1421 Lansdowne St. W.

Peterborough, ON, K9J 7M3

Climate Action Roadmap

1421 Lansdowne

EFFICIENCY ENGINEERING .COM
A Kontrol Technologies Company

peterborough

EE Project #: 22-198

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List of Abbreviations

AC – Air Conditioner
AHU – Air Handling Unit
ASHP – Air Source Heat Pump
ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers
BAU – Business as Usual
CDD – Cooling Degree Days
CEM – Certified Energy Manager
CFL – Compact Fluorescent Lamp
DHW – Domestic Hot Water
ECM – Energy Conservation Measure
EIFS – Exterior Insulation and Finishing System
ERV – Energy Recovery Ventilator
EUI - Energy Use Intensity
GA - Global Adjustment
GHG - Green House Gases
GSHP - Ground Source Heat Pump
HDD – Heating Degree Days
HOEP - Hourly Ontario Energy Price
HPS – High Pressure Sodium
HRU - Heat Recovery Unit
HVAC – Heating Ventilation and Air Conditioning.
IAQ - Air Quality and Comfort
IRR – Internal Rate of Return
kW - Kilowatt
kWh – Kilowatt Hour
kVA – Kilovolt Ampere
KPI – Key Performance Indicator
LCC - Life Cycle Cost
LCCA – Life Cycle Cost Analysis
LDC – Local Distribution Company
LED – Light Emitting Diode
MARR – Minimum Acceptable Rate of Return
MW – Megawatt
NPV – Net Present Value
RTU – Rooftop Unit
RSMeans – Cost Data Base
WMO ID – World Meteorological Organization Identification

1 The Executive Summary

A comprehensive site investigation was performed by Efficiency Engineering at 1421 Lansdowne for the City of Peterborough. The purpose of this report is to catalogue the existing energy and water consuming systems in the building, highlight the deficiencies of these systems, provide recommendations on how to improve the energy and water efficiency of these systems, and develop a path forward to achieve 50% Greenhouse Gas (GHG) emissions reductions by 2030 and 100% GHG emission reductions by 2040. Two (2) paths were identified – a business-as-usual case where equipment is replaced as it reaches end of life and a more aggressive path that maximizes energy reductions.

1.1 Building Overview

The following table summarizes the facility details:

TABLE 1.1: FACILITY DETAILS

Address:	1421 Lansdowne St. W.
	Peterborough, ON
Facility Area:	102,178ft^2
Building Type:	Community Centre
Year Constructed:	1963
Number of Stories:	2

1.1.1 Existing Building Profile

1421 Lansdowne Street contains a church tenancy in the south portion of the building, and the north portion will soon be renovated as a police services building.

The south portion of the building is served by four (4) gas-fired rooftop units with the main auditorium served by a large air handling unit located in the mechanical room. The AHU is provided hot and chilled water by an atmospheric boiler and chiller plant, also located in the mechanical room.

The north portion of the building is served by several air handling units ducted to different areas of the building. Most of the AHUs are heated using electric duct heaters, although some use hot water coils served by one of the two other boiler plants. The boiler plant in the main section of the building consists of two condensing boilers. The other gas-fired boiler plant, located in the basement of the police offices, contains two forced draft boilers. Other than serving heating coils in some of the AHUs, the boilers also serve separate perimeter heating loops.

Domestic hot water is provided solely by electric water heaters. The south portion of the building has its own heater, while the north portion has two.

The building is illuminated by a variety of technology, but primarily T8 fluorescent. Some LED can be found scattered around the building. Exterior lighting has been upgraded to LED. Water fixtures (toilets, shower heads, faucets, etc.) were observed to be standard flow.

The original building was constructed over 60 years ago as a manufacturing facility for Johnson & Johnson; however, the south portion of the building was constructed in 1993 with a major renovation in 2002 to increase the height of the roof to accommodate the church assembly space.

There are currently plans underway to undergo substantial renovations of the north portion of the building. These renovations will involve re-purposing all spaces (including the cafeteria and kitchen) as offices, meeting rooms, administration, etc.

1.1.2 Existing Energy & GHG Emissions

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

TABLE 1.2: EXISTING ENERGY KPI DETAILS

Utility	Consumption	EUI* (ekWh/ft²)	Total Energy (ekWh)	Emissions (tCO_2e)	Total Cost ($)
Electricity	547,475 kWh	5.3	547,475	15	$69,072
Natural Gas	95,789 m^3	9.7	988,542	185	$38,929
Total	**N/A**	**15.0**	**1,536,016**	**200**	**$110,301**

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

1.2 Master List of Measures

Opp. #	Opportunity	Demand (kW)	Electricity (kWh)	Nat Gas (m^3)	Water (m^3)	GHG Emissions (tCO_2e)	Annual Savings	Project Costs	Cost per tCO_2e	Simple Payback	Capital Payback	NPV	IRR
1	Install Low Flow Water Fixtures	0	17,400	0	113	0.5	$2,460	$7,210	$0	2.9	2.7	$32,212	40.7%
2	Install LED Lighting	300	167,900	-12,226	0	-18.9	$16,214	$229,901	$96	14.2	10.5	$36,189	9.0%
3	Install High Efficiency Windows	0	2,970	6,323	0	12.3	$2,944	$476,315	$945	161.8	30.6	($232,516)	-3.9%
4	Install EIFS	0	-890	10,281	0	19.8	$4,066	$2,996,711	$7,388	737.0	73.3	($2,931,195)	-18.7%
5	Increase Roof Insulation	0	-70	10,369	0	20.0	$4,205	$2,949,357	$3,344	701.4	49.4	($1,339,834)	-6.0%
6	Replace Gas-Fired Boilers with Electric	-332	-277,950	34,103	0	58.1	-$21,208	$667,662	$875	No Payback	No Payback	($1,017,342)	No IRR
7	Install Hybrid ASHP DHW Heater Tanks	107	22,470	0	0	0.6	$2,835	$179,220	$6,063	63.2	21.0	($76,296)	-0.6%
8	Install Hybrid ASHP RTUs w/ Gas Backup	-111	-82,820	19,350	0	35.1	-$2,585	$712,374	$701	No Payback	No Payback	($491,530)	No IRR
9	Install Hybrid ASHP RTUs w/ Electric Backup	-161	-134,450	26,269	0	47.0	-$6,287	$657,088	$811	No Payback	No Payback	($762,213)	No IRR
10	Install a Building Automation System	0	1,580	4,798	0	9.3	$2,149	$37,842	$17	17.6	12.4	($3,150)	6.4%
11	Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler	-25	8,560	15,037	0	29.3	$7,191	$1,515,390	$1,268	210.7	36.6	($742,669)	-6.9%
12	Replace North Side AHUs with VRF and Heat Recovery	-40	-10,290	61,474	0	118.5	$23,685	$4,452,152	$889	188.0	33.2	($2,106,407)	-5.1%
13	Implement Demand Control Ventilation for AHU-1	0	80	9,401	0	18.2	$3,831	$7,027	$0	1.8	1.7	$54,723	62.3%

1.3 GHG Reduction Pathways

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

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

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

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

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

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

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

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

Roadmap 4 – Business-As-Usual

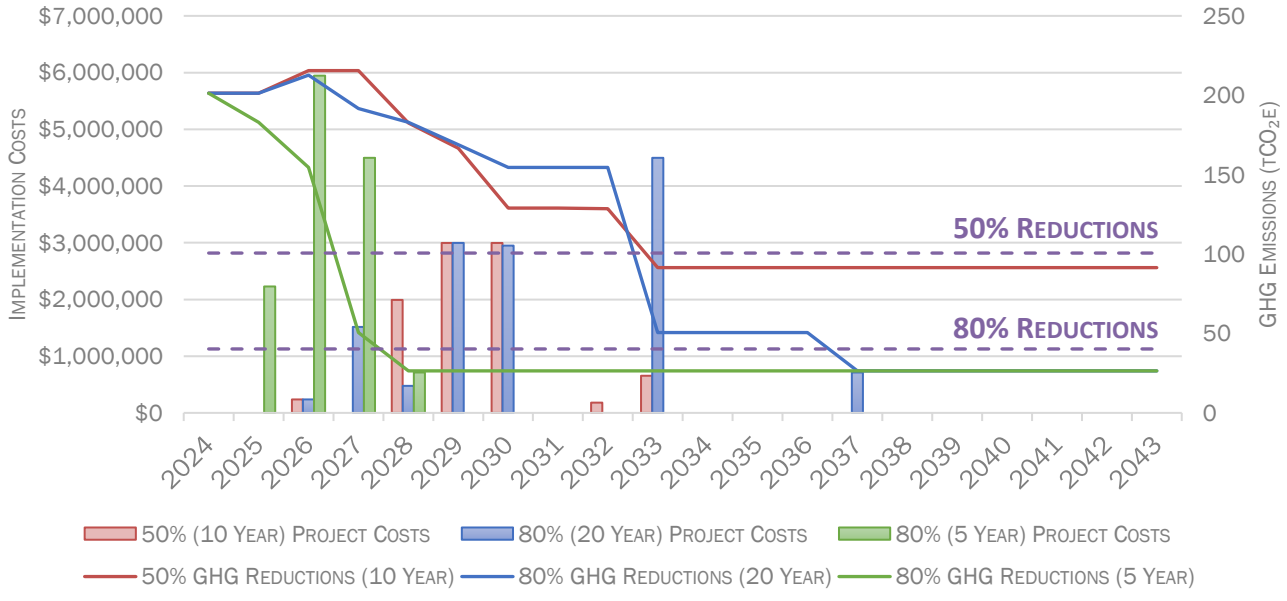
The Business-As-Usual Roadmap will include the project costs associated with replacing the equipment with like-for-like equivalents. This will provide a cost baseline for the other roadmaps to understand how much additional capital is required to implement the more energy efficient options.

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

TABLE 1.3: SUMMARY OF SCENARIO LEVEL ANALYSIS

Opp. #	Opportunity	50% Reduction Pathway (10 Year)	80% Reduction Pathway (20 Year)	80% Reduction Pathway (5 Year)
1	Install Low Flow Water Fixtures	•	•	•
2	Install LED Lighting	•	•	•
3	Install High Efficiency Windows	•	•	•
4	Install EIFS	•	•	•
5	Increase Roof Insulation	•	•	•
6	Replace Gas-Fired Boilers with Electric			
7	Install Hybrid ASHP DHW Heater Tanks	•		
8	Install Hybrid ASHP RTUs w/ Gas Backup		•	•
9	Install Hybrid ASHP RTUs w/ Electric Backup	•		
10	Install a Building Automation System	•	•	•
11	Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler	•	•	•
12	Replace North Side AHUs with VRF and Heat Recovery		•	•
13	Implement Demand Control Ventilation for AHU-1	•	•	•

FIGURE 1.3.1.1: GHG REDUCTION PATHWAY SUMMARY



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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 2.1: 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 2.2: FINANCIAL FACTORS

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

3 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 3.3.1: FACILITY DETAILS

Address:	1421 Lansdowne St. W.
	Peterborough, ON
Facility Area:	102,178ft^2
Building Type:	Community Centre, Offices
Year Constructed:	1963
Number of Stories:	2

3.1 Heating, Cooling & Ventilation

The building is separated into a north and south section. The south section (which is occupied by 1421 Lansdowne) is provided heating, cooling and ventilation via several RTUs and an air handling unit.

The large air handling unit supplies the main auditorium. It uses hot water and chilled water supplied by a boiler and chiller to condition the air. Details regarding coil capacities and airflow are not available.

TABLE 3.2: SOUTH BUILDING BOILER DETAILS

Tag ID	Type	Capacity	Efficiency	Condition	Age
B-1	Atmospheric	1,200 MBH	81%	Poor	22 years

TABLE 3.3: COOLING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition	Age
Chiller	Reciprocating	24 tons	~4.0 COP	Poor	31 years

The remainder of the south portion of the building is served by several rooftop units.

TABLE 3.4: ROOFTOP UNIT DETAILS

Tag ID	Make	Model #	Capacity	HP	Airflow	Condition
RTU-1	York	ZF060N10N5AAA1A	125 MBH	1.5	1,750 CFM	Fair
RTU-2	Trane	YSC092AWRHA10F	200 MBH	2.0	3,000 CFM	Fair
RTU-3	Trane	YSC120AWRKA14H	250 MBH	3.0	4,000 CFM	Fair
RTU-4	Trane	YSC092AWRHA10F	200 MBH	2.0	3,000 CFM	Fair

The north section of the building is served by several old air handling units and two separate boiler plants. The air handlers are original to the building and details regarding their specifications are

unknown. They are generally equipped with duct heaters, although a number of them are served by the boiler plants.

TABLE 3.5: NORTH BUILDING BOILER DETAILS

Tag ID	Serves	Type	Capacity	Efficiency	Condition	Age
B-2	Main Building	Condensing	600 MBH	97.5%	Good	10 years
B-3	Main Building	Condensing	600 MBH	97.5%	Good	10 years
B-4	Police Services	Forced Draft	500 MBH	84%	Fair	Unknown
B-5	Police Services	Atmospheric	700 MBH	80%	Poor	48 years

3.2 Domestic Hot Water

Domestic hot water is provided by several electric heater tanks. One tank serves the south portion of the building, and two more serve the north.

