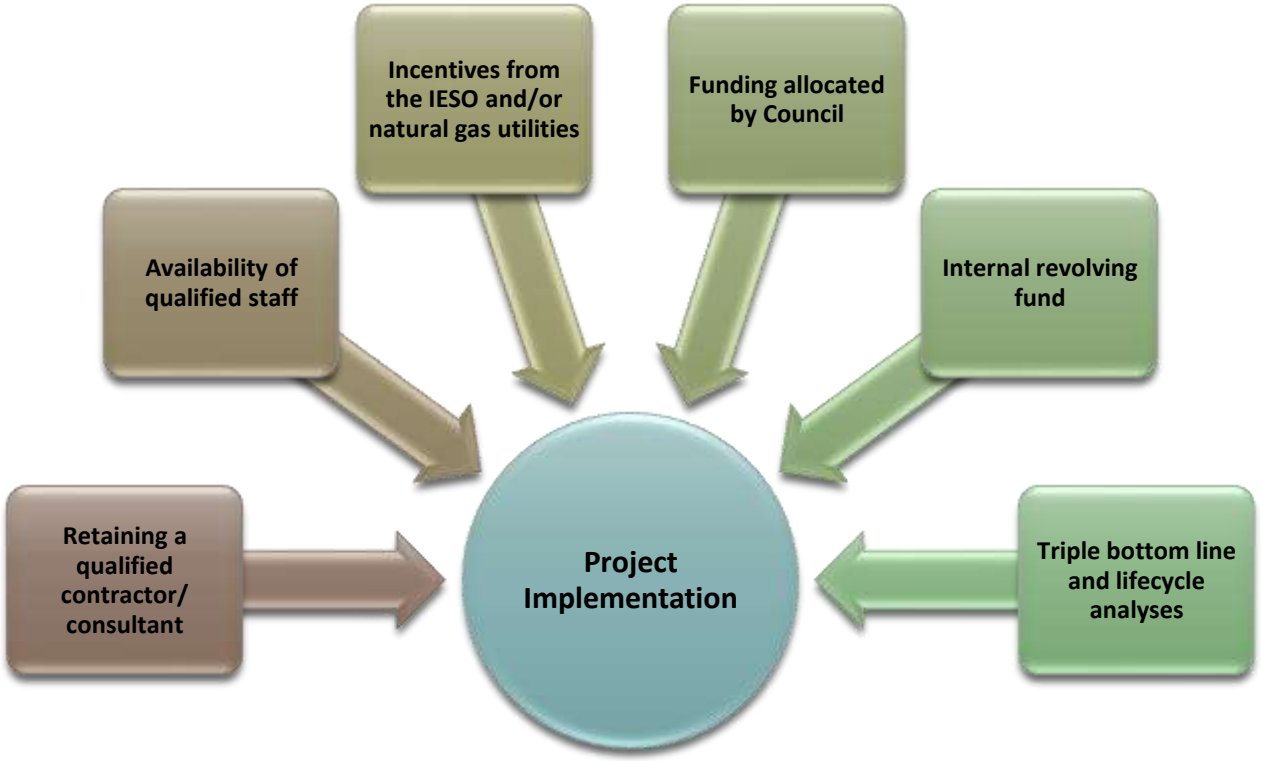


[6] Energy Efficiency Planning and Management Guide, CIPEC, 2002

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 NMS. 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.

2024 & 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 NMS 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

