BURNSIDE

Community Energy Plan

Volume 3
North Dufferin Community Centre, Honeywood Arena Energy Audit Report

Township of Mulmur

June 2020

North Dufferin Community Centre (Honeywood Arena)
CEP Volume 3: Energy Audit Report

Township of Mulmur
758070 2 Line East
Mulmur, ON L9V 0G8

R.J. Burnside & Associates Limited
15 Townline
Orangeville ON   L9W 3R4 CANADA

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R.J. Burnside & Associates Limited

Report Prepared By:

Spencer Brown, P.Eng., C.E.A.
Project Engineer
SB:kl

Peter Mensinga, M.A.Sc., P.Eng.
Manager, Building Restoration
PM:kl

Report Reviewed By:

Dominic Garisto, C.E.T., LET
Mechanical Technologist
DG:kl

Lyle Parsons, B.E.S.
Vice President Environment
LP:kl

Executive Summary

Introduction: Project Scope, Objective and Strategies

R.J. Burnside & Associates Limited (Burnside) was engaged by the Township of Mulmur (Mulmur) to develop a Community Energy Plan (CEP). As part of that CEP a number of demonstration projects were included to show the benefits of energy conservation. This particular component of the study was to conduct an Energy Audit (EA) of the North Dufferin Community Center building in Honeywood. Its address is 706114 County Rd 21, Mulmur, ON, L0N1H0. These kind of EAs can be conducted at any building and are case specific to the buildings being assessed.

Fourteen separate Energy Efficiency Measures (EEMs) were identified with implementation costs and annual energy savings estimates. Eight Energy Efficiency Measures (EEMs) recommendations were identified with implementation costs and annual energy savings estimates. The annualized savings of all recommendations totals $21,996.00 (at projected energy prices). If fully implemented, the average weighted payback period from annual energy savings for these EEMs is estimated to be 8.0 years, and simple payback 5.4 years. A significant reduction in electricity and fuel usage would be achieved if recommendations were implemented. Details are outlined in the tables below.

Table 1: North Dufferin Community Centre Energy Efficiency Recommendations

EEM No.	Energy Efficiency Measure	Measure Type	Approx. Annual Savings	Net Estimated Costs	Simple Payback Years
1	LED Lighting – Interior Lights	Upgrade Building Systems	$216.00	$1,105.00	5.1
2	LED Lighting – Exterior Parking Lot Lights	Upgrade Building Systems	$160.00	$790.00	4.9
3	Install Programmable Thermostats	Upgrade Building Systems	$750.00	$400.00	0.5
4	Building Envelope Analysis – Roof Insulation	Upgrade Building Envelope	$1,780.00	$8,500.00	4.8
7	Water Conservation -Low Flow Fixtures	Upgrade Building Systems	$490.00	$1,800.00	3.7
10	New Zamboni Hot Water System	Upgrade Building Systems	$1,165.00	$8,000.00	6.9
12	DDC Controller	Upgrade Building Systems	$5,000.00	$41,154.00	8.2
14	Rooftop Solar	Renewable Technology	$12,435.00	$114,375.00	9.2
		Totals	**$21,996.00**	**$176,124.00**	**5.4**

Table 2: Summary of Utility Reductions from Recommendations

	Electricity	Oil	GHG Reduction
	kWh	L	MTCDE
Total 2017/2018 Utility Consumptions	300,000	18,221	49
Percentage Reduction in Utility Consumption	90%	24%	24%
Total Projected Utility Consumptions	31,274	13,824	37

Results and Recommendations with Climate Action Incentive Fund (CAIF)

There is a program expected to be announced from the Federal government to provide incentives to Municipalities for energy efficiency and renewable energy projects. A similar program for private businesses was operational in 2019 providing 25% incentive on capital costs. With the capital incentive one additional measure was recommended for a total of nine measures, and overall paybacks were reduced. The tables below outline the revised paybacks for projects, should this program be launched.

The annualized savings of all recommendations with the CAIF Incentive totals $25,706.00 (at projected energy prices). Details are outlined in the tables below. There could be further funding available from programs like FCM's Green Municipal Fund Capital Project: Retrofit of Municipal Facilities.

Table 3: North Dufferin Community Centre Energy Efficiency Recommendations with CAIF Funding

EEM No.	Energy Efficiency Measure	Measure Type	Approx. Annual Savings	CAIF Incentive	Net Estimated Costs	Simple Payback Years
1	LED Lighting – Interior Lights	Upgrade Building Systems	$216.00	$374.00	$731.00	3.4
2	LED Lighting – Exterior Parking Lot Lights	Upgrade Building Systems	$160.00	$223.00	$568.00	3.5
3	Install Programmable Thermostats	Upgrade Building Systems	$750.00	$100.00	$300.00	0.4
4	Building Envelope Analysis – Roof Insulation	Upgrade Building Envelope	$1,780.00	$2,125.00	$6,375.00	3.6
7	Water Conservation -Low Flow Fixtures	Upgrade Building Systems	$490.00	$450.00	$1,350.00	2.8
10	New Zamboni Hot Water System	Upgrade Building Systems	$1,165.00	$2,000.00	$6,000.00	5.2
11	Desuperheater	Upgrade Building Systems	$3,710.00	$10,625.00	$31,875.00	8.6
12	DDC Controller	Upgrade Building Systems	$5,000.00	$11,250	$29,904	6.0
14	Rooftop Solar	Renewable Technology	$12,435.00	$28,594.00	$85,781.00	6.9
		Totals	**$25,706.00**	**$55,740.00**	**$162,884.00**	**4.5**

Note: Simple payback is an average of all projects

Energy Audit Strategies and Methods

This report review includes all the energy and estimated cost saving measures as follows with regards to both functionality and code upgrades:

- Building Automation Systems (BAS);
- Boilers, furnaces, heaters;
- Toilet and fixture replacement;
- LED lighting;
- Roof insulation;
- Rooftop solar; and
- Heat Recovery.

The energy audit method was broken down into four phases which are described as follows:

Baseline Development

Gathering all pertinent data: billing information histories, drawings, specifications, engineering report, conduct site visit and interview building operators, generate equipment list and identify potential energy saving measures. Interview with building operators, generate equipment list and conduct site inspection for individual system to identify the potential energy saving measures.

Analysis and Energy Efficiency Measures (EEMs)

Collect all historic data for utility and energy consumption simulation, and building assessment report(s), drawings and other related information (provided by the Township). Provide an analysis of potential Energy Efficiency Measures for conventional and renewable energy technologies, taking into consideration of the building behavior, operational schedule changes and deficiencies. Review and calculation energy consumption before and after a potential retrofit.

Draft and Final Report

Produce the draft energy audit report and for the North Dufferin Community Centre review and incorporate comments and suggestion for the final report.

Table 4: North Dufferin Community Centre Energy Efficiency Details

EEM	Measure Category	Measure Type	Energy Efficiency Measure	Electricity	Oil	GHG Reduction	Total Savings per Year	Original Cost	Incentives	Net Costs	Cost ($) / MTCDE	Simple Payback w/Incentives Years
				kWh	L	MTCDE						
1	No-Cost/Low-Cost	Upgrade Building Systems	EEM 1 - LED Lighting – Interior Lights	1,300	0	0	$216.00	$1,495.00	$390.00	$1,105.00	$0.00	5.1
2	No-Cost/Low-Cost	Upgrade Building Systems	EEM 2 - LED Lighting – Exterior Parking Lot Lights	964	0	0	$160.00	$890.00	$100.00	$790.00	$0.00	4.9
3	Capital Investment	Upgrade Building Systems	EEM 3 - Install Programmable Thermostats	0	1000	3	$750.00	$400.00	$0.00	$400.00	$0.00	0.5
4	Capital Investment	Upgrade Building Envelope	EEM 4 – Building Envelope Analysis – Roof Insulation	0	2144	6	$1,780.00	$8,500.00	$0.00	$8,500.00	$1,485.00	4.8
5	Capital Investment	Upgrade Building Envelope	EEM 5 – Building Envelope Analysis – New Doors	0	136	0	$103.00	$1,500.00	$0.00	$1,500.00	$4,131.00	14.6
6	Capital Investment	Upgrade Building Envelope	EEM 6 – Building Envelope Analysis – New Windows	0	1075	3	$806.00	$38,000.00	$0.00	$38,000.00	$13,239.00	47.1
7	Capital Investment	Upgrade Building Systems	EEM 7 – Water Conservation -Low Flow Fixtures	0	571	2	$490.00	$1,800.00	$0.00	$1,800.00	$1,181.00	3.7
8	Capital Investment	Upgrade Building Systems	EEM 8 – Upgrade Furnace to Higher Efficiency	0	125	0	$104.00	$7,000.00	$0.00	$7,000.00	$20,974.00	67.5
9	Capital Investment	Upgrade Building Systems	EEM 9 - Drain Water Heat Recovery	0	367	1	$304.00	$4,500.00	$0.00	$4,500.00	$4,592.00	14.8
10	Capital Investment	Upgrade Building Systems	EEM 10 New Zamboni Hot Water System	0	682	2	$1,165.00	$8,000.00	$0.00	$8,000.00	$4,393.00	6.9
11	Capital Investment	Upgrade Building Systems	EEM11 Desuperheater	0	4,470	12	$3,710.00	$42,500.00	$0.00	$42,500.00	$3,561.00	11.5
12	Capital Investment	Upgrade Building Systems	EEM12 DDC Controller	38,462	0	0	$5,000	$45,000	$3,846	$41,154	$0	8.2
13	Capital Investment	Upgrade Building Systems	EEM13 Electric Desiccant Humidifier	19,231	0	0	$2,500	$40,000	$1,923	$38,077	$0	15.2
14	Capital Investment	Renewable Technology	EEM14 Rooftop Solar	228,000	0	0	$12,435.00	$114,375.00	$0.00	$114,375.00	$0.00	9.2

Table 5: Glossary of Terms

Term	Description
Watt (W)	Unit of Power in Joules/s.
Kilowatt (kW)	1000 Watts
Megawatt (MW)	1000 kilowatts
ekWh	Equivalent Kilo-watt hours, standard unit of energy consumption to compare energy sources.
Watthour (Wh)	A measure of power over time – 1 Wh is 1W power consumption over 1 hour.
Kilowatt hour (kWh)	1000 Wh
Megawatt Hour (MWh)	1000 kWh
British Thermal Unit (BTU)	A measure of energy.
kBTU	One thousand BTUs.
m^3	Meter cubed, a unit of volume.
ECI	The Energy Cost Index (ECI) of the building (expressed in dollars per floor area per year).
GHG	Green house fuel oil.
Source EUI	The Energy Utilization Index (EUI) of the Source (expressed in $kBtu/ft^2$ [MJ/m^2] per year).
Site EUI	The Energy Utilization Index (EUI) of the Site (expressed in $kBtu/ft^2$ [MJ/m^2] per year).
Demand Charge	Charge from Hydro distribution companies based on the capacity amount allocated to your building.
Peak Demand	The largest power consumption for a system, usually over a 1 year time period.
EEM	Energy Efficiency Measure.
ECM	Energy Conservation Measure.
Blended Rate	A rate $/kWh for electricity including demand charges, regulatory charges, supply charges, global adjustment, and taxes.
Heating Degree Day (HDD)	The number of degrees that a day's average temperature is below 18 degrees Celsius.
Net Present Value (NPV)	The value of all the future cash flows added up and multiplied with the discount rate.
Discount Rate	Often considered the hurdle rate this is the rate which an entity can receive on other investments. A discount rate is used to discount future cash flows to measure project risk.
Simple Payback	The time in years it takes to recoup an initial capital investment. Comparing paybacks of different investments provides a good way to make financial decisions.
Return on Investment (ROI)	The ROI is the net profit of an investment divided by the capital cost. Comparing ROI's of different investments provides a good way to make financial decisions.

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Disclaimer

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1.0 Energy Utility Analysis

1.1 Audit Scope and Methodology

R.J. Burnside & Associates Limited (Burnside) conducted a site visit at the North Dufferin Community Centre on July 1, 2019. Following the site visit, analysis was performed by Burnside and included a review of mechanical, electrical, building sciences, energy modelling, and renewable energy. Included in the analysis was a preliminary end use analysis, energy audit, and water consumption review. A review of safety features such as ammonia monitoring equipment was not included in this review.

1.1.1 Preliminary Analysis

The preliminary analysis precedes an audit of a building. During the preliminary analysis the historic utility use, peak demand, and cost were analyzed. A comparison of electricity usage to similar buildings, where available (including the source, size and date of the sample) was completed. Monthly energy use and peak demand was reviewed to identify efficiency or behavioral modification opportunities. Sequence of operations reports, floor plan, mechanical, electrical, architectural, and structural drawings for each of the buildings that were received were reviewed.

1.1.2 Audit Site Investigation

During the site investigation a description of the physical characteristics of the facility, as well as its current condition, state of repair and maintenance, approximate date of last major renovation, age and construction type were reviewed. The major existing electricity-using equipment including lighting, main sources of heating and cooling, their energy consumption and fuel type as well as the manufacturer, model number, age, physical condition and estimated remaining years of service were noted.

1.1.3 Water Consumption Review

The water closets and faucets are manually operated and have not been fully retrofitted to low-flow fixtures. They may be consuming significant amounts of water, typically 6 Litres per flush (LPF) for toilet and 5.7 liters per minute (LPM) for lavatory faucet respectively. No significant water leakage is identified per building operator. An estimate of the base case of water consumption calibrated to annual water bills was completed.

1.2 Description of the Site and Building

Table 6: North Dufferin Community Centre Building Information

Address	706114 Regional Road 21, Mulmur, ON
Building Type	Recreation Facility
Height	Two Floors Above Grade
Parking Description	Outdoor parking spaces
Building Construction Type	Concrete and Wood
Year Constructed	1965
Gross Floor Area (GFA)	27,724 sq. ft.

Building Energy Audit Summary

The following items highlight the key observations of the Energy Audit by subject area.

Energy Audit:	**North Dufferin Community Centre**
Year of Construction	1965
General Description	The North Dufferin Community Center is an arena, with a two-story community centre complete with an ice rink, auditorium, canteen, changerooms, and viewing area. There are 4 changerooms, and 2 smaller changerooms, 2 male and 2 female washrooms. There is a community hall and stage on the 2nd floor above the foyer overlooking the arena. There are 2 main entrances both on the west side of the building. The parking lot is on the west side of the building, shared in part with the fire hall to the north. The building is generally occupied from September when ice making ramps up until the end of April with the facility being used sparingly for special events in the summer.
Building Envelope	Exterior walls are composed of metal siding over insulation and a concrete block back-up wall. Windows are composed of two sets of single pane glazing in metal frames. The Community Centre portion of the building is protected with a flat roof overtop an insulated attic space. The ice rink's is protected by an uninsulated, sloped metal roof with a urethane foam coating to reduce leakage.
Heating, Domestic Hot Water, and Zamboni Hot Water Systems	The domestic hot water heating consists of 1 John Wood oil-fired tank. Common areas at the front of the arena are heated with 2 oil furnaces and duct work to heat the areas. An electric heater is used at the back maintenance and Zamboni area in the wintertime. The Zamboni Hot Water heating consists of an oil-fired hot water tank that is pumped into an insulated holding tank. The holding tank is circulated by a Grundfos pump and the insulated water heater is kept hot by electrical resistance heating.
Cooling System	The building doesn't have central cooling system.
Dehumidification System	The building contains 2 dehumidifiers at opposite corners of the rink.
Ventilation System	The building is equipped with 2 make-up air unit (MUA) with in-direct fuel oil-fired heaters to supply conditioned (heating only) fresh air in heating season to the common areas in the foyer and the auditorium.
Lighting System	Interior Lighting: Most common area lighting on the 1st level including the foyer, front entrance, canteen, changerooms, bathrooms, front entrance, hallways, laundry and stair ways has been converted to electronic ballasts and LED tubes. It is estimated about 75% of lights have been switched to LED. However, some areas are still using fluorescent bulbs so there is still an opportunity for savings by implementing a complete conversion.

Energy Audit:	**North Dufferin Community Centre**
	Exterior Lighting: Consists of 2 mounted 50 w LED fixtures on front face of building, 1 High-Pressure Sodium (HPS) fixtures on a hydro pole, 1 HPS fixture on the exterior wall and 3 wall-mounted LED fixtures. These exterior lights provide lighting to the building and parking area.
Building Automation System (BAS)	There is currently no BAS system in operation.

1.3 Preliminary End Use Analysis

1.3.1 Billing Data Review

Consumption data for 2016 to 2018 was reviewed for Propane, Fuel oil and Electricity. Water bills and consumption for the last year were also reviewed. The following section describes the various charges and consumption related data and discusses trends in the data and opportunities for recommending Energy Efficiency Measures (EEM).

1.3.1.1 Electricity Rates

Table 7: North Dufferin Community Centre Electricity Charges

Charge	Supplier	Current Cost	Forecast Cost c/kwh
Base Electricity Price	Hydro One	2.430	3.013
Global Adjustment	OEB	9.318	11.555
Delivery	Hydro One	0.127	0.157
Regulatory Charges	OEB	0.004	0.005
Debt Retirement Charge	OEB	0.007	0.008
H.S.T.		13%	13%
Total Cost		**13.43**	**16.65**

Electricity rates vary with the Ontario electricity market. Mulmur is currently purchasing energy at an average cost of 2.43 c/kWh. The global adjustment rate varies every month and is difficult to predict a rate going forward. Due to Ontario's Fair Hydro Plan the global adjustment was been reduced. This credit is assumed to continue for the foreseeable future. The global adjustment charge over the past year is currently $9.32 c/kWh; however, electricity rates are expected to increase. Assuming an average rate of increase of 4% the average increase over the next 10 years is 24%. Therefore, multiplying the current cost by 24% yields a forecasted cost of $16.65 kwh.

Table 8: Hydro One Charges General Service Greater than 50 kW

Item	Rates	Unit of Measure	Rate as of Jan 1, 2019
Electricity	RPP – Tiered Rate, Spot Market or Weighted Average Spot Market	Per kWh*	
Delivery	Fixed Monthly Charge	Per Month	$89.48
	Distribution Volume Charge	Per kW	$16.0236
	Transmission Network Charge	Per kW	$1.6048
	Transmission Connection Charge	Per kW	$1.0743
	Line Loss Adjustment Factor		$1.061
Regulatory	Wholesale Market Service Charge	Per kWh*	$0.0030
	Rural Rate Protection Charge	Per kWh*	$0.0005
	SSS Administration Charge	Per Month	$0.25

1.3.2 Fuel Oil Rates

Table 9: Fuel Oil Charges

Description	Charge c/L
Average Cost for 2016	63.1
Average Cost for 2017	76.1
Average Cost for 2018	88.0

Current Cost of Fuel Oil 83 c/L.

1.3.3 Propane Rates

Current Cost of Propane .49 c/L.

1.3.4 Water Rates

There is no municipal water at North Dufferin Community Centre. Groundwater is pumped from a well onsite.

