2507 Honey Harbour Rd
Georgian Bay, ON P0E 1E0

Climate Action Roadmap

Fire Station 2

EFFICIENCY ENGINEERING .COM
A Kontrol Technologies Company

Township of Georgian Bay
Muskoka

TOWNSHIP OF
GEORGIAN BAY

EE Project #: 23-014

February 2024

Table of Contents

1 The Executive Summary

Efficiency Engineering has performed a comprehensive Net Zero Retrofit Study at the Fire Hall 1, 2507 Honey Harbour Rd., for the Township of Georgian Bay. The Township has set aggressive greenhouse gas reduction targets. The purpose of this study is to catalogue the existing energy consuming systems at the building, analyze energy usage within the facility and provide recommendations on how to significantly reduce GHG emissions while improving the energy and water efficiency of the facility.

This study has been developed in accordance with the Federation of Canadian Municipalities (CFM) Community Building Retrofit (CBR) initiative guidelines which require the following scenarios to be studied:

- 50% GHG reductions in 10 years
- 80% GHG reductions in 20 years
- 80% GHG reductions in 5 years

A "business-as-usual" scenario will also be developed to create a 20-year cost baseline for the purposes of comparison.

1.1 Building Overview

The following table summarizes the facility details:

TABLE 1.1.1: FACILITY DETAILS

Building Name:	Fire Hall 1
Client Name:	Township of Georgian Bay
Site Contact:	Jennifer Schnier
Address:	2507 Honey Harbour Rd
	Honey Harbour, ON
	P0E 1E0
Facility Area:	2,200 ft^2
Building Type:	Fire Hall
Year Constructed:	1960's
Number of Stories:	1

1.1.1 Existing Building Profile

Fire Hall #1 is a 2,200 ft^2 facility comprised of offices and an equipment bay. The Fire Hall operates with a volunteer base and is therefore unoccupied much of the time. In addition to responding to emergency calls, it is also used for meetings, testing & training purposes.

Space heating for the facility is supplied by a combination of electric baseboards in the office areas and propane fired tube heaters in the equipment bay. All heating equipment is controlled by single setpoint thermostats.

Domestic hot water for the facility is supplied by an electric tank heater.

Lighting at the facility is provided primarily by florescent fixtures with T-8 and T-12 lamps. Lighting is primarily controlled via wall switches. Exterior lighting has been upgraded to LED.

Ventilation to the building is provided by an exhaust vent on the roof in the truck bay that is controlled by a manually operated timer. Additional exhaust fans for washrooms are controlled by light switches.

Water fixtures (toilets, shower heads, faucets, etc.) are primarily standard flow units.

1.1.2 Previous Energy Conservation Measures

The building has not been subject to energy conservation measures. All existing equipment including lighting, heating, ventilation, and features for water use are standard performance according to what was available at the time the building was developed.

1.1.3 Existing Energy & GHG Emissions

The facility's existing energy consumption and GHG emissions are summarized as follows:

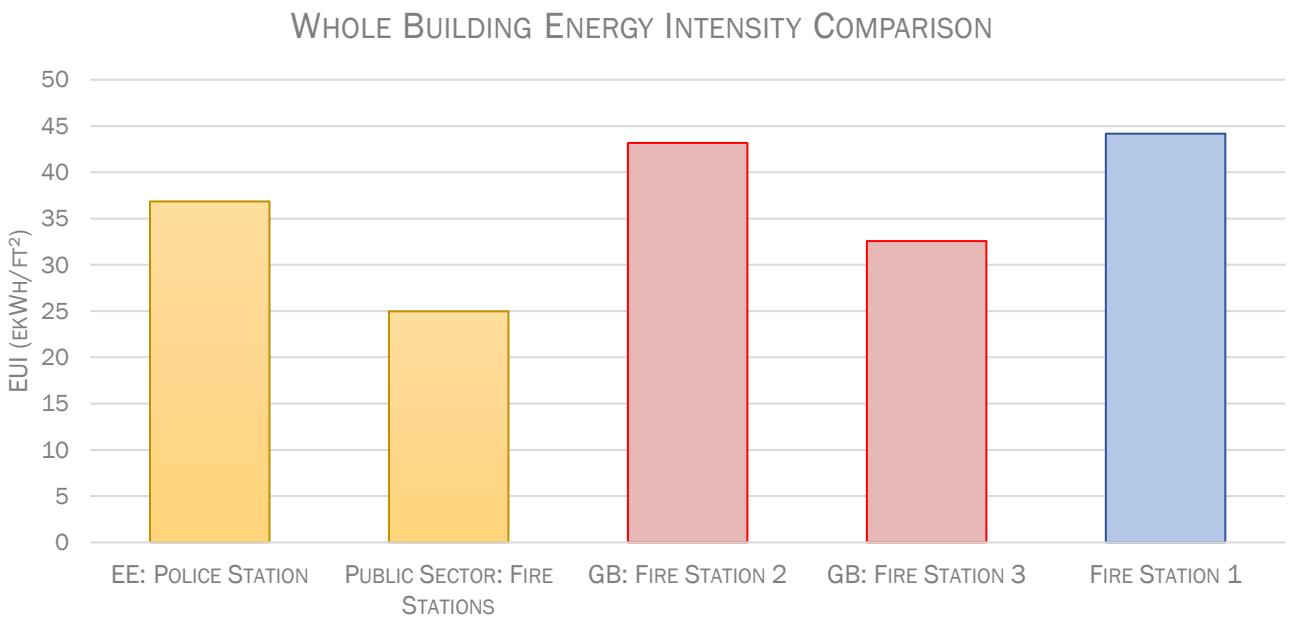
TABLE 1.1.2: EXISTING ENERGY KPI DETAILS

Utility	Consumption	EUI* (ekWh/ft²)	Total Energy (ekWh)	Emissions (tCO2e)	% of Total Emissions
Electricity	26,590 kWh	12.1	26,590	0.73	4.4%
Propane	9,956 L	32.1	70,578	15.91	95.6%
Total	**N/A**	**44.2**	**97,179**	**16.65**	**100%**

*EUI values presented throughout this report are calculated based on purchased energy and includes electricity provided by the grid and propane.

Propane consumption at the facility is responsible for over 95% of GHG emissions at the facility. Propane fired equipment at this facility consists of two (2) infrared tube heaters that provide space heating in the equipment bay. Addressing this equipment with a low carbon alternative will be required to achieve either the 50% or 80% GHG reduction target.

The following benchmarking graph displays the comparative energy performance of the Fire Station 1 with other similar buildings including other two fire stations in Georgian Bay.



The EUI in the Fire Station 1 of Georgian Bay is approximately 44 ekWh/ft_2 which is 1.7 times higher than the average value for other fire stations (25 ekWh/ft_2). This indicates that there is an opportunity for improvement in the heating system of the truck bay area considering that propane is used for heating only in that area of the building, and it accounts for 72.6% of the energy consumption and 95% of the GHG emissions.

1.2 Master List of Measures

Opp. #	Opportunity	Demand (kW)	Electricity (kWh)	Propane (l)	Water (m^3)	GHG Emissions (tCO_2e)	Annual Savings	Project Costs	Cost per tCO_2e	Simple Payback	Capital Payback	NPV	IRR
1	Replace Tube Heaters with Electric Radiant Heating	0	-34,630	10,279	0	14.9	$2,505	$42,952	$1	17.1	10.4	($325)	7.2%
2	Install Low Flow Water Fixtures	0	1,830	0	41	0.1	$375	$3,878	$0	10.3	8.1	$2,246	12.9%
3	Replace DHW Heater with Hybrid ASHP Tank Heater	0	1,346	0	0	0.04	$276	$5,971	$0	21.7	8.1	$1,272	10.6%
4	Install a BAS	0	2,897	1,542	0	2.5	$2,032	$52,568	$400	25.9	16.4	($19,788)	2.6%
5	Install EIFS	0	1,720	1,153	0	1.8	$1,428	$475,355	$12,320	332.9	57.5	($452,343)	-14.6%
6	Replace BB Elect Heaters with ASHPs	0	6,940	0	0	0.2	$1,421	$37,863	$3,516	26.6	16.6	($14,640)	2.5%
7	Install a 5-kW Solar PV System	0	5,243	0	0	0.2	$1,074	$36,108	$5,901	33.6	19.3	($18,564)	0.5%
8	Install Triple Pane Windows	0	160	0	0	0.0	$33	$8,444	$82,381	257.8	51.7	($7,909)	-13.1%
9	Upgrade to LED Lighting	0	90	0	0	0.0	$18	$4,732	$82,048	256.8	51.6	($4,431)	-13.1%
10	Electrical Service Upgrade	0	0	0	0	0.0	$0	$132,384	N/A	No Payback	No Payback	($132,384)	No IRR

The costs of the project required to implement the opportunities (energy conservation measures - ECM) presented above do not include the cost of the electrical service upgrade which might be required due to an additional electrical load. However, the total cost of the projects including the electrical upgrade is addressed when evaluating the project implementation cost for the different Roadmaps to reduce GHG emissions (see Table 13.2 and 1.3.3).

1.3 GHG Reduction Pathways

The GHG Reduction Pathways tie together all aspects of the audit, providing an implementation plan which considers energy savings and the results of the financial analysis as well as the need for capital renewal and budgeting.

This study analyzes four potential roadmaps for decarbonization. Generally speaking, the Roadmaps progress from less complex measures with lower installation costs to more complex and more efficient solutions with the understanding that more expensive equipment may provide lower operating costs.

Roadmap 1 – Minimum Performance: 50% GHG Reductions over 10 Years

This includes a group of energy reduction measures that will achieve a 50% reduction in GHGs over the following 10 years. This will generally include the lowest cost measures available to achieve this target.

Roadmap 2 – Minimum Performance: 80% Reductions over 20 Years

This includes a group of energy reduction measures that will achieve a 80% reduction in GHGs over the following 20 years. This will generally require the inclusion of the most aggressive GHG reduction measures, regardless of cost.

Roadmap 3 – Aggressive Performance: 80% Reductions over 5 Years

This roadmap will include the same suite of measures that Roadmap 2 includes, but with a more accelerated timeline of 5 years.

Roadmap 4 – Business-As-Usual

The Business-As-Usual Roadmap will include the project costs associated with replacing the equipment with like-for-like equivalents. This will provide a cost baseline for the other roadmaps to understand how much additional capital is required to implement the more energy efficient options.

Bundling measures into these pathways often results in interactive effects between systems. As a result, the total GHG reduction for a particular Roadmap will typically differ from the sum of the GHG reductions from individual measures. The Scenario Level Analysis accounts for these interactive effects between systems which are not represented in the Measure Level Analysis.

TABLE 1.3.1: SUMMARY OF SCENARIO LEVEL ANALYSIS

Opp. #	Opportunity	Emissions (tCO_2e)	50% Reduction Pathway	80% Reduction Pathway
1	Replace Tube Heaters with Electric Radiant Heating	14.9	•	•
2	Install Low Flow Water Fixtures	0.1	•	•
3	Replace DHW Heater with Hybrid ASHP Tank Heater	0.04		•
4	Install a BAS	2.5		
5	Install EIFS	1.8		
6	Replace BB Elect Heaters with ASHPs	0.2		
7	Install a 5-kW Solar PV System	0.2		
8	Install Triple Pane Windows	0.0		
9	Upgrade to LED Lighting	0.0		
10	Electrical Service Upgrad3	0.0	•	•

Bundling measures into pathways, or scenarios, often results in interactive effects between systems. As a result, the total GHG reduction for a particular Roadmap will typically differ from the sum of the GHG reductions from the individual measures. The Scenario Level Analysis accounts for these interactive effects between systems which are not represented in the Measure Level Analysis.

TABLE 1.3.2: REDUCTION PATHWAY SUMMARY OF ENERGY & COSTS

	Reductions				Financials		
GHG Reduction Pathways	Energy (ekWh)	Energy (%)	Emissions (tCO_2e)	Emissions (%)	Annual Savings	Project Costs	20-Year LC Cost
50% Reductions (10 Year)	40,080	41%	14.9	90%	$2,879	$179,213	$335,226
80% Reductions (20 Year)	41,426	43%	15.0	90%	$3,155	$185,185	$324,163
80% Reductions (5 Year)	41,426	43%	15.0	90%	$3,155	$185,185	$347,095
Business-As-Usual	$0	0%	$0	0%	$0	$10,501	$259,373

The study compares the costs of implementing multiple options or Pathways against the costs of operating the facility in a “business-as-usual” manner. The Pathways provide options to upgrade HVAC equipment and other energy consuming systems to more efficient options. However, all of the equipment addressed in this study will have to be replaced at some point - if not by more efficient equipment, then by “like-for-like” equipment replacements. By implementing these energy efficiency measures, the “like-for-like” costs are avoided.

Table 1.3.3 presents the financial details of each pathway taking into consideration the incremental costs of implementing energy efficient measures through the GMF program.

TABLE 1.3.3: REDUCTION PATHWAY SUMMARY OF LIFE CYCLE COSTS

	Financials						
Pathway	**Project Costs**	**Potential Grant**	**Avoided Cost**	**Incremental Costs**	**LC Cost**	**Incremental 20-Year LC Cost**	**Incremental LC Cost per tCO_2e**
50% Reductions in 10 Years	$179,213	$35,843	$7,482	$132,869	$335,226	$75,853	$254
80% Reductions in 20 Years	$185,185	$37,037	$10,501	$137,646	$324,163	$64,790	$216
80% Reductions in 5 Years	$185,185	$37,037	$10,501	$137,646	$347,095	$87,722	$293
Business-As-Usual	$10,501	$0	$0	$0	$259,373	N/A	N/A

The costs of the project presented above include the cost of the electrician service upgrade which is required to implement the Energy Conservation Measure 1 due to an additional electrical load of approximately 48kW (200Amp @240V).

Limited Liability

This report was prepared by Efficiency Engineering Inc. for the account of the Township of Georgian Bay. The material in it reflects our best judgment in light of the information available to us at the time of preparation. Without express written permission, any use which a third-party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Efficiency Engineering Inc. accepts no responsibility for damages, if any, suffered by any third-party as a result of decisions made or actions based on this report.

Acknowledgements

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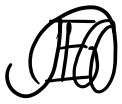
- Jennifer Schnier, MAES., Director of Sustainability, Township of Georgia Bay

Report prepared by Javier Galvan, CEM, CMVP



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2 Methodology

Efficiency Engineering utilizes a rigorous and standardized approach for all of our energy audits. We utilized a comprehensive "form based" data collection process to ensure all relevant data is collected during our site visits. Utility bills are collected and analyzed to ASHRAE14-2002 standards. Savings for each Opportunity are calculated based on sound engineering principles and always related back to actual consumptions. Costing utilizes a combination of MEANS standard costing tools, vendor quotes and our experience in design and project management.

Utility Bill Analysis

The purpose of performing a detailed utility bill analysis on the building is to:

- Normalize the consumption or demand for billing period, heating degree days (HDD), Cooling Degree Days (CDD) and any other independent variables.
- Calculate the energy use for benchmarking (comparison to typical buildings).
- Break out the consumption into weather dependent and weather independent portions.
- Calculate the heating and cooling balance point temperatures.
- Look for anomalies that may indicate heating plant efficiency, accuracy of the building automation system, building use, etc.
- Look for changes in the consumption over a period of time.
- Look for billing errors (over-billing) that may be recouped from the utility.

The utility meters have been modeled using standard modeling calculations. The utility data received has been correlated with actual weather data from the nearest weather station to produce a "best fit" equation using linear regression. The data has been normalized for billing periods, HDD, CDD as well as up to three user-defined variables. The heating and cooling balance point temperatures are adjusted to your specific building to properly model each utility.

The Modeling process creates an equation that allows us to calculate the consumption for any given period. A typical equation is as follows:

Consumption (kWh) = Days x 5,000 + HDD (13°C) x 50 + CDD (14°C) x 100
Regression (R^2 Value) = 0.92

Heating Degree Days (HDD) and Cooling Degree Days (CDD) are relative measurements of outdoor air temperature used as an index for heating and cooling energy requirements. Heating/cooling degree days are the number of degrees that the daily average temperature falls below or rises above a given balance point temperature. Coefficients are the constants in the baseline models. They are the values that are multiplied by the independent variables to get the model results, and are determined during the baseline model process. The Regression value indicates how well the actual bills match the equation, with 1.0 being a perfect fit. Typical year data (Environment Canada) is used to calculate the consumption for an average year. This consumption is used in all of the savings calculations.

Savings Methodology

Savings for opportunities are calculated using rigorous scientific modeling tools to ensure accuracy. The first step in the savings calculations is to find the existing consumption(s) of the equipment, based on equipment nameplate data, operating parameters, logged data (when available) and modeling from the utility bill analysis. The next step is to calculate the retrofit consumption once the opportunity is implemented. The savings are simply the difference between the two.

The calculation method varies depending on the Opportunity. For weather dependent savings, we would typically use a modified bin method from our own proprietary software. The underlying data used for creating the modified bins is ASHRAE WYEC (Weather Year for Energy Calculations). This ensures that the savings are based on a typical year, not an abnormally warm or abnormally cold year. When appropriate, we use other well-accepted methods such as eQUEST whole-building simulation.

Savings calculations for a particular Opportunity assume that other Opportunities listed ahead of it have been implemented. For example, if Opportunity 1 recommends upgrading to better technology and Opportunity 2 recommends reducing lighting hours, the savings for Opportunity 2 will be based on the lighting upgrade recommended in Opportunity 1. This ensures that savings are not "double counted".

Certain Opportunities have additional annual savings or costs, such as an increase or decrease in annual maintenance. The Annual Savings noted in the financial analysis tables throughout the report includes the energy savings as well as these additional annual savings or costs.

Cost Estimates

Cost estimates are calculated based on our experience, industry standards and market conditions. Market conditions can vary significantly between the writing of this report and the actual implementation of the recommendations.

PWGSC (Public Works and Government Services Canada) has defined classes of cost estimation for building construction or renovation. We provide Class C Cost Estimates as standard, however in many instances (especially with lighting opportunities) our work is closer to Class B.

TABLE 1.3.1: CLASSES OF COST ESTIMATES

Class D	Rule of thumb costing to get an order of magnitude – for study approval.
Class C	Measured quantities based on preliminary design – for project approval.
Class B	Measured quantities based on detailed engineering sizing calculations
Class A	Measured quantities based on design drawings

The Project Cost shown in the Financial Analysis tables throughout the report includes materials and labour, contingency as well as engineering, and third-party project management where appropriate. Costing does not include any applicable taxes.

Financial Analysis

The following Financial Factors are taken into account in the life cycle costing analysis presented throughout this report. The table lists the actual values used in the calculations.

