9 Haig St

MacTier, ON P0C 1H0

Climate Action Roadmap

MacTier Memorial Arena

EFFICIENCY ENGINEERING .COM
A Kontrol Technologies Company

TOWNSHIP OF
GEORGIAN BAY

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1 The Executive Summary

Efficiency Engineering has performed a comprehensive Net Zero Retrofit Study at the MacTier Memorial Arena, 9 Haig St MacTier, 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:	MacTier Memorial Arena
Client Name:	Township of Georgian Bay
Site Contact:	Jennifer Schnier
Address:	9 Haig St
	MacTier, ON
	P0C 1H0
Facility Area:	19,023
Building Type:	Indoor Arena
Year Constructed:	1976
Number of Stories:	1

1.1.1 Existing Building Profile

The MacTier Memorial Arena is a 19,000 ft2 single pad indoor arena. Ice is typically maintained between September and May.

The refrigeration plant consists of two 50-hp reciprocating compressors along with their associated chiller, evaporative condenser and pumps.

Space heating for the facility is primarily supplied by two propane fired furnaces rated at 120 MBH each. Cooling is provided only to the second-floor community rooms and is supplied by a dedicated air handling unit equipped with a remote 5-ton condensing unit.

Domestic hot water is supplied by a single propane fired tank heater rated at 65 MBH with 50 gallons of capacity.

A dedicated flood water system (for ice resurfacing) consists of single propane fired tank heater rated at 75 MBH with 75-gallons of storage capacity. Two additional flood water storage tanks bring the system's total storage capacity to approximately 275-gallons.

Ventilation to the building is provided by multiple exhaust fans.

Lighting has been upgraded to LED throughout the facility. Lighting is primarily controlled by wall switches and breakers.

Water fixtures (toilets, shower heads, faucets, etc.) are a mix of standard flow units.

Major HVAC systems, including the furnaces, exhaust fans, DHW and flood water systems are controlled via stand-alone controls including thermostats and timers. The refrigeration plant utilizes a digital refrigeration controls system provided by Black and McDonald.

1.1.2 Previous Energy Conservation Measures

The facility has previously implemented the following energy conservation measures:

- All lighting was upgraded to LED
- Refrigeration controls upgraded to DDC

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	315,180 kWh	16.6	315,180	9.5	20%
Propane	24,267 litres	9.0	172,050	37.6	80%
Total	**N/A**	**25.6**	**487,230**	**47.0**	**100%**

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

Propane consumption at the facility is responsible for 80% of GHG emissions at the facility. Propane fired equipment at this facility includes:

- Two propane fired furnaces used for space heating
- One propane fired domestic hot water heater rated at 55 MBH
- One propane fired flood hot water heater rated at 75 MBH

Addressing this equipment with a low carbon alternative will be required to achieve either the 50% or 80% GHG reduction target.

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	Install Low Flow Showerheads & Washroom Faucets	0	0	447	87	0.7	$835	$2,568	$701	3.1	2.8	$9,707	37.7%
2	Replace Flood Water Boiler with Electric	-212	-16,950	3,067	0	4.2	-$920	$29,383	-$487	No Payback	No Payback	($41,312)	No IRR
3	Replace DHW Heater with Hybrid ASHP Tank Heater	-54	-4,231	1,404	0	2.0	$366	$13,997	-$101	38.2	12.8	($4,138)	3.3%
4	Repalce Furnaces with ASHP & Propane Backup	-94	-22,290	13,953	0	20.9	$8,049	$71,491	$173	8.9	5.2	$72,483	17.2%
5	Replace Ice Resurfacer with Electric	-18	-20,480	3,171	0	4.3	-$1,611	$185,369	-$1,276	No Payback	No Payback	($109,573)	No IRR
6	Install an 200-kW Solar PV System	720	221,480	0	0	6.6	$49,429	$922,523	-$863	18.7	12.9	($114,739)	5.9%
7	Install Cold Water Flooding Equipment	0	11,862	0	0	0.4	$2,647	$57,000	-$1,930	21.5	14.3	($13,738)	4.5%
8	Replace Furnaces w ASHP & Electric Backup	-64	-35,220	16,188	0	24.0	$7,250	$73,861	$118	10.2	5.9	$56,415	15.1%
9	Install a Desuperheater	0	10,544	0	0	0.3	$2,353	$72,999	-$5,460	31.0	18.3	($34,544)	1.1%
10	Install Triple Pane Windows	0	-30	336	0	0.5	$307	$166,180	-$15,549	542.1	67.4	($161,265)	-17.2%
11	Install EIFS	0	60	2,051	0	3.2	$1,928	$1,263,625	-$19,402	655.5	71.2	($1,232,699)	-18.1%
12	Replace Furnaces with Electric	0	-68,840	16,184	0	23.0	-$258	$27,912	-$44	No Payback	No Payback	($20,323)	No IRR
13	Replace DHW Heater with Electric	0	-9,610	1,851	0	2.6	-$417	$16,948	-$388	No Payback	No Payback	($20,012)	No IRR
14	Replace Flood Water Heater w ASHP & Electric Backup	-240	-9,975	3,065	0	4.4	$635	$228,820	-$2,422	360.5	67.2	($215,342)	-14.7%
15	Electrical Service Upgrade - 300 kVA Transformer	0	0	0	0	0.0	$0	$274,269	N/A	No Payback	No Payback	($274,269)	No IRR

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.

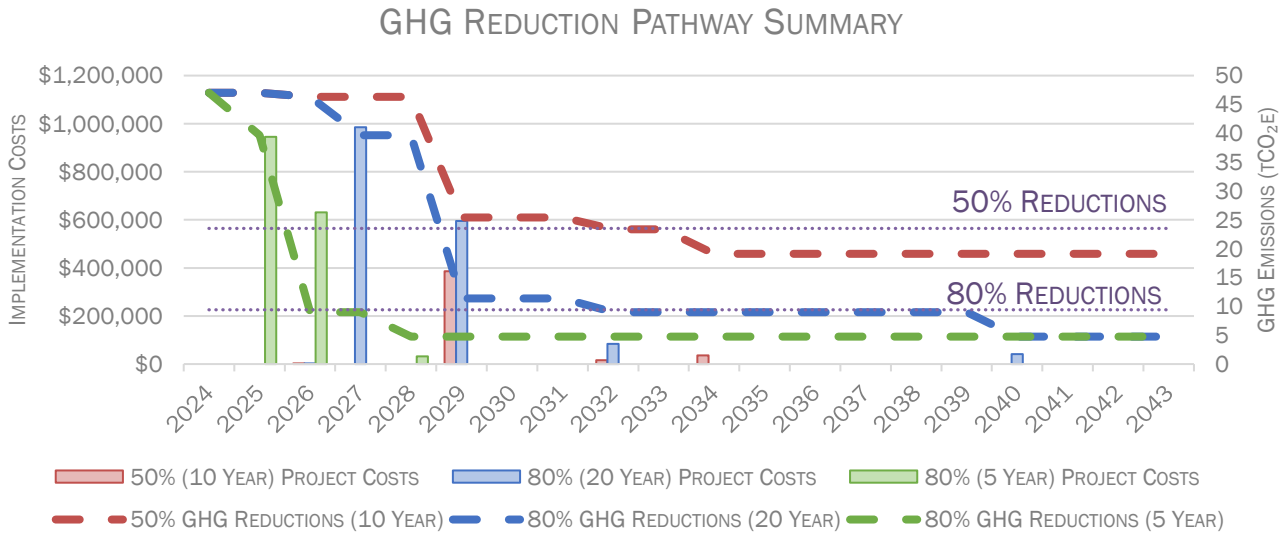
Roadmap 4 – Business-As-Usual

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	Install Low Flow Showerheads & Washroom Faucets	0.7	•	•
2	Replace Flood Water Boiler with Electric	4.2	•	•
3	Replace DHW Heater with Hybrid ASHP Tank Heater	2.0	•	•
4	Repalce Furnaces with ASHP & Propane Backup	20.9	•	
5	Replace Ice Resurfacer with Electric	4.3		•
6	Install an 200-kW Solar PV System	6.6		•
7	Install Cold Water Flooding Equipment	0.4		•
8	Replace Furnaces w ASHP & Electric Backup	24.0		•
9	Install a Desuperheater	0.3		
10	Install Triple Pane Windows	0.5		
11	Install EIFS	3.2		
12	Replace Furnaces with Electric	23.0		
13	Replace DHW Heater with Electric	2.6		
14	Replace Flood Water Heater w ASHP & Electric Backup	4.4		
15	Electrical Service Upgrade - 300 kVA Transformer	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)	90,373	19%	27.9	59%	$8,331	$391,707	$1,742,672
80% Reductions (20 Year)	328,602	67%	42.3	90%	$57,996	$1,558,969	$1,814,152
80% Reductions (5 Year)	328,602	67%	42.3	90%	$57,996	$1,558,969	$1,834,701
Business-As-Usual	$0	0%	$0	0%	$0	$165,130	$1,732,447

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**	**20-Year LC Cost**	**Incremental 20-Year LC Cost**	**Incremental LC Cost per tCO_2e**
50% Reductions in 10 Years	$391,707	$78,341	$33,652	$279,713	$1,742,672	$10,224	$18
80% Reductions in 20 Years	$1,558,969	$311,794	$165,130	$1,082,045	$1,814,152	$81,705	$97
80% Reductions in 5 Years	$1,558,969	$311,794	$165,130	$1,082,045	$1,834,701	$102,254	$121
Business-As-Usual	$165,130	$0	$0	$0	$1,732,447	N/A	N/A

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.

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

Report prepared by Thomas Kitson, 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 a 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 and contingency as well as engineering and or 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:	MacTier Memorial Arena
Client Name:	Township of Georgian Bay
Site Contact:	Jennifer Schnier
Address:	9 Haig St
	MacTier, ON
	P0C 1H0
Facility Area:	19,023
Building Type:	Indoor Arena
Year Constructed:	1976
Number of Stories:	1

4.1 Heating & Cooling

The building is heated by two propane fired furnaces located in a ground floor mechanical room. The furnaces were installed in 2009 and are currently 15-years into an expected 20-year service life.

A cooling only HVAC unit equipped with a 5-ton remote condensing unit supplies air conditioning to the function hall on the second floor.

Propane Furnace: Typical of (2)

TABLE 4.1.1: HEATING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition
HVAC1	Furnace	120MBH	80%	Fair
HVAC2	Furnace	120 MBH	80%	Fair
HVAC3	AC	5-Ton		Fair

4.2 Domestic Hot & Flood Water Systems

Domestic hot water for the facility is supplied by a single higher efficiency propane fired tank heater rated at 65 MBH with 50 gallons of capacity. The tank heater was installed in 2010 and is currently 14-years old with a life expectancy of 15-20 years.

TABLE 4.2.1: DHW EQUIPMENT DETAILS

Tag ID	Boiler Type	Capacity	Efficiency	Condition
DHW1	Forced Draft	65 MBH	87%	Fair
FWB	Forced Draft	75 MBH	87%	Fair

Propane DHW Heater

Flood water for the ice resurfacer is provided by a dedicated flood water system consisting of a single propane fired tank heater rated at 75 MBH with 75-gallons of storage capacity. Two additional flood water storage tanks bring the system's total storage capacity to approximately 275-gallons. The flood water tank heater was replaced in 2020 and is currently 4-years old.

4.3 Refrigeration Plant

The ice pad is supplied by a refrigeration plant consisting of two 50-hp reciprocating compressors coupled to a shell & tube chiller and an evaporative condenser. A 20-hp brine pump circulates chilled brine for the ice pad. The refrigeration plant typically operates from September through April.

A propane powered ice resurfacer is used to maintain the ice surface.

4.4 Building Envelope

The facility was constructed in 1976 and consists of steel & concrete block construction with brick and corrugated steel façade. The roof is built-up of tar and gravel. Windows are generally double glazed with an air fill. Entrance doors are primarily steel with hollow cores.

As the building is approaching 50 years old. It is in fair condition for its age.

Building Façade

4.5 Water Fixtures

Water fixtures in the facility were generally observed to be standard flow. Water and domestic hot water consumption at this facility are relatively low.

TABLE 4.5.1: WATER FIXTURE DETAILS

Fixture	Flow
Bathroom Faucets:	2-2.2 GPM
Kitchen Faucets:	2.2 GPM
Toilets:	1.6 GPF
Shower Heads:	2.5 GPM

Typical Washroom Faucet: 2-2.2 GPM

4.6 Lighting

All lighting at the facility has been upgraded to high efficiency LED.

4.7 Controls

The facility is not equipped with a centralized control system such as a BAS. Major HVAC systems, including the furnaces, exhaust fans, DHW and flood water systems are controlled via stand-alone controls including thermostats, aquastats and timers. The refrigeration plant utilizes a digital refrigeration controls system provided by Black and McDonald.

4.8 Electrical Service

The site is serviced by three pole mounted 50kVA transformers supplying a 400 A 600 V main disconnect.

Limited demand data was available for the facility. Of the available demand data, the facility's peak demand was 135-kW. This suggests that the facility is at or close to its allowable peak electrical demand.

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%	$0.2232	0.000030
Propane	l	5.0%	$0.9334	0.001548
Water	m^3	3.0%	$4.7748	0.000000

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

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 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

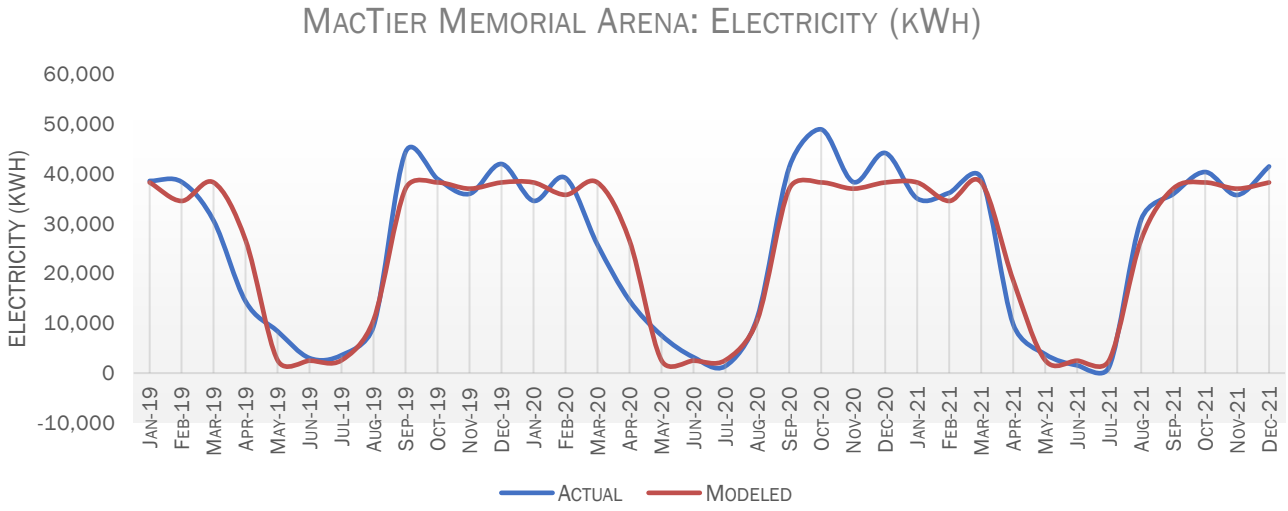
Daily mean temperatures from Toronto International Airport (WMO ID 71624) were used in creating the baseline models for this facility.

5.3.1 Electricity

Baseline Equation:

Electricity (kWh) = Days x 85.91 + Arena Days x 1151.85.
The underlying regression of this baseline equation is R^2 = 0.9685.
In a typical year, consumption will be 310,877 kWh.

Modeling Graphs:



Rate Structure:

Electricity for this building is provided by Hydro One. It is classified as a Small Commercial account with a monthly demand of between 50 and 500-kW. 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. Demand and Regulatory Charges are also added to this cost on a per kWh basis.

Comments:

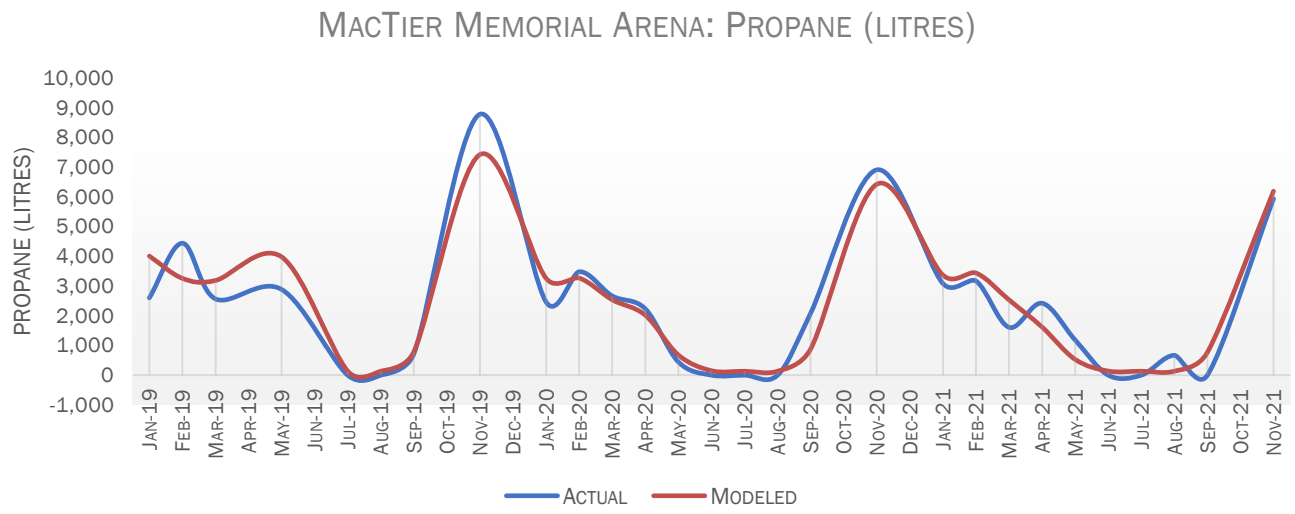
Electrical consumption at the facility is driven primarily by the operation of the refrigeration plant. As a result, electrical consumption at this facility does not have a statistical correlation to weather data.

5.3.2 Propane

Baseline Equation:

Propane (litres) = Days x 4.49 + HDD x 4.91 + Arena Days x 21.61.
The underlying regression of this baseline equation is $R^2 = 0.9467$.
HDD (Heating Degree Days) calculated using a balance point of 12°C.
In a typical year, consumption will be 22,435 litres.

Modeling Graphs:



Rate Structure:

Propane for the facility is purchased and delivered by the Township's fuel provider. The township is charged based on litres of propane delivered to the site.

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.

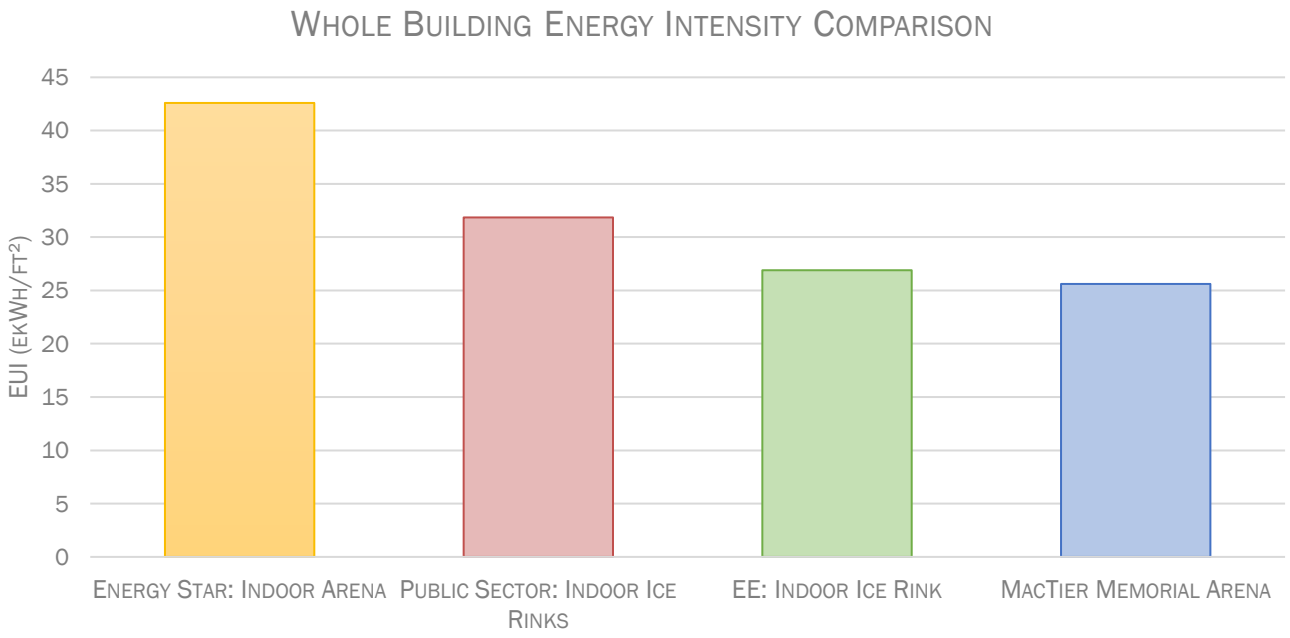
Electricity intensity for the building is 16.6 ekWh/ft² (0.64 GJ/m²). Propane intensity for the building is 9.0 ekWh/ft² (0.35 GJ/m²). Total energy intensity for the building is 25.6 ekWh/ft² (0.99 GJ/m²).

The energy performance of the Memorial Arena is compared to arenas from multiple benchmarking databases including Energy Star, Ontario Broader Public Sector buildings and a database of energy use intensities maintained by Efficiency Engineering:

Benchmark	EUI	% Variance
Energy Star: Indoor Arena	42.6	-40%
Public Sector: Indoor Ice Rinks	31.9	-20%
EE: Indoor Ice Rink	26.9	-5%
MacTier Memorial Arena	**25.6**	

*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 indoor arenas, the overall energy intensity at MacTier Memorial Arena is low. As energy intensity at this facility is primarily driven by the refrigeration plant and use of the ice surface, the low consumption at this facility is attributed mostly to lower overall usage.

