ASHRAE LEVEL II ENERGY AUDIT

THE TOWNSHIP OF NORTH DUMFRIES

ROSEVILLE COMMUNITY CENTRE
3195 Roseville Rd, Ayr, Ontario

Project No.: 2018-0527-11

May 8, 2019

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Project No.: 2018-0527-11

May 8, 2019

Shelley Stedall
The Township of North Dumfries
2958 Greenfield Road
Ayr, ON N0B 1E0

Dear Shelley Stedall,

RE: North Dumfries Energy Audits

WalterFedy is pleased to submit the attached ASHRAE Level II Energy Audit to The Township of North Dumfries. This report encompasses the originally agreed to scope, and has identified the potential for energy consumption and cost saving measures at Roseville Community Centre located at 3195 Roseville Rd in Ayr, Ontario.

Based on the information provided by the The Township of North Dumfries, the report was completed with the data supplied and collected, as well as engineering judgement and various analysis tools to arrive at the final recommendations.

All of which is respectfully submitted,

WALTERFEDY

Josh Gibbins, P.Eng.
Senior Energy Engineer
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EXECUTIVE SUMMARY

This report presents the results of a ASHRAE Level II Energy Audit completed by WalterFedy for The Township of North Dumfries at Roseville Community Centre located at 3195 Roseville Rd in Ayr, Ontario.

The purpose of this ASHRAE Level II Energy Audit is to review how energy is currently being consumed within the facility, gain an understanding of how the facility is being operated, and provide recommendations for how energy can be saved through energy conservation measures (ECMs).

This ASHRAE Level II Energy Audit was prepared in conjunction with a Building Condition Assessment (BCA) of Roseville Community Centre. ECMs are based on replacement recommendations with energy savings potential in the BCA report as well as emerging and renewable energy technologies when applicable.

Roseville Community Centre is a 1 storey Community Centre facility built in 1977.

Table 1 summarizes the annual electricity, natural gas, and water consumption for Roseville Community Centre during the baseline year of 2017. The facility's energy use intensity was benchmarked against other similar arena facilities.

Table 1: Facility annual utility summary

Annual Electricity Consumption	[kWh]	11,454
Annual Electricity Cost	[$]	1,500
Facility Electricity EUI	[kWh/ft^2]	4.1
Median Electricity EUI	[kWh/ft^2]	5.3
Annual Natural Gas Consumption	[m^3]	5,014
Annual Natural Gas Cost	[$]	1,230
Facility Natural Gas EUI	[m^3/ft^2]	1.8
Median Natural Gas EUI	[m^3/ft^2]	1.5
Annual Water Consumption	[m^3]	11
Annual Water Cost	[$]	31

*Utility costs calculated using utility rates described in Table 6.

Table 2 summarizes the annual utility savings and simple paybacks for the recommended conservation measures evaluated in this report. Conservation measures were evaluated independently and do not reflect interactive effects.

Table 2: Recommended ECM summary table

ECM	**Electricity Savings** [kWh]	**Demand Savings** [kW]	**Nat. Gas Savings** [m^3]	**Cost Savings** [$]	**Capital Cost** [$]	**Utility Incentive** [$]	**Simple Payback** [years]
Install NG DHW heater	1,642	0.0	-194	167	1,500	0	9.0

Note: Cost savings calculated using utility rates from Table 6.

Table 3 summarizes the recommended ECMs which were analyzed qualitatively.

Table 3: Recommended ECM summary table

ECM	**Estimated Cost**	**Estimated Annual Savings**	**Priority**
Programmable thermostat schedules	Low	High	High

1 INTRODUCTION

1.1 Objectives

WalterFedy was hired by The Township of North Dumfries to complete an ASHRAE Level II Energy Audit at their Roseville Community Centre facility at 3195 Roseville Rd in Ayr, Ontario. The purpose of this ASHRAE Level II Energy Audit is to review how energy and water is currently being consumed within the facility, gain an understanding of how the facility is being operated, and provide recommendations for how energy and water can be saved through conservation measures.

This report identifies and explains potential energy and water conservation measures and provides economic analyses in order to estimate utility savings, budget implementation costs, and simple payback periods. Energy savings are within an accuracy of +/-30% while implementation costs are within an accuracy of +/-50%.

The goal is to recognize ECMs with high savings and reasonable payback periods. An analysis of historical energy and water use provides insight into the consumption patterns of the facilities. The data and information pertaining to the property reflects conditions and operations at the time of the site survey on November 28, 2018.

1.2 Scope of work

The scope of work is as follows:

- Review and analyze the historical energy consumption of each building.
- Conduct an on-site survey of each building's energy consuming equipment and system areas.
- Review operating logs and interview site building operations personnel to obtain insight into operating issues and practices.
- Perform an opportunity assessment including but not limited to:
  - The estimated energy unit and cost savings identified for each Energy Conservation Measures (ECM);
  - The energy saving recommendations from current state for each new ECM identified, documenting proposed equipment or operational changes from current equipment;
  - An explanation of the methodology and calculations utilized to obtain the energy and cost saving estimates;
- and document such assessment.
- Determine the cost to implement the recommended measures, including equipment installation and significant changes to maintenance costs, and determine the simple payback period for each ECM using the estimated savings.
- Provide a ranking of ECM opportunities in order of payback period category (1 to 3 years, 3 to 5 years, and 6 to 10 years)
- Identify and include in the final Report all available grants or incentives per identified ECM available through the Independent Electricity System Operator (IESO), Local Utility or other Government programs and include identified grant.

1.3 Contact information

The contact information of the the Owner and Consultant (WalterFedy) can be found in Table 4.