TABLE 3.6: DHW EQUIPMENT DETAILS

Tag ID	Serves	Boiler Type	Capacity	Efficiency	Condition
HWT-1	South Building	Electric	4,500 W	100%	Poor
HWT-2	North Building	Electric	3,000 W	100%	Good
HWT-3	North Building	Electric	3,000 W	100%	Good

3.3 Building Envelope

The north portion of the building was constructed in 1963 as a manufacturing facility. It has little-to-no insulation in the exterior walls and minimal insulation in the roof. Most of the windows are single glazed with wood frames. The south building has a steel-frame construction with R-20 batt insulation in the walls and R-20 rigid insulation on the roof. Windows are generally double-glazed with aluminum frames.

The envelope for the north portion of the building is in very poor condition and is in need of a renewal. Single-glaze windows and exterior walls with no insulation lead to excessive amounts of heat loss. There are reportedly leaks in the pitched room. The envelope for the south portion of the building appears to be in good condition.

3.4 Water Fixtures

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

TABLE 3.7: WATER FIXTURE DETAILS

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

3.5 Lighting

The building is illuminated by a variety of technology, but primarily T8 fluorescent. Some LED can be found scattered around the building. Exterior lighting has been upgraded to LED. A full, room-by-room lighting count is available in the Appendices.

3.6 Controls

All equipment use stand-alone controls. There is no central building automation system.

3.7 Electrical Service

The site is serviced by a 750 kVA 600V/347V pad mounted step-down transformer. This supplies the main disconnect for the facility, which is rated at 1,200A.

Actual demand data was not available, but according to the energy model used in this analysis, the annual peak demand is approximately 220 kW.

4 The Energy Usage Report

4.1 Utility Meters

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

TABLE 4.1.1: UTILITY METER DETAILS

Utility	Units	Escalation Rate	Marginal Rate ($/Unit)	GHG Emissions (Tonnes/Unit)
Electricity	kW	5.2%	$0.1262	0.000028
Natural Gas	m^3	5.0%	$0.4064	0.001932
Water	m^3	3.0%	$2.3396	0.000000

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

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

4.2 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.

4.3 Meter Modeling

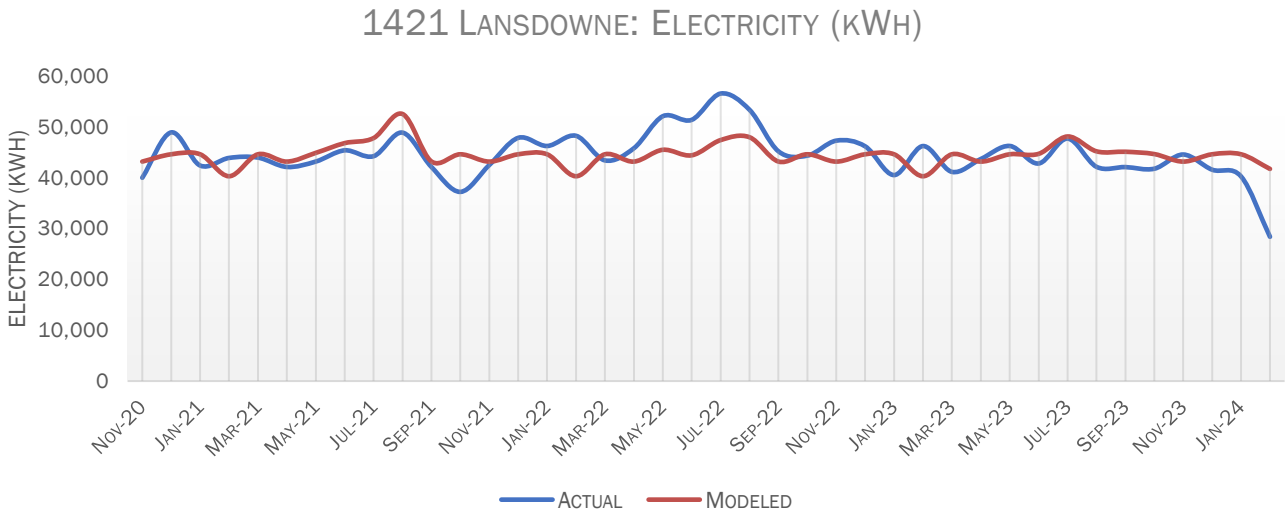
Daily mean temperatures from Peterborough (WMO ID 71436) were used in creating the baseline models for this facility.

4.3.1 Electricity

Baseline Equation:

Electricity (kWh) = Days x 1439.26 + CDD x 131.75.
The underlying regression of this baseline equation is R^2 = 0.9901.
CDD (Cooling Degree Days) calculated using a balance point of 20°C.
In a typical year, consumption will be 547,475 kWh.

Modeling Graphs:



Rate Structure:

Electricity for this building is provided by Hydro One. It is classified as a General Service account with a monthly demand of between 50 and 999 kW. This is a "Standard Rate" structure which charges electricity based on the Hourly Ontario Energy Price (HOEP) and Global Adjustment (GA). Both of these rates change from month-to-month as they are based on real-time market conditions. Regulatory Charges are also added to this cost on a per kWh basis.

Comments:

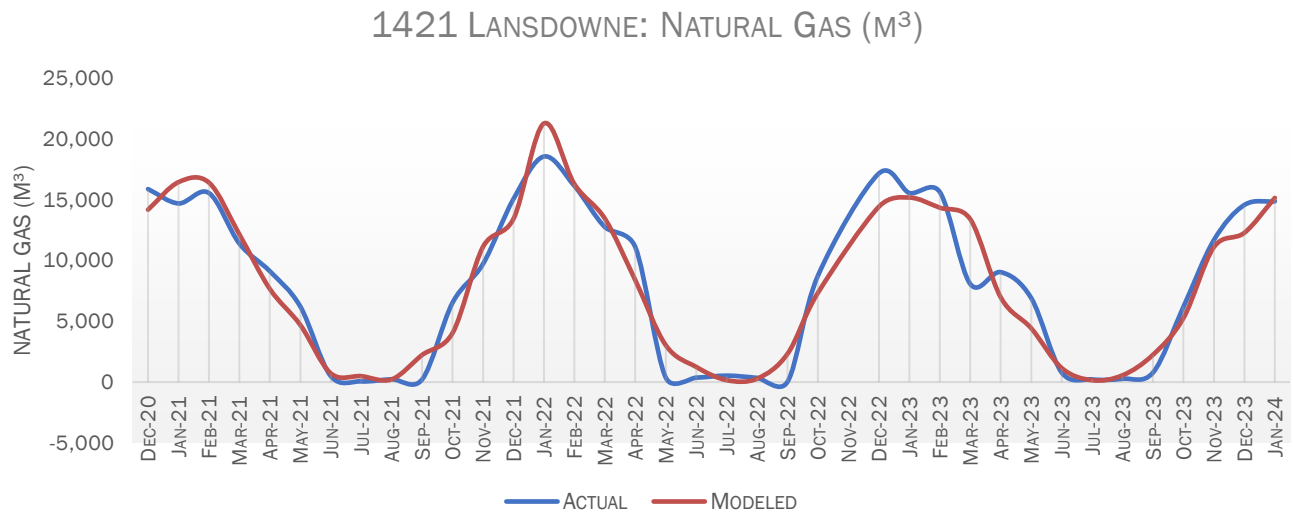
No anomalies or irregularities were noted during the modeling period of this report.

4.3.2 Natural Gas

Baseline Equation:

Natural Gas (m^3) = HDD x 22.48.
The underlying regression of this baseline equation is R^2 = 0.9697.
HDD (Heating Degree Days) calculated using a balance point of 18°C.
In a typical year, consumption will be 95,789 m^3.

Modeling Graphs:



Rate Structure:

Natural Gas for this building is provided by Enbridge. It is a "Block Rate" structure which charges set monthly rates for gas consumed, storage and adjustments and variable delivery charges based on "blocks" of gas consumption. For example, the Delivery portion of charges for gas consumed up to 1,000 cubic meters might be 3.7 ¢/m^3 while gas consumed between 7,000 and 20,000 cubic meters might have a Delivery charge of 3.4¢/m^3.

Comments:

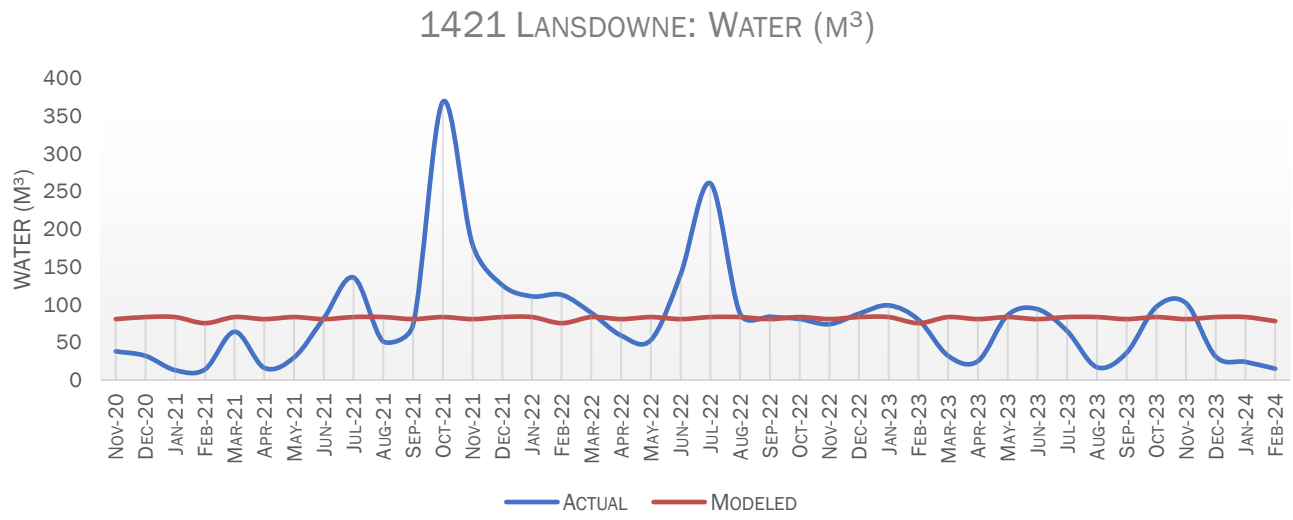
No anomalies or irregularities were noted during the modeling period of this report.

4.3.3 Water

Baseline Equation:

Water (m^3) = Days x 2.69.
The underlying regression of this baseline equation is R^2 = 0.5873.
In a typical year, consumption will be 983 m^3.

Modeling Graphs:



Rate Structure:

Water for this building is provided by the City of Peterborough. It is classified as a Commercial account. Billing for this account includes a flat daily rate (based on meter size) as well as both water consumed, and the associated wastewater produced. If the building uses 100 cubic meters of water in a given month, it is billed the daily service rate (based on meter size) as well as for the 100 m^3 of water and for 100m^3 of waste water.

Comments:

Water consumption at this facility is highly variable, seemingly with no measurable cause, making an accurate regression analysis difficult.

4.4 Building Energy Performance

The following section provides benchmarking information for the facility.

Electricity intensity for the building is 5.3 ekWh/ft² (0.2 GJ/m²). Natural Gas intensity for the building is 9.7 ekWh/ft² (0.37 GJ/m²). Total energy intensity for the building is 14.9 ekWh/ft² (0.58 GJ/m²).