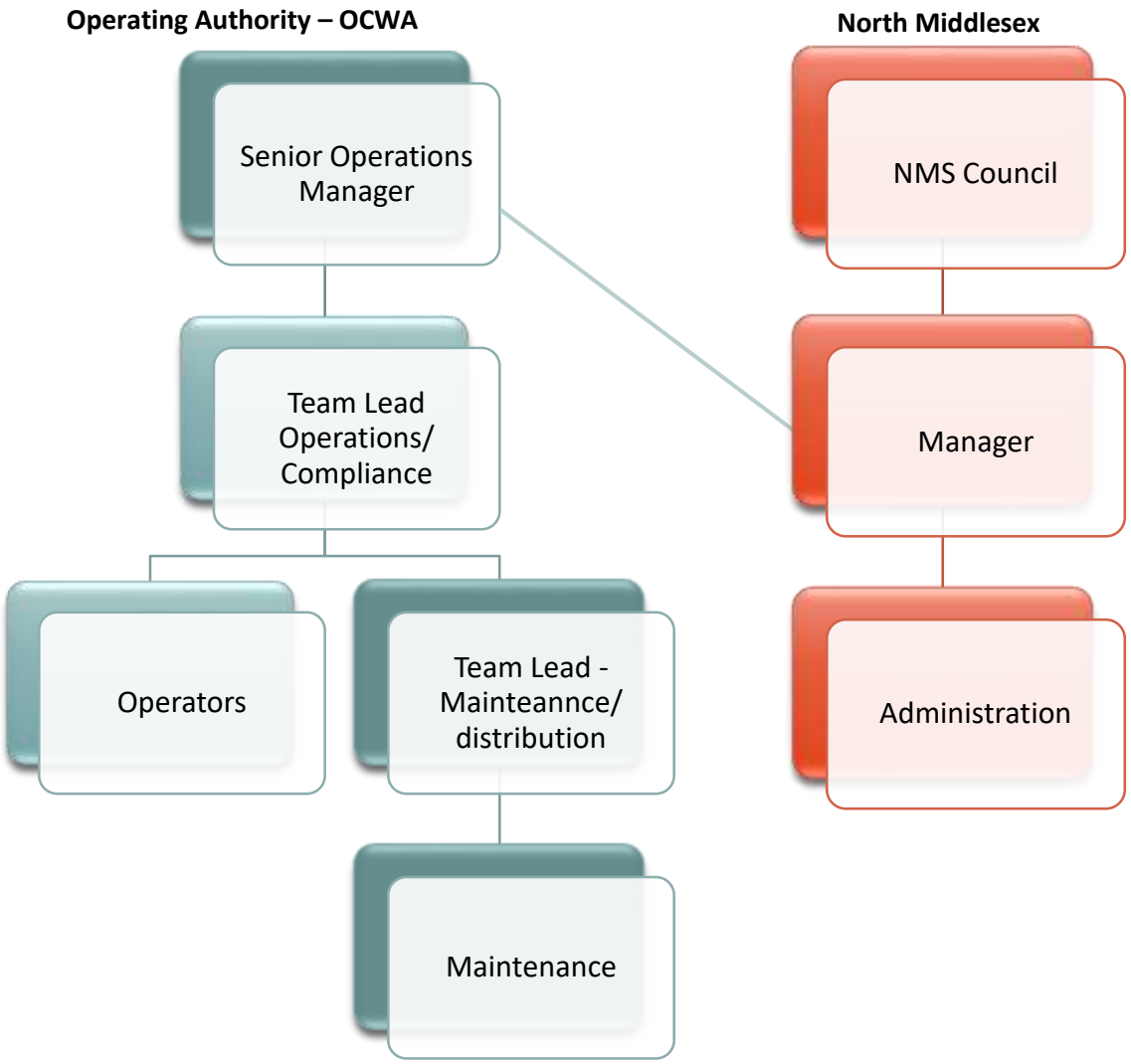
implementation of the CDM Plan, future years will allow staff to apply their knowledge to investigate energy efficiency initiatives that will emerge as the energy management field continues to thrive and evolve.

Responsibilities

Energy Management Team

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

Structure of the Energy Management Team



The NMS 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 Council. 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 Energy Management Team shall be established by the Council and the Terms of Reference drafted by the following CDM Plan update in 2029. The Terms of Reference will be presented to council for approval. The Energy Management Team shall draft the Terms of Reference for the Manadate. Terms of Reference shall be based generally on the following:

- Track energy spending by department
- Analyze and prioritize projects for consideration by the Council 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 NMS 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 NMS 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 2026. As stated, a short term target of 3-5% energy reduction by the end of 2026 from the 2017 baseline is established. Energy usage of each facility for the year 2026 will be compiled and compared to the baseline energy usage in 2017. The comparison would provide the NMS an idea where it stands in meeting the short term goal and the long term goals.