Table 4: Contact Information

Client:	Consultant:
Shelley Stedall	Josh Gibbins, P.Eng.
Treasurer, Director of Corporate Services	Senior Energy Engineer
519.632.8800 x123	519.576.2150 x480
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The Township of North Dumfries	WalterFedy
2958 Greenfield Road	675 Queen Street South, Suite 111
Ayr, ON N0B 1E0	Kitchener, ON N2M 1A1

2 HISTORICAL ENERGY USE ANALYSIS

2.1 General information

Electricity, natural gas, and water suppliers for Roseville Community Centre are summarized in Table 5.

Table 5: Facility utility information.

Facility Name:	Roseville Community Centre
Location:	3195 Roseville Rd, Ayr, Ontario
Electrical LDC*:	Energy+
LDC Account No.:	00015036-00
Natural Gas Distributor:	Union Gas
NG Account No.:	174-1272 161-9328
Water Provider:	Region of Waterloo
Water Account No.:	220 10075 000

*Electrical Local Distribution Company

2.2 Utility rates

The utility rates shown in Table 6 are used throughout this report to evaluate the energy conservation measures identified in this ASHRAE Level II Energy Audit.

The electricity and natural gas rates are an average determined using the previous 24 months of utility bills. The water rate is taken from the Region of Waterloo website and current as of November 1, 2018.

Table 6: Facility utility rates

Electricity Consumption	[$/kWh]	0.13
Natural Gas Consumption	[$/m^3]	0.25
Water Consumption	[$/m^3]	2.78

2.3 Incentive summary

Electricity incentives

Electricity savings incentives have been calculated based on the IESO saveONenergy Retrofit Program as summarized in Table 7.

Table 7: Electricity savings incentives

Project Type	Demand Incentive	Consumption Incentive
Lighting	$400 / kW	$0.05 / kWh
Non-lighting	$800 / kW	$0.10 / kWh

1. The greater of the kW or kWh incentive will apply
2. Incentive capped at 50% of project cost

Natural gas incentives

Union Gas offers prescriptive and custom incentives for high efficiency natural gas consuming equipment. The incentives vary depending on the type of equipment. Information on all the incentives available can be found on the following webpage: *https://www.uniongas.com/business/save-money-and-energy/equipment-incentive-program*.

2.4 Data sources

The following data sources were used in this historical energy use analysis:

- 24 months of Energy+ monthly electricity bills.
- 24 months of Union Gas monthly natural gas bills.
- 24 months of Region of Waterloo bi-monthly water bills.
- Daily weather data for Kitchener/Waterloo.

2.5 Facility utility use

Due to different billing periods among the utilities, monthly consumption was determined by calculating an average daily consumption over a billing period and summing the average daily consumption for each month of the year.

Electricity consumption

Table 8 summarizes the annual electricity consumption of Roseville Community Centre for the baseline year of 2017.

Table 8: Facility annual electricity consumption

Annual Electricity Consumption	[kWh]	11,454
Annual Electricity Consumption Costs	[$]	1,500

As seen in Figure 1, electricity consumption varies with time of year and is heavily tied to occupancy. Typically, the electricity consumption is higher during the summer months due to space cooling. The baseload electricity consumption in the winter months consists of lighting, appliances and other plug loads, and ventilation fans.

Natural gas consumption

Table 9 summarizes the annual natural gas consumption of Roseville Community Centre for the baseline year of 2017.

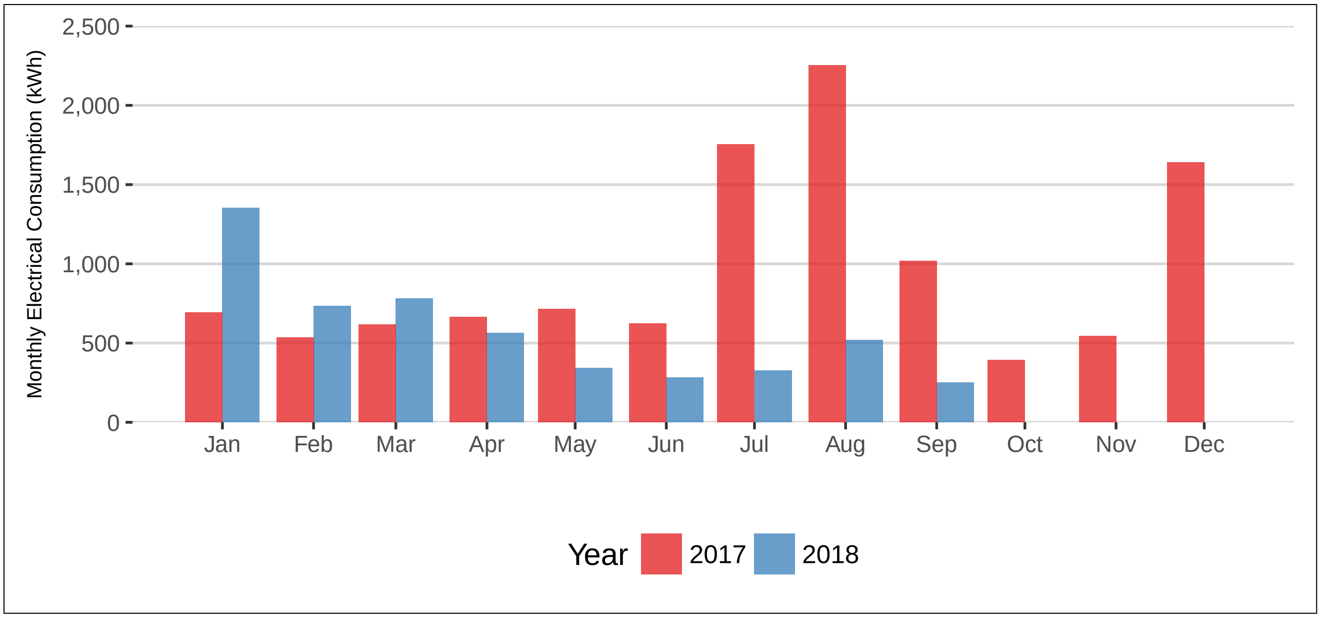


Figure 1: Monthly electricity consumption for the baseline period

Table 9: Facility annual natural gas consumption

Annual Natural Gas Consumption	[m^3]	5,014
Annual Natural Gas Consumption Costs	[$]	1,230

Natural gas is used for heating domestic hot water and for heating the ventilation air during the winter season. As seen in Figure 2, the summer natural gas consumption reflects the baseload natural gas consumption for domestic hot water while the ventilation air natural gas consumption increases as outdoor temperature decreases.