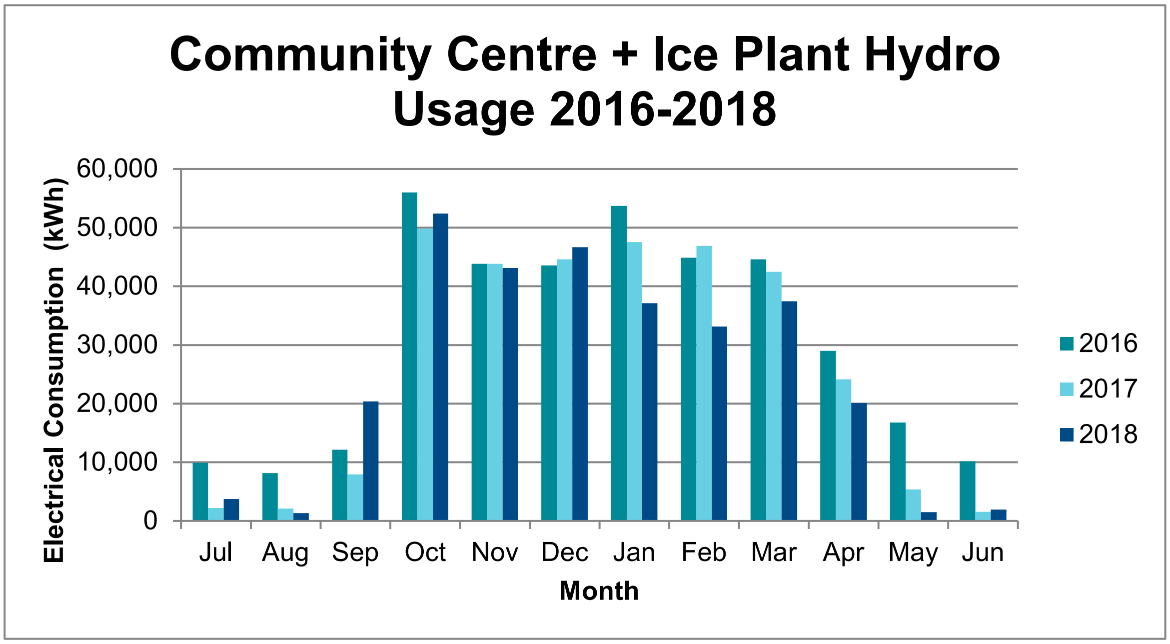
1.3.5 Monthly Energy Usage

Monthly energy data was received from Mulmur. Below in Table 11 Hydro and Fuel consumption tables are shown. The total for Hydro is averaging approximately 330,000 kWh per year for 2016 to 2018. Total fuel oil usage averages approximately 12,000 L per year for 2016 to 2018. Total Propane usage averages approximately 6400 L per year.

Table 10: North Dufferin Community Centre Electricity Consumption Summary

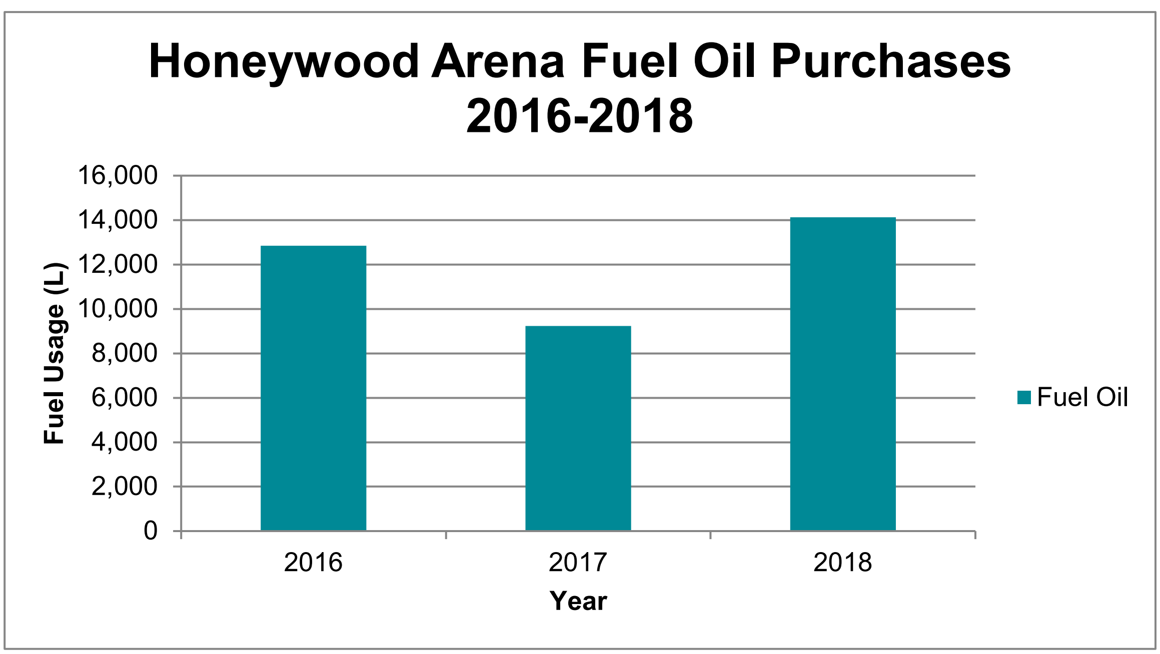
North Dufferin Community Centre - Utilities Summary													
Year Over Year Hydro Consumption in kWh:													
	July	**August**	**September**	**October**	**November**	**December**	**January**	**February**	**March**	**April**	**May**	**June**	**Total**
2016	9,878	8,145	12,122	55,976	43,820	43,560	53,703	44,870	44,597	29,003	16,762	10,167	**372,603**
2017	2,228	2,090	7,924	49,805	43,825	44,600	47,558	46,909	42,451	24,154	5,398	1,544	**318,486**
2018	3,760	1,320	20,381	52,373	43,140	46,680	37,129	33,126	37,440	20,121	1,507	1,940	**298,917**

Figure 1: North Dufferin Community Centre 2016-2018 Hydro Usage



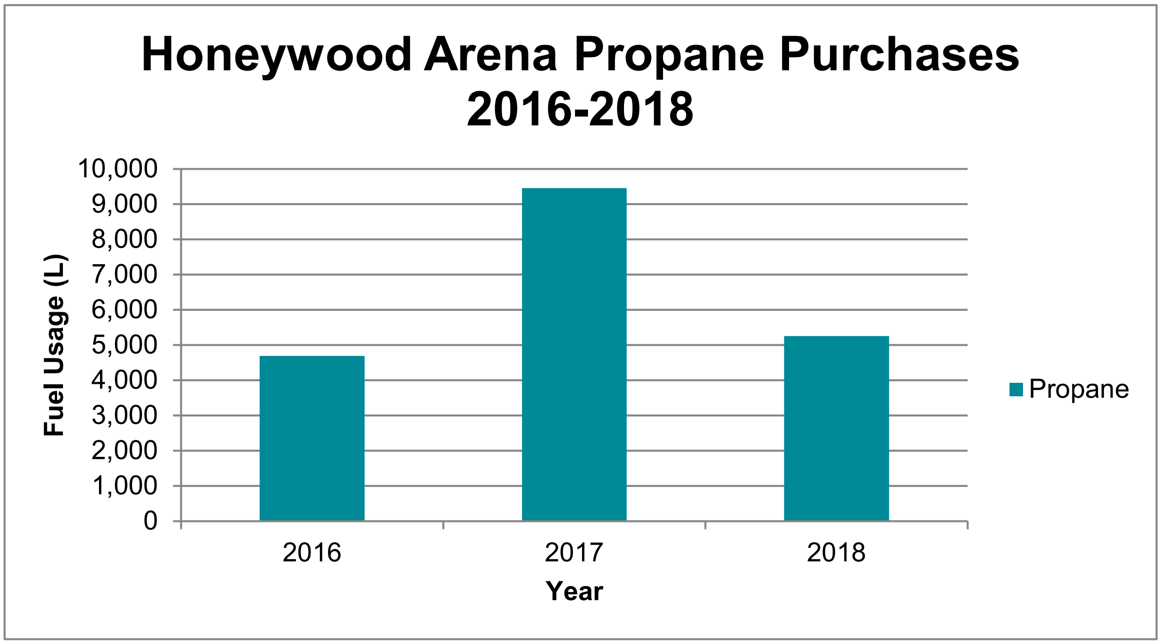
Electricity usage goes up significantly in the winter months as the ice rink is in full operation. The highest usage being in October when ice is being made, and high through November to March when the ice is being used extensively. The total kWh usage in 2018 was approximately 300,00 kwh which is less than 2016, 2017 and the average of the 3 years. This reduction is assumed to be due in large part to the replacement of lighting within the arena to LED. No other large changes in use have been identified during the audit. The average kWh usage per month in 2018 was approximately 24,910 kWh.

Figure 2: North Dufferin Community Centre 2016-2018 Fuel Oil Usage



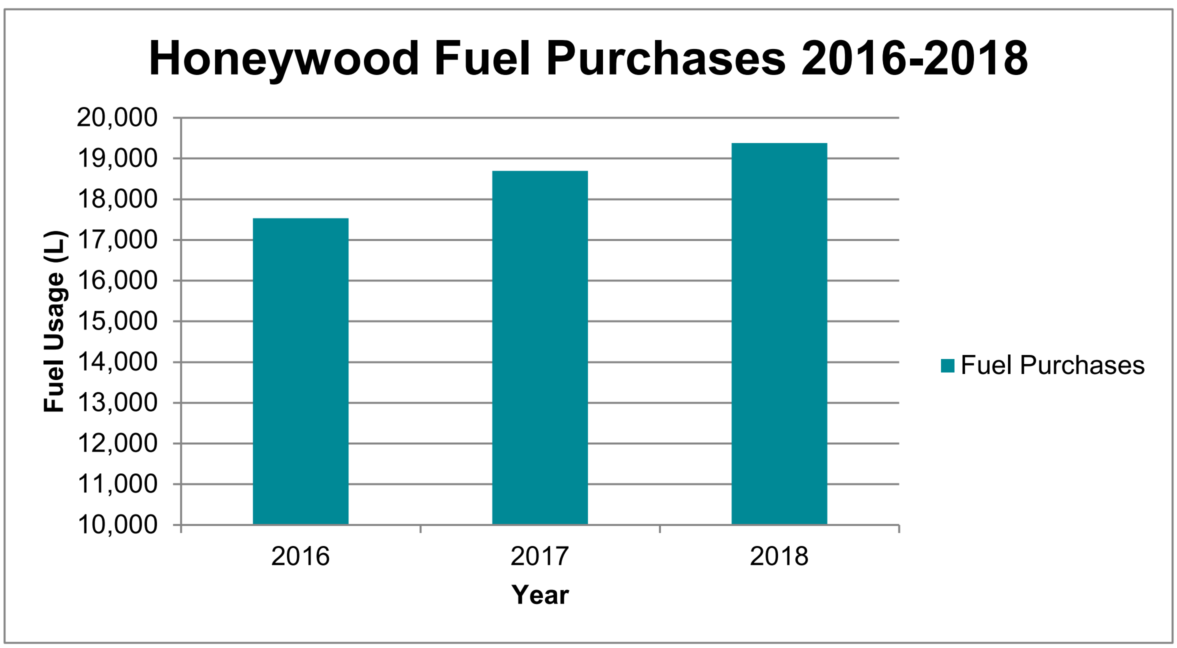
The amount of fuel oil varies year by year and month by month. Fuel oil consumption increases in the winter as fuel oil provides the main source of heat. The average amount of fuel per year is around 12,000 L.

Figure 3: North Dufferin Community Centre 2016-2018 Estimated Propane Usage



The amount of propane varies year by year and month by month. Propane is used to operate the Zamboni as well as the cooking equipment in the canteen. The average amount of propane used per year is around 6,400 L.

Figure 4: North Dufferin Community Centre 2016-2018 Estimated Fuel Usage



The amount of propane and fuel oil varies year by year and month by month, however the total fuel use over 2016-2018 has remained fairly constant. The total L of fuel usage has ranged from approximately 17,500 in 2016 to 19,400 in 2018 for an average amount of approximately 18,500 L.

1.3.6 Fuel Oil Adjusted Baseline for Heating

The average fuel oil consumption from 2016 to 2018 is 12,065 L. Using 2016 to 2018 data, the heating load can be correlated to Heating Degree Data (HDD) to determine the adjusted baseline for an average year. Taking the total fuel and dividing by the heating degree days (HDD) per year gives an average m^3 fuel oil used per HDD as shown in Table 11

Table 11: Average m^3 Consumption Per HDD

Year	Total Fuel Oil (L)	HDD	L/HDD
2016	12841	3,588	3.58
2017	9234	3,734	2.47
2018	14121	4,018	3.51

The average L/HDD can be multiplied by the average HDD per year, which for Mulmur in the last 10 years is approximately 3,855[1]. This results in 12,293 L which is the fuel oil consumption that would be used in an average year. This can be used as the fuel oil consumption baseline.

Table 12: Adjusted Fuel oil Use Baseline

HDD Average	L/HDD	Adjusted Average Fuel Oil (L)
3,855	3.2	12,293

1.3.7 Electricity Adjusted Baseline

The average kWh usage for North Dufferin Community Centre over the last 3 years is 330,002 kWh per year. However, the 2018 performance is likely more indicative of future performance. Occupancy is assumed to have remained constant for the time-period of analysis. Approximately 50% of common areas have been retrofitted to LED; as well as the arena area significantly reducing electricity and total energy consumption. The 2018 usage was 298,917 kWh therefore an approximation of the 2018 electricity usage of 300,000 kWh will be carried forward as the electricity baseline usage.

[1] Environment and Climate Change Canada "Collingwood Historical Heating Degree Days". November 22, 2017. Accessed November 22, 2017. https://sarnia.weatherstats.ca/metrics/hdd.html

1.3.8 Breakdown of Energy Charges and Consumption

Figure 5: North Dufferin Community Centre 2018 Total Energy Usage (kWh)

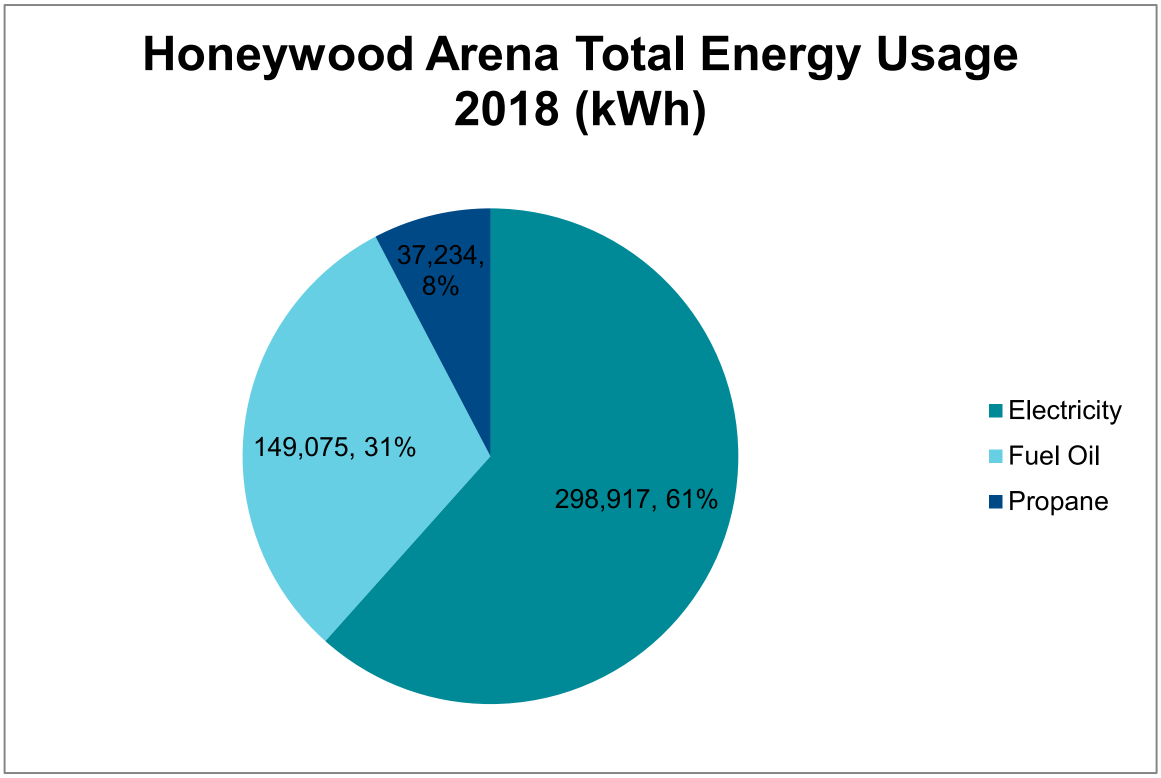
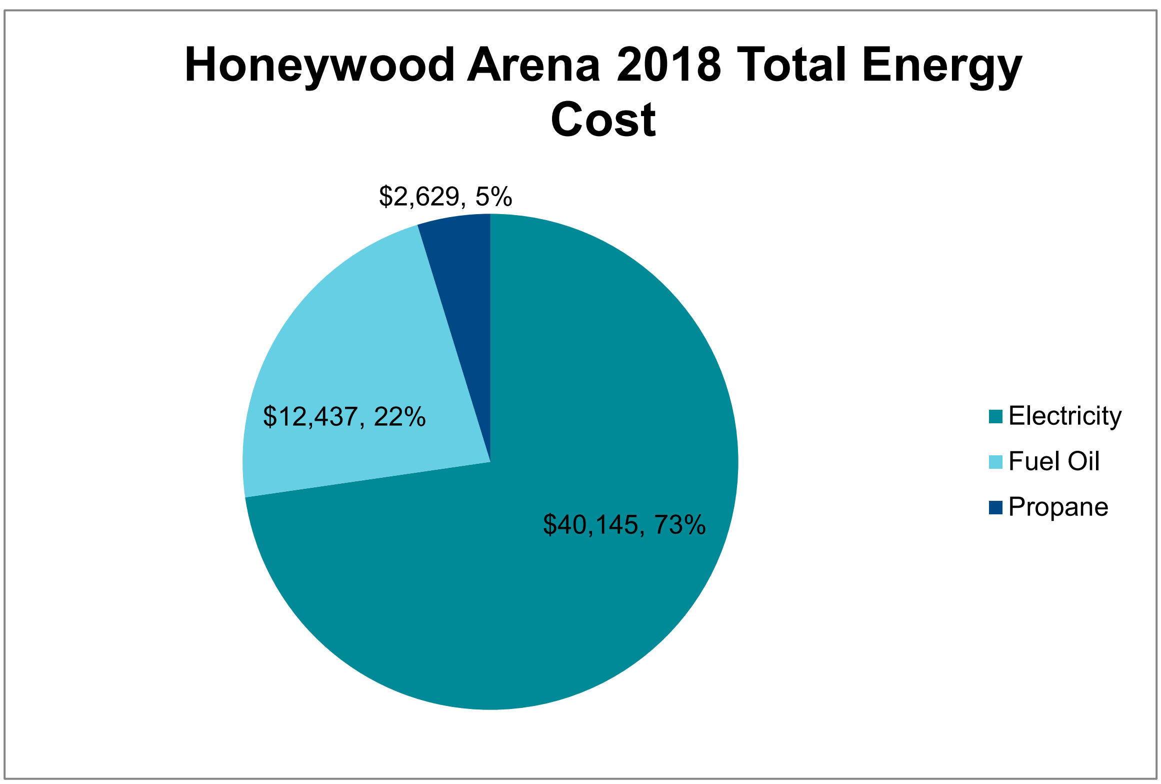


