45 Lone Pine Rd

Port Severn, ON L0K 1S0

Climate Action Roadmap

Bressette Homestead

EFFICIENCY ENGINEERING .COM
A Kontrol Technologies Company

Township of Georgian Bay
Muskoka

TOWNSHIP OF
GEORGIAN BAY

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a Fund financed by the Government of Canada and administered by the Federation of Canadian Municipalities. Notwithstanding this support,
the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.

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1 The Executive Summary

Efficiency Engineering has performed a comprehensive Net Zero Retrofit Study at the Bressette Homestead 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:	Bressett Homestead
Client Name:	Township of Georgian Bay
Site Contact:	Jennifer Schnier
Address:	45 Lone Pine Rd.
	Port Severn, ON
	L0K 1S0
Facility Area:	2,504 ft^2
Building Type:	House/Tourist Site
Year Constructed:	1890s
Number of Stories:	2

1.1.1 Existing Building Profile

The Discovery Centre is a 2,500 ft^2 heritage building that was formerly a home but now acts as a tourist destination.

Space heating for the facility is provided by a single, 80 MBH fuel-fired furnace and a small split system DX unit for cooling. A small 10-gallon electric heater tank supplies DHW.

Lighting at the building is provided primarily by LED fixtures and lamps. Water fixtures (toilets, faucets, etc.) are standard flow.

1.1.2 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	24,708 kWh	9.9	24,708	0.7	12%
Propane	3,395 l	10.0	25,084	5.3	87%
Total	**N/A**	**19.9**	**49,792**	**6.0**	**100%**

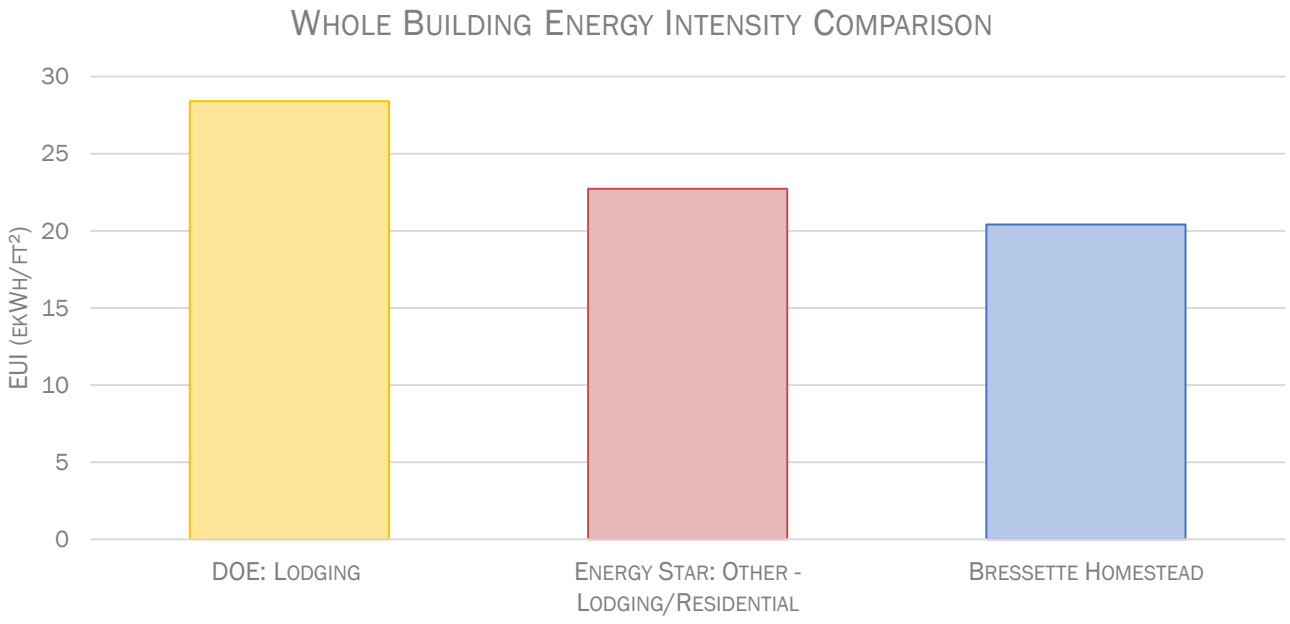
*EUI values presented throughout this report are calculated based on purchased energy and includes electricity provided by the grid, purchased propane etc.

Propane consumption at the facility is responsible for over 87% of GHG emissions at the facility. Propane fired equipment at this facility includes:

- A single propane-fired furnace

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

The following benchmarking graph displays the comparative energy performance of the buildings studied as a part of this project.



1.2 Master List of Measures

Opp. #	Opportunity	Demand (kW)	Electricity (kWh)	Propane (l)	Water (m^3)	GHG Emissions (tCO_2e)	Annual Savings	Project Costs	Cost per tCO_2e	Simple Payback	Capital Payback	NPV	IRR
1	Replace Furnace with ASHP & Electric Backup	0	-12,530	0	0	3.47	$1,583	$16,938	$0	10.7	8.5	$7,886	12.0%
2	Install Low Flow Washroom Faucets	0	340	0	0	0.01	$51	$600	$0	11.8	9.0	$233	11.2%
3	Install Triple Pane Windows	0	310	0	0	0.52	$509	$22,183	$1,341	43.6	23.0	($14,012)	-1.8%
4	Replace DHW Heater with Hybrid ASHP Tank Heater	0	1,394	0	0	0.04	$209	$7,506	$4,886	35.9	20.1	($4,088)	-0.1%
5	Replace Furnace with ASHP Propane Backup	0	-9,060	0	0	2.86	$1,462	$17,671	$0	12.1	9.4	$5,369	10.4%
6	Replace Furnace with Electric	0	-15,150	0	0	3.39	$1,190	$20,110	$25	16.9	12.3	($1,708)	6.3%

1.3 GHG Reduction Pathways

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

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

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

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

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

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

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

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

Roadmap 4 – Business-As-Usual

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

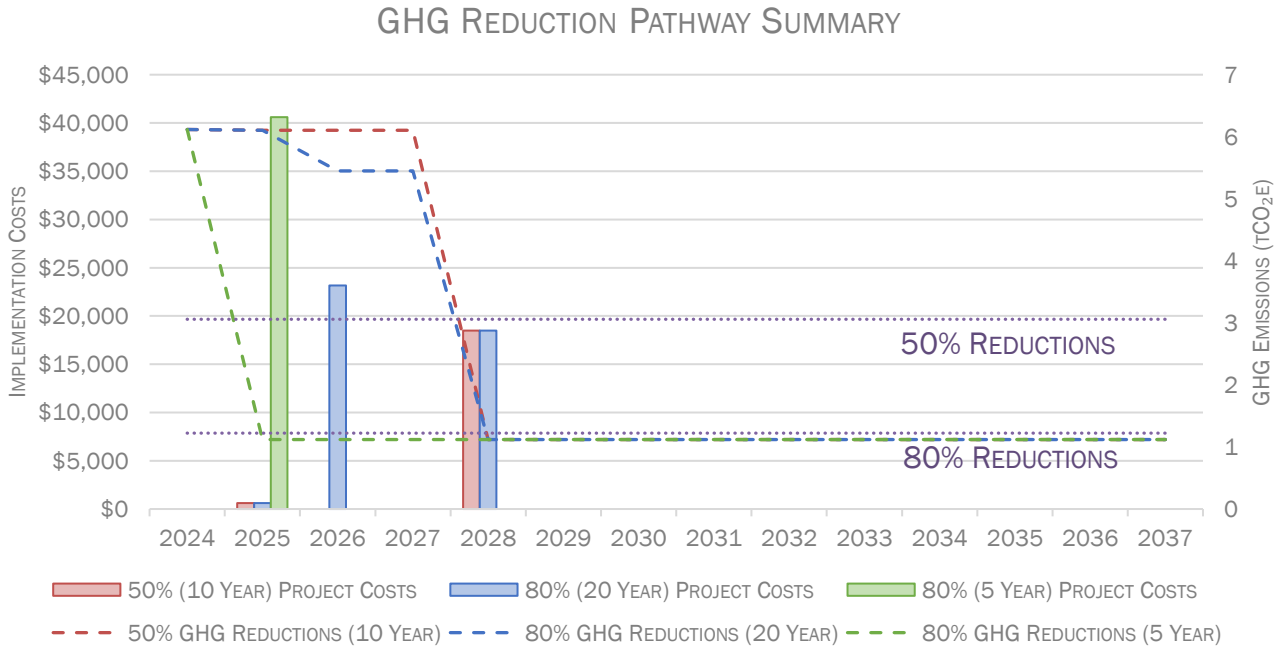
Bundling measures into these pathways often results in interactive effects between systems. As a result, the total GHG reduction for a particular Roadmap will typically differ from the sum of the GHG reductions from individual measures. The Scenario Level Analysis accounts for these interactive effects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

The building's furnace is the sole piece of propane fired heating equipment and is responsible for over 87% of GHG emissions at the site. As a result, to achieve either the 50% or 80% GHG reduction targets requires this piece of equipment to be addressed. Changing this piece of equipment to an electric alternative, such as an air source heat pump, achieves both GHG reductions targets.

As a result, the 50% and 80% reduction pathways for this facility include the same measures and result in the same GHG reductions, energy savings and project costs. Life cycle costs may vary between Pathways due to differing implementation timelines.

TABLE 1.3.1: SUMMARY OF SCENARIO LEVEL ANALYSIS

Opp. #	Opportunity	Emissions (tCO_2e)	50% Reduction Pathway	80% Reduction Pathway
1	Replace Furnace with ASHP & Electric Backup	3.47	•	•
2	Install Low Flow Washroom Faucets	0.01	•	•
3	Install Triple Pane Windows	0.52		
4	Replace DHW Heater with Hybrid ASHP Tank Heater	0.04		
5	Replace Furnace with ASHP Propane Backup	2.86		
6	Replace Furnace with Electric	3.39		



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)	13,189	26%	5.0	82%	$1,634	$17,538	$135,678
80% Reductions (20 Year)	13,189	26%	5.0	82%	$1,634	$17,538	$135,678
80% Reductions (5 Year)	13,189	26%	5.0	82%	$1,634	$17,538	$132,908
Business-As-Usual	$0	0%	$0	0%	$0	$5,220	$147,412

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	$17,538	$3,508	$2,536	$11,495	$135,678	($11,734)	($117)
80% Reductions in 20 Years	$17,538	$3,508	$5,220	$8,810	$135,678	($11,734)	($117)
80% Reductions in 5 Years	$17,538	$3,508	$2,536	$11,495	$132,908	($14,504)	($145)
Business-As-Usual	$5,220	$0	$0	$0	$147,412	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.

Acknowledgements

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

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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:	Bressett Homestead
Client Name:	Township of Georgian Bay
Site Contact:	Jennifer Schnier
Address:	45 Lone Pine Rd.
	Port Severn, ON
	L0K 1S0
Facility Area:	2,504 ft^2
Building Type:	House/Tourist Site
Year Constructed:	1890s
Number of Stories:	2

4.1 Heating

The building is heated via a fuel-fired furnace. Supplemental heating is provided by some electric baseboards.

TABLE 4.1.1: HEATING EQUIPMENT DETAILS

Tag ID	Fuel	Capacity	Efficiency	Condition
F-1	Propane	80 MBH	100%	Fine

4.2 Cooling

The building is cooled via a single split-system DX air condition unit.

TABLE 4.2.1: COOLING EQUIPMENT DETAILS

Tag ID	Chiller Type	Capacity	EER	Condition
DX-1	Reciprocating	5 MBH	9.7	Fine

4.3 Domestic Hot Water

A small 10-gallon electric heater heater tank provides DHW to the building.