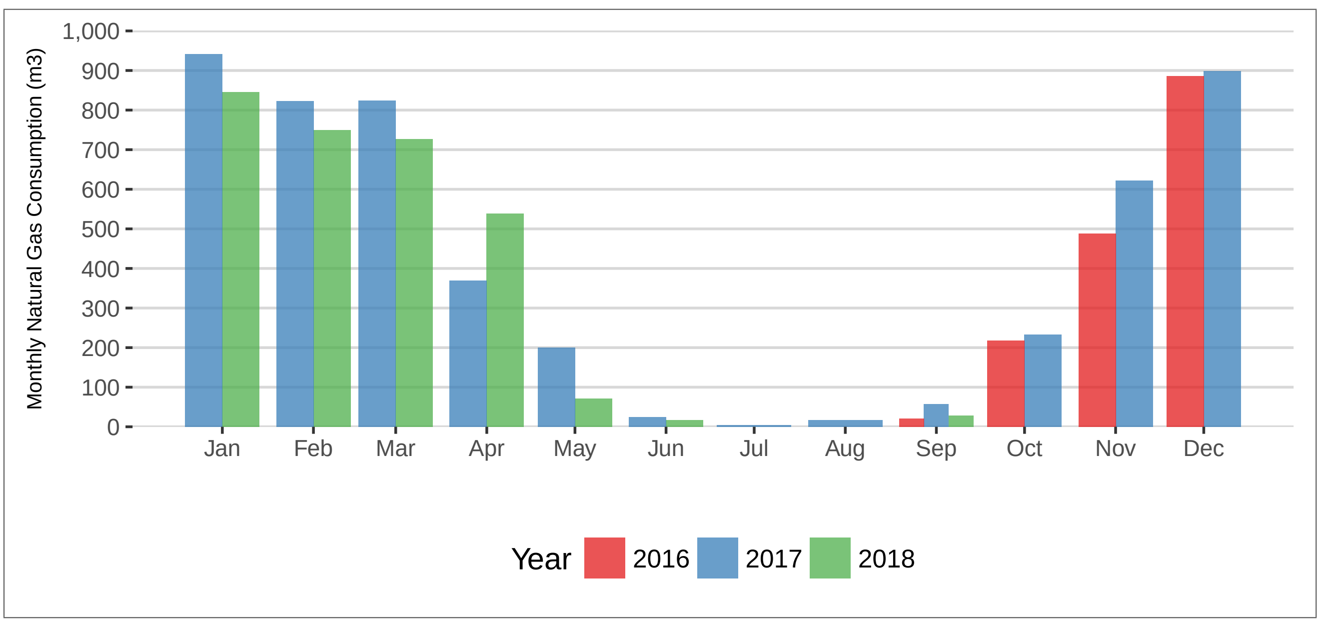


Figure 2: Monthly natural gas consumption for the baseline period

Natural gas regression analysis

As natural gas is used to heat outdoor ventilation air during the heating season, a linear regression analysis was completed comparing monthly natural gas consumption to heating degree days as seen in Figure 3.

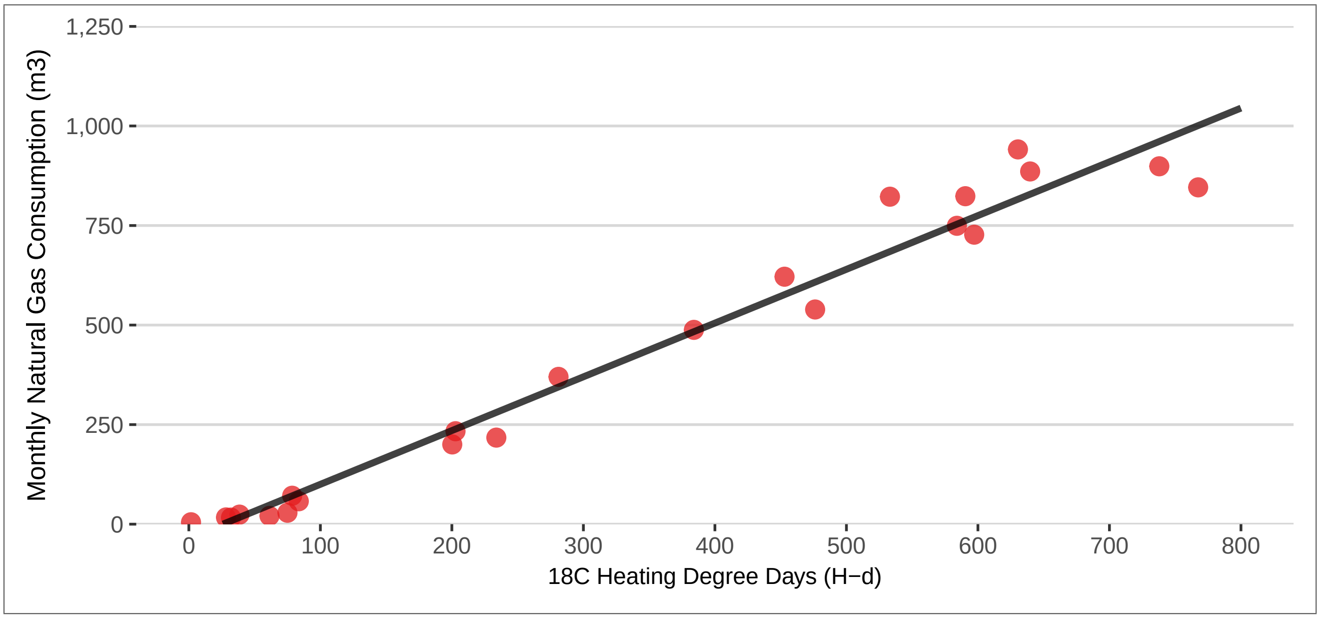


Figure 3: Linear regression of natural gas consumption vs. heating degree days

Linear regression resulted in the following model for natural gas consumption based on heating degree days (HDD):

Natural gas consumption [m^3] = -35 + 1.3 x 18°C HDD (r^2 = 0.97)

The r^2 value, also called the coefficient of determination, is a measure of how well the model predicts the actual consumption data. An r^2 value of 1 indicates that the linear regression model correctly predicts every data point. In this case, 97% of the variability in the natural gas consumption data can be explained by correlating consumption to heating degree days.