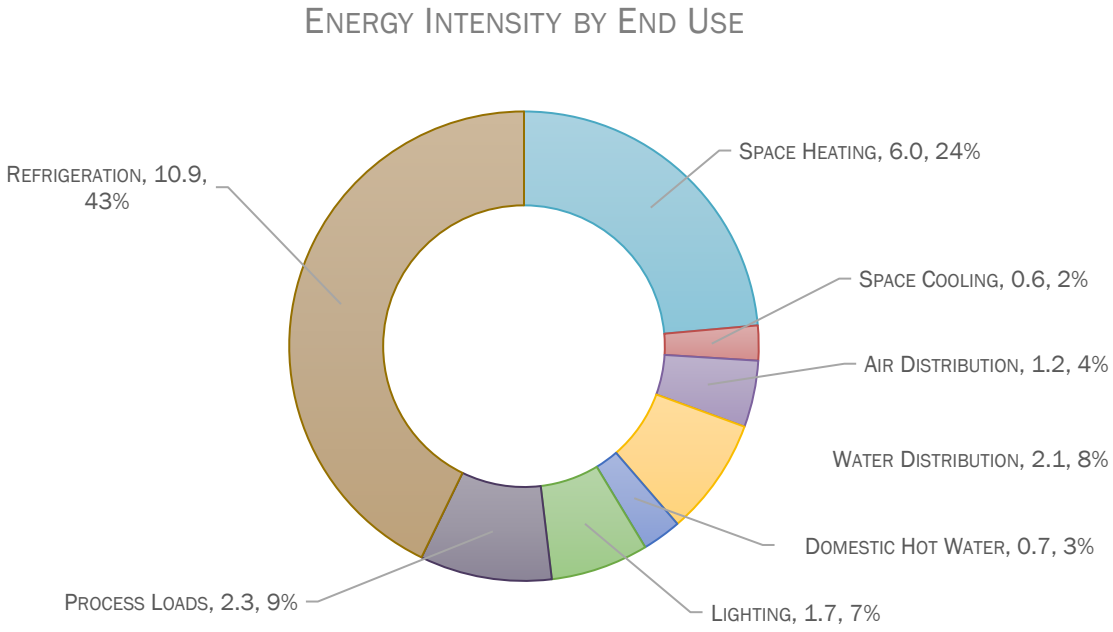
5.5 Energy Breakout by End Use

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:

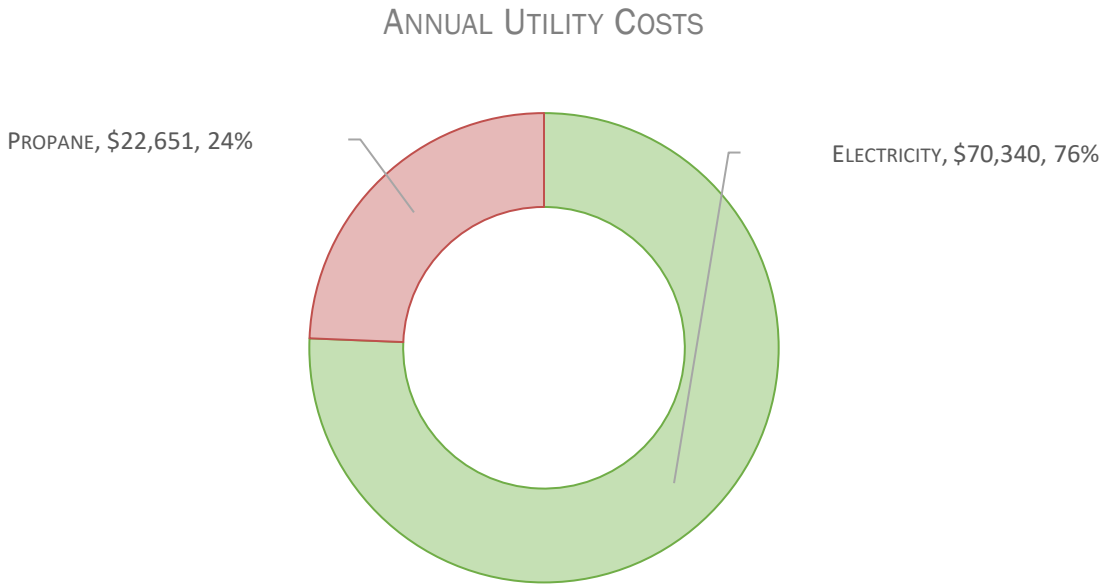
End Use	Electricity (kWh)	Propane (l)	EUI (ekWh/ft²)	GHG Emissions (Tonnes)
Space Heating	0	16,182	6.0	25.0
Space Cooling	11,680	0	0.6	0.4
Air Distribution	22,300	0	1.2	0.7
Water Distribution	39,370	0	2.1	1.2
Domestic Hot Water	0	1,851	0.7	2.9
Lighting	32,800	0	1.7	1.0
Plug Loads	800	0	0.0	0.0
Process Loads	0	6,234	2.3	9.7
Refrigeration	208,230	0	10.9	6.2
Other	0	0	0.0	0.0
Total	**315,180**	**24,267**	**25.6**	**47.0**

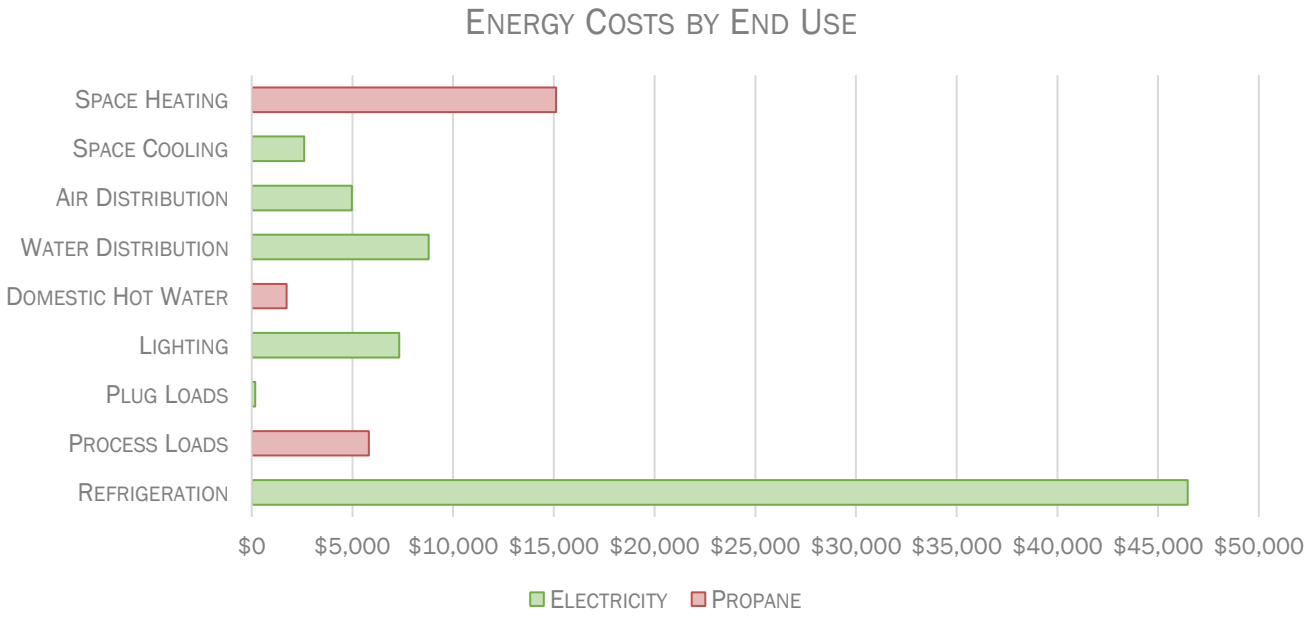
The following chart shows the energy intensity of the Memorial Arena broken out by end use.



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 includes 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.

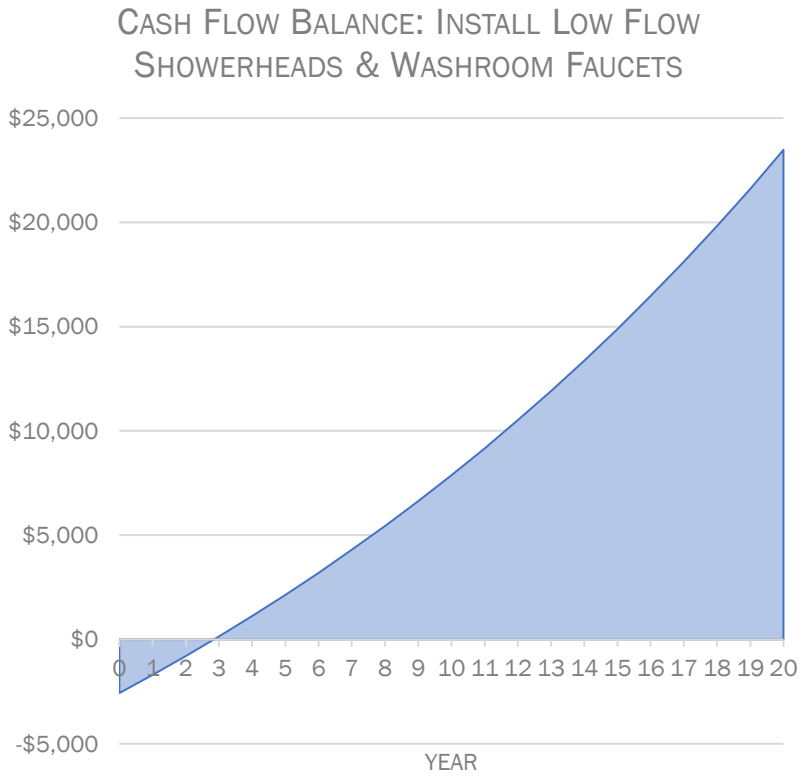
6.1 Opportunity 01: Install Low Flow Shower Heads & Washroom Faucets

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):	0
Propane (l):	447
Water (m^3):	87
Emissions (tCO_2e):	0.7
Financials	
Utility Savings:	$835
Materials & Labour:	$2,054
Engineering & PM:	$308
Contingency:	$205
Project Costs:	$2,568
Simple Payback:	3.1
Capital Payback:	2.8
NPV:	$9,707
IRR:	37.7%



Existing Conditions

Water fixtures at the facility were generally observed to be a mix of standard flow and low flow units.

TABLE 6.1.2: WATER FIXTURE DETAILS

Fixture	Flow
Bathroom Faucets:	2-2.2 GPM
Kitchen Faucets:	2 GPM
Toilets:	1.6 GPF
Shower Heads:	2.5 GPM

Retrofit Conditions

We recommend installing new ultra low-flow (0.5 gpm) washroom faucets and low-flow (1.5 GPM) shower heads at the facility. These fixtures perform similarly to standard flow units but consume considerably less water and hot water resulting in significant utility savings and GHG reductions.

TABLE 6.1.3: WATER FIXTURE DETAILS

Fixture	Existing	Retrofit
Bathroom Faucets:	2-2.2 GPM	0.5 GPM
Kitchen Faucets:	2 GPM	2 GPM
Toilets:	1.6 GPF	1.6 GPF
Shower Heads:	2.5 GPM	1.5 GPM

While it is possible (and less expensive) to replace just the aerators on the existing fixtures, aerators are easily removed or damaged, resulting in reduced savings.

It is recommended that only well reviewed products from quality manufacturers be installed. Quality fixtures will result in greater user satisfaction and reduce the risk of complaints and fixture replacement by occupants.

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

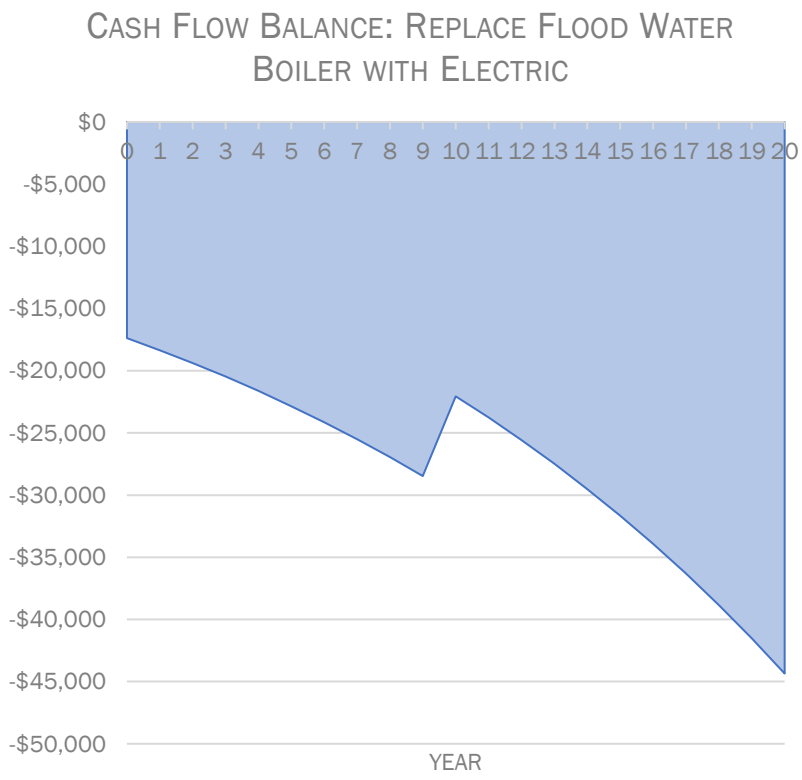
6.2 Opportunity 02: Replace Flood Water Boiler with Electric

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):	-212
Electricity (kWh):	-16,950
Propane (l):	3,067
Water (m³):	0
Emissions (tCO_2e):	4.2
Financials	
Utility Savings:	-$920
Materials & Labour:	$23,506
Engineering & PM:	$3,526
Contingency:	$2,351
Project Costs:	$29,383
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$41,312
IRR:	No IRR



Existing Conditions

Flood water for the ice resurfacer is provided by a dedicated flood water system consisting of a single propane fired tank heater rated at 75 MBH

with 75-gallons of storage capacity. Two additional flood water storage tanks bring the system's total storage capacity to approximately 275-gallons.

The flood water tank heater was replaced in 2020 and is currently 4-years old.

Propane Tank Heater

TABLE 6.2.2: DHW EQUIPMENT DETAILS

Tag ID	Boiler Type	Capacity	Efficiency	Condition
FWB	Forced Draft	75 MBH	87%	Fair

Retrofit Conditions

The existing propane fired flood water heater can be replaced with an electric flood water heater of equivalent recovery and storage capacity.

This measure includes removal of the existing propane fired flood water tank heater and its associated venting as well as the two auxiliary storage tanks.

A new electric tank heater rated at approximately 18-kW would be installed in the location of the existing propane fired unit along with new electrical feeds to the nearest panel and new auxiliary storage tanks.

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

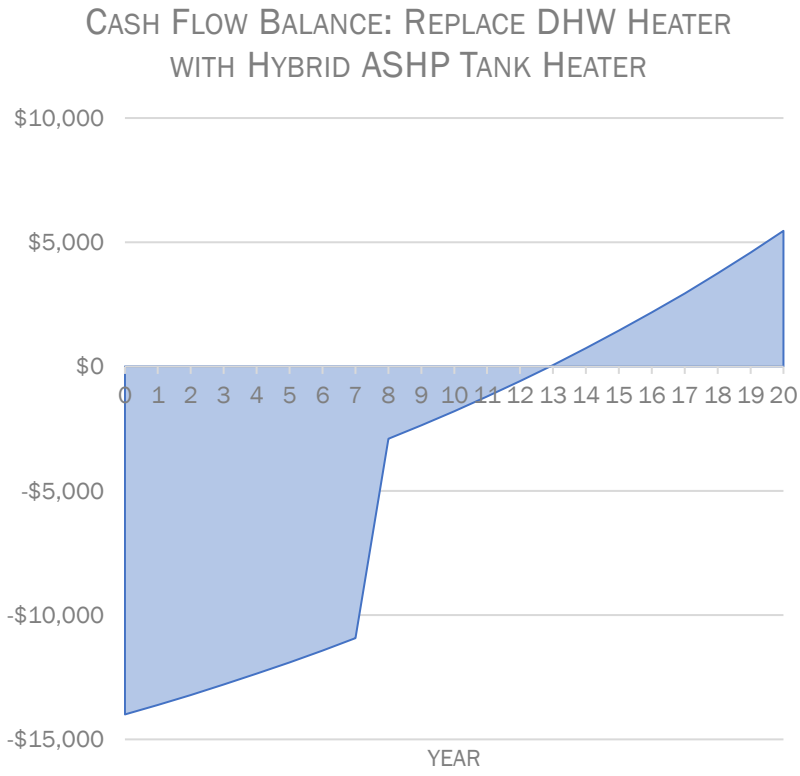
6.3 Opportunity 03: Replace DHW Heater with Hybrid ASHP Tank Heaters

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):	-54
Electricity (kWh):	-4,231
Propane (l):	1,404
Water (m³):	0
Emissions (tCO_2e):	2.0
Financials	
Utility Savings:	$366
Materials & Labour:	$11,197
Engineering & PM:	$1,680
Contingency:	$1,120
Project Costs:	$13,997
Simple Payback:	38.2
Capital Payback:	12.8
NPV:	-$4,138
IRR:	3.3%



Existing Conditions

Domestic hot water for the facility is supplied by a single higher efficiency propane fired tank heater rated at 65 MBH with 50 gallons of storage capacity.

The tank heater was installed in 2010 and is currently 14-years old with a life expectancy of 15-20 years.

Propane DHW Heater

TABLE 6.3.2: DHW EQUIPMENT DETAILS

Tag ID	Boiler Type	Capacity	Efficiency	Condition
DHW1	Forced Draft	65 MBH	87%	Fair

Retrofit Conditions

The existing propane fired DHW heater can be replaced with residential style “hybrid” ASHP tank heater.

Multiple manufacturers currently offer residential and light commercial hybrid domestic hot water tanks which utilize a combination of an air source heat pump and electric resistance heating. The air source heat pump operates at a low capacity over longer durations of time to slowly increase or maintain tank temperatures. During times of high loads, the electric resistance heater cycles on to carry the peak loads.

Typical Hybrid ASHP/Electric Tank Heater

This measure includes demolition and removal of the existing propane fired tank heater and its associated venting. A new hybrid tank heater would be installed in the location of the existing equipment.

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

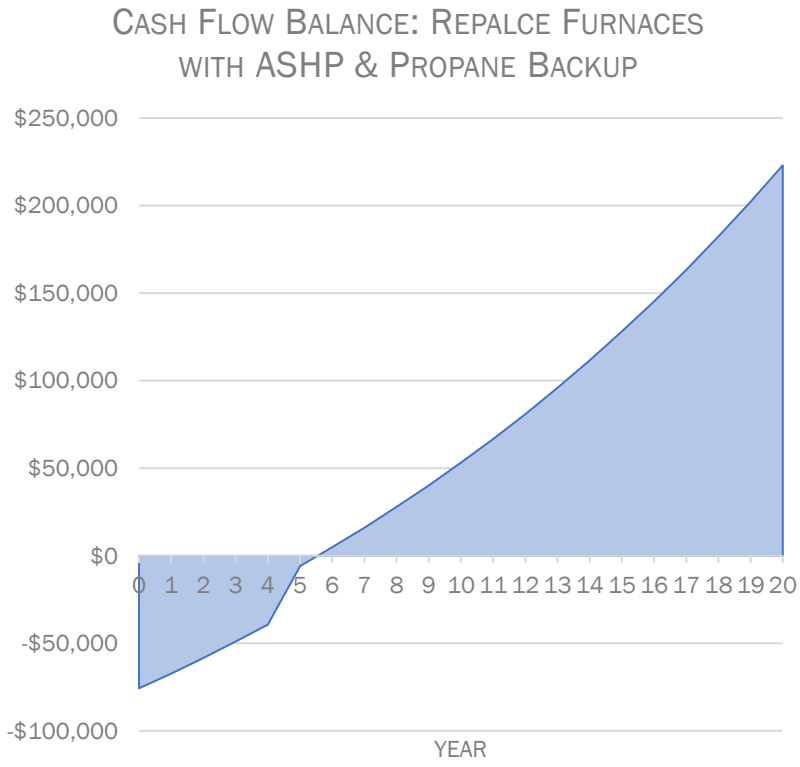
6.4 Opportunity 04: Replace Furnaces with ASHP & Propane Backup

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):	-94
Electricity (kWh):	-22,290
Propane (l):	13,953
Water (m^3):	0
Emissions (tCO_2e):	20.9
Financials	
Utility Savings:	$8,049
Materials & Labour:	$57,193
Engineering & PM:	$8,579
Contingency:	$5,719
Project Costs:	$71,491
Simple Payback:	8.9
Capital Payback:	5.2
NPV:	$72,483
IRR:	17.2%



Existing Conditions

The building is heated by two propane fired furnaces located in a ground floor mechanical room.

The furnaces were installed in 2009 and are currently 15-years into an expected 20-year service life.

TABLE 6.4.2: HEATING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition
HVAC1	Furnace	120 MBH	80%	Fair
HVAC2	Furnace	120 MBH	80%	Fair

Propane Furnace: Typical of (2)

Retrofit Conditions

The existing propane fired furnaces can be replaced with new propane fired furnaces equipped with remote air source heat pump (ASHP) condensing units.

Typical ASHP Condensing Unit

During the shoulder seasons and into the heating season, the air source heat pump will operate to supply space heating. During the peak heating season or when the outdoor temperatures drop below the operating envelope of the air source heat pump, the propane furnace will operate to provide peak heating capacity and redundancy.