4.4 Building Envelope

The building was constructed in the 1890's. The roof is pitched with shingles. Windows are generally single glazed. Doors are made of wood.

Single Pane Window

4.5 Water Fixtures

Water fixtures in the facility were generally observed to be standard flow.

TABLE 4.5.1: WATER FIXTURE DETAILS

Fixture	Flow
Bathroom Faucets:	2.2 GPM
Kitchen Faucets:	2.2 GPM
Toilets:	1.6 GPF

4.6 Lighting

Lighting in the facility generally consists of LED in all observed areas.

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%	$0.2130	0.000050
Propane	l	5.0%	$0.9334	0.001515

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

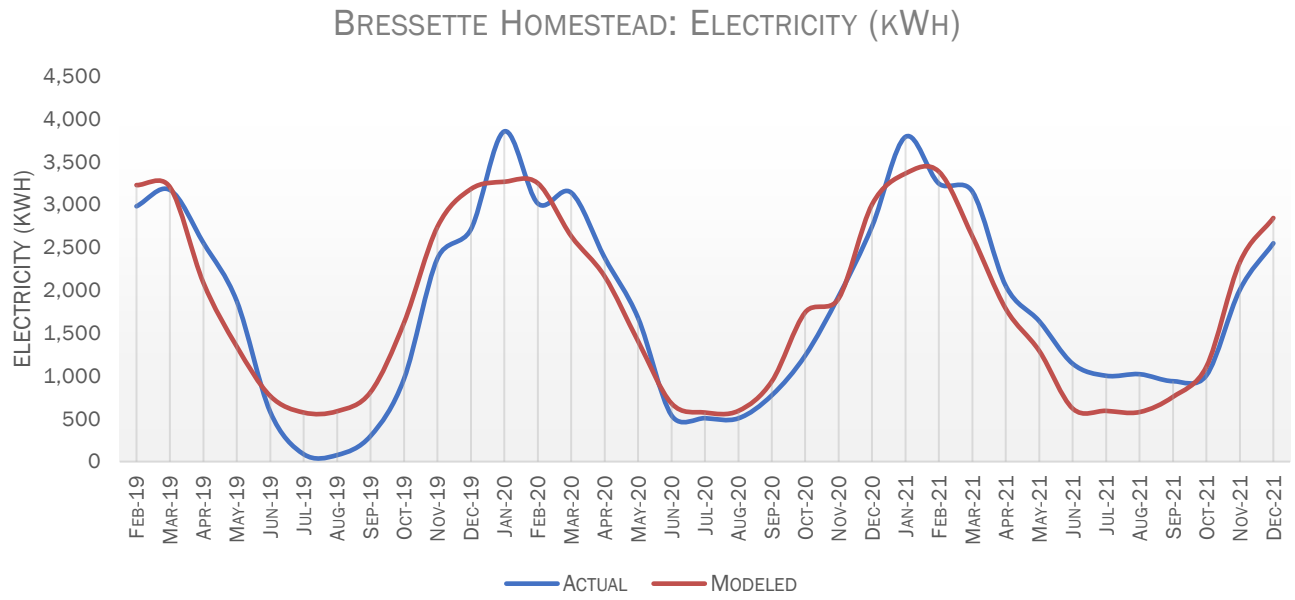
Daily mean temperatures from Barrie-Oro (WMO ID 71314) were used in creating the baseline models for this facility.

5.3.1 Electricity

Baseline Equation:

Electricity (kWh) = Days x 19.09 + HDD x 4.32.
The underlying regression of this baseline equation is $R^2 = 0.9672$.
HDD (Heating Degree Days) calculated using a balance point of 16°C.
In a typical year, consumption will be 24,708 kWh.

Modeling Graphs:



Rate Structure:

Electricity for this building is provided by Hydro One. It is classified as a Small Service account with a monthly demand less than 50 kW. This is a "Time of Use" structure which charges varying rates based on Off-Peak, Mid-Peak and On-Peak hours of the day. These rates and blocks of time also vary seasonally. Regulatory and Debt Retirement Charges are also added to this cost on a per kWh basis. The "Effective Marginal Rate" uses a blended average of the time of use rates plus additional per kWh charges.

Comments:

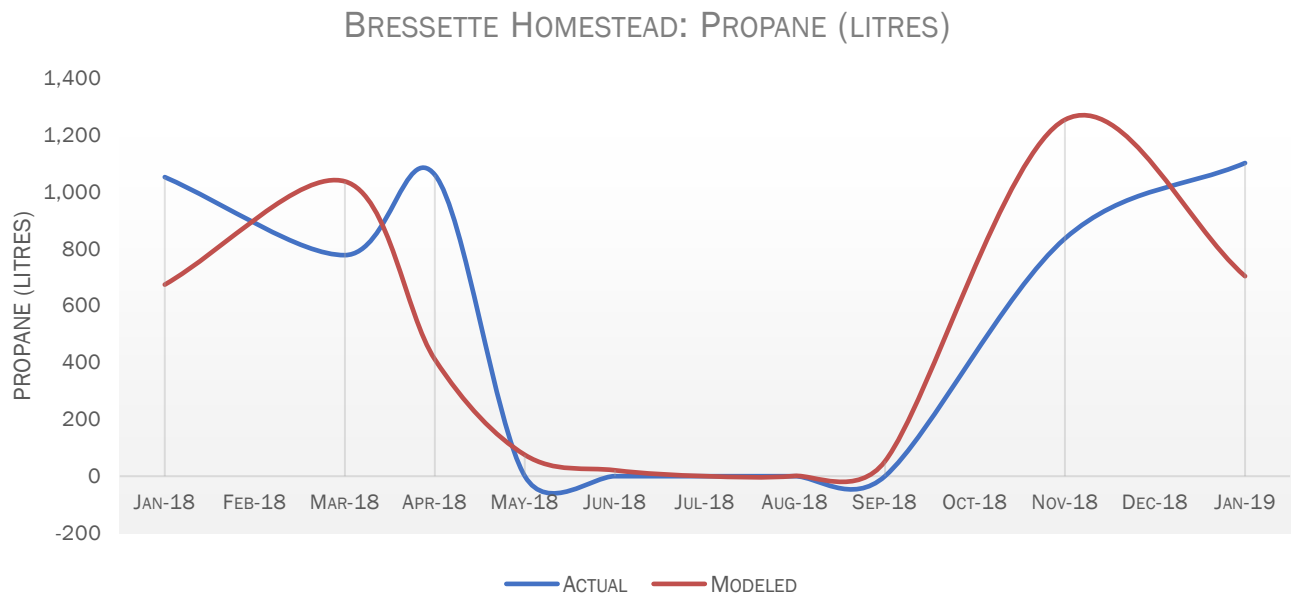
No anomalies or irregularities were noted during the modeling period of this report.

5.3.2 Propane

Baseline Equation:

Propane (litres) = Days x 0 + HDD x 0.91.
The underlying regression of this baseline equation is $R^2 = 0.7657$.
HDD (Heating Degree Days) calculated using a balance point of 16°C.
In a typical year, consumption will be 3,721 litres.

Modeling Graphs:



Rate Structure:

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

Comments:

Propane is purchased sporadically and does not necessarily correlate directly to consumption. Because of this, obtaining a strong regression is not possible.

5.4 Building Energy Performance

The following section provides benchmarking information for the facility.

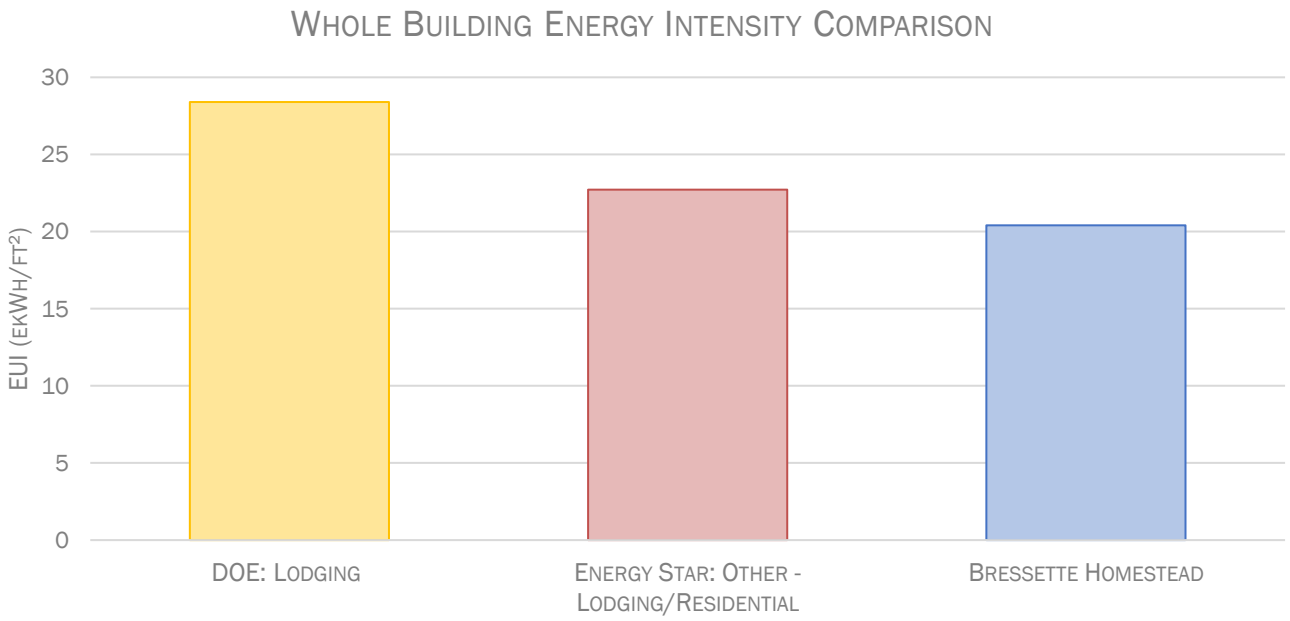
Electricity intensity for the building is 9.9 ekWh/ft² (0.38 GJ/m²). Propane intensity for the building is 10.5 ekWh/ft² (0.41 GJ/m²). Total energy intensity for the building is 20.4 ekWh/ft² (0.79 GJ/m²).

The energy performance of the Bressette Homestead is compared to buildings of similar usage or size from multiple benchmarking databases including Energy Star, Department of Energy (DOE), Ontario Broader Public Sector buildings and a database of energy use intensities maintained by Efficiency Engineering:

Benchmark	EUI	% Variance
DOE: Lodging	28.4	-28%
Energy Star: Other - Lodging/Residential	22.7	-10%
Bressette Homestead	**20.4**	

*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 buildings of a similar type, the overall energy intensity at the Bressette Homestead is low.