Figure 6: North Dufferin Community Centre Total Energy Cost 2016 to 2017



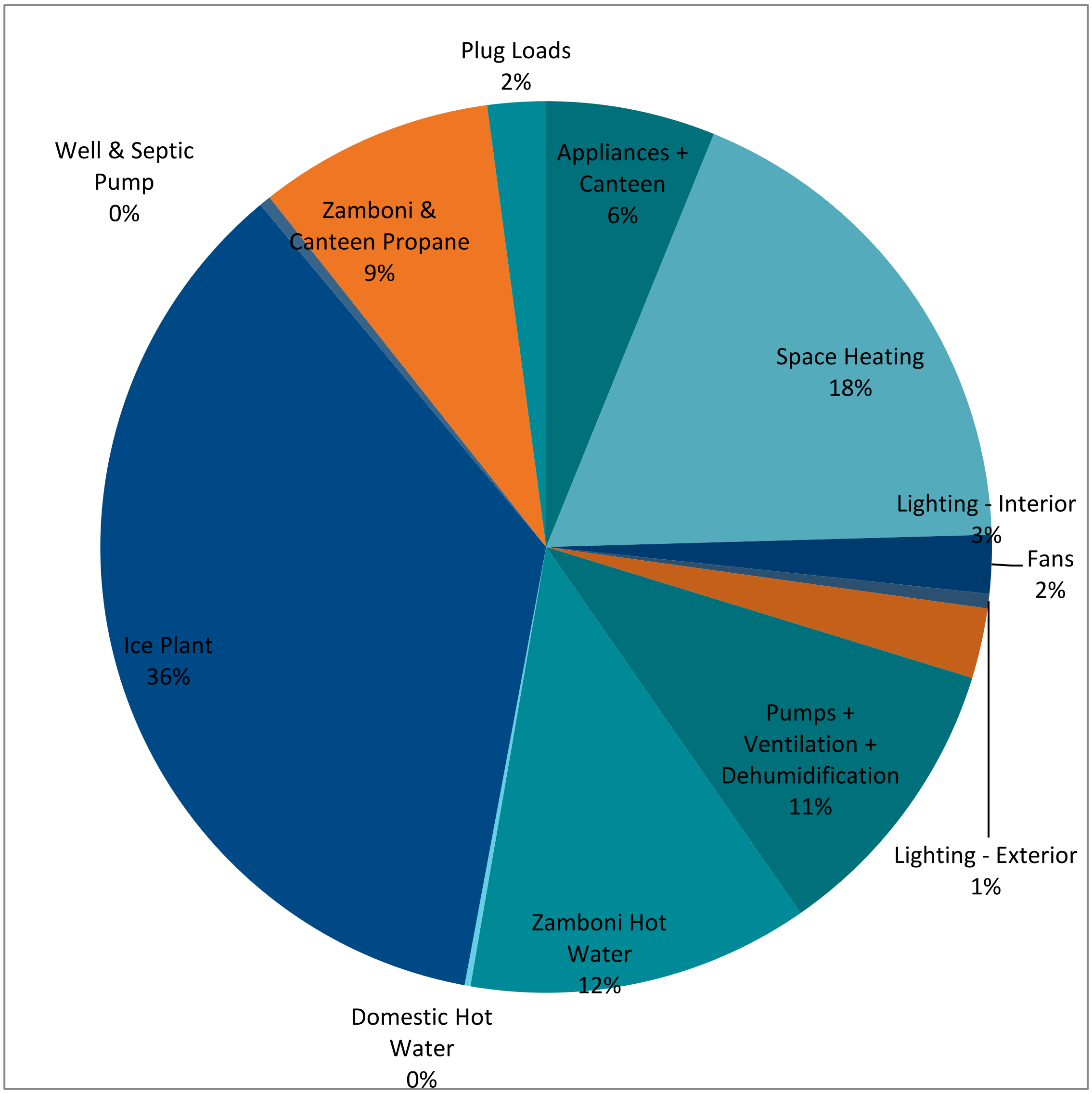
1.3.9 End Use Breakdown

An end use breakdown for all the different uses within the building was estimated and calibrated to the actual usage from the energy bills.

Table 13: Combined kWh Breakdown for North Dufferin Community Centre

End Use	Input Energy Units		Combined Energy Use	
	Electric	Fuel Oil/Propane		
	kWh	kWh	kWh	Percent
Appliances + Canteen	24000	5000	29,000	6%
Space Heating	15000	72000	87,000	18%
Fans	10000		10,000	2%
Lighting - Exterior	2500		2,500	1%
Lighting - Interior	12000		12,000	3%
Pumps + Ventilation + Dehumidification	50000		50,000	11%
Zamboni Hot Water	3500	55000	58,500	12%
Domestic Hot Water	1000		1,000	0%
Ice Plant	170000		170,000	36%
Well & Septic Pump	2000		2,000	0%
Zamboni & Canteen Propane		40312	40,312	9%
Plug Loads	10000		10,000	2%
Total Estimated	**300,000**	**172,312**	**472,312**	**100%**
Historical Billing	**300,000**	**172,000**	**472,000**	
Percent of Actual	**100.0%**	**100.2%**	**100.1%**	
Total per ft^2	**11.5**	**6.6**	**18.0**	

Figure 7: Total kWh by End Use for North Dufferin Community Centre



1.3.10 Energy Benchmark

An energy benchmark is important to compare building usage to similar buildings as well as comparing current usage to past usage. It is an effective way to identify poorly performing buildings, and to establish a baseline for measuring improvement in energy consumptions for all buildings[2]. A rating has been determined from energy star portfolio manager for North Dufferin Community Centre from details about the buildings, utility bills, and regional and climate data. In Appendix A the score of 86 is shown. This means that the arena is operating in the 86th percentile, compared to other buildings, which means it is operating well. Furthermore, some local data was used to benchmark the building against other local arenas. In Figure 8 summary table is below and a copy of the analysis is in Appendix B.

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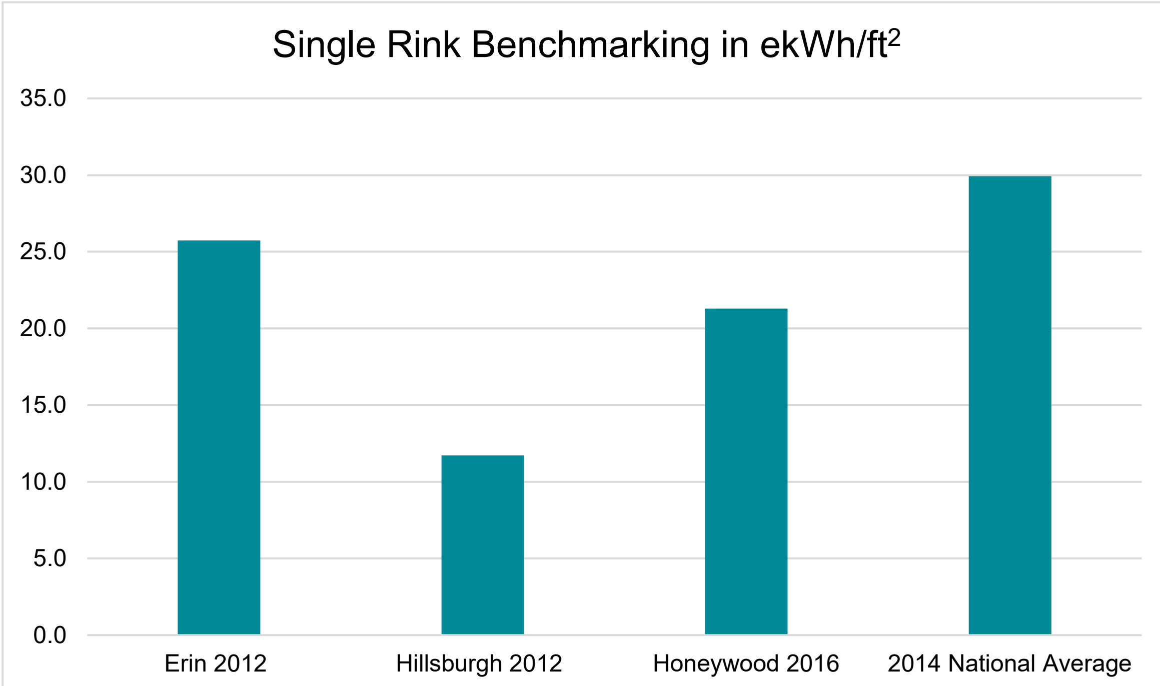
[2] Natural Resources Canada "Energy benchmarking: the basics". Government of Canada June 09, 2017, Accessed November 10, 2017. http://www.nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/building/18260#details-panel20

Figure 8: Total ekWh/ft² by End Use for North Dufferin Community Centre



Per Survey of Energy Consumption of Arenas 2014[3], the Energy Use Index (EUI) Benchmark for similar buildings is 29.9 ekWh/ft². The EUI for North Dufferin Community Centre in 2016 was is 21.3 ekWh/ft². Benchmarking analysis indicates that North Dufferin Community Centre is operating better than average and is in the first quartile relative to the energy efficiency benchmark window. Although, it is operating at a higher energy intensity than Hillsburgh Arena[4]. Currently the Community Centre is operating well from an energy efficiency perspective, however there are still opportunities for energy efficiency, and renewable generation within the arena.

2.0 Building Envelope

2.1 Exterior Cladding System

The building's exterior walls generally consist of a concrete block back-up wall with insulation and metal siding outboard of it. Based on the depth of the window flashing we estimate that insulation is between 100 to 125 mm thick, however destructive openings to confirm the actual thickness were outside the scope of our review.

The windows generally consist of two, single pane operable (horizontal sliding) and fixed windows. The windows appear to be approximately 30 years old and are nearing the end of their service life. The windows separating the Community Centre to the ice rink are single pane in metal frames.

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[3] https://www.nrcan.gc.ca/energy-efficiency/energy-star-benchmarking-commercial-and-institutional-buildings/energy-benchmarking-technical-information/building-energy-use-surveys/19454
4 Data from Burnside Energy Conservation Measures for the Hillsburgh and Erin Community Centre Arenas

Figure 9: North Dufferin Community Centre Exterior Wall Assembly

Figure 10: Common Area Window

Figure 11: Common Area Single Pane Window to Unheated Arena

2.2 Roofing

The Community Centre has both a flat roof, located over the community centre, and a sloped roof supported by wood trusses located above the ice rink. The flat roof has an unheated attic space below it that is insulated with 90 mm [3.5 in.] fibreglass batt insulation in ceiling and wall cavities with wood frame construction. The ice rink roof is uninsulated, the Urethane Foam/Gascosil coating is for leak protection rather than thermal insulation.

Figure 12: Community Centre Attic Space Insulation

Figure 12: Roof Over Rink

3.0 Building Systems

3.1 Lighting Systems

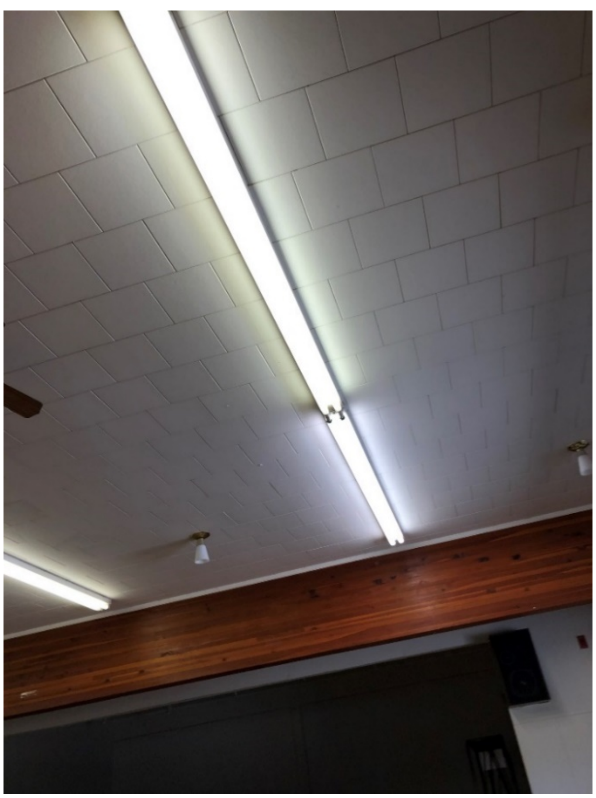
3.1.1 Interior Lighting

Most common area lighting on the first level including the foyer, front entrance, canteen, changerooms, bathrooms front entrance, hallways, laundry and stair ways has been converted to electronic ballasts and LED tubes. It is estimated about 75% of lights have been switched to LED. These retrofits have been completed within the last 3 years. However, some units are still using incandescent, and fluorescent bulbs so there is still a significant opportunity for savings by implementing a complete conversion. The lighting in the rink has been completely converted to LED, and the lighting upstairs in the auditorium is generally still fluorescent. There is no opportunity for improvement in the rink, and in the auditorium, there is limited opportunity as the occupancy of the space is only a few hours per week, not allowing for a benefit to outlay capital.

Figure 13: Changeroom Lighting Example

Figure 14: Rink Lighting

Figure 15: Auditorium Lighting

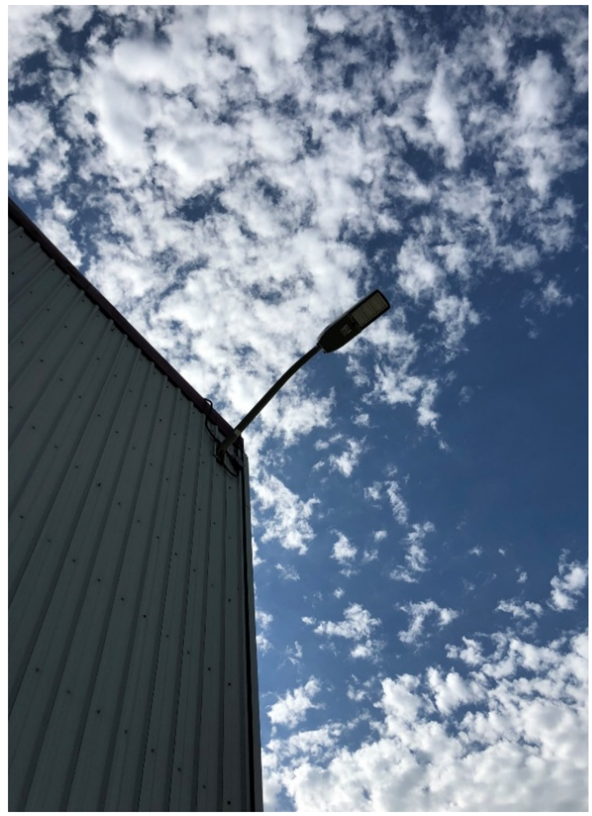


3.1.2 Exterior Lighting

The lighting on the exterior consists of 2 mounted 50 W LED fixtures on front face of building, 1 High-Pressure Sodium (HPS) fixtures on a hydro pole, 1 HPS fixture on the exterior wall and 3 wall-mounted LED fixtures.

Figure 16: HPS Parking Lot Lights

Figure 17: LED Parking Lot Lights



3.2 Mechanical Systems

3.2.1 HVAC System

3.2.1.1 Heating

Common areas at the front of the arena are heated with 2 oil furnaces and duct work to heat the areas. An electric heater is used at the back maintenance and Zamboni area in the wintertime.

Figure 18: Common Area Oil Furnaces

3.2.1.2 Ventilation

The building is not equipped with Ventilation units. Only the fans within the oil furnaces deliver air to the heated common areas.

3.2.1.3 Cooling

There is large fan that is used rarely for ventilation in the rink area only required for fumes that are present from maintenance activities.

3.2.2 Plumbing and Fixtures

Plumbing is mostly original to the building. The 4 changerooms each generally have 1 toilet, 1 sink, and 1 shower. There is also a men's washroom, a women's washroom, a referee's room and a girls changeroom. Upstairs there is a women's and a men's washroom. Upgrades to low flow showerheads and low flow kitchen and bathroom sinks have not taken place.

Figure 19: Typical Changeroom

Figure 20: Typical Sink Fixtures

3.2.3 Domestic Hot Water

The Domestic Hot Water heating consists of 1 John Wood oil-fired tank.

Figure 21: Domestic Hot Water Tank

3.2.4 Zamboni Hot Water

The Zamboni Hot Water heating consists of an oil-fired hot water tank that is pumped into an insulated holding tank. The holding tank is circulated by a Grundfos pump and the insulated water heater is kept hot by electrical resistance heating. The current hot water system is old and showing signs of wear.

Figure 22: Zamboni Hot Water Storage Tank

Figure 23: Zamboni Hot Water Heating Tank and Electrical Heating Wall Mount

3.2.5 Ice Refrigeration System

The ice refrigeration system is ammonia based. The primary refrigeration side consists of 2 compressors, 1 cooling tower/condenser, 1 chiller, circulation pumps and piping. The secondary refrigeration side consists of circulation pumps and the arena slab piping. The refrigeration system was replaced in 2009. Typical ammonia-based refrigeration systems last for 30 years[5]. Therefore, only 1/3 into its useable life it was not analyzed for replacement or major retrofit.

5 https://www.nrcan.gc.ca/energy/efficiency/buildings/research/publications/16002#_Toc364163192

Figure 24: Ice Plant Compressors

Figure 25: Ice Plant

4.0 Occupancy Schedule

Below is the occupancy schedule for North Dufferin Community Centre. Typically, the Arena is used in the winter from September to April and follows this occupancy schedule below.

Table 14: Occupancy Schedule

Zone Name / Description	Winter Operation of North Dufferin Community Centre Occupancy (Number of People) Per Hour							
Days	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**	**Holiday**
0:00 - 1:00								
1:00 - 2:00								
2:00 - 3:00								
3:00 - 4:00								
4:00 - 5:00								
5:00 - 6:00								
6:00 - 7:00							2	2
7:00 - 8:00						2	100	100
8:00 - 9:00						100	100	100
9:00 - 10:00						100	100	100
10:00 - 11:00						100	100	100
11:00 - 12:00						100	100	100
12:00-13:00						100	100	100
13:00-14:00						100	100	100
14:00-15:00						100	100	100
15:00-16:00						100	100	100
16:00-17:00	2	2	2	2	2	100	100	100
17:00-18:00	30	30	30	30	100	125	100	100
18:00-19:00	30	30	30	30	100	125	100	100
19:00-20:00	30	30	30	30	100	125	100	100
20:00-21:00	30	30	30	30	100	125	100	100
21:00-22:00	30	30	30	30	100	125	2	2
22:00-23:00	30	30	30	30	100	125		
23:00-24:00	2	2	2	2	2	2		
Total Showers Estimated	**30**	**12**	**15**	**30**	**30**	**20**	**100**	
	Note: Plus, every other week 50 people for 6 hours in auditorium.							