The energy performance of 1421 Lansdowne 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:

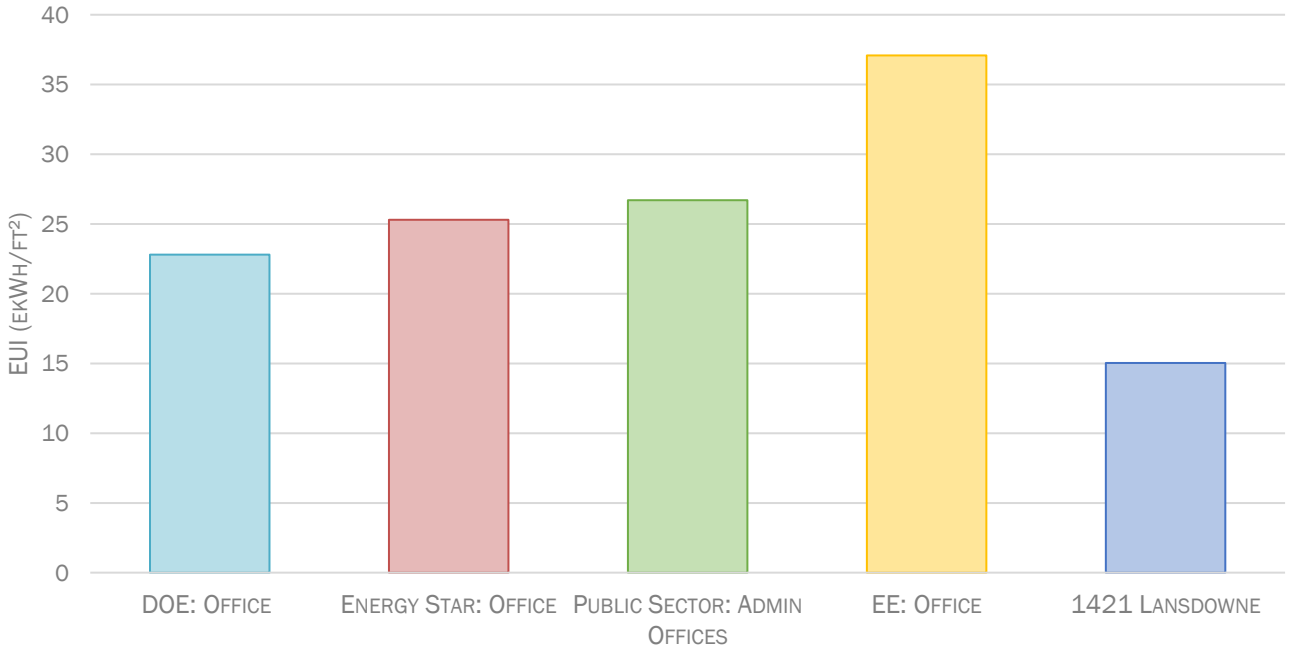
TABLE 4.4.1: BENCHMARKING SUMMARY

Benchmark	EUI	% Variance
DOE: Office	22.8	-34%
Energy Star: Office	25.3	-41%
Public Sector: Admin Offices	26.7	-44%
EE: Office	37.1	-59%
1421 Lansdowne	**15.0**	

*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.

FIGURE 4.4.4.1: WHOLE BUILDING ENERGY INTENSITY COMPARISON



4.5 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.

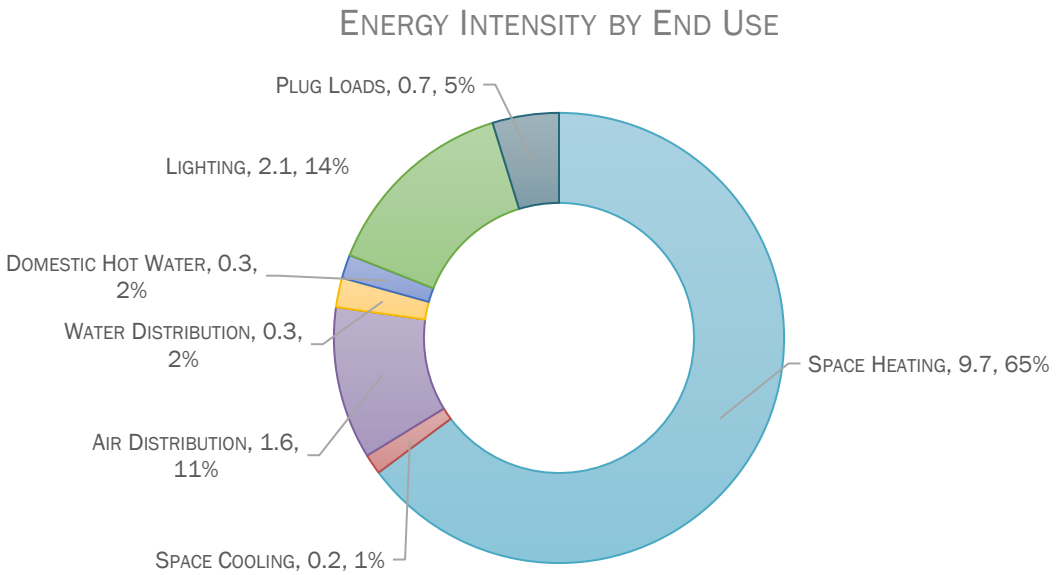
The end use energy breakdown for this facility is:

TABLE 4.5.1: END USE ENERGY BREAKOUT

End Use	Electricity (kWh)	Natural Gas (m^3)	EUI ($ekWh/ft^2$)	GHG Emissions (tCO_2e)
Space Heating	0	95,789	9.7	181.5
Space Cooling	22,144	0	0.2	0.6
Air Distribution	166,840	0	1.6	4.7
Water Distribution	32,320	0	0.3	0.9
Domestic Hot Water	25,850	0	0.3	0.7
Lighting	217,200	0	2.1	6.1
Plug Loads	72,700	0	0.7	2.0
Water	0	0	0.0	0.0
Other	10,420	0	0.1	0.3
Total	**539,993**	**95,789**	**15.0**	**200.4**

The following chart shows the energy intensity of 1421 Lansdowne broken out by end use.

FIGURE 4.5.1



4.6 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:

FIGURE 4.6.1: ANNUAL UTILITY COSTS

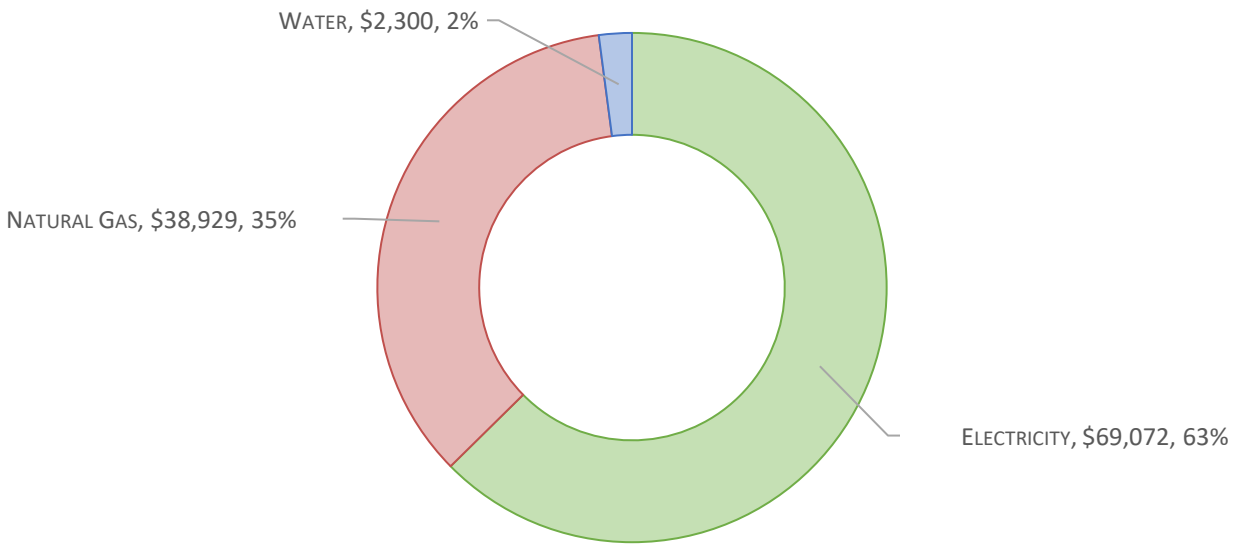
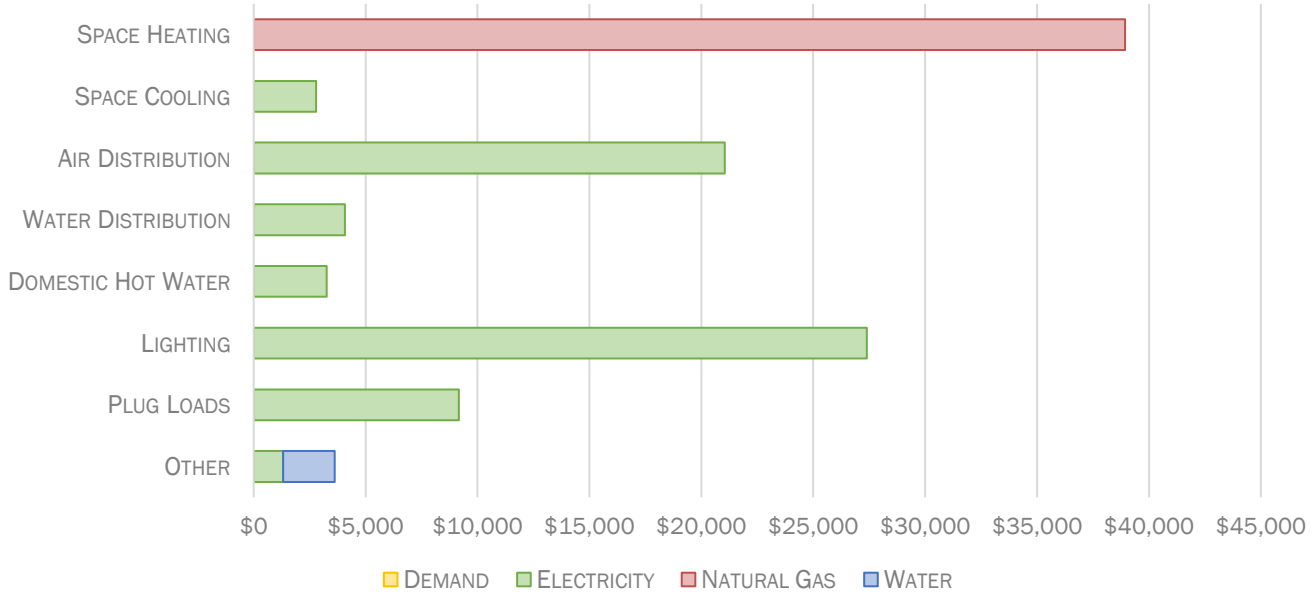


FIGURE 4.6.2: ENERGY COSTS BY END USE



5 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.

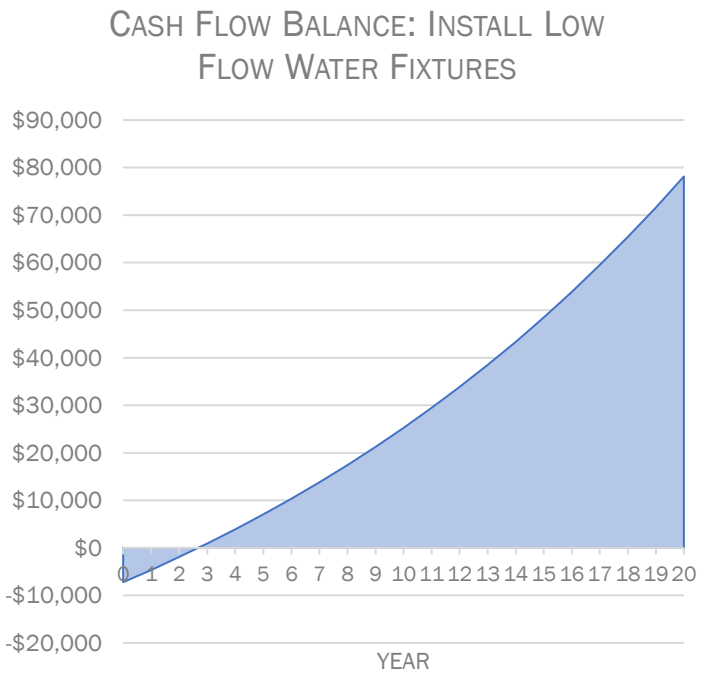
5.1 Opportunity 01: Install Low Flow Water Fixtures

The Detailed Financial Analysis

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

TABLE 5.1.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	17,400
Natural Gas (m^3):	0
Water (m^3):	113
Emissions (tCO_2e):	0.5
Financials	
Utility Savings:	$2,460
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$5,768
Engineering & PM:	$865
Contingency:	$577
Project Costs:	$7,210
Simple Payback:	2.9
Capital Payback:	2.7
NPV:	$32,212
IRR:	40.7%



Existing Conditions

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

TABLE 5.1.2: WATER FIXTURE DETAILS

Fixture	Flow
Bathroom Faucets:	2.2 GPM
Kitchen Faucets:	2.2 GPM
Shower Heads:	2.5 GPM

Retrofit Conditions

We recommend replacing these fixtures with low-flow variants: 1.0 GPM washroom faucets, 1.5 GPM kitchen faucets and 1.5 GPM showerheads. Installing these low flow fixtures will greatly reduce water consumption and water heating consumption.

As the building is fairly old, we recommend full fixture replacements for the faucets instead of merely changing out the aerators. The costs here reflect the additional costs of full fixture replacements.

