ASHRAE LEVEL II ENERGY AUDIT

THE TOWNSHIP OF NORTH DUMFRIES

SCHMIDT PARK STORAGE BUILDING

53 Hilltop Drive, 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 Schmidt Park Storage Building located at 53 Hilltop Drive 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

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Senior Energy Engineer
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Table of Contents

EXECUTIVE SUMMARY

This report presents the results of a ASHRAE Level II Energy Audit completed by WalterFedy for The Township of North Dumfries at Schmidt Park Storage Building located at 53 Hilltop Drive 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 Schmidt Park Storage Building. ECMs are based on replacement recommendations with energy savings potential in the BCA report as well as emerging and renewable energy technologies when applicable.

Schmidt Park Storage Building is a 1 storey Storage Building facility built in 2003.

Table 1 summarizes the annual electricity, natural gas, and water consumption for Schmidt Park Storage Building 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]	12,276
Annual Electricity Cost	[$]	1,460
Annual Natural Gas Consumption	[m^3]	1,668
Annual Natural Gas Cost	[$]	333

*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]
Interior LED lighting retrofit	6,905	1.3	0	822	4,800	510	5.2
Exterior LED lighting retrofit	2,453	0.0	0	292	2,800	200	8.9

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

Table 3 summarizes all recommended ECMs which were analyzed qualitatively.

Table 3: Recommended ECM summary table

ECM	**Estimated Cost**	**Estimated Annual Savings**	**Priority**
Force flow heater setpoints	None	Low - Medium	High
Winterize facility	Low	Medium	Medium

1 INTRODUCTION

1.1 Objectives

WalterFedy was hired by The Township of North Dumfries to complete an ASHRAE Level II Energy Audit at their Schmidt Park Storage Building facility at 53 Hilltop Drive 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 Treasurer, Director of Corporate Services 519.632.8800 x123 sstedall@northdumfries.ca	Josh Gibbins, P.Eng. Senior Energy Engineer 519.576.2150 x480 jgibbins@walterfedy.com
The Township of North Dumfries 2958 Greenfield Road Ayr, ON N0B 1E0	WalterFedy 675 Queen Street South, Suite 111 Kitchener, ON N2M 1A1

2 HISTORICAL ENERGY USE ANALYSIS

2.1 General information

Electricity, natural gas, and water suppliers for Schmidt Park Storage Building are summarized in Table 5.

Table 5: Facility utility information.

Facility Name:	Schmidt Park Storage Building
Location:	53 Hilltop Drive, Ayr, Ontario
Electrical LDC*:	Energy+
LDC Account No.:	00042708-00
Natural Gas Distributor:	Union Gas
NG Account No.:	195-6374 249-9309

*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	[$/kWh]	0.12
Natural Gas Consumption	[$/m^3]	0.20

2.3 Incentive summary

Electricity incentives

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

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

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

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.
- 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 Schmidt Park Storage Building for the baseline year of 2017.

Table 8: Facility annual electricity consumption

Annual Electricity Consumption	[kWh]	12,276
Annual Electricity Consumption Costs	[$]	1,460

Electricity is used for lighting, ventilation, and some space heating. As seen in Figure 1, monthly electricity consumption was relatively constant throughout 2017. There is an abnormally large increase in electricity consumption from January 2018 - May 2018.

Natural gas consumption

Table 9 summarizes the annual natural gas consumption of Schmidt Park Storage Building for the baseline year of 2017.