5.0 Energy Efficiency Measures

5.1 No-Cost/Low-Cost Measures

Please note that savings calculations reflect savings from individual measures only and do not assume that other recommendations have been implemented. Calculations and assumptions used are solely based on the existing equipment and usage schedules.

5.1.1 EEM 1 – Interior Lighting Analysis – LED Lighting

Budget Cost	Annual Utility Savings		MTCDE	Total Savings/Year	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
1,105	1,300	-	-	216.45	390	5.11	6.91

Existing Condition: Inefficient Lighting

Some common area lighting including the foyer, front entrance, changerooms, laundry and stair ways has been converted to electronic ballasts and LED tubes. These retrofits have been completed within the last 3 years. However, some lighting is still fluorescent bulbs so there is still an opportunity for savings by implementing a complete conversion.

Recommendations

Replace existing fluorescent lighting with LED lighting. The replacement LEDs also have a rated lifespan of 45,000 hours versus approximately 20,000 hours for the existing fluorescent lamps, which will help reduce maintenance costs associated with replacing burn outs.

Implementation

Estimate includes the cost for supply of lamps and fixtures and installation. In order to estimate the electric savings assumptions for daily usage were made based on space type. Save on Energy offers incentives for each of these lamps installed and these incentives are included in the price calculations. Further information regarding assumptions and the calculations made for this EEM can be found in Appendix B.

5.1.2 EEM 2 – Exterior Parking Lot Lights - LED Lighting

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
890	964	-		160	100	5.6	6.2

Existing Condition: Inefficient Lighting

Based on a visual inspection from the ground, the lighting on the exterior consists of 2 mounted 30 W LED fixtures on front face of building, 1 High-Pressure Sodium (HPS) fixtures on a hydro pole, 1 HPS fixture on the exterior wall, and 3 wall-mounted LED fixtures.

Recommendations

Replace existing lighting with LED lighting when the lamps burn out. There is a significant cost for a lift truck rental ($500 to 600/day) to reach the height of the lights. Therefore, when the lamps need to be replaced it makes sense to replace the remaining halogen lamps with LED. The replacement LEDs also have a rated lifespan of 45,000 hours versus 2,000 hours for the existing halogen lamps, which will help reduce maintenance costs associated with replacing burn outs. Furthermore, a comment was received at a Public Information Consultation that recommended the lights to be turned off at night. If turning off the lights was acceptable from a safety perspective, there would be additional savings from the reduced electricity during nighttime hours.

5.1.3 EEM 3 – Programmable Thermostats

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
400		1,000	2.5	750	-	0.5	0.5

Existing Condition

Currently the heated portion of the arena is heated at 20°C during the heating season from mid-October to mid-May.

Recommendations

Replace thermostats with programmable thermostats which would reduce costs by about 15% if the heat was turned down from 20°C to 16°C when unoccupied. Calculations are provided in Appendix B. There would be also be electricity savings from a reduced fan operating schedule.

The auditorium of the arena is mostly unoccupied, and the arena's occupied hours are about 70 hours per week. By reducing the temperature in unoccupied spaces and at night significant savings in heating fuel can be made at a low cost.

5.2 Capital Investment Measures

5.2.1 EEM 4 – Building Envelope Analysis – Roof Insulation

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
8,500	0	2,144	6	1,780	0	4.8	4.8

Existing Condition: Low R Value Roof Insulation.

Currently this is just one 3.5 in. layer of insulation in the attic space below the flat roof area with an approximate R-value of R-12.

Recommendations

Blow-in additional insulation into the attic space to bring up to Ontario Building Code (OBC) 2012 requirements of R-50.

5.2.2 EEM 5 – Building Envelope Analysis – New Doors

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
1,500	0	136	0.4	102.8	0	14.6	14.6

Existing Condition: Interior doors from unheated arena to heated foyer have significant air leakage, as well as 1 exterior door on second floor Auditorium.

Recommendations

Replace doors at the end of their useful life with new doors to limit air leakage. The payback is not appealing enough to replace doors before their useful life is over.

5.2.3 EEM 6 – Building Envelope Analysis – New Windows

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
38,000	0	1,075	2.9	806	0	47.1	47.1

Existing Condition: Existing windows between the heated area of the arena and the unheated rink part of the arena are single pane.

Recommendations

Install new windows assumed to be equivalent to thermally unbroken aluminum frame with fixed, double glazing, low-ε=0.2, 12.7 mm argon space, fire rated coating.

5.2.4 EEM 7 – Water Conservation – Low Flow Fixtures

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
1,800	100	571	1.5	490	0	3.7	3.7

Existing Condition: Inefficient Plumbing Fixtures.

Our visual inspection revealed the following:

- The showerheads in the units were rated 2.5 GPM;
- The washroom faucet aerators were rated 2.2 GPM; and
- Kitchen aerators were typically rated at 2.2 GPM.

Recommendations

In order to reduce the water consumption and the energy used for DHW, we recommend the following measures:

- Replace all showerheads as 1.6 GPM (or less) showerheads;
- Replace the existing washroom faucet aerators rated with low-flow aerators rated for 0.5 GPM; and
- Replace the existing kitchen faucet aerators rated with low-flow aerators rated for 1.0 GPM.

Note: The cost of pumping and disinfecting water does not allow for significant cost savings to change to low flow toilets.

5.2.5 EEM 8 – Upgrade Furnace to Higher Efficiency Furnace

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
7,000	-	125	0.3	104	0	67.5	67.5

Existing Condition: Minimal Control of Common Area Heating

The building is equipped with 2 forced air oil furnaces. The furnaces come with one 1/2 HP supply fan. The units provide approximately 1,000 CFM of ventilation each. The supply fan is manually operating at full speed. The current efficiency of both units is assumed to be 84%. Between the two furnaces approximately 5,000 L of oil is used.

Recommendations

When the life of the furnace is over replacement of either a new 90% efficiency oil furnace or a 95% propane furnace should be installed, or an air source or ground source heat pump. A heat pump could offer cost savings as well as air conditioning in the summer for arena activities. Assuming 1 furnace uses approximately 2,500 L of oil, an increase in 5% efficiency saves approximately 125 L. It is not recommended to replace the furnace until useful life is over.

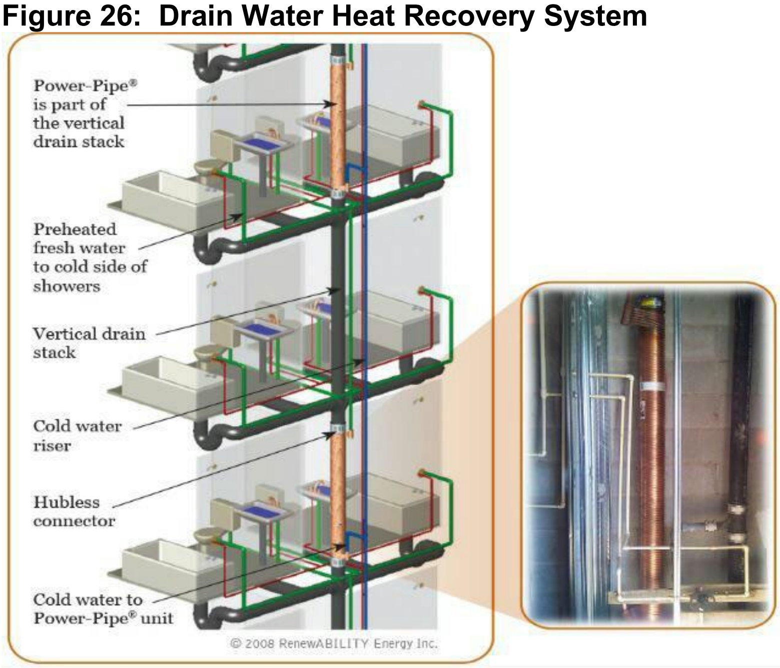
5.2.6 EEM 9 – Drain Water Heat Recovery

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	NG					
$	kWh	m^3	Metric Tons	$	$	Years	Years
4,500	0	367	1.0	304	0	14.8	14.8

Existing Condition: Heat Recovery Opportunity

Drain-water heat exchangers can recover heat from the hot water used in showers, bathtubs, sinks, dishwashers, and clothes washers. They generally have the ability to store recovered heat for later use.

Figure 26: Drain Water Heat Recovery System



Recommendation

Implementing a drain water heat recover system in not recommended as the payback is close to 15 years.

5.2.7 EEM 10 – New Zamboni Hot Water System

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	L	Metric Tons	$	$	Years	Years
8,000	2,600	682	1.8	1,165	0	6.9	6.9

Existing Condition: Inefficient Hot Water System

The Zamboni Hot Water heating consists of an oil-fired hot water tank that is pumped into an insulated holding tank. The holding tank is circulated by a Grundfos pump and the insulated water heater is kept hot by electrical resistance heating. The existing hot water storage tank is large and has inefficient insulation.

Recommendations

Remove the existing storage tank with electrical resistance heating and circulation pump with two 75-gal propane tanks, this will reduce the Arena's electricity bill. New propane heaters are assumed to have greater efficiency than the existing oil furnace, furthermore, propane delivery prices are more economical for the Arena than oil.

5.2.8 EEM 11 – Desuperheater - Heat Recovery

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	m^3	Metric Tons	$	$	Years	Years
42,500		4,470	11.9	3,710		11.5	11.5

Existing Condition: No heat recovery

Currently Zamboni hot water is pumped to the oil heater for heating then into the holding tank circulated and heated by electricity. Compressors within the compressor room give off waste heat that is vented to the outside wasting that energy.

Recommendations

A desuperheater can take the waste heat from the compressors and heat the incoming groundwater from the well. This hot water can be used for the Zamboni hot water rather than heating it with propane. The desuperheater is assumed to be functional to pre-heat the water to 120°Fahrenheit (F) approximately 80% of the time.

Unfortunately, the capital cost is quite high, and the payback period falls outside of 10 years. For that reason, this measure is not recommended at this time. With an incentive from the government this could make this project viable.

5.2.9 EEM 12 – DDC Controller on Refrigeration System

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	m^3	Metric Tons	$	$	Years	Years
45,000	38,500		0	6,000	$3,850	8.2	9.0

Existing Condition: No Automation

The existing refrigeration system was replaced around 2009. There appear to be no automatic controls or setbacks with the system.

Recommendations

There is currently no automation on the refrigeration system. It is recommended to install a seasonal controller with infrared camera as well as a VFD on the condenser FAN motor and a new condenser fan inverter duty motor. The controller can monitor outside temperature and control the refrigeration system for optimal energy use. The controller can also provide the customer with a host of other features like “game mode”, “nighttime set back”, that can also further reduce energy, as well as an interface with remote alarming, plant readings, and temperature control. Based on a discussion with a qualified refrigeration contractor cost savings per year can be between $5,000-$10,000. A conservative estimate of $5,000 was used in analysis. Typically, a save on energy will provide an incentive for $0.10/kwh of energy savings. This is to be confirmed should the project move forward.

5.2.10 EEM 13 – Electric Desiccant Dehumidifier

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	Oil					
$	kWh	m^3	Metric Tons	$	$	Years	Years
40,000	19,000		0	$2,500	$1,900	15.2	16.0

Existing Condition: 1 Mechanical dehumidifier

The arena currently has 2 dehumidifiers, 1 electric desiccant dehumidifier and 1 mechanical dehumidifier (refrigerator coil technology).

Recommendations

Typically, electric desiccant dehumidifiers are 2.5 times more energy efficient than mechanical dehumidifiers. Since the payback with incentives is over 10 years, it is recommended to replace the mechanical dehumidifier when the mechanical dehumidifier is at the end of it's life. Based on a discussion with a qualified contractor cost savings per year can be between $2,500-$4,000. A conservative estimate of $2,500 was used in analysis. Typically, save on energy will provide an incentive for $0.10/kwh of energy savings. This is to be confirmed should the project move forward.

5.3 Distributed Generation/Renewable Energy Measures

5.3.1 EEM 14 – Rooftop Solar with Net Metering Connections

Budget Cost	Annual Utility Savings		MTCDE	Total Savings	Available Incentives	Payback with Incentives	Payback without Incentives
	Electricity	NG					
$	kWh	m^3	Metric Tons	$	$	Years	Years
114,375	228,000	-	-	12,435	-	7.0	9.3

Existing Condition: Renewable Generation

The roof of the building has been considered for a solar PV installation. Applying safety setbacks from roof edges and impacts of shading, the panels are modeled to cover most of the south facing roof area. This space accommodates a total of approximately 190 kW.

Net metering allows you to send electricity generated from Renewable Energy Technologies (RETs) to the distribution system for a credit towards your electricity costs. Excess generation credits can be carried forward for a consecutive 12-month period to offset future electricity costs. Net-metered customers can now pair energy storage with renewable energy systems.

Recommendations

With a total nameplate capacity of approximately 190 kW, and consideration of system losses, the system is modeled to produce approximately 233 MWh of electricity per year. This will offset approximately 77% of the Community Centre's electricity use. With a simple payback on the equity of 9.3 years, Mulmur should consider developing this EEM.

Mulmur should keep an eye on the Climate Action Incentive Fund (CAIF) program outlined in the section below. This fund is scheduled to be announced in late 2019 or early 2020. The current program is for private businesses only. It is the writer's opinion that if a program were to be announced for municipalities as scheduled, that fund would likely be similar by providing 25% of the capital costs in a rebate. This would significantly improve the economics for the Community Centre solar project.

Investigate a loan from Infrastructure Ontario. Infrastructure Ontario states they have flexible terms designed to match the life of the asset. Receiving a loan for 30 years to match the life of the asset at a low interest rate would maximize the return on investment (ROI) of the system.

The Loan Program provides various benefits to public sector borrowers:

- Affordable interest rates;
- Flexible terms of up to 30 years, designed to match the life of the asset;
- Access to dedicated and experienced staff throughout the loan process;
- Instant access to capital markets with no extra fees or commissions; and
- No need to refinance over the life of the loan.

Implementation

The next step would be a structural and roof assessment of the arena, connection feasibility assessment with Hydro One, and create a bid package for installation pricing. A ground mount solar project could also be considered, if Mulmur wanted to dedicate some ground space to solar.

6.0 Incentive Programs

6.1 Climate Action Initiative Fund

The Climate Action Incentive Fund (CAIF) SME Project stream provides support to small- and medium-sized enterprises (SMEs) for retrofit projects in sectors such as building, transportation, industry, waste, agriculture, and more. Up to 25% of the project's total eligible costs are applicable. Project minimum funding is $20,000.00 and maximum is $250,000.00. Currently they are accepting applications.

Eligible project category for building retrofits are below:

Building Retrofits

- Enhancements to building envelope (with direct energy savings), including energy efficient windows/doors/skylights, increased insulation, weatherproofing, and glazing;
- Energy efficient lighting system;
- Heating, ventilation, and air conditioning (HVAC) equipment/systems/controls;
- Water heating retrofits, including high efficiency condensing water heating;
- High-efficiency motors and controls;
- Energy management controls, including building automation systems; and
- Fuel switching to lower emitting energy sources in existing buildings.

Currently this funding is only available for small to medium sized business. However, Funding for municipalities, universities/colleges and hospitals under the Municipalities, Universities, Schools and Hospitals (MUSH) Retrofit stream will be announced later in 2019 to 2020.

Additional information about funding for energy efficiency and retrofit projects will be posted on their website as it becomes available.

Presumably, under the MUSH program the government will announce a similar level of funding for municipalities as private businesses. If that is true and an incentive fund of 25% becomes available some of the measures for Mulmur would become much more appealing. To illustrate this point, a new table of measures has been outlined below with updated payback periods.

6.2 EEMs Recommended with CAIF

If the CAIF was applied for and received for these energy efficiency projects the updated economics are presented in the below table. Including the potential 25 percent savings from the CAIF fund, eight Energy Efficiency Measures (EEMs) are recommended. The annualized savings of all recommendations totals more than $20,706.00 (at projected energy prices). If fully implemented, the average weighted payback period from annual energy savings for these EEMs is estimated to be 6.4 years. Details are outlined in the table below.

Table 15: North Dufferin Community Centre Energy Efficiency Recommendations with CAIF Funding

EEM No.	Energy Efficiency Measure	Measure Type	Approx. Annual Savings	CAIF Incentive	Estimated Net Costs	Simple Payback Years
1	LED Lighting – Interior Lights	Upgrade Building Systems	$216.00	$374.00	$731.00	3.4
2	LED Lighting – Exterior Parking Lot Lights	Upgrade Building Systems	$160.00	$223.00	$568.00	3.5
3	Install Programmable Thermostats	Upgrade Building Systems	$750.00	$100.00	$300.00	0.4
4	Building Envelope Analysis – Roof Insulation	Upgrade Building Envelope	$1,780.00	$2,125.00	$6,375.00	3.6
7	Water Conservation - Low Flow Fixtures	Upgrade Building Systems	$490.00	$450.00	$1,350.00	2.8
10	New Zamboni Hot Water System	Upgrade Building Systems	$1,165.00	$2,000.00	$6,000.00	5.2
11	Desuperheater	Upgrade Building Systems	$3,710.00	$10,625.00	$31,875.00	8.6
12	Controller	Upgrade Building Systems	$5,000.00	$11,250	$29,904	6.0
14	Rooftop Solar	Renewable Technology	$12,435.00	$28,594.00	$85,781.00	6.9
		Totals	**$25,706.00**	**$55,740.00**	**$162,884.00**	**4.5**

6.3 FCM Retrofit of Municipal Facilities

Another program available is the Green Municipal Fund Capital Project: Retrofit of Municipal Facilities. A minimum of 30% energy efficiency of the municipal facility must be met to be approved for this funding with a minimum 20% coming from energy efficiency and 10% from onsite renewable energy. A low-interest loan of up to $5 million and a grant of up to 15% of the loan; to cover up to 80% of eligible costs can be attained.

7.0 Summary

Fourteen separate Energy Efficiency Measures (EEMs) were identified with implementation costs and annual energy savings estimates. Eight Energy Efficiency Measures (EEMs) recommendations were identified with implementation costs and annual energy savings estimates. The annualized savings of all recommendations totals $21,996.00 (at projected energy prices). If fully implemented, the average weighted payback period from annual energy savings for these EEMs is estimated to be 8.0 years. Details are outlined in the tables below.

If all recommendations are implemented a substantial reduction in utility consumption will be achieved. If solar is implemented, the electricity consumption could be close to net zero, and significant savings in fuel savings can be achieved as well approximated at 24% savings.

Table 16: North Dufferin Community Centre Energy Efficiency Recommendations

EEM No.	Energy Efficiency Measure	Measure Type	Approx. Annual Savings	Estimated Net Costs	Simple Payback Years
1	LED Lighting – Interior Lights	Upgrade Building Systems	$216.00	$1,105.00	5.1
2	LED Lighting – Exterior Parking Lot Lights	Upgrade Building Systems	$160.00	$790.00	4.9
3	Install Programmable Thermostats	Upgrade Building Systems	$750.00	$400.00	0.5
4	Building Envelope Analysis – Roof Insulation	Upgrade Building Envelope	$1,780.00	$8,500.00	4.8
7	Water Conservation - Low Flow Fixtures	Upgrade Building Systems	$490.00	$1,800.00	3.7
10	New Zamboni Hot Water System	Upgrade Building Systems	$1,165.00	$8,000.00	6.9
12	DDC Controller	Upgrade Building Systems	$5,000.00	$41,154	8.2
14	Rooftop Solar	Renewable Technology	$12,435.00	$114,375.00	9.2
		Totals	**$21,996.00**	**$180,460.00**	**5.4**

Note: Simple payback is an average of all projects.

