

Conservation and Demand Management (CDM) Plan

Township of Sioux Narrows – Nestor Falls

June 28, 2024



LBE group inc.

Engineering Services

www.lbegroup.ca

Executive Summary

The Township of Sioux Narrows Nestor Falls uses approximately 1411 GJ of energy per year from sources of electricity and propane. Energy usage will increase annually over the next five years due to expansion of facilities and services. Implementing energy conservation measures will help mitigate the eventual increase in energy consumption. Ontario Energy costs are forecast to increase over the next 5 years due to removal of Hydro rebates and scheduled increases to the carbon tax.

In order to maintain operation cost, the Township has the objective of decreasing energy usage by 1.5% per year over the next five years. Due to scheduled increases in the carbon tax, we recommend the Township explore electrifying their heating sources to avoid increasing propane costs.

Energy conservation measures such as lighting upgrades, HVAC upgrades, domestic hot water upgrades, water conservation and renewable energy may continue to be implemented. In addition, organizational measures and behavioural measures will continue to contribute to the overall energy savings and must be supported by council. Most energy conservation projects have paybacks of less than 5-7 years.

With capital investment it is possible to decrease energy usage by greater than 8.51% over the next five years to make up for increases in consumption and Solar Generation degradation due to age.

Energy conservation beyond those identified here are likely to be cost prohibitive until new conservation technologies are available.

Table of Contents

Executive Summary	ii
Table of Contents	iii
List of Tables	iv
List of Figures	iv
Appendices	iv
1. Annual Energy Consumption Summary	1
2. Goals and Objectives	3
2.1 Past Initiative Summary	3
2.1.1 Lighting Upgrades to LED	3
2.1.2 Heating/Cooling Systems	3
2.1.3 Domestic Hot Water Systems	3
2.1.4 Domestic Water Conservation	4
2.1.5 Renewable Energy	4
2.1.6 Exceeding OBC Insulation Requirements	4
2.1.7 Procedural Modifications	4
3. Capital Requirements	5
3.1 Lighting	5
3.2 Heating/Cooling Systems	6
3.3 Occupancy Setpoints	7
3.4 Domestic Hot Water Systems	7
3.5 Domestic Water Conservation	8
3.6 Renewable Energy	8
4. Renewable Energy Generation	10
5. Alternatives to Propane Heating	11
6. Conservation and Demand Management Plan	13
6. Closure	15
7. Company Information	15

List of Tables

Table 1 - Annual Energy Summary	1
Table 2 - Forecasted energy usage.....	14
Table 3 - Historical Hydro Electricity Usage.....	1
Table 4 - Historical Propane Usage.....	2

List of Figures

Figure 1 - Historic Heating Degree Days (HHD) in Kenora, Ontario	2
<i>Figure 2 - Scheduled increase in carbon tax for gasoline and propane fuels - Source: Government of Canada.</i>	12

Appendices

Appendix A	Utility Consumption
------------------	---------------------

1. Annual Energy Consumption Summary

Energy usage for the Township of Sioux Narrows – Nestor Falls, is comprised of electricity and propane. Fuel oil was used for heating in the past but has been phased out and replaced by propane. Figure 1 plots Heating Degree Days (HDD) for the closest weather station in Kenora, Ontario.

Electricity and propane consumption from 2014 to 2018 and from 2022 to 2023 has been used to determine the average annual energy of the Township.

A summary of utility consumption for various municipal buildings is provided in Appendix A.

Year	Electricity (kWh)	Propane	Total GJ
		(Litres)	
2014	250,721	31,497	1709
2015	186,041	27,148	1365
2016	161,071	23,241	1175
2017	135,751	25,904	1152
2018	191,903	31,488	1497
2022	177,476	32,094	1460
2023	172,962	35,133	1522
Total	1,275,925	206,505	9879
Est. Annual Average	182,275	29,501	-
Est. Annual Energy (GJ)	656.19	755.04	1411