The existing furnaces each have a heating capacity of 120 MBH (input). Analysis shows that equipping each furnace with a 5-ton ASHP condensing unit would offset over 70% of the propane consumption of each furnace.

Costing for this measure includes removal of the two existing furnaces, installation of two new propane fired furnaces of equivalent heating capacity along with two new 5-ton ASHP condensing units, mounting pads & new electrical feeds.

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

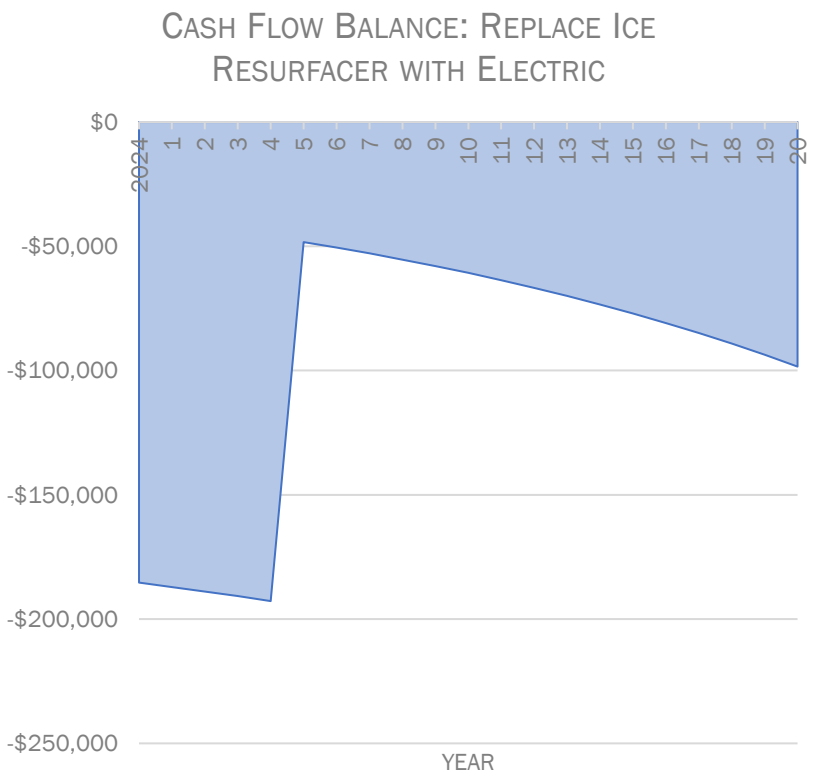
6.5 Opportunity 05: Replace Ice Resurfacer with Electric

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):	-18
Electricity (kWh):	-20,480
Propane (l):	3,171
Water (m³):	0
Emissions (tCO_2e):	4.3
Financials	
Utility Savings:	-$1,611
Materials & Labour:	$161,190
Engineering & PM:	$8,060
Contingency:	$16,119
Project Costs:	$185,369
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$109,573
IRR:	No IRR



Existing Conditions

The facility is equipped with a propane fired ice re-surfacer used to maintain the ice surface quality.

Retrofit Conditions

All major manufacturers now offer electric ice re-surfacers across most of their model lines. Electric ice resurfacers are powered by electric motors and equipped with rechargeable batteries, similar to electric cars.

As with electric cars, the performance of electric ice resurfacers has improved greatly even in the last 5-years. Electric ice resurfacers are currently being used with success by multiple municipalities within Ontario.

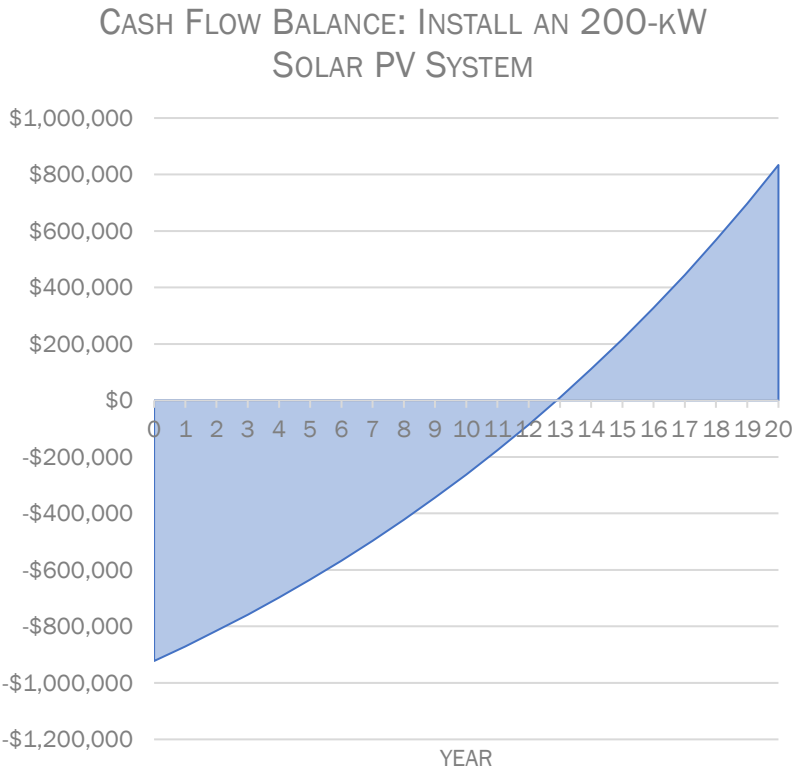
6.6 Opportunity 06: Install a 200-kW Solar PV System

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 6.6.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	720
Electricity (kWh):	221,480
Propane (l):	0
Water (m³):	0
Emissions (tCO_2e):	6.6
Financials	
Utility Savings:	$49,429
Materials & Labour:	$838,657
Engineering & PM:	$0
Contingency:	$83,866
Project Costs:	$922,523
Simple Payback:	18.7
Capital Payback:	12.9
NPV:	-$114,739
IRR:	5.9%



Existing Conditions

The facility has a large, unobstructed roof space which allows for the installation of a sizable solar PV system.

All electricity for the site is currently supplied by Hydro One

MacTier Memorial Arena: Aerial View

Retrofit Conditions

Photovoltaic (PV) solar panels convert solar energy directly into electricity. The electricity can then be coupled to the building's electrical distribution, where it can be used within the building or sold back to the utility (with a net-metering agreement). Clear exposures to eastern, southern, and western skies will help maximize the electricity production of the PV system.

Analysis shows that the roof of the arena has space to support a solar PV system of up to 200-kW of solar PV. A 200-kW system is expected to generate approximately 220,000 kWh of electricity. This equates to approximately 70% of the building's existing electrical consumption.

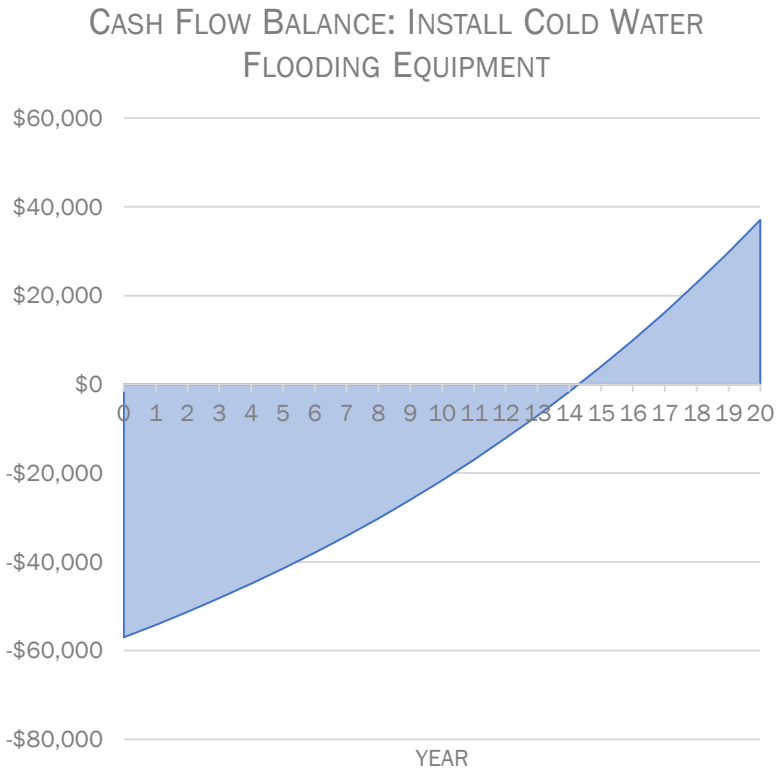
6.7 Opportunity 07: Install Cold Water Flooding Equipment

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):	11,862
Propane (l):	0
Water (m^3):	0
Emissions (tCO_2e):	0.4
Financials	
Utility Savings:	$2,647
Materials & Labour:	$45,600
Engineering & PM:	$6,840
Contingency:	$4,560
Project Costs:	$57,000
Simple Payback:	21.5
Capital Payback:	14.3
NPV:	-$13,738
IRR:	4.5%



Existing Conditions

Arenas typically utilize hot water when flooding. Flood water is heated to remove contaminants and dissolved gases which can lead to poor ice quality.

Arena flooding typically accounts for approximately 12% of the ice surface refrigeration requirements. When the flooding at high temperatures increases the following inefficiencies:

- The propane fired water heater uses a significant amount of fuel to produce hot water.
- The ice surfaces pond and take longer to freeze.
- The refrigeration equipment will use more energy to freeze the water.

The Flood water temperature is presently maintained at 120°F by the facility's flood water equipment.

Flood water for the ice resurfacer is provided by a dedicated flood water system consisting of a single propane fired tank heater rated at 75 MBH with 75-gallons of storage capacity. Two additional flood water storage tanks bring the system's total storage capacity to approximately 275-gallons. The flood water tank heater was replaced in 2020 and is currently 4-years old.

Propane FW Heater

TABLE 6.7.2: DHW EQUIPMENT DETAILS

Tag ID	Boiler Type	Capacity	Efficiency	Condition
FWB	Forced Draft	75 MBH	87%	Fair

Retrofit Conditions

Products are available on the market which utilize other methods for de-aerating and removing contaminants from city water. This allows arenas to flood at lower temperatures than traditionally used.

We recommend implementing a cold-water flood system to allow for lower temperature water to be utilized for flooding. Systems, such as REALice, utilize vortices to remove impurities. Other systems claim to utilize magnetic fields to achieve similar results.

This measure will have a negligible impact on operations and maintenance at the facility as these systems typically do not include moving parts. While some operators find the cold-water flooding works well, some operators have reported reduced ice hardness.

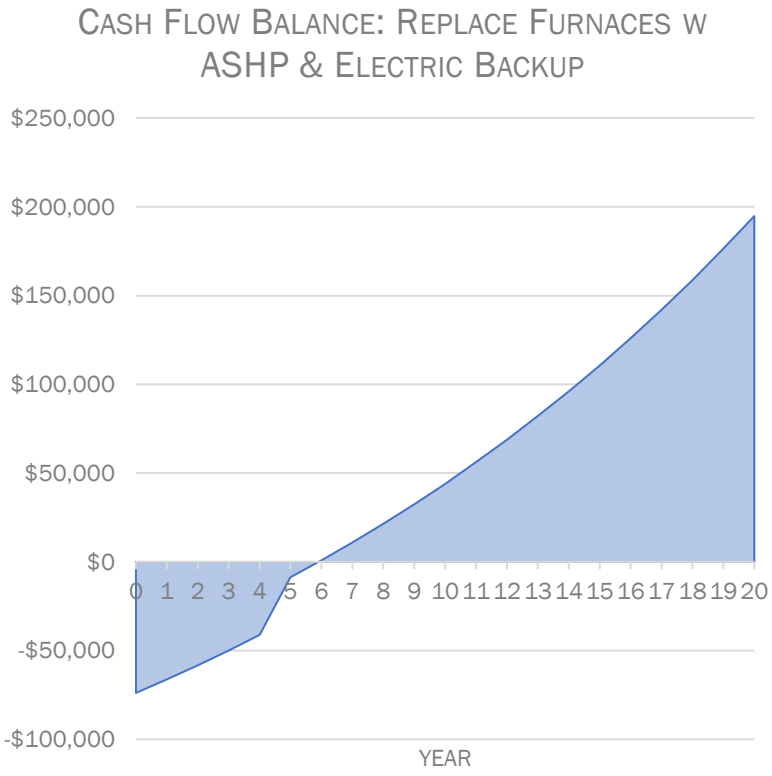
6.8 Opportunity 08: Replace Furnaces with ASHPs & Electric Backup

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):	-64
Electricity (kWh):	-35,220
Propane (l):	16,188
Water (m^3):	0
Emissions (tCO_2e):	24.0
Financials	
Utility Savings:	$7,250
Materials & Labour:	$59,089
Engineering & PM:	$8,863
Contingency:	$5,909
Project Costs:	$73,861
Simple Payback:	10.2
Capital Payback:	5.9
NPV:	$56,415
IRR:	15.1%



Existing Conditions

The building is heated by two propane fired furnaces located in a ground floor mechanical room.

The furnaces were installed in 2009 and are currently 15-years into an expected 20-year service life.

TABLE 6.8.2: HEATING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition
HVAC1	Furnace	120 MBH	80%	Fair
HVAC2	Furnace	120 MBH	80%	Fair

Propane Furnace: Typical of (2)

Retrofit Conditions

The existing propane fired furnaces can be replaced with new furnaces equipped with remote air source heat pump (ASHP) condensing units and electric resistance backup heat.

Typical ASHP Condensing Unit

During the shoulder seasons and into the heating season, the air source heat pump will operate to supply space heating. During the peak heating season or when the outdoor temperatures drop below the operating envelope of the air source heat pump, electric resistance heating will operate to provide peak capacity and redundancy.

Utilizing electricity as the backup heating source offsets 100% of the propane consumption of the existing furnaces.

Costing for this measure includes removal of the two existing furnaces, installation of two new electric furnaces of equivalent heating capacity along with two new 5-ton ASHP condensing units, mounting pads & new electrical feeds.

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

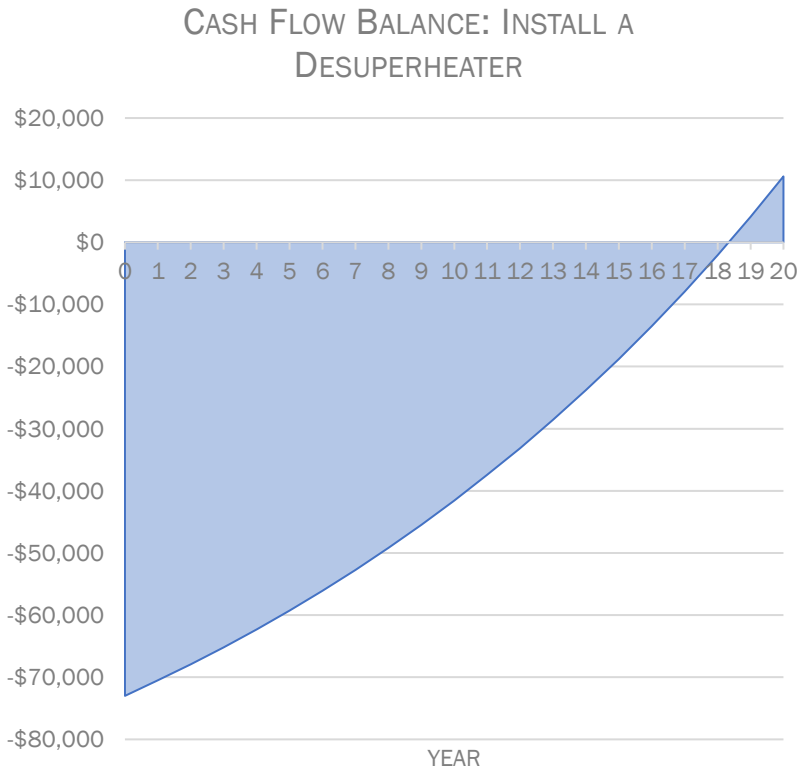
6.9 Opportunity 09: Install a Desuperheater

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):	10,544
Propane (l):	0
Water (m³):	0
Emissions (tCO_2e):	0.3
Financials	
Utility Savings:	$2,353
Materials & Labour:	$58,399
Engineering & PM:	$8,760
Contingency:	$5,840
Project Costs:	$72,999
Simple Payback:	31.0
Capital Payback:	18.3
NPV:	-$34,544
IRR:	1.1%



Existing Conditions

The arena refrigeration plants use ammonia as a refrigerant to transfer waste heat from the brine to the evaporative condensers where it is rejected to the atmosphere.

When ammonia leaves the compressor, it is in a superheated state. At a typical pressure of 170 psig, the temperature of the superheated vapour would be around 240°F.

Retrofit Conditions

Desuperheaters recover “high-grade” waste heat from the compressed ammonia for use elsewhere in the building.

A desuperheater could be installed in the refrigeration mechanical room to recover waste heat from the refrigeration plant. The desuperheater would be connected to the flood water system in the Zamboni room via a pre-heat tank. Waste heat from the refrigeration plant would be uti

This measure will have no measurable impact on operations and maintenance at the facility. Proper cleaning and servicing would be performed by an HVAC contractor.

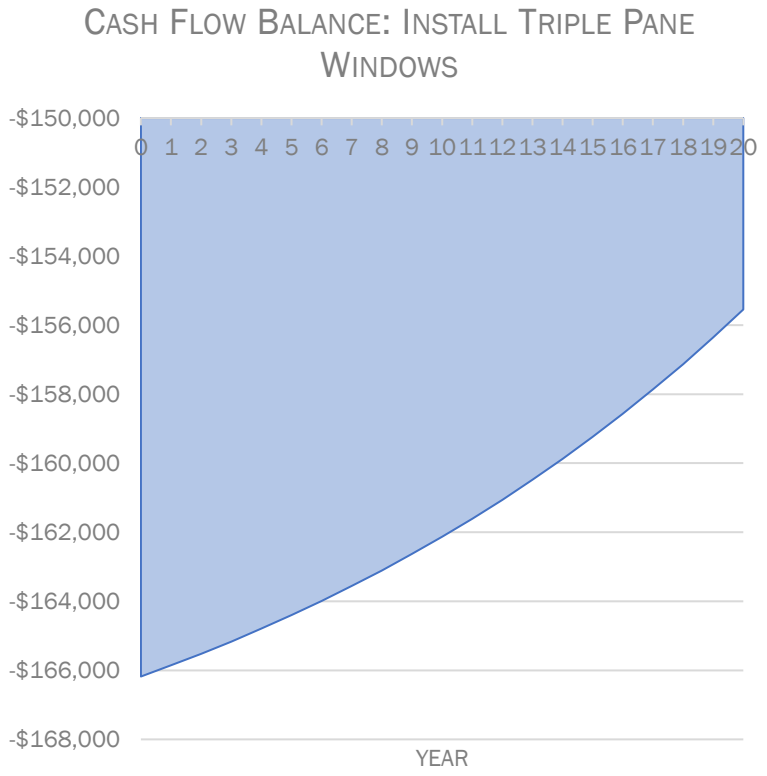
6.10 Opportunity 10: Install Triple Pane Windows

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 6.10.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	30
Propane (l):	336
Water (m³):	0
Emissions (tCO_2e):	0.5
Financials	
Utility Savings:	$307
Materials & Labour:	$132,944
Engineering & PM:	$19,942
Contingency:	$13,294
Project Costs:	$166,180
Simple Payback:	542.1
Capital Payback:	67.4
NPV:	-$161,265
IRR:	-17.2%



The Existing Conditions

The facility was constructed in 1976 and has a very low percentage of window area. Existing windows are double glazed with an argon fill.

MacTier Memorial Arena

The Retrofit Conditions

The windows can be replaced with more efficient triple glazed, argon filled windows to reduce energy consumption and GHG emissions. Window frames should be made of thermally broken aluminum or fiberglass. Existing operable windows should be replaced with operable windows. Newer windows will have a higher R-value (better insulating characteristics) and will also have tighter frames resulting in less infiltration. Specify argon-filled windows with a low-emissivity interior coating to block some of the summer radiant heat gain. Savings calculations were determined using a new window with an R-value of 4.

The existing windows have an average life expectancy of 50-years. This measure is relatively expensive when compared to other GHG reduction measures and is not required to achieve either the 50% or 80% GHG reduction targets. It is recommended that this measure be reconsidered when the existing windows approach the end of their life expectancy and are scheduled for replacement.

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

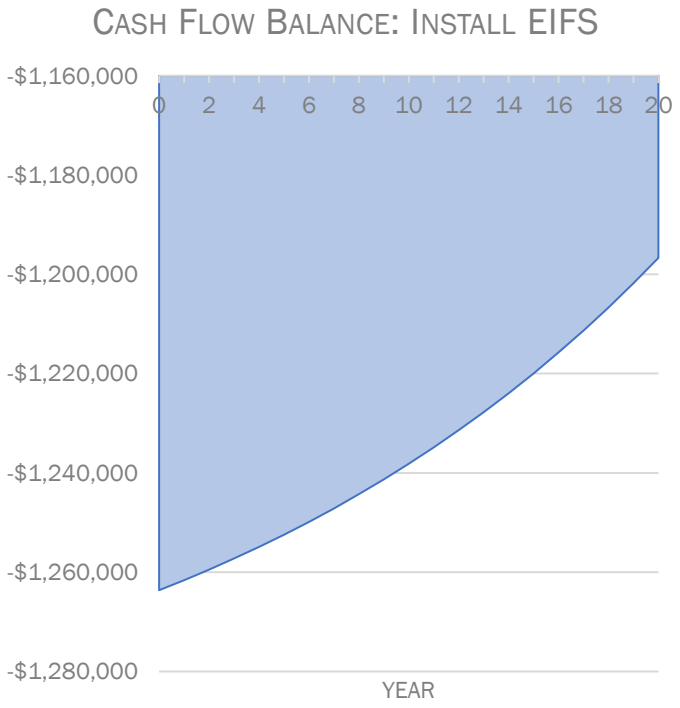
6.11 Opportunity 11: Install External Insulation & Finishing System (EIFS)

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 6.11.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	60
Propane (l):	2,051
Water (m^3):	0
Emissions (tCO_2e):	3.2
Financials	
Utility Savings:	$1,928
Materials & Labour:	$1,010,900
Engineering & PM:	$151,635
Contingency:	$101,090
Project Costs:	$1,263,625
Simple Payback:	655.5
Capital Payback:	71.2
NPV:	-$1,232,699
IRR:	-18.1%



Existing Conditions

The facility was constructed in 1976 consisting of steel & concrete block with corrugated steel. The facility is approaching 50-years old.