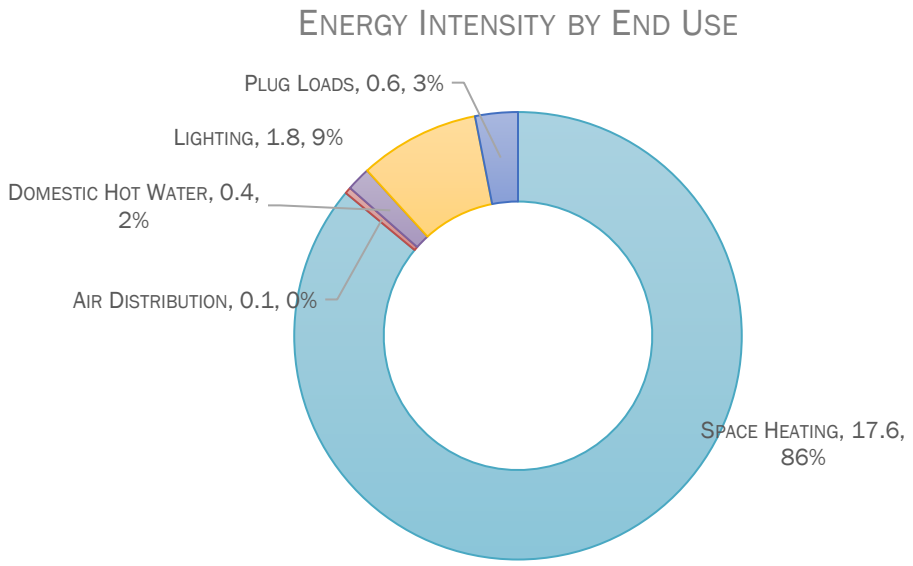
5.5 Energy Breakout by End Use

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:

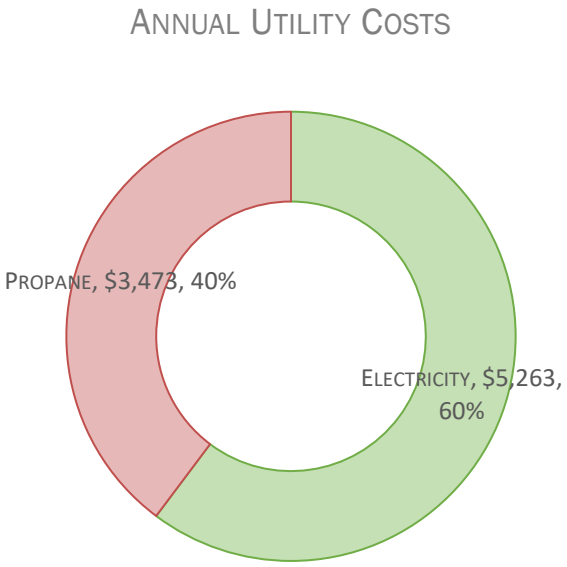
End Use	Electricity (kWh)	Propane (l)	EUI (ekWh/ft²)	GHG Emissions (Tonnes)
Space Heating	17,741	3,721	17.6	6.29
Air Distribution	240	0	0.1	0.0
Domestic Hot Water	890	0	0.4	0.0
Lighting	4,460	0	1.8	0.13
Plug Loads	1,580	0	0.6	0.0
Total	**24,911**	**3,721**	**20.5**	**6.51**

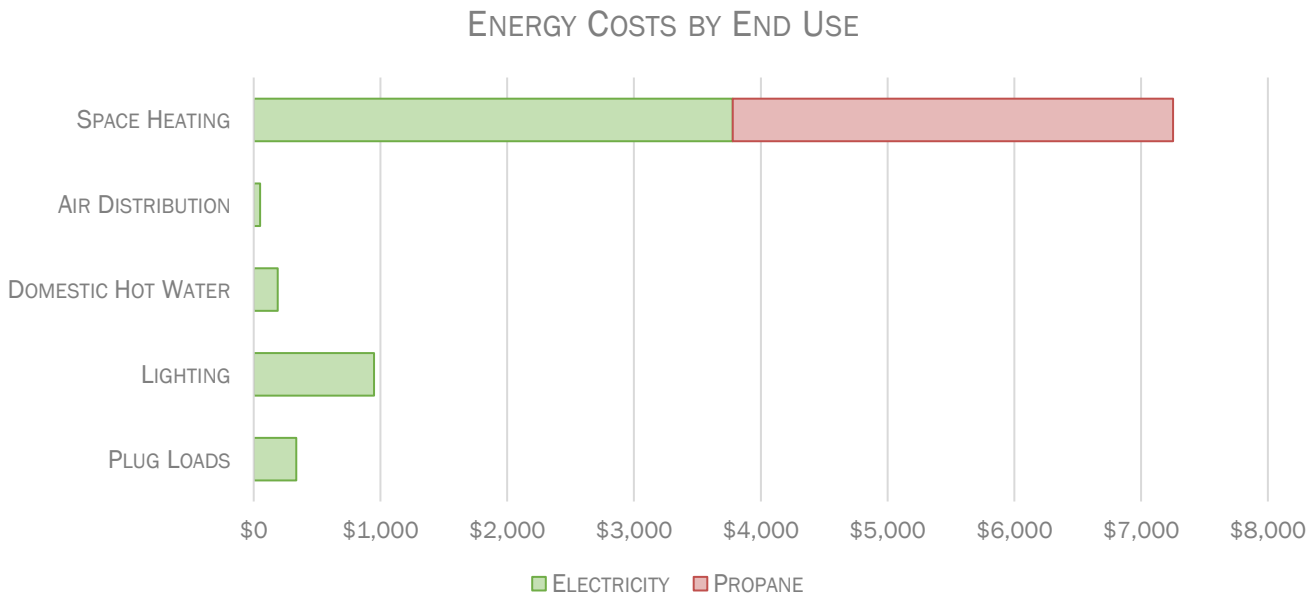
The following chart shows the energy intensity of Bressette Homestead broken out by end use.



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.

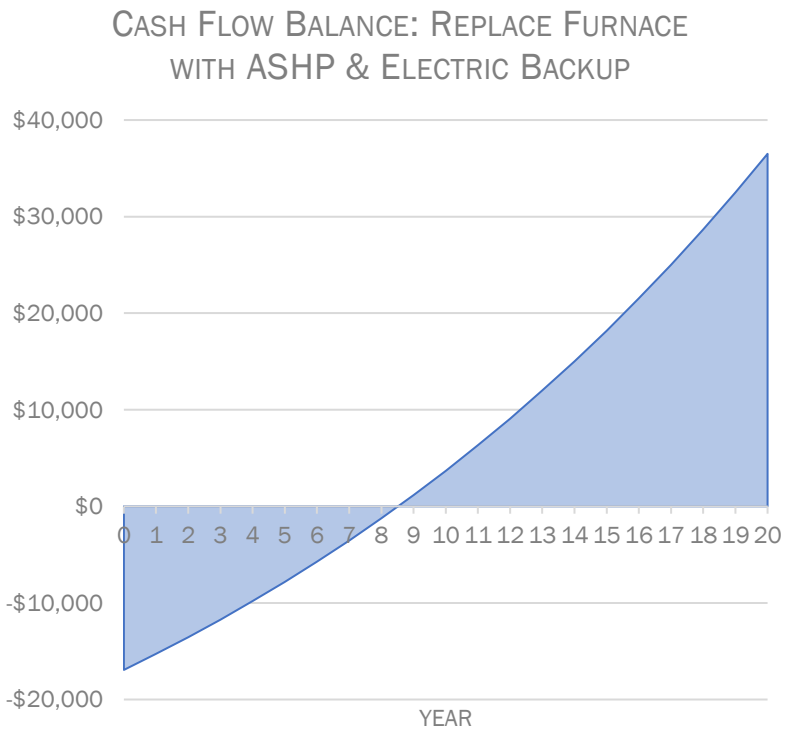
6.1 Opportunity 1: Replace Furnace with ASHP & Electric Backup

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 6.1.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-12,530
Propane (l):	2,475
Water (m^3):	0
Emissions (tCO_2e):	3.5
Financials	
Utility Savings:	$1,583
Materials & Labour:	$13,551
Engineering & PM:	$2,033
Contingency:	$1,355
Project Costs:	$16,938
Simple Payback:	10.7
Capital Payback:	8.5
NPV:	$7,886
IRR:	12.0%



Existing Conditions

The building is heated via a fuel-fired furnace.

TABLE 6.1.2: HEATING EQUIPMENT DETAILS

Tag ID	Fuel	Capacity	Efficiency	Condition
F-1	Propane	80 MBH	100%	Fine

Retrofit Conditions

This measure includes replacing the existing propane fired furnace with a hybrid air-source heat pump/electric furnace. The heat pump is classified as “cold climate” and can operate with outdoor air temperatures as low as -20°C. Below that, the backup electric resistance portion may need to activate to provide adequate heating.

Costs also include the installation of new electrical feeds from the rooftop units to their respective electrical panels.

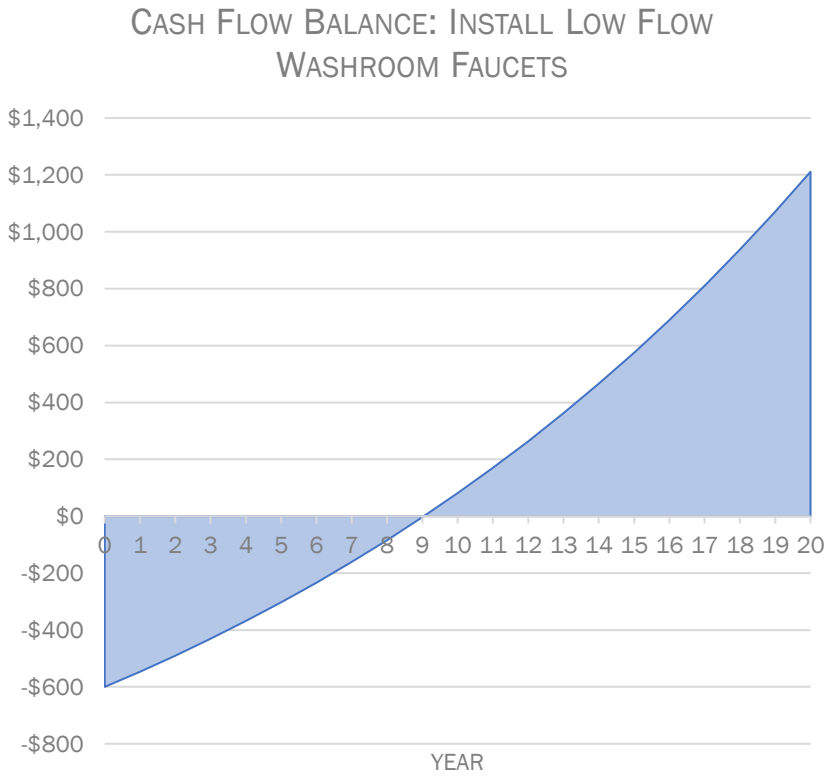
6.2 Opportunity 2: Install Low Flow Washroom Faucets

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 6.2.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	340
Propane (l):	0
Water (m³):	0
Emissions (tCO_2e):	0.01
Financials	
Utility Savings:	$51
Materials & Labour:	$480
Engineering & PM:	$72
Contingency:	$48
Project Costs:	$600
Simple Payback:	11.8
Capital Payback:	9.0
NPV:	$233
IRR:	11.2%



Existing Conditions

Washrooms faucets in the building are not equipped with any aerators so the flow is constant and high.

The fixtures themselves are in good operating condition, however, they consume more water than necessary.

Retrofit Conditions

We recommend installing new low-flow (1.0-1.2 GPM) faucets 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.

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

Only well reviewed products from quality manufacturers should be installed. Quality fixtures will result in greater user satisfaction and reduce the risk of complaints and fixture replacement by occupants.

7 Other Measures Considered

The following Opportunities were also considered during the process of the audit; however, were not pursued due to implementation restrictions, poor financial results or other logistical challenges when viewed at a high level. Opportunities that fall within this category also are not required to hit GHG reduction targets and/or were asked to be removed from both of the scenarios presented within this report at the request of the client.