Table 1 - Annual Energy Summary

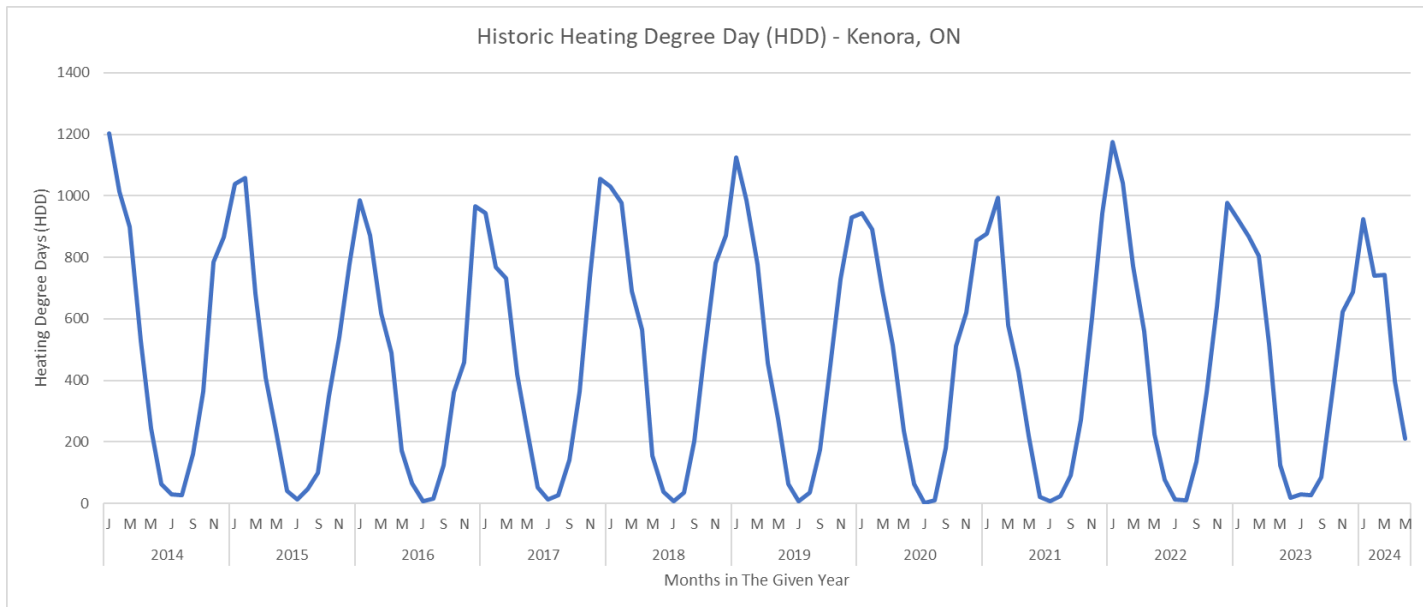


Figure 1 - Historic Heating Degree Days (HDD) in Kenora, Ontario

The Township of Sioux Narrows-Nestor Falls averaged approximately 1411 GJ of energy per year from sources of electricity and propane from 2014 to 2018 and from 2022 to 2023. Energy usage may increase every year based on expansion of facilities and services and is dependent upon weather conditions. Without the implementation of energy conservation measures the annual energy usage over the next five years will likely increase. The scheduled increases to the carbon tax should also be considered as the carbon tax for propane is scheduled to increase from 0.1006 \$/litre to 0.2631 \$/litre by 2030. With this information in mind, it becomes apparent that energy conservation is extremely important to ensure the sustainability of the Township.

2. Goals and Objectives

The Township Council has made it their mandate to conserve energy and natural resources through the implementation of conservation measures, education and environmental protection.

Over the next five years the township will aim to decrease energy consumption by 1.5% per year to offset increasing energy costs. The Township shall also explore any government incentives to convert their propane heating systems to high efficiency propane or electric systems.

2.1 Past Initiative Summary

Since the development of the 2014 and 2019 energy conservation and demand management measures, the Township has implemented the following initiatives.

2.1.1 Lighting Upgrades to LED

Upgrades to LED lighting have been conducted on an as needed basis when existing fixtures and bulbs require replacement. It is suspected that 25% of the lighting has been upgraded over the past five years. The policy is to continue to replace all non-LED lights with LED lights.

2.1.2 Heating/Cooling Systems

As heating and cooling systems required replacement during the past five years, higher efficiency systems have been selected. Additionally, a fuel oil furnace in use at the Nestor Falls Community Hall was replaced by a new propane forced air furnace – as stated in the 2019 Report. Many of the Township's heating systems are suspected to be less than 90% AFUE and should be investigated for replacement.