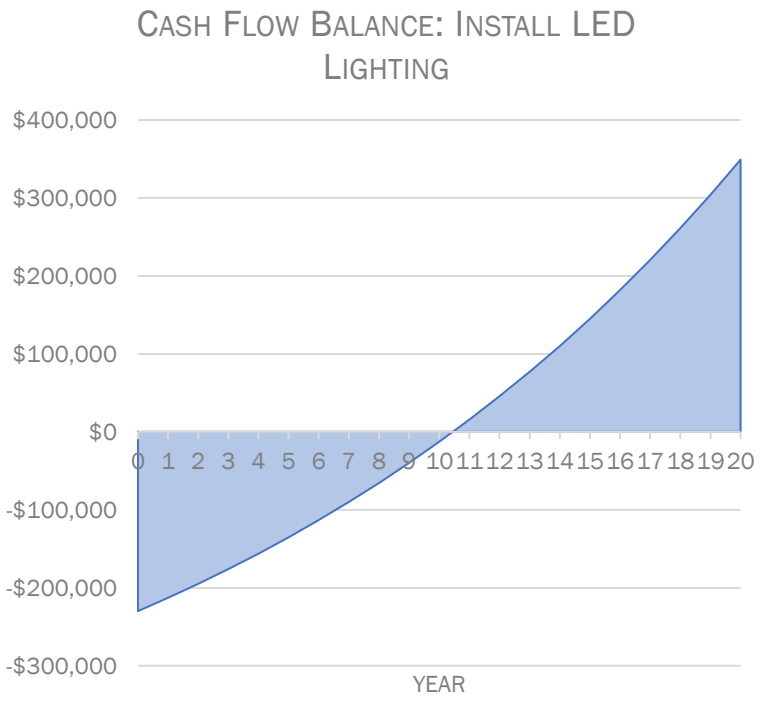
5.2 Opportunity 02: Install LED Lighting

The Detailed Financial Analysis

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

TABLE 5.2.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	167,900
Natural Gas (m³):	-12,226
Water (m³):	0
Emissions (tCO_2e):	-18.9
Financials	
Utility Savings:	$16,214
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$183,920
Engineering & PM:	$27,588
Contingency:	$18,392
Project Costs:	$229,901
Simple Payback:	14.2
Capital Payback:	10.45
NPV:	$36,189
IRR:	9.0%



Existing Conditions

The building is illuminated by a variety of technology, but primarily fluorescent T8. Some LED can be found scattered around the building. Exterior lighting has been upgraded to LED.

Retrofit Conditions

We recommend replacing all interior linear fluorescent T8 and T12 fixtures with LED equivalents.

Advantages of LED:

- Instant "ON/OFF"
- Work well with occupancy sensors/photocells/lighting control systems
- Dimmable
- Long Life (50,000-100,000+ hours)
- Reduced Maintenance Costs

- Good Colour Rendering (>80 CRI)
- Typical Colour Temperatures Availability from 2700K up to 5000K
- Many fixtures have option for Integrated Occupancy Sensors

In addition to the upfront energy savings, LEDs true savings lie in the reduced maintenance costs associated with lamp and ballast life. Typical LED fixtures are rated for 50,000 - 100,000+ hours as opposed to the 15,000 - 24,000 hour average lamp life for High Intensity Discharge (HID) or the 20,000 – 36,000 hour average lamp life for linear fluorescent lamps. Care should be taken in selecting a quality LED fixture which meets the needs of the application while being supported by a reputable company guaranteeing a lengthy warranty. LED fixtures should be either Design Lighting Consortium (DLC) listed or Energy Star Certified."

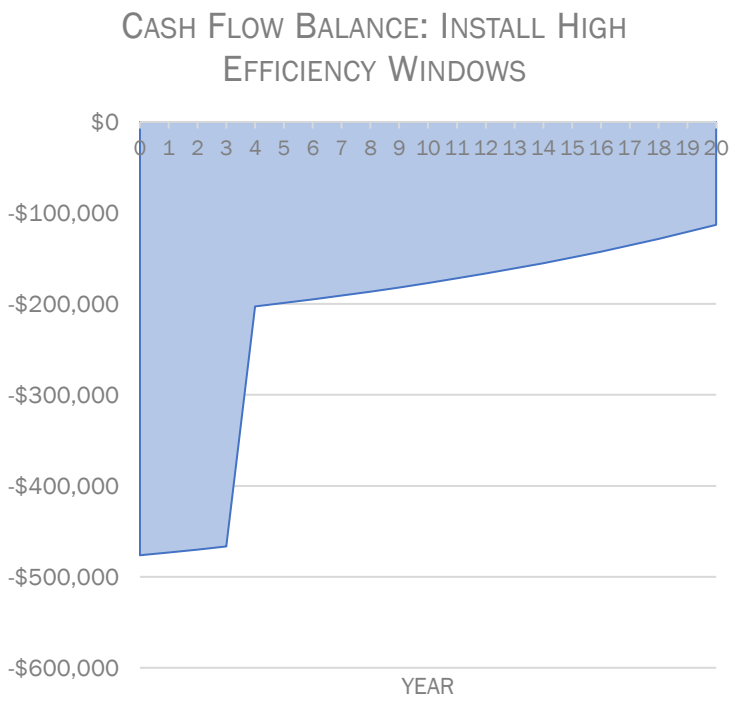
5.3 Opportunity 03: Install High Efficiency Windows

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 5.3.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	2,970
Natural Gas (m³):	6,323
Water (m³):	0
Emissions (tCO_2e):	12.3
Financials	
Utility Savings:	$2,944
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$381,052
Engineering & PM:	$57,158
Contingency:	$38,105
Project Costs:	$476,315
Simple Payback:	161.8
Capital Payback:	30.6
NPV:	-$232,516
IRR:	-3.9%



Existing Conditions

Visual inspection showed a lack of caulking around the windows which can cause air leakages, particularly on the north portion of the building. This leads to drafts and discomfort in the door area and also increases the heating and cooling loads on the building. Many windows on the north portion of the building appear to be single pane.

Retrofit Conditions

We recommend that the windows on the north section of the building be replaced with triple-glaze, argon-filled windows. Window frames should be made of thermally broken aluminum or fibreglass. 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.

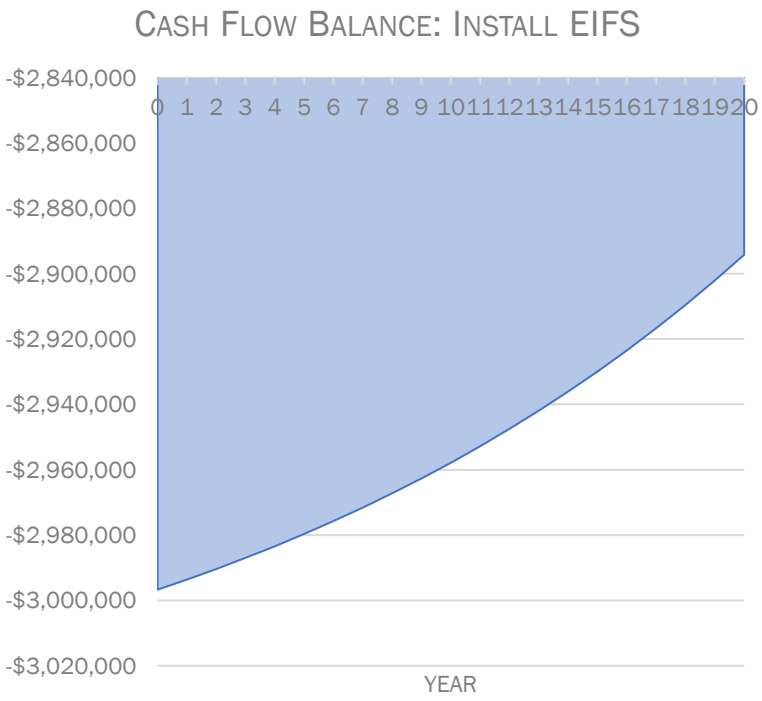
5.4 Opportunity 04: Install EIFS

The Detailed Financial Analysis

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

TABLE 5.4.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-890
Natural Gas (m³):	10,281
Water (m³):	0
Emissions (tCO_2e):	19.8
Financials	
Utility Savings:	$4,066
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$2,397,369
Engineering & PM:	$359,605
Contingency:	$239,737
Project Costs:	$2,996,711
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$2,931,195
IRR:	-18.7%



Existing Conditions

The exterior walls of the north section of the building are largely uninsulated or only very lightly insulated.

Retrofit Conditions

We recommend installing an exterior insulation and finish system (EIFS) on the exterior walls of the north portion of the building. An EIFS system typically contains about 4 inches of rigid insulation. One inch of rigid insulation provides an average R-value of 5 and a total of R20 in addition to the existing insulation. The insulation will be protected by an exterior veneer. Sealing the building with additional insulation will also greatly reduce the infiltration of the building, reducing the heating load and improving occupancy comfort.

Sealing the envelope has the added effect of increasing the impact of internal heating loads on the building. With heat from internal loads being less able to escape, the space heating equipment doesn't need to work as hard to satisfy set points.

However, this same effect has a negative impact on the cooling systems. Most cooling energy spent in a typical building is used to remove internal heating loads. There isn't as much heat transfer through the envelope in the summertime compared to winter due to the smaller difference in temperatures between the indoors and outdoors. Since heat from internal loads are now trapped in the building, this will increase the amount of energy required by space cooling systems. This accounts for the increase in electrical consumption for this EIFS measure shown in the table above.

This cooling penalty is fairly negligible to begin with and since we are in a heating dominated climate, the positive effect of EIFS on the heating system is ultimately a net benefit.

This EIFS system will be installed and maintained by a qualified contractor. No additional staff training is required.

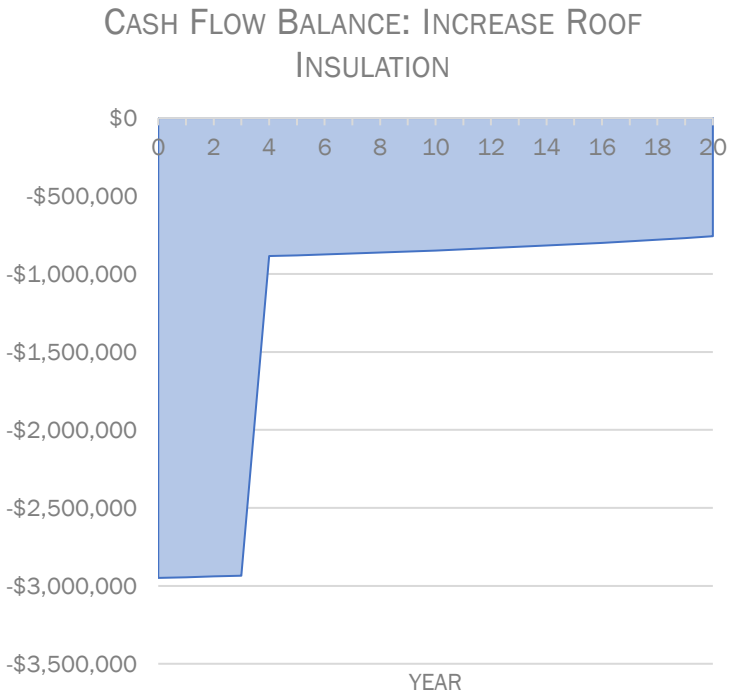
5.5 Opportunity 05: Increase Roof Insulation

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 5.5.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-70
Natural Gas (m³):	10,369
Water (m³):	0
Emissions (tCO_2e):	20.0
Financials	
Utility Savings:	$4,205
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$2,359,486
Engineering & PM:	$353,923
Contingency:	$235,949
Project Costs:	$2,949,357
Simple Payback:	701.4
Capital Payback:	49.4
NPV:	-$1,339,834
IRR:	-6.0%



Existing Conditions

The pitched roof portion of the building on the north side has a layer of rigid insulation in between the joists, approximately R5. The flat roof portion of the building is assumed to have 2" of rigid insulation, or R10 continuous.

Retrofit Conditions

For all roof sections on the north portion of the building, we recommend installing rigid insulation on the flat and pitched roof sections (interior insulation for the pitched roof is not possible). During this process, replace the existing insulation with newer insulation, and increase the depth of insulation by a further 4". This will provide a minimum of R30 (or higher, depending on the material used).

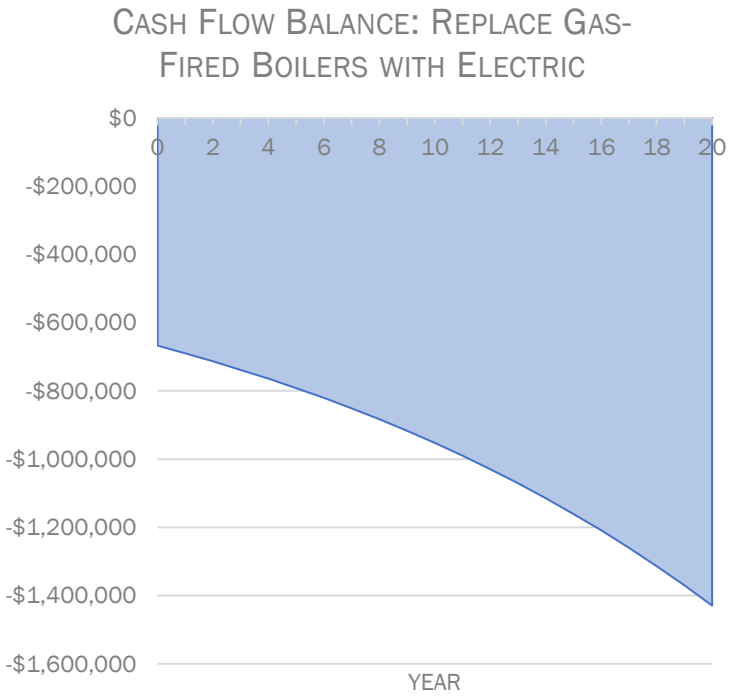
5.6 Opportunity 06: Replace Gas-Fired Boilers with Electric

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 5.6.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-277,950
Natural Gas (m³):	34,103
Water (m³):	0
Emissions (tCO_2e):	58.1
Financials	
Utility Savings:	-$21,208
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$534,130
Engineering & PM:	$80,119
Contingency:	$53,413
Project Costs:	$667,662
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$1,017,342
IRR:	No IRR



Existing Conditions

The building has three separate boiler plants: one is located in the south portion and two in the north.