Table 17: North Dufferin Community Centre EEMs not Recommended

EEM No.	Energy Efficiency Measure	Measure Type	Approx. Annual Savings	Net Costs	Simple Payback Years
5	Building Envelope Analysis – New Doors	Upgrade Building Envelope	$103.00	$1,500.00	14.6
6	Building Envelope Analysis – New Windows	Upgrade Building Envelope	$806.00	$38,000.00	47.1
8	Upgrade Furnace to Higher Efficiency	Upgrade Building Systems	$104.00	$7,000.00	67.5
9	Drain Water Heat Recovery	Upgrade Building Systems	$304.00	$4,500.00	14.8
11	Desuperheater	Upgrade Building Systems	$3,710.00	$42,500.00	11.5
13	Electric Desiccant Humidifier	Upgrade Building Systems	$2,500	$38,077	15.2
		Totals	**$7,527.00**	**$93,500.00**	**28.4**

Table 18: Summary of Utility Reductions for Recommendations

	Electricity	Oil	GHG Reduction
	kWh	**L**	**MTCDE**
Total 2017/2018 Utility Consumptions	300,000	18,221	49
Percentage Reduction in Utility Consumption	90%	24%	24%
Total Projected Utility Consumptions	31,274	13,824	37

BURNSIDE
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Appendix A

Data

Honeywood Arena Ice Plant 2000 5377 1313
2016 - 2018

Year over year Hydro consumption in kWh:

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2006													**0**
2007													**0**
2008													**0**
2009													**0**
2010													**0**
2011													**0**
2012													**0**
2013													**0**
2014													**0**
2016	8,658	7,385	9,422	52,456	40,000	38,960	51,183	42,270	40,997	26,483	16,042	9,167	**343,023**
2017	1,528	1,273	6,111	46,599	40,000	40,000	43,798	43,289	38,451	22,154	4,838	764	**288,805**
2018	2,292	509	18,843	48,127	38,451	42,016	33,358	29,029	33,358	18,589	764	764	**266,100**

Honeywood Arena Building 2000 6638 4343
2016 - 2018

Year over year Hydro consumption in kWh:

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2006													**0**
2007													**0**
2008													**0**
2009													**0**
2010													**0**
2011													**0**
2012													**0**
2013													**0**
2014													**0**
2016	1,220	760	2,700	3,520	3,820	4,600	2,520	2,600	3,600	2,520	720	1,000	**29,580**
2017	700	817	1,813	3,206	3,825	4,600	3,760	3,620	4,000	2,000	560	780	**29,681**
2018	1,468	811	1,538	4,246	4,689	4,664	3,771	4,097	4,082	1,532	743	1,176	**32,817**

Honeywood Arena Building + Ice Plant 2000 6638 4343 + 2000 5377 1313
2016 - 2018

Year over year Hydro consumption in kWh:

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2006													**0**
2007													**0**
2008													**0**
2009													**0**
2010													**0**
2011													**0**
2012													**0**
2013													**0**
2014													**0**
2016	9,878	8,145	12,122	55,976	43,820	43,560	53,703	44,870	44,597	29,003	16,762	10,167	**372,603**
2017	2,228	2,090	7,924	49,805	43,825	44,600	47,558	46,909	42,451	24,154	5,398	1,544	**318,486**
2018	3,760	1,320	20,381	52,373	43,140	46,680	37,129	33,126	37,440	20,121	1,507	1,940	**298,917**

Year over year Furnace Oil consumption in Litres:

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total	kWh/L	Total kWh
2006													**0**	10.557	0
2007													**0**	10.557	0
2008													**0**	10.557	0
2009													**0**	10.557	0
2010													**0**	10.557	0
2011													**0**	10.557	0
2012													**0**	10.557	0
2013													**0**	10.557	0
2014													**0**	10.557	0
2015/2016												2016	**12,841**	10.557	135,562
2016/2017												2017	**9,234**	10.557	97,483
2017/2018												2018	**14,121**	10.557	149,075

[redacted]

[redacted]

Year over year Propane consumption Estimate in Litres:

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total	kWh/L	Total kWh
2006													**0**	7.08	0
2007													**0**	7.08	0
2008													**0**	7.08	0
2009													**0**	7.08	0
2010													**0**	7.08	0
2011													**0**	7.08	0
2012													**0**	7.08	0
2013													**0**	7.08	0
2014													**0**	7.08	0
2015/2016												2016	**4,695**	7.08	33,241
2016/2017												2017	**9,461**	7.08	66,984
2017/2018												2018	**5,259**	7.08	37,234

[redacted]

[redacted]

Year over year Total Fuel consumption Estimate in Litres:

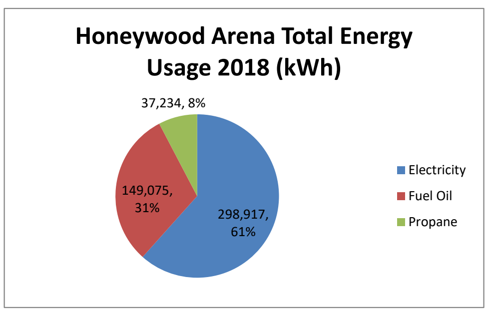
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total	kWh/L	Total kWh
2006													**0**		0
2007													**0**		0
2008													**0**		0
2009													**0**		0
2010													**0**		0
2011													**0**		0
2012													**0**		0
2013													**0**		0
2014													**0**		0
2015/2016												2016	**17,536**	9.63	168,803
2016/2017												2017	**18,695**	8.80	164,467
2017/2018												2018	**19,380**	9.61	186,309

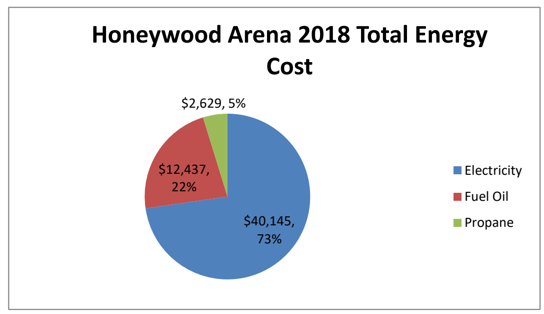
	Input	Output
Propane	1 L Propane	7.08 kWh
Fuel Oil	1 L Fuel Oil	10.57 kWh

Total Energy Use

	2016	2017	2018
Electricity	372,603	318,486	298,917
Fuel Oil	135,562	97,483	149,075
Propane	33,241	66,984	37,234
Total	541,406	482,953	485,226

2018 Energy Cost	
Electricity	$40,145
Fuel Oil	$12,437
Propane	$2,629
	$52,582





NDCC Oil Useage for 2016, 2017, 2018

Date	Litres	Price	Total
12/28/2016	475.2	0.718	341.19
12/28/2016	5.6	0.718	4.02
12/21/2016	544.6	0.709	386.12
12/21/2016	11	0.79	8.69
12/14/2016	25.3	0.701	17.74
12/14/2016	590.1	0.701	413.66
12/7/2016	58.5	0.713	41.71
12/7/2016	1197.7	0.713	853.96
11/25/2016	1500.3	0.689	1,033.71
11/25/2016	361.8	0.689	249.28
9/21/2016	211.5	0.571	120.77
9/21/2016	14.7	0.571	8.39
5/2/2016	1442.6	0.639	921.82
5/2/2016	157.1	0.639	100.39
3/31/2016	668.5	0.689	460.60
3/31/2016	34.1	0.689	23.49
3/18/2016	438.6	0.585	256.58
3/18/2016	93.8	0.585	54.87
3/7/2016	146.4	0.576	84.33
3/7/2016	894.6	0.576	515.29
2/3/2016	681.7	0.565	385.16
2/18/2016	346.3	0.568	196.70
2/18/2016	1024.5	0.568	581.92
2/24/2016	53.5	0.556	29.75
2/24/2016	342.2	0.556	190.26
1/13/2016	13.8	0.572	7.89
1/13/2016	880.4	0.572	503.59
1/22/2016	595	0.54	321.30
1/22/2016	32.5	0.54	17.55
	12,841.90	0.631	8,130.73

Furnace Maintenance

10/3/2016	470.00

11/22/2017	750.9	0.87	653.28
11/22/2017	19.5	0.87	16.97
11/6/2017	466.6	0.804	375.15
11/6/2017	30.5	0.804	24.52
10/4/2017	42.7	0.767	32.75
10/4/2017	1245.8	0.767	955.53
10/25/2017	56.5	0.776	43.84
10/25/2017	464.8	0.776	360.68

Furnace Maintenance

11/1/2017	367.25
10/10/2017	470.00
	837.25

4/6/2017	396.9	0.727	288.55
3/16/2017	700	0.705	493.50
3/7/2017	415.6	0.748	310.87
3/23/2017	74.3	0.699	51.94
3/23/2017	278.9	0.699	194.95
3/29/2017	409.8	0.703	288.09
2/28/2017	306.9	0.751	230.48
2/22/2017	24.6	0.75	18.45
2/22/2017	235.9	0.75	176.93
2/15/2017	350.1	0.738	258.37
2/9/2017	568.3	0.778	442.14
2/9/2017	24.3	0.778	18.91
2/1/2017	838.8	0.738	619.03
1/19/2017	395	0.749	295.86
1/13/2017	8.6	0.75	6.45
1/13/2017	600.3	0.75	450.23
1/6/2017	529	0.788	416.85
	9234.6	0.761	7,024.31

12/7/2018	1350.8	0.816	1,102.25
12/7/2018	442.6	0.816	361.16
11/15/2018	189.6	0.879	166.66
11/15/2018	734.1	0.897	658.49
11/2/2018	2275.2	0.926	2,106.84
11/2/2018	466.3	0.926	431.79
4/26/2018	423	0.921	389.58
4/26/2018	176.7	0.921	162.74
4/18/2008	1129.7	0.887	1,002.04
3/29/2018	443.1	0.904	400.56
3/29/2018	44.5	0.904	40.23
3/19/2018	1065.1	0.854	909.60
3/19/2018	209.9	0.854	179.25
2/28/2018	918.8	0.881	809.46
2/28/2018	249.5	0.881	219.81
2/14/2018	290.8	0.832	241.95
2/9/2018	327.25	0.858	280.78
2/9/2018	1762.2	0.858	1,511.97
1/16/2018	1622.6	0.901	1,461.96
	14121.75	0.880	12,437.13

Furnace Maintenance	
3/8/2018	295.00
12/10/2018	269.99
12/10/2018	269.99
12/20/2018	154.91
12/20/2018	564.47
	1,554.36

Year	Total Cost	Furnace Oil Cost	Propane Cost	Assumed Cost/L	Propane L
2016	$ 10,009	8,130.73	$ 1,878.27	0.4	4695.7
2017	$ 11,282	7,024.31	$ 4,257.69	0.45	9461.5
2018	$ 15,067	12,437.13	$ 2,629.87	0.5	5259.7
Average		$ 9,197.39	$ 2,921.95		6472.3

NDCC Board of Management
2018 Budget

Account	Description	2016 Actual	2016 Budget	2017 Actuals	2017 Budget	2018 Draft 1	2018 Draft 2	Budget Change	Comments
01-2000-4000	MULMUR GRANT	(27,000)	(27,000)	(47,240)	(47,240)	(20,758)	(25,042)	*22,199*	
01-2000-4010	MELANCTHON GRANT	(17,500)	(17,500)	(17,500)	(17,500)	(20,758)	(25,042)	*(7,542)*	
01-2000-4020	DONATION REVENUE	(7,200)	0	0	0	0	0	*0*	
01-2000-4030	FUNDRAISING REVENUE	(19,922)	(14,500)	(17,382)	(19,380)	(20,000)	(20,000)	*(620)*	Incl. BBQ
01-2000-4100	MINOR RATE RENTAL REVENUE	(55,131)	(53,997)	(48,069)	(56,300)	(50,000)	(45,000)	*11,300*	half the year at lower amt so next yr lower
01-2000-4110	ICE RENTAL REVENUE (PRIME)	(44,955)	(50,719)	(50,442)	(42,000)	(49,000)	(52,000)	*(10,000)*	renting more to other groups
01-2000-4115	ICE RENTAL REVENUE (NON-PRIME)	(1,301)	(1,200)	(743)	(500)	(500)	(500)	*0*	
01-2000-4120	NON-RESIDENT USER FEES	(3,044)		(3,396)	(2,250)	(3,000)	(3,000)	*(750)*	
01-2000-4200	BOOTH RENTAL REVENUE	(4,331)	(5,000)	(5,328)	(5,000)	(4,300)	(4,300)	*700*	includes $1000 for Strawberry supper
01-2000-4210	HALL RENTAL REVENUE	(2,628)	(2,400)	(2,850)	(2,400)	(2,400)	(2,600)	*(200)*	
01-2000-4220	FLOOR RENTAL REVENUE	(372)	(100)	0	(100)	(100)	0	*100*	
01-2000-4230	SIGN RENTAL REVENUE	(4,168)	(4,200)	(4,160)	(4,500)	(4,160)	(4,160)	*340*	
01-2000-4240	VENDING MACHINE REVENUE	(304)	(300)	(251)	(300)	(300)	(250)	*50*	
01-2000-4300	PENALTIES & INTEREST	(885)	(300)	(527)	(450)	(525)	(525)	*(75)*	
01-2000-7000	WAGES	50,561	47,000	42,898	50,000	50,000	45,000	*(5,000)*	
01-2000-7005	BENEFITS-EI/CPP/WSIB/EHT	5,969	5,000	5,192	5,600	6,000	5,600	*0*	
01-2000-7010	BENEFITS-OMERS	590		2,913	4,500	0	3,000	*(1,500)*	
01-2000-7015	STAFF TRAINING/DUES, FEES, SUBSCRIP	303	0	145	484	300	300	*(184)*	billed from County at end of year
01-2000-7100	OFFICE/COMPUTER SUPPLIES	480	100	1,171	1,680	730	730	*(950)*	
01-2000-7110	COMMUNICATION	2,422	1,553	3,075	1,500	2,425	3,000	*1,500*	incls advertising, phone, internet, 1 email acct $73.20
01-2000-7115	INSURANCE	20,605	19,000	16,445	21,225	12,200	12,200	*(9,025)*	RFQ large decrease in insurance
01-2000-7120	HEALTH & SAFETY	2,527	3,248	2,723	2,800	2,600	2,800	*0*	billed from County at end of year
01-2000-7125	PROF FEES - AUDIT	1,120	1,089	1,153	1,075	1,120	1,188	*113*	
01-2000-7130	PROF FEES - WATER TESTING	300	300	300	300	300	300	*0*	
01-2000-7150	BANK CHARGES	251	500	108	250	25	500	*250*	
01-2000-7200	HYDRO	78,970	56,206	58,050	56,206	56,500	60,000	*3,794*	increase in hydro rates
01-2000-7210	FURNACE FUEL/ZAMB PROPANE	10,009	16,240	11,282	9,000	10,000	12,000	*3,000*	
01-2000-7220	BLDG/GROUNDS MAINTENANCE	16,489	12,180	15,863	14,500	14,000	15,000	*500*	Includes grounds mtne, snow removal
01-2000-7230	BOOTH MAINTENANCE	1,048	1,300	1,280	1,300	1,100	1,300	*0*	
01-2000-7240	ICE PLANT/MACH MAINT	15,406	6,000	8,581	12,000	8,000	9,000	*(3,000)*	
01-2000-7300	FUNDRAISING EXPENSE	10,395	7,500	7,324	10,500	10,500	10,500	*0*	Incl. BBQ
01-2000-7400	BAD DEBT	26		33	0	0	0	*0*	
01-2000-6010	TSFR TO REC RESERVES			5,000	5,000				
01-2000-6015	TSFR TO BLDG RESERVES			1,105	0				
	Amount needed	28,732	0	(13,245)	0	41,515	50,083		

7.6.4

FEB - 8 2018

MARCH 8, 2018

NDCC Board of Management

2020 Budget

Account	Description	2018 Actuals	2018 Budget	2019 Actual	2019 Budget	Draft #1 2020 Budget	Draft #2 2020 Budget	Budget Variance	Comments
REVENUES									
01-2000-4000	MULMUR GRANT	25,277	25,277	40,966	55,024	49,262	48,812	(6,212)	-10.47%
01-2000-4010	MELANCTHON GRANT	25,277	25,277	40,966	55,024	49,262	48,812	(6,212)	-10.47%
01-2000-4020	DONATION REVENUE	100	-	-	-			0	
01-2000-4030	FUNDRAISING REVENUE	20,273	20,000	19,047	20,000	20,000	20,000	0	BBQ, Straw. Supper
01-2000-4100	MINOR RATE RENTAL REVENUE	45,901	45,000	26,079	45,000	45,000	45,000	0	
01-2000-4110	ICE RENTAL REVENUE (PRIME)	47,663	52,000	25,342	52,000	51,000	51,000	(1,000)	
01-2000-4115	ICE RENTAL REVENUE (NON-PRIME)	697	500	186	500	500	500	0	
01-2000-4120	NON-RESIDENT USER FEES	3,578	3,000	2,617	3,250	3,250	3,250	0	
01-2000-4200	BOOTH RENTAL REVENUE	3,561	4,300	1,120	5,000	3,500	3,500	(1,500)	
01-2000-4210	HALL RENTAL REVENUE	2,230	2,600	3,035	2,600	2,600	2,600	0	
01-2000-4220	FLOOR RENTAL REVENUE	463	-	-	-			0	
01-2000-4230	SIGN RENTAL REVENUE	3,980	4,160	3,620	4,160	3,700	3,700	(460)	
01-2000-4240	VENDING MACHINE REVENUE	238	250	109	-	-	-	0	
01-2000-4300	PENALTIES & INTEREST	773	525	451	525	676	788	263	
01-2000-4500	PRIOR YEAR DEFICIT			(29,582)	(29,582)			29,582	
	TOTAL REVENUE	180,011	182,888	133,955	213,500	228,750	227,961		
EXPENSES	$12,000 on fuel oil -> $3000 on Zamboni Propane								
01-2000-7000	WAGES	52,760	45,000	36,634	55,000	65,000	65,000	10,000	based on 2018/19 actuals
01-2000-7005	BENEFITS-EI/CPP/WSIB/EHT	5,066	5,600	3,510	5,600	5,600	5,600	0	
01-2000-7010	BENEFITS-OMERS	1,740	3,000	-	-	4,950	4,950	4,950	OMERS must be offered
01-2000-7015	STAFF TRAINING/DUES, FEES, SUBSCRIP	1,556	300	940	300	1,000	1,000	700	
01-2000-7100	OFFICE/COMPUTER SUPPLIES	1,901	1,200	1,823	1,700	2,000	2,000	300	
01-2000-7110	COMMUNICATION	2,512	3,000	1,378	3,000	3,000	3,000	0	
01-2000-7115	INSURANCE	11,763	12,200	12,518	12,200	13,300	13,300	1,100	
01-2000-7120	HEALTH & SAFETY	2,087	2,800	39	2,800	2,500	2,500	(300)	billed at y/e
01-2000-7125	PROF FEES - AUDIT	1,403	1,188	-	1,400	1,400	611	(789)	per quote
01-2000-7130	PROF FEES - WATER TESTING	232	300	168	300	300	300	0	
01-2000-7150	BANK CHARGES	388	500	302	400	500	500	100	
01-2000-7200	HYDRO	55,360	60,000	24,049	60,000	60,000	60,000	0	
01-2000-7210	FURNACE FUEL/ZAMB PROPANE	15,067	12,000	8,792	12,000	15,000	15,000	3,000	
01-2000-7220	BLDG/GROUNDS MAINTENANCE	23,665	15,000	9,044	20,000	17,400	17,400	(2,600)	
01-2000-7230	BOOTH MAINTENANCE	4,462	1,300	404	1,300	1,300	1,300	0	
01-2000-7240	ICE PLANT/MACH MAINT	18,771	9,000	3,334	12,000	10,000	10,000	(2,000)	
01-2000-7300	FUNDRAISING EXPENSE	10,859	10,500	9,965	10,500	10,500	10,500	0	
01-2000-7400	BAD DEBT	0	-	203	-	-	-	0	
01-2000-7500	CAPITAL PURCHASES	0		-	15,000	15,000	15,000	0	
	TOTAL EXPENSES	209,593	182,888	113,103	213,500	228,750	227,961	14,461	6.77%
	Net Income/(Deficit)	(29,582)	0	20,852	0	0	0		