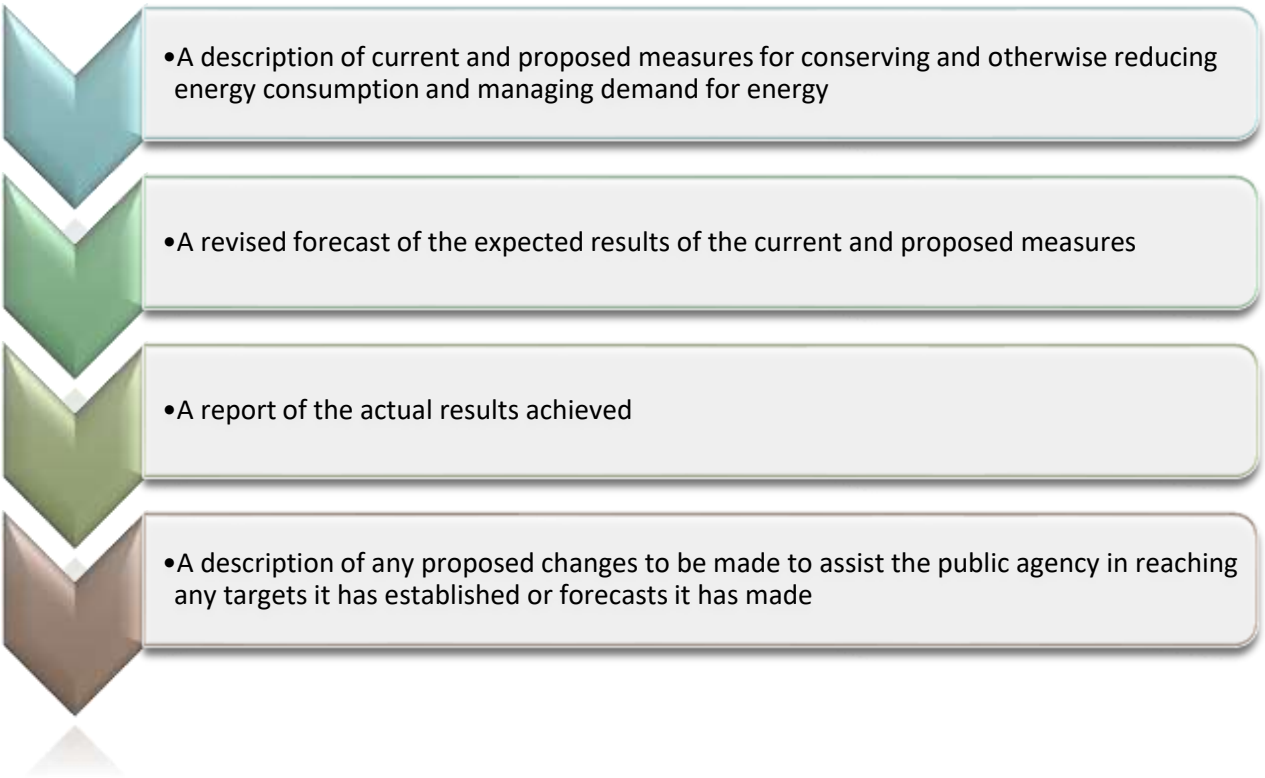
This also provides an opportunity to examine measures implemented and their effectiveness in reducing energy consumption at mid-term. A plan could be developed to further implement the successful measures for other facilities.