2.1.3 Domestic Hot Water Systems

Any propane fueled domestic hot water systems that required replacement in the past five years were upgraded with higher efficiency models or on-demand. It is estimated that 50% of the Township's water heaters are propane fired, mid efficiency and these should be considered for upgrade.

2.1.4 Domestic Water Conservation

Efforts have been made during the past five years to convert all toilets in Township facilities to dual-flush models to improve water conservation. The status of such upgrades is unavailable at the time of this report.

2.1.5 Renewable Energy

The Township operates solar energy generation equipment. The 2019 Report identified that significant repairs have been made to the existing system, including replacing all faulty inverters and maximizing their generating capacity.

2.1.6 Exceeding OBC Insulation Requirements

As indicated in the 2019 report, the Township has continued to improve their new and existing facilities by ensuring adequate insulation and vapor barrier is installed during construction or remodeling projects.

2.1.7 Procedural Modifications

The Township has continued to implement procedural changes for staff dealing with the building systems. These changes include turning off lights and adjusting heating and cooling systems during periods of being unoccupied. Furthermore, lockboxes are utilized around thermostats in public spaces to prevent the unauthorized adjustment of heating or cooling.

3. Capital Requirements

The following Energy Conservation Measures (ECM) have been identified and are discussed in the following sections:

Technical Measures

- *Lighting upgrades to LED*
- *Heating/Cooling system upgrades to higher efficiency*
- *Occupied/Unoccupied HVAC setpoints*
- *Occupancy sensors for lighting*
- *Domestic hot water heater upgrades*
- *Water Conservation*
- *Renewable Energy*

Organizational Measures

- *All new municipal buildings to exceed OBC minimum insulation R-Value requirements by 20%*
- *All municipal capital decisions to consider energy consumption*

Behavioural Measures

- *Solicit energy savings ideas from Township staff*
- *Encourage energy saving attitude within Township*

3.1 Lighting

Existing Equipment: The 2019 Report identified that the majority of the remaining lighting requiring upgrading is provided by fluorescent tubes. There is also some lighting by incandescent bulbs and some high-pressure sodium flood lights. Lighting run times vary from occasional use in the community centres to frequent use in the Township offices and Emergency Services buildings.

Proposed Measure: Light fixtures and bulbs should continue to be upgraded to LED at end of usable life to reduce electricity consumption. The Township should investigate any Government incentives to convert to high efficiency LED lighting throughout their facilities. In addition to the energy savings the LED lamps will

have a longer lifespan of 50,000-100,000 hours compared to 7,000-15,000 hours for fluorescent tubes.

Simple Payback: Estimated cost to purchase LED replacements for the fluorescent tubes is \$200-\$300 with an additional cost to install. LED replacements for the other bulbs are estimated to be \$30 each plus installation. Energy savings will be approximately 50% with payback ranging from 1 year to 10 years depending on operating hours per year. Government incentives shall help to significantly reduce the payback period by reducing the initial capital cost.

3.2 Heating/Cooling Systems

Existing Equipment: There is a combination of electric heat and propane heat installed throughout the Township. Some of the propane appliances are mid efficiency while others are high efficiency.

Proposed Measure: Continue replacing existing equipment with higher efficiency models when upgrading is required. To decrease demand on the electrical grid, ground source heat pump systems could be investigated. Modifying existing propane heating systems with air-to-air heat pumps should also be investigated to provide heating and cooling to the facilities. These measures will reduce the rate of propane consumption and will help mitigate the increasing cost of propane.

Simple Payback: As previously indicated in the 2019 Report, the payback to upgrade all the existing furnaces to high efficiency will be in excess of 20 years, however at the time that equipment needs to be replaced it should be replaced with high efficiency models.

The replacement of electric heat with ground source heat pumps will decrease demand and consumption of the appliance by approximately 50% with substantial capital cost. Payback is expected to be in the range of 6-12 years depending on building loads and ground loop restrictions. The lifetime for a ground source heat pump is expected to be 20+ years while the underground

infrastructure is expected to be approximately 25-50 years depending on the installation conditions.