Operating Reserve Continuity	2018	2019	2020
Opening Reserve Balance	-	40,000	40,000
Operating Levy Mulmur	20,000	-	-
Operating Levy Melancthon	20,000	-	-
Ending Reserve Balance	40,000	40,000	40,000

GB# 1.4

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Appendix B

Calculations

Appendix B

Appendix B1 EEM1 Interior Light Calculation

Honeywood Arena

Current Fixtures

	Area	Fixture Type	Number of Lamps in the Fixture	Type of Lamp	# Fixtures	KW/Fixture	hrs/day	Peak Demand (KW)	kwh/day	working days	kwh/year	$/kwh (variable)	cost per year
1	FOYER	A1	2x28	28w Fluorescent	3	0.06	10	0.18	1.80	250	450.00	0.1665	$74.93
2		B	2x10	10w led	9	0.02	10	0.18	1.80	250	450.00	0.1665	$74.93
3	4 Change Rooms	A	2x28	28w Fluorescent	4	0.06	10	0.24	2.40	250	600.00	0.1665	$99.90
4		B	2x10	10w led	4	0.02	10	0.08	0.80	250	200.00	0.1665	$33.30
5	GIRLS CHANGE ROOM	A	2x28	28w Fluorescent	2	0.06	10	0.12	1.20	250	300.00	0.1665	$49.95
6	MENS & WOMENS BATHROOM	A	2x28	28w Fluorescent	2	0.06	10	0.12	1.20	250	300.00	0.1665	$49.95
7	OFFICE & REFFERES ROOM	A	2x28	28w Fluorescent	2	0.06	10	0.12	1.20	250	300.00	0.1665	$49.95
8	CANTEEN	C	4X32	32w Fluorescent	3	0.128	12	0.38	4.61	110	506.88	0.1665	$84.40
9		G	1x100	100w Incandescent	2	0.1	12	0.20	2.40	110	264.00	0.1665	$43.96
10	ICE RINK	A	4x10	9w LED	50	0.04	10	2.00	20.00	250	5000.00	0.1665	$832.50
11	Maintenance area	A	2x10	2x10 watt	4	0.02	10	0.08	0.80	250	200.00	0.1665	$33.30
12	Auditorium	D	2x32	2x32 w flourescent	18	0.064	10	1.15	11.52	20	230.40	0.1665	$38.36
13	Auditorium Kitchen	C	4X32	32w Fluorescent	3	0.128	10	0.38	3.84	20	76.80	0.1665	$12.79
								4.86	**49.73**		**8801.28**		**$1,427.05**

New Fixtures

	Area	Fixture Type	Number of Lamps in the Fixture	Type of Lamp	# Fixtures	KW	hrs/day	Peak Demand (KW)	kwh/day	working days	kwh/year	$/kwh (variable)	cost per year
1	FOYER	A1	2x28	10w led	3	0.02	10	0.06	0.60	250	150.00	0.1665	$24.98
2		A1	2x10	10w led	9	0.02	10	0.18	1.80	250	450.00	0.1665	$74.93
3	4 Change Rooms	A1	2x28	10w led	4	0.02	10	0.08	0.80	250	200.00	0.1665	$33.30
4		A1	2x10	10w led	4	0.02	10	0.08	0.80	250	200.00	0.1665	$33.30
5	GIRLS CHANGE ROOM	A1	2x28	10w led	2	0.02	10	0.04	0.40	250	100.00	0.1665	$16.65
6	MENS & WOMENS BATHROOM	A1	2x28	10w led	2	0.02	10	0.04	0.40	250	100.00	0.1665	$16.65
7	OFFICE & REFFERES ROOM	A1	2x28	10w led	2	0.02	10	0.04	0.40	250	100.00	0.1665	$16.65
8	CANTEEN	C	4X32	32w Fluorescent	3	0.128	12	0.38	4.61	110	506.88	0.1665	$84.40
9		G	1x100	100w Incandescent	2	0.1	12	0.20	2.40	110	264.00	0.1665	$43.96
10	ICE RINK	A	4x10	9w LED	50	0.04	10	2.00	20.00	250	5000.00	0.1665	$832.50
11	Maintenance area	A	2x10	2x10 watt	4	0.02	10	0.08	0.80	250	200.00	0.1665	$33.30
12	Auditorium	D	2x32	2x32 w flourescent	18	0.064	10	1.15	11.52	20	230.40	0.1665	$38.36
13	Auditorium Kitchen	C	4X32	32w Fluorescent	3	0.128	10	0.38	3.84	20	76.80	0.1665	$12.79
								4.72	**48.37**		**7578.08**		**$1,261.75**

Savings 4 Lamp Replacement

		Savings and Payback	Number of Lamps in the Fixture	Type of Lamp	# Fixtures	KW	hrs/day	Peak Demand (KW)	kwh/day	working days	kwh/year	$/kwh (variable)	Savings	Material Cost	Fixture Cost Total	Incentive per fixture	Incentive Total	Labour/ fixture	Labour	Total Cost w/o Incentives	Total Cost w/ Incentives	Simple Payback
1	FOYER	A1	2x28	10w led	3	0.04	10	0.12	1.20	250	300.00	0.1665	$49.95	$75.00	$225.00	$30.00	$90.00	$40.00	$120.00	$345.00	$255.00	5.11
2		A1	2x10	10w led	9	0	10	0.00	0.00	250	0.00	0.1665	$0.00									
3	4 Change Rooms	A1	2x28	10w led	4	0.04	10	0.16	1.60	250	400.00	0.1665	$66.60	$75.00	$300.00	$30.00	$120.00	$40.00	$160.00	$460.00	$340.00	5.11
4		A1	2x10	10w led	4	0	10	0.00	0.00	250	0.00	0.1665										
5	GIRLS CHANGE ROOM	A1	2x28	10w led	2	0.04	10	0.08	0.80	250	200.00	0.1665	$33.30	$75.00	$150.00	$30.00	$60.00	$40.00	$80.00	$230.00	$170.00	5.11
6	MENS & WOMENS BATHROOM	A1	2x28	10w led	2	0.04	10	0.08	0.80	250	200.00	0.1665	$33.30	$75.00	$150.00	$30.00	$60.00	$40.00	$80.00	$230.00	$170.00	5.11
7	OFFICE & REFFERES ROOM	A1	2x28	10w led	2	0.04	10	0.08	0.80	250	200.00	0.1665	$33.30	$75.00	$150.00	$30.00	$60.00	$40.00	$80.00	$230.00	$170.00	5.11
8	CANTEEN	C	4X32	32w Fluorescent	3	0	12	0.00	0.00	110	0.00	0.1665										
9		G	1x100	100w Incandescent	2	0	12	0.00	0.00	110	0.00	0.1665										
10	ICE RINK	A	4x10	9w LED	50	0	10	0.00	0.00	250	0.00	0.1665										
11	Maintenance area	A	2x10	2x10 watt	4	0	10	0.00	0.00	250	0.00	0.1665										
12	Auditorium	D	2x32	2x32 w flourescent	18	0	10	0.00	0.00	20	0.00	0.1665										
13	Auditorium Kitchen	C	4X32	32w Fluorescent	3	0	10	0.00	0.00	20	0.00	0.1665										
								0.52	**5.2**				**$216.45**				**$390.00**			**$1,495.00**	**$1,105.00**	**5.11**

Payback without incentives

1 year savings	$216.45
Implementation cost	$1,495.00
Simple Payback (years)	6.91

Payback with incentives

1 year savings	$216.45
Implementation cost	$1,105.00
Simple Payback (years)	5.11

Appendix B2 EEM2 Exterior Light Calculation

Exterior Lighting Honeywood Arena

Current Fixtures

	Area	Fixture Type	Number of Lamp in the Fixture	Type of Lamp	# Fixtures	KW	hrs/day	Peak Demand (KW)	kwh/day	working days	kwh/year	$/kwh (variable)	cost per year
1	Exterior Lighting	J	1x70	70w HPS	1	0.07	12	0.07	0.84	365	306.60	0.1665	$51.05
2	Exterior Lighting	L	1x250	250w HPS	1	0.25	12	0.25	3.00	365	1,095.00	0.1665	$182.32
3	Exterior Lighting	P	1x25	30w LED	2	0.03	12	0.06	0.72	365	262.80	0.1665	$43.76
4	Wall Packs	Z	1x14	LED Wall pack	3	0.014	12	0.04	0.50	365	183.96	0.1665	$30.63
								0.32	**3.84**		**1,848.36**		**$233.37**

New Fixtures

	Area	Fixture Type	Number of Lamp in the Fixture	Type of Lamp	# Fixtures	KW	hrs/day	Peak Demand (KW)	kwh/day	working days	kwh/year	$/kwh (variable)	cost per year
1	Exterior Lighting	J	1x30	LED Bulb	1	0.03	12	0.03	0.36	365	131.40	0.1665	$21.88
2	Exterior Lighting	L	1x70	LED Bulb	1	0.07	12	0.07	0.84	365	306.60	0.1665	$51.05
								0.10	**1.20**		**438.00**		**$72.93**

Need to add boom truck or discuss boom truck

Savings 4 Lamp Replacement

		Savings and Payback	Number of Lamp in the Fixture	Type of Lamp	# Fixtures	KW	hrs/day	Peak Demand (KW)	kwh/day	working days	kwh/year	$/kwh (variable)	Savings	Material Cost	Fixture Cost Total	Incentive per fixture	Incentive Total	Labour/ fixture	Lift Rental	Labour	Total Cost w/o Incentives	Total Cost w/ Incentives	Simple Payback
1	Exterior Lighting	J	1x70	LED Bulb	1	0.07	12	0.04	0.48	365	175.20	0.1665	$29.17	$200.00	$200.00	$25.00	$25.00	$120.00	$500.00	$120.00	$320.00	$295.00	10.11
2	Exterior Lighting	L	1x250	LED Bulb	1	0.25	12	0.18	2.16	365	788.40	0.1665	$131.27	$600.00	$600.00	$75.00	$75.00	$70.00		$70.00	$670.00	$595.00	4.53
								0.22			**963.60**		**$160.44**				**$100.00**			**$190.00**	**$990.00**	**$890.00**	**5.55**

Payback without incentives

1 year savings	$160.44
Implementation cost	$990.00
Simple Payback (years)	6.17

Payback with incentives

1 year savings	$160.44
Implementation cost	$890.00
Simple Payback (years)	5.55

Heating Power | Include measure? Comparison | Dashboard... End-use... Target... Steps... | Show image | Copy base to proposed | Window properties

-use | Step 4 - Optimize supply | Step 5 - Summary | Options

Appendix B3 EEM3 Programmable Thermostat

Subscribe

Building envelope

Description	Building envelope
Note	

Building envelope

		Base case	Proposed case
Building north	°	350	350
Schedule		24/7	Schedule
Incremental initial costs	$		

	Unit	North	East	South	West	North	East	South	West
Walls									
Area	m²	72	180	72	180	72	180	72	180
Net area	m²	68.4	162	68.4	171	68.4	162	68.4	171
U-value	(W/m²)/°C	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Incremental initial costs	$								
Windows									
Area	%	5%	10%	5%	5%	5%	10%	5%	5%
R-value	m² - °C/W								
Solar heat gain coefficient									
Incremental initial costs	$								
Solar shading - season of use									
Solar shading - winter	%								
Solar shading - summer	%								
Incremental initial costs	$								

Doors

	Unit	Base case	Proposed case
Roof			
Area	ft²	4,000	4,000
U-value	(W/m²)/°C	0.5	0.5
Incremental initial costs	$		

Skylight

Floor

Wall - below-grade

Floor - below-grade

Natural air infiltration

	Unit	Base case	Proposed case	Energy saved
Method		Calculated		
Walls		Medium	Medium	
Window		Medium	Medium	
Doors		Medium	Medium	
Natural air infiltration	L/s	269	269	
Incremental initial costs	$			
Incremental initial costs - total	$		0	
Incremental O&M savings	$			
Number of building envelope units		1	1	
System selection		Heating	Heating	
Heating system		Furnace	Furnace	
Heating	kWh	70,071	59,133	10,938
				15.6%

Appendix B4 EEM4 Roof Insulation

Heat Profile for Lobby to Exterior

Month	Time (hr)	Avg. Exterior[1] (°C)	Annual Heating ΔT between Interior and Exterior: T_{int}[2] (°C)	$\Delta T_{int\text{-}ext}$ (K)	$\Delta T_{int\text{-}ext}\cdot$Time (K·h)
January	744	-9	20	29	21576
February	672	-8.4	20	28.4	19085
March	744	-3.1	20	23.1	17186
April	720	4.4	20	15.6	11232
May	744	10.8	20	9.2	6845
June	720	15.6	20	4.4	3168
July	744	18.1	20	1.9	1414
August	744	17.3	20	2.7	2009
September	720	13.5	20	6.5	4680
October	744	7.8	20	12.2	9077
November	720	1.7	20	18.3	13176
December	744	-5.2	20	25.2	18749
				Σ=	**128196**

[1]Source: RETScreen - Mount Forest Station

[2]Interior temperature assumed to be constant at 20°C

Energy Efficiency Measure - Roof Insulation

Project Description	$R_{imp,existing}$ (hr·ft^2·°F/BTU)	$U_{existing}$ (W/m^2·K)	$R_{imp,improved}$ (hr·ft^2·°F/BTU)	$U_{improved}$ (W/m^2·K)	|ΔU| (W/m^2·K)	ΔT·Time (K·h)	Roof Area (m^2)	Energy (kWh)
Increase Lobby Roof Insulation to R-50	12	0.47	50	0.11	0.36	104940	372	14,024

Oil Furnace Efficiency	Oil L	Cost of Oil Per L	Total Cost of Oil	Comments
0.62	2,144	$ 0.83	$ 1,779.48	Lobby Roof Area

OPINION OF COST

Our opinion of costs is based on our experience with contractors specializing in these fields, historical cost data from similar projects, and/or current construction cost data published by the R.S. Means Company. These cost estimates should be used as a guide only, as costs may vary according to the time of year, quality of materials used, volume of work, actual site conditions, etc.

Door Weatherstripping

Item No.	Item	Cost
A	Mobilization/Demobilization	$ 700
B	Blown Insulation	$ 6,800
	Construction Sub-Total	*$ 7,500*
C	HST (13%)	$ 975
	TOTAL (ROUNDED)	**$ 8,500**

Appendix B5 EEM5 Air Leakage

Heat Profile for Lobby to Exterior and Arena

Month	Time (hr)	Avg. Exterior[1] (°C)	Estimated Arena[2] (°C)	Annual Heating ΔT between Interior and Exterior: T_{int}[3] (°C)	$\Delta T_{int-ext}$ (K)	$\Delta T_{int-ext} \cdot Time$ (K·h)	Annual Heating ΔT between Interior and Arena: T_{int}[3] (°C)	$\Delta T_{int-arena}$ (K)	$\Delta T_{int-arena} \cdot Time$ (K·h)
January	744	-9	-7	20	29	21576	20	27	20088
February	672	-8.4	-6.4	20	28.4	19085	20	26.4	17741
March	744	-3.1	-1.1	20	23.1	17186	20	21.1	15698
April	720	4.4	5.4	20	15.6	11232	20	14.6	10512
May	744	10.8	10.8	20	9.2	6845	20	9.2	6845
June	720	15.6	15.6	20	4.4	3168	20	4.4	3168
July	744	18.1	18.1	20	1.9	1414	20	1.9	1414
August	744	17.3	17.3	20	2.7	2009	20	2.7	2009
September	720	13.5	13.5	20	6.5	4680	20	6.5	4680
October	744	7.8	8.8	20	12.2	9077	20	11.2	8333
November	720	1.7	2.7	20	18.3	13176	20	17.3	12456
December	744	-5.2	-3.2	20	25.2	18749	20	23.2	17261
					Σ=	**128196**		**Σ=**	**120204**

[1]Source: RETScreen - Mount Forest Station

[2]Estimated service room interior temp is +2°C when exterior is <0°C; +1°C when exterior is 0°C to 10°C; same as exterior when >10°C.

[3]Interior lobby temperature assumed to be constant at 20°C

Energy Efficiency Measure - Door Air Leakage

	Door Area[2] (m²)	Air Leakage Rates[1] $q_{existing}$ (L/s·m²)	$q_{improved}$ (L/s·m²)	Δq (L/s·m²)	U[3] (W/K)	ΔT·Time (K·h)	Energy (kWh)
Lobby to Arena							
1	2.2	3.0	1.5	1.5	3.9	120204	469
2	2.2	3.0	1.5	1.5	3.9	120204	469
Lobby to Exterior							
3	2.2	3.0	1.5	1.5	3.9	128196	500
						ΣE=	**1438**

L of Fuel 10.56kWh/L	Cost of Fuel $0.75/L	Measure Cost	Simple Payback
136	**$ 102.18**	**$ 1,500.00**	**14.68**

[1]Air Leakage values taken from AAMA/WDMA/CSA 101/I.S.2/A440-17, Table 6.2:
- Existing air leakage rates of service doors assumed to be double A2 rating (2 x 1.5 L/s·m²)
- Improved air leakage rates of original doors assumed to be equivalent to A2 air leakage of 1.5 L/s·m²)

[2]Door dimensions assumed to be 3'-6"wide by 6'-8" tall

[3]U= Door area x Δq x heat capacity of air

Heat Capacity of Air is 1.0 kJ/kg·K = 1.2 W·s/L·K assuming air density of 1.2kg/m³

OPINION OF COST

Our opinion of costs is based on our experience with contractors specializing in these fields, historical cost data from similar projects, and/or current construction cost data published by the R.S. Means Company. These cost estimates should be used as a guide only, as costs may vary according to the time of year, quality of materials used, volume of work, actual site conditions, etc.