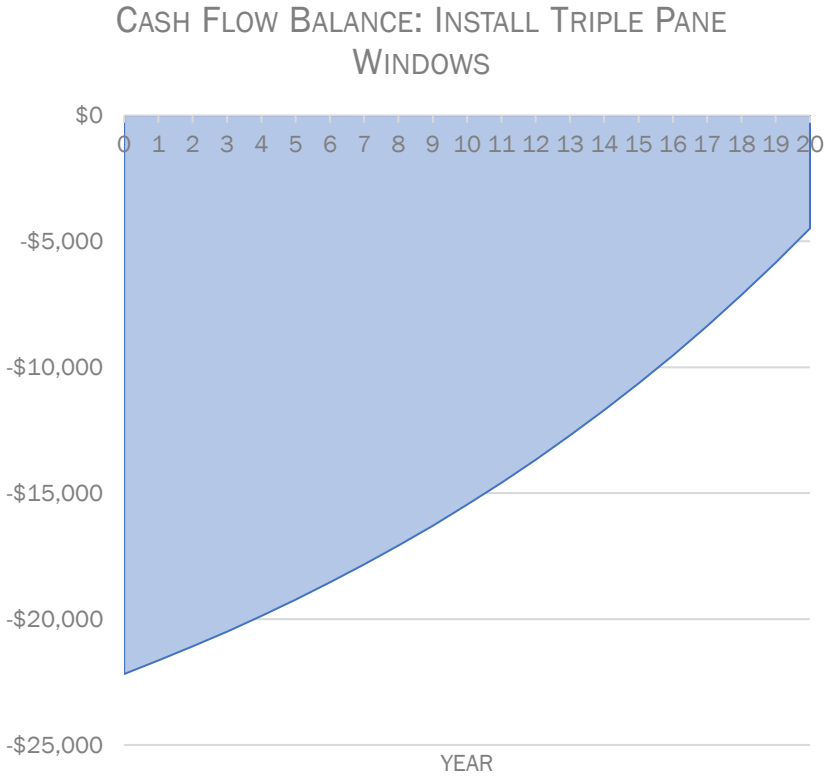
7.1 Opportunity 3: Install Triple Pane Windows

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 7.1.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	310
Propane (l):	330
Water (m³):	0
Emissions (tCO_2e):	0.5
Financials	
Utility Savings:	$509
Materials & Labour:	$17,747
Engineering & PM:	$2,662
Contingency:	$1,775
Project Costs:	$22,183
Simple Payback:	43.6
Capital Payback:	23.0
NPV:	-$14,012
IRR:	-1.8%



Existing Conditions

Windows are single glaze. The windows themselves are in relatively good condition with the exception of the caulking around window frames which have begun to crack/degrade.

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.

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.

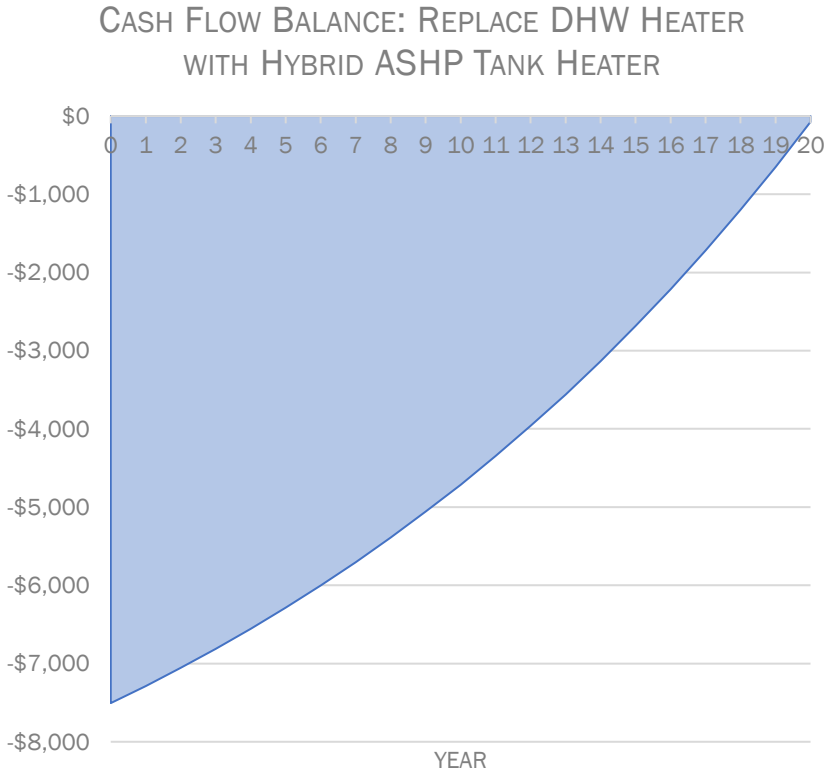
7.2 Opportunity 4: Replace DHW Heater with Hybrid ASHP Tank Heater

The Detailed Financial Analysis

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

TABLE 7.2.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,394
Propane (l):	0
Water (m³):	0
Emissions (tCO_2e):	0.0
Financials	
Utility Savings:	$209
Materials & Labour:	$6,527
Engineering & PM:	$326
Contingency:	$653
Project Costs:	$7,506
Simple Payback:	35.9
Capital Payback:	20.1
NPV:	-$4,088
IRR:	-0.1%



Existing Conditions

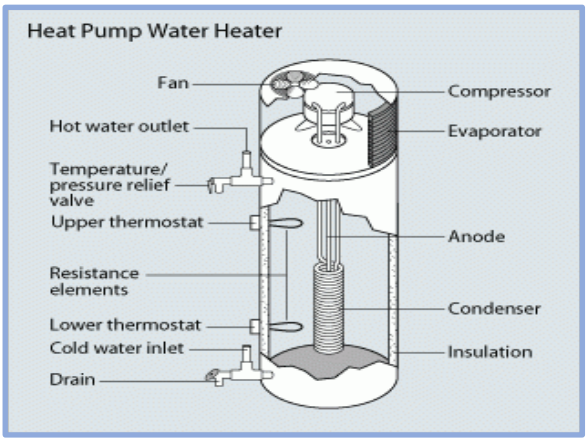
Hot water in the building is generated by an electric water heater. The water heater was observed to be in good condition, and there is no need to replace it for at least ten years considering the time and regiment of use.

Retrofit Conditions

As the measure is not necessary to reach the GHG reduction targets, and it has a negative financial outlook, we do no recommend replacing your heater tank at this time.

The proposed measure will lead to energy savings due higher efficiency to generate the same volume of hot water[1]. Hybrid tanks technology is commercially available and there are well-known manufacturers offering service and spares. Thus, there is no additional risk associated with the technology.

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



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

Typical Hybrid ASHP/Electric Tank Heater

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

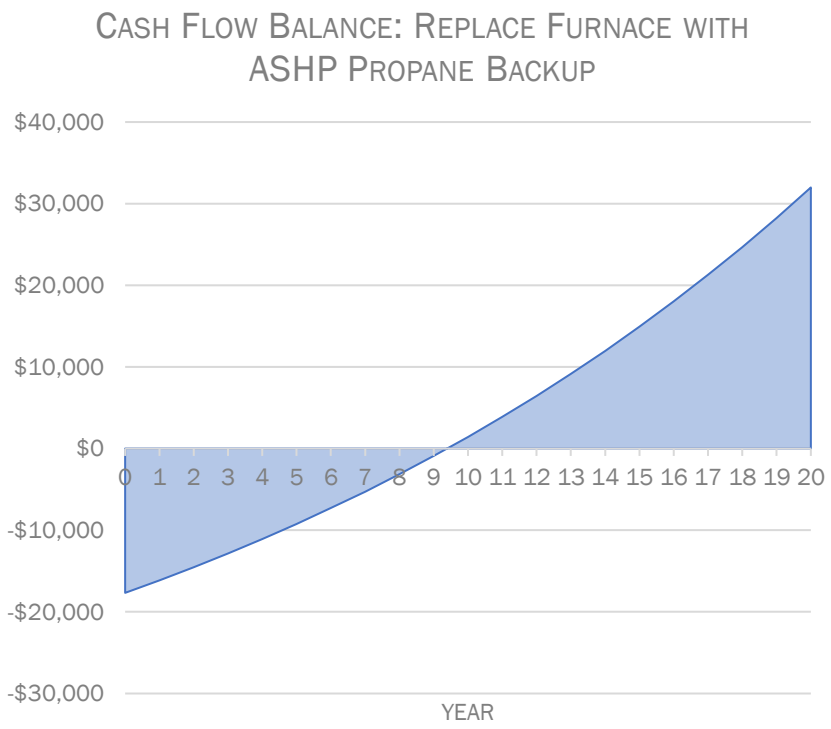
7.3 Opportunity 5: Replace Furnace with ASHP & Electric Backup

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 7.3.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-9,060
Propane (l):	2,016
Water (m^3):	0
Emissions (tCO_2e):	2.9
Financials	
Utility Savings:	$1,462
Materials & Labour:	$14,137
Engineering & PM:	$2,121
Contingency:	$1,414
Project Costs:	$17,671
Simple Payback:	12.1
Capital Payback:	9.4
NPV:	$5,369
IRR:	10.4%



Existing Conditions

The building is heated via a fuel-fired furnace.

TABLE 7.3.2: HEATING EQUIPMENT DETAILS

Tag ID	Fuel	Capacity	Efficiency	Condition
F-1	Propane	80 MBH	100%	Fine

Retrofit Conditions

This measure includes replacing the existing propane fired furnace with a hybrid air-source heat pump/propane-fired furnace. The heat pump is classified as “cold climate” and can operate with outdoor air temperatures as low as -20°C. Below that, the backup propane burner may need to activate to provide adequate heating.

Costs also include the installation of new electrical feeds from the rooftop units to their respective electrical panels.

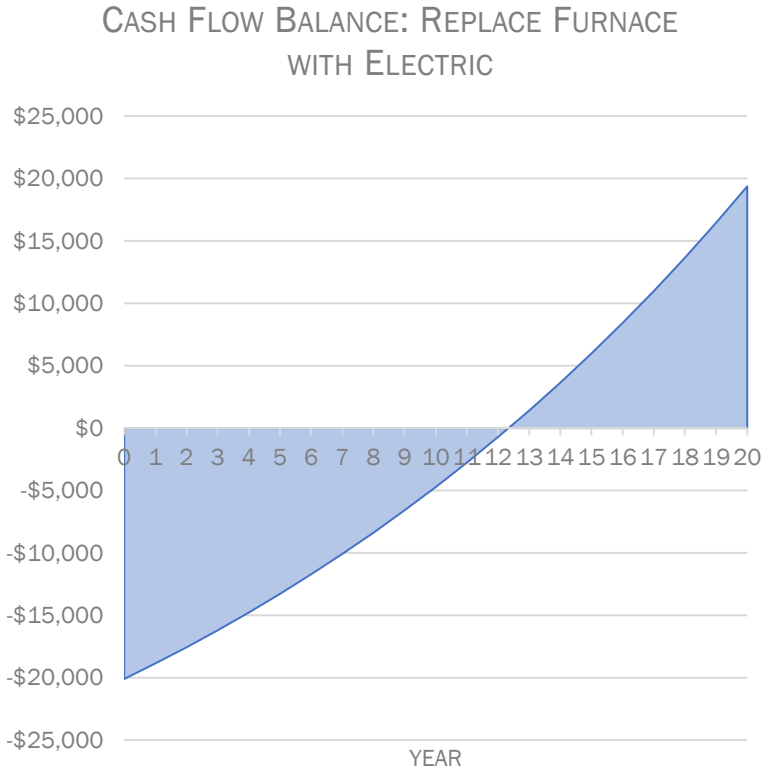
7.4 Opportunity 6: Replace Furnace with Electric

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 7.4.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-15,150
Propane (l):	2,475
Water (m^3):	0
Emissions (tCO_2e):	3.4
Financials	
Utility Savings:	$1,190
Materials & Labour:	$16,088
Engineering & PM:	$2,413
Contingency:	$1,609
Project Costs:	$20,110
Simple Payback:	16.9
Capital Payback:	12.3
NPV:	-$1,708
IRR:	6.3%



Existing Conditions

The building is heated via a fuel-fired furnace.