Water consumption

Table 10 summarizes the annual water consumption of Roseville Community Centre for the baseline year of 2017.

Table 10: Facility annual water consumption

Annual Water Consumption	[m^3]	11
Annual Water Consumption Costs	[$]	31

Figure 4 summarizes the monthly water consumption. Water consumption is slightly lower during the summer season. However, it is observed that there was an abnormally large increase in water consumption in July - August 2018.

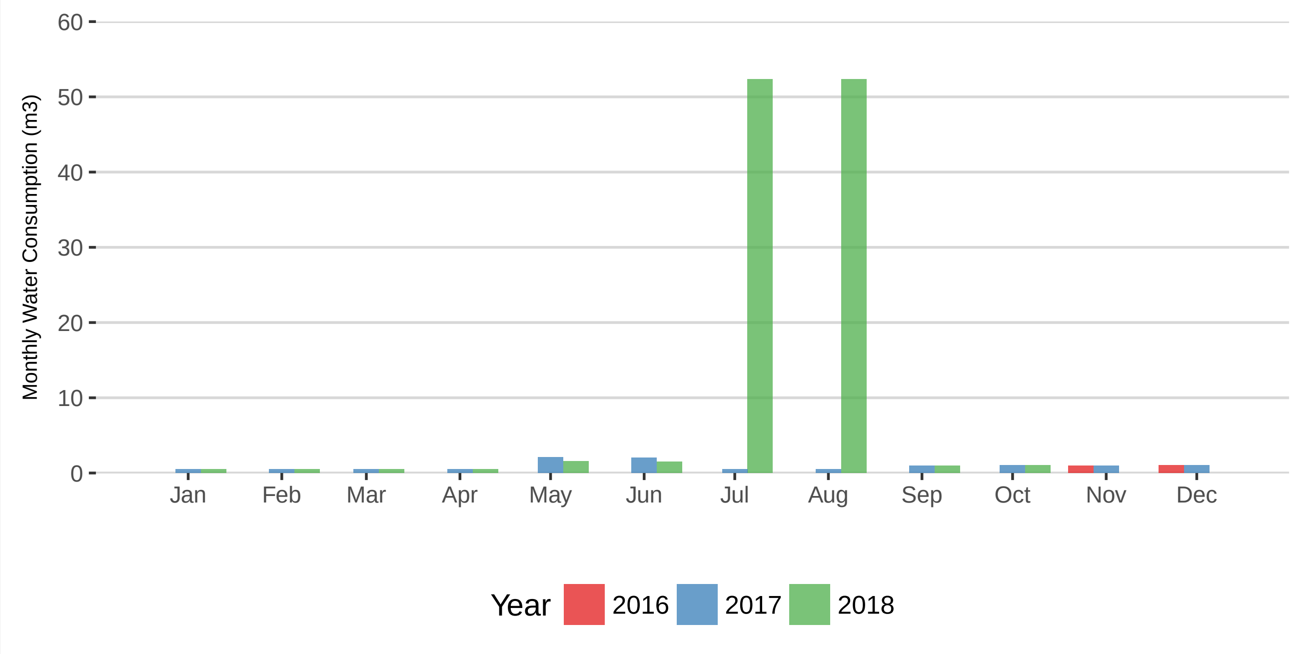


Figure 4: Monthly water consumption for the baseline period

2.6 Energy end uses

Table 11 summarizes the energy end uses for Roseville Community Centre.

Table 11: Annual energy end uses

End Use	Natural Gas Consumption [m^3]	Electricity Consumption [kWh]	Total Energy Consumption [ekWh]	Total Energy Percentage [%]	Energy Costs [$]
Space Heating	5,014	-	52,932	82.2	1,230
Space Cooling	-	4,395	4,395	6.8	576
HVAC	-	3,740	3,740	5.8	490
Water Heating	-	1,642	1,642	2.6	215
Lighting	-	1,445	1,445	2.2	189
Appliances/Plug loads	-	231	231	0.36	30
Totals	5,014	11,454	64,386	100	2,730

1. Refer to Table 6 for the utility rates used.
2. Natural gas converted to ekWh using factor of 11 ekWh/m^3
3. HVAC includes equipment such as ventilation fans and motors.
4. Total end use energy consumption matches the total baseline year energy consumption.

Calculations

- Natural gas consumption is used only for space heating.
- Electricity consumption was divided into space cooling, domestic hot water heating, lighting, appliances/plug loads, and HVAC.
- Space cooling electricity consumption estimated as the difference between the total summer electricity consumption and the base electricity consumption in the winter.
- Domestic hot water heating electricity consumption estimated based on typical domestic hot water usage throughout the year.

- Interior lighting electricity consumption estimated based on typical operating hours throughout the year.
- Exterior lighting electricity consumption estimated based on 12 hour/day operation throughout the year.
- Appliances and plug loads estimated based on Canada ACP - NECB 2011 guidelines.
- HVAC loads (fans, pumps, etc.) estimated as the remainder of the total annual electricity consumption.