Table 9: Facility annual natural gas consumption

Annual Natural Gas Consumption	[m^3]	1,668
Annual Natural Gas Consumption Costs	[$]	333

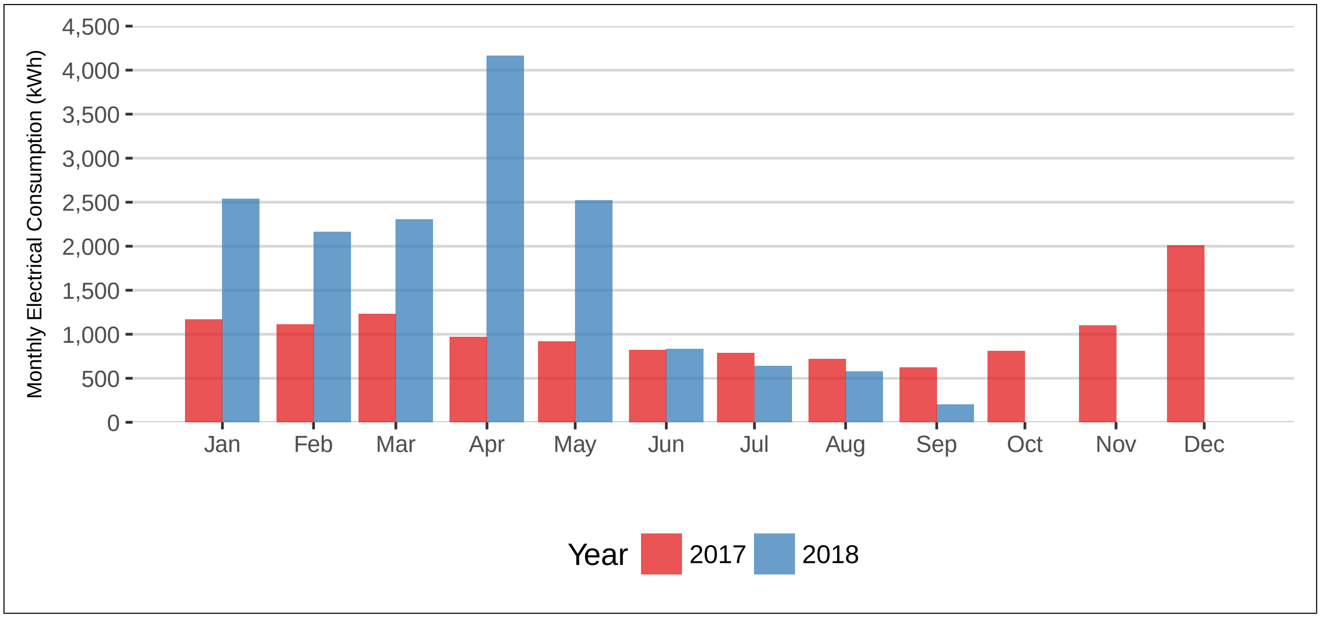


Figure 1: Monthly electricity consumption for the baseline period

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.