Modifying existing propane heating systems with air-to-air heat pumps should be considered when the system's condensing units reach their end of life. An air-to-air heat pump will operate for the majority of the year and provide adequate building heat that will be supplemented by the existing propane heating system. In addition, the heat pumps will also provide building cooling during the summer months. Government incentives are available for such conversions and will significantly reduce the payback period. Without any incentives, the payback period can be expected to be approximately 5-6 years. As the cost of propane continues to increase, the validity of such a conversion will also increase.

3.3 Occupancy Setpoints

Existing Equipment: As indicated in the 2019 Report, there are currently no occupancy controls on the HVAC equipment or lighting.

Proposed Measure: Though the Township has procedural methods in place to address non-occupancy of their facilities, it is still recommended to install controls or implement operational procedures that decrease HVAC and lighting loads during times when buildings are unoccupied. This will include ensuring that lighting is turned off when not in use and decreasing heat set-point when the building is unoccupied.

Simple Payback: According to a Natural Resources Canada study in 2013, night setback of heating can save from 6-12%.

3.4 Domestic Hot Water Systems

Existing Equipment: There is a combination of electric and propane hot water installed. The propane appliances are mid efficiency.

Proposed Measure: The electric hot water systems will not create any savings in energy by replacement unless they are changed to on demand tank-less type heaters. The capital cost to upgrade does not make sense until the existing equipment fails. Upgrading the propane appliances to higher efficiency does not show a good payback until the existing equipment must be replaced due to failure. Typical hot water demand is mostly limited to washrooms.

Simple Payback: According to the Department of Energy, the use of on demand, tank-less type, water heaters is documented to save 24-34% of hot water costs when buildings are using less than 41 gallons per day of hot water. Most of the buildings owned by the Township have very low water usage. The actual energy savings will be less when the building is heated with electric heat since the storage tank losses are contributing to building heat. Payback is anticipated to be in the range of 5 to 7 years for buildings with low water usage.

3.5 Domestic Water Conservation

Existing Equipment: As indicated in the 2019 Report, there are a combination of standard and low flow fixtures installed throughout the Township's facilities. Many of the faucets are equipped with aerators. All toilets have been upgraded to dual-flush models to provide water conservation.

Proposed Measure: Continue upgrading fixtures (including faucets and showerheads) with low flow versions to decrease demand on the water and sewage systems upon end of usable life for the fixtures.

Simple Payback: There will be very little energy savings from these upgrades but there will be other benefits such as decreased maintenance on the water treatment systems and increased septic system life.

3.6 Renewable Energy

Existing Equipment: As indicated in the 2019 Report, the Township has invested in solar photovoltaics, totalling 30 kW installed capacity.

Proposed Measure: The Township will consider renewables such as solar PV, solar hot water, solar air heating and geothermal on an individual project basis as opportunities arise. Maintenance on existing renewable energy systems should be kept up to date to maximize electrical generation or offset.

Simple Payback: The capital cost associated with renewable energy sources often doesn't present a good payback unless there are incentives. Payback without incentives could be expected to be in the range of 6 to 15 years, maybe longer depending on the individual project. Equipment life is typically 20-25 years.

4. Renewable Energy Generation

The Township has invested in three 10 kW solar photovoltaic systems to generate renewable electricity. All three solar systems are tied into the Hydro One power distribution grid and in 2013 generated a total of 33,956 kWh of renewable energy.

The Township has considered a water source heat pump system at the Northern Ontario Fishing Centre, but the capital cost is great and will consider the technology for future renovation and/or construction projects. Geographic conditions in the area are beneficial in some areas and detrimental in others and therefore heat pump installations would be considered on a specific project basis.

The Township does not have any installed solar thermal air or solar thermal water systems, but these technologies will be considered for future installation.

5. Alternatives to Propane Heating

As indicated throughout the body of the Report, the cost of propane is expected to rise due to inflation, increases to operating costs and scheduled increases to the federal carbon tax. The Canadian Government has scheduled increases on April 1st of each calendar year to 2030. As a result, the Township should consider plans to reduce the reliance on propane as a primary heating source.

Figure 2 plots the trends for the scheduled increase to the carbon tax for gasoline and propane. It is reasonable to suspect that a linear increase in the tax will continue past 2030. The cost of gasoline will compound on delivery charges for propane heating appliances.