2.7 Energy use intensity (EUI)

The intent of this section is to compare annual energy consumption of the facility under investigation to a database of similar Community Centre facilities. Data was obtained from the Ontario government which collects energy consumption and other building data from Broader Public Sector (BPS) organizations such as municipalities, school boards, universities, and hospitals. Annual consumption was normalized against the building's floor area to determine each facility's EUI.

As seen in Table 12, Roseville Community Centre is 23% below the median electricity EUI and is 16% above the median natural gas EUI for similar Community Centre facilities. The red bars in Figure 5 show the electricity and natural gas EUI of Roseville Community Centre in comparison to similar Community Centre facilities (under 10,000 sqft.) in the database.

Table 12: Facility Electricity EUI comparison

Facility Electricity EUI	[kWh/ft^2]	4.1
Median Electricity EUI	[kWh/ft^2]	5.3
Facility Natural gas EUI	[m^3/ft^2]	1.8
Median Natural gas EUI	[m^3/ft^2]	1.5

Figure 6 compares the total annual electricity and natural gas consumption of all North Dumfries facilities.

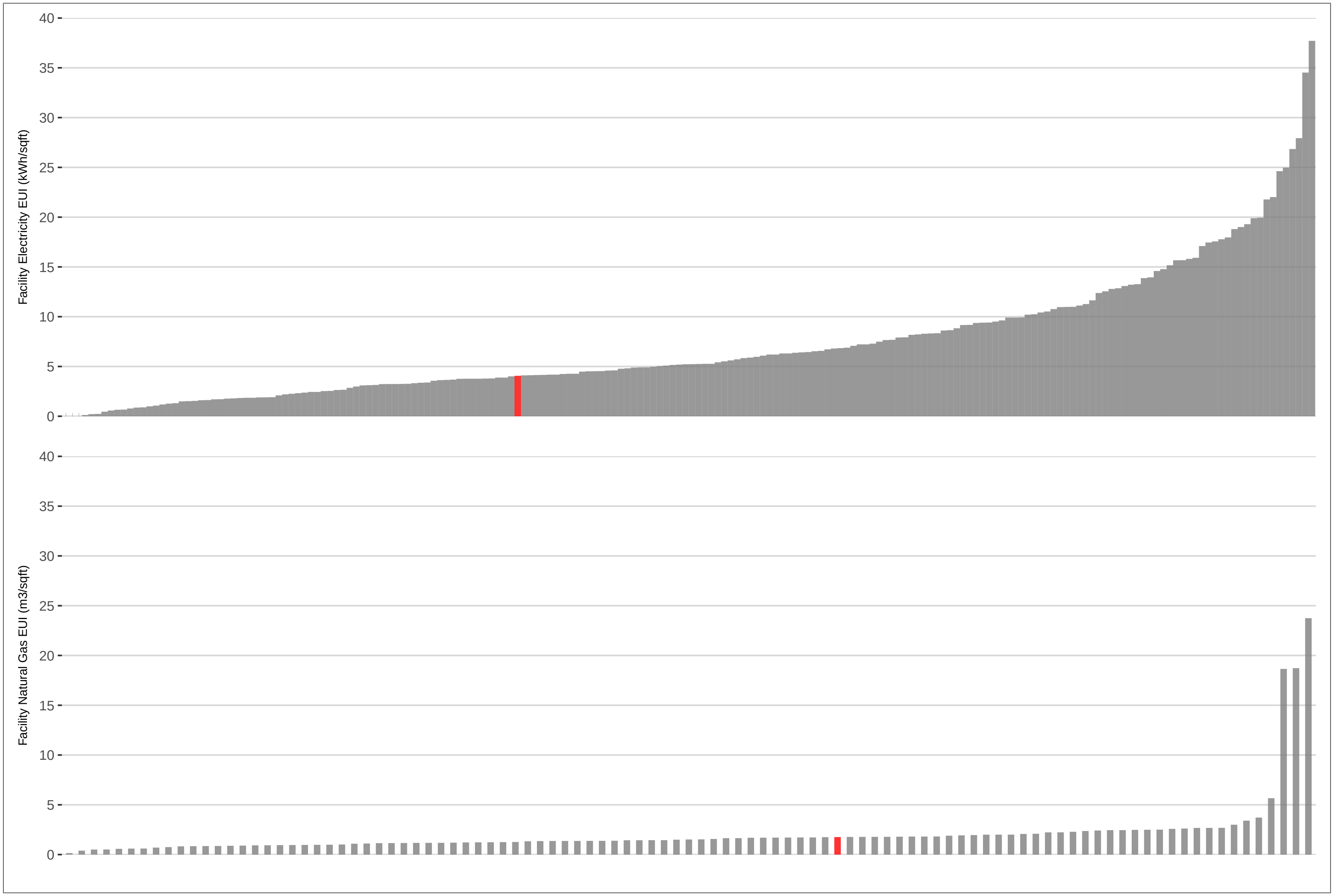


Figure 5: Electricity and natural gas energy use intensity by building

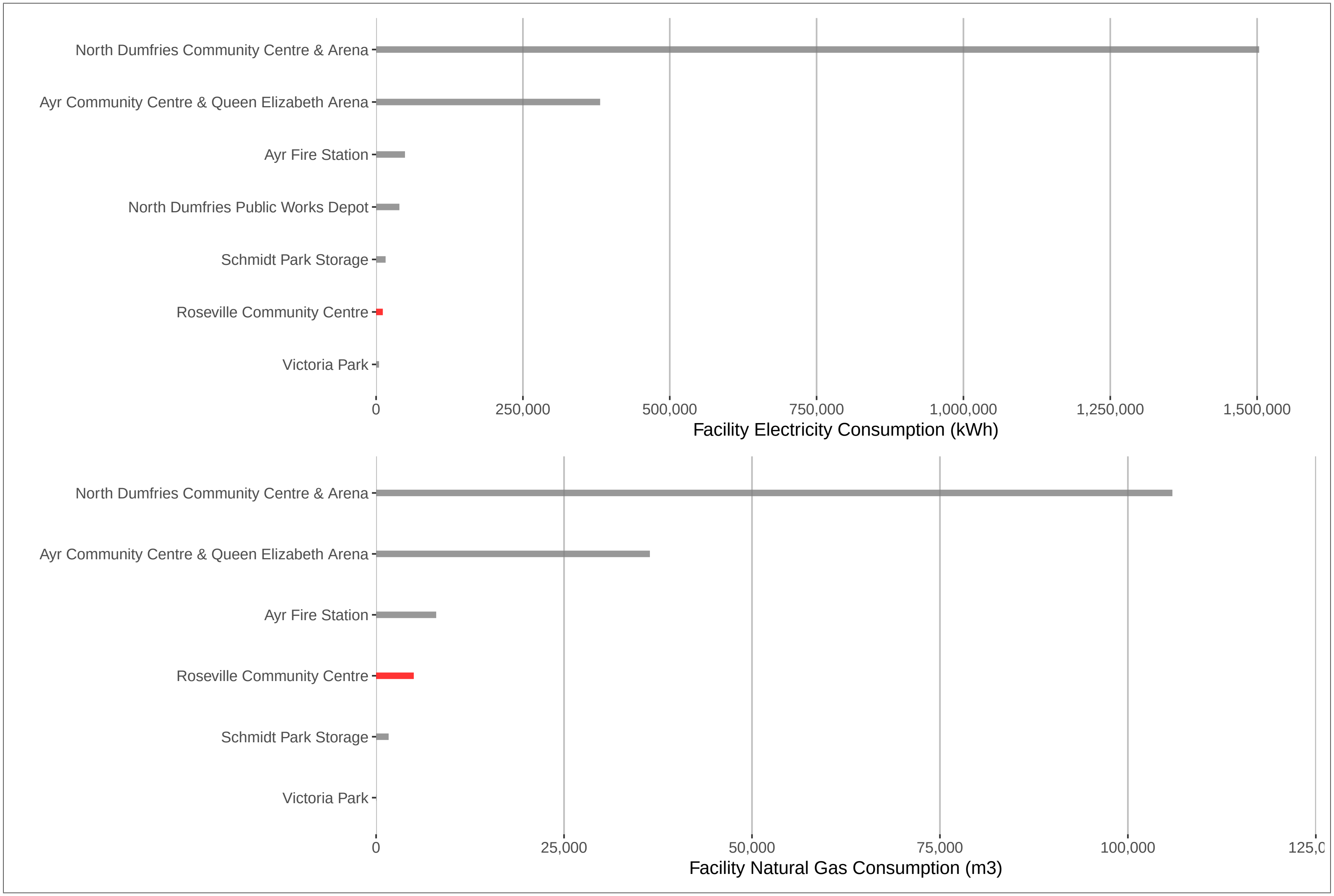


Figure 6: Annual electricity and natural gas energy use by building

3 EXISTING CONDITIONS

3.1 General facility information

Roseville Community Centre is a 1-storey Community Centre facility constructed in 1977. It consists mainly of a kitchen, meeting rooms, and washrooms. Table 13 summarizes the general facility information for Roseville Community Centre.

Table 13: Facility background information

Facility name:	Roseville Community Centre
Location:	3195 Roseville Rd, Ayr, Ontario
Number of floors:	1
Facility floor area:	3,054 ft^2
Year of construction:	1977
Building type:	Community Centre

3.2 Facility occupancy schedule

The facility is seldomly occupied. It is typically used only on weekends during the summer months (May - September). The Ayr-North Dumfries Lions Club occupies the facility two evenings per month from September - June.

3.3 Building envelope

Table 14: Existing building envelope details

Component	Installed	Description