FIGURE 5.6.2: EXISTING BOILER SUMMARY

Tag ID	Serves	Type	Capacity	Efficiency	Condition	Age
B-1	South Building	Atmospheric	1,200 MBH	81%	Poor	22 years
B-2	Main Building	Condensing	600 MBH	97.5%	Good	10 years
B-3	Main Building	Condensing	600 MBH	97.5%	Good	10 years
B-4	Police Services	Forced Draft	500 MBH	84%	Fair	Unknown
B-5	Police Services	Atmospheric	700 MBH	80%	Poor	48 years

Retrofit Conditions

As a means of eliminating GHG emissions from the building, the natural gas boilers will need to be replaced with electric. However, the costs associated with this can be excessive as the need to electrically support boilers of these sizes would require an extensive upgrade to the electrical distribution system. These costs would be in addition to what is shown in the above table as the true extent of the electrical systems upgrade can only be determine on an overall scenario basis once the collection of ECMs has been selected.

If possible, we suggest leaving gas-fired boilers as is (with potential upgrades to condensing) as they will mostly be utilized as backup in the event the heat pumps recommended in this report are not able to function (due to very low outdoor air temperatures) and, as such, will not operate for any significant amount of time during the year.

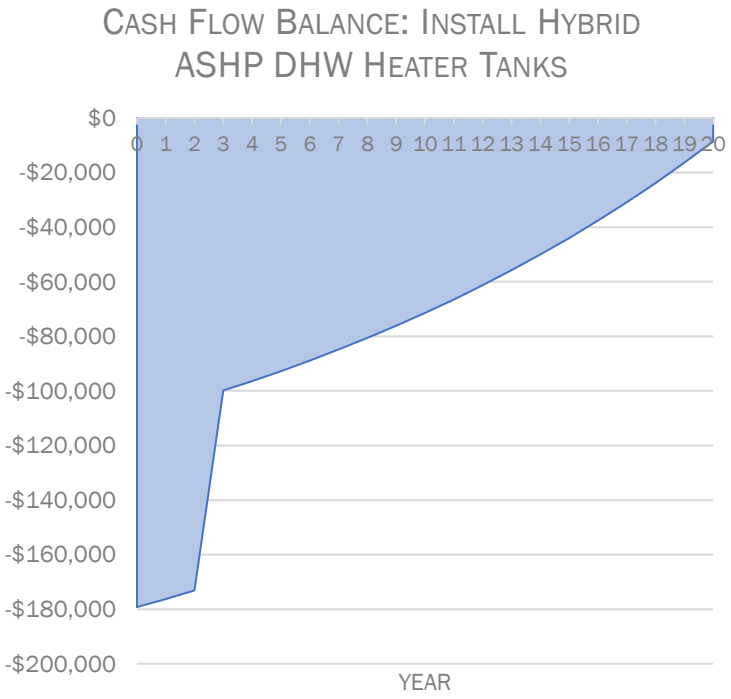
5.7 Opportunity 07: Install Hybrid ASHP DHW Heater Tanks

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 5.7.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	22,470
Natural Gas (m^3):	0
Water (m^3):	0
Emissions (tCO_2e):	0.6
Financials	
Utility Savings:	$2,835
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$143,376
Engineering & PM:	$21,506
Contingency:	$14,338
Project Costs:	$179,220
Simple Payback:	63.2
Capital Payback:	21.0
NPV:	-$76,296
IRR:	-0.6%



Existing Conditions

Domestic hot water is provided by several electric heater tanks. One tank serves the south portion of the building, and two more serve the north.

TABLE 5.7.2: DHW EQUIPMENT DETAILS

Tag ID	Serves	Boiler Type	Capacity	Efficiency	Condition
HWT-1	South Building	Electric	4,500 W	100%	Poor
HWT-2	North Building	Electric	3,000 W	100%	Good
HWT-3	North Building	Electric	3,000 W	100%	Good

Retrofit Conditions

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

This measure includes demolition and removal of the existing gas fired tank heater. New hybrid tank heaters will be installed in the location of the existing equipment.

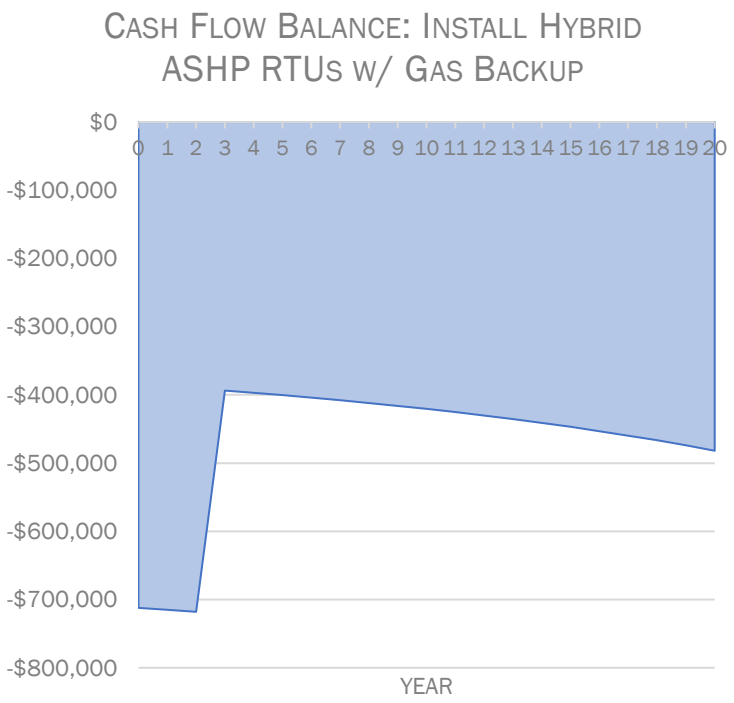
5.8 Opportunity 08: Install Hybrid ASHP RTUs w/ Gas Backup

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 5.8.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-82,820
Natural Gas (m^3):	19,350
Water (m^3):	0
Emissions (tCO_2e):	35.1
Financials	
Utility Savings:	-$2,585
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$569,899
Engineering & PM:	$85,485
Contingency:	$56,990
Project Costs:	$712,374
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$491,530
IRR:	No IRR



Existing Conditions

The south portion of the building is conditioned primarily through several air-side systems, including 4 rooftop units (RTUs). The details for the RTUs are summarized in the table below:

TABLE 5.8.2: ROOFTOP UNIT DETAILS

Tag ID	Make	Model #	Capacity	HP	Airflow	Condition
RTU-1	York	ZF060N10N5AAA1A	125 MBH	1.5	1,750 CFM	Fair
RTU-2	Trane	YSC092AWRHA10F	200 MBH	2.0	3,000 CFM	Fair
RTU-3	Trane	YSC120AWRKA14H	250 MBH	3.0	4,000 CFM	Fair
RTU-4	Trane	YSC092AWRHA10F	200 MBH	2.0	3,000 CFM	Fair

Retrofit Conditions

This measure includes replacing the existing gas fired rooftop units with air source heat pump rooftop units equipped with gas backup heat.

An air source heat pump rooftop unit utilizes a compressor operating a refrigeration cycle to extract heat from the atmosphere for heating purposes. As outdoor air temperatures decrease, the efficiency and heating capacity of the air source heat pump diminish. When outdoor air temperatures drop below the operating envelope of the air source heat pump, the gas fired burner will cycle on to provide backup heating.

The average weight of ASHP rooftop units is typically slightly higher than that for standard rooftop units when comparing similar compressor capacities.

To account for potential structural issues, the costing for this measure includes increased allowances for structural evaluations of the roof structure and increased costs for structural reinforcement which may be required.

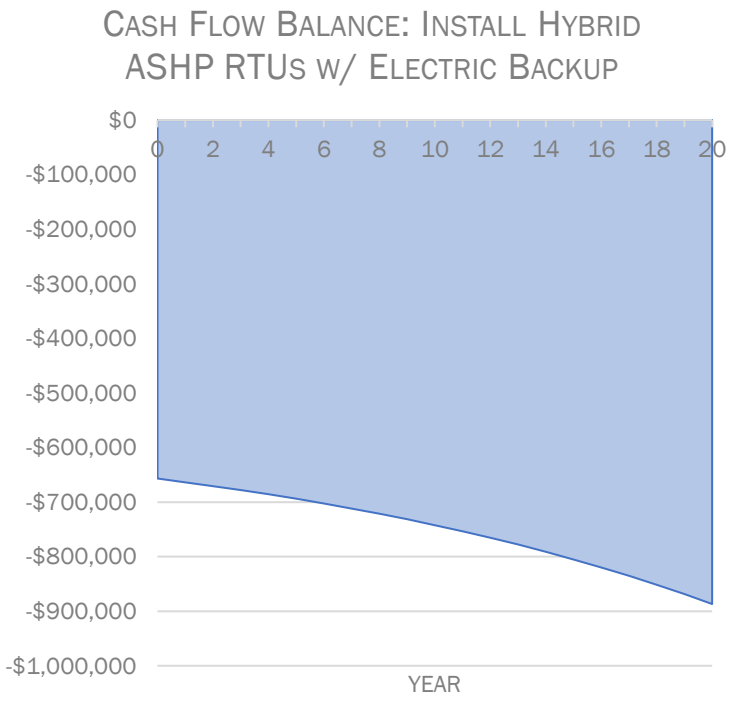
5.9 Opportunity 09: Install Hybrid ASHP RTUs w/ Electric Backup

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 5.9.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-134,450
Natural Gas (m³):	26,269
Water (m³):	0
Emissions (tCO_2e):	47.0
Financials	
Utility Savings:	-$6,287
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$525,671
Engineering & PM:	$78,851
Contingency:	$52,567
Project Costs:	$657,088
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$762,213
IRR:	No IRR



Existing Conditions

The south portion of the building is conditioned primarily through several air-side systems, including 4 rooftop units (RTUs). The details for the RTUs are summarized in the table below:

TABLE 5.9.2: ROOFTOP UNIT DETAILS

Tag ID	Make	Model #	Capacity	HP	Airflow	Condition
RTU-1	York	ZF060N10N5AAA1A	125 MBH	1.5	1,750 CFM	Fair
RTU-2	Trane	YSC092AWRHA10F	200 MBH	2.0	3,000 CFM	Fair
RTU-3	Trane	YSC120AWRKA14H	250 MBH	3.0	4,000 CFM	Fair
RTU-4	Trane	YSC092AWRHA10F	200 MBH	2.0	3,000 CFM	Fair

Retrofit Conditions

This measure includes replacing the existing gas fired rooftop units with air source heat pump rooftop units equipped with electric backup heat.

An air source heat pump rooftop unit utilizes a compressor operating a refrigeration cycle to extract heat from the atmosphere for heating purposes. As outdoor air temperatures decrease, the efficiency and heating capacity of the air source heat pump diminish. When outdoor air temperatures drop below the operating envelope of the air source heat pump, the electric resistance heater will cycle on to provide backup heating.

The average weight of ASHP rooftop units is typically slightly higher than that for standard rooftop units when comparing similar compressor capacities.

To account for potential structural issues, the costing for this measure includes increased allowances for structural evaluations of the roof structure and increased costs for structural reinforcement which may be required.

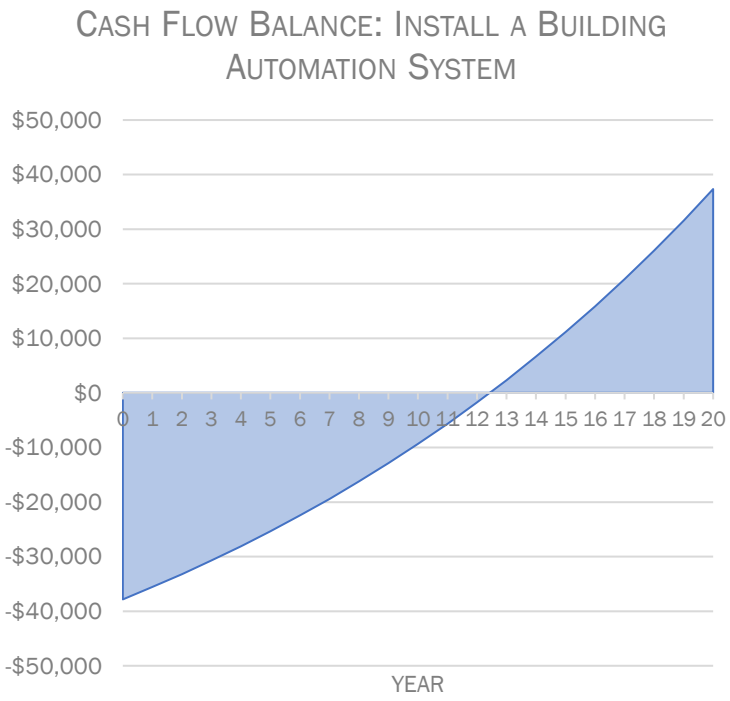
5.10 Opportunity 10: Install a Building Automation System

The Detailed Financial Analysis

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

TABLE 5.10.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,580
Natural Gas (m^3):	4,798
Water (m^3):	0
Emissions (tCO_2e):	9.3
Financials	
Utility Savings:	$2,149
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$30,274
Engineering & PM:	$4,541
Contingency:	$3,027
Project Costs:	$37,842
Simple Payback:	17.6
Capital Payback:	12.4
NPV:	-$3,150
IRR:	6.4%



Existing Conditions

The building currently has no centralized building automation system.