Heat pumps, and more specifically, air-to-air heat pumps are a reliable and attractive alternative to propane heat as a primary source. Heat pumps can be installed in existing ductwork and with a little controls work, the heat pump can be designed to function as primary heating and cooling. When ductwork is not available, indoor head units can be installed to provide heating and cooling. Typical heat pumps can operate to -25°C, which will cover the majority of the heating season while relying on propane or electric secondary heating. The payback period for such an installation will vary depending on the scale of the facility but it is reasonable to estimate a payback period of 5-6 years.

The carbon tax model is intended to assist in the transition away from fossil fuel sources. Government incentives will continue to be released over the coming years and the Township should continuously investigate incentives as they are released.

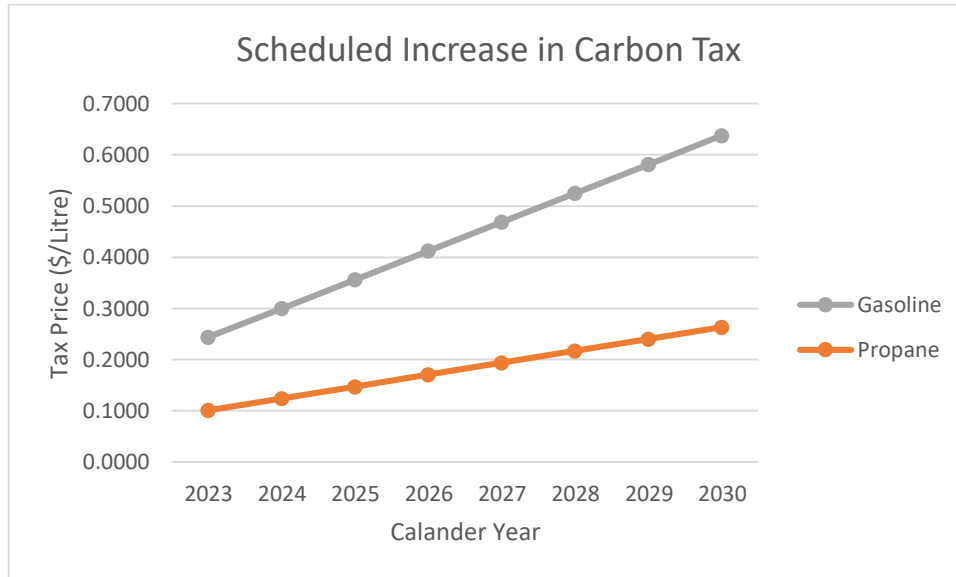


Figure 2 - Scheduled increase in carbon tax for gasoline and propane fuels - Source: Government of Canada.

6. Conservation and Demand Management Plan

The Township of Sioux Narrows - Nestor Falls used an average of 1,411 GJ of energy over from 2014 to 2018 and from 2022 to 2023. The Council have identified the importance of energy savings and will aim to decrease energy usage by 1.5% per year over the next five years.

Implementation of the energy conservation measures outlined in this document will make it possible to decrease energy usage by greater than 6% over the next five years. This will require capital investment in measures such as lighting upgrades, HVAC upgrades, domestic hot water upgrades, water conservation and renewable energy. In addition, organizational measures and behavioural measures will contribute to the overall energy savings and must be supported by council.

Table 2 below summarizes the baseline energy usage and shows the effect of implementing the energy conservation measures. As can be seen, the annual net energy is still increasing over time, even with energy conservation measures, due to an increase in energy load every year based on expansion of facilities and services.

Energy conservation beyond the 8.51% identified here is likely to be cost prohibitive until new conservation technologies or government incentives are available.

Annual Energy (GJ)						
Calander Year	2023	2024	2025	2026	2027	2028
Baseline Electricity *	656.19	661	666	671	675	680
Baseline Propane *	755.04	761	766	772	777	783
Baseline Solar Generation **	-110	-107.8	-105.6	-103.5	-101.5	-99.4
Lighting upgrades to LED		8.20	8.26	8.32	8.38	8.44
HVAC Upgrades		9.44	9.51	9.58	9.64	9.71
Occupancy Setpoints				1	1	
Domestic hot water			3.83			3.91
Water Conservation			1		1	
Renewable Energy (other than existing solar)						
Organizational Measures			3.55	3.58	3.61	
Behavioural Measures			1		1	
Total Baseline (Consumption minus generation)	1301.23	1313.66	1326.13	1338.62	1351.14	1363.71
Savings from Conservation Current Year (GJ)		17.64	27.15	22.48	24.63	22.07
Savings (%)		1.34%	2.05%	1.68%	1.82%	1.62%
Annual Net Energy (GJ)	1301	1296	1299	1316	1327	1342

Table 2 - Forecasted energy usage.