Foundations	1867	poured concrete foundation
Gabled roof structure	1867	wood framed gabled roof
Clay brick masonry wall system	1867	clay brick masonry veneers
Wood clad exterior walls	2012	vertical wood siding
Exterior soffits	2017	aluminum soffits on underside of roof overhang
Exterior windows	2005	double glazed fixed and operable windows within vinyl frames
Exterior windows	1867	single glazed windows fixed within wood frames
Exterior doors	1990	hollow metal doors
Roof coverings	2017	ashphalt roof shingles and aluminum fascia
Gutters and downspouts	2017	gutters and downspouts along roof perimeter for rain drainage

Exterior roof

The gabled roof above the building is comprised of a asphalt shingled roof and aluminum fascia.

Exterior walls

The exterior walls along the north and west elevations are comprised of clay brick masonry veneers. The exterior walls along the south and east elevations are comprised of vertical wood siding.

(a) Exterior brick and wood wall (b) Exterior wood wall
Figure 7: Building exterior walls

Exterior windows and doors

Fourteen double glazed fixed and operable windows within vinyl frames are situated throughout the perimeter of the building. Two single glazed windows fixed within wood frames are situated next to the main entrance of the building and dates is presumed to be original to construction. Five exterior hollow metal doors are the primary means of entry and egress for the building.

(a) Exterior door (b) Exterior windows (c) Window details
Figure 8: Building exterior windows and doors

3.4 Mechanical systems

Table 15: Existing mechanical equipment

Description	Manufacturer	Model	Qty	Location	Installed	Size
DHW heater	Knight	ATD40-16N	1	Mechnical room	1964	40 GAL
Furnace (gas)	Carrier	59SC5A060S14–10	1	Mechanical room	2013	60,00 BTUH
Furnace (gas)	Carrier	59TP5A100E21–20	1	Mechanical room	2013	100,00 BTUH
Exhaust fan	N/A	N/A	1	Roof	2010	N/A
A/C condensing unit	Carrier	24ABB324A0033010	1	Site	2013	N/A
A/C condensing unit	Carrier	24ABB348A0034010	1	Site	2013	N/A

Space heating system

Space heating throughout the facility is provided by two condensing furnaces. The furnaces are controlled by digital thermostats located in the meeting room areas. Setpoints are manually set by occupants whenever they enter and leave the facility.