Financial Factors

- Real Dollars: Monetary units of constant purchasing power.
- Real MARR: $MARR_R$, the minimum acceptable rate of return when cash flows are expressed in real dollars.
- Actual Dollars: Monetary units at the time of payment.
- Actual MARR: $MARR_A$, The minimum acceptable rate of return for actual dollar cash flows. It is the real MARR adjusted upwards for inflation. (Also called discount rate)
- Net Present Value (NPV): Total value of all cash streams discounted to present day dollars, or Net Present Value.
- Internal Rate of Return (IRR): The IRR represents the annualized (year over year) Return on Investment (ROI) an Opportunity is expected to generate. For example, if an investment provides 10% each year over 5 years, a $1 investment turns into 1 x $(1+10\%)^5$ = $1.61. The IRR is 10%, the average annual ROI is 10% and the ROI over the five-year period is 61%.
- Inflation: The rate of increase in average prices of goods and services over a one-year period; Also, the rate year period of decrease in purchasing power of money over a one-year period
- Escalation Rate: The rate of increase in utility costs due to a combination of factors including inflation, supply, demand, environmental and political effects.
- Simple Payback: Determines the financial payback or the time taken for the cash flows from a capital investment project to equal the cash outflows. The payback is represented in years and provides a timeframe for when initial costs will be recovered.
- Capital Payback: provides the time required to recover capital investment in years, while taking into consideration factors such as the time value of money and life cycle costing

TABLE 1.3.2: FINANCIAL FACTORS

$MARR_R$:	5.0%
Inflation:	2.20%
$MARR_A$:	7.31%
Interest Rate (APR):	1.9%

4 The Existing Building Profile

The following section highlights the main building details and examines each energy-consuming system, including all HVAC system, lighting, building envelope, etc. The facility details are as follows:

TABLE 3.1: FACILITY DETAILS

Building Name:	Fire Station 1
Client Name:	Township of Georgian Bay
Site Contact:	Jennifer Schnier
Address:	2507 Honey Harbour Rd
	Honey Harbour, ON
	P0E 1E0
Facility Area:	2,200 ft^2
Building Type:	Volunteer Fire Hall
Year Constructed:	1960's
Number of Stories:	1

4.1 Heating

Office areas of the building are heated via electric base boards while the equipment bay is heated via propane fired infrared tube heaters. All heating equipment is controlled by single setpoint thermostats.

TABLE 4.1.1: HEATING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition
H-1	Propane	40 MBH	65%	Good
H-2	Propane	40 MBH	65%	Good

IR tube heaters (propane)

4.2 Cooling

The building has no cooling equipment/systems.

4.3 Domestic Hot Water

Domestic hot water for the facility is supplied by a single electric tank heater. Details regarding the domestic hot water heater are as follows:

TABLE 4.3.1: DHW EQUIPMENT DETAILS

Tag ID	Heater Type	Capacity	Efficiency	Condition
T-1	Electric	3.5kW	80%	Fair

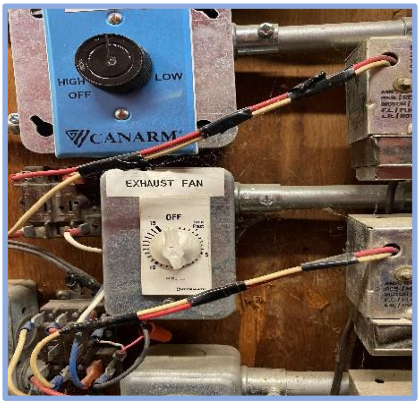
Domestic Hot Water Tank

Hot water cooper pipes were observed to be uninsulated. The DHW tank is dated 2005 and is to be replaced by 2025. Its replacement should be planned and budgeted for.

Domestic water for the building is supplied by truck and stored in a tank. The system utilizes a pressurized accumulator tank to minimize the pump's run time.

4.4 Ventilation

Ventilation is provided by infiltration due to negative pressure induced by the exhaust fan in the truck bay area when it is turned on manually. The exhaust fan is turned off using a timer after being turned on manually. Also, the bathrooms have exhaust fans, which run on demand when turned on with wall switches. These two exhaust systems induce fresh ambient air into the building.



Exhaust fan control.

4.5 Building Envelope

The facility was constructed in the ’60s with concrete blocks and a red brick façade. Windows are generally double-glazed with an air fill. The front entrance door is metallic with hollow cores.

The building has over 50 years of service, and its envelope looks in good shape. However, there has been some wear and tear on it. The door was observed to have weather stripping, but much of the weather stripping is damaged and should be replaced.

Red brick façade

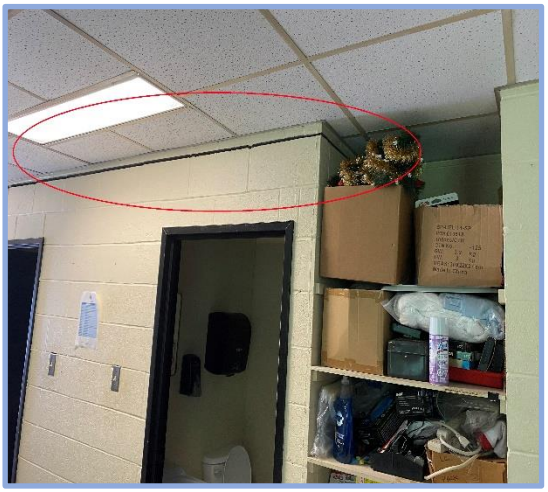
Red brick façade

Entrance door

Red brick façade and concrete blocks walls

It was noticed that the building floor is sinking, causing damage to the floor, and some walls are already separated from the ceiling, as shown in the following pictures.

Floor sinking



Walls showing a crack.

4.6 Water Fixtures

Water fixtures in the facility were generally observed to be standard flow. There are two washrooms with faucets, a toilet, and a shower. Additionally, there is a faucet in the kitchen and one in the service area.

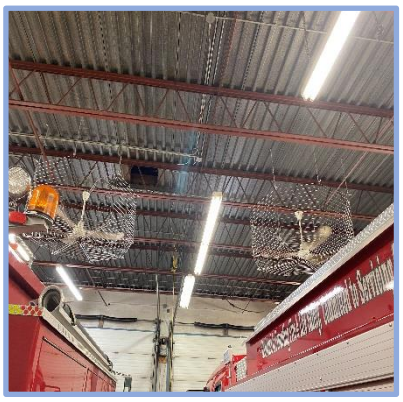
Faucet in washrooms

TABLE 4.6.1: WATER FIXTURE DETAILS

Fixture	Qty	Flow
Bathroom Faucets:	2	2.2 GPM
Kitchen Faucets:	1	2.2 GPM
Toilets:	2	1.6 GPF
Shower Heads:	2	2.5 GPM
Service area Faucet	1	2.2 GPM

4.7 Lighting

Lighting in the facility generally consists of T12 fluorescent in the office, corridor, electrical room, and equipment bay. Wall switches or circuit breakers control all lighting.



Fluorescent lamps

TABLE 4.7.1: INTERIOR LIGHTING DETAILS

Lamp Type	Watts	Location
T12 Fluorescent	32 W	Truck bay, corridors, offices, washroom rooms

4.7.1 Exterior Lighting

Exterior lighting consists of wall packs along the outer walls of the building. Photocells control all exterior lighting.

TABLE 4.7.2: EXTERIOR LIGHTING DETAILS

Fixture Type	Lamp Type	Wattage
Wall Packs	LED	75 W

Fluorescent lamps

4.8 Controls

The building has no building automation system (BAS). Heating equipment operates via single setpoint thermostats. All other equipment operates under standalone controls.

4.9 Electrical Service

The building is served with a 240V AC / 2 Pole system that supplies the main disconnect for the facility, which is rated at 200A. The electrical capacity is estimated to be 38.4 kW, assuming a reserve of 20%.

No metered demand data was available at the time of this study. The electrical meter is identified as number J2868117, and the account number is 301288367.

The calibrated energy model estimates the facility's peak electrical demand at 7.7kW. The facility's monthly base demand as well as the peak summer and peak winter demands are as follows:

Average Monthly Base Demand (kW)	Peak Summer Demand (kW)	Peak Winter Demand (kW)
5.1	3.3	7.7

5 The Energy Usage Report

5.1 Utility Meters

The following utility meters were modeled as part of this report:

TABLE 5.1.1: UTILITY METER DETAILS

Utility	Units	Escalation Rate	Marginal Rate ($/Unit)	GHG Emissions (Tonnes/Unit)
Electricity	kW	5.2%	$0.2048	0.000050
Propane	l	5.0%	$0.9334	0.001515
Water	m^3	3.0%	N/A *	N/A *

These utility meters and account numbers can be used to cross-reference reports in *the Appendices*.

* Data related to the water cost was not available when this report was written.

The "Effective Marginal Rate" is an average of the base marginal rates plus additional charges that the Utility Providers charge per unit of consumption or demand. This number is used in calculations to determine the utility cost savings of individual measures.

5.2 Utility Rate Structures

The following charges apply to this facility through the utility bills:

Energy Consumption Charges: typically billed monthly per unit of energy used by the building. Such charges may include customer charges, energy charges and other miscellaneous charges. These charges may vary from month to month.

Electric Demand Charges: determined by the maximum power demand in kilowatts that a building requires each month. The demand charge is based on the "peak demand" that the building required during the billing cycle. The peak demand is typically set during a period varying from 15 minutes to one hour. This can mean that very short periods of high energy demand during the billing cycle can result in higher demand charges.

Regulatory Charges: the costs of administering the wholesale electricity system and maintaining the reliability of the provincial grid and include costs associated with funding Ontario Power Authority conservation and renewable energy programs.

Distribution Charges: delivering electricity from electricity generating stations across the province to your LDC, then to your facility. This includes the costs to build and maintain the transmission and distribution lines, towers and poles and operate provincial and local electricity systems.

A portion of these charges are fixed and do not change from month to month. Others are variable and increase or decrease depending on the amount of electricity used.

Power Factor Charges: "Power Factor" is the ratio of real power (kilowatt) to apparent power (kilovolt-ampere, kVA) for any given load and time. It is a measure of how much of the power being delivered to the facility is actually performing work.

Power factors for resistive loads, such as lighting and electrical heating are (ideally) 1.0, meaning that all power being supplied is performing work. Electric motors (used for pumps, fans, elevators etc.) are inductive loads which have a power factor of less than 1.0. A motor with a power factor of 0.85 effectively uses only 85% of the power being delivered.

A low power factor affects the utilization of the installed capacity of the electrical system. Additional charges for having a low or less-than-optimum power factor are often structured as additional demand charges or can be per kilovolt-ampere reactive (KVAR) charges.

Time-of-use Rates: Time-of-use rate structures use varying rates for energy costs based on the time of day. The rates are typically associated with peak, off-peak and mid-peak periods. Prices can vary based on the time of day, day of the week, or season. They are higher during peak periods and lower during off-peak periods. Since time of use rates are designed to encourage energy conservation during peak periods, load shifting strategies used in the energy model can result in significant energy cost savings.

Global Adjustment Charges: Consumers who pay the Hourly Ontario Energy Price (HOEP), or have signed a retail contract, will see their electricity bills also include a line for the Global Adjustment. This charge accounts for the differences between the market price and the rates paid to regulated and contracted generators and for conservation and demand management programs. The charge shows on bills in different ways, depending on the type of customer:

1. Class B Consumers: those with a peak demand over 50kW and under 5MW
2. Class A Consumers: those with an average hourly peak demand of 3MW or higher

Other Charges: Utilities often charge additional taxes and surcharges based on local regulations and/or programs, such as energy conservation and low-income assistance programs. Additionally, there can also be fuel adjustment charges, which are related to the cost of resource energy to the utility. Often this charge is an additional multiplier that is applied to the energy charge and will vary monthly based on fuel cost fluctuations.

5.3 Meter Modeling

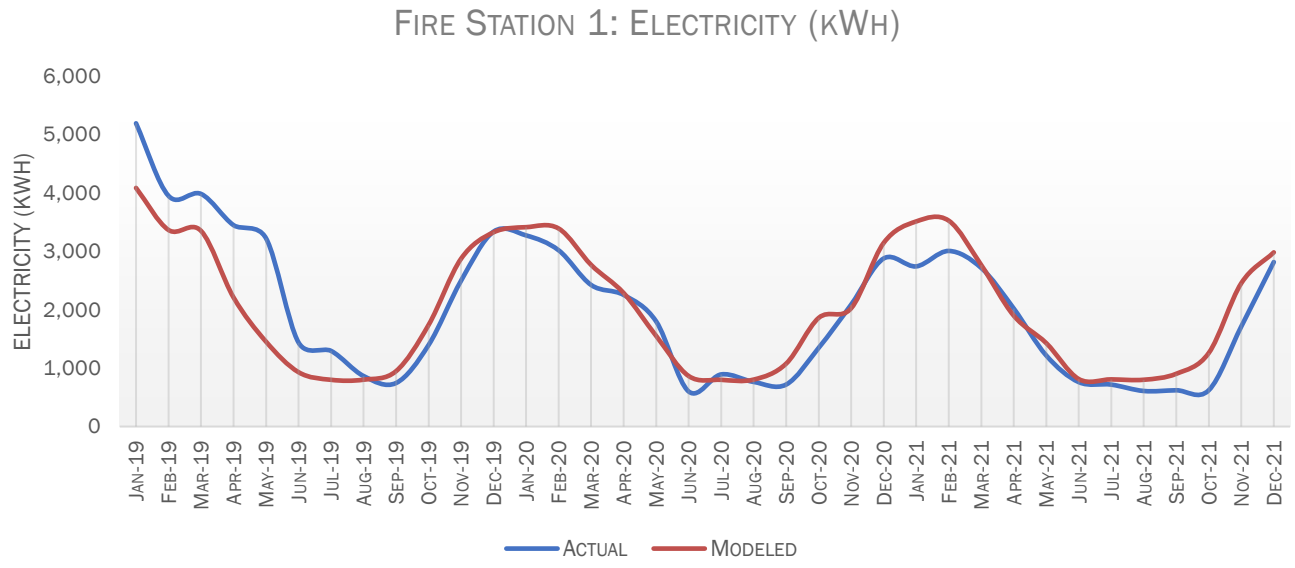
Daily mean temperatures from Barrie weather station (WMO ID 71314) were used in creating the baseline models for this facility.

5.3.1 Electricity

Baseline Equation:

Electricity (kWh) = Days x 26.66 + HDD x 4.4.
The underlying regression of this baseline equation is $R^2 = 0.9444$.
HDD (Heating Degree Days) calculated using a balance point of 15°C.
In a typical year, consumption will be 26,591 kWh.

Modeling Graphs:



Rate Structure:

Electricity for this building is provided by Hydro One. It is classified as a General Service account with a monthly demand lower than 50. This is a "Standard Rate" structure which charges electricity based on the Hourly Ontario Energy Price (HOEP) and Global Adjustment (GA). Both of these rates change from month-to-month as they are based on real-time market conditions. Regulatory Charges are also added to this cost on a per kWh basis.

Comments:

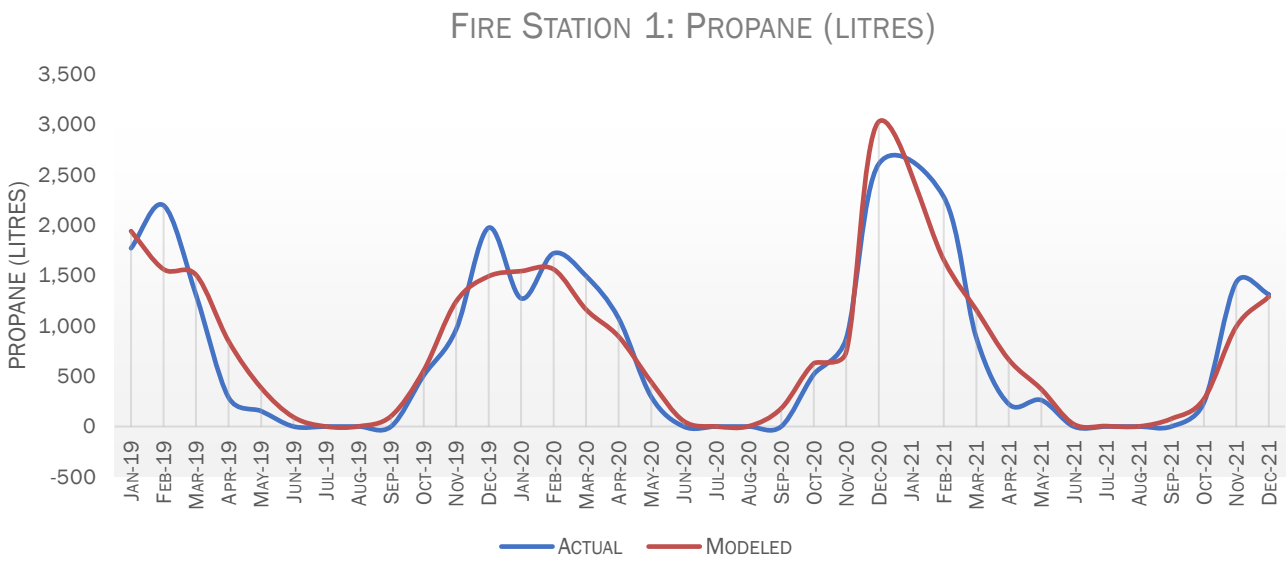
No anomalies or irregularities were noted during the modeling period of this report.

5.3.2 Propane

Baseline Equation:

Propane (litres) = Days x 0 + HDD x 2.6.
The underlying regression of this baseline equation is R^2 = 0.9354.
HDD (Heating Degree Days) calculated using a balance point of 15°C.
In a typical year, consumption will be 9,956 litres.

Modeling Graphs:



Rate Structure:

Propane for the facility is purchased and delivered by the Township's fuel provider.

Comments:

No anomalies or irregularities were noted during the modeling period of this report.

5.4 Building Energy Performance

The following section provides benchmarking information for the facility.

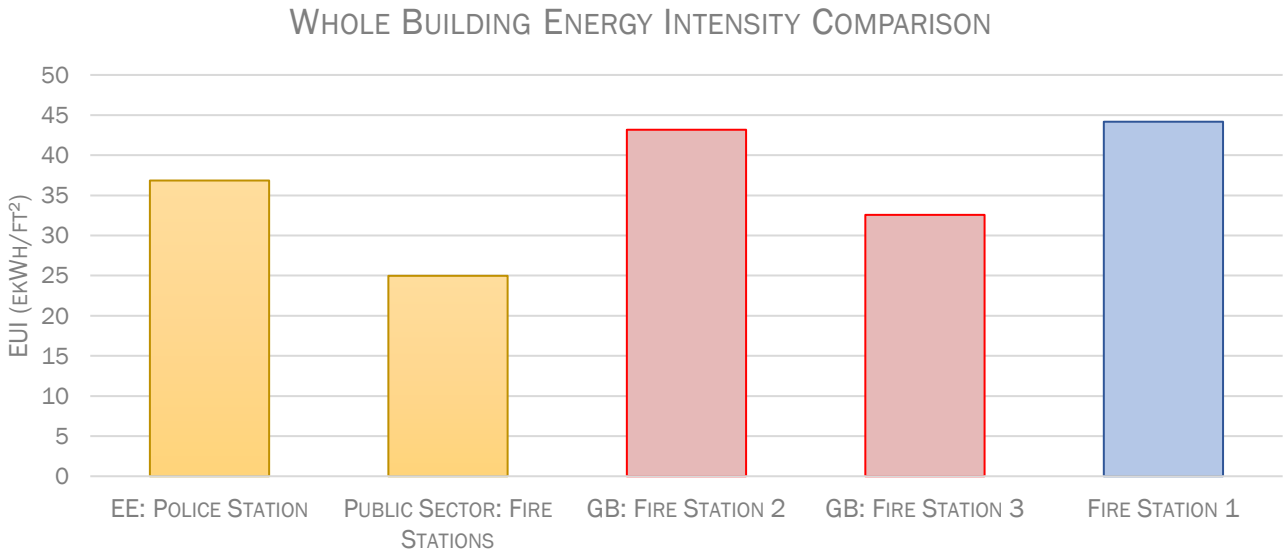
Electricity intensity for the building is 12.1 ekWh/ft² (0.47 GJ/m²). Propane intensity for the building is 32.1 ekWh/ft² (1.24 GJ/m²). Total energy intensity for the building is 44.2 ekWh/ft² (1.71 GJ/m²).

The energy performance of the Fire Staton 1 is compared to buildings of similar usage or size from multiple benchmarking databases including Energy Star, Department of Energy (DOE), Ontario Broader Public Sector buildings and a database of energy use intensities maintained by Efficiency Engineering. Additionally, it was compared with other two fire stations in the Township of Georgian Bay.