TABLE 7.4.2: HEATING EQUIPMENT DETAILS

Tag ID	Fuel	Capacity	Efficiency	Condition
F-1	Propane	80 MBH	100%	Fine

Retrofit Conditions

This measure includes replacing the existing propane fired furnaces with an electric resistance equivalent. The units would be sized to the nominal heating capacities of the existing furnaces.

Costs also include the installation of new electrical feeds from the rooftop units to their respective electrical panels.

8 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

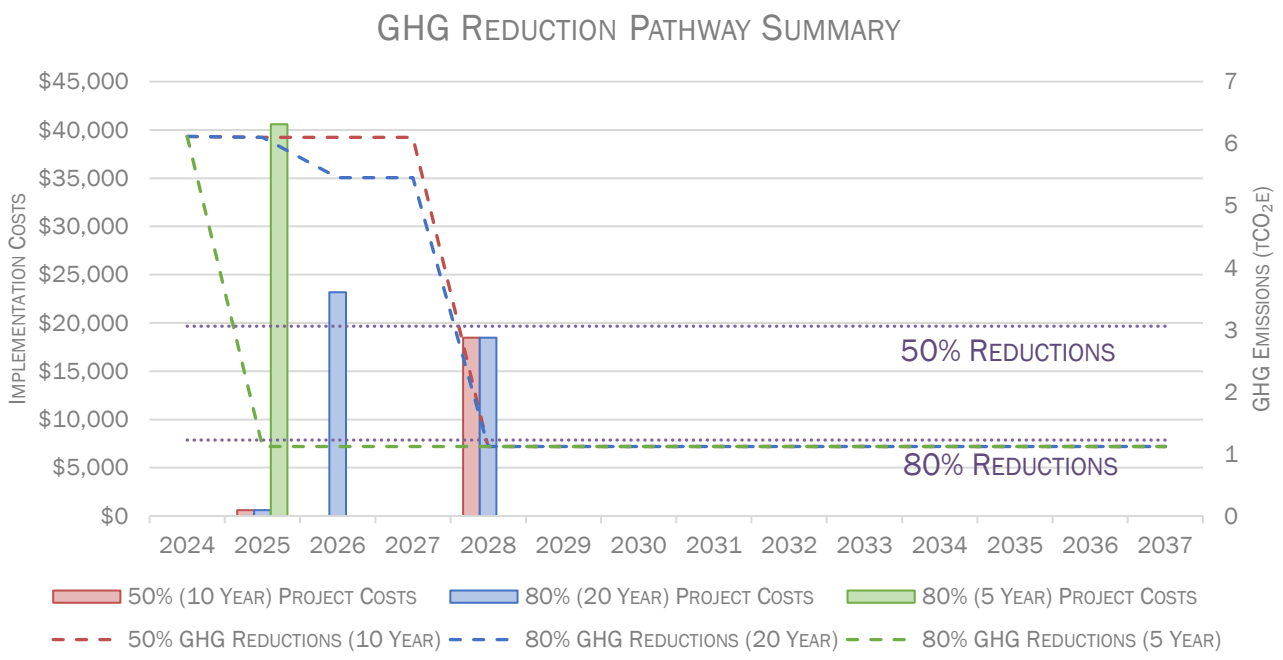
8.1 GHG Reduction Pathway Summary

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

Opp. #	Opportunity	Emissions (tCO_2e)	50% Reduction Pathway	80% Reduction Pathway
1	Replace Furnace with ASHP & Electric Backup	3.47	•	•
2	Install Low Flow Washroom Faucets	0.01	•	•
3	Install Triple Pane Windows	0.52		
4	Replace DHW Heater with Hybrid ASHP Tank Heater	0.04		
5	Replace Furnace with ASHP Propane Backup	2.86		
6	Replace Furnace with Electric	3.39		

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)	13,189	26%	5.0	82%	$1,634	$17,538	$135,678
80% Reductions (20 Year)	13,189	26%	5.0	82%	$1,634	$17,538	$135,678
80% Reductions (5 Year)	13,189	26%	5.0	82%	$1,634	$17,538	$132,908
Business-As-Usual	$0	0%	$0	0%	$0	$5,220	$147,412



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

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

	Financials						
Pathway	**Project Costs**	**Potential Grant**	**Avoided Cost**	**Incremental Costs**	**LC Cost**	**Incremental 20-Year LC Cost**	**Incremental LC Cost per tCO_2e**
50% Reductions in 10 Years	$17,538	$3,508	$2,536	$11,495	$135,678	($11,734)	($117)
80% Reductions in 20 Years	$17,538	$3,508	$5,220	$8,810	$135,678	($11,734)	($117)
80% Reductions in 5 Years	$17,538	$3,508	$2,536	$11,495	$132,908	($14,504)	($145)
Business-As-Usual	$5,220	$0	$0	$0	$147,412	N/A	N/A

8.2 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 to an electric equivalent 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.

The existing facility does not get charged for demand. The existing capacity of the building should be able to accommodate the installation of an electric furnace.

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.

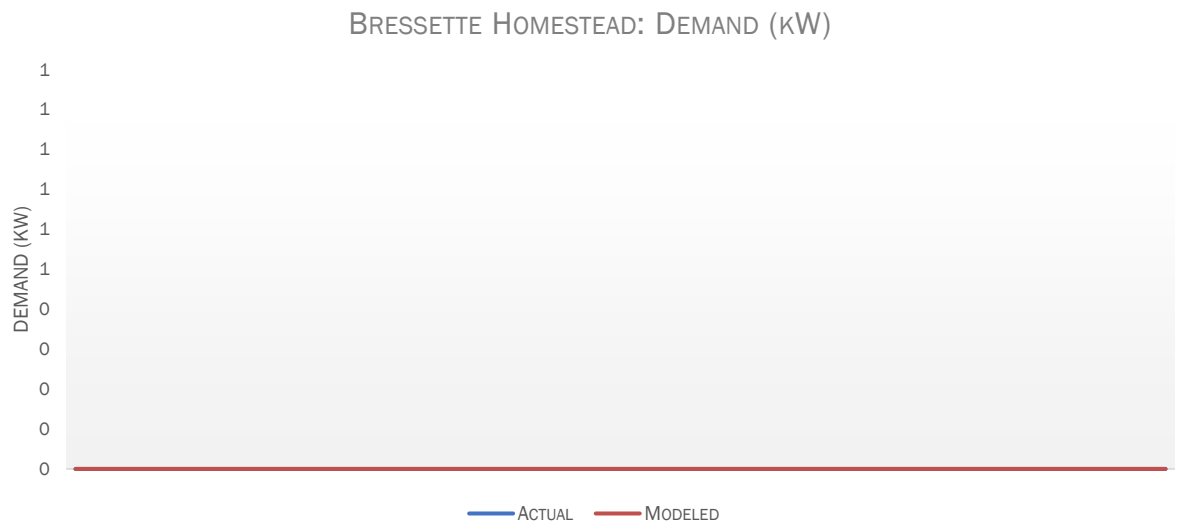
APPENDIX A

UTILITY BILL ANALYSIS

Bressette Homestead: Demand (kW)

M01	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	No	No	No	No	No	No
Balance Point:	N/A			N/A	N/A	N/A
Calculated BP:	N/A			N/A	N/A	N/A
Coefficient:	0.00	0.00	0.00	0.00	0.00	0.00
T-Stat:	0.00	0.00	0.00	0.00	0.00	0.00
Adj R^2:	**#DIV/0!**					

Demand (kW) = Days x 0.
#DIV/0!
HDD (Heating Degree Days) calculated using a balance point of °C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
The average monthly base demand is 0 kW..

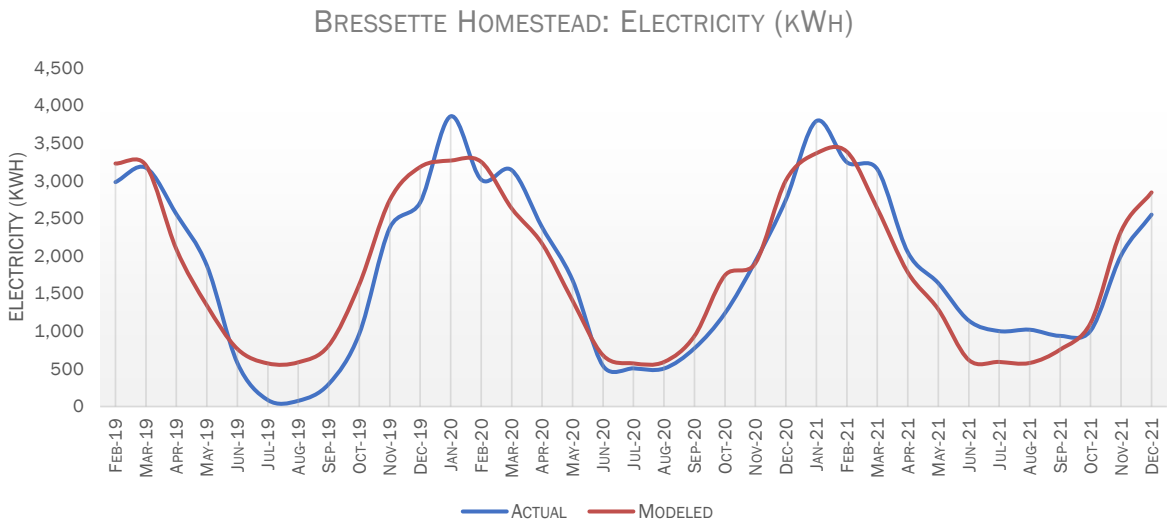


Include in Model?	Start Date	Read Date	Demand (kW)	IV1	IV2	IV3	Month Allocation

Bressette Homestead: Electricity (kWh)

	1	2				
M02	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	Yes	Yes	No	No	No	No
Balance Point:	N/A	16		N/A	N/A	N/A
Calculated BP:	N/A	16		N/A	N/A	N/A
Coefficient:	19.09	4.32	0.00	0.00	0.00	0.00
T-Stat:	5.57	16.10	0.00	0.00	0.00	0.00
Adj R^2:	**0.9672**					

Electricity (kWh) = Days x 19.09 + HDD x 4.32.
The underlying regression of this baseline equation is R^2 = 0.9672.
HDD (Heating Degree Days) calculated using a balance point of 16°C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
In a typical year, consumption will be 24,708 kWh.