Door Weatherstripping

Item No.	Item	Cost
A	Mobilization/Demobilization	$ 200
B	Door Weatherstripping	$ 1,100
	Construction Sub-Total	*$ 1,300*
C	HST (13%)	$ 169
	TOTAL (ROUNDED)	**$ 1,500**

Appendix B6 EEM6 Interior Windows

Heat Profile for Tank to Service Room Heat Transfer

Month	Time (hr)	Avg. Exterior[1] (°C)	Estimated Arena[2] (°C)	Annual Heating ΔT between Interior and Arena: T_{int}[3] (°C)	$\Delta T_{int\text{-}arena}$ (K)	$\Delta T_{int\text{-}arena}\cdot$Time (K·h)
January	744	-9	-7	20	27	20088
February	672	-8.4	-6.4	20	26.4	17741
March	744	-3.1	-1.1	20	21.1	15698
April	720	4.4	5.4	20	14.6	10512
May	744	10.8	10.8	20	9.2	6845
June	720	15.6	15.6	20	4.4	3168
July	744	18.1	18.1	20	1.9	1414
August	744	17.3	17.3	20	2.7	2009
September	720	13.5	13.5	20	6.5	4680
October	744	7.8	8.8	20	11.2	8333
November	720	1.7	2.7	20	17.3	12456
December	744	-5.2	-3.2	20	23.2	17261
					Σ=	**120204**

[1]Source: RETScreen - Mount Forest Station

[2]Estimated service room interior temp is +2°C when exterior is <0°C; +1°C when exterior is 0°C to 10°C; same as exterior when >10°C.

[3]Interior lobby temperature assumed to be constant at 20°C

Energy Efficiency Measure - Interior Window Replacement

Description	$U_{existing}$ ($W/m^2 \cdot K$)	$U_{improved}$ ($W/m^2 \cdot K$)	ΔT·Time (K·h)	Area (m^2)	Energy (kWh)
EEM-X Replace Thermally Unbroken Hollow Metal Frame Windows between Arena and Interior Lobby	6.42	3.47	120204	32.0	11347

L of Fuel 10.56kWh/L	Cost of Fuel $0.75/L	Measure Cost	Simple Payback
1075	**$ 806.14**	**$ 38,000.00**	**47.14**

*Window U-values taken from 2011 ASHRAE fundamentals handbook (Table 4, page 30.8):
- Existing windows assumed to be equivalent to thermally unbroken aluminum frame with fixed, 3.2mm thick, single glazing
- Upgraded windows assumed to be equivalent to thermally unbroken aluminum frame with fixed, double glazing, low-ε=0.2, 12.7mm argon space, fire rated coating (e.g. Pyrostop by Pilkington). Aluminium frames cannot be thermally broken as the butyl break compromises its fire rating.

OPINION OF COST

Our opinion of costs is based on our experience with contractors specializing in these fields, historical cost data from similar projects, and/or current construction cost data published by the R.S. Means Company. These cost estimates should be used as a guide only, as costs may vary according to the time of year, quality of materials used, volume of work, actual site conditions, etc.

EEM-X: Interior Window Replacement

Item No.	Item	Cost
A	Mobilization/Access/Protection/Demobilization	$ 2,000
B	Window Replacement	$ 23,400
C	Allowances	
i)	Building Permit	$ 200
D	Construction Contingency	$ 3,000
	Construction Sub-Total	*$ 28,600*
E1	Engineering Services: Design & Tender	$ 3,500
E2	Engineering Services: Construction Review (Based on a 1 week construction schedule)	$ 1,800
	Sub-Total	*$ 33,900*
F	HST (13%)	$ 4,407
	TOTAL (ROUNDED)	**$ 38,000**

Appendix B7 EEM7 Water Conservation

Honeywood Arena Water Usage Calculation

Baseline Case: change occupant values to reflect anticipated occupancy

Fixture Type	Number of Fixtures	Consumption (	Daily Uses	Duration (min)	Occupants	Daily Water Use (gal)	Notes
3.5 gpf toilet - male (gallons per flush) changerooms	4	3.5	2.5	1	60	525	75 people in the arena per day on average for 8.5 hour day - 60 hours per week Assur
3.5 gpf toilet - female (gallons per flush)	3	3.5	3	1	15	158	
2.0 gpf urinal - male (gallons per flush) 1st Floor Lobby	2	2	0.5	1	60	60	Only two urinals in lobby - most flushing would be from changerooms toilets
Commercial Lavatory Faucets- 2.2 gpm	9	2.2	3	0.3	75	149	
Canteen sink - 2.2 gpm	1	2.2	20	0.25	2	22	Used only on weekends
Dishwasher	1	6	2	1	1	12	Used only on weekends
Coffee/Tea/Water	1	2			75	150	2 L of water per occupant
Showerhead - 2.5 gpm	4	2.5	1	4	34	339	237 Showers per week across 4 showers
					Total Daily Volume	1,414	
					Monthly	29,685	
					m^3/month	112	
					Annual Work Days	250	
					Total Annual Usage (g)	353,393	
					Total Annual Usage (m⁴	1,338	

Pumping Costs

Assumption 12Gal/min pump

1.1kw pump

m3	Gal	Min	hours	kwh
1,337.6	353,354.3	29,446.2	490.8	539.8

Heating Costs

L/Year	Cost per year
2098.6	$1,741.83

Calculator: To determine estimated savings, insert occupant values (same as Baseline) and consumption values based on fixtures and fixture fittings installed

Fixture Type	Number of Fixtures	Consumption	Daily Uses	Duration	Occupants	Daily Water Use (gal)
3.5 gpf toilet - male (gallons per flush) changerooms	4	3.5	2.5	1	60	525
3.5 gpf toilet - female (gallons per flush)	3	3.5	3	1	15	158
2.0 gpf urinal - male (gallons per flush) 1st Floor Lobby	2	2	0.5	1	60	60
Commercial Lavatory Faucet - 0.5 gpm	9	0.5	3	0.3	75	34
Canteen sink - 1.0 gpm	1	1	20	0.25	2	10
Dishwasher	1	6	2	1	1	12
Coffee/Tea/Water	1	2			75	150
Low Flow Showerhead - 1.6 gpm	4	1.6	1	4	34	217
					Total Daily Volume	1,165
					Monthly	24,464
					m^3/month	93
					Annual Operation Days	250
					Total Annual Usage (g)	291,234
					Total Annual Usage (m⁴	1,102
					Annual Savings	62,159
					% Reduction	-17.6%
					m^3 reduction	235

Assumption 12Gal/min pump

1.1kw pump

m3	Gal	Min	hours	kwh
235.3	62,152.2	5,179.3	86.3	95.0

Heating Costs

L/Year	Cost per year
1527.8	$1,268.04

Yearly Savings

Pumping kwh saved		94.95
$ ($0.01665/kwh)	$	15.81
Cost Savings	$	489.60
Implementation Cost	$	1,800.00
Total Savings	$	1,800.00
Simple Payback		3.68 years

Low Flow Fixtures Domestic Water Heater Cost Savings from Reduced Oil Consumption

Yearly Savings

Fixture	# of Fixtures	Cost per fixture	Installation cost/fixture	Total Cost
Commercial Lavatory Faucet - 0.5 gpm	9	$100	$100	$1,800
Kitchen sink - 0.5 gpm	1	$100	$100	$200
Dishwasher	1			$0
Low Flow Shower Head	4	$25	$10	$140
Total				$1,800
			Simple payback (years)	3.68

John wood Efficiency is 0.62

Oil Water Heater Savings	Gallons Heated	BTU/Gallon of Water	BTU Required	BTU/gal/no. 2 oil	Gal of Fuel Oil/Day	Days in Peak Season	Gal/Year	L/Year	Cost per year
Before	365.6	846.8	309604.8	139600.0	2.2	250.0	554.4	2098.6	$1,741.83
After	266.2	846.8	225389.5	139600.0	1.6	250.0	403.6	1527.8	$1,268.04
Savings								**570.84**	**$473.79**

Appendix B8 EEM8 Furnace Calculation

Honeywood Arena
Furnace Oil Consumption Calculation

20187Consumption	**12,841**
2017 Consumption	**9,234**
2016 Consumption	**14,121**

-

Average 3 Year Oil Usage

	L of Oil	kWh/L	kWh
Annual	12,065	10.5570	127,374
DHW	2,000	10.5570	21,114
Zamboni	5,200	10.5570	54,896
Furnace	4,865	10.5570	51,363

	L of Oil
Replace 1 Furnace 5% More Efficient Savings	**121.63**

Estimated Oil Usage by Arena Use

1		
2	**2018**	
3	Total Oil	**12,841**
4	DHW	2,000
	Zamboni Hot Water	5,200
5	Total Heating Load	5,641
1	**2017**	
2	Total Oil	**9,234**
3	DHW	2,000
4	Zamboni Hot Water	5,200
5	Total Heating Load	2,034
	2016	
	Total Oil	**14,121**
	DHW	2,000
	Zamboni Hot Water	5,200
	Total Heating Load	6,921

Appendix B9 EEM9 Drain Water Heat Recovery

Drain Water Heat Recovery on Low Flow Fixtures

Yearly Savings

Fixture	# of Fixtures	Cost per fixture	Installation cost/fixture	Total Cost
Powerpipe or similar	2	$700	$1,200	$3,800
Total				$3,800
			Simple payback (years)	12.49

John wood Efficiency is 0.62

Oil Water Heater Savings	Gallons Heated	BTU/Gallon of Water	BTU Required	BTU/gal/no. 2 oil	Gal of Fuel Oil/Day	Days in Peak Season	Gal/Year	L/Year	Cost per year
Including Low Flow Fixtures	266.2	846.8	225389.5	139600.0	1.6	250.0	403.6	1527.8	$1,268.04
With DWHR 24% Heat Recovery							306.8	1161.1	$963.71
Savings								**366.66**	**$304.33**

Appendix B10 EEM10 New Zamboni Hot Water System

Zamboni Water Heater Cost Comparison

John wood EF is 0.62

Oil Water Heater Zamboni Cost	Gallons/year	EF	BTU/Gallon of Water	BTU Required	BTU/gal/no. 2 oil	Gal of Fuel Oil/yr	L/Year	kWh	$/L	Cost per year
Before	227700.0	0.62	846.8	192810483.9	139600.0	1381.2	5227.7	55152.3	$ 0.83	$3,973.06
						682.2949787				

75 Gal Propane EF assumed 0.75

Propane Water Heater Zamboni Cost	Gallons/year	EF	BTU/Gallon of Water	BTU Required	BTU/gal/propane	Gal of Fuel Oil/yr	L/Year			Cost per year
Before	227700.0	0.75	700.0	159390000.0	91000.0	1751.5	6629.6	45713.7	$ 0.49	$3,248.49

Savings **$724.57**

Appendix B11 EEM11 Desuperheater Heat Recovery

Desuperheater Raises incoming tempurature from 55 to 120 degrees 80% of the time

Q=McpΔT
Q= Heat Gain by quantity of water in btu/hr
M=Mass in pounds/min
Cp=Specific Heat of Water =1
ΔT= Change in Temp Farenheit

1) Water Flow Rate though heater of 2.3 US gallons/min = 19.48 lbs= M
19.4
2) Cp=1
3) ΔT= 120-55=65

Q= 19.48lb/min*60min/hr*1*65 =
75,972 btu/hr

8 floods per day
607776 btu/day

1 Therm=100,000 BTU
140000 BTU/Gallon of No. 2 Fuel Oil
62% water heater efficiency + 80% Desuperheater Efficiency

Using Fuel Oil 2 62% efficiency = output BTU/Gallon= 0.62*140,000BTU=
86,800 BTU/Gallon

BTU/Day/BTU/Gallon*80% Desuperheater Efficiency =

5.60 Gallons per day
Gallons/Day * 7 months per year* 30 days per month * 3.8 Gallons/L=
4470 L of Fuel Oil/ year (Estimated 5200 total)

$0.83/L of Fuel Oil
$ 3,710.18

Based on 7 month ice season =
$ 3,710.18

Capital Cost of $42,500
Payback =
11.45

Appendix B12 EEM12 DDC Controller

From Qualified Refrigeration Contractor
Proper Operation of DDC controller for 1 rink arena with 6.5 month operation yields
$5,000-$10,000 yearly savings for ice plant

Conservatively estimated at $5,000 per year
Current Rate of energy is approximately $0.13/kWh

Total Energy Savings for $5,000 yearly savings

=	$5,000/0.13	
=	38461.538	kwh
Rounded	38500	kwh

Potential Incentive from Hydro One
Estimated at $0.10/kWh saved

Incentive = $ 3,850.00

Budget Cost from Contractor $45,000

Payback without Incentive	9	years
Payback with Incentive	8.2	years

Appendix B13 EEM13 Electric Desiccant De-Humidifier

From Qualified Refrigeration Contractor
Electric Desiccant De-humidifier provides savings of $2500-$4,000 for single rink operation

Conservatively estimated at $2,500 per year
Current Rate of energy is approximately $0.13/kWh

Total Energy Savings for $5,000 yearly savings

=	$2500/0.13	
=	19230.769	kWh
Rounded	19000	kWh

Potential Incentive from Hydro One
Estimated at $0.10/kWh saved

Incentive = $ 1,900.00

Budget Cost from Contractor $40,000

Payback without Incentive	16	years
Payback with Incentive	15.2	years

Natural Resources Canada Ressources naturelles Canada

Canada

RETScreen® International

www.retscreen.net

Clean Energy Project Analysis Software

Project information

See project database

Project name	North Dufferin Community Centre Solar
Project location	Mulmur, ON
Prepared for	Mulmur Township
Prepared by	RJ Burnside & Associates
Project type	Power
Technology	Photovoltaic
Grid type	Central-grid
Analysis type	Method 2
Heating value reference	Higher heating value (HHV)
Show settings	☐

Site reference conditions

Select climate data location

Climate data location	Mount Forest (MARS)
Show data	☐

Complete Energy Model sheet

RETScreen4 2013-08-27

NRCan/CanmetENERGY

RETScreen Energy Model - Power project

☐ Show alternative units

Proposed case power system

Analysis type		⦿ Method 1 ○ Method 2	
Photovoltaic			
Power capacity	kW	190.00	*See product database*
Manufacturer			
Model			
Capacity factor	%	14.0%	
Electricity exported to grid	MWh	233.0	
Electricity export rate	$/MWh	134.00	

RETScreen Cost Analysis - Power project

Settings		
⊙ Method 1	⊙ Notes/Range	Notes/Range
○ Method 2	○ Second currency	None
	○ Cost allocation	

Initial costs (credits)	Unit	Quantity	Unit cost	Amount	Relative costs
Feasibility study					
Feasibility study	cost	1	$ 5,000	$ 5,000	
Subtotal:				**$ 5,000**	1.1%
Development					
Development	cost	1	$ 20,000	$ 20,000	
Subtotal:				**$ 20,000**	4.3%
Engineering					
Engineering	cost	1	$ 10,000	$ 10,000	
Subtotal:				**$ 10,000**	2.2%
Power system					
Photovoltaic	kW	190.00	$ 2,250	$ 427,500	
Road construction	km			$ -	
Transmission line	km			$ -	
Substation	project			$ -	
Energy efficiency measures	project			$ -	
User-defined	cost			$ -	
				$ -	
Subtotal:				**$ 427,500**	92.4%
Balance of system & miscellaneous					
Spare parts	%			$ -	
Transportation	project			$ -	
Training & commissioning	p-d			$ -	
User-defined	cost			$ -	
Contingencies	%		$ 462,500	$ -	
Interest during construction			$ 462,500	$ -	
Subtotal:		Enter number of months		**$ -**	0.0%
Total initial costs				**$ 462,500**	100.0%

Annual costs (credits)	Unit	Quantity	Unit cost	Amount
O&M				
Parts & labour	project	190	$ 39	$ 7,410
User-defined	cost			$ -
Contingencies	%		$ 7,410	$ -
Subtotal:				**$ 7,410**

Periodic costs (credits)	Unit	Year	Unit cost	Amount
User-defined	cost			$ -
				$ -
End of project life	cost			$ -

RETScreen Emission Reduction Analysis - Power project

☑ Emission Analysis

⦿ Method 1
○ Method 2
○ Method 3

Base case electricity system (Baseline)

Country - region	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Canada - Ontario	Other	0.131		0.131

☐ Baseline changes during project life

Base case system GHG summary (Baseline)

Fuel type	Fuel mix %	Fuel consumption MWh	GHG emission factor tCO2/MWh	GHG emission tCO2
Electricity	100.0%	233	0.131	30.5
Total	100.0%	233	0.131	30.5

Proposed case system GHG summary (Power project)

Fuel type	Fuel mix %			Fuel consumption MWh	GHG emission factor tCO2/MWh	GHG emission tCO2
Solar	100.0%			233	0.000	0.0
Total	100.0%			233	0.000	0.0
			T&D losses			
Electricity exported to grid	MWh	233		0	0.131	0.0
					Total	0.0

GHG emission reduction summary

	Base case GHG emission tCO2	Proposed case GHG emission tCO2	Gross annual GHG emission reduction tCO2	GHG credits transaction fee %	Net annual GHG emission reduction tCO2
Power project	30.5	0.0	30.5		30.5

Net annual GHG emission reduction 30.5 tCO2 is equivalent to 5.6 Cars & light trucks not used

RETScreen Financial Analysis - Power project

Financial parameters

General		
Fuel cost escalation rate	%	0.0%
Inflation rate	%	2.0%
Discount rate	%	4.0%
Project life	yr	30
Finance		
Incentives and grants	$	
Debt ratio	%	75.0%
Debt	$	346,875
Equity	$	115,625
Debt interest rate	%	2.50%
Debt term	yr	30
Debt payments	$/yr	16,573

Income tax analysis ☐

Annual income

Electricity export income		
Electricity exported to grid	MWh	233
Electricity export rate	$/MWh	134.00
Electricity export income	$	31,224
Electricity export escalation rate	%	3.5%

GHG reduction income ☐

Net GHG reduction	tCO2/yr	31
Net GHG reduction - 30 yrs	tCO2	916

Customer premium income (rebate) ☐

Other income (cost) ☐

Clean Energy (CE) production income ☐

Project costs and savings/income summary

Initial costs			
Feasibility study	1.1%	$	5,000
Development	4.3%	$	20,000
Engineering	2.2%	$	10,000
Power system	92.4%	$	427,500
Balance of system & misc.	0.0%	$	0
Total initial costs	**100.0%**	**$**	**462,500**
Annual costs and debt payments			
O&M		$	7,410
Fuel cost - proposed case		$	0
Debt payments - 30 yrs		$	16,573
Total annual costs		**$**	**23,983**
Periodic costs (credits)			
Annual savings and income			
Fuel cost - base case		$	0
Electricity export income		$	31,224
Total annual savings and income		**$**	**31,224**