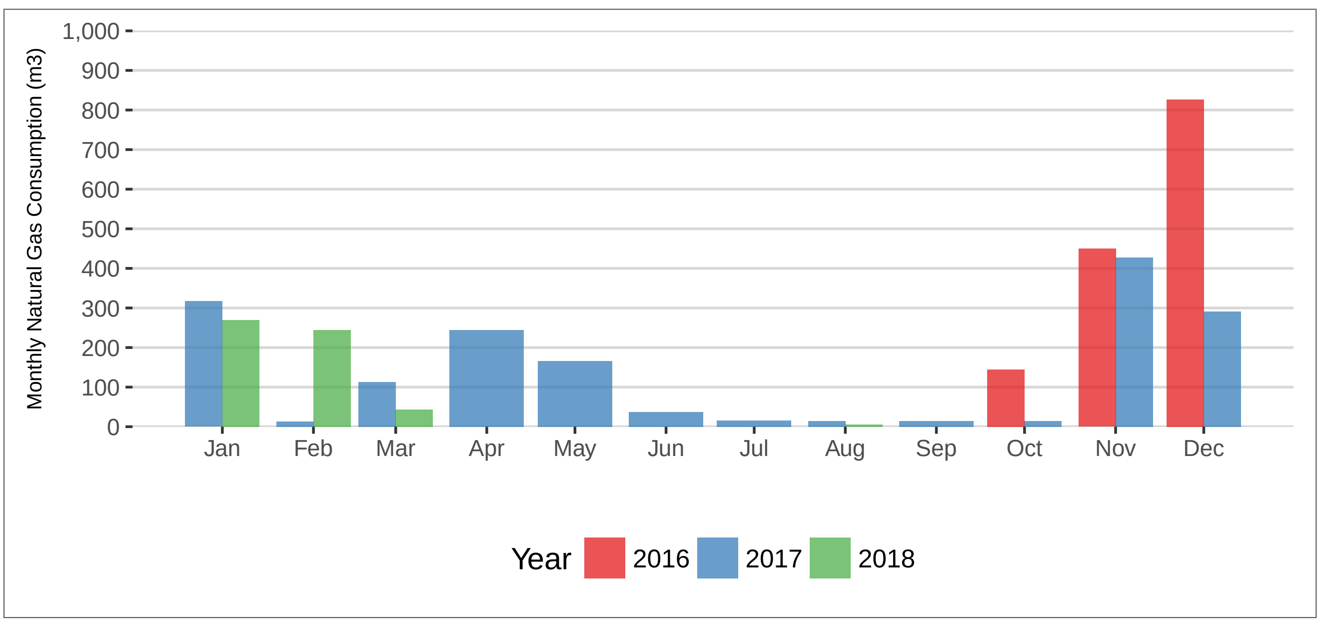


Figure 2: Monthly natural gas consumption for the baseline period

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.

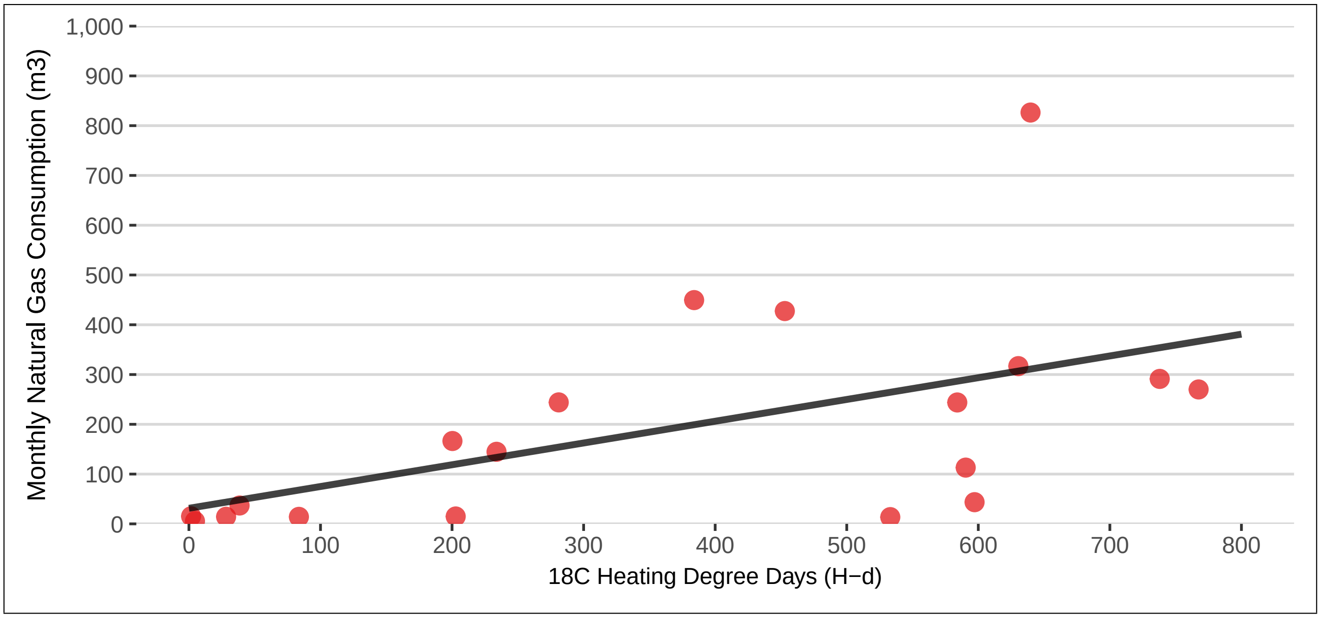


Figure 3: Linear regression of natural gas consumption vs. heating degree days

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

$$\text{Natural gas consumption } [m^3] = 31 + 0.44 \times 18°C \text{ HDD } (r^2 = 0.3)$$

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, 30% of the variability in the natural gas consumption data can be explained by correlating consumption to heating degree days.