	Include in Model?	Start Date	Read Date	Electricity (kWh)	IV1	IV2	IV3	Month Allocation
	No	1-Jan-19	31-Jan-19	334				Jan-19
1	Yes	1-Feb-19	28-Feb-19	2,980				Feb-19
2	Yes	1-Mar-19	31-Mar-19	3,171				Mar-19
3	Yes	1-Apr-19	30-Apr-19	2,554				Apr-19
4	Yes	1-May-19	31-May-19	1,872				May-19
5	Yes	1-Jun-19	30-Jun-19	579				Jun-19
6	Yes	1-Jul-19	31-Jul-19	86				Jul-19
7	Yes	1-Aug-19	31-Aug-19	76				Aug-19
8	Yes	1-Sep-19	30-Sep-19	299				Sep-19
9	Yes	1-Oct-19	31-Oct-19	964				Oct-19
10	Yes	1-Nov-19	30-Nov-19	2,371				Nov-19
11	Yes	1-Dec-19	31-Dec-19	2,710				Dec-19
12	Yes	1-Jan-20	31-Jan-20	3,854				Jan-20
13	Yes	1-Feb-20	29-Feb-20	3,014				Feb-20
14	Yes	1-Mar-20	31-Mar-20	3,140				Mar-20
15	Yes	1-Apr-20	30-Apr-20	2,381				Apr-20
16	Yes	1-May-20	31-May-20	1,678				May-20
17	Yes	1-Jun-20	30-Jun-20	540				Jun-20
18	Yes	1-Jul-20	31-Jul-20	507				Jul-20
19	Yes	1-Aug-20	31-Aug-20	505				Aug-20
20	Yes	1-Sep-20	30-Sep-20	773				Sep-20
21	Yes	1-Oct-20	31-Oct-20	1,238				Oct-20
22	Yes	1-Nov-20	30-Nov-20	1,931				Nov-20
23	Yes	1-Dec-20	31-Dec-20	2,747				Dec-20
24	Yes	1-Jan-21	31-Jan-21	3,792				Jan-21
25	Yes	1-Feb-21	28-Feb-21	3,245				Feb-21
26	Yes	1-Mar-21	31-Mar-21	3,152				Mar-21
27	Yes	1-Apr-21	30-Apr-21	2,049				Apr-21
28	Yes	1-May-21	31-May-21	1,639				May-21
29	Yes	1-Jun-21	30-Jun-21	1,142				Jun-21
30	Yes	1-Jul-21	31-Jul-21	1,002				Jul-21
31	Yes	1-Aug-21	31-Aug-21	1,020				Aug-21
32	Yes	1-Sep-21	30-Sep-21	938				Sep-21
33	Yes	1-Oct-21	31-Oct-21	1,007				Oct-21
34	Yes	1-Nov-21	30-Nov-21	2,007				Nov-21
35	Yes	1-Dec-21	31-Dec-21	2,549				Dec-21

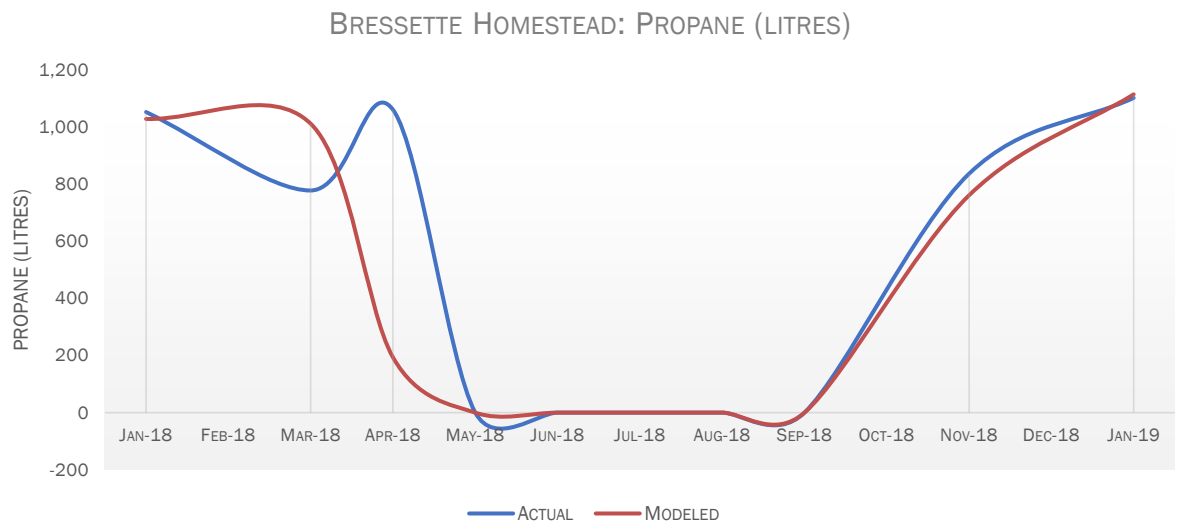
Bressette Homestead: Propane (litres)

1

M03	Days	HDD	CDD	IV1	IV2	IV3
Dependent?:	No	Yes	No	No	No	No
Balance Point:	N/A	1		N/A	N/A	N/A
Calculated BP:	N/A	1	1	N/A	N/A	N/A
Coefficient:	0.00	3.39	0.00	0.00	0.00	0.00
T-Stat:	0.00	6.60	0.00	0.00	0.00	0.00
Adj R^2:	**0.8045**					

Propane (litres) = Days x 0 + HDD x 3.39.
The underlying regression of this baseline equation is R^2 = 0.8045.
HDD (Heating Degree Days) calculated using a balance point of 1°C.
CDD (Cooling Degree Days) calculated using a balance point of °C.
In a typical year, consumption will be 3,395 litres.

Note: No propane data for 2019-2021



APPENDIX B

CALCULATIONS

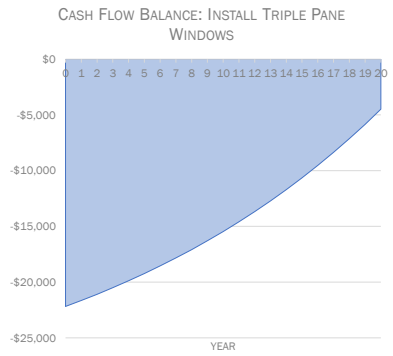
Energy Conservation Measure 1

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):	310
Propane (litres):	330
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.5
Financials	
Annual Utility Savings:	$509
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$17,747
Engineering & PM:	$2,662
Contingency:	$1,775
Project Costs:	$22,183
Simple Payback:	43.6
Capital Payback:	#NAME?
NPV:	-$14,012
IRR:	-1.8%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	98,500	99,141
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Triple Pane Windows

			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			EMM1			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)					
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	17.8	87.2	43,348.1	17.5	78.8	40,616.7	290	330					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	0.9	0.0	890.0	0.9	0.0	890.0	0	0					
Vent. Fans	0.2	0.0	240.0	0.2	0.0	220.0	20	0					
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Ext. Usage	0.1	0.0	80.0	0.1	0.0	80.0	0	0					
Misc. Equip	1.6	0.0	1,580.0	1.6	0.0	1,580.0	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	4.4	0.0	4,380.0	4.4	0.0	4,380.0	0	0					
0	**25**	**87**	**50,518**	**25**	**79**	**47,767**	**310**	**330**	**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 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				Triple Glazed		per sqft of	Pinpoint	$91	$18	$0	Yes	Project	105.825	$14,784	$2,963	$0	$17,747
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:	**$14,784**	**$2,963**	**$0**	**$17,747**

Escalation Rates: Install Triple Pane Windows

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	11.8277	12.5374	13.2896	14.0870	14.9322	15.8281	16.7778	17.7845	18.8516	19.9827	21.1816	22.4525	23.7997	25.2276	26.7413	28.3458	30.0465	31.8493	33.7603	35.7859	37.9330
Electricity ($/kWh):	0.1500	0.1578	0.1660	0.1746	0.1837	0.1933	0.2033	0.2139	0.2250	0.2367	0.2490	0.2620	0.2756	0.2899	0.3050	0.3209	0.3376	0.3551	0.3736	0.3930	0.4134
Propane ($/litres):	1.3990	1.4690	1.5424	1.6195	1.7005	1.7855	1.8748	1.9685	2.0670	2.1703	2.2788	2.3928	2.5124	2.6380	2.7699	2.9084	3.0538	3.2065	3.3669	3.5352	3.7120
Water ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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 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:	-$22,183	$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):		$49	$51	$54	$57	$60	$63	$66	$70	$73	$77	$81	$85	$90	$95	$99	$105	$110	$116	$122	$128
Annual Savings (M03):		$485	$509	$535	$562	$590	$619	$650	$683	$717	$753	$790	$830	$871	$915	$961	$1,009	$1,059	$1,112	$1,168	$1,226
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:	-$22,183	$534	$561	$589	$619	$650	$682	$717	$752	$790	$830	$872	$915	$961	$1,009	$1,060	$1,113	$1,169	$1,228	$1,289	$1,354
Cash Balance:	-$22,183	-$21,649	-$21,088	-$20,499	-$19,881	-$19,231	-$18,549	-$17,832	-$17,080	-$16,290	-$15,460	-$14,588	-$13,673	-$12,712	-$11,702	-$10,642	-$9,529	-$8,360	-$7,132	-$5,842	-$4,488
Undepreciated Amount:	-$22,183	-$18,856	-$16,027	-$13,623	-$11,580	-$9,843	-$8,366	-$7,111	-$6,045	-$5,138	-$4,367	-$3,712	-$3,155	-$2,682	-$2,280	-$1,938	-$1,647	-$1,400	-$1,190	-$1,012	-$860

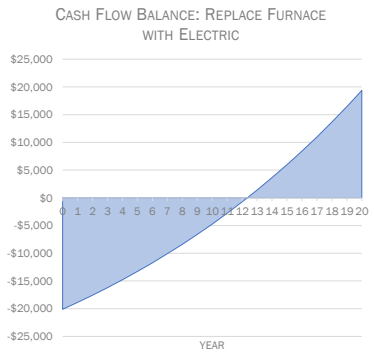
Energy Conservation Measure 2

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Furnace with Electric

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$2,685**
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):	-15,150
Propane (litres):	2,475
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	3.4
Financials	
Annual Utility Savings:	$1,190
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$16,088
Engineering & PM:	$2,413
Contingency:	$1,609
Project Costs:	$20,110
Simple Payback:	16.9
Capital Payback:	#NAME?
NPV:	-$1,708
IRR:	6.3%



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

QC Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	90,790	78,115
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace Furnace with Electric

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

End-Use	Existing			Replace Furnace with Electric			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)				
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	17.8	87.2	43,348.1	33.0	0.0	32,950.0	-15,150	2,475				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.9	0.0	890.0	0.9	0.0	890.0	0	0				
Vent. Fans	0.2	0.0	240.0	0.2	0.0	240.0	0	0				
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.1	0.0	80.0	0.1	0.0	80.0	0	0				
Misc. Equip	1.6	0.0	1,580.0	1.6	0.0	1,580.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	4.4	0.0	4,380.0	4.4	0.0	4,380.0	0	0				
0	**25**	**87**	**50,518**	**40**	**0**	**40,120**	**-15,150**	**2,475**	**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: Replace Furnace with Electric

Cost Breakout: Replace Furnace 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				Demolition	Remove Existing	Each	EE Est	$0	$750	$0	Yes	Both	1	$0	$1,154	$0	$1,154
111	0	0				Condensing Furnace	75 MBH	each	Means 24	$995	$292	$0	No	Avoided	1	$995	$292	$0	$1,287
112	0	0											Yes	Avoided	0	$0	$0	$0	$0
113	0	0				30 kW Furnace	Electric	Each	Online Estimate	$4,520	$1,295	$0	Yes	Project	1	$6,939	$1,992	$0	$8,931
114	0	0											Yes	Project	0	$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	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
117	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
118	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 60A	Circuit Breaker - NEMA 1	600V, 60A	Each	Means '18	$635	$166	$0	Yes	Project	3	$2,925	$766	$0	$3,691
119	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	3	$90	$390	$0	$480
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:	**$10,672**	**$5,415**	**$0**	**$16,088**

Escalation Rates: Replace Furnace with Electric

Cash Flow Balance: Replace Furnace with Electric

Year:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Implementation Cost:	-$20,110	$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):		-$2,391	-$2,515	-$2,646	-$2,783	-$2,928	-$3,080	-$3,241	-$3,409	-$3,586	-$3,773	-$3,969	-$4,175	-$4,392	-$4,621	-$4,861	-$5,114	-$5,380	-$5,660	-$5,954	-$6,264
Annual Savings (M03):		$3,636	$3,817	$4,008	$4,209	$4,419	$4,640	$4,872	$5,116	$5,372	$5,640	$5,922	$6,218	$6,529	$6,856	$7,198	$7,558	$7,936	$8,333	$8,750	$9,187
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:	-$20,110	$1,245	$1,302	$1,363	$1,425	$1,491	$1,560	$1,632	$1,707	$1,785	$1,867	$1,953	$2,043	$2,137	$2,235	$2,337	$2,444	$2,556	$2,673	$2,796	$2,924
Cash Balance:	-$20,110	-$18,865	-$17,562	-$16,200	-$14,774	-$13,283	-$11,723	-$10,092	-$8,385	-$6,600	-$4,732	-$2,779	-$736	$1,400	$3,635	$5,972	$8,417	$10,973	$13,647	$16,442	$19,366
Undepreciated Amount:	-$20,110	-$17,093	-$14,529	-$12,350	-$10,497	-$8,923	-$7,584	-$6,447	-$5,480	-$4,658	-$3,959	-$3,365	-$2,860	-$2,431	-$2,067	-$1,757	-$1,493	-$1,269	-$1,079	-$917	-$779