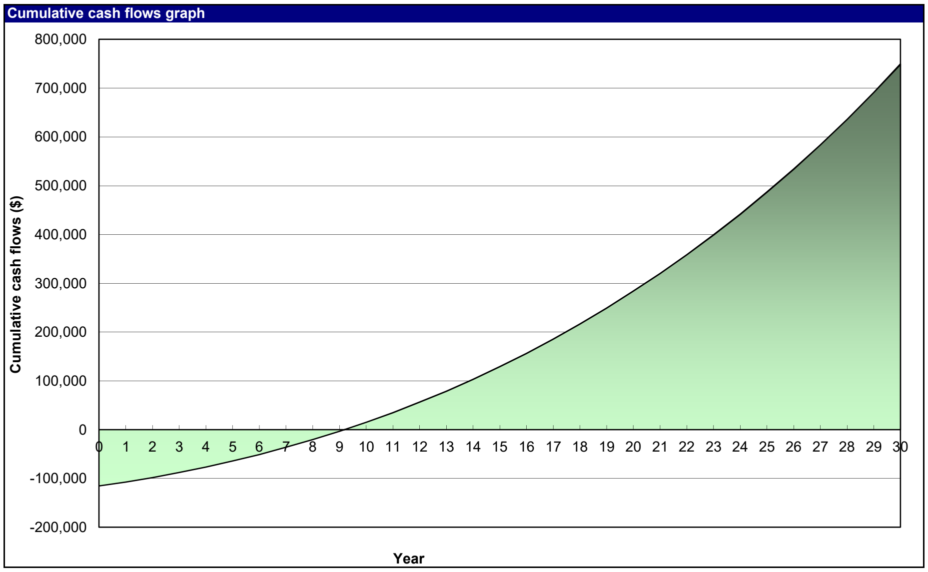
Financial viability

Pre-tax IRR - equity	%	13.9%
Pre-tax IRR - assets	%	3.4%
After-tax IRR - equity	%	13.9%
After-tax IRR - assets	%	3.4%
Simple payback	yr	19.4
Equity payback	yr	9.2
Net Present Value (NPV)	$	300,998
Annual life cycle savings	$/yr	17,407
Benefit-Cost (B-C) ratio		3.60
Debt service coverage		1.49
Energy production cost	$/MWh	87.63
GHG reduction cost	$/tCO2	(570)

Yearly cash flows

Year #	Pre-tax $	After-tax $	Cumulative $
0	-115,625	-115,625	-115,625
1	8,186	8,186	-107,439
2	9,166	9,166	-98,273
3	10,182	10,182	-88,091
4	11,237	11,237	-76,854
5	12,330	12,330	-64,524
6	13,465	13,465	-51,059
7	14,641	14,641	-36,418
8	15,861	15,861	-20,556
9	17,127	17,127	-3,430
10	18,439	18,439	15,009
11	19,800	19,800	34,809
12	21,211	21,211	56,021
13	22,675	22,675	78,695
14	24,192	24,192	102,888
15	25,766	25,766	128,653
16	27,397	27,397	156,050
17	29,089	29,089	185,139
18	30,842	30,842	215,981
19	32,661	32,661	248,642
20	34,546	34,546	283,187
21	36,500	36,500	319,687
22	38,526	38,526	358,213
23	40,626	40,626	398,840
24	42,804	42,804	441,643
25	45,061	45,061	486,704
26	47,400	47,400	534,104
27	49,825	49,825	583,929
28	52,339	52,339	636,268
29	54,944	54,944	691,212
30	57,645	57,645	748,857

Cumulative cash flows graph



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Benchmark Report

Appendix C

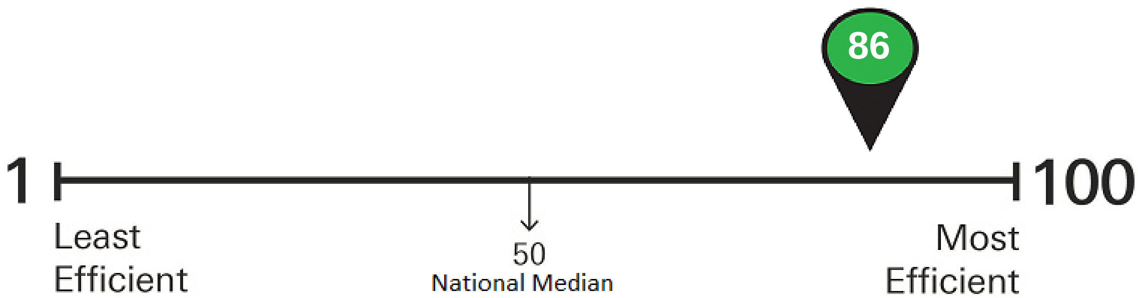
ENERGY STAR® Energy Performance Scorecard

86

out of 100

Honeywood Arena Version 2

For Year Ending	December 31, 2018
Property Address	706114 County Rd 21 Mulmur, ON, Ontario L9V0W3
Primary Function	Ice/Curling Rink
Gross Floor Area (ft²)	26,182
Year built	1965
Energy Use per sq. ft.*	58.8 kBtu



What is the ENERGY STAR Score?
The ENERGY STAR score rates commercial building's energy performance relative to similar buildings nationwide. Expressed as a number on a simple 1-100 scale, the score rates performance on a percentile basis: a building with a score of 50 performs better than 50% of its peers. Higher scores mean better energy efficiency, resulting in less energy use and fewer greenhouse gas emissions. If a 1-100 score for a specific building type has not been developed, Site Energy Use Intensity (EUI) will be displayed on this scorecard.

Learn more at:
energystar.gov/scorecard

*Site energy use

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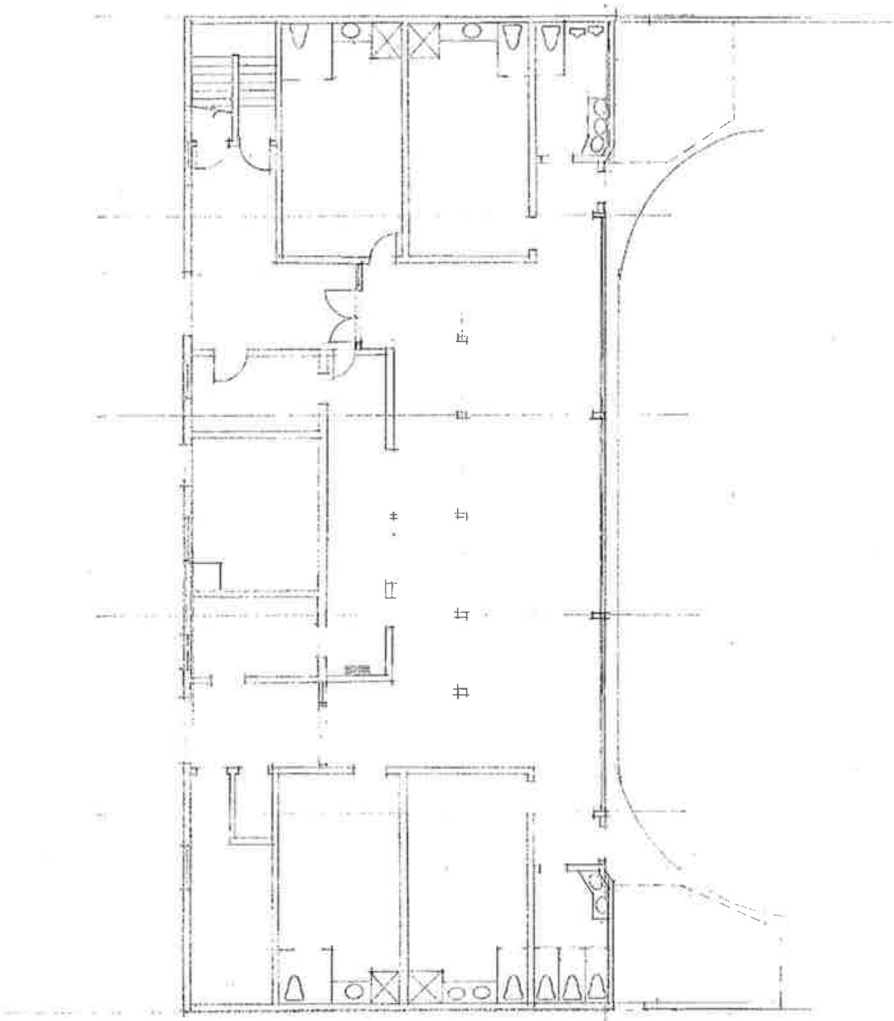
Appendix D

Drawings

Appendix D

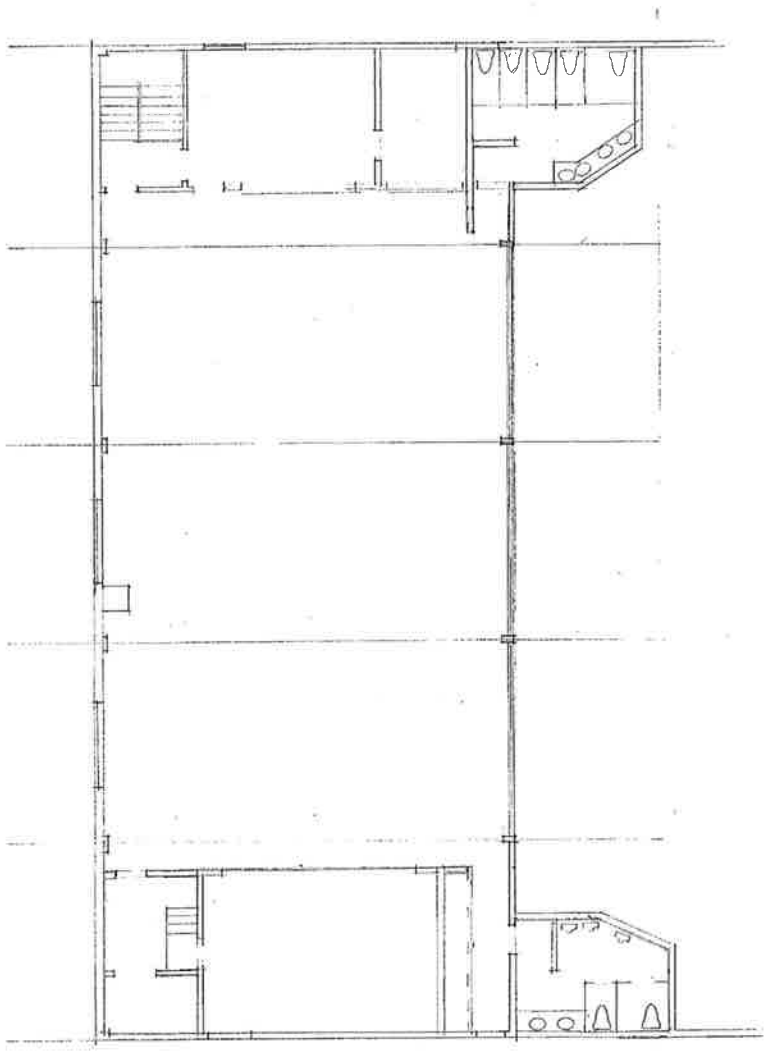
612800 Drawings



Honeywood Arena
Township of Mulmur

MAIN FLOOR
EXISTING

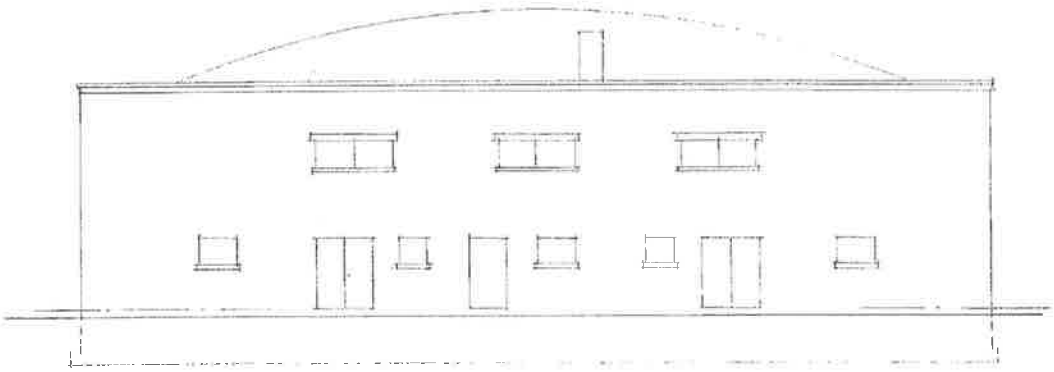
Project 2714 Design BR Drawn BR	Scale 1/8 " = 1'-0" Date September 2014 Issued

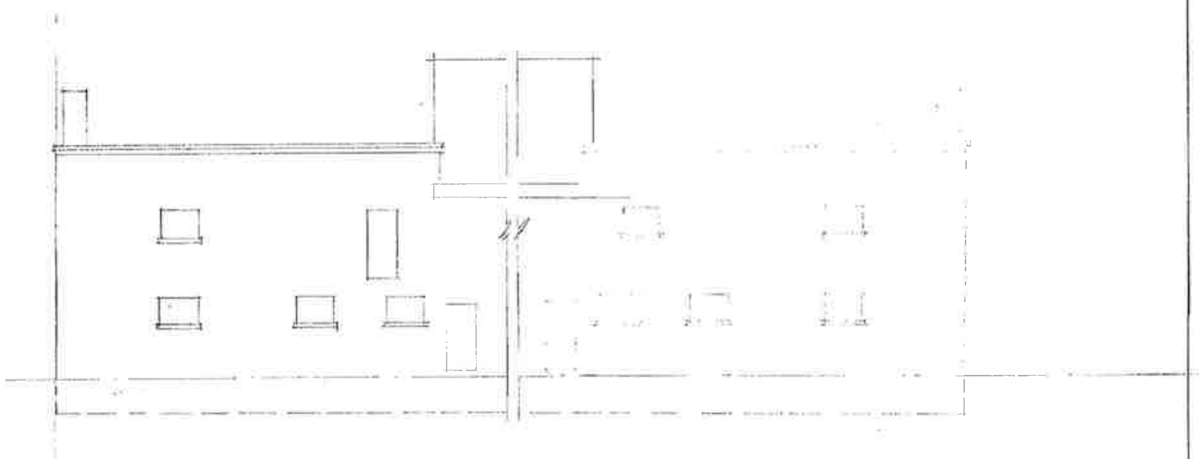


Honeywood Arena
Township of Mulmur

UPPER FLOOR
EXISTING

Project 2714 Design BR Drawn BR	Scale 1/8" = 1' 0" Date September 2014 Issued

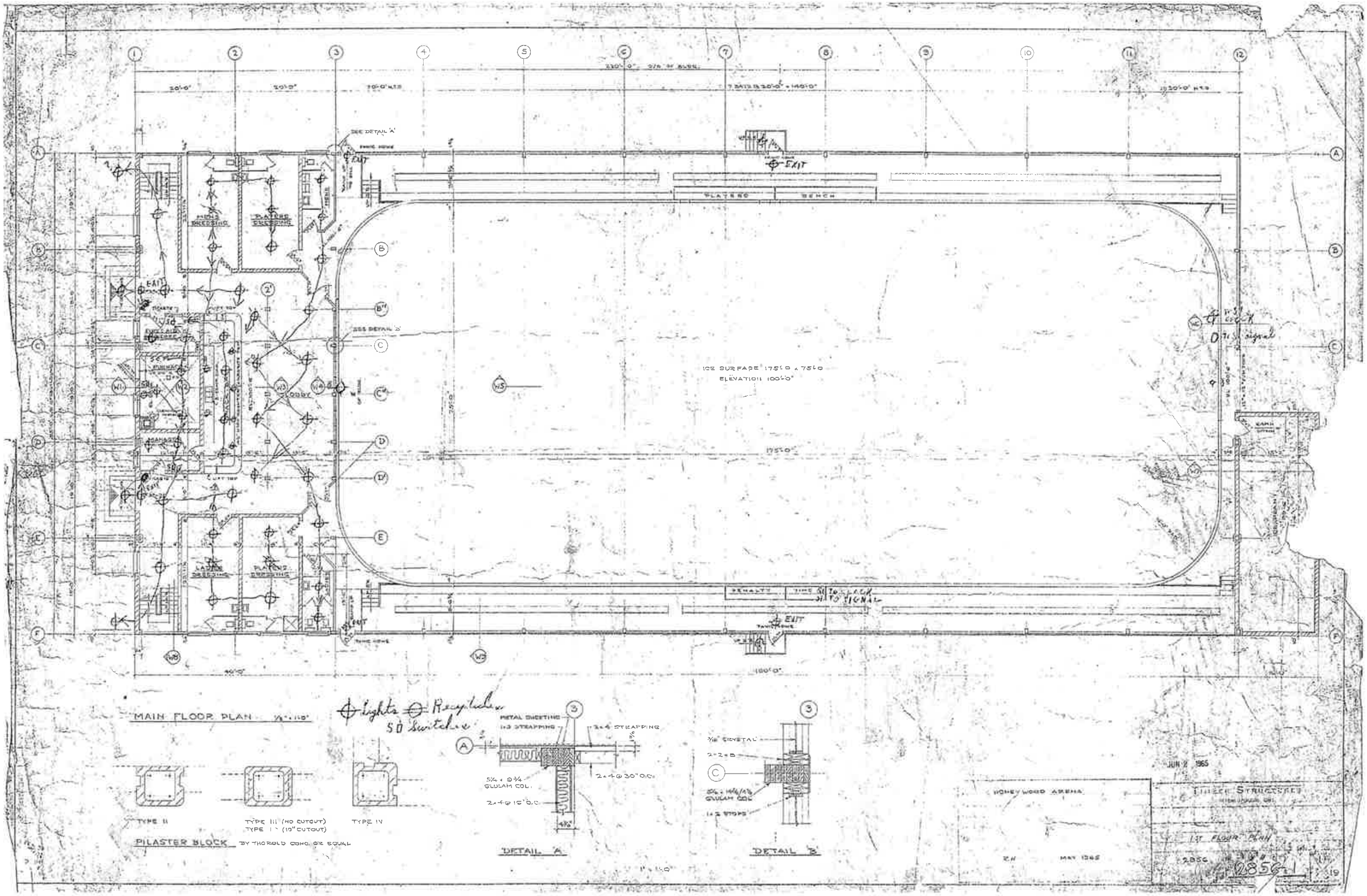




Honeywood Arena
Township of Mulmur

ELEVATIONS,
EXISTING

Project 2714	Scale 1/8 " = 1' 0"
Design BR	Date September 2014
Drawn BR	Issued



SEE DETAIL 'A'
EXIT
PLAYERS BENCH
SEE DETAIL 'B'
ICE SURFACE 175'-0" x 75'-0"
ELEVATION 100'-0"
175'-0"
PENALTY
TIME
to clock
to signal
MAIN FLOOR PLAN
Lights Receptacles
SD Switches
PILASTER BLOCK BY THOROLD CONC. OR EQUAL
TYPE II
TYPE III (NO CUTOUT)
TYPE IV
METAL SHEETING
2x4 STRAPPING
5¼ x 9¾ GLULAM COL.
DETAIL 'A'
DETAIL 'B'
JUN 2 1965
HONEYWOOD ARENA
1st FLOOR PLAN
MAY 1965
2856

R.J. Burnside & Associates Limited