Benchmark	EUI	% Variance
EE: Police Station	30.5	45%
Public Sector: Fire Stations	25.0	77%
GB: Fire Station 2	43.2	2%
GB: Fire Station 3	32.6	36%
Fire Station 1	**44.2**	

*A positive variance indicates that the facility EUI is xx% higher than the stated benchmark. A negative variance indicates that this facility's EUI is below the indicated benchmark, consuming less energy per unit of area.

A comparison of the total energy intensity of the facility with buildings of a similar type and characteristics are shown in the chart below.



Compared to other benchmark buildings of similar type as well as to Georgian Bay's other fire halls, the overall energy intensity at Fire Station 1 is high.

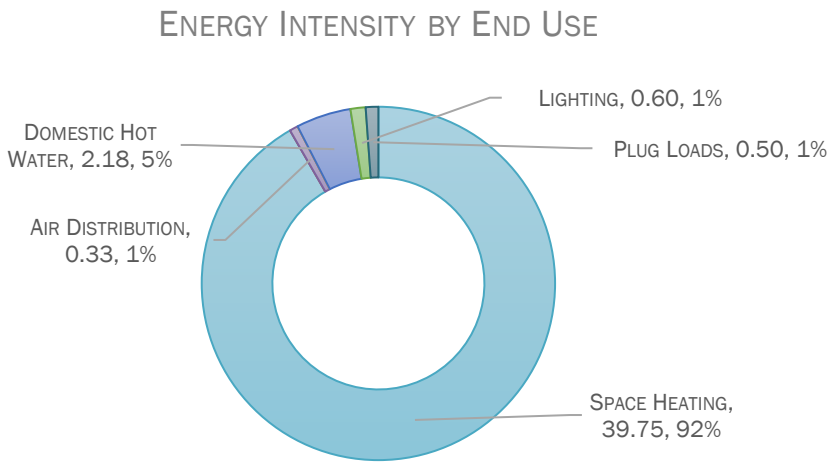
5.5 Energy Breakout by End Use

Energy consumption by end use for the facility has been calculated based on the building's overall energy consumption, calibrated energy models, nameplate information, schedules and estimated cycle times for equipment.

The end use energy breakdown for this facility is:

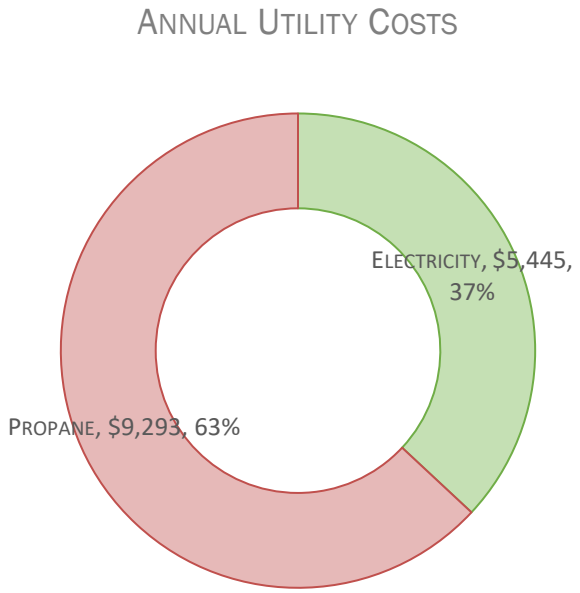
End Use	Electricity (kWh)	Propane (l)	EUI (ekWh/ft²)	GHG Emissions (Tonnes)
Space Heating	16,861	9,956	39.75	15.92
Air Distribution	735	0	0.33	0.02
Domestic Hot Water	4,797	0	2.18	0.14
Lighting	1,317	0	0.60	0.04
Plug Loads	1,100	0	0.50	0.03
Other	1,781	0	0.81	0.05
Total	**26,591**	**9,956**	**44.2**	**16.2**

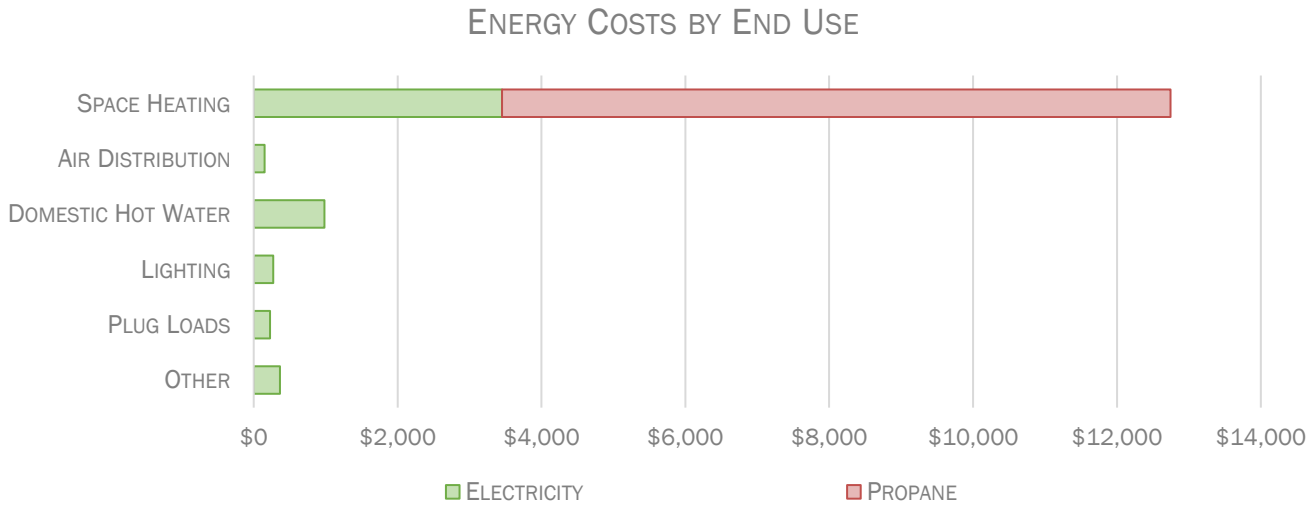
The following chart shows the energy intensity of Fire Station 1 broken out by end use.



5.6 Utility Costs

In a Typical Model Year, the building would expect to spend the following at the current utility rates. Energy costs by end use are:





6 Measure Level Analysis

The Measure Level Analysis quantifies the energy savings and implementation costs for each Opportunity (or "Measure"). As Opportunities are organized into Roadmaps, interactive effects will occur. As such, the total GHG emissions reductions may differ between the sum of the individual measures and the total for the Roadmap. Individual Opportunities may be included in multiple roadmaps.

The financial analyses for the Opportunities listed in the following section include a Life Cycle Cost Analysis or LCCA. The LCCA provides a more detailed analysis over the lifespan of the measure and includes the following items:

- **Inflation Rate:** An annual inflation rate is included for future avoided costs and additional annual maintenance costs/savings.
- **Discount Rate:** The rate used to approximate the present-day value of future costs/savings.
- **Utility Escalation Rate:** Utility costs escalate year after year. This value increases the energy savings/costs accordingly over the 20-year period. These escalation rates can be found in Table 5.1.1.
- **Operational Costs:** Implementing some measures will require additional annual maintenance (for example, chemical treatment for a new boiler plant), while others require less annual maintenance (such as longer lasting LED lighting).
- **Avoided Costs:** If some pieces of equipment are due for replacement in the coming years, then by implementing related energy efficiency measures as a part of this project, you are avoiding the future costs associated with the replacement of this equipment.

The results of the LCCA are summarized in a single value: the Capital Payback. Where a simple payback will give you a general idea of how an Opportunity will perform economically (using first year utility savings and the upfront implementation costs), the Capital Payback identifies at what point along the 20-year LCCA the Opportunity recoups its initial investment, taking all of the above into consideration.

Further details are located in the Appendices of this report.

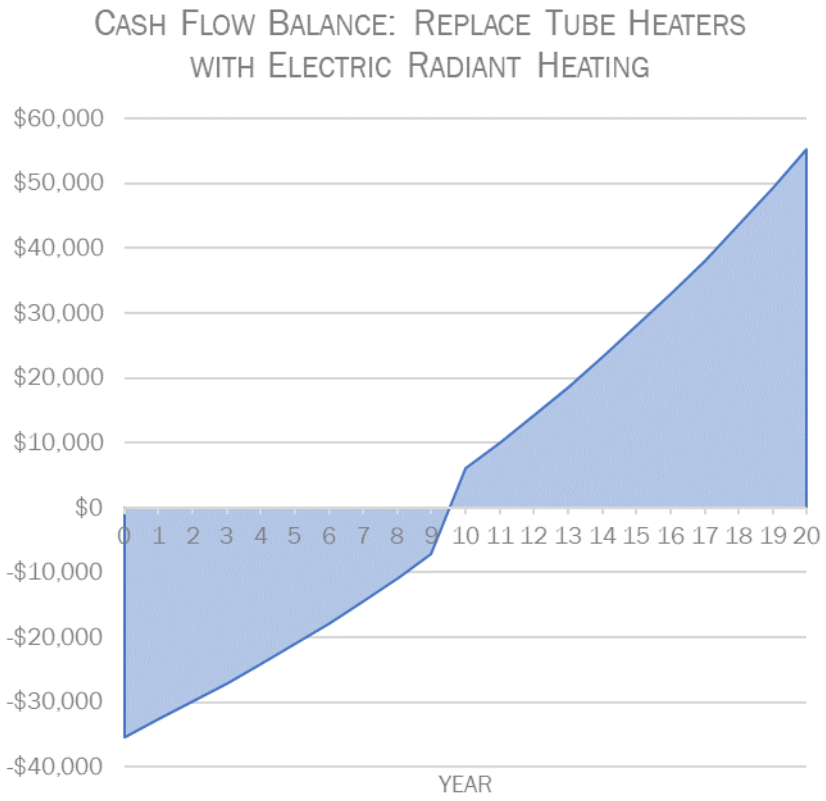
6.1 Opportunity 01: Replace Tube Heaters with Electric Radiant Heating

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.1.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-34,630
Propane (l):	10,279
Emissions (tCO_2e):	14.9
Financials	
Utility Savings:	$2,505
Materials & Labour:	$34,362
Engineering & PM:	$5,154
Contingency:	$3,436
Project Costs:	$42,952
Simple Payback:	17.1
Capital Payback:	10.4
NPV:	-$325
IRR:	7.2%



Existing Conditions

The existing IR tube heaters use propane to generate heat and are responsible for 74% of the energy consumption and 95% of the GHG emissions. Due to the nature of this technology, the heaters must operate at high temperature to radiate heat because energy transfer by radiation is a function of the fourth power of the surface temperature ($E = \sigma.e.T4$). At high temperatures, the heaters must vent hot combustion gases, which causes high energy losses (> 30%).

IR tube heaters (propane)

Retrofit Conditions

Since the IR tube heaters are the single source of propane consumption, it would not be possible to significantly reduce the GHG emissions without significantly reducing their propane consumption or replacing them with an alternative technology.

Electric infrared heaters are significantly more efficient propane fired units as they do not require venting of hot combustion gasses. All the thermal energy (heat) generated is transferred to space by radiation and some by convection.

This measure will have no measurable impact on operations and maintenance at the facility. However, the proposed electrical heaters will increase the power demand by approximately 48 KVA (@240V). This demand exceeds the building's existing electrical capacity, which is estimated to be approximately 39 KVA. Thus, an electrical service upgrade would be required to implement this measure. The estimated cost of the electrical upgrade is not included in the Project Costs for this measure but is included in the Project Costs for each of the GHG reduction pathways analyzed.

In addition to energy savings, this measure will provide increased comfort to building occupants thanks to a more even distribution of the radiated heat. The existing tube heaters tend to release most of the heat in the section close to the burner where the temperature is the highest and less heat from the section close to the vent where the temperature is the lowest. This is not the case for IR electrical heaters because all the surfaces of the electrical resistors operate at a similar temperature. Moreover, having five or more heaters makes it possible to distribute heat more evenly over the area. OBJ

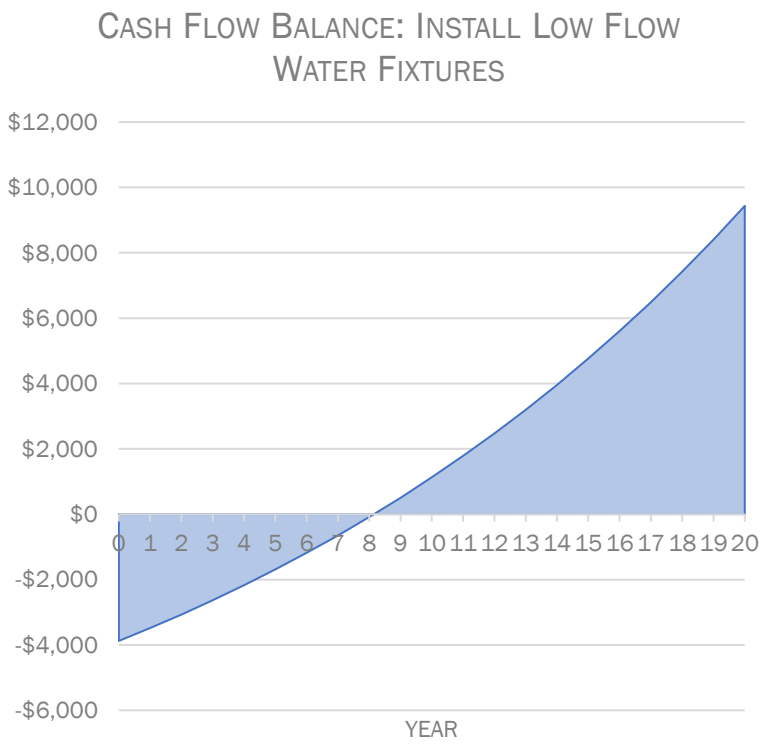
6.2 Opportunity 02: Install Low Flow Water Fixtures

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.2.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,830
Propane (l):	0
Water (m^3):	41
Emissions (tCO_2e):	0.1
Financials	
Utility Savings:	$375
Materials & Labour:	$3,102
Engineering & PM:	$465
Contingency:	$310
Project Costs:	$3,878
Simple Payback:	10.3
Capital Payback:	8.15
NPV:	$2,246
IRR:	12.9%



Existing Conditions

Water fixtures in the facility were generally observed to be standard flow. There are two washrooms with faucets, toilet and shower on each. Additionally, there is a faucet in the kitchen and one in the service area. There is no cost assigned to water consumption because water is obtained from an existing water well.

Retrofit Conditions

By installing low water flow fixtures in washroom's faucets and toilets, the new water flow can be reduced to 20 to 30% of the original consumption. This measure will have no measurable impact on operations and maintenance at the facility. In addition to energy savings, this measure will provide savings of electrical energy due to less power consumed by the water pumps. However, the additional energy savings and GHG reductions are minor when compared with the energy and GHG reductions due to less electrical energy consumed to heat up the water.

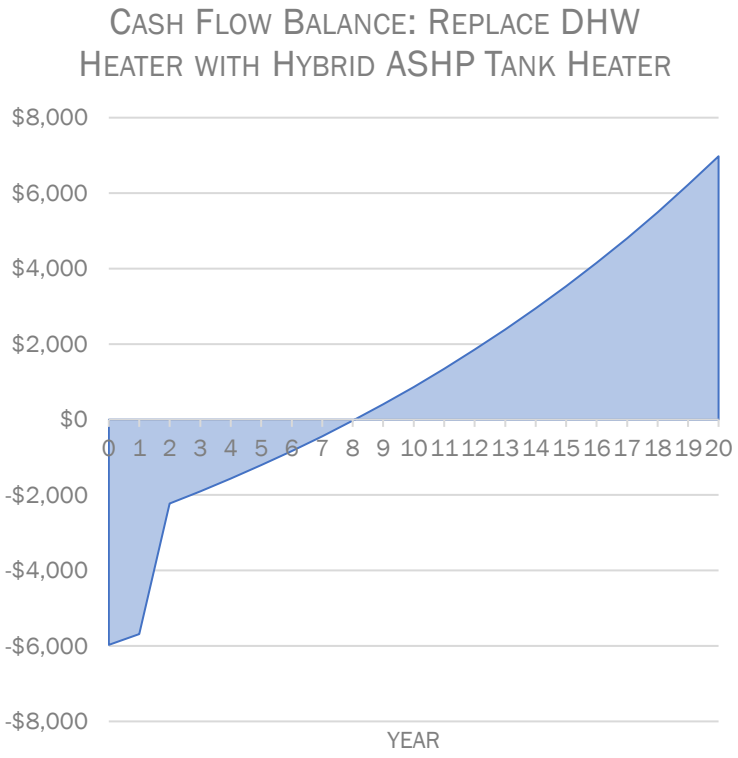
6.3 Opportunity 03: Replace DHW Heater with Hybrid electric/ASHP Tank Heater

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.3.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,346
Propane (l):	0
Emissions (tCO_2e):	0,04
Financials	
Utility Savings:	$276
Materials & Labour:	$4,777
Engineering & PM:	$717
Contingency:	$478
Project Costs:	$5,971
Simple Payback:	21.7
Capital Payback:	8.1
NPV:	$1,272
IRR:	10.6%



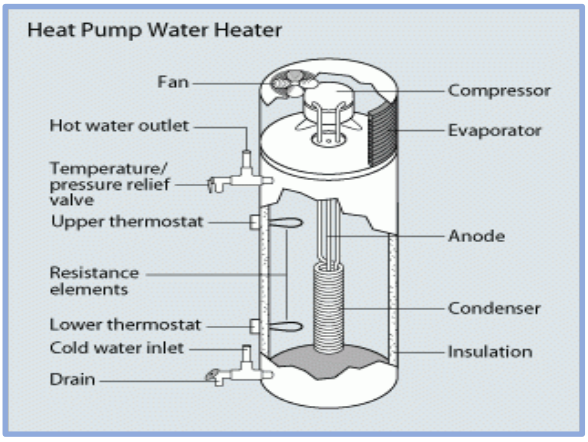
Existing Conditions

Hot water in the building is generated by an electric DHW tank heater, which was manufactured in 2005. The equipment is approaching the end of its life. Moreover, it is expected that the hardness of the water has caused the internal elements of the tank, including the resistors, to build scales due to the accumulation of minerals dissolved in water that precipitates when temperature increases.

Retrofit Conditions

The results presented above include reduced water consumption due to implementing low-flow water fixtures (opportunity 02).

Considering an average life span of 20 years, the equipment should be replaced by 2025. Thus, there is an opportunity to replace the existing tank with a hybrid electric/ASHP water heater tank[1]. This will lead to energy savings due higher efficiency to generate the same volume of hot water[2]. Hybrid tanks technology is commercially available and there are well-known manufacturers offering service and spares. Thus, there is no additional risk associated with the technology.



Heat pump water heater tank (source: US DOE) [1]

Typical Hybrid ASHP/Electric Tank Heater

This measure will have no significant impact on operations and maintenance at the facility.