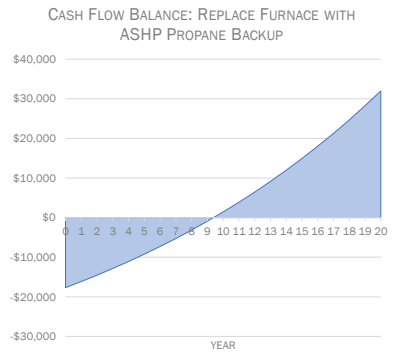
Energy Conservation Measure 3

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Furnace 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:	**$2,685**
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):	-9,060
Propane (litres):	2,016
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	2.9
Financials	
Annual Utility Savings:	$1,462
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$14,137
Engineering & PM:	$2,121
Contingency:	$1,414
Project Costs:	$17,671
Simple Payback:	12.1
Capital Payback:	#NAME?
NPV:	$5,369
IRR:	10.4%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	89,444	82,400
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace Furnace with ASHP Propane Backup

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

End-Use	Existing			Replace Furnace with ASHP Propane Backup			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)				
Space Cool	0.0	0.0	0.0	0.0	0.0	10.0	-10	0				
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	17.8	87.2	43,348.1	23.4	16.2	28,113.3	-5,580	2,016				
HP Supp.	0.0	0.0	0.0	0.8	0.0	810.0	-810	0				
Hot Water	0.9	0.0	890.0	0.9	0.0	890.0	0	0				
Vent. Fans	0.2	0.0	240.0	2.8	0.0	2,830.0	-2,590	0				
Pumps & Aux	0.0	0.0	0.0	0.1	0.0	70.0	-70	0				
Ext. Usage	0.1	0.0	80.0	0.1	0.0	80.0	0	0				
Misc. Equip	1.6	0.0	1,580.0	1.6	0.0	1,580.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	4.4	0.0	4,380.0	4.4	0.0	4,380.0	0	0				
0	**25**	**87**	**50,518**	**34**	**16**	**38,763**	**-9,060**	**2,016**	**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: Replace Furnace with ASHP Propane Backup

Cost Breakout: Replace Furnace 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				New ASHP										$0	$0	$0	$0
112	0	0				ASHP Outdoorunit	4 Ton Cooling, 24 MBH Heating	each	Means 24	$3,465	$1,375		Yes	Project	1	$5,319	$2,115	$0	$7,434
113	0	0				Indoor Units	fan coil unit (heating and ventilating)	each	Means 24	$580	$850		Yes	Project	1	$890	$1,307	$0	$2,198
114	0	0				Tube/wiring kit	25ft kit	each	Means 24	$53	$39		Yes	Project	1	$81	$60	$0	$141
115	0	0				Condensing Furnace	75 MBH	each	Means 24	$995	$292		Yes	Project	1	$1,528	$449	$0	$1,977
116	0	0				Elect Instalation for Interior Unit										$0	$0	$0	$0
117	26	05.19.90	Electrical	Wire	Cu-XHHW-#12, 1 Wire, 25A, 21kW			100 LF	Means '18	$18	$43	$0	Yes	Project	4	$113	$261	$0	$374
118	26	05.33.13	Electrical	Conduit	PVC Conduit-1/2" (3x#8,4x#10)	PVC Conduit	1/2" (3x#8,4x#10)	LF	Means '18	$1	$2	$0	Yes	Project	100	$137	$377	$0	$513
119	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 30A	Circuit Breaker - NEMA 1	600V, 30A	Each	Means '18	$520	$146	$0	Yes	Project	1	$798	$225	$0	$1,023
120	26	05.33.18	Electrical	Pull Boxes	Pull Box-10"x10"x6" diam	Pull Box	10"x10"x6" diam	Each	Means '18	$20	$85	$0	Yes	Project	1	$30	$130	$0	$160
121	0	0				Elect Instalation for Exterior Unit							Yes	Project		$0	$0	$0	$0
122	26	05.19.90	Electrical	Wire	Cu-XHHW-#12, 1 Wire, 25A, 21kW	Cu-XHHW	#12, 1 Wire, 25A, 21kW	100 LF	Means '18	$18	$43	$0	Yes	Project	2	$56	$131	$0	$187
123	26	05.33.13	Electrical	Conduit	PVC Conduit-1/2" (3x#8,4x#10)	PVC Conduit	1/2" (3x#8,4x#10)	LF	Means '18	$1	$2	$0	Yes	Project	25	$34	$94	$0	$128
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:	**$8,987**	**$5,150**	**$0**	**$14,137**

Escalation Rates: Replace Furnace 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 ($/kW):	11.8277	12.5374	13.2896	14.0870	14.9322	15.8281	16.7778	17.7845	18.8516	19.9827	21.1816	22.4525	23.7997	25.2276	26.7413	28.3458	30.0465	31.8493	33.7603	35.7859	37.9330
Electricity ($/kWh):	0.1500	0.1578	0.1660	0.1746	0.1837	0.1933	0.2033	0.2139	0.2250	0.2367	0.2490	0.2620	0.2756	0.2899	0.3050	0.3209	0.3376	0.3551	0.3736	0.3930	0.4134
Propane ($/litres):	1.3990	1.4690	1.5424	1.6195	1.7005	1.7855	1.8748	1.9685	2.0670	2.1703	2.2788	2.3928	2.5124	2.6380	2.7699	2.9084	3.0538	3.2065	3.3669	3.5352	3.7120
Water ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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 Furnace 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:	-$17,671	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		-$1,430	-$1,504	-$1,582	-$1,664	-$1,751	-$1,842	-$1,938	-$2,039	-$2,145	-$2,256	-$2,374	-$2,497	-$2,627	-$2,763	-$2,907	-$3,058	-$3,217	-$3,385	-$3,561	-$3,746
Annual Savings (M03):		$2,962	$3,110	$3,266	$3,429	$3,600	$3,780	$3,969	$4,168	$4,376	$4,595	$4,825	$5,066	$5,319	$5,585	$5,865	$6,158	$6,466	$6,789	$7,129	$7,485
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:	-$17,671	$1,532	$1,606	$1,683	$1,764	$1,849	$1,938	$2,032	$2,129	$2,232	$2,339	$2,451	$2,569	$2,693	$2,822	$2,958	$3,100	$3,249	$3,405	$3,568	$3,739
Cash Balance:	-$17,671	-$16,139	-$14,533	-$12,849	-$11,085	-$9,235	-$7,297	-$5,265	-$3,136	-$904	$1,435	$3,886	$6,455	$9,148	$11,970	$14,928	$18,028	$21,276	$24,681	$28,249	$31,988
Undepreciated Amount:	-$17,671	-$15,021	-$12,767	-$10,852	-$9,224	-$7,841	-$6,665	-$5,665	-$4,815	-$4,093	-$3,479	-$2,957	-$2,514	-$2,137	-$1,816	-$1,544	-$1,312	-$1,115	-$948	-$806	-$685

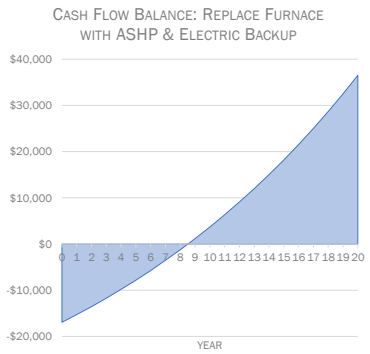
Energy Conservation Measure 4

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Furnace with ASHP & Electric Backup

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$2,685**
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):	-12,530
Propane (litres):	2,475
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	3.5
Financials	
Annual Utility Savings:	$1,583
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$13,551
Engineering & PM:	$2,033
Contingency:	$1,355
Project Costs:	$16,938
Simple Payback:	10.7
Capital Payback:	#NAME?
NPV:	$7,886
IRR:	12.0%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	88,168	78,113
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace Furnace with ASHP & Electric Backup

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

End-Use	Existing			Replace Furnace with ASHP & Electric Backup			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)					
Space Cool	0.0	0.0	0.0	0.0	0.0	10.0	-10	0					
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	17.8	87.2	43,348.1	23.4	0.0	23,380.0	-5,580	2,475					
HP Supp.	0.0	0.0	0.0	4.3	0.0	4,280.0	-4,280	0					
Hot Water	0.9	0.0	890.0	0.9	0.0	890.0	0	0					
Vent. Fans	0.2	0.0	240.0	2.8	0.0	2,830.0	-2,590	0					
Pumps & Aux	0.0	0.0	0.0	0.1	0.0	70.0	-70	0					
Ext. Usage	0.1	0.0	80.0	0.1	0.0	80.0	0	0					
Misc. Equip	1.6	0.0	1,580.0	1.6	0.0	1,580.0	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	4.4	0.0	4,380.0	4.4	0.0	4,380.0	0	0					
0	**25**	**87**	**50,518**	**38**	**0**	**37,500**	**-12,530**	**2,475**	**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: Replace Furnace with ASHP & Electric Backup

Cost Breakout: Replace Furnace with 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				New ASHP										$0	$0	$0	$0
112	0	0				ASHP Outdoorunit	4 Ton Cooling, 24 MBH Heating	each	Means 24	$3,465	$1,375		Yes	Project	1	$5,319	$2,115	$0	$7,434
113	0	0				Indoor Units	fan coil unit (heating and ventilating)	each	Means 24	$580	$850		Yes	Project	1	$890	$1,307	$0	$2,198
114	0	0				Tube/wiring kit	25ft kit	each	Means 24	$53	$39		Yes	Project	1	$81	$60	$0	$141
115	0	0				Electric Furnace	30 kW	each	Means 24	$600	$305		Yes	Project	1	$921	$469	$0	$1,390
116	0	0				Elect Instalation for Interior Unit										$0	$0	$0	$0
117	26	05.19.90	Electrical	Wire	Cu-XHHW-#12, 1 Wire, 25A, 21kW			100 LF	Means '18	$18	$43	$0	Yes	Project	4	$113	$261	$0	$374
118	26	05.33.13	Electrical	Conduit	PVC Conduit-1/2" (3x#8,4x#10)	PVC Conduit	1/2" (3x#8,4x#10)	LF	Means '18	$1	$2	$0	Yes	Project	100	$137	$377	$0	$513
119	26	28	Electrical	Circuit Breakers	Circuit Breaker - NEMA 1-600V, 30A	Circuit Breaker - NEMA 1	600V, 30A	Each	Means '18	$520	$146	$0	Yes	Project	1	$798	$225	$0	$1,023
120	26	05.33.18	Electrical	Pull Boxes	Pull Box-10"x10"x6" diam	Pull Box	10"x10"x6" diam	Each	Means '18	$20	$85	$0	Yes	Project	1	$30	$130	$0	$160
121	0	0				Elect Instalation for Exterior Unit							Yes	Project		$0	$0	$0	$0
122	26	05.19.90	Electrical	Wire	Cu-XHHW-#12, 1 Wire, 25A, 21kW	Cu-XHHW	#12, 1 Wire, 25A, 21kW	100 LF	Means '18	$18	$43	$0	Yes	Project	2	$56	$131	$0	$187
123	26	05.33.13	Electrical	Conduit	PVC Conduit-1/2" (3x#8,4x#10)	PVC Conduit	1/2" (3x#8,4x#10)	LF	Means '18	$1	$2	$0	Yes	Project	25	$34	$94	$0	$128
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:	**$8,381**	**$5,170**	**$0**	**$13,551**