(a) Furnace (b) Digital thermostat

Figure 9: Space heating system

Space cooling system

Space cooling throughout the facility is provided by two air conditioning units. Setpoints are manually set by occupants whenever they enter and leave the facility.

(a) Air conditioning units

Figure 10: Space cooling system

Domestic hot water system

Domestic hot water is provided by an electric domestic hot water heater.

(a) DHW heater

Figure 11: Domestic hot water system

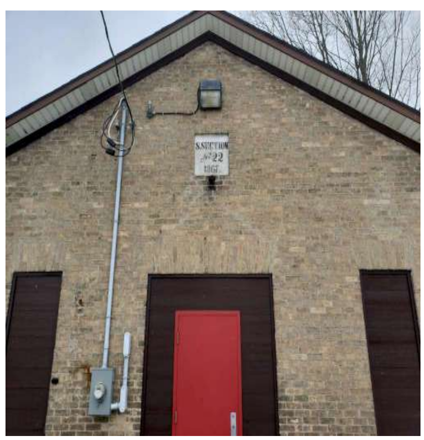
3.5 Lighting

Table 16: Existing lighting fixtures

Location	Fixture Type	Wattage	Quantity	Installed
Throughout	T5 Fluorescent	190	14	N/A
Lions Hall	T12 Fluorescent	84	6	N/A
Washrooms	T5 Fluorescent	95	2	N/A
Washrooms	T5 Fluorescent	42	2	N/A

Exterior lighting

The exterior lighting and consists of wallpacks installed on the side elevations.



(a) Wallpack

Figure 12: Exterior lighting

Interior lighting

All interior spaces have lighting provided by fluorescent fixtures.

(a) Typical fluorescent fixtures (b) Typical fluorescent fixtures (c) Typical fluorescent fixtures

Figure 13: Interior lighting

3.6 Plumbing fixtures

Multiple plumbing fixtures were found throughout the building during inspection including: one sink, two urinals and one toilet in the men's washroom, two sinks, three toilets in the women's washroom, one slop sink in the janitor closet and one stainless steel sink in the kitchen.

Table 17: Existing plumbing fixtures

Description	Manufacturer	Qty	Location	Installed
Faucet	Kohler	3	Washrooms	2000
Faucet	Kohler	1	Janitor closet	2000
Faucet	Kohler	1	Kitchen	2000
Urinals	Kohler	2	Washrooms	2000
Toilets	Kohler	4	Washrooms	2000

(a) Washroom faucet (b) Toilet (c) Urinals

Figure 14: Typical plumbing fixtures

4 ENERGY CONSERVATION MEASURES

4.1 Building envelope upgrades

Building envelope upgrades typically include the following components:

- Roof: Increasing insulation to reduce heat losses through the roof.

- Exterior walls: Increase insulation to reduce heat losses through the exterior walls.
- Windows: Replacing old windows with new high efficiency windows to reduce heat losses through the windows.

Building envelope upgrades are not recommended to be considered until the envelope components are due for replacement due to the high cost of implementation, and low opportunity for utility savings. A qualitative analysis of the building envelope upgrades are presented in Table 18.

Table 18: Building envelope upgrades

Category	Description
Building component	Building envelope (roof, exterior walls, windows)
Recommended change	Increase insulation in roof and exterior walls, and replace windows
Impact on occupant comfort	Improved thermal comfort due to reduced heat loss, and increased air tightness
Estimated cost	High (> $100,000)
Estimated level of annual savings	Low (> 100 year payback)
Priority	Low

4.2 Programmable thermostat schedules

There are currently programmable thermostats which control the temperature setpoints in the facility. A programmable thermostat has the ability to have set schedules such that temperature setbacks can be implemented during unoccupied hours. This would reduce the space heating and cooling energy consumption by lowering the heating/cooling loads during unoccupied periods.

Although programmable thermostats are installed at the facility, it was unclear whether they were operating on set schedules. It is recommended to ensure a schedule is implemented such that the space is normally maintained at setback temperatures. Occupants can adjust setpoints manually when utilizing the facility which will temporarily override the schedule. However, the thermostat will return to the regularly scheduled setpoints at the end of the day.

A qualitative analysis of the programmable thermostat scheduling is presented in Table 19.

Table 19: Building envelope upgrades

Category	Description
Building component	HVAC (heating and cooling)
Recommended change	Ensure schedules with setbacks are implemented
Impact on occupant comfort	N/A
Estimated cost	Low (< $1,000)
Estimated level of annual savings	High (< 1 year payback)
Priority	High (no-cost measure which has potential for significant energy savings)

4.3 LED lighting retrofit

LED lighting technology continues to rapidly advance, resulting in increased energy efficiency, improved product reliability, increased selection, and reduced costs. Applications where lighting retrofits are typically the most feasible include facilities with dated light fixtures (prior to T8 fluorescent lamps), contain high light fixture densities (resulting in a high W/ft^2 ratio), and have extended daily use (24/7 operation). Replacing existing fixtures with LED fixtures can decrease overall lighting costs significantly, while providing improved lighting levels for occupants.

This report analyzes a LED fixture replacement with no fixture reduction. LED fixture replacement has the following benefits:

- Allows for the highest level of flexibility for enhanced lighting controls, whether it is tied to occupancy and daylight sensors, zonal controls, wireless, addressable sensors, or network solutions to be integrated on each luminaire.
- Maximized performance when the fixture body is designed with the proper heat dissipation for LED light sources.
- Optimized visual comfort with lenses designed to reduce LED glare and improve the light distribution.

Assumptions

- The existing light fixtures were retrofitted on a one-for-one basis.
- LED fixture replacement costs on a per fixture basis were held constant. No economies of scale were assumed.
- Costs include both fixture and installation costs.
- No maintenance cost savings were taken into account.
- Operating hours for the majority of fixtures are 420 hours per year.