Long Term Goal & CDM Plan Update

The NWM will strive to reduce total system-wide energy consumption by 5% by the end of 2029 from the 2017 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 2029 will include the following items:



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

Ontario Regulation 25/23 requires that the NMS 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 2029, the NMS will provide an update to include any revisions to the 2025-2029 CDM Plan. The NMS has submitted and published all of its annual Energy and GHG Emission Reports and will continue to do so annually until July 1, 2029. 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 NMS will take advantage of all funding and grant opportunities related to energy efficient projects, the NMS will liaise with representatives from municipalities and local utility providers. NMS staff and utility representatives are in a unique position to review current and future process improvements, program implementations and projects that can meet future

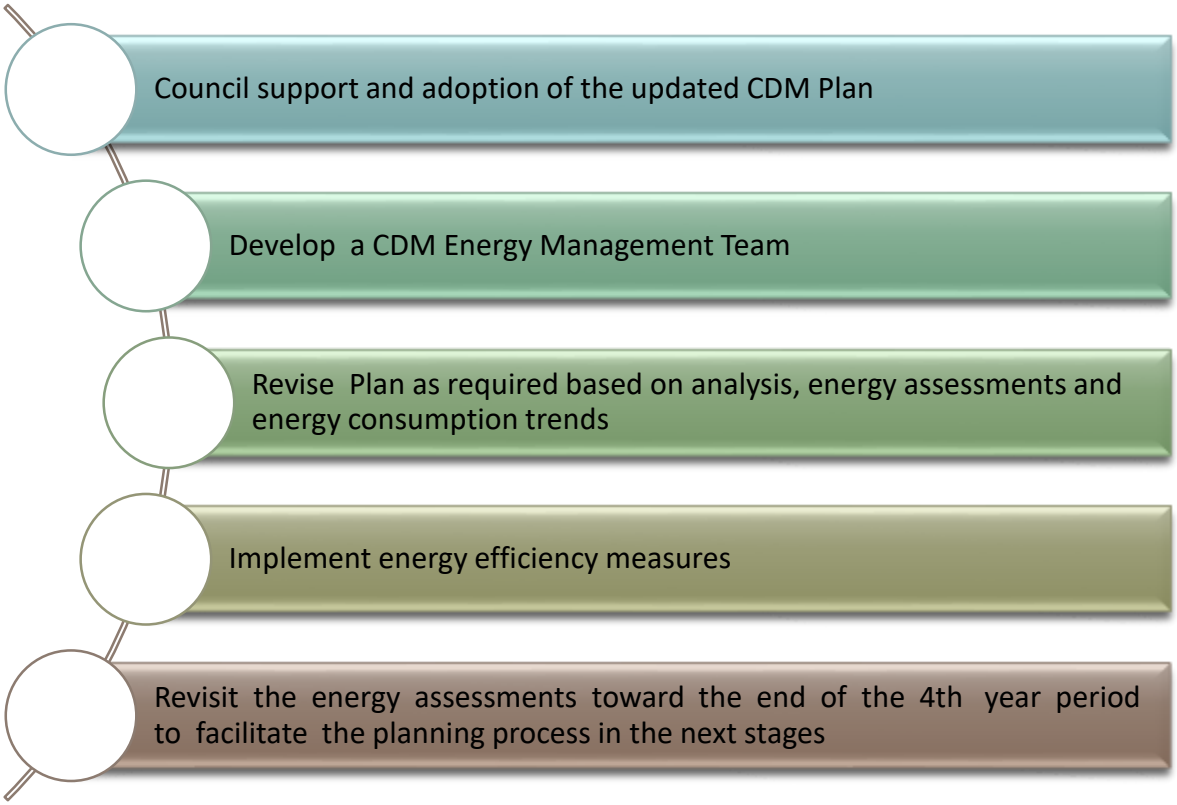
funding requirements. As funding opportunities arise that are suitable for specific energy conservation projects, NMS Staff will report to the Council and clearly outline the cost savings associated with a successful application. One of the examples of this already occurring is the exploration of the application to the GMF capital system retrofit stream as part of the proposed primary aeration blower upgrade with inclusion of the HVAC retrofit for the intake and exhaust fans at Ailsa Craig WPCP. In addition, once the project is approved for the grant by the GMF, OCWA will assist NMS in applying for additional performance incentives from the IESO as part of the SOE custom retrofit stream – targeting the energy consumption reductions at the wastewater treatment plant.