[1] https://www.energy.gov/energysaver/heat-pump-water-heaters
[2] https://natural-resources.canada.ca/energy-efficiency/products/water-heaters/heat-pump-water-heaters/14556

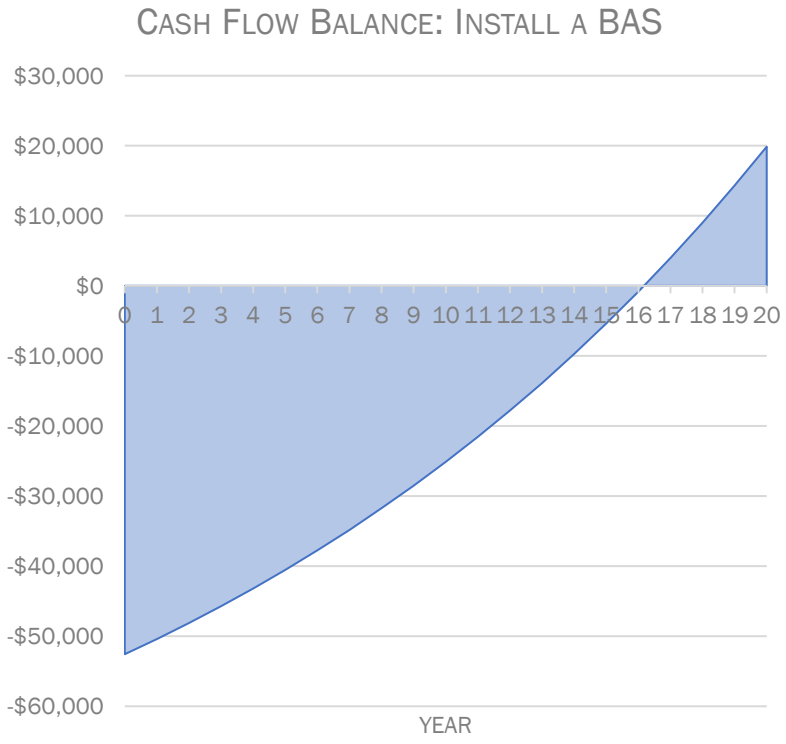
6.4 Opportunity 04: Install a Building Automation System (BAS)

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.4.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	2,897
Propane (l):	1,542
Emissions (tCO_2e):	2.5
Financials	
Utility Savings:	$2,072
Materials & Labour:	$42,054
Engineering & PM:	$6,308
Contingency:	$4,205
Project Costs:	$52,568
Simple Payback:	25.9
Capital Payback:	16.4
NPV:	-$19,788
IRR:	2.6%



Existing Conditions

The building has no BAS. All equipment at the facility, including lights and heating systems (IR tube heaters and electric base board heaters), are controlled manually by means of wall switches or circuit breakers. Only exterior light has an automatic control with photocell sensor. Moreover, the IR tube heaters are controlled with a timer.

Retrofit Conditions

The proposed system will allow to have better control of the conditions in the building and to schedule the lighting and heating as required.

To estimate the cost of the proposed BAS, the following elements were considered.

- 4 Analog inputs
- 4 Analog outputs
- 6 Digital inputs
- 6 Digital outputs
- Required DCC controllers.

The BAS will bring the possibility to significantly reduce energy consumption thanks to better control of temperature, ventilation, and capacity to schedule lighting.

This measure will have a minor impact on operations and maintenance at the facility. In addition to energy savings, this measure will provide increased comfort to building occupants. The addition of a BAS will require basic additional training of the facility staff. However, this will allow the staff to operate the building remotely and to track key variables and conditions.

The impact of this measure on GHG reductions depends on the type of energy source that is used for heating in the truck bay area, which is currently propane in the existing IR tube heaters. This means that ones the ECM-01 is implemented, the implementation of BAS will have minor impact on GHG reductions. However, due to the higher cost of electricity, the economic performance of the project could improve.

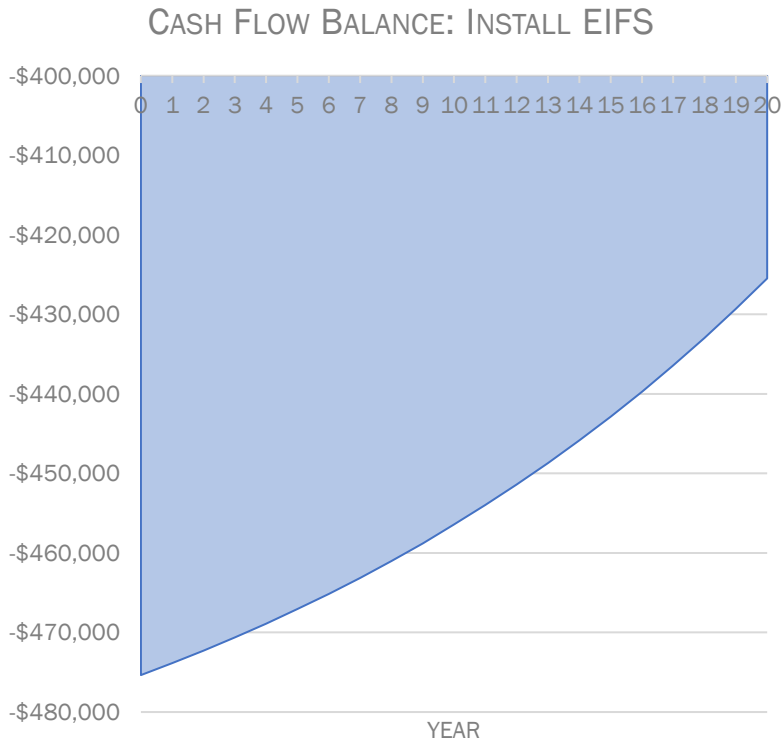
6.5 Opportunity 05: Install Exterior Insulation Finishing Systems (EIFS)

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.5.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,720
Propane (l):	1,153
Emissions (tCO_2e):	1.8
Financials	
Utility Savings:	$1,428
Materials & Labour:	$380,284
Engineering & PM:	$57,043
Contingency:	$38,028
Project Costs:	$475,355
Simple Payback:	332.9
Capital Payback:	57.5
NPV:	-$452,343
IRR:	-14.6%



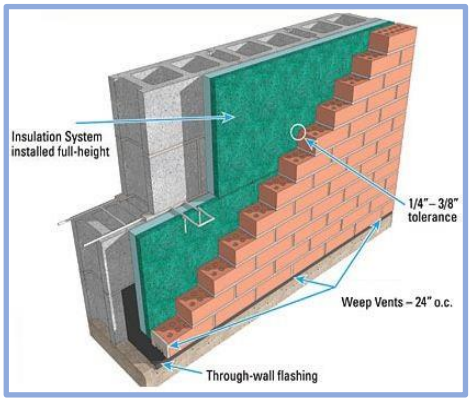
Existing Conditions

The facility was constructed in the '60s with concrete blocks and a red brick façade. Windows are generally double-glazed with an air fill.

The building has over 50 years of service, and its envelope is in fair condition. However, settling the foundation has led to some cracking of interior and exterior walls, potentially leading to increased infiltration.

Building drawings for the facility are not available. The calibrated energy model, as well as the high energy intensity of the facility, suggest that the thermal insulation between the blocks and the bricks, though likely adequate at the time of construction, is significantly lower than what would be considered best practices by today's standards.

Existing block and brick walls

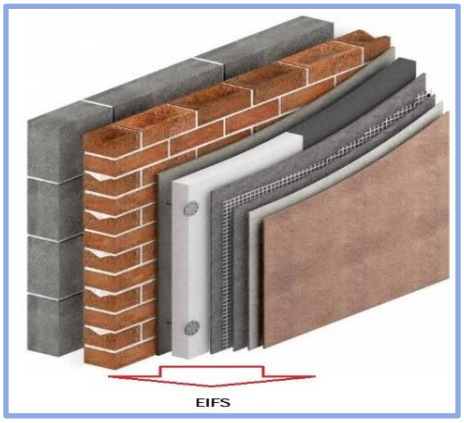


Typical wall with internal insulation system

Retrofit Conditions

Installing an EIFS will help reduce thermal losses through the walls. According to the results of the model, this measure would lead to a reduction of approximately 11% of the energy required to heat the building.

It is relevant to note that this measure will have a marginal impact on GHG reduction after switching from propane to electricity for the heating system. The energy savings will be similar. However, the GHG reduction will drop significantly due to the lower emissions factor for grid electricity.

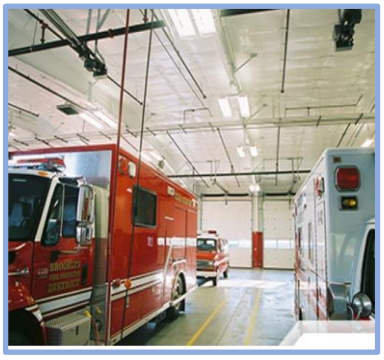


External Insulation Finishing System

In addition to the exterior insulation system, it might be possible to install thermal insulation under the existing metallic roof as shown in the following pictures. This will reduce thermal losses through the existing roof.

Existing metallic roof

Sample of thermal insulation for metallic roof



Typical metallic roof with thermal insulation

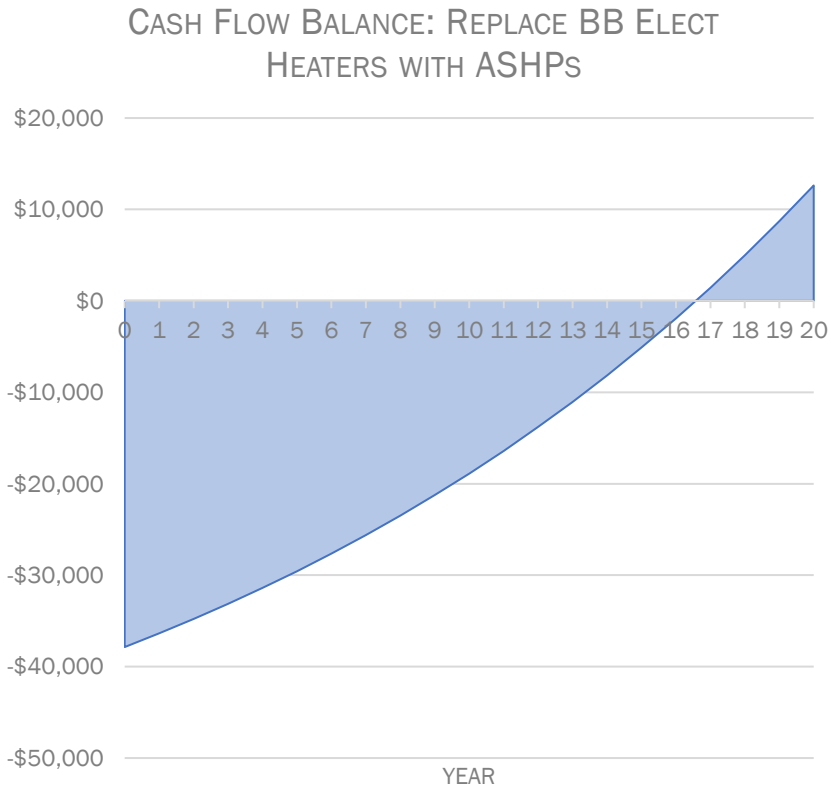
6.6 Opportunity 06: Replace BB Elect Heaters with ASHPs

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.6.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	6,940
Propane (l):	0
Emissions (tCO_2e):	0.2
Financials	
Utility Savings:	$1,421
Materials & Labour:	$30,290
Engineering & PM:	$4,544
Contingency:	$3,029
Project Costs:	$37,863
Simple Payback:	26.6
Capital Payback:	16.6
NPV:	-$14,640
IRR:	2.5%



Existing Conditions

Space heating to office areas is supplied by electric baseboard heaters totaling 6.5kW. The baseboards are believed to original to the building. The existing electric heaters are in fair condition however are approaching the end of their expected service life due to age.

Retrofit Conditions

An air source heat pump system can be installed to offset the heating consumption of the electric baseboard units.

The proposed system ductless split air source heat pump system consists of an outdoor condensing/evaporator unit coupled to a wall-mounted indoor unit.

Rather than generating heat directly, air source heat pumps operate by extracting heat from, or rejecting heat to the atmosphere. As a result, they're able to provide heating energy much more efficiently than either electric resistance heating or combustion of fossil fuels.

External Insulation Finishing System

The existing electric baseboard heaters will remain in place as a backup to provide heating during peak demand on the coldest days in winter.

In addition to significantly reducing the amount of electricity required for space heating, the new split system ASHP can also provide cooling during summer months. This would improve comfort during hot summer days, considering that the building does not have a cooling system.

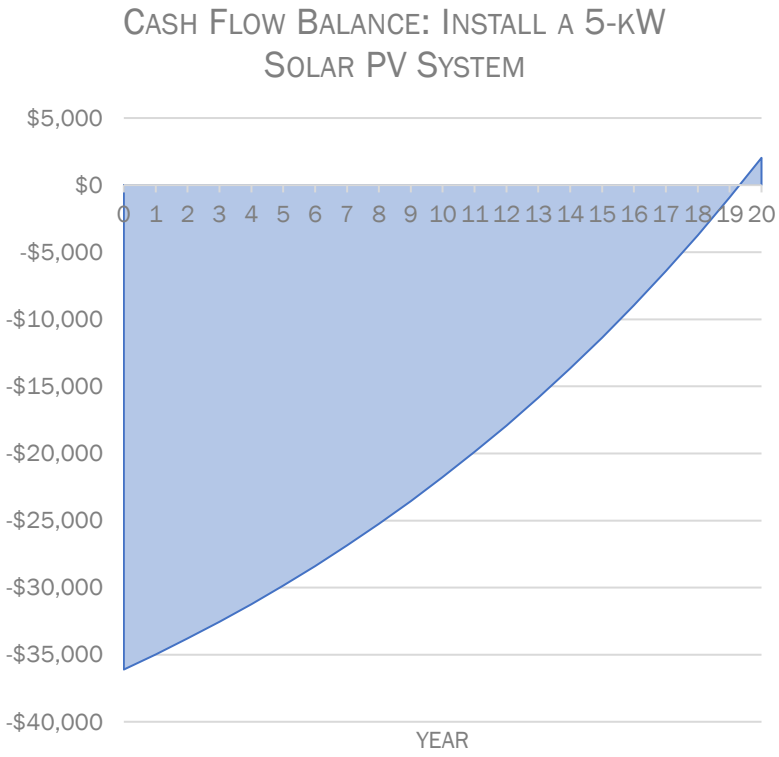
6.7 Opportunity 07: Install a 5-kW Solar PV System

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.7.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	5,243
Emissions (tCO_2e):	0.2
Financials	
Utility Savings:	$1,074
Materials & Labour:	$32,825
Contingency:	$3,283
Project Costs:	$36,108
Simple Payback:	33.6
Capital Payback:	19.3
NPV:	-$18,564
IRR:	0.5%



Existing Conditions

All electricity is imported from the electrical grid.

Retrofit Conditions

The building has an estimated roof area of 194 m^2, and the usable area for a solar PV system is about 128 m^2. However, the shadowing caused by the surrounding trees located to the south, east, and west of the building (as shown in the picture) will negatively affect the power generation potential.

Trees around the building

The shadowing effect due to the surrounding trees affects the power generation capacity and, consequently, the financial performance of the PV system.

The implementation cost used to evaluate this ECM considered the need to perform a structural resistance analysis to assess the capacity of the roof structure to bear additional load due to the solar modules.

Moreover, the implementation cost included the potential cost of any electrical system upgrade required to comply with the electrical code and any specific requirement for a distributed energy generation system interconnected with the electrical grid.

This measure will have no measurable impact on operations and maintenance at the facility. The maintenance and operation cost of the PV system is included in the financial analysis.

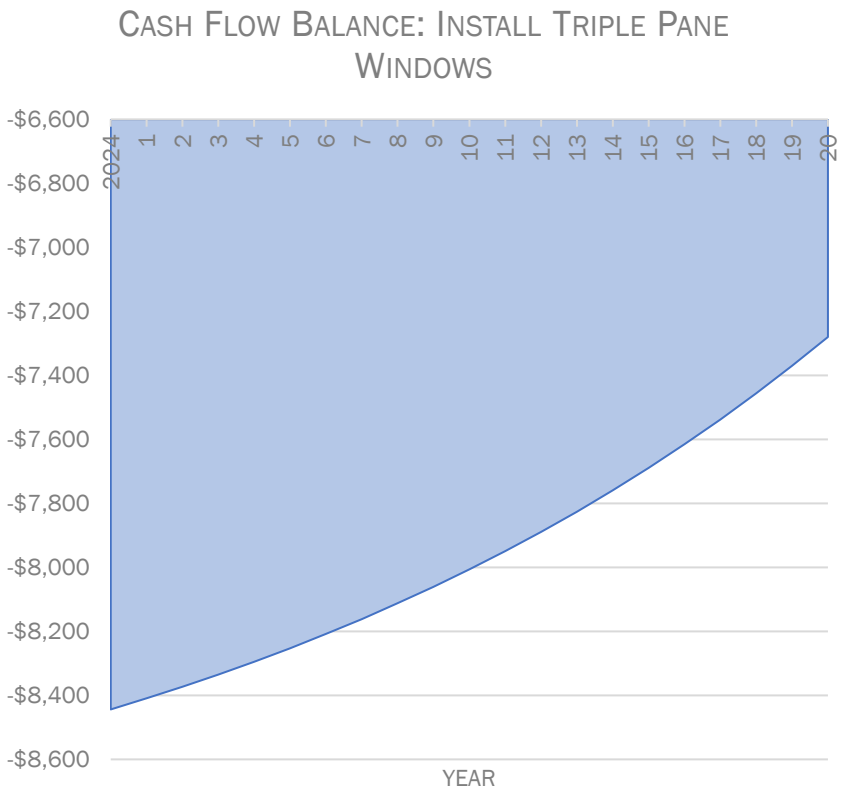
6.8 Opportunity 08: Install Triple Pane Windows

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

TABLE 6.8.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	160
Propane (l):	0
Emissions (tCO_2e):	0
Financials	
Utility Savings:	$33
Materials & Labour:	$6,755
Engineering & PM:	$1,013
Contingency:	$676
Project Costs:	$8,444
Simple Payback:	257.8
Capital Payback:	57.1
NPV:	-$7,909
IRR:	-13.1%



Existing Conditions

This building has only three windows located in the office area and the estimated area of window is 4.46 m^2 (48 ft^2).

The existing windows were observed to be double glass. It might be possible to reduce the thermal losses by installing triple glass windows.

Existing windows

Retrofit Conditions

Changing the windows will reduce the heating energy consumption only for the office area, which is heated with baseboard electrical heaters, and will not impact the propane consumption, which is used for heating only in the equipment bay area. The estimated electrical energy savings were only 1% due to the small window area. Moreover, the impact on GHG reduction is not relevant.

This measure will have no measurable impact on operations and maintenance at the facility.