Building Envelope: MacTier Memorial Arena

Retrofit Conditions

The facilty is aproaching 50-years in age. What was considered as acceptable or even "best practice" decades ago has evolved. Additionally, insulation values of wall assemblies typically deteriorates over time due to cracks, penetrations and moisture infiltration into materials.

External Insulation and Finishing Systems (EIFS) consist of an added layer of rigid insulation applied over the building's existing façade and then finished with an overlay of cladding or exterior veneer. EIFS systems typically contain an additional 4 inches of rigid insulation. One inch of rigid insulation provides an average R-value of 5. Four inches of rigid insulation would add a total of R20 to the building's existing insulation.

This EIFS system will be installed and maintained by a qualified contractor. No additional staff training is required. This measure will have no measurable impact on operations and maintenance costs at the facility and will have no impact on occupancy comfort or safety.

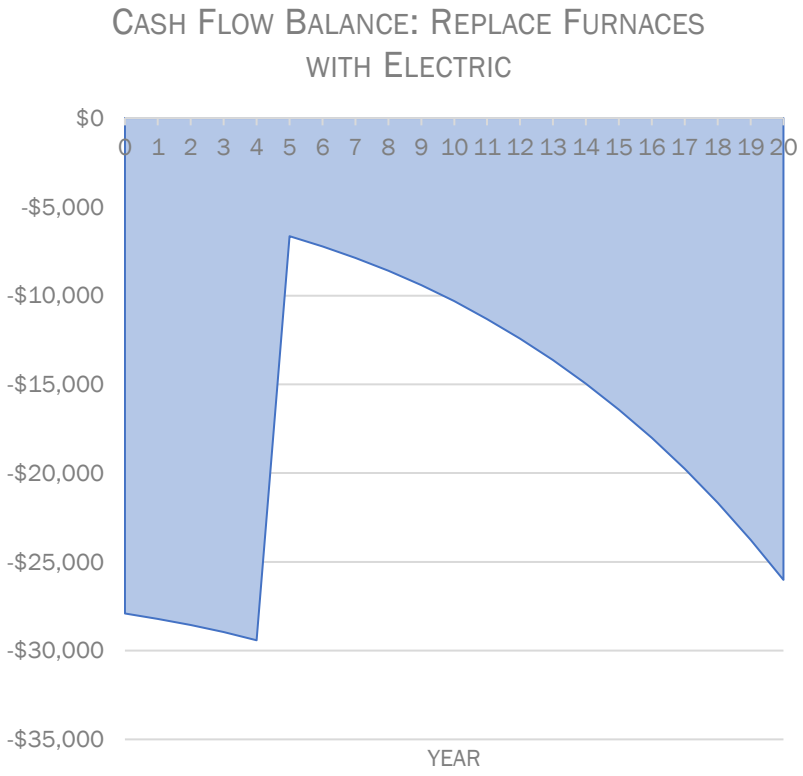
6.12 Opportunity 12: Replace Furnaces with Electric

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.1: 6.12ETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-68,840
Propane (l):	16,184
Water (m³):	0
Emissions (tCO_2e):	23.0
Financials	
Utility Savings:	-$258
Materials & Labour:	$22,329
Engineering & PM:	$3,349
Contingency:	$2,233
Project Costs:	$27,912
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$20,323
IRR:	No IRR



Existing Conditions

The building is heated by two propane fired furnaces located in a ground floor mechanical room.

The furnaces were installed in 2009 and are currently 15-years into an expected 20-year service life.

TABLE 6.12.2: HEATING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition
HVAC1	Furnace	120 MBH	80%	Fair
HVAC2	Furnace	120 MBH	80%	Fair

Propane Furnace: Typical of (2)

Retrofit Conditions

The existing propane fired furnaces can be replaced with new electric furnaces of equivalent capacity.

Utilizing electricity as the heating source offsets 100% of the propane consumption of the existing furnaces.

Costing for this measure includes removal of the two existing furnaces, installation of two new electric furnaces of equivalent heating capacity & new electrical feeds.

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

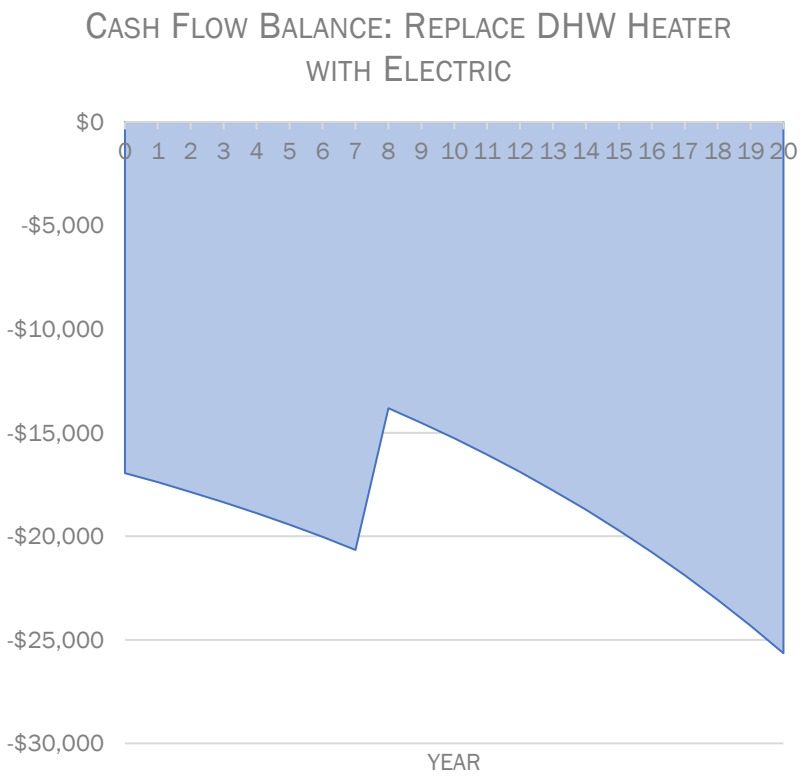
6.13 Opportunity 13: Replace Domestic Hot Water Heater with Electric

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 6.13.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-9,610
Propane (l):	1,851
Water (m^3):	0
Emissions (tCO_2e):	2.6
Financials	
Utility Savings:	-$417
Materials & Labour:	$13,558
Engineering & PM:	$2,034
Contingency:	$1,356
Project Costs:	$16,948
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$20,012
IRR:	No IRR



Existing Conditions

Domestic hot water for the facility is supplied by a single higher efficiency propane fired tank heater rated at 65 MBH with 50 gallons of storage capacity.

The tank heater was installed in 2010 and is currently 14-years old with a life expectancy of 15-20 years.

Propane DHW Heater

TABLE 6.13.2: DHW EQUIPMENT DETAILS

Tag ID	Boiler Type	Capacity	Efficiency	Condition
DHW1	Forced Draft	65 MBH	87%	Fair

Retrofit Conditions

The existing propane fired DHW heater can be replaced an electric tank heater of similar heating and storage capacity, approximately 15-kW % 50-gallons of storage. These capacities may be reduced if lower flow water fixtures are installed.

Costing for this measure includes demolition and removal of the existing propane tank heater. A new hybrid tank heater would be installed in the location of the existing equipment.

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

Typical Electric Tank Heater

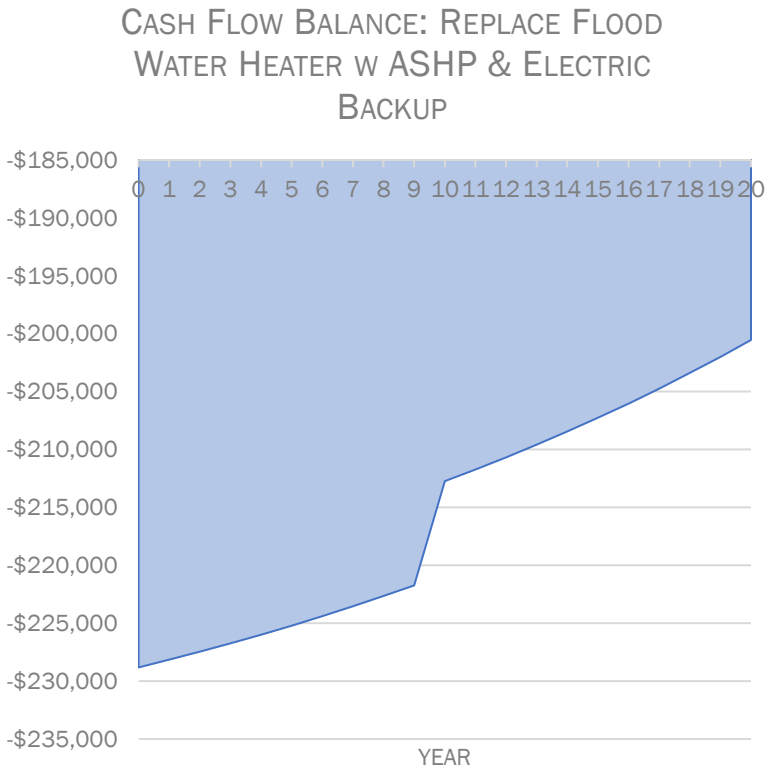
6.14 Opportunity 14: Replace Flood Water Heater with an ASHP & Electric Backup

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 6.14.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	-240
Electricity (kWh):	-9,975
Propane (l):	3,065
Water (m^3):	0
Emissions (tCO_2e):	0
Financials	
Utility Savings:	$635
Materials & Labour:	$183,056
Engineering & PM:	$27,458
Contingency:	$18,306
Project Costs:	$228,820
Simple Payback:	360.5
Capital Payback:	0.5
NPV:	-$215,342
IRR:	-14.7%



Existing Conditions

Flood water for the ice resurfacer is provided by a dedicated flood water system consisting of a single propane fired tank heater rated at 75 MBH

with 75-gallons of storage capacity. Two additional flood water storage tanks bring the system's total storage capacity to approximately 275-gallons.

The flood water tank heater was replaced in 2020 and is currently 4-years old.

Propane Tank Heater

TABLE 6.14.2: DHW EQUIPMENT DETAILS

Tag ID	Boiler Type	Capacity	Efficiency	Condition
FWB	Forced Draft	75 MBH	87%	Fair

Retrofit Conditions

The existing propane fired flood water heater can be replaced with a hybrid flood heating water system consisting of a remote mounted air source heat pump (ASHP) coupled to electric tank heaters.

When outdoor temperatures are within the operating envelope of the ASHP, the ASHP will operate to extract heat from the atmosphere to heat the flood water. During times of peak demand (back to back floods etc.) or when outdoor air temperatures drop below the operating envelope of the ASHP, the electric tank heaters will provide peak capacity

Utilizing electricity as the backup heating source offsets 100% of the propane consumption of the existing flood water heater.

Costing for this measure includes removal of the existing water heater and storage tanks, installation of a remote mounted ASHP connected to two electric tank heaters via a plate & frame heat exchanger. Costing also includes installation of new electrical feeds to all equipment.

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

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

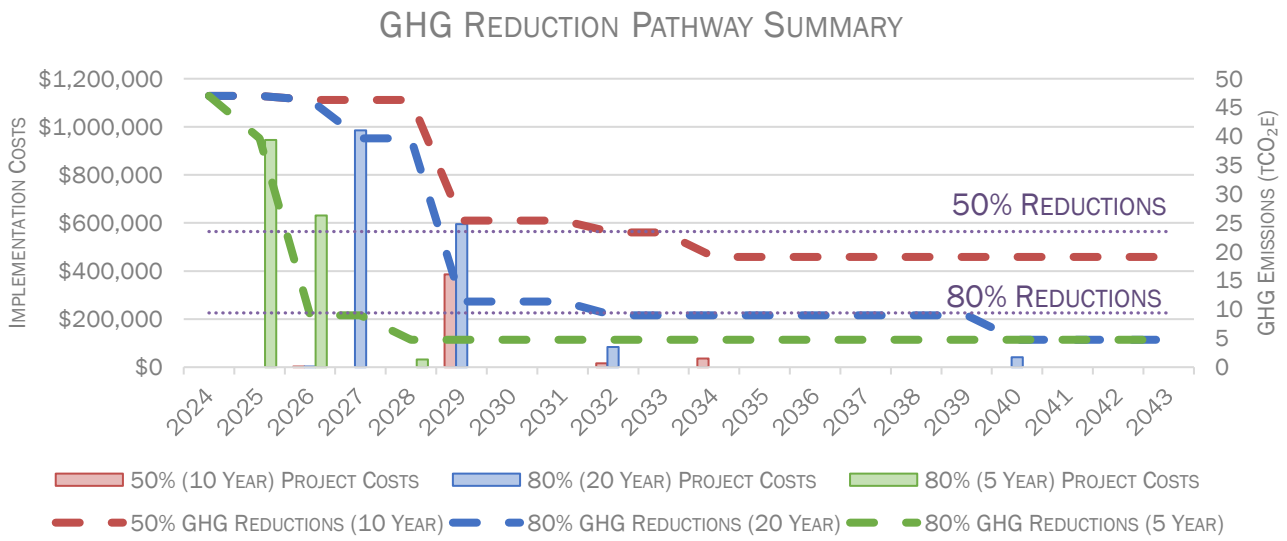
7.1 GHG Reduction Pathway Summary

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

Opp. #	Opportunity	Emissions (tCO_2e)	50% Reduction Pathway	80% Reduction Pathway
1	Install Low Flow Showerheads & Washroom Faucets	0.7	•	•
2	Replace Flood Water Boiler with Electric	4.2	•	•
3	Replace DHW Heater with Hybrid ASHP Tank Heater	2.0	•	•
4	Repalce Furnaces with ASHP & Propane Backup	20.9	•	
5	Replace Ice Resurfacer with Electric	4.3		•
6	Install an 200-kW Solar PV System	6.6		•
7	Install Cold Water Flooding Equipment	0.4		•
8	Replace Furnaces w ASHP & Electric Backup	24.0		•
9	Install a Desuperheater	0.3		
10	Install Triple Pane Windows	0.5		
11	Install EIFS	3.2		
12	Replace Furnaces with Electric	23.0		
13	Replace DHW Heater with Electric	2.6		
14	Replace Flood Water Heater w ASHP & Electric Backup	4.4		
15	Electrical Service Upgrade - 300 kVA Transformer	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)	90,373	19%	27.9	59%	$8,331	$391,707	$1,742,672
80% Reductions (20 Year)	328,602	67%	42.3	90%	$57,996	$1,558,969	$1,814,152
80% Reductions (5 Year)	328,602	67%	42.3	90%	$57,996	$1,558,969	$1,834,701
Business-As-Usual	$0	0%	$0	0%	$0	$165,130	$1,732,447



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**	**20-Year LC Cost**	**Incremental 20-Year LC Cost**	**Incremental LC Cost per tCO_2e**
50% Reductions in 10 Years	$391,707	$78,341	$33,652	$279,713	$1,742,672	$10,224	$18
80% Reductions in 20 Years	$1,558,969	$311,794	$165,130	$1,082,045	$1,814,152	$81,705	$97
80% Reductions in 5 Years	$1,558,969	$311,794	$165,130	$1,082,045	$1,834,701	$102,254	$121
Business-As-Usual	$165,130	$0	$0	$0	$1,732,447	N/A	N/A

7.2 Demand Impact Summary

A major component of achieving net-zero carbon is fuel switching from fossil fuels 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.

Limited demand data was available for the facility. Of the available demand data, the facility's peak demand was 135-kW.

This suggests that the facility is at or close to its allowable peak electrical demand.

The site is serviced by three pole mounted 50kVA transformers supplying a 400 A 600 V main disconnect.

The peak demand of 135-kW for data provided suggests that the building is very close to or at its peak electrical capacity. Implementation of measures in both the 50% and 80% reduction pathways are likely to necessitate an upgrade of the building's electrical service feed. The cost for this upgrade is included in the Project Costs for respective pathways.

Pathway	Demand Increase (kW)	Demand Upgrade Costs
50% Reductions in 10 Years	40	$274,269
80% Reductions in 20 Years	84	$274,269
80% Reductions in 5 Years	84	$274,269

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

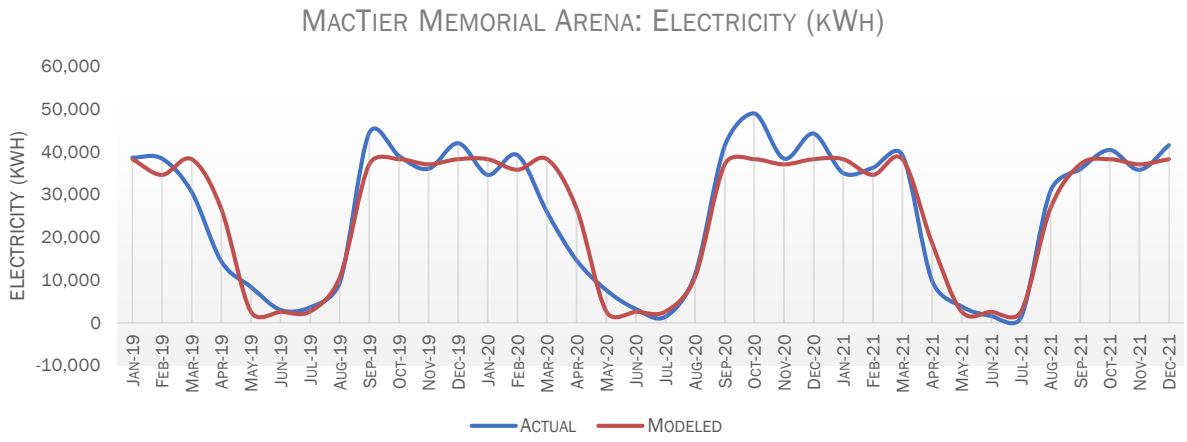
UTILITY BILL ANALYSIS

MacTier Memorial Arena: Electricity (kWh)

	1			2		
M02	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	Yes	No	No	Yes	No	No
Balance Point:	N/A			N/A	N/A	N/A
Calculated BP:	N/A	25		N/A	N/A	N/A
Coefficient:	85.91	0.00	0.00	1,151.85	0.00	0.00
T-Stat:	1.55	0.00	0.00	17.03	0.00	0.00
Adj R²:	**0.9685**	0.810024775				kWh

Base Cons	31,357	10.1%
IV1: Rink Day Cons	279,519	89.9%
Htg Cons	-	0.0%
Clg Cons	-	0.0%
Total	310,877	100.0%

Electricity (kWh) = Days x 85.91 + Arena Days x 1151.85.
The underlying regression of this baseline equation is R² = 0.9685.
HDD (Heating Degree Days) calculated using a balance point of °C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
In a typical year, consumption will be 310,877 kWh.