Retrofit Conditions

Installing a building automation system (BAS) can allow a much higher level of control over the mechanical equipment in the building. The BAS can allow for equipment schedule, overnight temperature setbacks and damper control.

The costs included here are just for the startup materials and labour. Total BAS costs are highly dependent on what equipment will be selected. Control costs for each individual piece of equipment are included in their respective measures.

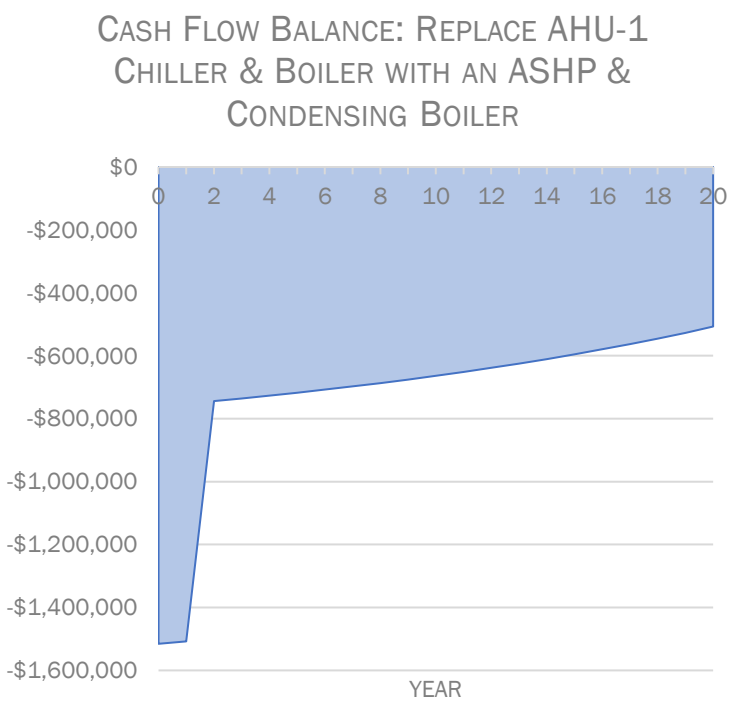
5.11 Opportunity 11: Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler

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 5.11.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	8,560
Natural Gas (m³):	15,037
Water (m³):	0
Emissions (tCO_2e):	29.3
Financials	
Utility Savings:	$7,191
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$1,212,312
Engineering & PM:	$181,847
Contingency:	$121,231
Project Costs:	$1,515,390
Simple Payback:	210.7
Capital Payback:	36.6
NPV:	-$742,669
IRR:	-6.9%



Existing Conditions

AHU-1 in the south portion of the building serves the auditorium area. It uses hot water and chilled water provided by the atmospheric boiler and reciprocating chiller located in the same room.

TABLE 5.11.1: SOUTH BUILDING BOILER DETAILS

Tag ID	Type	Capacity	Efficiency	Condition	Age
Boiler	Atmospheric	1,200 MBH	81%	Poor	22 years

TABLE 5.11.3: COOLING EQUIPMENT DETAILS

Tag ID	Type	Capacity	Efficiency	Condition	Age
Chiller	Reciprocating	24 tons	~4.0 COP	Poor	31 years

Retrofit Conditions

Both the boiler and the chiller in the south portion of the building have surpassed the life expectancy of the equipment and will need to be replaced in the short term.

Upon reaching the end of life expectancy the following retrofit option has been developed:

The chiller will be replaced with an air-source heat pump with a remote condenser, similar to what exists currently. This heat pump will function identically to the chiller, but will also be able to provide heating in the winter. When outdoor temperatures fall below the operating envelope of the ASHPs, the hydronic heating coil, connected to a new condensing boiler, will provide heat to the system.

A gas fired condensing boiler will be installed to supply heat during times of the year when the outdoor temperature falls below the operating envelope of the ASHPs. The boiler, rated at 1,200 MBH will supply backup heat to the AHU and the perimeter loop.

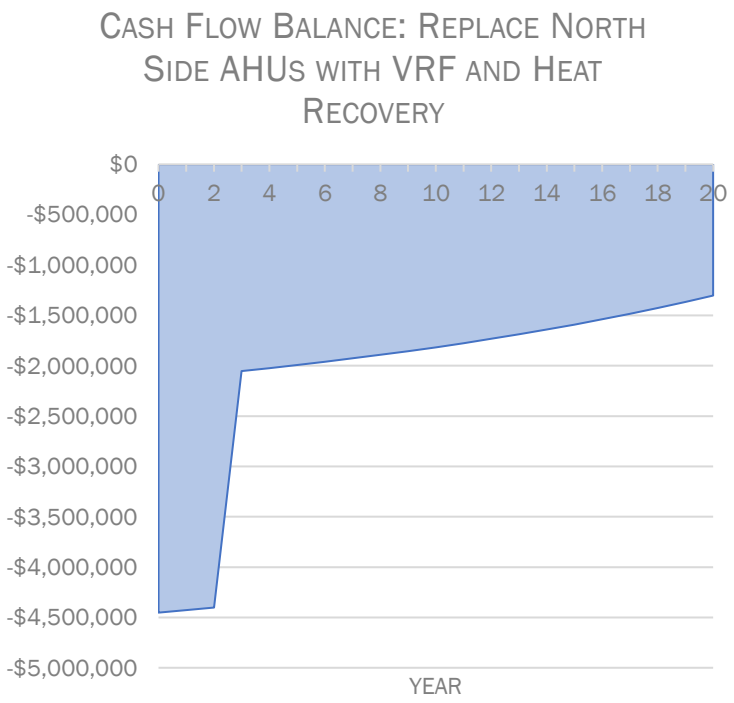
5.12 Opportunity 12: Replace North Side AHUs with VRF and Heat Recovery

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 5.12.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-10,290
Natural Gas (m³):	61,474
Water (m³):	0
Emissions (tCO_2e):	118.5
Financials	
Utility Savings:	$23,685
Add'l Annual Saving:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$3,561,721
Engineering & PM:	$534,258
Contingency:	$356,172
Project Costs:	$4,452,152
Simple Payback:	188.0
Capital Payback:	34.0
NPV:	-$2,191,809
IRR:	-5.4%



Existing Conditions

For the north portion of the building, heating is primarily provided via several isolated AHUs. A couple of boiler plants supply heating for the hot water coils in the ducts and the perimeter loop.

TABLE 5.12.2: NORTH BUILDING BOILER DETAILS

Tag ID	Serves	Type	Capacity	Efficiency	Condition	Age
B-1	Main Building	Condensing	600 MBH	97.5%	Good	10 years
B-2	Main Building	Condensing	600 MBH	97.5%	Good	10 years
B-3	Police Services	Forced Draft	500 MBH	84%	Fair	Unknown
B-4	Police Services	Atmospheric	700 MBH	80%	Poor	48 years

Retrofit Conditions

With the north portion of the building, a variable refrigerant flow system (VRF) will be used to provide heating and cooling with ventilation provided by heat recovery ventilators. The VRF, like other ASHPs, will provide heating and cooling throughout the year, with the existing boiler plants providing backup heating for the perimeter loop for when the outdoor air temperatures drop below their operating conditions.

The total system heating load is about 1,900 MBH and the cooling load is about 1,300 MBH. The north side of the building will be broken into 8 zones, 6 of which will be served by separate VRF loops. There is expected to be a fitness centre and a lab in the renovated building. These 2 remaining zones will be served by dedicated ASHP RTUs with gas backup.

This measure will have a significant impact on maintenance costs at the facility due to the installation of the air source heat pumps in addition to the boilers. These impacts to maintenance costs have been accounted for in the cash flow balance for this measure as an additional annual cost.

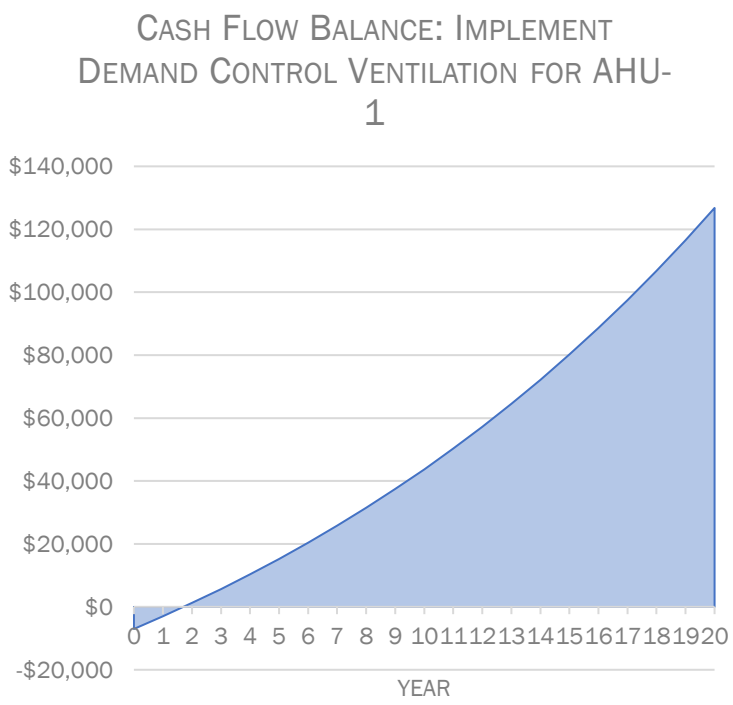
5.13 Opportunity 13: Implement Demand Control Ventilation for AHU-1

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 5.13.1: DETAILED FINANCIAL ANALYSIS

Utility Savings	
Demand (kW):	0
Electricity (kWh):	80
Natural Gas (m^3):	9,401
Water (m^3):	0
Emissions (tCO_2e):	18.2
Financials	
Utility Savings:	$3,831
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$5,622
Engineering & PM:	$843
Contingency:	$562
Project Costs:	$7,027
Simple Payback:	1.8
Capital Payback:	1.7
NPV:	$54,723
IRR:	62.3%



Existing Conditions

AHU-1 provides heating, cooling and ventilation to the auditorium area of the south building, blending fresh air and return air to a fixed mixed air temperature setpoint. This provides temperature and humidity control in the space, but tends to bring in more ventilation air than needed, especially during partial occupancy periods. Any outside air brought into the building has to be conditioned by heating or cooling equipment, so it is best to minimize it.

Retrofit Conditions

We recommend implementing demand control ventilation (DCV) for these units. DCV would ensure that ventilation air volumes are matched to occupancy under all conditions. CO_2 sensors would be installed in occupied areas and return air ducts, as appropriate. ASHRAE Standard 62 recognizes that ambient (outdoor) CO_2 levels can fluctuate, and that a better measure of ventilation requirements in the space is to use the difference between indoor and ambient levels. An outside sensor would also be installed to determine the ambient CO_2 levels.

This level of control does require the implementation of a building automation system. The new sensors would be connected to the building automation system, which would be reprogrammed to maintain the indoor air CO_2 levels at 700 ppm above ambient.

The outside air and relief dampers would be replaced with low leakage dampers.