Conclusions and Recommendations

Conclusions

- ✓ The NMS is on its way to the implementation of a structured Conservation Program
- ✓ The NMS 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 2017-2022 Energy Consumption

2017-2022 Municipal Energy Consumption

A lot of changes have occurred to the NMS' 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 NMS' three facilities reported on from 2017 to 2022. The original table sorting from 2019 CDM plan has been used for consistency across the plan updates. Please note that a water tower has been added to the list, and

Table S-1: Change in Electricity Consumption (2017-2022)

Total Annual Electricity Consumption (kWh)				
Facility	**2017**	**2019**	**2022**	**2017-2022 Electricity Consumption Variance**
Ailsa Craig Sewage Treatment Plant	810,000	881,562	663,410	**-18%**
North Middlesex Arena	458,030	478,703	493,623	**8%**
Parkhill Reservoir	173,058	186,033	162,718	**-6%**
Municipal Office	163,907	150,248	134,134	**-18%**
Parkhill Street Lights	44,053	95,111	98,890	**124%**
Ailsa Craig Recreation Centre	67,700	91,484	81,651	**21%**
McGillivray Works Department	75,971	79,133	54,805	**-28%**
Victoria Street Sewage	30,096	53,507	45,202	**50%**
Kerwood Rd Pump	52,263	45,286	49,759	**-5%**
North Middlesex Community Centre	25,009	43,817	54,314	**117%**
Lieury Rd. Pump	26,528	33,785	21,553	**-19%**
Ailsa Craig Library	30,461	25,803	19,089	**-37%**
Parkhill Works Shop	20,220	25,567	16,157	**-20%**
Lieury Water Shop	14,120	14,763	9,766	**-31%**

Ailsa Craig Fire Station	15,859	16,242	12,098	**-24%**
McLeod Street Ball Diamonds	17,239	17,876	19,215	**11%**
Parkhill Medical Centre	10,225	10,091	15,385	**50%**
Bear Creek Pump	13,982	16,441	11,281	**-19%**
West Williams community Centre	9,908	11,492	9,654	**-3%**
Parkhill Fire Station	12,776	16,990	N/A	**N/A**
New Ontario Rd Pump	9,566	10,697	7,841	**-18%**
Parkhill Library	6,042	6,260	4,433	**-27%**
Ailsa Craig Works Shop	3,300	2,861	3,057	**-7%**
Elginfield Rd Streetlight	2,448	2,448	2,244	**-8%**
Clandeboye Streetlights	2,160	2,160	1,980	**-8%**
Water Tower	N/A	N/A	9,260	**N/A**
NMS TOTAL	**2,094,921**	**2,318,360**	**2,001,519**	**-4.46%**

The following figure shows the distribution of electricity consumption amongst the NMS' 26 facilities in 2022.