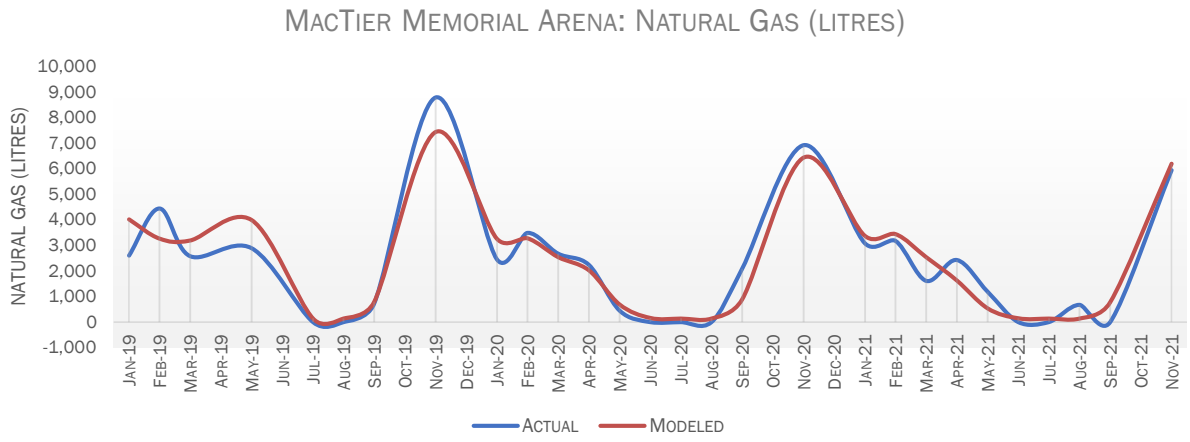
	Include In Model?	Start Date	Read Date	Electricity (kWh)	Arena Days	IV2	IV3	Month Allocation
1	Yes	1-Jan-19	31-Jan-19	38,600	31			Jan-19
2	Yes	1-Feb-19	28-Feb-19	38,400	28			Feb-19
3	Yes	1-Mar-19	31-Mar-19	30,600	31			Mar-19
4	Yes	1-Apr-19	30-Apr-19	14,400	21			Apr-19
5	Yes	1-May-19	31-May-19	8,400	0			May-19
6	Yes	1-Jun-19	30-Jun-19	3,000	0			Jun-19
7	Yes	1-Jul-19	31-Jul-19	3,600	0			Jul-19
8	Yes	1-Aug-19	31-Aug-19	9,400	7			Aug-19
9	Yes	1-Sep-19	30-Sep-19	44,400	30			Sep-19
10	Yes	1-Oct-19	31-Oct-19	39,000	31			Oct-19
11	Yes	1-Nov-19	30-Nov-19	36,000	30			Nov-19
12	Yes	1-Dec-19	31-Dec-19	42,000	31			Dec-19
13	Yes	1-Jan-20	31-Jan-20	34,600	31			Jan-20
14	Yes	1-Feb-20	29-Feb-20	39,200	29			Feb-20
15	Yes	1-Mar-20	31-Mar-20	25,800	31			Mar-20
16	Yes	1-Apr-20	30-Apr-20	14,600	21			Apr-20
17	Yes	1-May-20	31-May-20	7,600	0			May-20
18	Yes	1-Jun-20	30-Jun-20	3,200	0			Jun-20
19	Yes	1-Jul-20	31-Jul-20	1,400	0			Jul-20
20	Yes	1-Aug-20	31-Aug-20	11,200	7			Aug-20
21	Yes	1-Sep-20	30-Sep-20	41,400	30			Sep-20
22	Yes	1-Oct-20	31-Oct-20	48,944	31			Oct-20
23	Yes	1-Nov-20	30-Nov-20	38,374	30			Nov-20
24	Yes	1-Dec-20	31-Dec-20	44,206	31			Dec-20
25	Yes	1-Jan-21	31-Jan-21	35,064	31			Jan-21
26	Yes	1-Feb-21	28-Feb-21	36,205	28			Feb-21
27	Yes	1-Mar-21	31-Mar-21	39,195	31			Mar-21
28	Yes	1-Apr-21	30-Apr-21	9,803	14			Apr-21
29	Yes	1-May-21	31-May-21	3,786	0			May-21
30	Yes	1-Jun-21	30-Jun-21	1,555	0			Jun-21
31	Yes	1-Jul-21	31-Jul-21	1,256	0			Jul-21
32	Yes	1-Aug-21	31-Aug-21	30,827	21			Aug-21
33	Yes	1-Sep-21	30-Sep-21	35,945	30			Sep-21
34	Yes	1-Oct-21	31-Oct-21	40,388	31			Oct-21
35	Yes	1-Nov-21	30-Nov-21	35,763	30			Nov-21
36	Yes	1-Dec-21	31-Dec-21	41,508	31			Dec-21

MacTier Memorial Arena: Natural Gas (litres)

	1	2		3		
M03	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	Yes	Yes	No	Yes	No	No
Balance Point:	N/A	12		N/A	N/A	N/A
Calculated BP:	N/A	1	19	N/A	N/A	N/A
Coefficient:	4.49	4.91	0.00	21.61	0.00	0.00
T-Stat:	0.60	7.17	0.00	2.15	0.00	0.00
Adj R²:	**0.9467**	0.732				

Base Cons (DHW)	1,639.4	7%
IV1 Cons (Days) & Water & Increased washroom/shower usage	5,756.3	26%
Winter Extra (space heating)	15,039.3	67%
Total	22,435.1	100%

Natural Gas (litres) = Days x 4.49 + HDD x 4.91 + 21.61
The underlying regression of this baseline equation is R² = 0.9467.
HDD (Heating Degree Days) calculated using a balance point of 12°C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
In a typical year, consumption will be 22,435 litres.



	Include In Model?	Start Date	Read Date	Natural Gas (litres)	Arena Days	IV2	IV3	Month Allocation
1	Yes	1-Jan-19	31-Jan-19	2,602	30			Jan-19
2	Yes	1-Feb-19	28-Feb-19	4,441	27			Feb-19
3	Yes	1-Mar-19	31-Mar-19	2,568	30			Mar-19
4	Yes	1-Apr-19	30-Jun-19	2,887	90			May-19
	No	1-May-19	31-May-19	684	0			May-19
	No	1-Jun-19	30-Jun-19	502	0			Jun-19
5	Yes	1-Jul-19	31-Jul-19	0	0			Jul-19
6	Yes	1-Aug-19	31-Aug-19	0	0			Aug-19
7	Yes	1-Sep-19	30-Sep-19	720	29			Sep-19
8	Yes	1-Oct-19	31-Dec-19	8,784	91			Nov-19
	No	1-Nov-19	30-Nov-19	4,071	29			Nov-19
	No	1-Dec-19	31-Dec-19	0	30			Dec-19
9	Yes	1-Jan-20	31-Jan-20	2,462	30			Jan-20
10	Yes	1-Feb-20	29-Feb-20	3,481	28			Feb-20
11	Yes	1-Mar-20	31-Mar-20	2,666	30			Mar-20
12	Yes	1-Apr-20	30-Apr-20	2,233	29			Apr-20
13	Yes	1-May-20	31-May-20	445	0			May-20
14	Yes	1-Jun-20	30-Jun-20	0	0			Jun-20
15	Yes	1-Jul-20	31-Jul-20	0	0			Jul-20
16	Yes	1-Aug-20	31-Aug-20	0	0			Aug-20
17	Yes	1-Sep-20	30-Sep-20	2,086	29			Sep-20
18	Yes	1-Oct-20	31-Dec-20	6,911	91			Nov-20
	No	1-Nov-20	30-Nov-20	4,577	29			Nov-20
	No	1-Dec-20	31-Dec-20	1,278	30			Dec-20
19	Yes	1-Jan-21	31-Jan-21	3,087	30			Jan-21
20	Yes	1-Feb-21	28-Feb-21	3,169	27			Feb-21
21	Yes	1-Mar-21	31-Mar-21	1,610	30			Mar-21
22	Yes	1-Apr-21	30-Apr-21	2,421	29			Apr-21
23	Yes	1-May-21	31-May-21	1,185	0			May-21
24	Yes	1-Jun-21	30-Jun-21	0	0			Jun-21
25	Yes	1-Jul-21	31-Jul-21	0	0			Jul-21
26	Yes	1-Aug-21	31-Aug-21	667	0			Aug-21
27	Yes	1-Sep-21	30-Sep-21	0	29			Sep-21
28	Yes	1-Oct-21	31-Dec-21	5,940	91			Nov-21
	No	1-Nov-21	30-Nov-21	4,105	29			Nov-21
	No	1-Dec-21	31-Dec-21	1,835	30			Dec-21

APPENDIX B

CALCULATIONS

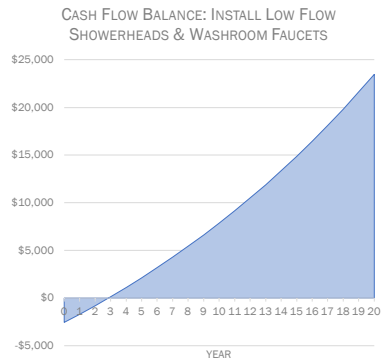
Energy Conservation Measure 1

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Low Flow Showerheads & Washroom Faucets

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):	0
Natural Gas (litres):	447
Water (m³):	87
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.7
Financials	
Annual Utility Savings:	$835
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$2,054
Engineering & PM:	$308
Contingency:	$205
Project Costs:	$2,568
Simple Payback:	3.1
Capital Payback:	2.8
NPV:	$9,707
IRR:	37.7%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	961,494	962,029
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Low Flow Showerheads & Washroom Faucets

			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 Low Flow Showerheads & Washroom Faucet			Savings					
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)	Water			
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0	8741%			
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.0	391.6	114,762.6	0.0	391.6	114,759.7	0	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.0	44.8	13,127.2	0.0	34.0	9,959.0	0	447				
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0				
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0				
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0				
Misc. Equip	186.8	150.9	231,011.6	186.8	150.9	231,011.6	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0				
0	**315**	**587**	**487,281**	**304**	**576**	**472,460**	**-30**	**447**	**87**	**0**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	Select	M03	M04	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Savings	
Propane L	447
Eff	80%
MBTU	8,656
dT	90
Gallons Hot Water:	11,546
Hot Water m3:	44
% Hot Water:	50%
Water Savings: m3	87

General Requirements: Install Low Flow Showerheads & Washroom Faucets

Cost Breakout: Install Low Flow Showerheads & Washroom Faucets

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				Washroom Faucet	0.5 gpm	Each	Web Search	$125	$31	$0	Yes	Project	6	$1,151	$288	$0	$1,440
112	22	40	Plumbing	Plumbing Fixtures	Showerhead, 1.5 GPM	Showerhead	1.5 GPM	Each	Web Estimate '20	$50	$50	$0	Yes	Project	4	$307	$308	$0	$615
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:	**$1,458**	**$596**	**$0**	**$2,054**

Escalation Rates: Install Low Flow Showerheads & Washroom Faucets

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):	0.2232	0.2348	0.2470	0.2598	0.2733	0.2876	0.3025	0.3182	0.3348	0.3522	0.3705	0.3898	0.4100	0.4314	0.4538	0.4774	0.5022	0.5283	0.5558	0.5847	0.6151
Natural Gas ($/litres):	0.9334	0.9801	1.0291	1.0805	1.1346	1.1913	1.2508	1.3134	1.3791	1.4480	1.5204	1.5964	1.6763	1.7601	1.8481	1.9405	2.0375	2.1394	2.2463	2.3587	2.4766
Water ($/m³):	4.7748	4.9180	5.0656	5.2176	5.3741	5.5353	5.7014	5.8724	6.0486	6.2300	6.4169	6.6094	6.8077	7.0120	7.2223	7.4390	7.6622	7.8920	8.1288	8.3726	8.6238
Natural Gas ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	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
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: Install Low Flow Showerheads & Washroom Faucets

	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:	-$2,568	$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):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M03):		$438	$460	$483	$507	$533	$559	$587	$617	$647	$680	$714	$750	$787	$826	$868	$911	$957	$1,004	$1,055	$1,107
Annual Savings (M04):		$430	$443	$456	$470	$484	$498	$513	$529	$545	$561	$578	$595	$613	$631	$650	$670	$690	$711	$732	$754
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:	-$2,568	$868	$903	$939	$977	$1,017	$1,058	$1,101	$1,145	$1,192	$1,241	$1,292	$1,345	$1,400	$1,458	$1,518	$1,581	$1,646	$1,715	$1,787	$1,861
Cash Balance:	-$2,568	-$1,700	-$797	$142	$1,119	$2,136	$3,193	$4,294	$5,439	$6,631	$7,872	$9,164	$10,508	$11,908	$13,366	$14,884	$16,465	$18,111	$19,826	$21,613	$23,474
Undepreciated Amount:	-$2,568	-$2,183	-$1,855	-$1,577	-$1,341	-$1,139	-$969	-$823	-$700	-$595	-$506	-$430	-$365	-$310	-$264	-$224	-$191	-$162	-$138	-$117	-$100

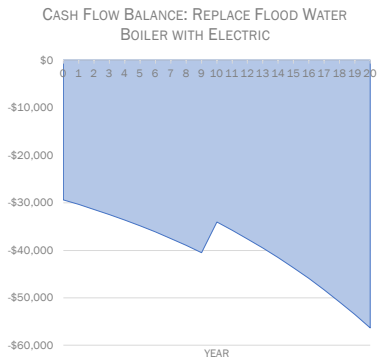
Energy Conservation Measure 11

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Flood Water Boiler with Electric

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$6,464**
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):	-212	
Electricity (kWh):	-16,950	-$ 3,783
Natural Gas (litres):	3,067	$ 2,863
Water (m³):	0	
Natural Gas (m³):	0	
():	0	
Emissions (Tonnes of CO_2e):	4.2	
Financials		
Annual Utility Savings:	-$920	
Add'l Annual Savings:	$0	
Add'l Annual Costs:	$0	
Incentives:	$0	
Materials & Labour:	$23,506	
Engineering & PM:	$3,526	
Contingency:	$2,351	
Project Costs:	$29,383	
Simple Payback:	No Payback	
Capital Payback:	No Payback	
NPV:	-$41,312	
IRR:	No IRR	



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	971,508	957,413
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
18			18

Savings: Replace Flood Water Boiler with Electric

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			Replace Flood Water Boiler with Electric			Savings					
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)	Demand Impact kW			
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0	-212			
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.0	391.6	114,762.6	0.0	391.6	114,759.7	0	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,115.5	0	2				
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0				
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0				
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0				
Misc. Equip	186.8	150.9	231,011.6	203.7	76.7	226,193.6	-16,920	3,065				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0				
0	**315**	**587**	**487,281**	**332**	**513**	**482,479**	**-16,950**	**3,067**	**-212**	**0**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	M01	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

DHW	Equip. Tag	Equip Type	Htg Cap - MBH	Storage Cap - USG	Date of Install	Renewal Date	Notes
	HT1	FW Heater Tank	75.5	275	2020	2040	lood Water Heater
	HT2	DHW Heater Tan	55	50	2012	2032	rimary DHW heater
	HT3	DHW Heater Tan	4.5 kW (ele)	50	2004	2024	W for 2nd fl kitchen

	HT2
Input MBH	76
Efficiency	80%
Output MBH	60
Ele Eq - kW	18

General Requirements: Replace Flood Water Boiler with Electric

Cost Breakout: Replace Flood Water Boiler with Electric

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				Demolish Existing		Each	EE Est	$0	$750	$0	Yes	Both	1	$0	$1,154	$0	$1,154
111	0	0				Ele Tank Heater	18 kW	ECH	Means '24	$9,594	$1,275	$0	No	Project	1	$9,594	$1,275	$0	$10,869
112	26	05.19.90	Electrical	Wire	Cu-XHHW-#6, 1 Wire, 65A, 54kW	Cu-XHHW	#6, 1 Wire, 65A, 54kW	100 LF	Means '18	$52	$72	$0	Yes	Project	2	$158	$220	$0	$378
113	26	05.33.13	Electrical	Conduit	PVC Conduit-3/4" (3x#6,4x#6)	PVC Conduit	3/4" (3x#6,4x#6)	LF	Means '18	$1	$3	$0	Yes	Project	50	$77	$247	$0	$324
114	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
115	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	1	$30	$130	$0	$160
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0				Fuel Fired Tank Heater	85 MBH	Each	2575	$2,300	$775	$0	Yes	Avoided	1	$3,531	$1,192	$0	$4,723
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0				Storage Tanks	120 USG Rheem	Each	Web Search	$2,500	$625	$0	Yes	Project	2	$7,676	$1,923	$0	$9,599
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:	**$18,333**	**$5,173**	**$0**	**$23,506**

Escalation Rates: Replace Flood Water Boiler with Electric

Cash Flow Balance: Replace Flood Water Boiler with Electric

	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:	-$29,383	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,036	$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):		-$3,980	-$4,186	-$4,404	-$4,633	-$4,874	-$5,128	-$5,394	-$5,675	-$5,970	-$6,280	-$6,607	-$6,950	-$7,312	-$7,692	-$8,092	-$8,513	-$8,955	-$9,421	-$9,911	-$10,426
Annual Savings (M03):		$3,006	$3,156	$3,314	$3,480	$3,654	$3,837	$4,028	$4,230	$4,441	$4,663	$4,897	$5,141	$5,398	$5,668	$5,952	$6,249	$6,562	$6,890	$7,234	$7,596
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:	-$29,383	-$973	-$1,030	-$1,090	-$1,153	-$1,220	-$1,291	-$1,366	-$1,445	-$1,528	$6,419	-$1,710	-$1,809	-$1,913	-$2,024	-$2,140	-$2,263	-$2,393	-$2,531	-$2,676	-$2,830
Cash Balance:	-$29,383	-$30,356	-$31,386	-$32,476	-$33,629	-$34,849	-$36,140	-$37,506	-$38,951	-$40,479	-$34,060	-$35,770	-$37,579	-$39,493	-$41,516	-$43,656	-$45,919	-$48,313	-$50,844	-$53,520	-$56,350
Undepreciated Amount:	-$29,383	-$24,975	-$21,229	-$18,045	-$15,338	-$13,037	-$11,082	-$9,419	-$8,006	-$6,806	-$5,785	-$4,917	-$4,179	-$3,553	-$3,020	-$2,567	-$2,182	-$1,854	-$1,576	-$1,340	-$1,139

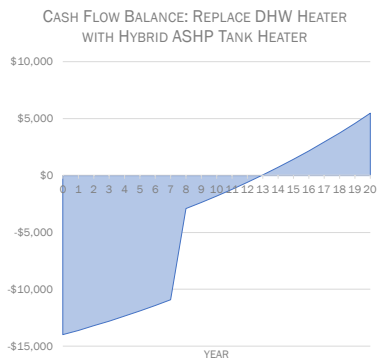
Energy Conservation Measure 15

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:	**$6,304**
Avoided Capital Year:	**8**
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	-54
Electricity (kWh):	-4,231
Natural Gas (litres):	1,404
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	2.0
Financials	
Annual Utility Savings:	$366
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$11,197
Engineering & PM:	$1,680
Contingency:	$1,120
Project Costs:	$13,997
Simple Payback:	38.2
Capital Payback:	12.8
NPV:	-$4,138
IRR:	3.3%



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

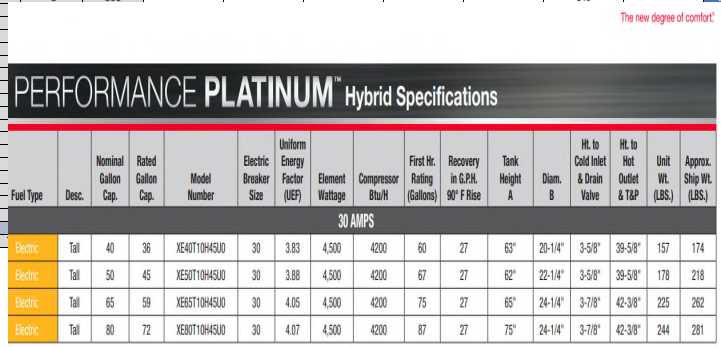
Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	1,034,543	1,031,661
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
5			5

Interactive Effects: Propane Savings - l
ECM1 Low Flow Fixt 447

Savings: Replace DHW Heater with Hybrid ASHP Tank Heater

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								
28								
33								
38								
43								
48								
53								
58								
63								
68								
73								
78								
83								
88								
93								
98								
103								



Fuel Type	Desc.	Nominal Gallon Cap.	Rated Gallon Cap.	Model Number	Electric Breaker Size	Uniform Energy Factor (UEF)	Element Wattage	Compressor Btu/H	First Hr. Rating (Gallons)	Recovery in G.P.H. 90° F Rise	Tank Height A	Diam. B	Ht. to Cold Inlet & Drain Valve	Ht. to Hot Outlet & T&P	Unit Wt. (LBS.)	Approx. Ship Wt. (LBS.)
Electric	Tall	40	36	XE40T10H45U0	30	3.83	4,500	4200	60	27	63"	20-1/4"	3-5/8"	39-5/8"	157	174
Electric	Tall	50	45	XE50T10H45U0	30	3.88	4,500	4200	67	27	62"	22-1/4"	3-5/8"	39-5/8"	178	218
Electric	Tall	65	59	XE65T10H45U0	30	4.05	4,500	4200	75	27	65"	24-1/4"	3-7/8"	42-3/8"	225	262
Electric	Tall	80	72	XE80T10H45U0	30	4.07	4,500	4200	87	27	75"	24-1/4"	3-7/8"	42-3/8"	244	281

End-Use	Existing			Replace DHW Heater with Electric			Savings		Existing DHW Propane Cons - l	Adj DHW Propane Cons - l	DHW Efficiency	DHW MBTu
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)				
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0	1,851	1,404	85%	28,883
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.0	391.6	114,762.6	0.0	391.6	114,759.7	0	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.0	44.8	13,127.2	9.6	0.0	9,580.0	-9,580	1,851				
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0				
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0				
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0				
Misc. Equip	186.8	150.9	231,011.6	186.8	150.9	231,011.6	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0				
0	315	587	487,281	325	542	483,761	-9,610	1,851	1,851	1,404	1	28,883
elect	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select
elect	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

	Existing	Retro
nput MBH	55	
tput MBH	1	
orage gal	50	80
overy gph	68	27
pacity gal	118	107

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				Demolish Existing		Each	EE Est	$0	$750	$0	Yes	Both	1	$0	$1,154	$0	$1,154
111	0	0				Hybrid Tank Heater	4.5 kW 80 Gal	Each	Web Search	$4,250	$1,063	$0	Yes	Project	1	$6,525	$1,634	$0	$8,159
112	26	05.19.90	Electrical	Wire	Cu-XHHW-#6, 1 Wire, 65A, 54kW	Cu-XHHW	#6, 1 Wire, 65A, 54kW	100 LF	Means '18	$52	$72	$0	Yes	Project	2	$158	$220	$0	$378
113	26	05.33.13	Electrical	Conduit	PVC Conduit-3/4" (3x#6,4x#6)	PVC Conduit	3/4" (3x#6,4x#6)	LF	Means '18	$1	$3	$0	Yes	Project	50	$77	$247	$0	$324
114	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
115	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	1	$30	$130	$0	$160
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0				Fuel Fired Tank Heater	55 MBH	Each	Means '24	$2,300	$680	$0	Yes	Avoided	1	$3,531	$1,046	$0	$4,577
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:	**$7,588**	**$3,609**	**$0**	**$11,197**

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:	-$13,997	$0	$0	$0	$0	$0	$0	$0	$7,502	$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):		-$993	-$1,045	-$1,099	-$1,157	-$1,217	-$1,280	-$1,347	-$1,417	-$1,490	-$1,568	-$1,649	-$1,735	-$1,825	-$1,920	-$2,020	-$2,125	-$2,236	-$2,352	-$2,474	-$2,603
Annual Savings (M03):		$1,376	$1,445	$1,517	$1,593	$1,673	$1,756	$1,844	$1,937	$2,033	$2,135	$2,242	$2,354	$2,472	$2,595	$2,725	$2,861	$3,004	$3,154	$3,312	$3,478
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:	-$13,997	$383	$400	$418	$437	$456	$476	$498	$8,022	$543	$567	$593	$619	$646	$675	$705	$736	$769	$803	$838	$875
Cash Balance:	-$13,997	-$13,614	-$13,214	-$12,796	-$12,359	-$11,903	-$11,427	-$10,929	-$2,907	-$2,363	-$1,796	-$1,204	-$585	$61	$736	$1,441	$2,177	$2,946	$3,749	$4,587	$5,462
Undepreciated Amount:	-$13,997	-$11,897	-$10,113	-$8,596	-$7,306	-$6,210	-$5,279	-$4,487	-$3,814	-$3,242	-$2,756	-$2,342	-$1,991	-$1,692	-$1,438	-$1,223	-$1,039	-$883	-$751	-$638	-$543