Calculations

- The existing lighting electrical demand [kW] was determined by summing the electrical demand for all lights in the building.
- The existing lighting electrical demand [kW] was multiplied by the annual operating hours to determine the annual electricity consumption [kWh] for the existing lighting.
- A review of each existing light fixture type was completed to determine a suitable LED fixture replacement (per unit basis).
- An approximate cost and electrical power [W] for each LED fixture replacement was determined.
- The annual electricity consumption and monthly demand for the LED retrofit scenario was calculated and compared to the existing conditions.

Table 20 provides a summary of the LED lighting retrofit analysis results.

Table 20: LED lighting retrofit

ECM	**Electricity Savings** [kWh]	**Nat. Gas Savings** [m^3]	**Cost Savings** [$]	**Capital Cost** [$]	**Utility Incentive** [$]	**Simple Payback** [years]
LED lighting retrofit	738.4	0	97	6,000	703	54.8

Note: Cost savings calculated using utility rates from Table 6.

4.4 Install natural gas DHW heater

Domestic hot water for Roseville Community Centre is provided by an electric DHW heater. A potential utility cost reducing measure is to existing electric DHW heater with a natural gas DHW heater. Although electric DHW heaters are 100% efficient while natural gas DHW heaters are approximately 80% efficient, there is a potential for cost savings due to the cost difference between electricity and natural gas.

Assumptions

- Natural gas DHW heaters have a thermal efficiency of 80%.
- The capital cost of a natural gas DHW heater is estimated at $1,500.

Calculations

- Electricity savings are calculated from current electric DHW heater consumption.
- Natural gas consumption is determined from the conversion of electricity savings to m^3 and dividing by the efficiency of the natural gas DHW heater.

Table 21 summarizes the natural gas savings for installing natural gas DHW heaters

Table 21: Install natural gas DHW heater

ECM	Electricity Savings [kWh]	Nat. Gas Savings [m^3]	Cost Savings [$]	Capital Cost [$]	Utility Incentive [$]	Simple Payback [years]
Install NG DHW heater	1,642.5	-194	167	1,500	0	9.0

Note: Cost savings calculated using utility rates from Table 6.

4.5 Install rooftop solar PV system

A solar PV analysis was conducted for Roseville Community Centre using the HelioScope online modeling tool. A detailed report of the analysis and results can be found in the Appendices. This section provides a summary of the report's analysis and recommendations.

Assumptions

- The roof can structurally support the solar panels.
- Solar panels were placed with setbacks from roof edge and accounting for existing rooftop structures and shading.
- Solar panels were arranged in a configuration to maximize power production.

Calculations

- 26 x 320 W panels for total system size of 8.3 kW.
- Demand savings estimated at 20% of total system size.
- Electricity will be credited under a net metering scenario at the utility price of $0.131/kWh.
- Total system installed cost estimated at $3.00/W.

Table 22 provides a summary of the solar PV analysis results.

Table 22: Install solar PV system

ECM	Electricity Savings [kWh]	Nat. Gas Savings [m^3]	Cost Savings [$]	Capital Cost [$]	Utility Incentive [$]	Simple Payback [years]
Install solar PV system	9,469.0	0	1,240	25,000	0	20.2

Note: Cost savings calculated using utility rates from Table 6.

4.6 Replace plumbing fixtures

The existing plumbing fixtures are described in Section 3.6. Replacing the existing fixtures with new low flow fixtures presents an opportunity to reduce water consumption and electricity consumption through reduced domestic hot water consumption

Table 23 compares existing fixtures to new low flow fixtures.

Table 23: Proposed plumbing fixtures

Fixture	Duration [min]	Current Flow [lpm]	Current Use [m^3]	New Flow [lpm]	New Use [m^3]	Savings [m^3]
Washroom faucet	0.25	6	0.9	4.5	0.68	0.22
Toilet	N/A	6	28	4.8	23	5.6

A qualitative analysis of the plumbing fixture replacements are presented in Table 24.

Table 24: Building envelope upgrades

Category	Description
Building component	Plumbing fixtures (faucets, toilets, etc.)
Recommended change	Replace existing fixtures with low flow fixtures
Impact on occupant comfort	N/A
Estimated cost	Medium (> $1,000)
Estimated level of annual savings	Low (> 100 year payback)
Priority	Low (low opportunity for cost savings due to low fixture usage)

5 RECOMMENDATIONS

Table 25 summarizes the annual energy savings and simple paybacks for the conservation measures evaluated in this report. Conservation have been sorted based on their payback period.

Table 25: Conservation measures summary table

ECM	Electricity Savings [kWh]	Nat. Gas Savings [m^3]	Cost Savings [$]	Capital Cost [$]	Utility Incentive [$]	Simple Payback [years]
Install NG DHW heater	1,642.5	-194	167	1,500	0	9.0
Install solar PV system	9,469.0	0	1,240	25,000	0	20.2
LED lighting retrofit	738.4	0	97	6,000	703	54.8

Note: Cost savings calculated using utility rates from Table 6.

Table 26 summarizes the conservation measures recommended for implementation or further investigation. These were selected as they had a payback period of less than 10 years.

Table 26: Recommended conservation measures summary table

ECM	Electricity Savings [kWh]	Nat. Gas Savings [m^3]	Cost Savings [$]	Capital Cost [$]	Utility Incentive [$]	Simple Payback [years]
Install NG DHW heater	1,642.5	-194	167	1,500	0	9.0

Note: Cost savings calculated using utility rates from Table 6.

Table 27 summarizes all ECMs which were analyzed qualitatively.

Table 27: Qualitative ECM summary table

ECM	Estimated Cost	Estimated Annual Savings	Priority
Programmable thermostat schedules	Low	High	High
Replace plumbing fixtures	Medium	Low	Low
Building envelope upgrades	High	Low	Low