6 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

6.1 GHG Reduction Pathway Summary

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

TABLE 6.1.1: GHG REDUCTION PATHWAY SUMMARY

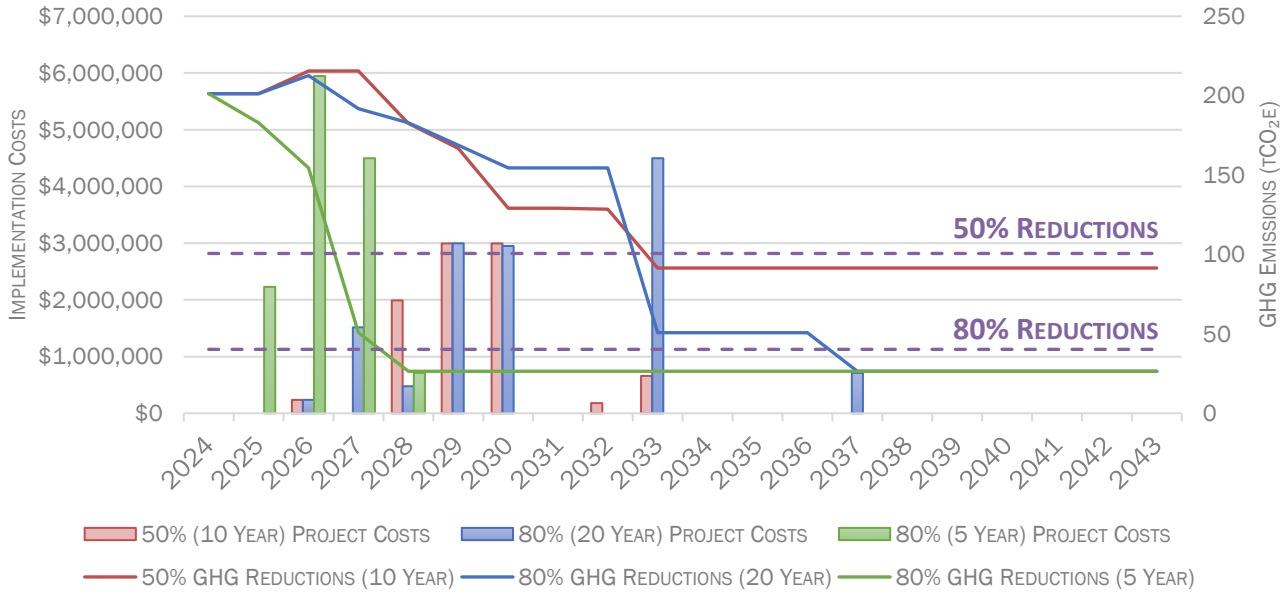
Opp. #	Opportunity	50% Reduction Pathway (10 Year)	80% Reduction Pathway (20 Year)	80% Reduction Pathway (5 Year)
1	Install Low Flow Water Fixtures	•	•	•
2	Install LED Lighting	•	•	•
3	Install High Efficiency Windows	•	•	•
4	Install EIFS	•	•	•
5	Increase Roof Insulation	•	•	•
6	Replace Gas-Fired Boilers with Electric			
7	Install Hybrid ASHP DHW Heater Tanks	•		
8	Install Hybrid ASHP RTUs w/ Gas Backup		•	•
9	Install Hybrid ASHP RTUs w/ Electric Backup	•		
10	Install a Building Automation System	•	•	•
11	Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler	•	•	•
12	Replace North Side AHUs with VRF and Heat Recovery		•	•
13	Implement Demand Control Ventilation for AHU-1	•	•	•

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.

TABLE 6.1.2: PROJECT ROADMAP ENERGY, EMISSION AND FINANCIAL OVERVIEW

GHG Reduction Pathways	Energy (ekWh)	Energy (%)	Emissions (tCO_2e)	Emissions (%)	Annual Savings	Project Costs	20-Year LC Costs
Business-As-Usual	0	0%	0.0	0%	$0	$5,482,375	$6,223,962
50% Reductions in 10 Years	649,727	42%	109.8	55%	$39,610	$9,056,061	$7,299,387
80% Reductions in 20 Years	1,026,904	67%	174.8	87%	$64,162	$13,384,278	$9,661,153
80% Reductions in 5 Years	1,026,904	67%	174.8	87%	$64,162	$13,384,278	$11,381,733

FIGURE 6.1.1: GHG REDUCTION PATHWAY SUMMARY



There's a slight increase in GHG emissions in 2026. This is due to the heating penalty created by the LED lighting retrofit. This increase is later erased when measures switching from natural gas to electricity are implemented.

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.

TABLE 6.1.3: PROJECT ROADMAP LIFE CYCLE COSTING OVERVIEW

Pathway	Project Costs	Potential Grant	Avoided Cost	Incremental Costs	20-Year LC Cost	Incremental 20-Year LC Cost	Incremental LC Cost per Tonne CO_2e
Business-As-Usual	$5,482,375	$0	$0	$0	$6,223,962	$0	N/A
50% Reductions in 10 Years	$9,056,061	$1,448,970	$3,208,511	$4,398,581	$7,299,387	$1,075,425	490
80% Reductions in 20 Years	$13,384,278	$2,000,000	$5,416,860	$5,967,418	$9,661,153	$3,437,191	983
80% Reductions in 5 Years	$13,384,278	$2,000,000	$5,416,860	$5,967,418	$11,381,733	$5,157,771	1,475

6.2 Demand Impact Summary

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

Demand data from the utility bills was not available. According to the energy model, the facility's existing peak demand is approximately 220 kW.

The site is serviced by a 750 kVA 600V/347V pad mounted step-down transformer. This supplies the main disconnect for the facility which is rated at 400A. The site has approximately 720 kW of total electrical capacity. The demand impact of each reduction pathway are summarized in the table below.

TABLE 6.2.1: DEMAND IMPACT SUMMARY

Pathway	Demand Increase (kW)	Extra Capacity Required (kW)	Demand Upgrade Costs
50% Reductions in 10 Years	0	0	$0
80% Reductions in 20 Years	375	0	$0
80% Reductions in 5 Years	375	0	$0

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

Overall, the existing capacity appears to be sufficient to accommodate the ECMs recommended in this report. No service upgrade will be required.

APPENDIX A

ENERGY MODEL OUTPUT REPORTS

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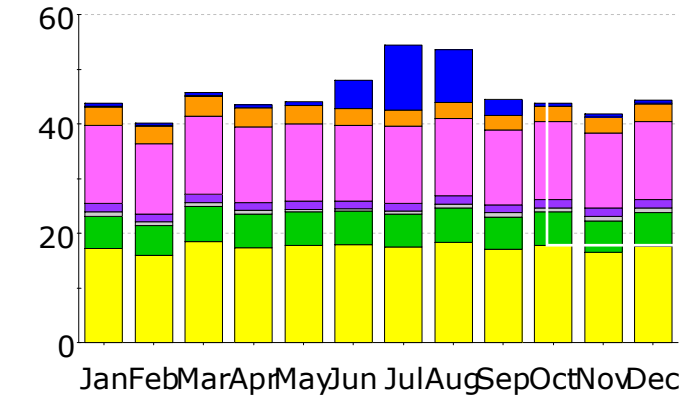

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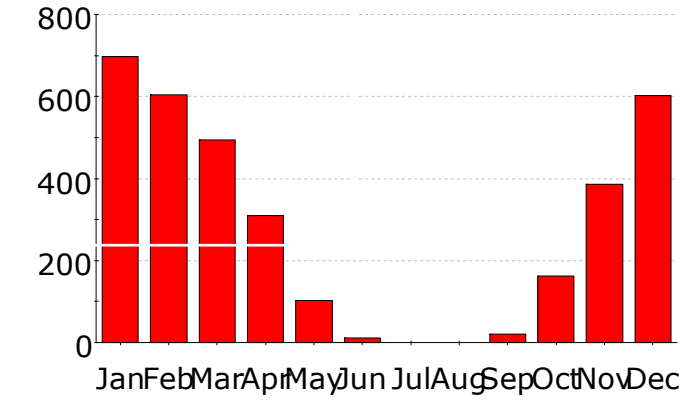

Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.51	0.46	0.51	0.50	0.70	5.16	11.89	9.65	2.96	0.52	0.50	0.51	33.88
Heat Reject.	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.05	0.01	0.00	0.00	0.00	0.16
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.13	0.12	0.11	0.09	0.06	0.02	-	-	0.00	0.03	0.08	0.11	0.76
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	3.38	3.24	3.76	3.49	3.32	3.08	2.81	2.80	2.62	2.84	2.85	3.26	37.45
Vent. Fans	14.21	12.83	14.21	13.75	14.21	13.75	14.21	14.21	13.75	14.21	13.75	14.21	167.26
Pumps & Aux.	1.60	1.44	1.59	1.52	1.49	1.41	1.45	1.45	1.42	1.53	1.53	1.59	18.03
Ext. Usage	0.82	0.63	0.69	0.67	0.48	0.46	0.48	0.78	0.75	0.78	0.79	0.82	8.15
Misc. Equip.	5.96	5.53	6.40	6.06	6.14	6.20	6.08	6.33	5.95	6.14	5.76	6.15	72.70
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	17.13	15.90	18.45	17.41	17.71	17.85	17.44	18.28	17.02	17.71	16.53	17.62	209.05
Total	43.74	40.16	45.73	43.48	44.10	47.95	54.43	53.55	44.48	43.76	41.79	44.27	547.45

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	697.2	604.6	493.4	309.1	103.0	10.9	0.4	0.8	20.4	162.2	385.8	602.1	3,389.9
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	697.2	604.6	493.4	309.1	103.0	10.9	0.4	0.8	20.4	162.2	385.8	602.1	3,389.9

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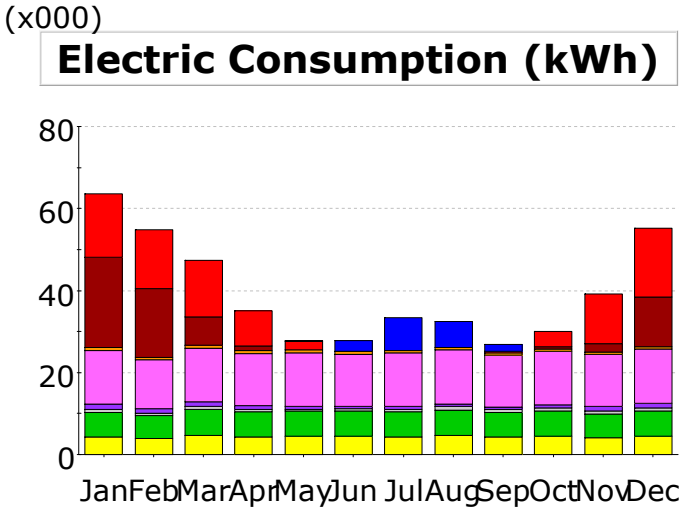

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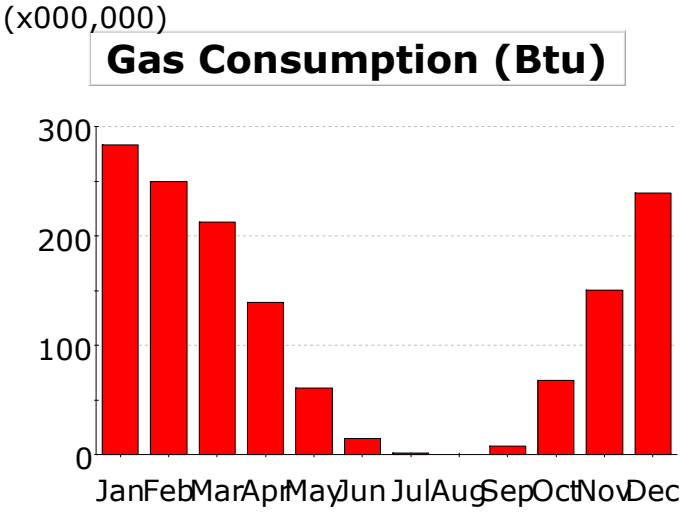

Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	0.03	2.69	7.93	6.35	1.69	-	-	-	18.69
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	15.41	14.37	13.69	8.68	2.06	0.04	0.01	-	0.28	3.91	12.04	16.73	87.21
HP Supp.	21.98	16.75	6.92	1.05	0.06	-	-	-	0.02	0.38	2.15	12.05	61.36
Hot Water	0.72	0.69	0.80	0.74	0.71	0.66	0.60	0.60	0.56	0.62	0.62	0.70	8.02
Vent. Fans	13.11	11.84	13.11	12.69	13.11	12.69	13.11	13.11	12.69	13.11	12.69	13.11	154.37
Pumps & Aux.	1.21	1.08	1.08	0.90	0.67	0.63	0.77	0.72	0.62	0.75	0.98	1.16	10.57
Ext. Usage	0.82	0.63	0.69	0.67	0.48	0.46	0.48	0.78	0.75	0.78	0.79	0.82	8.15
Misc. Equip.	5.96	5.53	6.40	6.06	6.14	6.20	6.08	6.33	5.95	6.14	5.76	6.15	72.70
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	4.28	3.98	4.61	4.35	4.43	4.46	4.36	4.57	4.25	4.43	4.13	4.40	52.26
Total	63.50	54.88	47.31	35.13	27.69	27.82	33.34	32.46	26.80	30.12	39.15	55.13	473.32

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	282.9	249.8	212.4	139.1	60.7	14.4	1.5	-	7.8	67.8	150.6	239.0	1,426.1
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	282.9	249.8	212.4	139.1	60.7	14.4	1.5	-	7.8	67.8	150.6	239.0	1,426.1

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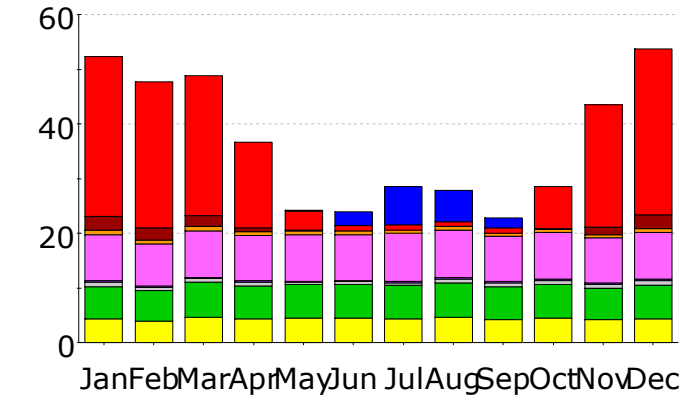