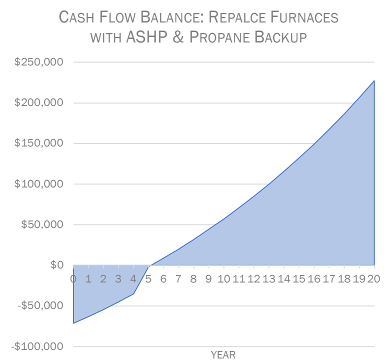
Energy Conservation Measure 6

Opp Cat:	Select
Opp Desc:	
Opp Name:	Repalce Furnaces with ASHP & Propane Backup

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$20,884**
Avoided Capital Year:	**5**
Financial Analysis Term (years):	**20**

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

Utility Savings			
Demand (kW):	-94		
Electricity (kWh):	-22,290	-$	4,975
Natural Gas (litres):	13,953	$	13,024
Water (m³):	0		
Natural Gas (m³):	0		
():	0		
Emissions (Tonnes of CO_2e):	20.9		
Financials			
Annual Utility Savings:	$8,049		
Add'l Annual Savings:	$0		
Add'l Annual Costs:	$0		
Incentives:	$0		
Materials & Labour:	$57,193		
Engineering & PM:	$8,579		
Contingency:	$5,719		
Project Costs:	$71,491		
Simple Payback:	8.9		
Capital Payback:	5.2		
NPV:	$72,483		
IRR:	17.2%		



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	1,821,073	1,812,642
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
14			14

Savings: Repalce Furnaces with ASHP & Propane Backup

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	M03 Winter	Select	Select	Select	Select
-33	-36	0		0				0%
-28	-33	0		0				0%
-23	-30	0		0				0%
-18	-28	1		8				0%
-13	-25	24		179				0%
-8	-22	37		260				0%
-3	-19	68		431				0%
3	-16	153		887				0%
8	-14	201		1,052				0%
13	-11	364		1,703				0%
18	-8	506		2,075				0%
23	-5	638		2,257				0%
28	-3	605		1,794				0%
33	0	810		1,944				0%
38	3	629		1,151				0%
43	6	606		765				0%
48	9	646		448				0%
53	11	688		86				0%
58	14	669		0				0%
63	17	724		0				0%
68	20	625		0				0%
73	23	449		0				0%
78	25	225		0				0%
83	28	82		0				0%
88	31	10		0				0%
93	34	0		0				0%
98	36	0		0				0%
103	39	0		0				0%
Totals		**8,760**	**0**	**15,039**	**0**	**0**	**0**	**0**

End-Use	Existing			Repalce Furnaces with ASHP & Propane Backup			Savings					
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)	Demand Impact kW			
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0	-94			
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.0	391.6	114,762.6	18.4	53.9	34,196.0	-18,390	13,953				
HP Supp.	0.0	0.0	0.0	1.9	0.0	1,860.0	-1,860	0				
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,127.2	0	0				
Vent. Fans	22.3	0.0	22,300.0	24.2	0.0	24,170.0	-1,870	0				
Pumps & Aux	39.4	0.0	39,370.0	39.5	0.0	39,510.0	-140	0				
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0				
Misc. Equip	186.8	150.9	231,011.6	186.8	150.9	231,011.6	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0				
0	**315**	**587**	**487,281**	**337**	**250**	**410,615**	**-22,290**	**13,953**	**-94**	**0**	**0**	**0**
Main Meter: Select	Select	Select	Select	Select	Select	Select	M02	M03	M01	Select	Select	Select
Breakout Meter: Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Furnace Cons - l	16,184
Offset	86%

ASHP Tons Nomina	Nominal COP	emand Impact - kW
5	3	6
5		6
10		12

RTUs/AHUs/Furnaces	Equip. Tag	Equip Type	Htg Cap - MBH	Clg Cap - Tons	Date of Install	Renewal Date	Notes
	HVAC1	Furnace	120	0	2009	2029	Ground floor unit
	HVAC2	Furnace	120	0	2009	2029	d Floor Heating Unit
	HVAC3	AC	0	5	2009	2029	d Floor Cooling Unit

Propane Offset: 74%

General Requirements: Repalce Furnaces with ASHP & Propane Backup

Cost Breakout: Repalce Furnaces with ASHP & Propane Backup

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				Demolition	Furnaces & Venting	Each	Means '24	$0	$680	$0	Yes	Both	2	$0	$2,092	$0	$2,092
112	0	0				Furnace	125 MBH	Each	Means '24	$1,400	$345	$0	Yes	Project	2	$4,299	$1,061	$0	$5,360
113	0	0				ASHP Condensing unit	5 Ton	Each	Means '24	$5,625	$2,550	$0	Yes	Project	2	$17,271	$7,845	$0	$25,116
114	0	0				Electrical							Yes	Project		$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	$52	$72	$0	Yes	Project	8	$633	$880	$0	$1,512
116	26	05.33.13	Electrical	Conduit	PVC Conduit-3/4" (3x#6,4x#6)	PVC Conduit	3/4" (3x#6,4x#6)	LF	Means '18	$1	$3	$0	Yes	Project	200	$307	$988	$0	$1,295
117	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	2	$1,597	$449	$0	$2,046
118	0	0				Furnace	125 MBH	Each	Means '24	$1,400	$345	$0	Yes	Avoided	2	$4,299	$1,061	$0	$5,360
119	0	0				Pad	Concrete	Each	EE Est	$2,000	$500	$0	Yes	Project	2	$6,141	$1,538	$0	$7,679
120	23	82.16	HVAC	Air Coils	2 Row Flanged Coil-30"Hx45"L, 4700cfm	2 Row Flanged Coil	30"Hx45"L, 4700cfm	Each	Means '18	$2,600	$400	$0	Yes	Project	2	$7,983	$1,231	$0	$9,214
121	0	0				Refrigerant Piping		Each	EE Est	$750	$188	$0	Yes	Project	2	$2,303	$577	$0	$2,880
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:	**$40,532**	**$16,660**	**$0**	**$57,193**

Escalation Rates: Repalce Furnaces with ASHP & Propane Backup

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):	0.2232	0.2348	0.2470	0.2598	0.2733	0.2876	0.3025	0.3182	0.3348	0.3522	0.3705	0.3898	0.4100	0.4314	0.4538	0.4774	0.5022	0.5283	0.5558	0.5847	0.6151
Natural Gas ($/litres):	0.9334	0.9801	1.0291	1.0805	1.1346	1.1913	1.2508	1.3134	1.3791	1.4480	1.5204	1.5964	1.6763	1.7601	1.8481	1.9405	2.0375	2.1394	2.2463	2.3587	2.4766
Water ($/m³):	4.7748	4.9180	5.0656	5.2176	5.3741	5.5353	5.7014	5.8724	6.0486	6.2300	6.4169	6.6094	6.8077	7.0120	7.2223	7.4390	7.6622	7.8920	8.1288	8.3726	8.6238
Natural Gas ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	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
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: Repalce Furnaces with ASHP & Propane Backup

	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:	-$71,491	$0	$0	$0	$0	$23,285	$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):		-$5,233	-$5,505	-$5,792	-$6,093	-$6,410	-$6,743	-$7,094	-$7,462	-$7,850	-$8,259	-$8,688	-$9,140	-$9,615	-$10,115	-$10,641	-$11,195	-$11,777	-$12,389	-$13,033	-$13,711
Annual Savings (M03):		$13,675	$14,359	$15,077	$15,831	$16,622	$17,453	$18,326	$19,242	$20,204	$21,215	$22,275	$23,389	$24,559	$25,787	$27,076	$28,430	$29,851	$31,344	$32,911	$34,556
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:	-$71,491	$8,442	$8,854	$9,285	$9,738	$33,498	$10,710	$11,232	$11,780	$12,354	$12,956	$13,587	$14,249	$14,943	$15,671	$16,435	$17,235	$18,074	$18,955	$19,878	$20,845
Cash Balance:	-$71,491	-$63,049	-$54,195	-$44,910	-$35,172	-$1,675	$9,036	$20,268	$32,048	$44,402	$57,358	$70,945	$85,194	$100,138	$115,809	$132,244	$149,479	$167,553	$186,508	$206,385	$227,231
Undepreciated Amount:	-$71,491	-$60,767	-$51,652	-$43,904	-$37,319	-$31,721	-$26,963	-$22,918	-$19,481	-$16,558	-$14,075	-$11,963	-$10,169	-$8,644	-$7,347	-$6,245	-$5,308	-$4,512	-$3,835	-$3,260	-$2,771

Energy Conservation Measure 9

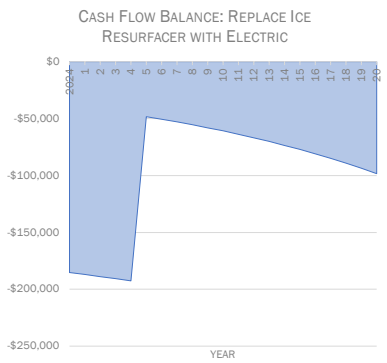
Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Ice Resurfacer with Electric

Costing Setup	
Engineering & PM:	**5%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$131,478**
Avoided Capital Year:	**5**
Financial Analysis Term (years):	**20**

Incentive Work Area

Rate	Qty	Total	Comments
		$0	
		$0	
		$0	
		$0	
		$0	
Total:		**$0**	

Utility Savings	
Demand (kW):	-18
Electricity (kWh):	-20,480
Natural Gas (litres):	3,171
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	4.3
Financials	
Annual Utility Savings:	-$1,611
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$161,190
Engineering & PM:	$8,060
Contingency:	$16,119
Project Costs:	$185,369
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$109,573
IRR:	No IRR



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	974,303	956,976
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
3			3

Savings: Replace Ice Resurfacer with Electric

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	M03 Total	M03 Winter	Select	Select	Select
-33	-36	0		0	0			0%
-28	-33	0		0	0			0%
-23	-30	0		0	0			0%
-18	-28	1		9	8			0%
-13	-25	24		199	179			0%
-8	-22	37		291	260			0%
-3	-19	68		488	431			0%
3	-16	153		1,016	887			0%
8	-14	201		1,221	1,052			0%
13	-11	364		2,010	1,703			0%
18	-8	506		2,502	2,075			0%
23	-5	638		2,796	2,257			0%
28	-3	605		2,304	1,794			0%
33	0	810		2,628	1,944			0%
38	3	629		1,683	1,151			0%
43	6	606		1,276	765			0%
48	9	646		993	448			0%
53	11	688		667	86			0%
58	14	669		564	0			0%
63	17	724		612	0			0%
68	20	625		527	0			0%
73	23	449		379	0			0%
78	25	225		190	0			0%
83	28	82		69	0			0%
88	31	10		8	0			0%
93	34	0		0	0			0%
98	36	0		0	0			0%
103	39	0		0	0			0%
Totals		**8,760**	**0**	**22,435**	**15,039**	**0**	**0**	**0**

End-Use	**Existing**			**Replace Ice Resurfacer with Electric**			**Savings**					
	Electricity (MWh)	**Gas (MMBTU)**	**Combined (kWh)**	**Electricity (MWh)**	**Gas (MMBTU)**	**Combined (kWh)**	**Electricity (kWh)**	**Propane (l)**		Dem Impact - kW		
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0		-18		
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.0	391.6	114,762.6	0.0	391.6	114,759.7	0	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,115.5	0	2				
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0				
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0				
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0				
Misc. Equip	186.8	150.9	231,011.6	207.3	74.2	228,988.0	-20,450	3,169				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0				
0	**315**	**587**	**487,281**	**336**	**510**	**485,273**	**-20,480**	**3,171**	**0**	**-18**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	M01	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

14%

7,396
43%

General Requirements: Replace Ice Resurfacer with Electric

Cost Breakout: Replace Ice Resurfacer with Electric

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				Electric Ice Resurfacer		Each	City of London	$158,283			No	Project	1	$158,283	$0	$0	$158,283
112	0	0				Gas Ice Resurfacer		Each	City of London	$119,525			No	Avoided	1	$119,525	$0	$0	$119,525
113	0	0											Yes	Project		$0	$0	$0	$0
114	0	0				Charging Station		Each	Web Estimate	$1,894			Yes	Project	1	$2,907	$0	$0	$2,907
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:	**$161,190**	**$0**	**$0**	**$161,190**

Escalation Rates: Replace Ice Resurfacer with Electric

Cash Flow Balance: Replace Ice Resurfacer with Electric

	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:	-$185,369	$0	$0	$0	$0	$146,591	$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):		-$4,808	-$5,058	-$5,321	-$5,598	-$5,889	-$6,195	-$6,518	-$6,856	-$7,213	-$7,588	-$7,983	-$8,398	-$8,834	-$9,294	-$9,777	-$10,286	-$10,820	-$11,383	-$11,975	-$12,598
Annual Savings (M03):		$3,108	$3,263	$3,426	$3,598	$3,777	$3,966	$4,165	$4,373	$4,592	$4,821	$5,062	$5,315	$5,581	$5,860	$6,153	$6,461	$6,784	$7,123	$7,479	$7,853
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:	-$185,369	-$1,701	-$1,795	-$1,895	-$2,000	$144,479	-$2,229	-$2,353	-$2,484	-$2,621	-$2,767	-$2,920	-$3,082	-$3,253	-$3,434	-$3,624	-$3,825	-$4,037	-$4,260	-$4,496	-$4,745
Cash Balance:	-$185,369	-$187,069	-$188,865	-$190,760	-$192,760	-$48,281	-$50,510	-$52,863	-$55,347	-$57,968	-$60,735	-$63,656	-$66,738	-$69,992	-$73,425	-$77,049	-$80,874	-$84,911	-$89,171	-$93,667	-$98,411
Undepreciated Amount:	$0	-$157,563	-$133,929	-$113,840	-$96,764	-$82,249	-$69,912	-$59,425	-$50,511	-$42,935	-$36,494	-$31,020	-$26,367	-$22,412	-$19,050	-$16,193	-$13,764	-$11,699	-$9,944	-$8,453	-$7,185

Energy Conservation Measure 19

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install an 200-kW Solar PV System

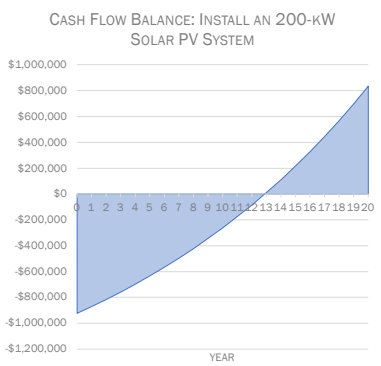
Costing Setup	
Engineering & PM:	**0%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$0**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	720
Electricity (kWh):	221,480
Natural Gas (litres):	0
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	6.6
Financials	
Annual Utility Savings:	$49,429
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$838,657
Engineering & PM:	$0
Contingency:	$83,866
Project Costs:	$922,523
Simple Payback:	18.7
Capital Payback:	12.9
NPV:	-$114,739
IRR:	5.9%

49428.61234

6.6444



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	4,269	226,469
% Reduction	#DIV/0!	#DIV/0!

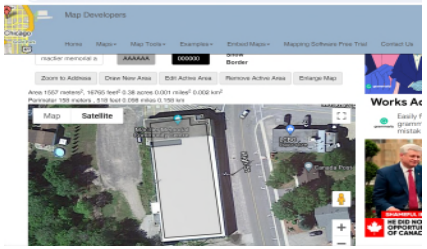
Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak

$/LCC for GHG Reductions
-$863.4

Savings: Install an 200-kW Solar PV System

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	M02 Total	Select	Select	Select	Select	Select
-33	-36	0	0					0%
-28	-33	0	0					0%
-23	-30	0	0					0%
-18	-28	1	37					0%
-13	-25	24	846					0%
-8	-22	37	1,328					0%
-3	-19	68	2,400					0%
3	-16	153	5,419					0%
8	-14	201	7,124					0%
13	-11	364	12,933					0%
18	-8	506	17,949					0%
23	-5	638	22,654					0%
28	-3	605	21,458					0%
33	0	810	28,759					0%
38	3	629	22,328					0%
43	6	606	21,504					0%
48	9	646	22,920					0%
53	11	688	24,410					0%
58	14	669	23,728					0%
63	17	724	25,706					0%
68	20	625	22,166					0%
73	23	449	15,952					0%
78	25	225	7,998					0%
83	28	82	2,909					0%
88	31	10	349					0%
93	34	0	0					0%
98	36	0	0					0%
103	39	0	0					0%
Totals		**8,760**	**310,877**	**0**	**0**	**0**	**0**	**0**

Roof Area - m2	Buffer	Usable Area - m2	System Size - m2	% of Area Used	System Capacity - kW	System Generation - kWh		Month	% of Peak Capacity	Dem Impact - kW		
1,557	20%	1,246	1,184	95%	200	221,480		1	10%	20		
								2	10%	20		
								3	10%	20		
								4	20%	40		
								5	30%	60		
								6	40%	80		
								7	50%	100		
								8	50%	100		
								9	50%	100		
								10	40%	80		
								11	30%	60		
								12	20%	40		
1,557	**0**	**1,246**	**1,184**	**1**	**200**	**221,480**	**0**	**78**	**4**	**720**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	M02	Select	Select	Select	M01	Select	Select
kout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select



71%

General Requirements: Install an 200-kW Solar PV System

Cost Breakout: Install an 200-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				Solar PV System	kW	Per W Installed		$2	$1		Yes	Project	200000	$614,080	$215,348	$0	$829,428
111	0	0											Yes	Project		$0	$0	$0	$0
112	0	0				Structural Analysis		Each	EE Est	$0	$6,000	$0	Yes	Project	1	$0	$9,229	$0	$9,229
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:	**$614,080**	**$224,577**	**$0**	**$838,657**

Escalation Rates: Install an 200-kW Solar PV System

Cash Flow Balance: Install an 200-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:	-$922,523	$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):		$51,999	$54,703	$57,547	$60,540	$63,688	$67,000	$70,484	$74,149	$78,005	$82,061	$86,328	$90,817	$95,540	$100,508	$105,734	$111,232	$117,016	$123,101	$129,502	$136,236
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:	-$922,523	$51,999	$54,703	$57,547	$60,540	$63,688	$67,000	$70,484	$74,149	$78,005	$82,061	$86,328	$90,817	$95,540	$100,508	$105,734	$111,232	$117,016	$123,101	$129,502	$136,236
Cash Balance:	-$922,523	-$870,524	-$815,821	-$758,274	-$697,734	-$634,046	-$567,046	-$496,563	-$422,414	-$344,409	-$262,348	-$176,020	-$85,203	$10,336	$110,844	$216,578	$327,810	$444,826	$567,927	$697,429	$833,666
Undepreciated Amount:	-$922,523	-$784,144	-$666,523	-$566,544	-$481,563	-$409,328	-$347,929	-$295,740	-$251,379	-$213,672	-$181,621	-$154,378	-$131,221	-$111,538	-$94,807	-$80,586	-$68,498	-$58,224	-$49,490	-$42,067	-$35,757

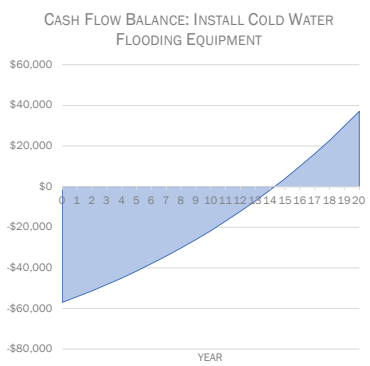
Energy Conservation Measure 2

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Cold Water Flooding Equipment

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):	11,862
Natural Gas (litres):	0
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.4
Financials	
Annual Utility Savings:	$2,647
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$45,600
Engineering & PM:	$6,840
Contingency:	$4,560
Project Costs:	$57,000
Simple Payback:	21.5
Capital Payback:	14.29
NPV:	-$13,738
IRR:	4.5%



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

QC Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	847,427	859,288
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Cold Water Flooding Equipment

			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 Cold Water Flooding Equipment			Savings			Existing		
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)		EWT - F	LWT - F	Flood Water Htg Cons - l
Space Cool	11.7	0.0	11,680.0	0.0	0.0	0.0	11,680	0		45	130	3,032
Heat Reject.	21.4	0.0	21,430.0	0.0	0.0	0.0	21,430	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.0	391.6	114,762.6	0.0	0.0	0.0	0	16,182				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.0	44.8	13,127.2	0.0	0.0	0.0	0	1,851				
Vent. Fans	22.3	0.0	22,300.0	0.0	0.0	0.0	22,300	0				
Pumps & Aux	39.4	0.0	39,370.0	0.0	0.0	0.0	39,370	0				
Ext. Usage	0.8	0.0	800.0	0.0	0.0	0.0	800	0				
Misc. Equip	186.8	150.9	231,011.6	0.0	0.0	0.0	186,800	6,234				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	32.8	0.0	32,800.0	0.0	0.0	0.0	32,800	0				
0	**315**	**587**	**487,281**	**0**	**0**	**0**	**315,180**	**24,267**	**0**	**45**	**130**	**3,032**
Main Meter:	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

General Requirements: Install Cold Water Flooding Equipment

Cost Breakout: Install Cold Water Flooding Equipment

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				REAL ice	Cold Water Flooding System	Each	Case Study	$41,040	$4,560		No	Project	1	$41,040	$4,560	$0	$45,600
111	0	0											Yes	Project		$0	$0	$0	$0
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:	**$41,040**	**$4,560**	**$0**	**$45,600**