2.6 Energy end uses

Table 10 summarizes the energy end uses for Schmidt Park Storage Building.

Table 10: 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	1,428	2,748	17,821	59.6	612
HVAC	-	170	170	0.57	20
Water Heating	240	-	2,534	8.5	48
Lighting	-	9,358	9,358	31.3	1,113
Totals	1,668	12,276	29,882	100	1,794

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 was divided into space heating and domestic water heating.

- Domestic water heating natural gas consumption estimated as the monthly average summer natural gas multiplied by 12 months.
- Space heating natural gas consumption estimated as the remainder of the total annual natural gas consumption.
- Electricity consumption was divided into space heating, lighting, and HVAC.
- 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.
- Space heating electricity consumption estimated as the difference between the monthly average summer electricity consumption and the monthly average winter electricity consumption.
- HVAC loads (fans, pumps, etc.) estimated as the remainder of the total annual electricity consumption.

2.7 Energy use intensity (EUI)

Figure 4 compares the total annual electricity and natural gas consumption of all North Dumfries facilities.

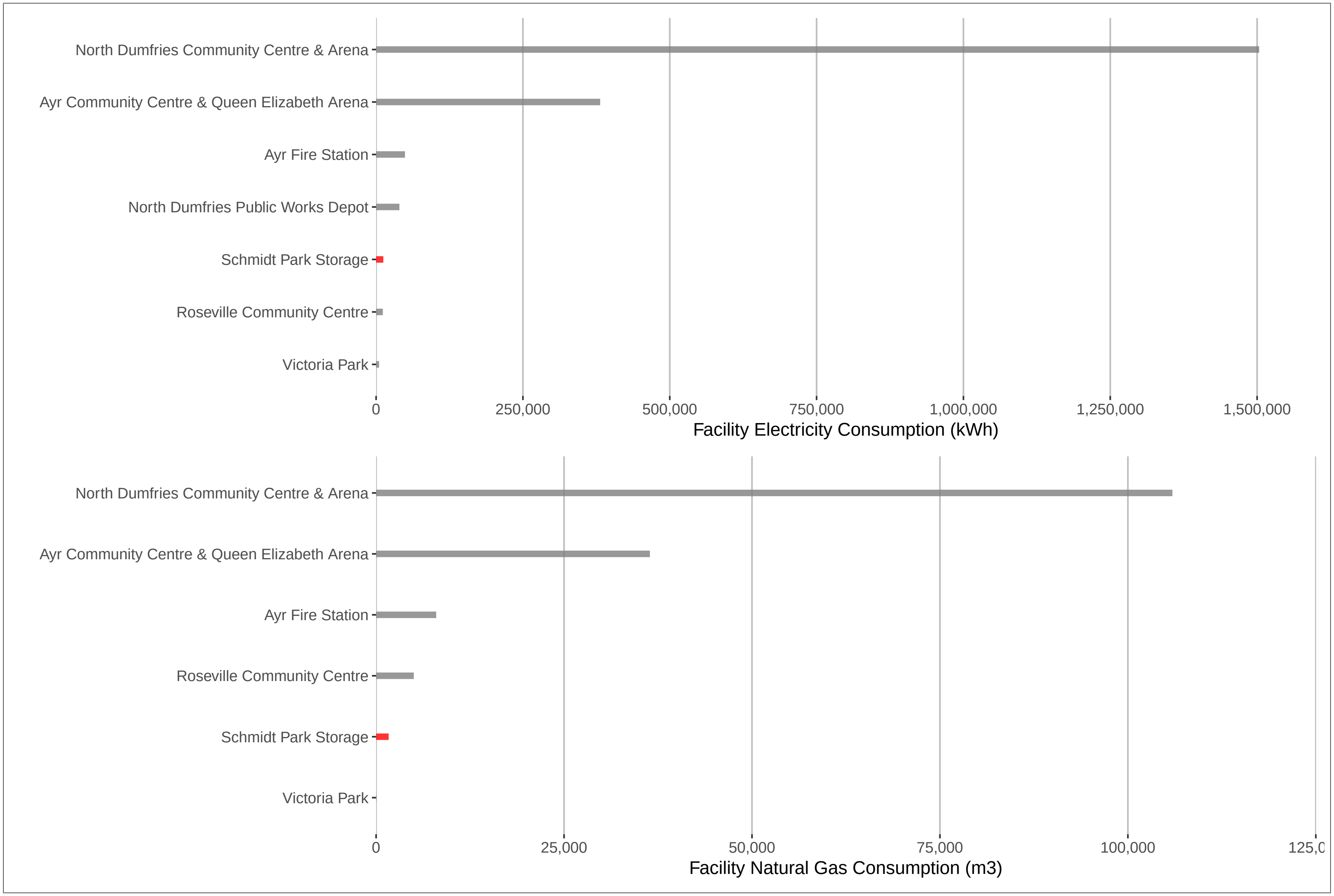


Figure 4: Annual electricity and natural gas energy use by building

3 EXISTING CONDITIONS

3.1 General facility information

Schmidt Park Storage Building is a 1-storey Storage Building facility constructed in 2003. It consists mainly of a kitchen, meeting rooms, and washrooms. Table 11 summarizes the general facility information for Schmidt Park Storage Building.

Table 11: Facility background information

Facility name:	Schmidt Park Storage Building
Location:	53 Hilltop Drive, Ayr, Ontario
Number of floors:	1
Facility floor area:	1,500 ft^2