Escalation Rates: Replace Furnace with ASHP & Electric Backup

Cash Flow Balance: Replace Furnace with 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:	-$16,938	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M01):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M02):		-$1,977	-$2,080	-$2,188	-$2,302	-$2,422	-$2,548	-$2,680	-$2,819	-$2,966	-$3,120	-$3,283	-$3,453	-$3,633	-$3,822	-$4,020	-$4,230	-$4,449	-$4,681	-$4,924	-$5,180
Annual Savings (M03):		$3,636	$3,817	$4,008	$4,209	$4,419	$4,640	$4,872	$5,116	$5,372	$5,640	$5,922	$6,218	$6,529	$6,856	$7,198	$7,558	$7,936	$8,333	$8,750	$9,187
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:	-$16,938	$1,658	$1,737	$1,820	$1,907	$1,997	$2,093	$2,192	$2,296	$2,405	$2,520	$2,640	$2,765	$2,896	$3,034	$3,178	$3,329	$3,487	$3,652	$3,825	$4,007
Cash Balance:	-$16,938	-$15,280	-$13,542	-$11,722	-$9,815	-$7,818	-$5,725	-$3,533	-$1,237	$1,168	$3,688	$6,328	$9,093	$11,989	$15,023	$18,201	$21,529	$25,016	$28,668	$32,494	$36,501
Undepreciated Amount:	-$16,938	-$14,397	-$12,238	-$10,402	-$8,842	-$7,516	-$6,388	-$5,430	-$4,615	-$3,923	-$3,335	-$2,834	-$2,409	-$2,048	-$1,741	-$1,480	-$1,258	-$1,069	-$909	-$772	-$657

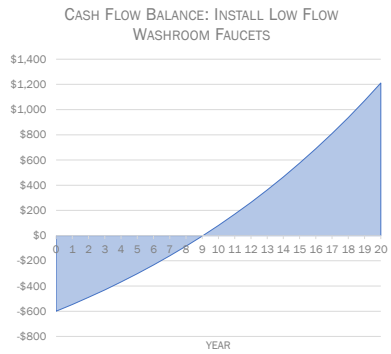
Energy Conservation Measure 5

Opp Cat:	Water
Opp Desc:	Install Low Flow Faucet Aerators in Washrooms
Opp Name:	Install Low Flow 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):	340
Propane (litres):	0
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.01
Financials	
Annual Utility Savings:	$51
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$480
Engineering & PM:	$72
Contingency:	$48
Project Costs:	$600
Simple Payback:	11.8
Capital Payback:	#NAME?
NPV:	$233
IRR:	11.2%



Write-ups	
Existing:	Most washrooms
Retrofit:	We recommend

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	103,594	103,934
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Low Flow 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 Washroom Faucets			Savings		Existing			
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	DHW Cons - kWh	Adj DHW Cons - kWh	WR Faucets - gpm	% of DHW used for WR Faucets
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0	890	890	2.2	80%
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	17.8	87.2	43,348.1	17.8	87.2	43,348.1	0	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.9	0.0	890.0	0.7	0.0	710.0	180	0				
Vent. Fans	0.2	0.0	240.0	0.2	0.0	240.0	0	0				
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.1	0.0	80.0	0.1	0.0	80.0	0	0				
Misc. Equip	1.6	0.0	1,580.0	1.6	0.0	1,580.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	4.4	0.0	4,380.0	4.4	0.0	4,380.0	0	0				
0	**25**	**87**	**50,518**	**25**	**87**	**50,338**	**180**	**0**	**890**	**890**	**2**	**1**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Install Low Flow Washroom Faucets

Cost Breakout: Install Low Flow 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 Faucets	0.5 GPM	Eah	Web Search	$125	$31	$0	Yes	Project	2	$384	$96	$0	$480
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:	**$384**	**$96**	**$0**	**$480**

Escalation Rates: Install Low Flow Washroom Faucets

Cash Flow Balance: Install Low Flow 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:	-$600	$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):		$54	$56	$59	$62	$66	$69	$73	$76	$80	$85	$89	$94	$99	$104	$109	$115	$121	$127	$134	$140
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:	-$600	$54	$56	$59	$62	$66	$69	$73	$76	$80	$85	$89	$94	$99	$104	$109	$115	$121	$127	$134	$140
Cash Balance:	-$600	-$546	-$490	-$431	-$368	-$302	-$233	-$161	-$84	-$4	$81	$170	$264	$362	$466	$575	$689	$810	$937	$1,071	$1,211
Undepreciated Amount:	-$600	-$510	-$433	-$368	-$313	-$266	-$226	-$192	-$163	-$139	-$118	-$100	-$85	-$73	-$62	-$52	-$45	-$38	-$32	-$27	-$23

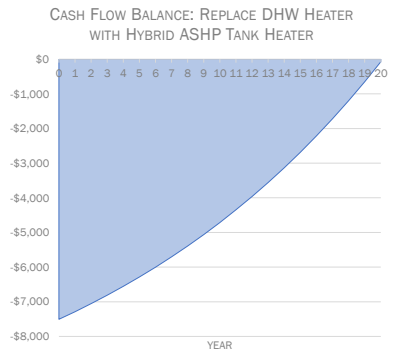
Energy Conservation Measure 6

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

Costing Setup	
Engineering & PM:	**5%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$2,536**
Avoided Capital Year:	
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,394
Propane (litres):	0
Water (m³):	0
Natural Gas (m³):	0
():	0
Emissions (Tonnes of CO_2e):	0.0
Financials	
Annual Utility Savings:	$209
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$6,527
Engineering & PM:	$326
Contingency:	$653
Project Costs:	$7,506
Simple Payback:	35.9
Capital Payback:	#NAME?
NPV:	-$4,088
IRR:	-0.1%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	80,245	81,639
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace DHW Heater with Hybrid ASHP Tank Heater

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

End-Use	Existing			Replace DHW Heater with Hybrid ASHP Tank Heate			Savings		Existing		Retrofit	
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	DHW Cons - kWh	Adj DHW Cons - kWh	Adj DHW Cons - KWh	ASHP Offset
Space Cool	0.0	0.0	0.0	0.0	0.0	0.0	0	0	890	890	890	85%
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	17.8	87.2	43,348.1	0.0	0.0	0.0	17,800	2,475				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	0.9	0.0	890.0	0.0	0.0	0.0	890	0				
Vent. Fans	0.2	0.0	240.0	0.0	0.0	0.0	240	0				
Pumps & Aux	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Ext. Usage	0.1	0.0	80.0	0.0	0.0	0.0	80	0				
Misc. Equip	1.6	0.0	1,580.0	0.0	0.0	0.0	1,580	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	4.4	0.0	4,380.0	0.0	0.0	0.0	4,380	0				
0	**25**	**87**	**50,518**	**0**	**0**	**0**	**24,970**	**2,475**	**890**	**890**	**890**	**1**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	M02	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Replace DHW Heater with Hybrid ASHP Tank Heater

Cost Breakout: Replace DHW Heater with Hybrid ASHP Tank Heater

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				Demolition	Remove Existing	Each	EE Est	$0	$500	$0	Yes	Both	1	$0	$769	$0	$769
111	0	0				Hybrid Tank Heater	80 Gal 4.5 kW	Each	Web Search	$3,500	$250	$0	Yes	Project	1	$5,373	$385	$0	$5,758
112	0	0											Yes	Project		$0	$0	$0	$0
113	0	0				Electric Tank Heater	3 kW	Each	Web Search	$750	$250	$0	Yes	Avoided	1	$1,151	$385	$0	$1,536
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0											Yes	Project		$0	$0	$0	$0
117	0	0											Yes	Project		$0	$0	$0	$0
118	0	0											Yes	Project		$0	$0	$0	$0
119	0	0											Yes	Project		$0	$0	$0	$0
120	0	0											Yes	Project		$0	$0	$0	$0
121	0	0											Yes	Project		$0	$0	$0	$0
122	0	0											Yes	Project		$0	$0	$0	$0
123	0	0											Yes	Project		$0	$0	$0	$0
124	0	0											Yes	Project		$0	$0	$0	$0
125	0	0											Yes	Project		$0	$0	$0	$0
126	0	0											Yes	Project		$0	$0	$0	$0
127	0	0											Yes	Project		$0	$0	$0	$0
128	0	0											Yes	Project		$0	$0	$0	$0
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0											Yes	Project		$0	$0	$0	$0
131	0	0											Yes	Project		$0	$0	$0	$0
132	0	0											Yes	Project		$0	$0	$0	$0
133	0	0											Yes	Project		$0	$0	$0	$0
134	0	0											Yes	Project		$0	$0	$0	$0
135	0	0											Yes	Project		$0	$0	$0	$0
136	0	0											Yes	Project		$0	$0	$0	$0
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0											Yes	Project		$0	$0	$0	$0
139	0	0											Yes	Project		$0	$0	$0	$0
140	0	0											Yes	Project		$0	$0	$0	$0
141	0	0											Yes	Project		$0	$0	$0	$0
142	0	0											Yes	Project		$0	$0	$0	$0
143	0	0											Yes	Project		$0	$0	$0	$0
144	0	0											Yes	Project		$0	$0	$0	$0
145	0	0											Yes	Project		$0	$0	$0	$0
146	0	0											Yes	Project		$0	$0	$0	$0
147	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$5,373**	**$1,154**	**$0**	**$6,527**

Escalation Rates: Replace DHW Heater with Hybrid ASHP Tank Heater

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	11.8277	12.5374	13.2896	14.0870	14.9322	15.8281	16.7778	17.7845	18.8516	19.9827	21.1816	22.4525	23.7997	25.2276	26.7413	28.3458	30.0465	31.8493	33.7603	35.7859	37.9330
Electricity ($/kWh):	0.1500	0.1578	0.1660	0.1746	0.1837	0.1933	0.2033	0.2139	0.2250	0.2367	0.2490	0.2620	0.2756	0.2899	0.3050	0.3209	0.3376	0.3551	0.3736	0.3930	0.4134
Propane ($/litres):	1.3990	1.4690	1.5424	1.6195	1.7005	1.7855	1.8748	1.9685	2.0670	2.1703	2.2788	2.3928	2.5124	2.6380	2.7699	2.9084	3.0538	3.2065	3.3669	3.5352	3.7120
Water ($/m³):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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 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:	-$7,506	$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):		$220	$231	$244	$256	$269	$283	$298	$314	$330	$347	$365	$384	$404	$425	$447	$471	$495	$521	$548	$576
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:	-$7,506	$220	$231	$244	$256	$269	$283	$298	$314	$330	$347	$365	$384	$404	$425	$447	$471	$495	$521	$548	$576
Cash Balance:	-$7,506	-$7,286	-$7,054	-$6,811	-$6,555	-$6,285	-$6,002	-$5,703	-$5,390	-$5,060	-$4,712	-$4,347	-$3,963	-$3,559	-$3,133	-$2,686	-$2,215	-$1,720	-$1,199	-$651	-$75
Undepreciated Amount:	-$7,506	-$6,380	-$5,423	-$4,610	-$3,918	-$3,330	-$2,831	-$2,406	-$2,045	-$1,738	-$1,478	-$1,256	-$1,068	-$908	-$771	-$656	-$557	-$474	-$403	-$342	-$291