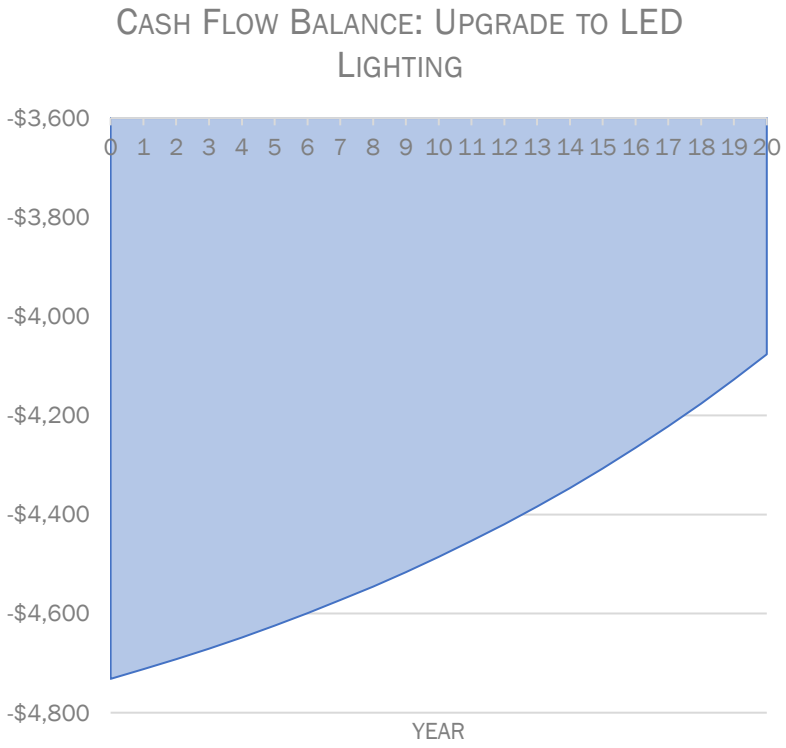
6.9 Opportunity 09: Upgrade to LED Lighting

The Detailed Financial Analysis

Using the Financial Factors listed in this report, this project results in the following Annual Utility Savings, Simple Payback and Net Present Value:

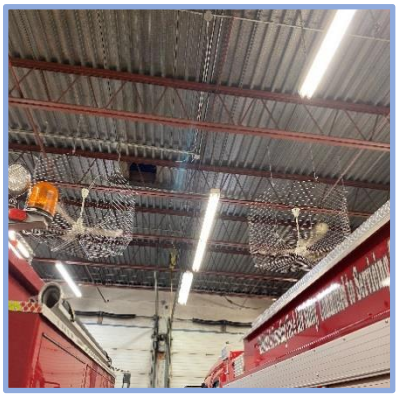
TABLE 6.9.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	90
Propane (l):	0
Emissions (tCO_2e):	0
Financials	
Utility Savings:	$18
Materials & Labour:	$4,115
Engineering & PM:	$206
Contingency:	$411
Project Costs:	$4,732
Simple Payback:	256.8
Capital Payback:	51.6
NPV:	-$4,431
IRR:	-13.1%



Existing Conditions

Lighting in the facility generally consists of T12 fluorescent lamps in offices, corridors, electrical room and equipment bay. All lighting is controlled by wall switches or circuit breakers.



Fluorescent lamps

Retrofit Conditions

The proposed retrofit is the replacement of the existing fluorescent lamps with tubular LED lamps. This retrofit can be easily implemented since it consists of the removal of the existing fluorescent lamps and the ballast, doing minor electrical connections in the existing features, and installing the new LED tubular lamps with similar lighting intensity capabilities.

This measure will have a minor positive impact on operations and maintenance at the facility. Since the new LED lamps have a longer life span than the existing fluorescent lamps, the cost due to maintenance (replacing lamps) is expected to be lower during the life of the project (20 years).

In addition to energy savings, this measure could provide improvement in lighting quality in areas where lighting can be improved.

The financial performance of the project is relatively lower than similar projects in other buildings due to the low number of operational hours of Fire Station. A complement to the proposed ECM could be the installation of occupation sensors in the office areas.

During the energy audit, information was received which said that in some cases the lights of the equipment bay are left ON permanently. If this is the case with the Fire Hall #1, the retrofit to LED lamps in the equipment bay area might have good financial performance due to longer operation time.

Finally, the implementation of this measure will cause the heating demand to increase lightly due to a decrease in thermal losses from the lamps.

7 Scenario Level Analysis

As per the funding guidelines set out by the Green Municipal Fund, the measures presented in this study will be grouped in the following GHG reduction target pathways:

- 50% GHG reductions in 10 years
- 80% GHG reductions in 20 years
- 80% GHG reductions in 5 years

7.1 GHG Reduction Pathway Summary

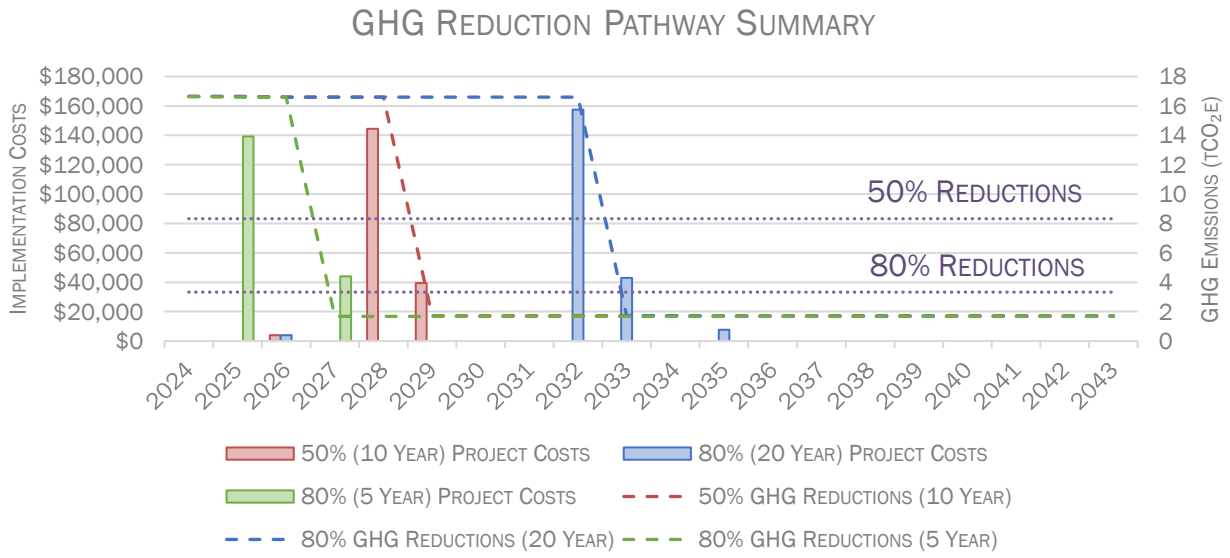
The following table summarizes which measures are included in each pathway.

Opp #	Opportunity	Emissions (tCO_2e)	50% Reduction Pathway	80% Reduction Pathway
1	Replace Tube Heaters with Electric Radiant Heating	14.9	•	•
2	Install Low Flow Water Fixtures	0.1	•	•
3	Replace DHW Heater with Hybrid ASHP Tank Heater	0.04		•
4	Install a BAS	2.5		
5	Install EIFS	1.8		
6	Replace BB Elect Heaters with ASHPs	0.2		
7	Install a 5-kW Solar PV System	0.2		
8	Install Triple Pane Windows	0.0		
9	Upgrade to LED Lighting	0.0		
10	Electrical Service Upgrade	0.0	•	•

Bundling measures into pathways, or scenarios, often results in interactive effects between systems. As a result, the total GHG reduction for a particular Roadmap will typically differ from the sum of the GHG reductions from individual measures. The Scenario Level Analysis accounts for these interactive effects between systems which are not represented in the Measure Level Analysis.

	Reductions				Financials		
GHG Reduction Pathways	**Energy (ekWh)**	**Energy (%)**	**Emissions (tCO_2e)**	**Emissions (%)**	**Annual Savings**	**Project Costs**	**20-Year LC Cost**
50% Reductions (10 Year)	40,080	41%	14.9	90%	$2,879	$179,213	$335,226
80% Reductions (20 Year)	41,426	43%	15.0	90%	$3,155	$185,185	$324,163
80% Reductions (5 Year)	41,426	43%	15.0	90%	$3,155	$185,185	$347,095
Business-As-Usual	$0	0%	$0	0%	$0	$10,501	$259,373

All the pathways give positive energy savings (41% to 43%). However, due to the relatively higher cost of electrical energy, the annual savings are limited but still positive. It is important to mention that any increase in the cost of propane in the future will improve the financial performance of the proposed projects.



Another aspect of this analysis is considering the costs associated with a “business-as-usual” approach. This study is offering upgrade options to HVAC equipment and other energy consuming systems to reduce overall GHG emissions. However, all of the equipment addressed in this study will have to be replaced at some point, if not by more efficiency equipment, then by “like-for-like” equipment replacements. By implementing these energy efficiency measures, the “like-for-like” costs are avoided.

The table below shows the financial details of each pathway taking into consideration the incremental costs of implementing energy efficient measures through the GMF program.

Financials							
Pathway	**Project Costs**	**Potential Grant**	**Avoided Cost**	**Incremental Costs**	**LC Cost**	**Incremental 20-Year LC Cost**	**Incremental LC Cost per tCO_2e**
50% Reductions in 10 Years	$179,213	$35,843	$7,482	$132,869	$335,226	$75,853	$254
80% Reductions in 20 Years	$185,185	$37,037	$10,501	$137,646	$324,163	$64,790	$216
80% Reductions in 5 Years	$185,185	$37,037	$10,501	$137,646	$347,095	$87,722	$293
Business-As-Usual	$10,501	$0	$0	$0	$259,373	N/A	N/A

Measures recommended in both the 50% and 80% Reduction Pathways include systems which will significantly increase the building's electrical demand above its existing capacity. The cost to upgrade the electrical system due to this increase in demand is included in the Project Costs for each Reduction Pathway. The cost of the upgrade of the electrical system accounts for approximately 77% of the required investment.

7.2 Demand Impact Summary

A major component of achieving net-zero carbon is fuel switching from propane to a fuel source that emits comparatively less emissions, such as electricity. However, converting most or all of a building's HVAC systems from propane-fired equipment to electrical can have a significant impact on the building's electrical demand. If the building is unable to support the sudden increase in electrical demand as a result of implementing fuel-switching measures, then further investment into bolstering the building's existing electrical capacity may be necessary.

According to energy model developed in eQuest, the facility's existing monthly base demand as well as the peak summer and peak winter demands are as follows:

Average Monthly Base Demand (kW)	Peak Summer Demand (kW)	Peak Winter Demand (kW)
5.1	3.3	7.7

The site is serviced by a post mounted step-down transformer. This supplies the main disconnect for the facility which is rated at 200A (120V/240V). The site has approximately 48 kW of total electrical capacity. The demand impact of each reduction pathway is summarized in the table below. The proposed electrical heaters will add a new demand of 48kW. Thus, it is required to upgrade the system by the same amount.

Pathway	Demand Increase (kW)	Demand Upgrade Costs
50% Reductions in 10 Years	48	$132,384
80% Reductions in 20 Years	48	$132,384
80% Reductions in 5 Years	48	$132,384

The costs of upgrading electrical distribution to support the implementation of a measure (wiring, conduit, circuit breakers, etc.) are already included in each measure's project costs. However, if the demand impact of implementing several measures exceeds the building's installed capacity, then further electrical costs will be required. These upgrades are typically done by the utility by local distribution company (LDC) and costs are passed onto the building owner. These costs are already included in the total project costs listed in the financial tables above.

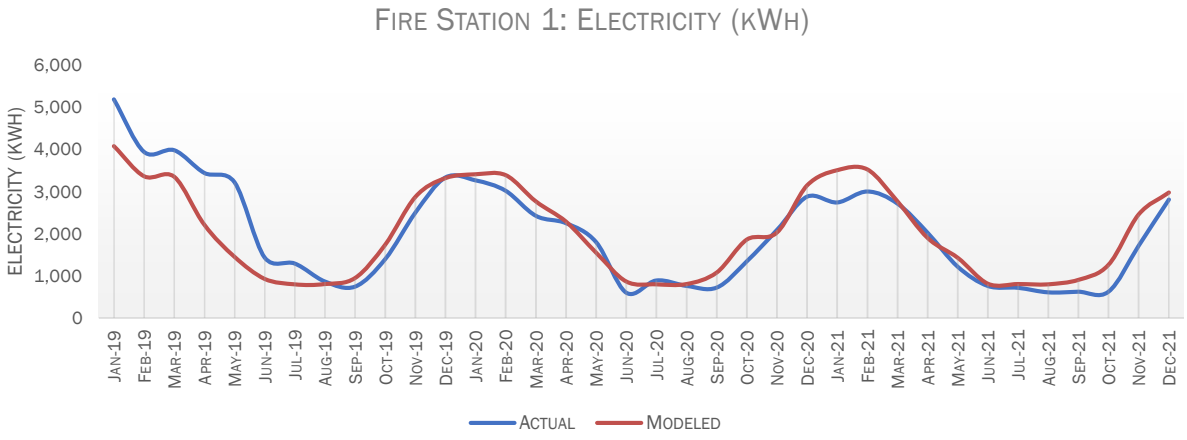
APPENDIX A

UTILITY BILL ANALYSIS

Fire Station 1: Electricity (kWh)

	1	2				
M02	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	Yes	Yes	No	No	No	No
Balance Point:	N/A	15		N/A	N/A	N/A
Calculated BP:	N/A	16		N/A	N/A	N/A
Coefficient:	26.66	4.40	0.00	0.00	0.00	0.00
T-Stat:	5.57	11.59	0.00	0.00	0.00	0.00
Adj R^2:	**0.9444**					

Electricity (kWh) = Days x 26.66 + HDD x 4.4.
The underlying regression of this baseline equation is R^2 = 0.9444.
HDD (Heating Degree Days) calculated using a balance point of 15°C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
In a typical year, consumption will be 26,591 kWh.



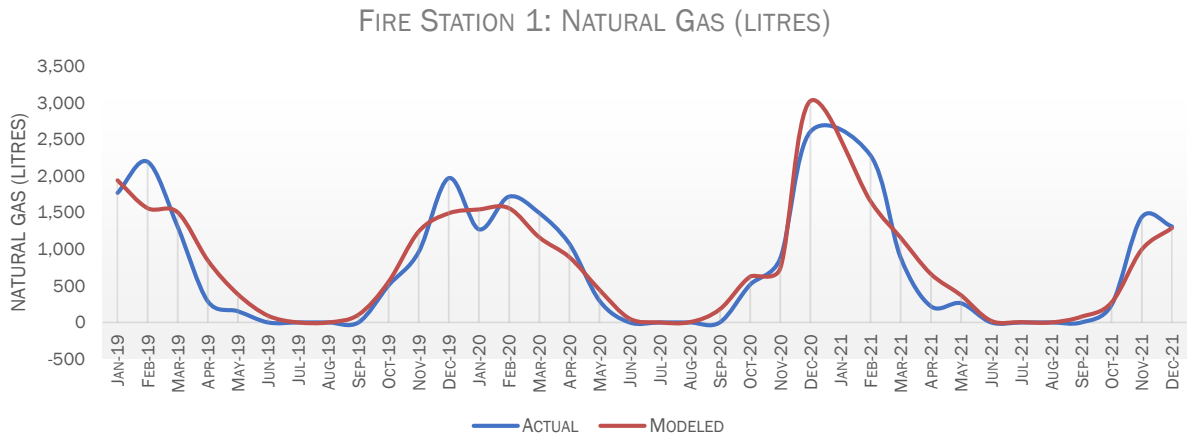
	Include In Model?	Start Date	Read Date	Electricity (kWh)	IV1	IV2	IV3	Month Allocation
1	Yes	1-Jan-19	31-Jan-19	5,191				Jan-19
2	Yes	1-Feb-19	28-Feb-19	3,949				Feb-19
3	Yes	1-Mar-19	31-Mar-19	3,982				Mar-19
4	Yes	1-Apr-19	30-Apr-19	3,448				Apr-19
5	Yes	1-May-19	31-May-19	3,222				May-19
6	Yes	1-Jun-19	30-Jun-19	1,438				Jun-19
7	Yes	1-Jul-19	31-Jul-19	1,295				Jul-19
8	Yes	1-Aug-19	31-Aug-19	864				Aug-19
9	Yes	1-Sep-19	30-Sep-19	745				Sep-19
10	Yes	1-Oct-19	31-Oct-19	1,396				Oct-19
11	Yes	1-Nov-19	30-Nov-19	2,498				Nov-19
12	Yes	1-Dec-19	31-Dec-19	3,338				Dec-19
13	Yes	1-Jan-20	31-Jan-20	3,272				Jan-20
14	Yes	1-Feb-20	29-Feb-20	3,018				Feb-20
15	Yes	1-Mar-20	31-Mar-20	2,423				Mar-20
16	Yes	1-Apr-20	30-Apr-20	2,253				Apr-20
17	Yes	1-May-20	31-May-20	1,799				May-20
18	Yes	1-Jun-20	30-Jun-20	600				Jun-20
19	Yes	1-Jul-20	31-Jul-20	892				Jul-20
20	Yes	1-Aug-20	31-Aug-20	764				Aug-20
21	Yes	1-Sep-20	30-Sep-20	719				Sep-20
22	Yes	1-Oct-20	31-Oct-20	1,348				Oct-20
23	Yes	1-Nov-20	30-Nov-20	2,089				Nov-20
24	Yes	1-Dec-20	31-Dec-20	2,878				Dec-20
25	Yes	1-Jan-21	31-Jan-21	2,742				Jan-21
26	Yes	1-Feb-21	28-Feb-21	3,006				Feb-21
27	Yes	1-Mar-21	31-Mar-21	2,715				Mar-21
28	Yes	1-Apr-21	30-Apr-21	2,021				Apr-21
29	Yes	1-May-21	31-May-21	1,216				May-21
30	Yes	1-Jun-21	30-Jun-21	761				Jun-21
31	Yes	1-Jul-21	31-Jul-21	718				Jul-21
32	Yes	1-Aug-21	31-Aug-21	608				Aug-21
33	Yes	1-Sep-21	30-Sep-21	621				Sep-21
34	Yes	1-Oct-21	31-Oct-21	621				Oct-21
35	Yes	1-Nov-21	30-Nov-21	1,714				Nov-21
36	Yes	1-Dec-21	31-Dec-21	2,816				Dec-21

Fire Station 1: Natural Gas (litres)

1

M03	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	No	Yes	No	No	No	No
Balance Point:	N/A	15		N/A	N/A	N/A
Calculated BP:	N/A	12		N/A	N/A	N/A
Coefficient:	0.00	2.60	0.00	0.00	0.00	0.00
T-Stat:	0.00	22.56	0.00	0.00	0.00	0.00
Adj R^2:	**0.9354**					

Natural Gas (litres) = Days x 0 + HDD x 2.6.
The underlying regression of this baseline equation is R^2 = 0.9354.
HDD (Heating Degree Days) calculated using a balance point of 15°C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
In a typical year, consumption will be 9,956 litres.