Year of construction:	2003
Building type:	Storage Building

3.2 Facility occupancy schedule

Table 12: Typical weekly hours

Monday - Friday	8:00 am - 11:00 pm
Saturday - Sunday	8:00 am - 11:00 pm

3.3 Building envelope

Table 13: Existing building envelope details

Component	**Installed**	**Description**
Floor foundation	1992	poured reinforced concrete
Mezzanine floor	1992	wood framed flooring
Dutch gable roof structure	1999	wood framed roof structure
Exterior walls	1999	split face concrete block
Exterior walls	1999	vinyl sided gables
Exterior soffits	1999	aluminum soffits around perimeter of roof
Exterior windows	1999	glass block window on north elevation
Exterior windows	1999	concession window with metal rolling door
Exterior doors	1999	hollow metal doors in metal frames
Overhead door	1999	insulated overhead doors within building
Roof coverings	2017	asphalt shingle roofing above storage, washroom, and concession
Sklights	1999	skylights installed in gable of roof above washrooms and concession
Eavestroughs and downspouts	1999	drainage system installed around perimeter of roof

Exterior roof

The dutch gabled roof structure is topped with asphalt shingle roofing. Three skylights are installed in the gable of the roof above the washrooms and concession.

Exterior walls

The exterior walls of the building consists of split face concrete block. Sections of the exterior wall and the roof gables are finished by vinyl siding.

(a) Exterior brick wall (b) Sloped roof

Figure 5: Building exterior walls

Exterior windows and doors

One glass block window is installed on the north elevation. One concession window is installed which has a metal rolling door. Six hollow metal doors in hollow metal frames are positioned along the perimeter of the building. There are two insulated overhead doors within the building.