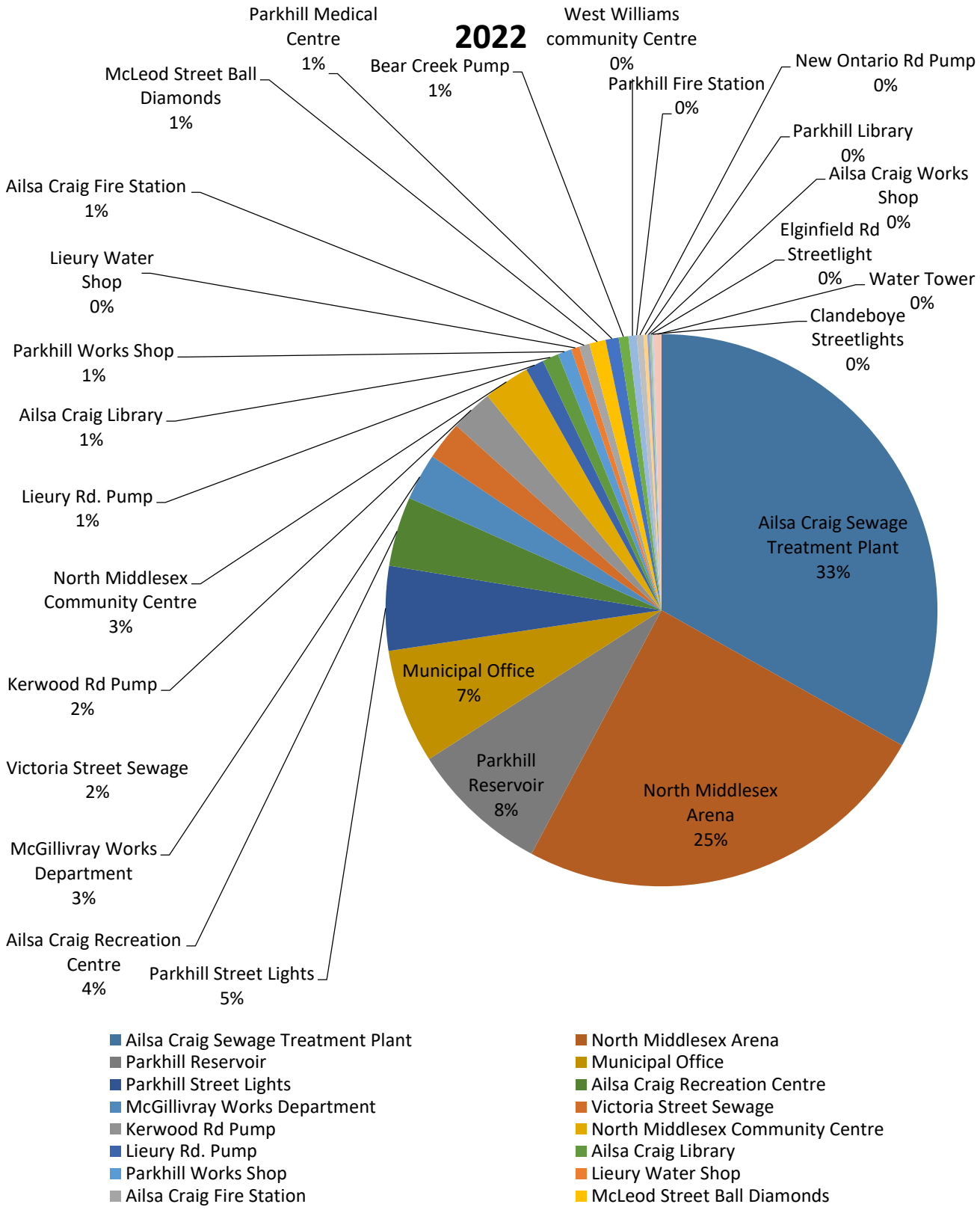


Figure S-1: 2022 NMS Electricity Consumption Profile

Table S-2: Change in Natural Gas Consumption (2017-2022)

Total Annual Natural Gas Consumption (m^3)				
Facility	**2017**	**2019**	**2022**	**2017-2022 Natural Gas Consumption Variance**
Ailsa Craig Sewage Treatment Plant				
North Middlesex Arena	45,490	51,772	42,208	**-7%**
Parkhill Reservoir				
Municipal Office	24,792	22,687	18,545	**-25%**
Parkhill Street Lights				
Ailsa Craig Recreation Centre	14,209	12,129	13,033	**-8%**
McGillivray Works Department			29,876	
Victoria Street Sewage				
Kerwood Rd Pump				
North Middlesex Community Centre	12,473	13,031	9,020	**-28%**
Lieury Rd. Pump				
Ailsa Craig Library	2,034	2,282	2,485	**22%**
Parkhill Works Shop	4,333	6,487	4,373	**1%**
Lieury Water Shop				
Ailsa Craig Fire Station	2,690	3,719	3,396	**26%**
McLeod Street Ball Diamonds				
Parkhill Medical Centre	1,385	1,702	1,700	**23%**
Bear Creek Pump				

West Williams community Centre	9,950	10,814	10,531	**6%**
Parkhill Fire Station	5,843	4,863	Station Deconstructed	
New Ontario Rd Pump				
Parkhill Library	3,959	4,713	4,780	**21%**
Ailsa Craig Works Shop	2,277	2,670	2,883	**27%**
Elginfield Rd Streetlight				
Clandeboye Streetlights				
NMS TOTAL				**-13%**

The following figure shows the distribution of natural gas consumption amongst the NMS' 26 facilities in 2022.