	Include In Model?	Start Date	Read Date	Natural Gas (litres)	IV1	IV2	IV3	Month Allocation
1	Yes	1-Jan-19	31-Jan-19	1,771				Jan-19
2	Yes	1-Feb-19	28-Feb-19	2,196				Feb-19
3	Yes	1-Mar-19	31-Mar-19	1,306				Mar-19
4	Yes	1-Apr-19	30-Apr-19	289				Apr-19
5	Yes	1-May-19	31-May-19	154				May-19
6	Yes	1-Jun-19	30-Jun-19	0.1				Jun-19
7	Yes	1-Jul-19	31-Jul-19	0.1				Jul-19
8	Yes	1-Aug-19	31-Aug-19	0.1				Aug-19
9	Yes	1-Sep-19	30-Sep-19	0.1				Sep-19
10	Yes	1-Oct-19	31-Oct-19	506.1				Oct-19
11	Yes	1-Nov-19	30-Nov-19	963				Nov-19
12	Yes	1-Dec-19	31-Dec-19	1,974				Dec-19
13	Yes	1-Jan-20	31-Jan-20	1,272				Jan-20
14	Yes	1-Feb-20	29-Feb-20	1,720				Feb-20
15	Yes	1-Mar-20	31-Mar-20	1,494				Mar-20
16	Yes	1-Apr-20	30-Apr-20	1,074				Apr-20
17	Yes	1-May-20	31-May-20	297.1				May-20
18	Yes	1-Jun-20	30-Jun-20	0.1				Jun-20
19	Yes	1-Jul-20	31-Jul-20	0.1				Jul-20
20	Yes	1-Aug-20	31-Aug-20	0.1				Aug-20
21	Yes	1-Sep-20	30-Sep-20	0.1				Sep-20
22	Yes	1-Oct-20	31-Oct-20	517				Oct-20
23	Yes	1-Nov-20	30-Nov-20	874.5				Nov-20
24	Yes	1-Dec-20	31-Jan-21	2,607				Dec-20
	No	1-Jan-21	31-Jan-21	935				Jan-21
25	Yes	1-Feb-21	28-Feb-21	2,281				Feb-21
26	Yes	1-Mar-21	31-Mar-21	885				Mar-21
27	Yes	1-Apr-21	30-Apr-21	223.3				Apr-21
28	Yes	1-May-21	31-May-21	262				May-21
29	Yes	1-Jun-21	30-Jun-21	0.1				Jun-21
30	Yes	1-Jul-21	31-Jul-21	0.1				Jul-21
31	Yes	1-Aug-21	31-Aug-21	0.1				Aug-21
32	Yes	1-Sep-21	30-Sep-21	0.1				Sep-21
33	Yes	1-Oct-21	31-Oct-21	234.2				Oct-21
34	Yes	1-Nov-21	30-Nov-21	1,434				Nov-21
35	Yes	1-Dec-21	31-Dec-21	1,312.8				Dec-21

APPENDIX B

CALCULATIONS

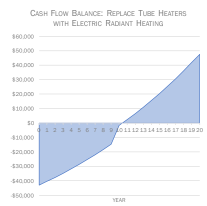
Energy Conservation Measure 7

Opp Cat:	Space_Heating
Opp Desc:	
Opp Name:	Replace Tube Heaters with Electric Radiant Heating

Costing Setup	
Engineering & PM:	15%
Contingency:	10%
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	No
Avoided Capital Costs:	$7,482
Avoided Capital Year:	10
Financial Analysis Term (years):	20

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		$0	

Utility Savings		
Demand (kW):	0	
Electricity (kWh):	-34,630	-$7,090.49
Natural Gas (litres):	10,279	$9,595.27
Water (m³):	0	
():	0	
():	0	
Emissions (Tonnes of CO₂e):	14.9	
Financials		
Annual Utility Savings:	$2,505	
Add'l Annual Savings:	$0	
Add'l Annual Costs:	$0	
Incentives:	$0	
Materials & Labour:	$34,362	
Engineering & PM:	$5,154	
Contingency:	$3,436	
Project Costs:	$42,952	
Simple Payback:	17.1	
Capital Payback:	10.4	
NPV:	-$325	
IRR:	7.2%	



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

15.41 tCO2e/t
14.9 tCO2e/t
96.51%

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	168,621	144,270
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak
		47.50	47.50

Total Cost of Project	$42,952	
Specific cost	$982	$/kW
	$288	$/MBH
Elec rate	$0.2048	
Propane rate	$0.9335	

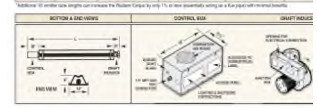
Savings: Replace Tube Heaters with Electric Radiant Heating

	Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection: Select	Select	Select	Select	Occupancy: Select	Eff. Profile: Select
1	-33	-36	0						0%
2	-28	-33	0						0%
3	-23	-30	0						0%
4	-18	-28	1						0%
5	-13	-25	24						0%
6	-8	-22	37						0%
7	-3	-19	68						0%
8	3	-16	153						0%
9	8	-14	201						0%
10	13	-11	364						0%
11	18	-8	506						0%
12	23	-5	638						0%
13	28	-3	605						0%
14	33	0	810						0%
15	38	3	629						0%
16	43	6	606						0%
17	48	9	646						0%
18	53	11	688						0%
19	58	14	669						0%
20	63	17	724						0%
21	68	20	625						0%
22	73	23	449						0%
23	78	25	225						0%
24	83	28	82						0%
25	88	31	10						0%
26	93	34	0						0%
27	98	36	0						0%
28	103	39	0						0%
	Totals		8,760	0	0	0	0	0	0

End-Use	Existing Electricity (MWh)	Existing Propane (MMBTU)	Existing Combined (kWh)	Replace Tube Heaters with Electric Radiant Heating Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Savings Electricity (kWh)	Propane (L)			Existing Propane [L/y]	Propane Consumption [MMBTU/y]	Eff of IR Tube heaters [%]	Retrofit Heating Load [MMBTU/y]	Heating Load [kWh/y]	Eff of IR Elect Heaters [%]	Savings Propane [L/y]	New Elect Load [kWh/y]
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0			9,956.02	254.08	65%	165.15	48,368.42	85%	9,956.02	(56,904.02)
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0										
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0										
Space Heat	16.7	248.7	89,621.5	51.4	0.0	51,350.0	-34,630.0	10,279										
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0										
Hot Water	4.7	0.0	4,730.0	4.7	0.0	4,730.0	0.0	0										
Vent. Fans	0.6	0.0	640.0	0.6	0.0	640.0	0.0	0										
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0										
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0										
Misc. Equip	1.1	0.0	1,090.0	1.1	0.0	1,090.0	0.0	0										
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0										
Area Lights	1.3	0.0	1,300.0	1.3	0.0	1,300.0	0.0	0										
								0.0										
0	24	249	97,382	59	0	59,110	-34,630	10,279	0	0	9,956	254	1	165	48,368	1	9,956	-56,904
Main Meter: Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select
Breakout Meter: Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Exisiting IR tube heaters
ForceRed (spaceray.com)

50,000 BTU 20' Total Emitter Tube Length
https://gordosales.com/product/sis50-20-50000-btu-20-total-emitter-tube-length/



kW
64

	input MBH	Eff existing	output MBH	output kW	Eff elect	Input Elect - kW	
IR Tube heater Propane (existing)	110	65%	72	21	90%	23	
Qty	2.00						
Installed Cap	220	65%	143	42	90%	47	
Preselected IR elect heaters			32.42	9.50	90%	10.56	
Proposed elect IR Heaters			4.41	Qty Heaters		43.9815	Amp per heater per ph
			42	kW		194	Amp (Total)
					40		
						220	Amp (Total)
						48	kW

https://www.grainger.ca/en/product/p/TPIFS595483?gucid=N:N:PS:Paid:GGL:CSM-9224:FDKJTB:20501128:APZ_1

	Value	Units
Area to be heated	1,350	sq ft
Watt per Sq Ft	9	W/ (sq ft) per 15F temp rise
T desired	59	F
T min	5	F
T rise max	54	F
Req Cap of IR heaters	43.74	kW
Preselected IR heater	9.50	kW
Qty IR heaters	4.60	ea 9.5kW
	10.9	ea 4kW
Reduction in Cap	32%	

Source
https://www.reverberray.com/wp-content/uploads/2023/04/LIOEDG_Electric-Heater-Design-Guide.pdf

General Requirements: Replace Tube Heaters with Electric Radiant Heating

Cost Breakout: Replace Tube Heaters with Electric Radiant Heating

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				Demolition	Remove Existing	Each	EE Est	$0	$3,100	$0	Yes	Both	2.0	$0	$3,384	$0	$3,384
111	0	0			Replacement like for like - IR Tube Heaters	40 MBH	Propane fired	Each	Web	$1,109	$600	$0	No	Avoided	2.0	$2,218	$1,200	$0	$3,418
112	0	0														$0	$0	$0	$0
113	0	0			New electrification IR	9.5 kW elect. heater	Electric	Each	Web	$1,752	$526	$0	Yes	Project	5.0	$13,448	$4,042	$0	$17,491
114	0	0														$0	$0	$0	$0
115	26	05.19.90	Electrical	Wire	Cu XHHW #6, 1 Wire, 65A, 54kW	Cu XHHW	#6, 1 Wire, 65A, 54kW	100 LF	Means '18	$32	$72	$0	Yes	Project	3.0	$395	$550	$0	$945
116	26	05.33.13	Electrical	Conduit	PVC Conduit 3/4" (3x#6,4x#8)	PVC Conduit	3/4" (3x#6,4x#8)	LF	Means '18	$3	$3	$0	Yes	Project	2503.0	$3,844	$1,234	$0	$5,078
117	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1 400V, 60A	Circuit Breaker	400V, 60A	Each	Means '18	$325	$346	$0	Yes	Project	5.0	$4,074	$1,277	$0	$5,351
118	26	05.33.18	Electrical	Pull Boxes	Pull Box 10"x10"x6" stain	Pull Box	10"x10"x6" stain	Each	Means '18	$20	$85	$0	Yes	Project	3.0	$90	$390	$0	$480
119	26	05.19.90	Electrical	wire	Cu XHHW #4/0, 1 Wire, 210A, 191kW	Cu XHHW	#4/0, 1 Wire, 210A, 191kW	100 LF	Means '18	$450	$212	$0	Yes	Project	7.0	$629	$326	$0	$956
120	26	05.33.13	Electrical	conduit	PVC Conduit 1 1/2" (3x3/0, 4x1/0)	PVC Conduit	1 1/2" (3x3/0, 4x1/0)	LF	Means '18	$2	$5	$0	Yes	Project	160.0	$160	$358	$0	$519
121	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1 600V, 200A	Circuit Breaker NEMA 1	600V, 200A	Each	Means '18	$1,525	$310	$0	Yes	Project	1.0	$2,341	$477	$0	$2,818
122	0	0														$0	$0	$0	$0
123	0	0				IR Quartz Electrical heater 240V 4kW	240V 4kW		Means 24	$385	$223		Yes	Project	0	$0	$0	$0	$0
124	0	0														$0	$0	$0	$0
125	0	0														$0	$0	$0	$0
126	0	0				Electrical Service Upgrade	Base Cost	Each	EE Est	$20,000	$5,000	$0	Yes	Project		$0	$0	$0	$0
127	0	0				Electrical Service Upgrade	Per Amp Cost	Amps	EE Est	$350	$88	$0	Yes	Project		$0	$0	$0	$0
128	0	0														$0	$0	$0	$0
129	0	0														$0	$0	$0	$0
130	0	0														$0	$0	$0	$0
131	0	0														$0	$0	$0	$0
132	0	0														$0	$0	$0	$0
133	0	0														$0	$0	$0	$0
134	0	0														$0	$0	$0	$0
195	0	0														$0	$0	$0	$0
136	0	0														$0	$0	$0	$0
137	0	0														$0	$0	$0	$0
138	0	0														$0	$0	$0	$0
139	0	0														$0	$0	$0	$0
140	0	0														$0	$0	$0	$0
141	0	0														$0	$0	$0	$0
142	0	0														$0	$0	$0	$0
143	0	0														$0	$0	$0	$0
144	0	0														$0	$0	$0	$0
145	0	0														$0	$0	$0	$0
146	0	0														$0	$0	$0	$0
147	0	0														$0	$0	$0	$0
																$22,323	$12,039	$0	$34,362

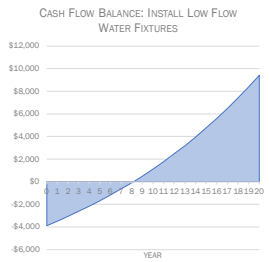
Energy Conservation Measure 2

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Low Flow Water Fixtures

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,830
Natural Gas (litres):	0
Water (m³):	41
():	0
():	0
Emissions (Tonnes of CO_2e):	0.1
Financials	
Annual Utility Savings:	$375
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$3,102
Engineering & PM:	$465
Contingency:	$310
Project Costs:	$3,878
Simple Payback:	10.3
Capital Payback:	8.15
NPV:	$2,246
IRR:	12.9%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

QC Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	203,001	204,872
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

23%

Savings: Install Low Flow Water Fixtures

	Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
				Select	Select	Select	Select	Select	Select
1	-33	-36	0						0%
2	-28	-33	0						0%
3	-23	-30	0						0%
4	-18	-28	1						0%
5	-13	-25	24						0%
6	-8	-22	37						0%
7	-3	-19	68						0%
8	3	-16	153						0%
9	8	-14	201						0%
10	13	-11	364						0%
11	18	-8	506						0%
12	23	-5	638						0%
13	28	-3	605						0%
14	33	0	810						0%
15	38	3	629						0%
16	43	6	606						0%
17	48	9	646						0%
18	53	11	688						0%
19	58	14	669						0%
20	63	17	724						0%
21	68	20	625						0%
22	73	23	449						0%
23	78	25	225						0%
24	83	28	82						0%
25	88	31	10						0%
26	93	34	0						0%
27	98	36	0						0%
28	103	39	0						0%
	Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Install Low Flow Water Fixtures			Savings		Existing					Retrofit Conditions		Savings		Water consumption		
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	DHW Cons - kWh	Kitchen Cons	Washroom Cons	Washroom DHW Cons - kWh	Wahroom Faucents - gpm	Wahroom Faucents - gpm	Washroom DHW Cons - kWh	Washroom DHW Cons - kWh		Estimated current water consumption (m3/y)	Reduction in water flow	Estimated water savings (m3/y)
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0	4,730	50.00%	50.00%	2,365	2.2	0.5	538	1,828		59	70%	41
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0												
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0												
Space Heat	16.7	248.7	89,621.5	16.7	248.7	89,621.5	0	0												
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0												
Hot Water	4.7	0.0	4,730.0	2.9	0.0	2,900.0	1,830	0												
Vent. Fans	0.6	0.0	640.0	0.6	0.0	640.0	0	0												
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0												
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0	0												
Misc. Equip	1.1	0.0	1,090.0	1.1	0.0	1,090.0	0	0												
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0												
Area Lights	1.3	0.0	1,300.0	1.3	0.0	1,300.0	0	0												
	0	**24**	**249**	**97,382**	**23**	**249**	**95,552**	**1,830**	**0**	**4,730**	**1**	**1**	**2,365**	**2**	**1**	**538**	**1,828**	**0**	**59**	**1**	**41**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	M04
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Install Low Flow Water Fixtures

Cost Breakout: Install Low Flow Water Fixtures

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				Demolition		each			$500		Yes	Project	1	$0	$769	$0	$769
111	0	0				Washroom Faucets	0.5 GPM	Eah	Web Search	$125.0	$31.0	$0.0	Yes	Project	2	$384	$95	$0	$479
112	22	40	Plumbing	Plumbing Fixtures	Showerhead, 1.5 GPM	Showerhead	1.5 GPM	Each	Web Estimate '20	$50.0	$50.0	$0.0	Yes	Project	2	$154	$154	$0	$307
113	22	40	Plumbing	Plumbing Fixtures	Toilet, Tank, 0.8 GPF	Toilet	Tank, 0.8 GPF	Each	Web Estimate '20	$260.0	$125.0	$0.0	Yes	Project	2	$798	$385	$0	$1,183
114	22	40	Plumbing	Plumbing Fixtures	Washroom Faucet Aerator, 1.0 GPM	Washroom Faucet Aerator	1.0 GPM	Each	Web Estimate '20	$3.5	$2.4	$0.0	Yes	Project	2	$11	$7	$0	$18
115	22	40	Plumbing	Plumbing Fixtures		Kitchen faucet	Low flow	Each	Web Search	$90.0	$22.5	$0.0	Yes	Project	1	$138	$35	$0	$173
116	22	40	Plumbing	Plumbing Fixtures		Laudry area faucet	Low flow	Each	Web Search	$90	$22.5	$0.0	Yes	Project	1	$138	$35	$0	$173
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$1,623**	**$1,479**	**$0**	**$3,102**

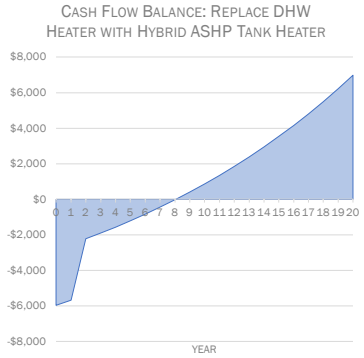
Energy Conservation Measure 4

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace DHW Heater with Hybrid ASHP Tank Heater

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$3,019**
Avoided Capital Year:	**2**
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,346
Natural Gas (litres):	0
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	0.04
Financials	
Annual Utility Savings:	$276
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$4,777
Engineering & PM:	$717
Contingency:	$478
Project Costs:	$5,971
Simple Payback:	21.7
Capital Payback:	8.1
NPV:	$1,272
IRR:	10.6%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	143,156	144,502
% Reduction	#DIV/0!	#DIV/0!

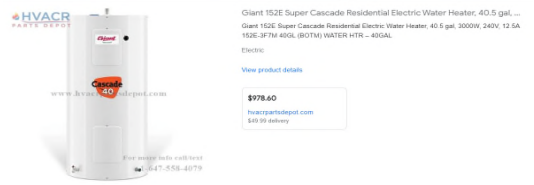
Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Savings: Replace DHW Heater with Hybrid ASHP Tank Heater

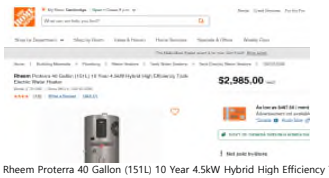
			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	1						0%
-13	-25	24						0%
-8	-22	37						0%
-3	-19	68						0%
3	-16	153						0%
8	-14	201						0%
13	-11	364						0%
18	-8	506						0%
23	-5	638						0%
28	-3	605						0%
33	0	810						0%
38	3	629						0%
43	6	606						0%
48	9	646						0%
53	11	688						0%
58	14	669						0%
63	17	724						0%
68	20	625						0%
73	23	449						0%
78	25	225						0%
83	28	82						0%
88	31	10						0%
93	34	0						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Replace DHW Heater with Hybrid ASHP Tank Hea			Savings		Existing			
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	DHW Cons - kWh	Adjusted DHW Cons - kWh		
Space Cool	0.00	0.00	0.00	0.0	0.0	0.0	-	0	4,730	2,900		
Heat Reject.	0.00	0.00	0.00	0.0	0.0	0.0	-	0				
Refrigeration	0.00	0.00	0.00	0.0	0.0	0.0	-	0				
Space Heat	16.72	248.74	89,621.52	0.0	0.0	0.0	16,720	10,279				
HP Supp.	0.00	0.00	0.00	0.0	0.0	0.0	-	0				
Hot Water	4.73	0.00	4,730.00	0.0	0.0	0.0	4,730	0				
Vent. Fans	0.64	0.00	640.00	0.0	0.0	0.0	640	0				
Pumps & Aux	0.00	0.00	0.00	0.0	0.0	0.0	-	0				
Ext. Usage	0.00	0.00	0.00	0.0	0.0	0.0	-	0				
Misc. Equip	1.09	0.00	1,090.00	0.0	0.0	0.0	1,090	0				
Task Lights	0.00	0.00	0.00	0.0	0.0	0.0	-	0				
Area Lights	1.30	0.00	1,300.00	0.0	0.0	0.0	1,300	0				
								-				
0	**24**	**249**	**97,382**	**0**	**0**	**0**	**24,480**	**10,279**	**4,730**	**2,900**	**0**	**0**

Main Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select



For reference
https://hvacrpartsdepot.com/product/giant-152e-super-cascade-residential-electric-water-heater-40-5-gal-3000w-240v-12-5a/



Rheem Proterra 40 Gallon (151L) 10 Year 4.5kW Hybrid High Efficiency Tank Electric Water Heater
https://www.homedepot.ca/product/rheem-proterra-40-gallon-151l-10-year-4-5kw-hybrid-high-efficiency-tank-electric-water-heater/1001610398?rrec=true

General Requirements: Replace DHW Heater with Hybrid ASHP Tank Heater

Cost Breakout: Replace DHW Heater with Hybrid ASHP Tank Heater

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				Demolition					$77		Yes	Project	1	$0	$118	$0	$118
111	0	0				electric water heater tk	40 gal	3 kW	Means 24	$850	$236.00	$0	Yes	Avoided	1	$1,305	$363	$0	$1,668
112	0	0				Demolition					$700		Yes	Both	1	$0	$1,077	$0	$1,077
113	0	0				Hydrid water heater Tk	40 gal	4.5kW	Web search	$2,985	$597	$0	No	Project	1	$2,985	$597	$0	$3,582
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0											No	Project		$0	$0	$0	$0
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$2,985**	**$1,792**	**$0**	**$4,777**