(a) Exterior door (b) Overhead door (c) Exterior window

Figure 6: Building exterior windows and doors

3.4 Mechanical systems

Table 14: Existing mechanical equipment

Description	Manufacturer	Model	Qty	Location	Installed	Size
DHW heater	John Wood	JW850SDE-30 250	1	Mechanical room	2017	N/A
Unit heater (gas)	Reznor	N/A	1	Storage	1999	N/A
Unit heater (electric)	Ouellet	N/A	5	Storage	1999	N/A
Exhaust fans	N/A	N/A	1	Rooftop	1999	N/A
Exhaust fans	N/A	N/A	3	Washroom and mechanical room	1999	N/A

Space heating system

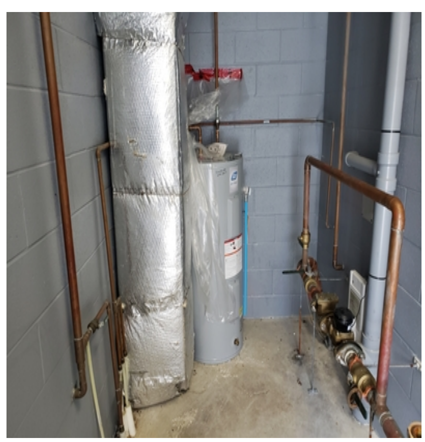
Space heating in the washrooms and concession are are provided by electric force flow heaters. The maintenance area has a natural gas unit heater.

(a) Force flow heater (b) Unit heater

Figure 7: Space heating system

Domestic hot water system

Domestic hot water is provided by a natural gas domestic hot water heater.



(a) DHW heater

Figure 8: Domestic hot water system

Table 15: Existing lighting fixtures

Location	Fixture Type	Wattage	Quantity	Installed
Throughout	T8 Fluorescent	59	44	N/A
Exterior	Wallpack	70	8	N/A

3.5 Lighting

Exterior lighting

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

(a) Wallpack
Figure 9: Exterior lighting

Interior lighting

All interior spaces have lighting provided by fluorescent fixtures.

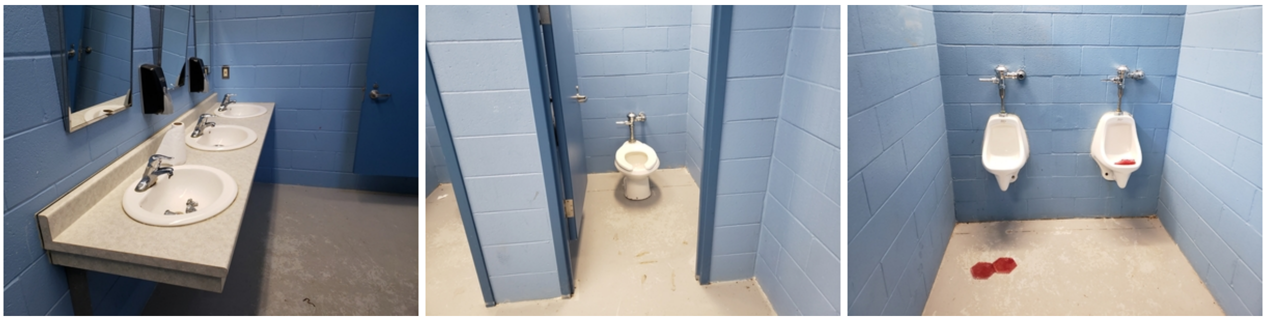
(a) Typical fluorescent fixtures (b) Typical fluorescent fixtures
Figure 10: Interior lighting

3.6 Plumbing fixtures

The plumbing fixtures within the building consists of with five floor mounted toilets, five washroom sinks, two wall mounted urinals in the men's and women's washrooms, and one double baisin steel kitchen sink in the concession room.

Table 16: Existing plumbing fixtures

Description	Manufacturer	Qty	Location	Installed
Toilet	N/A	5	washroom	1999
Faucet	N/A	6	washroom	1999
Urinals	N/A	2	washroom	1999



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

Figure 11: Urinals

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 17.