* includes 2% increase in base load each year based on expansion of facilities/services.

** includes 2% decrease in output each year due to degradation of panels

6. Closure

This study was performed by Andrew Brookes, P.Eng., CMVP and Kevin R. O'Flaherty, EIT.

Sincerely,



Andrew Brookes, P.Eng.
CMVP

Office 807-547-4445

Cell 807-464-2953

andrew@lbegroup.ca



Kevin R. O'Flaherty, EIT

Office 807-547-4445

Cell 807-407-1618

kevin@lbegroup.ca

7. Company Information



LBE group inc.

LBE Group Inc.

815 Ottawa Street, Keewatin, ON

Tel 807-547-4445

www.lbegroup.ca

Appendix A

Utility Consumption

Historical Hydro Electricity Usage					
Sioux Narrows Ambulance Base			Nestor Falls Community Hall		
Year	kWh	Total	Year	kWh	Total
2014	51,367.00	447,305.72	2014	60,118.00	164,658.40
2015	77,760.00		2015	26,588.00	
2016	71,919.40		2016	21,135.89	
2017	51,726.98		2017	7,937.37	
2018	67,530.36		2018	10,827.00	
2022	64,807.66		2022	18,671.62	
2023	62,194.32		2023	19,380.52	
Sioux Narrows Municipal Office/Fire Hall			Nestor Falls Multi-Use Building/Fire Hall		
Year	kWh	Total	Year	kWh	Total
2014	22,067.00	228,740.65	2014	20,767.00	162,810.73
2015	36,355.00		2015	12,538.00	
2016	29,723.05		2016	12,690.35	
2017	32,163.51		2017	13,536.46	
2018	32,885.27		2018	47,620.87	
2022	35,605.82		2022	29,617.96	
2023	39,941.00		2023	26,040.09	
Sioux Narrows Community			Overall Electricity Totals		
Year	kWh	Total	Year	kWh	Total
2014	96,402.00	272,409.50	2014	250,721.00	1,275,925.00
2015	32,800.00		2015	186,041.00	
2016	25,602.45		2016	161,071.14	
2017	30,386.77		2017	135,751.09	
2018	33,039.94		2018	191,903.44	
2022	28,772.49		2022	177,475.55	
2023	25,405.85		2023	172,961.78	

Table 3 - Historical Hydro Electricity Usage.

Historical Propane Usage					
Nestor Falls Community Hall			Sioux Narrows Municipal Office/Fire Hall		
Year	Litres	Total	Year	Litres	Total
2014	3,230.80	29,862.93	2014	16,765.60	93,180.20
2015	3,101.70		2015	10,592.30	
2016	3,744.30		2016	7,225.50	
2017	5,206.70		2017	10,763.10	
2018	4,511.43		2018	22,091.30	
2022	3,768.30		2022	11,748.30	
2023	6,299.70		2023	13,994.10	
Nestor Falls Multi-Use Building/Fire Hall			Sioux Narrows Community Hall/Maintenance Garage		
Year	Litres	Total	Year	Litres	Total
2014	6,016.40	38,966.90	2014	5,484.00	44,495.30
2015	6,415.30		2015	7,039.00	
2016	7,030.10		2016	5,241.10	
2017	6,390.60		2017	3,543.90	
2018	0.00		2018	4,885.20	
2022	9,021.40		2022	7,556.20	
2023	4,093.10		2023	10,745.90	
			Overall Propane Totals		
			Year	Litres	Total
			2014	31,496.80	206,505.33
			2015	27,148.30	
			2016	23,241.00	
			2017	25,904.30	
			2018	31,487.93	
			2022	32,094.20	
			2023	35,132.80	

Table 4 - Historical Propane Usage.