Escalation Rates: Replace DHW Heater with Hybrid ASHP Tank Heater

Cash Flow Balance: Replace DHW Heater with Hybrid ASHP Tank Heater

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$5,971	$0	$3,153	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		$290	$305	$321	$338	$355	$374	$393	$414	$435	$458	$481	$507	$533	$561	$590	$620	$653	$687	$722	$760
Annual Savings (M03):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$5,971	$290	$3,459	$321	$338	$355	$374	$393	$414	$435	$458	$481	$507	$533	$561	$590	$620	$653	$687	$722	$760
Cash Balance:	-$5,971	-$5,681	-$2,223	-$1,902	-$1,564	-$1,209	-$835	-$442	-$29	$406	$864	$1,345	$1,852	$2,385	$2,945	$3,535	$4,156	$4,808	$5,495	$6,217	$6,977
Undepreciated Amount:	-$5,971	-$5,076	-$4,314	-$3,667	-$3,117	-$2,650	-$2,252	-$1,914	-$1,627	-$1,383	-$1,176	-$999	-$849	-$722	-$614	-$522	-$443	-$377	-$320	-$272	-$231

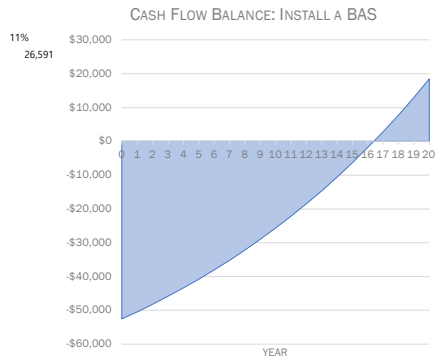
Energy Conservation Measure 3

Opp Cat:	Information_Technology
Opp Desc:	
Opp Name:	Install a BAS

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	2,897
Natural Gas (litres):	1,542
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	2.5
Financials	
Annual Utility Savings:	$2,032
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$42,054
Engineering & PM:	$6,308
Contingency:	$4,205
Project Costs:	$52,568
Simple Payback:	25.9
Capital Payback:	16.4
NPV:	-$19,788
IRR:	2.6%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	142,964	147,403
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Savings: Install a BAS

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	1						0%
-13	-25	24						0%
-8	-22	37						0%
-3	-19	68						0%
3	-16	153						0%
8	-14	201						0%
13	-11	364						0%
18	-8	506						0%
23	-5	638						0%
28	-3	605						0%
33	0	810						0%
38	3	629						0%
43	6	606						0%
48	9	646						0%
53	11	688						0%
58	14	669						0%
63	17	724						0%
68	20	625						0%
73	23	449						0%
78	25	225						0%
83	28	82						0%
88	31	10						0%
93	34	0						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Install a BAS			Savings		Retrofit			Savings
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	% Reduction	Ele - kWh	Propane - l	kWh
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	16.7	248.7	89,621.5	0.0	0.0	0.0	16,720	10,279	15%	2,508	1,542	10,160
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	4.7	0.0	4,730.0	0.0	0.0	0.0	4,730	0				
Vent. Fans	0.6	0.0	640.0	0.0	0.0	0.0	640	0	10%	64	0	64
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Misc. Equip	1.1	0.0	1,090.0	0.0	0.0	0.0	1,090	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	1.3	0.0	1,300.0	0.0	0.0	0.0	1,300	0	25%	325	0	325
0	**24**	**249**	**97,382**	**0**	**0**	**0**	**24,480**	**10,279**	**1**	**2,897**	**1,542**	**10,549**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Equipment	Quantity	AI	AO	DI	DO	
Exhaust Fans	2	0	0	2	2	
New IR elect heaters	1	1	1	1		
Base board Elect heater	1	1	1	1	1	
Misc.	2	2	2	2	2	
Other						Total
		4	**4**	**6**	**6**	20

General Requirements: Install a BAS

Cost Breakout: Install a BAS

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0														$0	$0	$0	$0
111	23	09.23	HVAC	Controls	Analog Inputs-Space Temperature	Analog Inputs	Space Temperature	Each	Means '22	$499	$166	$0	Yes	Project	4	$3,063	$1,023	$0	$4,086
112	23	09.23	HVAC	Controls	Analog Outputs-Electric (Not incl. Device)	Analog Outputs	Electric (Not incl. Device)	Each	Means '22	$285	$95	$0	Yes	Project	4	$1,750	$585	$0	$2,335
113	23	09.23	HVAC	Controls	Digital Inputs-Current Sensor	Digital Inputs	Current Sensor	Each	Means '22	$326	$109	$0	Yes	Project	6	$3,005	$1,004	$0	$4,009
114	23	09.23	HVAC	Controls	Digital Outputs-Start/Stop	Digital Outputs	Start/Stop	Each	Means '22	$255	$85	$0	Yes	Project	6	$2,349	$784	$0	$3,133
115	23	09.23	HVAC	Controls	DDC Controller-16 Point Controller	DDC Controller	16 Point Controller	Each	Means '22	$2,456	$819	$0	Yes	Project	3	$11,313	$3,778	$0	$15,091
116	23	09.23	HVAC	Controls	DDC Front End-Colour Graphics Software	DDC Front End	Colour Graphics Software	Each	Means '22	$2,944	$981	$0	Yes	Project	1	$4,519	$1,509	$0	$6,029
117	23	09.23	HVAC	Controls	DDC Front End-Calibration Labour	DDC Front End	Calibration Labour	Point	Means '22	$90	$30	$0	Yes	Project	20	$2,763	$923	$0	$3,686
118	23	09.23	HVAC	Controls	DDC Front End-Start-up Labour	DDC Front End	Start-up Labour	Point	Means '22	$90	$30	$0	Yes	Project	20	$2,763	$923	$0	$3,686
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$31,525**	**$10,529**	**$0**	**$42,054**

Escalation Rates: Install a BAS

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity ($/kWh):	0.2048	0.2154	0.2266	0.2384	0.2508	0.2638	0.2775	0.2920	0.3071	0.3231	0.3399	0.3576	0.3762	0.3958	0.4163	0.4380	0.4608	0.4847	0.5099	0.5364	0.5643
Natural Gas ($/litres):	0.9335	0.9801	1.0291	1.0806	1.1346	1.1913	1.2509	1.3135	1.3791	1.4481	1.5205	1.5965	1.6763	1.7602	1.8482	1.9406	2.0376	2.1395	2.2465	2.3588	2.4767
Water ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GHG Emissions (tCO2e):	0.000031	0.000043	0.000047	0.000054	0.000071	0.000072	0.000075	0.000069	0.000077	0.000083	0.000079	0.000079	0.000079	0.000077	0.000081	0.000082	0.000087	0.000088	0.000093	0.000093	0.000093

Cash Flow Balance: Install a BAS

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Implementation Cost:	-$52,568	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		$624	$656	$691	$726	$764	$804	$846	$890	$936	$985	$1,036	$1,090	$1,147	$1,206	$1,269	$1,335	$1,404	$1,477	$1,554	$1,635
Annual Savings (M03):		$1,511	$1,587	$1,666	$1,749	$1,837	$1,929	$2,025	$2,126	$2,233	$2,344	$2,462	$2,585	$2,714	$2,850	$2,992	$3,142	$3,299	$3,464	$3,637	$3,819
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$52,568	$2,135	$2,243	$2,357	$2,476	$2,601	$2,733	$2,871	$3,016	$3,169	$3,329	$3,498	$3,675	$3,861	$4,056	$4,261	$4,477	$4,703	$4,941	$5,191	$5,454
Cash Balance:	-$52,568	-$50,433	-$48,189	-$45,833	-$43,357	-$40,755	-$38,023	-$35,152	-$32,135	-$28,966	-$25,637	-$22,140	-$18,465	-$14,604	-$10,549	-$6,288	-$1,811	$2,892	$7,833	$13,024	$18,478
Undepreciated Amount:	-$52,568	-$44,683	-$37,980	-$32,283	-$27,441	-$23,325	-$19,826	-$16,852	-$14,324	-$12,176	-$10,349	-$8,797	-$7,477	-$6,356	-$5,402	-$4,592	-$3,903	-$3,318	-$2,820	-$2,397	-$2,038

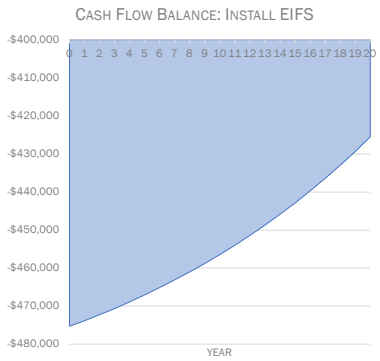
Energy Conservation Measure 8

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install EIFS

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,720
Natural Gas (litres):	1,153
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	1.8
Financials	
Annual Utility Savings:	$1,428
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$380,284
Engineering & PM:	$57,043
Contingency:	$38,028
Project Costs:	$475,355
Simple Payback:	332.9
Capital Payback:	57.5
NPV:	-$452,343
IRR:	-14.6%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	185,386	188,259
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Savings: Install EIFS

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	1						0%
-13	-25	24						0%
-8	-22	37						0%
-3	-19	68						0%
3	-16	153						0%
8	-14	201						0%
13	-11	364						0%
18	-8	506						0%
23	-5	638						0%
28	-3	605						0%
33	0	810						0%
38	3	629						0%
43	6	606						0%
48	9	646						0%
53	11	688						0%
58	14	669						0%
63	17	724						0%
68	20	625						0%
73	23	449						0%
78	25	225						0%
83	28	82						0%
88	31	10						0%
93	34	0						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Install EIFS			Savings			Savings		
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)		% elec	% propane	% total savings
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0		9.6%	11.2%	10.9%
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	16.7	248.7	89,621.5	15.1	220.9	79,837.4	1,610	1,153				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	4.7	0.0	4,730.0	4.7	0.0	4,730.0	0	0				
Vent. Fans	0.6	0.0	640.0	0.5	0.0	530.0	110	0				
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Misc. Equip	1.1	0.0	1,090.0	1.1	0.0	1,090.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	1.3	0.0	1,300.0	1.3	0.0	1,300.0	0	0				
0	**24**	**249**	**97,382**	**23**	**221**	**87,487**	**1,720**	**1,153**	**0**	**0**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Wall area	3,590	sqft
windows area	48	sqft

General Requirements: Install EIFS

Cost Breakout: Install EIFS

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0											Yes	Project		$0	$0	$0	$0
111	0	0				EIFS	Whole Building	per sqft	MTE Quote	$69			Yes	Project	3,590	$380,284	$0	$0	$380,284
112	0	0											Yes	Project		$0	$0	$0	$0
113	0	0											Yes	Project		$0	$0	$0	$0
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$380,284**	**$0**	**$0**	**$380,284**

Escalation Rates: Install EIFS

Cash Flow Balance: Install EIFS

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$475,355	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		$370	$390	$410	$431	$454	$477	$502	$528	$556	$585	$615	$647	$681	$716	$753	$793	$834	$877	$923	$971
Annual Savings (M03):		$1,130	$1,186	$1,245	$1,308	$1,373	$1,442	$1,514	$1,590	$1,669	$1,752	$1,840	$1,932	$2,029	$2,130	$2,237	$2,348	$2,466	$2,589	$2,719	$2,855
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$475,355	$1,500	$1,576	$1,655	$1,739	$1,827	$1,919	$2,016	$2,118	$2,225	$2,337	$2,455	$2,579	$2,709	$2,846	$2,990	$3,141	$3,300	$3,466	$3,641	$3,825
Cash Balance:	-$475,355	-$473,855	-$472,279	-$470,624	-$468,885	-$467,058	-$465,139	-$463,123	-$461,005	-$458,780	-$456,443	-$453,988	-$451,409	-$448,699	-$445,853	-$442,863	-$439,722	-$436,422	-$432,956	-$429,315	-$425,490
Undepreciated Amount:	-$475,355	-$404,052	-$343,444	-$291,928	-$248,139	-$210,918	-$179,280	-$152,388	-$129,530	-$110,100	-$93,585	-$79,548	-$67,615	-$57,473	-$48,852	-$41,524	-$35,296	-$30,001	-$25,501	-$21,676	-$18,425

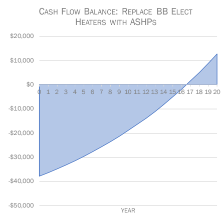
Energy Conservation Measure 6

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace BB Elect Heaters with ASHPs

Costing Setup	
Engineering & PM:	15%
Contingency:	10%
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	No
Avoided Capital Costs:	$0
Avoided Capital Year:	0
Financial Analysis Term (years):	20

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		$0	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	6,940
Natural Gas (litres):	0
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	0.2
Financials	
Annual Utility Savings:	$1,421
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$30,290
Engineering & PM:	$4,544
Contingency:	$3,029
Project Costs:	$37,863
Simple Payback:	26.6
Capital Payback:	16.6
NPV:	-$14,640
IRR:	2.5%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	371,655	378,595
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak
		2.17	2.166666667

Total cost of Project	$37,863	
Specific cost of ASHP	$1,707	$/MBH
	$5,825	$/kW

Savings: Replace BB Elect Heaters with ASHPs

				Meter Selection				Occupancy	Eff. Profile
	Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	Select	Select	Select	Select	Select
1	-33	-36	0						0%
2	-28	-33	0						0%
3	-23	-30	0						0%
4	-18	-28	1						0%
5	-13	-25	24						0%
6	-8	-22	37						0%
7	-3	-19	68						0%
8	3	-16	153						0%
9	8	-14	201						0%
10	13	-11	364						0%
11	18	-8	506						0%
12	23	-5	638						0%
13	28	-3	605						0%
14	33	0	810						0%
15	38	3	629						0%
16	43	6	606						0%
17	48	9	646						0%
18	53	11	688						0%
19	58	14	669						0%
20	63	17	724						0%
21	68	20	625						0%
22	73	23	449						0%
23	78	25	225						0%
24	83	28	82						0%
25	88	31	10						0%
26	93	34	0						0%
27	98	36	0						0%
28	103	39	0						0%
	Totals		8,760	0	0	0	0	0	0

Alternative Calculation

End-Use	Existing			Replace BB Heaters w/ ASHPs			Savings				Existinbg				Retrofit			Savings			Retrofit								Savings	
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)			Elect Enrgy Consump for Heating [kWh/y]	eff base board elect heaters [%]	Heating Load [kWh/y]	Heating Load [MMBTU/y]	HSPF [BTU/Wh]	Heating Load [kWh/y]		Savings [kWh/y]	Savings [%]		Performance Factor by T [BTU/W]	COP by T [W/W]		ASHP Heating Degrees Hours at balance T=16C	Elect Heater Heating Degrees Hours at balance T=16C	Energy consum by ASHP [kWh}	Energy consum by Elec Heater [kWh}	Total New Energy Consumption [kWh]	Energy Savings [kWh]	Savings [%]
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0			16,720	92%	15,382	52	8.00	6,561		8,822	53%		0.00	0.00		0	0	0	0	6,918	9,802	59%
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0													0.00	0.00		0	0	0	0			
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0													0.00	0.00		0	0	0	0			
Space Heat	16.7	248.7	89,621.5	6.0	248.7	78,851.5	10,770	0													0.00	0.00		0	47	0	7			
HP Supp.	0.0	0.0	0.0	3.6	0.0	3,570.0	-3,570	0													0.00	0.00		0	1,019	0	152			
Hot Water	4.7	0.0	4,730.0	4.7	0.0	4,730.0	0	0													0.00	0.00		0	1,494	0	223			
Vent. Fans	0.6	0.0	640.0	0.9	0.0	900.0	-260	0													5.57	1.63		0	2,514	0	376			
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0													6.28	1.84		0	5,251	0	784			
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0	0													6.99	2.05		6,346	0	463	0			
Misc. Equip	1.1	0.0	1,090.0	1.1	0.0	1,090.0	0	0													7.70	2.26		10,508	0	696	0			
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0													8.42	2.46		13,178	0	799	0			
Area Lights	1.3	0.0	1,300.0	1.3	0.0	1,300.0	0	0													9.13	2.67		14,859	0	831	0			
																					9.84	2.88		12,396	0	643	0			
																					10.55	3.09		14,362	0	695	0			
																					11.26	3.30		9,403	0	426	0			
																					11.97	3.50		7,372	0	314	0			
																					12.68	3.71		6,064	0	244	0			
																					13.39	3.92		4,547	0	173	0			
																					14.10	4.13		2,563	0	93	0			
																					14.81	4.34		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
																					0.00	0.00		0	0	0	0			
-	24.5	248.7	97,381.5	17.5	248.7	90,441.5	6,940.0	-	-	-	16,720.0	1	15,382	52	8	6,561	0	8,822	0.53	0	143	42	0	101,598	10,325	5,375	1,542	6,918	9,802	0.59
Main Meter: Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select
Breakout Meter: Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Existing BB elect Heaters

Installed Heating Capacity		
Current heating capacity	6.50	kW
	22,191	Btu/h
Estimated area of Offices	53.68	m2
	4.99	ft2
installed heating cap	4,449.73	(Btu/h) / ft2
	0.12	kW/m2
	4.45	MBH/ft2

Existing BB elect Heaters

W	Qty	Total W	
2,000		0	
1,500	3	4,500	
500	2	1,000	
1,000	1	1,000	
		6,500	
		22.2	MBH
Estimated additional Electric load		3.00	COP
		2.17	kW
		9.03	Amp @240V

Reference cost for New ASHP

Estimated Cost https://heatpumpsdirect.ca/product/mitsubishi-zuba-single/
$ 19,750.00 Estimated for 24000 Btu/h (heating) ext unit + 3 split int units
https://heatpumpsdirect.ca/product/mitsubishi-zuba-multi/?attribute_size=4+Ton&attribute_of-zones=4&attribute_payment=Financi
$ 19,750.00 Estimated for 24000 Btu/h (heating) ext unit + 3 split int units
Mitsubishi Heat Pumps - Tech info here
mem-201908v3-e_mitsubishi_mseries_mrslim_catalogue_lr_fin.pdf (agilitycms.com)

Reference values for BB electric Heater
STELPROStelpro BRAVA 28-In x 500 W/240 V White Metal Baseboard HeaterFormat 28"x500W-240V
https://www.rona.ca/en/product/stelpro-brava-38-in-x-750-w-240-v-white-metal-baseboard-heater-b0752w-03915118?viewStore=83224&cq_src=google_ads&cq_cmp=19597988781&cq_con=&cq_term=&cq_med=pla&cq_plac=&cq_net=x&cq_pos=&cq_plt=gp&&cm_mmc=paid_search-_-google-_-aw_pmax_generic_Cooling-_-&gad_source=4&gclid=EAIaIQobChMIz5iPm6T0gwMVOWZHAR1UjgsH