2022

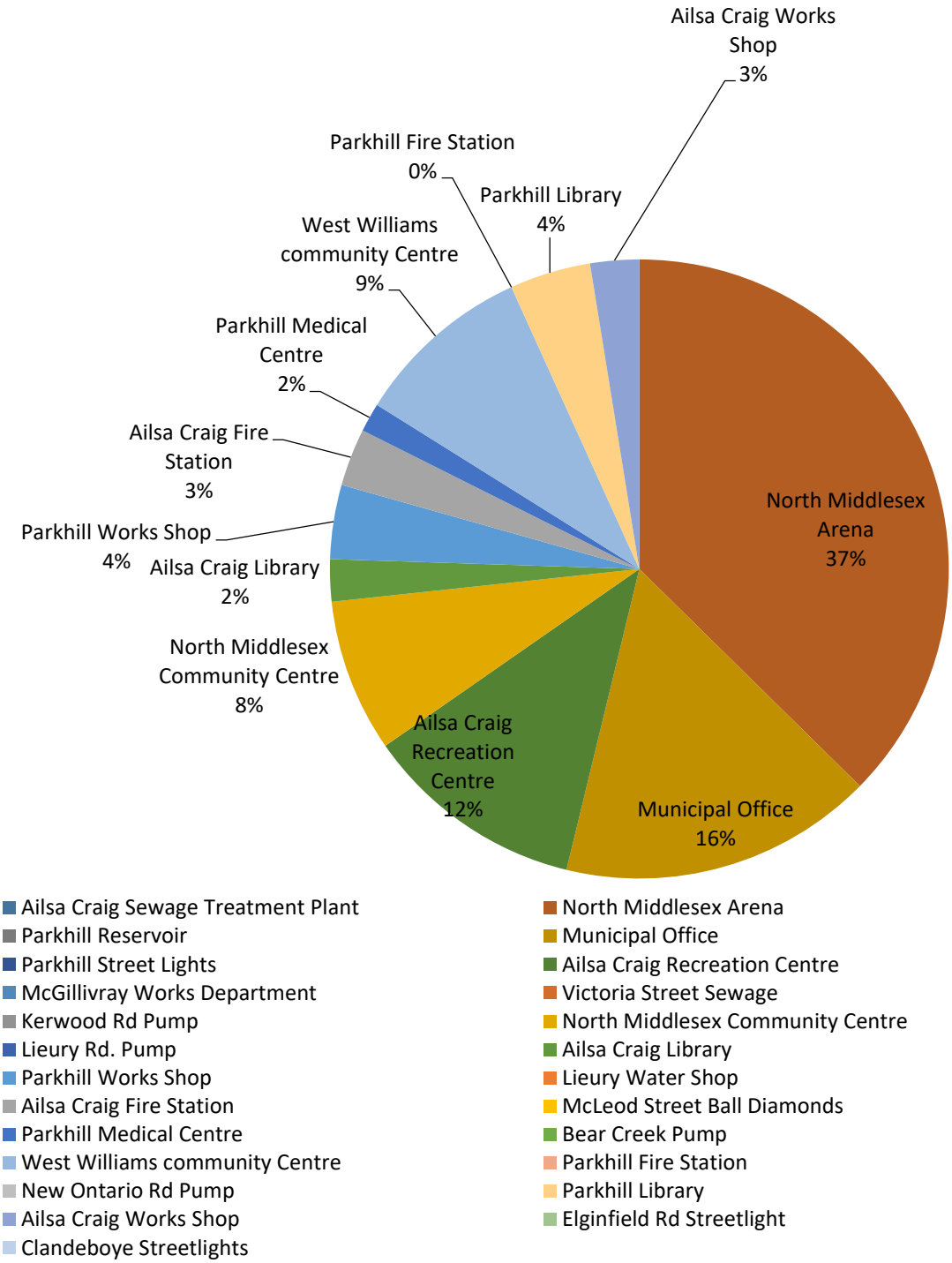


Figure S-2: 2022 NMS Natural Gas Consumption Profile

Table S-3: Change in Propane Gas Consumption (2017-2022)

Total Annual Propane Gas Consumption (m^3)				
Facility	**2017**	**2020**	**2022**	**2017-2022 Natural Gas Consumption Variance**
McGillivray Works Department	21,378	27,154	29,876	**40%**
Lieury Water Shop	8,692	8,418	13,099	**51%**
NMS TOTAL				**43%**

The following figure shows the distribution of propane gas consumption amongst the NMS' 26 facilities in 2022.