Escalation Rates: Install Cold Water Flooding Equipment

Cash Flow Balance: Install Cold Water Flooding Equipment

	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:	-$57,000	$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):		$2,785	$2,930	$3,082	$3,242	$3,411	$3,588	$3,775	$3,971	$4,178	$4,395	$4,623	$4,864	$5,117	$5,383	$5,663	$5,957	$6,267	$6,593	$6,936	$7,296
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:	-$57,000	$2,785	$2,930	$3,082	$3,242	$3,411	$3,588	$3,775	$3,971	$4,178	$4,395	$4,623	$4,864	$5,117	$5,383	$5,663	$5,957	$6,267	$6,593	$6,936	$7,296
Cash Balance:	-$57,000	-$54,215	-$51,285	-$48,203	-$44,961	-$41,550	-$37,962	-$34,187	-$30,216	-$26,038	-$21,644	-$17,020	-$12,156	-$7,040	-$1,657	$4,006	$9,963	$16,230	$22,823	$29,759	$37,055
Undepreciated Amount:	-$57,000	-$48,450	-$41,183	-$35,005	-$29,754	-$25,291	-$21,498	-$18,273	-$15,532	-$13,202	-$11,222	-$9,539	-$8,108	-$6,892	-$5,858	-$4,979	-$4,232	-$3,597	-$3,058	-$2,599	-$2,209

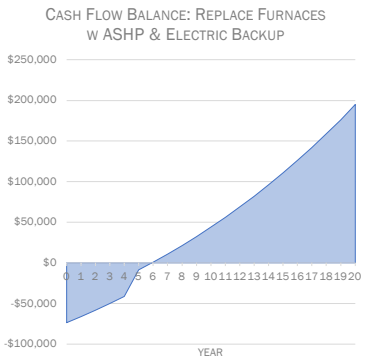
Energy Conservation Measure 7

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Furnaces w ASHP & Electric Backup

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$20,884**
Avoided Capital Year:	**5**
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	-64
Electricity (kWh):	-35,220
Natural Gas (litres):	16,188
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	24.0
Financials	
Annual Utility Savings:	$7,250
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$59,089
Engineering & PM:	$8,863
Contingency:	$5,909
Project Costs:	$73,861
Simple Payback:	10.2
Capital Payback:	5.9
NPV:	$56,415
IRR:	15.1%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	896,508	877,412
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
		56	56.3

Savings: Replace Furnaces w ASHP & Electric Backup

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			Replace Furnaces w ASHP & Electric Backup			Savings						
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)		Month	% of Peak Htg Dem	ASHP Dem - kW
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0		1	100%	-12
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0		2	100%	-12
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0		3	80%	-9
Space Heat	0.0	391.6	114,762.6	18.4	0.0	18,390.0	-18,390	16,182		4	50%	-6
HP Supp.	0.0	0.0	0.0	14.8	0.0	14,790.0	-14,790	0		5	20%	-2
Hot Water	0.0	44.8	13,127.2	0.0	44.6	13,083.2	0	6		6		0
Vent. Fans	22.3	0.0	22,300.0	24.2	0.0	24,170.0	-1,870	0		7		0
Pumps & Aux	39.4	0.0	39,370.0	39.5	0.0	39,510.0	-140	0		8		0
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0		9	20%	-2
Misc. Equip	186.8	150.9	231,011.6	186.8	150.9	231,011.6	0	0		10	40%	-5
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0		11	60%	-7
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0		12	80%	-9
0	**315**	**587**	**487,281**	**350**	**195**	**407,695**	**-35,220**	**16,188**	**0**	**78**	**6**	**-64**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	M01
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

ASHP Tons	10
Qty	2
Nom COP	3
Est kW	12

General Requirements: Replace Furnaces w ASHP & Electric Backup

Cost Breakout: Replace Furnaces w ASHP & Electric Backup

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				Demolition	Furnaces & Venting	Each	Means '24	$0	$680	$0	Yes	Both	2	$0	$2,092	$0	$2,092
112	0	0				0	0	0	0	0	0	0	Yes	Project	2	$0	$0	$0	$0
113	0	0				ASHP	10	Each	Means '24	$6,625	$2,650	$0	Yes	Project	2	$20,341	$8,152	$0	$28,494
114	0	0				Electrical							Yes	Project		$0	$0	$0	$0
115	26	05.19.90	Electrical	Wire	Cu-XHHW-#6, 1 Wire, 65A, 54kW	Cu-XHHW	#6, 1 Wire, 65A,	100 LF	Means '18	$52	$72	$0	Yes	Project	8	$633	$880	$0	$1,512
116	26	05.33.13	Electrical	Conduit	PVC Conduit-3/4" (3x#6,4x#6)	PVC Conduit	3/4" (3x#6,4x#6)	LF	Means '18	$1	$3	$0	Yes	Project	200	$307	$988	$0	$1,295
117	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 30A	Circuit Breaker -	600V, 30A	Each	Means '18	$520	$146	$0	Yes	Project	2	$1,597	$449	$0	$2,046
118	0	0				Furnace	125 MBH	Each	Means '24	$1,400	$345	$0	Yes	Avoided	2	$4,299	$1,061	$0	$5,360
119	0	0				Pad	Concrete	Each	EE Est	$2,000	$500	$0	Yes	Project	2	$6,141	$1,538	$0	$7,679
120	23	82.16	HVAC	Air Coils	2 Row Flanged Coil-30"Hx45"L, 4700cfm	2 Row Flanged	30"Hx45"L,	Each	Means '18	$2,600	$400	$0	Yes	Project	2	$7,983	$1,231	$0	$9,214
121	0	0				Refrigerant		Each	EE Est	$750	$188	$0	Yes	Project	2	$2,303	$577	$0	$2,880
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0				Furnace							Yes	Project		$0	$0	$0	$0
124	26	05.19.90	Electrical	Wire	Cu-XHHW-#4, 1 Wire, 85A, 71kW	Cu-XHHW	#4, 1 Wire, 85A,	100 LF	Means '18	$79	$88	$0	Yes	Project	4	$485	$541	$0	$1,027
125	26	05.33.13	Electrical	Conduit	PVC Conduit-1" (3x#2, 4x#4)	PVC Conduit	1" (3x#2, 4x#4)	LF	Means '18	$2	$4	$0	Yes	Project	100	$233	$572	$0	$806
126	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 30A	Circuit Breaker -	600V, 30A	Each	Means '18	$520	$146	$0	Yes	Project	2	$1,597	$449	$0	$2,046
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
																$41,619	**$17,469**	**$0**	**$59,089**

Escalation Rates: Replace Furnaces w ASHP & Electric Backup

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):	0.2232	0.2348	0.2470	0.2598	0.2733	0.2876	0.3025	0.3182	0.3348	0.3522	0.3705	0.3898	0.4100	0.4314	0.4538	0.4774	0.5022	0.5283	0.5558	0.5847	0.6151
Natural Gas ($/litres):	0.9334	0.9801	1.0291	1.0805	1.1346	1.1913	1.2508	1.3134	1.3791	1.4480	1.5204	1.5964	1.6763	1.7601	1.8481	1.9405	2.0375	2.1394	2.2463	2.3587	2.4766
Water ($/m³):	4.7748	4.9180	5.0656	5.2176	5.3741	5.5353	5.7014	5.8724	6.0486	6.2300	6.4169	6.6094	6.8077	7.0120	7.2223	7.4390	7.6622	7.8920	8.1288	8.3726	8.6238
Natural Gas ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	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
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: Replace Furnaces w ASHP & Electric Backup

	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:	-$73,861	$0	$0	$0	$0	$23,285	$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):		-$8,269	-$8,699	-$9,151	-$9,627	-$10,128	-$10,654	-$11,208	-$11,791	-$12,404	-$13,049	-$13,728	-$14,442	-$15,193	-$15,983	-$16,814	-$17,688	-$18,608	-$19,576	-$20,594	-$21,664
Annual Savings (M03):		$15,865	$16,659	$17,492	$18,366	$19,285	$20,249	$21,261	$22,324	$23,441	$24,613	$25,843	$27,135	$28,492	$29,917	$31,413	$32,983	$34,632	$36,364	$38,182	$40,091
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:	-$73,861	$7,597	$7,960	$8,340	$8,739	$32,442	$9,594	$10,053	$10,533	$11,036	$11,563	$12,115	$12,694	$13,299	$13,934	$14,599	$15,295	$16,024	$16,788	$17,589	$18,427
Cash Balance:	-$73,861	-$66,264	-$58,304	-$49,964	-$41,225	-$8,783	$812	$10,864	$21,397	$32,434	$43,997	$56,112	$68,806	$82,105	$96,039	$110,637	$125,932	$141,957	$158,745	$176,334	$194,760
Undepreciated Amount:	-$73,861	-$62,782	-$53,364	-$45,360	-$38,556	-$32,772	-$27,857	-$23,678	-$20,126	-$17,107	-$14,541	-$12,360	-$10,506	-$8,930	-$7,591	-$6,452	-$5,484	-$4,662	-$3,962	-$3,368	-$2,863

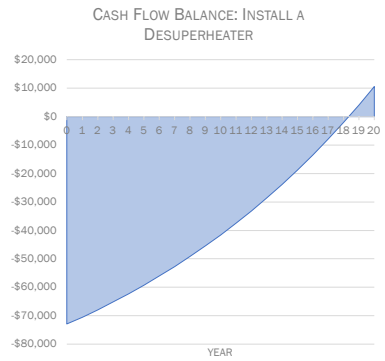
Energy Conservation Measure 8

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install a Desuperheater

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):	10,544
Natural Gas (litres):	0
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.3
Financials	
Annual Utility Savings:	$2,353
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$58,399
Engineering & PM:	$8,760
Contingency:	$5,840
Project Costs:	$72,999
Simple Payback:	31.0
Capital Payback:	18.3
NPV:	-$34,544
IRR:	1.1%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	10,065,266	10,075,810
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install a Desuperheater

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	M02 Base	M02 IV1	M02 Total	Select	Select	Select
-33	-36	0	0	35,707	0			0%
-28	-33	0	0	32,636	0			0%
-23	-30	0	0	35,707	0			0%
-18	-28	1	4	21,501	37			0%
-13	-25	24	85	1	846			0%
-8	-22	37	134	1	1,328			0%
-3	-19	68	242	1	2,400			0%
3	-16	153	547	13,438	5,419			0%
8	-14	201	719	34,556	7,124			0%
13	-11	364	1,305	35,707	12,933			0%
18	-8	506	1,810	34,556	17,949			0%
23	-5	638	2,285	35,707	22,654			0%
28	-3	605	2,164	0	21,458			0%
33	0	810	2,901	0	28,759			0%
38	3	629	2,252	0	22,328			0%
43	6	606	2,169	0	21,504			0%
48	9	646	2,312	0	22,920			0%
53	11	688	2,462	0	24,410			0%
58	14	669	2,393	0	23,728			0%
63	17	724	2,593	0	25,706			0%
68	20	625	2,236	0	22,166			0%
73	23	449	1,609	0	15,952			0%
78	25	225	807	0	7,998			0%
83	28	82	293	0	2,909			0%
88	31	10	35	0	349			0%
93	34	0	0	0	0			0%
98	36	0	0	0	0			0%
103	39	0	0	0	0			0%
Totals		**8,760**	**31,357**	**279,519**	**310,877**	**0**	**0**	**0**

End-Use	Existing			Install a Desuperheater			Savings					
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)		Arena Load Profile	Compressor Cons - kWh	CT Cons - kWh
Space Cool	11.7	0.0	11,680.0	0.0	0.0	0.0	11,680	0		20%	0	0
Heat Reject.	21.4	0.0	21,430.0	0.0	0.0	0.0	21,430	0		20%	0	0
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0		20%	0	0
Space Heat	0.0	391.6	114,762.6	0.0	0.0	0.0	0	16,182		20%	12	1
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0		20%	267	27
Hot Water	0.0	44.8	13,127.2	0.0	0.0	0.0	0	1,851		20%	419	42
Vent. Fans	22.3	0.0	22,300.0	0.0	0.0	0.0	22,300	0		20%	757	76
Pumps & Aux	39.4	0.0	39,370.0	0.0	0.0	0.0	39,370	0		21%	1,813	181
Ext. Usage	0.8	0.0	800.0	0.0	0.0	0.0	800	0		22%	2,519	252
Misc. Equip	186.8	150.9	231,011.6	0.0	0.0	0.0	186,800	6,234		24%	4,821	482
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0		25%	7,034	703
Area Lights	32.8	0.0	32,800.0	0.0	0.0	0.0	32,800	0		26%	9,312	931
										27%	9,231	923
										29%	12,922	1,292
										30%	10,460	1,046
										31%	10,486	1,049
										32%	11,615	1,161
										33%	12,837	1,284
										35%	12,933	1,293
										36%	14,503	1,450
										37%	12,930	1,293
											0	0
											0	0
											0	0
											0	0
											0	0
											0	0
											0	0
0	**315**	**587**	**487,281**	**0**	**0**	**0**	**315,180**	**24,267**	**0**	**5**	**134,869**	**13,487**
Main Meter:	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

kW/hp	0.746		Compressors		
Avg motor load	100%	C1	50		
Btus/m3	35,220	C2	50		
Btus/kWh	3,412	Total	100		
		CT hp	10		
		Brine Pump hp	15		
		Cond Pump hp	10		
2016 Costing		Other Pumps	2.0		
Desuperheater	100 ton	Each	Doucette Industrie	$	20,396
Inflation:	3%				

Specific Heat of Ammonia	0.52	btu/lbF
Compressor COP	3	
HR Multiplier*	1.15	
Desuperheater Delta	145	
Ammonia Vapour Enthalpy:	584	Btus/lb
Ammonia Liquid Enthalpy:	349	Btus/lb
Enthalpy Differency	235	Btus/lb

General Requirements: Install a Desuperheater

Cost Breakout: Install a Desuperheater

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				Desuperheater	100 ton	Each	Doucette Industries	$20,396	$4,079		Yes	Project	1	$31,311	$6,274	$0	$37,586
111	0	0											Yes	Project		$0	$0	$0	$0
112	22	11.13.44	Plumbing	Steel Pipe	Sched 40 Pipe-2" Threaded	Sched 40 Pipe	2" Threaded	Lin. Ft.	Means '22	$10	$16	$0	Yes	Project	200	$2,932	$4,830	$0	$7,762
113	22	11.13.45	Plumbing	Steel Pipe	90 ° Elbow-2" Threaded	90 ° Elbow	2" Threaded	Each	Means '22	$33	$56	$0	Yes	Project	8	$399	$689	$0	$1,088
114	22	11.13.45	Plumbing	Steel Pipe	Tee-2" Threaded	Tee	2" Threaded	Each	Means '22	$46	$92	$0	Yes	Project	4	$279	$563	$0	$842
115	0	0											Yes	Project		$0	$0	$0	$0
116	23	21.23	HVAC	Pumps	Close coupled Pump-1-1/2", 1-1/2 hp, to 40 gpm	Close coupled	1-1/2", 1-1/2 hp,	Each	Means '22	$2,750	$335	$0	Yes	Project	2	$8,444	$1,031	$0	$9,474
117	0	0											Yes	Project		$0	$0	$0	$0
118	23	05.23	HVAC	Valves	Butterfly Valve - Iron - Lever-2" Lug Type	Butterfly Valve - Iron - Lever	2" Lug Type	Each	Means '22	$228	$40	$0	Yes	Project	4	$1,400	$246	$0	$1,646
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:	**$44,766**	**$13,633**	**$0**	**$58,399**

Escalation Rates: Install a Desuperheater

Cash Flow Balance: Install a Desuperheater

	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:	-$72,999	$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):		$2,475	$2,604	$2,740	$2,882	$3,032	$3,190	$3,355	$3,530	$3,713	$3,907	$4,110	$4,323	$4,548	$4,785	$5,034	$5,295	$5,571	$5,860	$6,165	$6,486
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:	-$72,999	$2,475	$2,604	$2,740	$2,882	$3,032	$3,190	$3,355	$3,530	$3,713	$3,907	$4,110	$4,323	$4,548	$4,785	$5,034	$5,295	$5,571	$5,860	$6,165	$6,486
Cash Balance:	-$72,999	-$70,523	-$67,919	-$65,180	-$62,298	-$59,266	-$56,076	-$52,721	-$49,191	-$45,477	-$41,571	-$37,461	-$33,138	-$28,589	-$23,805	-$18,771	-$13,476	-$7,905	-$2,045	$4,120	$10,606
Undepreciated Amount:	-$72,999	-$62,049	-$52,742	-$44,830	-$38,106	-$32,390	-$27,531	-$23,402	-$19,891	-$16,908	-$14,372	-$12,216	-$10,383	-$8,826	-$7,502	-$6,377	-$5,420	-$4,607	-$3,916	-$3,329	-$2,829

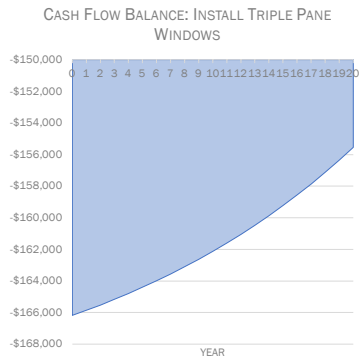
Energy Conservation Measure 4

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):	-30
Natural Gas (litres):	336
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.5
Financials	
Annual Utility Savings:	$307
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$132,944
Engineering & PM:	$19,942
Contingency:	$13,294
Project Costs:	$166,180
Simple Payback:	542.1
Capital Payback:	67.4
NPV:	-$161,265
IRR:	-17.2%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	974,011	974,316
% Reduction	#DIV/0!	#DIV/0!

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

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						
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)	Furnace Efficiency				
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0	100%				
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.0	391.6	114,762.6	0.0	383.5	112,403.3	0	333					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,115.5	0	2					
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0					
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0					
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0					
Misc. Equip	186.8	150.9	231,011.6	186.8	150.8	231,002.8	0	1					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0					
0	**315**	**587**	**487,281**	**315**	**579**	**484,932**	**-30**	**336**	**1**	**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

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											Yes	Project		$0	$0	$0	$0
111	0	0				HE Windows	Tripple pane, low e argon filled	ft2	Pinpoint	$68	$23	$0	Yes	Project	951	$99,659	$33,285	$0	$132,944
112	0	0				Potential Structural		Each	EE Est	$50,000	$12,500	$0	Yes	Project	0	$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:	**$99,659**	**$33,285**	**$0**	**$132,944**

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:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$166,180	$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):		-$7	-$7	-$8	-$8	-$9	-$9	-$10	-$10	-$11	-$11	-$12	-$12	-$13	-$14	-$14	-$15	-$16	-$17	-$18	-$18
Annual Savings (M03):		$329	$345	$363	$381	$400	$420	$441	$463	$486	$510	$536	$562	$591	$620	$651	$684	$718	$754	$791	$831
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:	-$166,180	$322	$338	$355	$373	$391	$411	$431	$453	$475	$499	$524	$550	$578	$607	$637	$669	$702	$737	$774	$813
Cash Balance:	-$166,180	-$165,858	-$165,520	-$165,165	-$164,792	-$164,401	-$163,991	-$163,559	-$163,107	-$162,631	-$162,132	-$161,608	-$161,058	-$160,480	-$159,874	-$159,237	-$158,568	-$157,866	-$157,129	-$156,355	-$155,543
Undepreciated Amount:	-$166,180	-$141,253	-$120,065	-$102,055	-$86,747	-$73,735	-$62,675	-$53,273	-$45,282	-$38,490	-$32,716	-$27,809	-$23,638	-$20,092	-$17,078	-$14,516	-$12,339	-$10,488	-$8,915	-$7,578	-$6,441

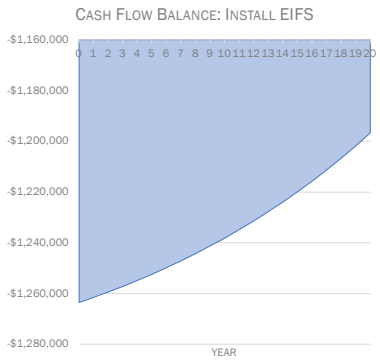
Energy Conservation Measure 3

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):	60
Natural Gas (litres):	2,051
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	3.2
Financials	
Annual Utility Savings:	$1,928
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$1,010,900
Engineering & PM:	$151,635
Contingency:	$101,090
Project Costs:	$1,263,625
Simple Payback:	655.5
Capital Payback:	71.2
NPV:	-$1,232,699
IRR:	-18.1%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	961,712	963,823
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): 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						
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)					
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0					
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.0	391.6	114,762.6	0.0	343.2	100,595.0	0	1,998					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,115.5	0	2					
Vent. Fans	22.3	0.0	22,300.0	22.2	0.0	22,240.0	60	0					
Pumps & Aux	39.4	0.0	39,370.0	39.3	0.0	39,340.0	30	0					
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0					
Misc. Equip	186.8	150.9	231,011.6	186.8	149.6	230,645.3	0	52					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0					
0	**315**	**587**	**487,281**	**315**	**538**	**472,676**	**60**	**2,051**	**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

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	9512	$1,010,900	$0	$0	$1,010,900
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:	**$1,010,900**	**$0**	**$0**	**$1,010,900**