Table 17: 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 (> $10,000)
Estimated level of annual savings	Low (> 100 year payback)
Priority	Low

4.2 Interior 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 an interior 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.

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 18 provides a summary of the LED lighting retrofit analysis results.

Table 18: Interior LED lighting retrofit

ECM	**Electricity Savings** [kWh]	**Nat. Gas Savings** [m^3]	**Cost Savings** [$]	**Capital Cost** [$]	**Utility Incentive** [$]	**Simple Payback** [years]
Interior LED lighting retrofit	6,905.4	0	822	4,800	510	5.2

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

4.3 Exterior LED lighting retrofit

An exterior LED lighting retrofit has the following benefits in addition to those described previously:

- Improved lighting levels in parking lots and areas surrounding the building for increased occupant safety.
- Increased fixture lifespan resulting in lower maintenance costs.

This report analyzes an exterior LED fixture replacement with no fixture reduction.

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.

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 19 provides a summary of the LED lighting retrofit analysis results.

Table 19: Exterior LED lighting retrofit

ECM	**Electricity Savings** [kWh]	**Nat. Gas Savings** [m^3]	**Cost Savings** [$]	**Capital Cost** [$]	**Utility Incentive** [$]	**Simple Payback** [years]
Exterior LED lighting retrofit	2,452.8	0	292	2,800	200	8.9

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

4.4 Force flow heater setpoints

There are currently electric force flow heaters located in the washrooms and concession area. As these spaces are unoccupied in the winter time, the heaters are only required to maintain the space at a minimum temperature. However, if the setpoints are currently set assuming there will be occupants in the space, then there is an opportunity to lower the setpoint which will decrease electricity consumption.

Table 20: Force flow heater setpoints

Category	Description
Building component	Electric force flow heaters
Recommended change	Ensure setpoints are based on setback temperatures
Impact on occupant comfort	N/A
Estimated cost	None
Estimated level of annual savings	Low - Medium
Priority	High (Potential for annual utility cost savings at no cost)

4.5 Winterize facility

As the facility is unoccupied in the winter, it can be winterized so that space heating would not be delivered to the spaces during the winter. This would involve draining all pipes, plumbing fixtures, and other equipment of all water and filling them with an antifreeze solution. Doing so would eliminate the requirement for heating to the washrooms and concession area.

It was observed on the site visit that water had been drained from all plumbing fixtures. It should be confirmed that all equipment and plumbing is drained, and that the space heating is shut off during the winter season.

Table 21: Winterize facility

Category	Description
Building component	Plumbing and DHW equipment
Recommended change	Winterize facility so that space heating can be removed in winter season
Impact on occupant comfort	N/A
Estimated cost	Low
Estimated level of annual savings	Medium
Priority	Medium (Potential for reasonable annual utility cost savings at low cost)

5 RECOMMENDATIONS

Table 22 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 22: Conservation measures summary table

ECM	Electricity Savings [kWh]	Nat. Gas Savings [m^3]	Cost Savings [$]	Capital Cost [$]	Utility Incentive [$]	Simple Payback [years]
Interior LED lighting retrofit	6,905.4	0	822	4,800	510	5.2
Exterior LED lighting retrofit	2,452.8	0	292	2,800	200	8.9

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

Table 23 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 23: Recommended conservation measures summary table

ECM	Electricity Savings [kWh]	Nat. Gas Savings [m^3]	Cost Savings [$]	Capital Cost [$]	Utility Incentive [$]	Simple Payback [years]
Interior LED lighting retrofit	6,905.4	0	822	4,800	510	5.2
Exterior LED lighting retrofit	2,452.8	0	292	2,800	200	8.9

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

Table 24 summarizes all ECMs which were analyzed qualitatively.

Table 24: Qualitative ECM summary table

ECM	Estimated Cost	Estimated Annual Savings	Priority
Force flow heater setpoints	None	Low - Medium	High
Winterize facility	Low	Medium	Medium
Building envelope upgrades	High	Low	Low