General Requirements: Replace 88 Elect Heaters with ASHPs

Cost Breakout: Replace 88 Elect Heaters with ASHPs

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0														$0	$0	$0	$0
111	0	0				New ASHP										$0	$0	$0	$0
112	0	0				ASHP Outdoorunit	4 Ton Cooling, 64 MBH Heating	each	Means 24	$3,465	$1,375		Yes	Project	1	$5,319	$2,115	$0	$7,434
113	0	0				Indoor Units	ten coil unit heating and ventilating	each	Means 24	$580	$850		Yes	Project	6	$5,342	$7,845	$0	$13,187
114	0	0				Tube/wiring kit	25ft kit	each	Means 24	$53	$39		Yes	Project	6				
115	0	0														$0	$0	$0	$0
116	0	0				Elect Installation for Interior Unit										$0	$0	$0	$0
117	26	05.19.90	Electrical	Wire	Cu-XHHW-#12, 1 Wire, 25A, 21kW	Cu-XHHW	#12, 1 Wire, 25A, 21kW	100 LF	Means '18	$18	$43	$0	Yes	Project	3	$85	$196	$0	$281
118	26	05.33.13	Electrical	Conduit	PVC Conduit-1/2" (3xHL4xHT0)	PVC Conduit	1/2" (3xHL4xHT0)	LF	Means '18	$1	$2	$0	Yes	Project	120	$164	$452	$0	$616
119	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 30A	Circuit Breaker - NEMA 1	600V, 30A	Each	Means '18	$520	$146	$0	Yes	Project	6	$4,790	$1,347	$0	$6,137
120	26	05.33.18	Electrical	Pull Boxes	Pull Box-10"x10"x6" diam	Pull Box	10"x10"x6" diam	Each	Means '18	$20	$85	$0	Yes	Project	6	$181	$780	$0	$960
121	0	0				Elect Installation for Exterior Unit										$0	$0	$0	$0
122	26	05.19.90	Electrical	Wire	Cu-XHHW-#12, 1 Wire, 25A, 21kW	Cu-XHHW	#12, 1 Wire, 25A, 21kW	100 LF	Means '18	$18	$43	$0	Yes	Project	0.5	$14	$33	$0	$47
123	26	05.33.13	Electrical	Conduit	Steel Conduit-1/2" (3xHL4xHT0)	Steel Conduit	1/2" (3xHL4xHT0)	LF	Means '18	$2	$5	$0	Yes	Project	25	$65	$179	$0	$244
124	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 30A	Circuit Breaker - NEMA 1	600V, 30A	Each	Means '18	$520	$146	$0	Yes	Project	1	$798	$225	$0	$1,023
125	22	11.13.23	Plumbing	Copper Pipe	Copper Pipe, Type L-1/4" Soldered	Copper Pipe, Type L	1/4" Soldered	Lin. Ft.	Means '22	$3	$6	$0	Yes	Project	25	$116	$244	$0	$360
126	0	0														$0	$0	$0	$0
127	0	0														$0	$0	$0	$0
128	0	0														$0	$0	$0	$0
129	0	0				Like for like repl										$0	$0	$0	$0
130	0	0				Elec heater	Baseboard 2000 W	ea	Means 24	$119	$42	$0	Yes	Avoided		$0	$0	$0	$0
131	0	0				Elec heater	Baseboard 1500 W	ea	Means 24	$90	$32	$0	Yes	Avoided		$0	$0	$0	$0
132	0	0				Elec heater	Baseboard 1000 W	ea	Means 24	$71	$25	$0	Yes	Avoided		$0	$0	$0	$0
133	0	0				Elec heater	Baseboard 500W	ea	Means 24	$53	$19	$0	Yes	Avoided		$0	$0	$0	$0
134	0	0														$0	$0	$0	$0
135	0	0														$0	$0	$0	$0
136	0	0														$0	$0	$0	$0
137	0	0														$0	$0	$0	$0
138	0	0														$0	$0	$0	$0
139	0	0														$0	$0	$0	$0
140	0	0														$0	$0	$0	$0
141	0	0														$0	$0	$0	$0
142	0	0														$0	$0	$0	$0
143	0	0														$0	$0	$0	$0
144	0	0														$0	$0	$0	$0
145	0	0														$0	$0	$0	$0
146	0	0														$0	$0	$0	$0
147	0	0														$0	$0	$0	$0
148	0	0														$0	$0	$0	$0
															Totals:	**$16,874**	**$13,416**	**$0**	**$30,290**

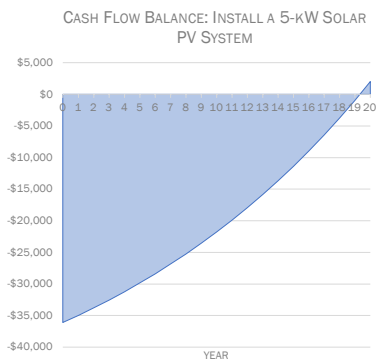
Energy Conservation Measure 5

Opp Cat:	Renewables
Opp Desc:	Install Solar Photovoltaic System
Opp Name:	Install a 5-kW Solar PV System

Costing Setup	
Engineering & PM:	**0%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	5,243
Natural Gas (litres):	0
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	0.2
Financials	
Annual Utility Savings:	$1,074
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$32,825
Engineering & PM:	$0
Contingency:	$3,283
Project Costs:	$36,108
Simple Payback:	33.6
Capital Payback:	19.3
NPV:	-$18,564
IRR:	0.5%



Write-ups	
Existing:	All electricity
Retrofit:	We recommend

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	450	5,693
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Project cost	$36,108	
Specific cost PV Syst	$7,052	$/kWdc

Savings: Install a 5-kW Solar PV System

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	1						0%
-13	-25	24						0%
-8	-22	37						0%
-3	-19	68						0%
3	-16	153						0%
8	-14	201						0%
13	-11	364						0%
18	-8	506						0%
23	-5	638						0%
28	-3	605						0%
33	0	810						0%
38	3	629						0%
43	6	606						0%
48	9	646						0%
53	11	688						0%
58	14	669						0%
63	17	724						0%
68	20	625						0%
73	23	449						0%
78	25	225						0%
83	28	82						0%
88	31	10						0%
93	34	0						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

Roof Area - m2		Usable Area - m2	System Size - m2	% of Area Used	System Capacity - kW	System Generation - kWh			
194		128	122	63%	5.12	5,243			
194	**0**	**128**	**122**	**1**	**5**	**5,243**	**0**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

	m2	
Total roof area	194	
Usable area for Solar PV	128	66%
High losses due to tree shading	18%	
Energy generation	1,024	kWh/kW

General Requirements: Install a 5-kW Solar PV System

Section	Description	Material Range	Labour Range	Material	Labour	Comments
Factors	Cut and Patch to match existing constructic	2% to 5%	3% to 9%	2.0%	3.0%	Only when required
	Dust Protection	1% to 4%	2% to 11%	1.0%	2.0%	Only when required
	Shift Work Requirements		5% to 30%	0.0%	0.0%	Only when required
	Material Handling and Storage Limitation	1% to 6%	1% to 7%	0.0%	0.0%	Only when required
	Work inside Prisons and High Security Area		30% to 50%	0.0%	0.0%	Only when required
Job Conditions	Economic Conditions	-2% to 5%		5.0%	5.0%	
	Hoisting Conditions	-2% to 5%		0.0%	0.0%	Only when required
	Labour Availability	-1% to 10%		5.0%	5.0%	
	Material Storage Area availability	-1% to 2%		-1.0%	-1.0%	Only when required
	Workspace Availability	-2% to 5%		-2.0%	-2.0%	Only when required
	Overtime Requirements		0% to 100%	0.0%	0.0%	Only when required
Cost Indexes	Location Factors	Toronto		15.9%	4.2%	Very important
Administrative Requirements	Building Permits	0.5% to 2%		0.0%	0.0%	0.5% for most cities
	Performance Bond	0.6% to 2.5%		0.0%	0.0%	Only when required
	Insurance	0.25% to 0.62%		0.3%	0.3%	All risk type
	Insurance - Public Liability	2.02%		2.0%	2.0%	
	Workers Comp and Employer's Liability		7% to 18%	0.0%	10.0%	
Overhead & Profit	Overhead & Profit	15% to 30%		25.0%	25.0%	Higher for smaller jobs
Cleaning	Cleaning after job completion	0.3% to 1%		0.3%	0.3%	

Cost Breakout: Install a 5-kW Solar PV System

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0																	
111	0	0				Solar PV System	kW	Per W Installed		$2	$1		Yes	Project	5120	$15,720	$7,876	$0	$23,596
112	0	0											Yes	Project		$0	$0	$0	$0
113	0	0				Structural Analysis		Each	EE Est	$0	$6,000	$0	Yes	Project	1	$0	$9,229	$0	$9,229
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	$15,720	$17,105	$0	$32,825

Escalation Rates: Install a 5-kW Solar PV System

Cash Flow Balance: Install a 5-kW Solar PV System

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$36,108	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		$1,129	$1,188	$1,250	$1,315	$1,383	$1,455	$1,531	$1,610	$1,694	$1,782	$1,875	$1,972	$2,075	$2,183	$2,296	$2,416	$2,541	$2,674	$2,813	$2,959
Annual Savings (M03):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$36,108	$1,129	$1,188	$1,250	$1,315	$1,383	$1,455	$1,531	$1,610	$1,694	$1,782	$1,875	$1,972	$2,075	$2,183	$2,296	$2,416	$2,541	$2,674	$2,813	$2,959
Cash Balance:	-$36,108	-$34,978	-$33,790	-$32,541	-$31,226	-$29,843	-$28,387	-$26,857	-$25,246	-$23,552	-$21,770	-$19,895	-$17,923	-$15,848	-$13,665	-$11,368	-$8,953	-$6,411	-$3,738	-$925	$2,034
Undepreciated Amount:	-$36,108	-$30,692	-$26,088	-$22,175	-$18,848	-$16,021	-$13,618	-$11,575	-$9,839	-$8,363	-$7,109	-$6,042	-$5,136	-$4,366	-$3,711	-$3,154	-$2,681	-$2,279	-$1,937	-$1,646	-$1,400

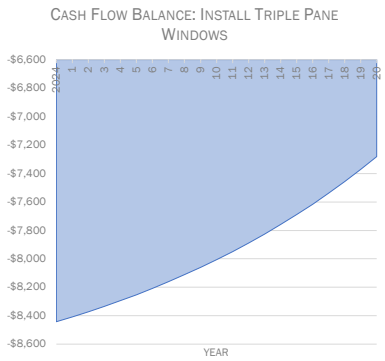
Energy Conservation Measure 9

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Triple Pane Windows

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	160
Natural Gas (litres):	0
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	0.005
Financials	
Annual Utility Savings:	$33
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$6,755
Engineering & PM:	$1,013
Contingency:	$676
Project Costs:	$8,444
Simple Payback:	257.8
Capital Payback:	51.7
NPV:	-$7,909
IRR:	-13.1%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	195,149	195,309
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Costo total Project $8,444
Specific cost $177.02 $/sq ft

Savings: Install Triple Pane Windows

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	1						0%
-13	-25	24						0%
-8	-22	37						0%
-3	-19	68						0%
3	-16	153						0%
8	-14	201						0%
13	-11	364						0%
18	-8	506						0%
23	-5	638						0%
28	-3	605						0%
33	0	810						0%
38	3	629						0%
43	6	606						0%
48	9	646						0%
53	11	688						0%
58	14	669						0%
63	17	724						0%
68	20	625						0%
73	23	449						0%
78	25	225						0%
83	28	82						0%
88	31	10						0%
93	34	0						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Install Triple Pane Windows			Savings			Savings		
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)		% elect		
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0		0.96%		
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	16.7	248.7	89,621.5	16.6	248.7	89,461.5	160	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	4.7	0.0	4,730.0	4.7	0.0	4,730.0	0	0				
Vent. Fans	0.6	0.0	640.0	0.6	0.0	640.0	0	0				
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Misc. Equip	1.1	0.0	1,090.0	1.1	0.0	1,090.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	1.3	0.0	1,300.0	1.3	0.0	1,300.0	0	0				
0	**24**	**249**	**97,382**	**24**	**249**	**97,222**	**160**	**0**	**0**	**0**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Number of windows	3	#
tipical window area	16	ft2
Windows area	48	ft2

General Requirements: Install Triple Pane Windows

Cost Breakout: Install Triple Pane Windows

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0														$0	$0	$0	$0
111	0	0				HE Windows	Tripple pane, low e argon filled	ft2	Pinpoint	$68	$23	$0	Yes	Project	48	$5,045	$1,710	$0	$6,755
112	0	0				Potential Structural		Each	EE Est	$50,000	$12,500	$0	Yes	Project		$0	$0	$0	$0
113	0	0											Yes	Project		$0	$0	$0	$0
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$5,045**	**$1,710**	**$0**	**$6,755**

Escalation Rates: Install Triple Pane Windows

Cash Flow Balance: Install Triple Pane Windows

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**2024**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$8,444	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		$34	$36	$38	$40	$42	$44	$47	$49	$52	$54	$57	$60	$63	$67	$70	$74	$78	$82	$86	$90
Annual Savings (M03):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$8,444	$34	$36	$38	$40	$42	$44	$47	$49	$52	$54	$57	$60	$63	$67	$70	$74	$78	$82	$86	$90
Cash Balance:	-$8,444	-$8,410	-$8,373	-$8,335	-$8,295	-$8,253	-$8,208	-$8,162	-$8,113	-$8,061	-$8,006	-$7,949	-$7,889	-$7,826	-$7,759	-$7,689	-$7,615	-$7,538	-$7,456	-$7,370	-$7,280
Undepreciated Amount:	$0	-$7,177	-$6,101	-$5,186	-$4,408	-$3,747	-$3,185	-$2,707	-$2,301	-$1,956	-$1,662	-$1,413	-$1,201	-$1,021	-$868	-$738	-$627	-$533	-$453	-$385	-$327

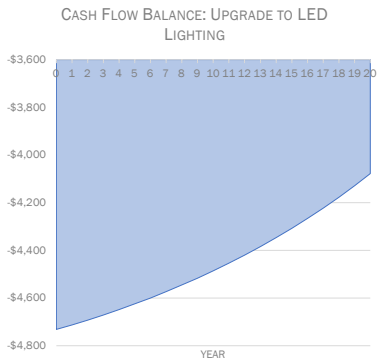
Energy Conservation Measure 1

Opp Cat:	Select
Opp Desc:	
Opp Name:	Upgrade to LED Lighting

Costing Setup	
Engineering & PM:	**5%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

Incentive Work Area			
Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	0
Electricity (kWh):	90
Natural Gas (litres):	0
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO_2e):	0.0
Financials	
Annual Utility Savings:	$18
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$4,115
Engineering & PM:	$206
Contingency:	$411
Project Costs:	$4,732
Simple Payback:	256.8
Capital Payback:	51.6
NPV:	-$4,431
IRR:	-13.1%



Write-ups	
Existing:	#N/A
Retrofit:	#N/A

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	196,778	196,868
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (kW): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Savings: Upgrade to LED Lighting

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	1						0%
-13	-25	24						0%
-8	-22	37						0%
-3	-19	68						0%
3	-16	153						0%
8	-14	201						0%
13	-11	364						0%
18	-8	506						0%
23	-5	638						0%
28	-3	605						0%
33	0	810						0%
38	3	629						0%
43	6	606						0%
48	9	646						0%
53	11	688						0%
58	14	669						0%
63	17	724						0%
68	20	625						0%
73	23	449						0%
78	25	225						0%
83	28	82						0%
88	31	10						0%
93	34	0						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Upgrade to LED Lighting			Savings			Existting	Retrofit	Savings
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)		Ltg Cons (Office/LivingArea Only)	Ltg Cons (Office/LivingArea Only)	Ltg Cons (Office/LivingArea Only)
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0		779	390	390
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	16.7	248.7	89,621.5	17.0	248.7	89,921.5	-300	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	4.7	0.0	4,730.0	4.7	0.0	4,730.0	0	0				
Vent. Fans	0.6	0.0	640.0	0.6	0.0	640.0	0	0				
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Misc. Equip	1.1	0.0	1,090.0	1.1	0.0	1,090.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	1.3	0.0	1,300.0	0.9	0.0	910.0	390	0				
0	**24**	**249**	**97,382**	**24**	**249**	**97,292**	**90**	**0**	**0**	**779**	**390**	**390**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Town Hall 0.92 $ 4.06

General Requirements: Upgrade to LED Lighting

Section	Description	Material Range	Labour Range	Material	Labour	Comments
Factors	Cut and Patch to match existing constructic	2% to 5%	3% to 9%	2.0%	3.0%	Only when required
	Dust Protection	1% to 4%	2% to 11%	1.0%	2.0%	Only when required
	Shift Work Requirements		5% to 30%	0.0%	0.0%	Only when required
	Material Handling and Storage Limitation	1% to 6%	1% to 7%	0.0%	0.0%	Only when required
	Work inside Prisons and High Security Area		30% to 50%	0.0%	0.0%	Only when required
Job Conditions	Economic Conditions	-2% to 5%		5.0%	5.0%	
	Hoisting Conditions	-2% to 5%		0.0%	0.0%	Only when required
	Labour Availability	-1% to 10%		5.0%	5.0%	
	Material Storage Area availability	-1% to 2%		-1.0%	-1.0%	Only when required
	Workspace Availability	-2% to 5%		-2.0%	-2.0%	Only when required
	Overtime Requirements		0% to 100%	0.0%	0.0%	Only when required
Cost Indexes	Location Factors	Toronto		15.9%	4.2%	Very important
Administrative Requirements	Building Permits	0.5% to 2%		0.0%	0.0%	0.5% for most cities
	Performance Bond	0.6% to 2.5%		0.0%	0.0%	Only when required
	Insurance	0.25% to 0.62%		0.3%	0.3%	All risk type
	Insurance - Public Liability	2.02%		2.0%	2.0%	
	Workers Comp and Employer's Liability		7% to 18%	0.0%	10.0%	
Overhead & Profit	Overhead & Profit	15% to 30%		25.0%	25.0%	Higher for smaller jobs
Cleaning	Cleaning after job completion	0.3% to 1%		0.3%	0.3%	

Cost Breakout: Upgrade to LED Lighting

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0											Yes	Project		$0	$0	$0	$0
111	0	0				LED Upgrade		All	EE Database	$3.0	$1.0	$0.0	Yes	Project	660	$3,084	$1,030	$0	$4,115
112	0	0											Yes	Project		$0	$0	$0	$0
113	0	0											Yes	Project		$0	$0	$0	$0
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	$3,084	$1,030	$0	$4,115

Escalation Rates: Upgrade to LED Lighting

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity ($/kWh):	0.2048	0.2154	0.2266	0.2384	0.2508	0.2638	0.2775	0.2920	0.3071	0.3231	0.3399	0.3576	0.3762	0.3958	0.4163	0.4380	0.4608	0.4847	0.5099	0.5364	0.5643
Natural Gas ($/litres):	0.9335	0.9801	1.0291	1.0806	1.1346	1.1913	1.2509	1.3135	1.3791	1.4481	1.5205	1.5965	1.6763	1.7602	1.8482	1.9406	2.0376	2.1395	2.2465	2.3588	2.4767
Water ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GHG Emissions (tCO_2e):	0.000031	0.000043	0.000047	0.000054	0.000071	0.000072	0.000075	0.000069	0.000077	0.000083	0.000079	0.000079	0.000079	0.000077	0.000081	0.000082	0.000087	0.000088	0.000093	0.000093	0.000093

Cash Flow Balance: Upgrade to LED Lighting

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Implementation Cost:	-$4,732	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		$19	$20	$21	$23	$24	$25	$26	$28	$29	$31	$32	$34	$36	$37	$39	$41	$44	$46	$48	$51
Annual Savings (M03):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$4,732	$19	$20	$21	$23	$24	$25	$26	$28	$29	$31	$32	$34	$36	$37	$39	$41	$44	$46	$48	$51
Cash Balance:	-$4,732	-$4,712	-$4,692	-$4,670	-$4,648	-$4,624	-$4,599	-$4,573	-$4,545	-$4,516	-$4,486	-$4,453	-$4,420	-$4,384	-$4,346	-$4,307	-$4,266	-$4,222	-$4,176	-$4,128	-$4,077
Undepreciated Amount:	-$4,732	-$4,022	-$3,419	-$2,906	-$2,470	-$2,099	-$1,785	-$1,517	-$1,289	-$1,096	-$932	-$792	-$673	-$572	-$486	-$413	-$351	-$299	-$254	-$216	-$183