Escalation Rates: Install EIFS

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):	0.2232	0.2348	0.2470	0.2598	0.2733	0.2876	0.3025	0.3182	0.3348	0.3522	0.3705	0.3898	0.4100	0.4314	0.4538	0.4774	0.5022	0.5283	0.5558	0.5847	0.6151
Natural Gas ($/litres):	0.9334	0.9801	1.0291	1.0805	1.1346	1.1913	1.2508	1.3134	1.3791	1.4480	1.5204	1.5964	1.6763	1.7601	1.8481	1.9405	2.0375	2.1394	2.2463	2.3587	2.4766
Water ($/m³):	4.7748	4.9180	5.0656	5.2176	5.3741	5.5353	5.7014	5.8724	6.0486	6.2300	6.4169	6.6094	6.8077	7.0120	7.2223	7.4390	7.6622	7.8920	8.1288	8.3726	8.6238
Natural Gas ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	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
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 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:	-$1,263,625	$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):		$14	$15	$16	$16	$17	$18	$19	$20	$21	$22	$23	$25	$26	$27	$29	$30	$32	$33	$35	$37
Annual Savings (M03):		$2,010	$2,111	$2,216	$2,327	$2,443	$2,565	$2,694	$2,828	$2,970	$3,118	$3,274	$3,438	$3,610	$3,790	$3,980	$4,179	$4,388	$4,607	$4,838	$5,079
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:	-$1,263,625	$2,024	$2,125	$2,232	$2,343	$2,461	$2,584	$2,713	$2,849	$2,991	$3,141	$3,298	$3,463	$3,636	$3,818	$4,009	$4,209	$4,420	$4,641	$4,873	$5,116
Cash Balance:	-$1,263,625	-$1,261,601	-$1,259,476	-$1,257,244	-$1,254,901	-$1,252,440	-$1,249,856	-$1,247,144	-$1,244,295	-$1,241,304	-$1,238,163	-$1,234,866	-$1,231,403	-$1,227,767	-$1,223,950	-$1,219,941	-$1,215,732	-$1,211,313	-$1,206,672	-$1,201,799	-$1,196,683
Undepreciated Amount:	-$1,263,625	-$1,074,082	-$912,969	-$776,024	-$659,620	-$560,677	-$476,576	-$405,089	-$344,326	-$292,677	-$248,775	-$211,459	-$179,740	-$152,779	-$129,862	-$110,383	-$93,826	-$79,752	-$67,789	-$57,621	-$48,978

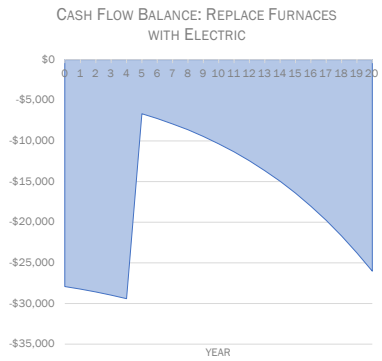
Energy Conservation Measure 5

Opp Cat:	Space_Heating
Opp Desc:	
Opp Name:	Replace Furnaces with Electric

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$20,884**
Avoided Capital Year:	**5**
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):	-68,840	-$	15,363
Natural Gas (litres):	16,184	$	15,106
Water (m³):	0		
Natural Gas (m³):	0		
():	0		
Emissions (Tonnes of CO_2e):	23.0	49%	
Financials			
Annual Utility Savings:	-$258		
Add'l Annual Savings:	$0		
Add'l Annual Costs:	$0		
Incentives:	$0		
Materials & Labour:	$22,329		
Engineering & PM:	$3,349		
Contingency:	$2,233		
Project Costs:	$27,912		
Simple Payback:	No Payback		
Capital Payback:	No Payback		
NPV:	-$20,323		
IRR:	No IRR		



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	930,110	877,454
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
		56	56

Savings: Replace Furnaces with Electric

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			Replace Furnaces with Electric			Savings						
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)					
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0					
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.0	391.6	114,762.6	68.8	0.0	68,810.0	-68,810	16,182					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,115.5	0	2					
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0					
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0					
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0					
Misc. Equip	186.8	150.9	231,011.6	186.8	150.9	231,011.6	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0					
0	**315**	**587**	**487,281**	**384**	**196**	**441,347**	**-68,840**	**16,184**	**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

MBH	120
kW eq	28

General Requirements: Replace Furnaces with Electric

Cost Breakout: Replace Furnaces with Electric

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				Demolition	Furnaces & Venting	Each	Means '24	$0	$680	$0	Yes	Both	2	$0	$2,092	$0	$2,092
112	0	0											Yes	Project	240	$0	$0	$0	$0
113	0	0											Yes	Project		$0	$0	$0	$0
114	0	0				Electrical							Yes	Project		$0	$0	$0	$0
115	26	05.19.90	Electrical	Wire	Cu-XHHW-#4, 1 Wire, 85A, 71kW	Cu-XHHW	#4, 1 Wire, 85A, 71kW	100 LF	Means '18	$79	$88	$0	Yes	Project	4	$485	$541	$0	$1,027
116	26	05.33.13	Electrical	Conduit	PVC Conduit-1" (3x#2, 4x#4)	PVC Conduit	1" (3x#2, 4x#4)	LF	Means '18	$2	$4	$0	Yes	Project	100	$233	$572	$0	$806
117	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	2	$1,597	$449	$0	$2,046
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0				Furnace	28 kW	Each	Web Search	$4,261	$1,065	$0	Yes	Project	2	$13,083	$3,277	$0	$16,360
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0				Furnace	120 MBH Propane	Each	Web Search	$4,400	$1,100	$0	Yes	Avoided	2	$13,510	$3,384	$0	$16,894
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:	**$15,398**	**$6,932**	**$0**	**$22,329**

Escalation Rates: Replace Furnaces with Electric

Cash Flow Balance: Replace Furnaces with Electric

	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:	-$27,912	$0	$0	$0	$0	$23,285	$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):		-$16,162	-$17,003	-$17,887	-$18,817	-$19,795	-$20,825	-$21,908	-$23,047	-$24,245	-$25,506	-$26,832	-$28,228	-$29,695	-$31,240	-$32,864	-$34,573	-$36,371	-$38,262	-$40,252	-$42,345
Annual Savings (M03):		$15,861	$16,654	$17,487	$18,361	$19,279	$20,243	$21,255	$22,318	$23,434	$24,606	$25,836	$27,128	$28,484	$29,908	$31,404	$32,974	$34,623	$36,354	$38,171	$40,080
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:	-$27,912	-$301	-$349	-$400	-$456	$22,769	-$582	-$652	-$729	-$811	-$900	-$996	-$1,100	-$1,211	-$1,331	-$1,460	-$1,599	-$1,748	-$1,908	-$2,080	-$2,265
Cash Balance:	-$27,912	-$28,213	-$28,562	-$28,962	-$29,417	-$6,649	-$7,230	-$7,882	-$8,611	-$9,422	-$10,323	-$11,319	-$12,419	-$13,630	-$14,961	-$16,422	-$18,021	-$19,769	-$21,677	-$23,757	-$26,022
Undepreciated Amount:	-$27,912	-$23,725	-$20,166	-$17,141	-$14,570	-$12,385	-$10,527	-$8,948	-$7,606	-$6,465	-$5,495	-$4,671	-$3,970	-$3,375	-$2,868	-$2,438	-$2,072	-$1,762	-$1,497	-$1,273	-$1,082

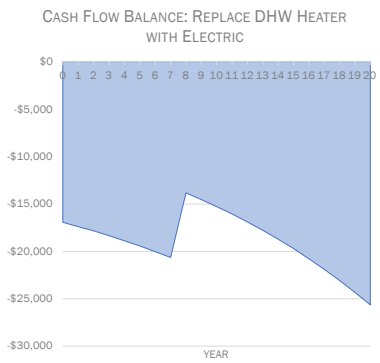
Energy Conservation Measure 10

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace DHW Heater with Electric

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$6,304**
Avoided Capital Year:	**8**
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):	-9,610
Natural Gas (litres):	1,851
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	2.6
Financials	
Annual Utility Savings:	-$417
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$13,558
Engineering & PM:	$2,034
Contingency:	$1,356
Project Costs:	$16,948
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$20,012
IRR:	No IRR



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	972,812	965,054
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace DHW Heater with Electric

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			Replace DHW Heater with Electric			Savings						
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)					
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0					
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.0	391.6	114,762.6	0.0	391.6	114,759.7	0	0					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	0.0	44.8	13,127.2	9.6	0.0	9,580.0	-9,580	1,851					
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0					
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0					
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0					
Misc. Equip	186.8	150.9	231,011.6	186.8	150.9	231,011.6	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0					
0	**315**	**587**	**487,281**	**325**	**542**	**483,761**	**-9,610**	**1,851**	**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

DHW	Equip. Tag	Equip Type	Htg Cap - MBH	Storage Cap - USG	Date of Install	Renewal Date	Notes
	HT1	FW Heater Tank	75.5	275	2020	2040	lood Water Heater
	HT2	DHW Heater Tan	55	50	2012	2032	rimary DHW heater
	HT3	DHW Heater Tan	4.5 kW (ele)	50	2004	2024	W for 2nd fl kitchen

	HT2
Input MBH	55
Efficiency	80%
Output MBH	44
Ele Eq - kW	13

General Requirements: Replace DHW Heater with Electric

Cost Breakout: Replace DHW Heater with Electric

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				Demolish Existing		Each	EE Est	$0	$750	$0	Yes	Both	1	$0	$1,154	$0	$1,154
111	0	0				Ele Tank Heater	15 kW	ECH	Means '24	$5,575	$1,275	$0	Yes	Project	1	$8,559	$1,961	$0	$10,520
112	26	05.19.90	Electrical	Wire	Cu-XHHW-#6, 1 Wire, 65A, 54kW	Cu-XHHW	#6, 1 Wire, 65A, 54kW	100 LF	Means '18	$52	$72	$0	Yes	Project	2	$158	$220	$0	$378
113	26	05.33.13	Electrical	Conduit	PVC Conduit-3/4" (3x#6,4x#6)	PVC Conduit	3/4" (3x#6,4x#6)	LF	Means '18	$1	$3	$0	Yes	Project	50	$77	$247	$0	$324
114	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
115	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	1	$30	$130	$0	$160
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0				Fuel Fired Tank Heater	55 MBH	Each	Means '24	$2,300	$680	$0	Yes	Avoided	1	$3,531	$1,046	$0	$4,577
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:	**$9,622**	**$3,936**	**$0**	**$13,558**

Escalation Rates: Replace DHW Heater with Electric

Cash Flow Balance: Replace DHW Heater with Electric

	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:	-$16,948	$0	$0	$0	$0	$0	$0	$0	$7,502	$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):		-$2,256	-$2,374	-$2,497	-$2,627	-$2,763	-$2,907	-$3,058	-$3,217	-$3,385	-$3,561	-$3,746	-$3,941	-$4,145	-$4,361	-$4,588	-$4,826	-$5,077	-$5,341	-$5,619	-$5,911
Annual Savings (M03):		$1,814	$1,905	$2,000	$2,101	$2,206	$2,316	$2,432	$2,553	$2,681	$2,815	$2,956	$3,103	$3,259	$3,421	$3,593	$3,772	$3,961	$4,159	$4,367	$4,585
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:	-$16,948	-$442	-$468	-$496	-$526	-$558	-$591	-$627	$6,838	-$704	-$746	-$790	-$837	-$887	-$940	-$995	-$1,054	-$1,117	-$1,182	-$1,252	-$1,326
Cash Balance:	-$16,948	-$17,390	-$17,858	-$18,354	-$18,881	-$19,439	-$20,030	-$20,657	-$13,818	-$14,522	-$15,268	-$16,058	-$16,895	-$17,782	-$18,722	-$19,717	-$20,771	-$21,887	-$23,070	-$24,322	-$25,648
Undepreciated Amount:	-$16,948	-$14,406	-$12,245	-$10,408	-$8,847	-$7,520	-$6,392	-$5,433	-$4,618	-$3,925	-$3,337	-$2,836	-$2,411	-$2,049	-$1,742	-$1,480	-$1,258	-$1,070	-$909	-$773	-$657

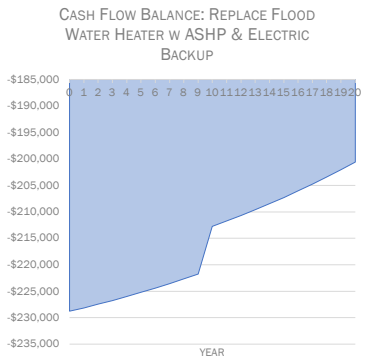
Energy Conservation Measure 14

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Flood Water Heater w ASHP & Electric Backup

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$6,464**
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):	-240	
Electricity (kWh):	-9,975	-$ 2,226
Natural Gas (litres):	3,065	$ 2,861
Water (m³):	0	
Natural Gas (m³):	0	
():	0	
Emissions (Tonnes of CO_2e):	4.4	
Financials		
Annual Utility Savings:	$635	
Add'l Annual Savings:	$0	
Add'l Annual Costs:	$0	
Incentives:	$0	
Materials & Labour:	$183,056	
Engineering & PM:	$27,458	
Contingency:	$18,306	
Project Costs:	$228,820	
Simple Payback:	360.5	
Capital Payback:	67.2	
NPV:	-$215,342	
IRR:	-14.7%	



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	1,102,948	1,095,798
% Reduction	#DIV/0!	#DIV/0!

Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak
20			20

Savings: Replace Flood Water Heater w ASHP & Electric Backup

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	M03 Winter	Select	Select	Select	Select
-33	-36	0		0				0%
-28	-33	0		0				0%
-23	-30	0		0				0%
-18	-28	1		8				0%
-13	-25	24		179				0%
-8	-22	37		260				0%
-3	-19	68		431				0%
3	-16	153		887				0%
8	-14	201		1,052				0%
13	-11	364		1,703				0%
18	-8	506		2,075				0%
23	-5	638		2,257				0%
28	-3	605		1,794				0%
33	0	810		1,944				0%
38	3	629		1,151				0%
43	6	606		765				0%
48	9	646		448				0%
53	11	688		86				0%
58	14	669		0				0%
63	17	724		0				0%
68	20	625		0				0%
73	23	449		0				0%
78	25	225		0				0%
83	28	82		0				0%
88	31	10		0				0%
93	34	0		0				0%
98	36	0		0				0%
103	39	0		0				0%
Totals		**8,760**	**0**	**15,039**	**0**	**0**	**0**	**0**

Highlighted Hrs: 5,976

End-Use	Existing			Replace Flood Water Boiler with Electric			Savings		Existing			
	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (l)	FW Propane Cons - l	Adj FW Propane Cons - l	ADJ FW Propane Cons - l	FW Efficiency
Space Cool	11.7	0.0	11,680.0	11.7	0.0	11,680.0	0	0	3,065	3,065	0	85%
Heat Reject.	21.4	0.0	21,430.0	21.4	0.0	21,430.0	0	0			0	
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0			0	
Space Heat	0.0	391.6	114,762.6	0.0	391.6	114,759.7	0	0			1	
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0			12	
Hot Water	0.0	44.8	13,127.2	0.0	44.8	13,115.5	0	2			19	
Vent. Fans	22.3	0.0	22,300.0	22.3	0.0	22,300.0	0	0			35	
Pumps & Aux	39.4	0.0	39,370.0	39.4	0.0	39,370.0	0	0			78	
Ext. Usage	0.8	0.0	800.0	0.8	0.0	800.0	0	0			103	
Misc. Equip	186.8	150.9	231,011.6	203.7	76.7	226,193.6	-16,920	3,065			187	
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0			259	
Area Lights	32.8	0.0	32,800.0	32.8	0.0	32,830.0	-30	0			327	
											310	
											416	
											323	
											311	
											331	
											353	
0	**315**	**587**	**487,281**	**332**	**513**	**482,479**	**-16,950**	**3,067**	**3,065**	**3,065**	**3,065**	**1**
Main Meter:	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

DHW	Equip. Tag	Equip Type	Htg Cap - MBH	Storage Cap - USG	Date of Install	Renewal Date	Notes
	HT1	FW Heater Tank	75.5	275	2020	2040	lood Water Heater
	HT2	DHW Heater Tan	55	50	2012	2032	rimary DHW heater
	HT3	DHW Heater Tan	4.5 kW (ele)	50	2004	2024	W for 2nd fl kitchen

	HT1	Mitsu QAHV	
Input MBH	75.5	180	
Efficiency	80%	3	COP Nominal
Output MBH	60		
Ele Eq - kW	18	18	

General Requirements: Replace Flood Water Heater w ASHP & Electric Backup

Cost Breakout: Replace Flood Water Heater w ASHP & Electric Backup

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	EE Est	$0	$1,500	$0	Yes	Both	1	$0	$2,307	$0	$2,307
111	0	0				Structural Analysis		Each	EE Est	$0	$5,500	$0	Yes	Project		$0	$0	$0	$0
112	0	0				Structural Reinforcement		Each	EE Est.	$5,000	$1,000	$0	Yes	Project		$0	$0	$0	$0
113	0	0				Mistu QAHV	180 MBH Air to Water	Each	HTS	$60,000	$15,000	$0	No	Project	1	$60,000	$15,000	$0	$75,000
114	0	0				Storage Tanks	AO Smith 200 USG	Each	Web Search	$10,699	$2,675	$0	Yes	Project	2	$32,850	$8,229	$0	$41,079
115	0	0				Electric Backup Boiler	50 kW	Each	Means '23	$7,175	$1,575	$0	Yes	Project	1	$11,015	$2,423	$0	$13,438
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0				Piping to/from ASHP Unit to Existing DHW Plant							Yes	Project		$0	$0	$0	$0
118	0	0				In-Line Pump	Cast Iron 3" 1 hp	Each	Means '23	$4,575	$260	$0	Yes	Project	1	$7,024	$400	$0	$7,423
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0				Sched 40 Pipe	2" Threaded	Lin. Ft.	Means '23	$21	$16	$0	Yes	Project	200	$6,294	$4,984	$0	$11,278
121	0	0				90 ° Elbow	2" Threaded	Each	Means '23	$42	$58	$0	Yes	Project	16	$1,032	$1,415	$0	$2,447
122	0	0				Tee	2" Threaded	Each	Means '23	$69	$95	$0	Yes	Project	4	$424	$581	$0	$1,005
123	0	0				Fibreglass Pipe Insul. w/serv jacket	2" Pipe, 1" Ins	Lin. Ft.	Means '23	$4	$5	$0	Yes	Project	200	$1,124	$1,446	$0	$2,570
124	0	0				Butterfly Valve - Iron - Lever	2" Lug Type	Each	Means '23	$775	$72	$0	Yes	Project	4	$4,759	$443	$0	$5,202
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0				ASHP Electrical							Yes	Project		$0	$0	$0	$0
127	0	0				Cu-XHHW	#2, 1 Wire, 115A, 96kW	100 LF	Meas '23	$226	$120	$0	Yes	Project	8	$2,776	$1,477	$0	$4,252
128	0	0				PVC Conduit	1 1/4" (3x1/0, 4x#2)	LF	Meas '23	$5	$8	$0	Yes	Project	200	$1,535	$2,461	$0	$3,996
129	0	0				Circuit Breaker - NEMA 1	600V, 100A	Each	Meas '23	$730	$234	$0	Yes	Project	1	$1,121	$360	$0	$1,481
130	0	0				Pull Box	10"x10"x6" diam	Each	Meas '23	$20	$85	$0	Yes	Project	1	$30	$130	$0	$160
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0				Pump Electrical							Yes	Project		$0	$0	$0	$0
133	0	0				Cu-XHHW	#8, 1 Wire, 50A, 42kW	100 LF	Meas '23	$53	$68	$0	Yes	Project	4	$325	$418	$0	$744
134	0	0				PVC Conduit	3/4" (3x#6,4x#6)	LF	Meas '23	$3	$6	$0	Yes	Project	100	$461	$923	$0	$1,383
135	0	0				Circuit Breaker - NEMA 1	600V, 30A	Each	Meas '23	$535	$168	$0	Yes	Project	1	$821	$258	$0	$1,080
136	0	0				Pull Box	10"x10"x6" diam	Each	Meas '23	$20	$85	$0	Yes	Project	1	$30	$130	$0	$160
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0				Ele Backup Electrical							Yes	Project		$0	$0	$0	$0
139	0	0				Cu-XHHW	#2/0, 1 Wire, 175A, 145kW	100 LF	Meas '23	$415	$186	$0	Yes	Project	4	$2,548	$1,144	$0	$3,693
140	0	0				PVC Conduit	2" (3x300, 4x4/0)	LF	Meas '23	$9	$9	$0	Yes	Project	100	$1,382	$1,384	$0	$2,766
141	0	0				Circuit Breaker - NEMA 1	600V, 100A	Each	Meas '23	$730	$202	$0	Yes	Project	1	$1,121	$311	$0	$1,431
142	0	0				Pull Box	10"x10"x6" diam	Each	Meas '23	$20	$85	$0	Yes	Project	1	$30	$130	$0	$160
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:	**$136,701**	**$46,355**	**$0**	**$183,056**

Escalation Rates: Replace Flood Water Heater w ASHP & Electric Backup

Cash Flow Balance: Replace Flood Water Heater w ASHP & Electric Backup

	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:	-$228,820	$0	$0	$0	$0	$0	$0	$0	$0	$0	$8,036	$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):		-$2,342	-$2,464	-$2,592	-$2,727	-$2,868	-$3,018	-$3,175	-$3,340	-$3,513	-$3,696	-$3,888	-$4,090	-$4,303	-$4,527	-$4,762	-$5,010	-$5,270	-$5,544	-$5,833	-$6,136
Annual Savings (M03):		$3,004	$3,154	$3,312	$3,478	$3,651	$3,834	$4,026	$4,227	$4,438	$4,660	$4,893	$5,138	$5,395	$5,665	$5,948	$6,245	$6,557	$6,885	$7,230	$7,591
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:	-$228,820	$662	$690	$720	$751	$783	$816	$851	$887	$925	$9,000	$1,005	$1,048	$1,092	$1,138	$1,186	$1,235	$1,287	$1,341	$1,397	$1,455
Cash Balance:	-$228,820	-$228,158	-$227,467	-$226,747	-$225,997	-$225,214	-$224,397	-$223,546	-$222,659	-$221,733	-$212,733	-$211,728	-$210,680	-$209,589	-$208,451	-$207,265	-$206,030	-$204,743	-$203,402	-$202,005	-$200,550
Undepreciated Amount:	-$228,820	-$194,497	-$165,322	-$140,524	-$119,445	-$101,529	-$86,299	-$73,354	-$62,351	-$52,999	-$45,049	-$38,291	-$32,548	-$27,666	-$23,516	-$19,988	-$16,990	-$14,442	-$12,275	-$10,434	-$8,869