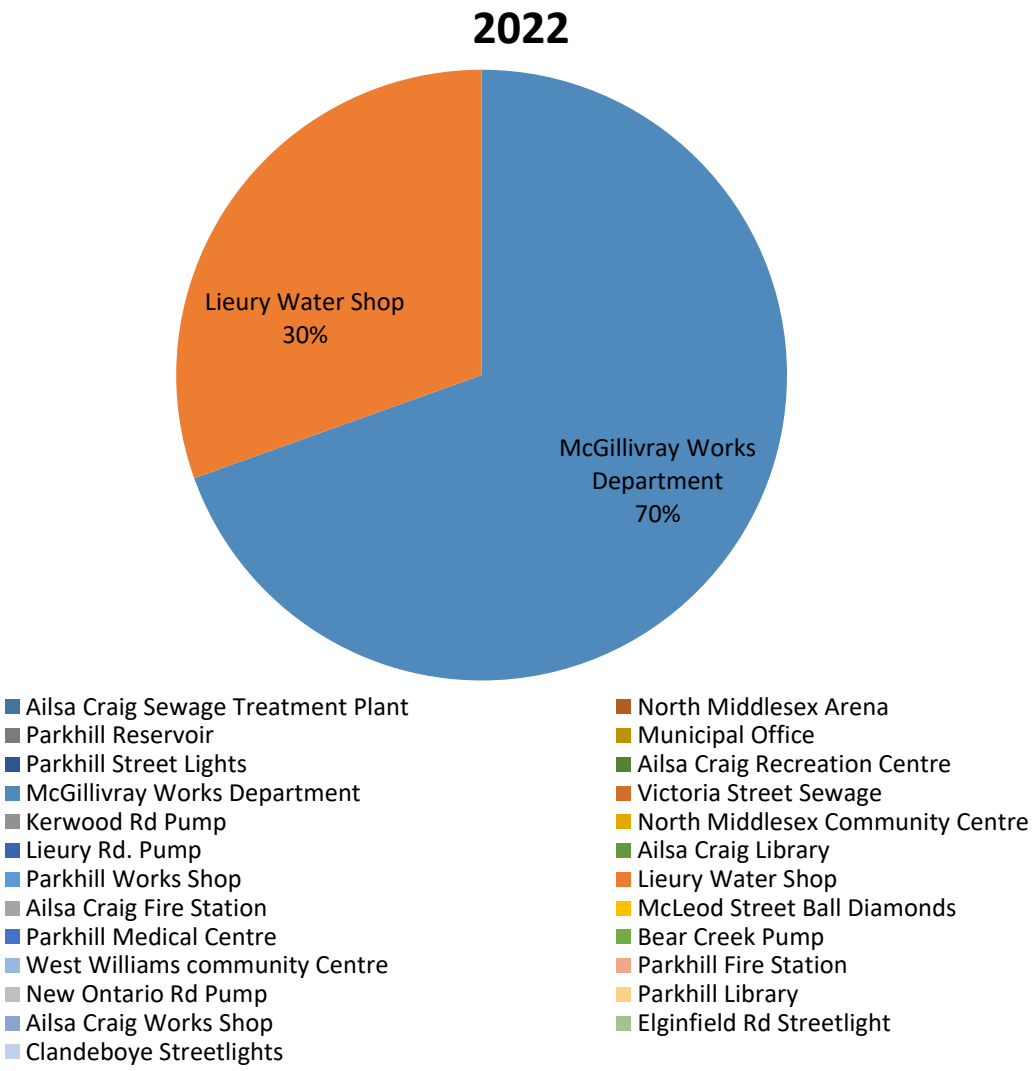


Figure S-3: 2022 NMS Propane Gas Consumption Profile