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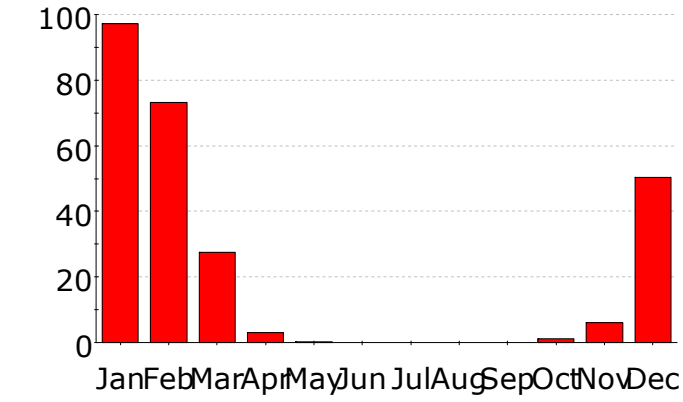


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	0.00	0.00	0.11	2.60	6.94	5.68	1.74	0.00	0.00	-	17.08
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	29.31	26.63	25.58	15.75	3.61	0.98	1.00	0.88	1.02	7.63	22.34	30.38	165.10
HP Supp.	2.53	2.30	1.96	0.66	0.04	-	-	-	0.02	0.21	1.45	2.52	11.69
Hot Water	0.72	0.69	0.80	0.74	0.71	0.66	0.60	0.60	0.56	0.62	0.62	0.70	8.02
Vent. Fans	8.52	7.70	8.52	8.25	8.53	8.40	8.79	8.70	8.29	8.52	8.25	8.52	101.01
Pumps & Aux.	0.21	0.18	0.19	0.18	0.18	0.19	0.24	0.22	0.18	0.20	0.17	0.18	2.31
Ext. Usage	0.82	0.63	0.69	0.67	0.48	0.46	0.48	0.78	0.75	0.78	0.79	0.82	8.15
Misc. Equip.	5.96	5.53	6.40	6.06	6.14	6.20	6.08	6.33	5.95	6.14	5.76	6.15	72.70
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	4.28	3.98	4.61	4.35	4.43	4.46	4.36	4.57	4.25	4.43	4.13	4.40	52.26
Total	52.36	47.63	48.75	36.67	24.23	23.96	28.49	27.76	22.77	28.52	43.51	53.68	438.33

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	97.21	73.10	27.40	2.97	0.17	-	-	-	0.02	1.19	6.06	50.29	258.42
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	97.21	73.10	27.40	2.97	0.17	-	-	-	0.02	1.19	6.06	50.29	258.42

APPENDIX B

SCHEMATICS

SAFETY FACTOR 30%

NORTH
ROUGH
DIRECTION

LAB
1.5CFM/SQFT
19 TON COOLING
300MBH INPUT
BY RTU

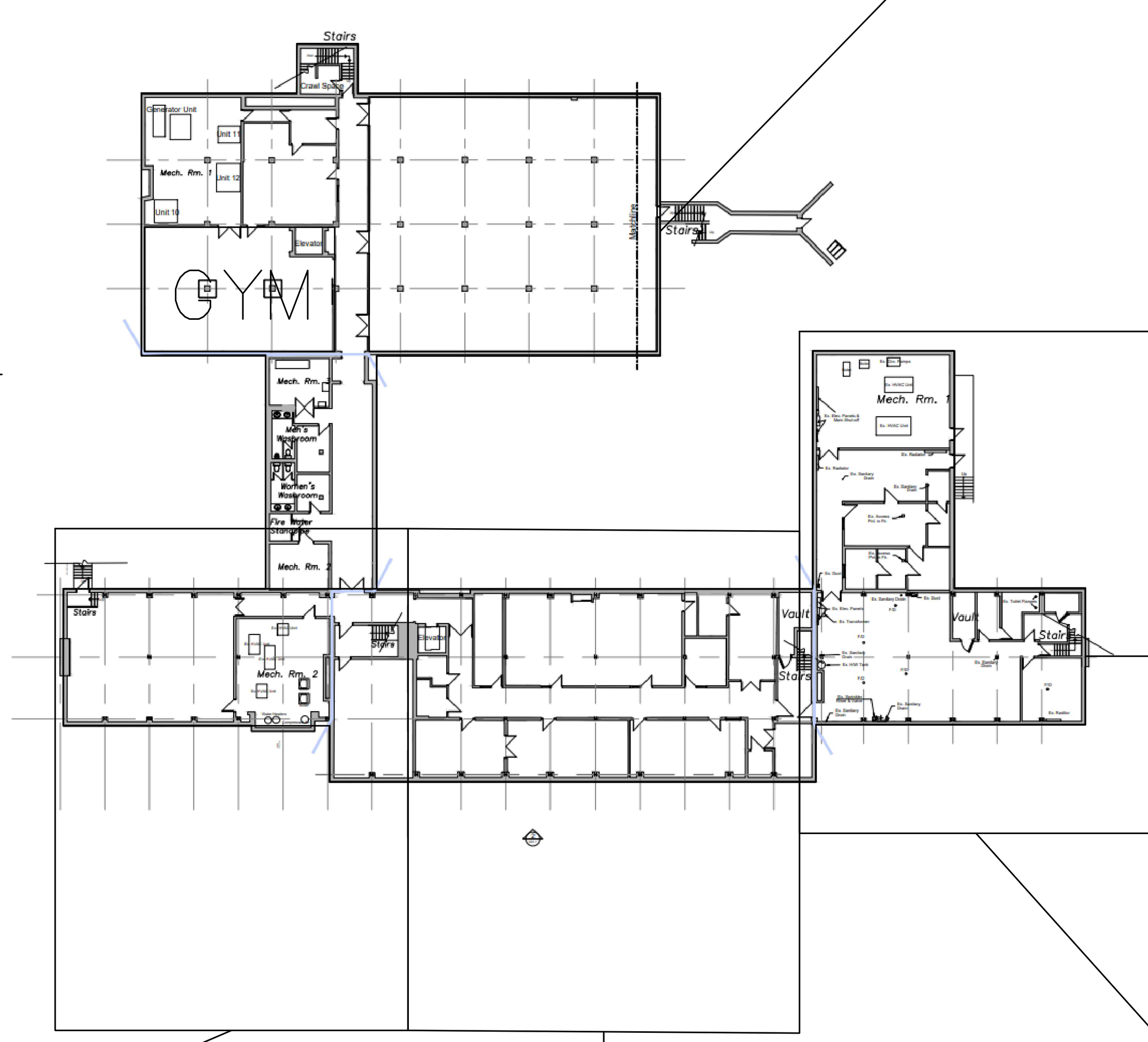
BASEMENT ZONE 2 INCLUDING GYM AND LAB
1117.53 m2

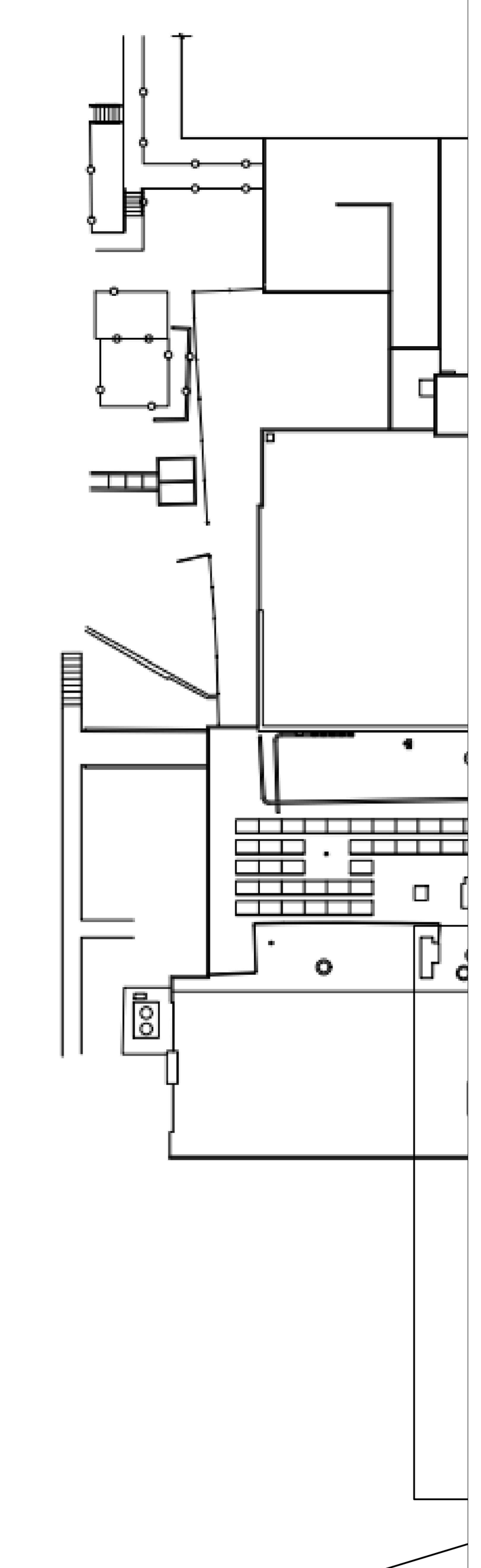
GYM 159.90 m2
50.4 MBH COOLING
8.4 MBH HEATING

LAB 459.79 m2
145.8 MBH COOLING
27 MBH HEATING

OTHER AREA
68.3 MBH COOLING
29.6 MBH HEATING

GYM
1.5CFM/SQFT
6 TON
COOLING
100MBH INPUT
BY RTU
(AR)





BASEMENT ZONE 1
1358.87 m2
101.3 MBH COOLING
84.5 MBH HEATING

VRF ZONE E
40 MBH COOLING
33 MBH HEATING
PUHY-P72ZKMU-B (-BS)

VRF ZONE G
40 MBH COOLING
33 MBH HEATING
PUHY-P72ZKMU-B (-BS)

VRF ZONE F
53 MBH COOLING
44 MBH HEATING
PUHY-P72ZKMU-B (-BS)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

NOTES:

SEAL: PRELIMINARY NOT FOR CONSTRUCTION

ORIENTATION: PROJECT NORTH

The contractor shall check and verify all dimensions and report any errors or omissions to the consultant before commencing or proceeding with work.

Do not scale this drawing.

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NO.	ISSUANCE	DATE	BY
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EFFICIENCY ENGINEERING .COM
A Kontrol Technologies Company

JOB NAME: ----
ADDRESS: ---- ----
DWN: ---- CHK: ----
DWG TITLE: BASEMENT ZONING
DATE: MM/DD/YYYY
SCALE: AS SHOWN
JOB NO. ----
DWG NO. M-1
ARCH D

2/19/2025 3:06 PM

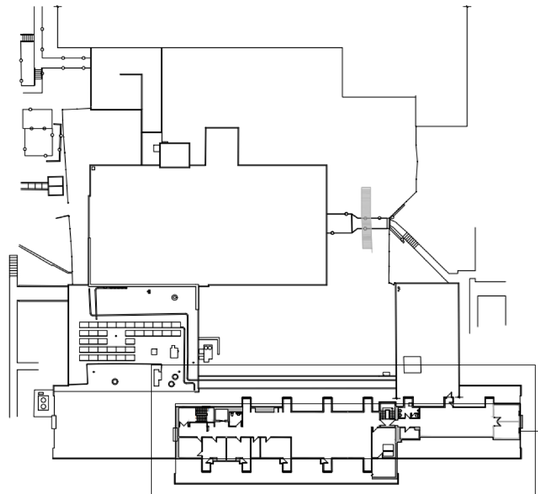
BASEMENT ZONE 2 INCLUDING GYM AND LAB
1117.53 m2

GYM 159.90 m2
50.4 MBH COOLING
8.4 MBH HEATING

LAB 459.79 m2
145.8 MBH COOLING
27 MBH HEATING

OTHER AREA
68.3 MBH COOLING
29.6 MBH HEATING

BASEMENT ZONE 1
1358.87 m2
101.3 MBH COOLING
84.5 MBH HEATING



SECOND FLOOR ZONE 1
606.60 m2
149.1 MBH COOLING
326.5 MBH HEATING

ZONE E
BH COOLING
BH HEATING
-P72ZKMU-B (-BS)

VRF ZONE A
194 MBH COOLING
424 MBH HEATING
PUHY-P336ZSKMU-B (-BS)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

NOTES:

SEAL:

PRELIMINARY
NOT FOR CONSTRUCTION

ORIENTATION:

PROJECT NORTH
N

The contractor shall check and verify all dimensions and report any errors or omissions to the consultant before commencing or proceeding with work.

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EFFICIENCY ENGINEERING .com
A Kontrol Technologies Company

JOB NAME:	----
ADDRESS:	---- ----
DWN: ----	DWG TITLE: SECOND FLOOR ZONING
CHK: ----	
DATE: MM/DD/YYYY	JOB NO. ----
SCALE: AS SHOWN	DWG NO. M-2
	ARCH D

2/19/2025 3:07 PM

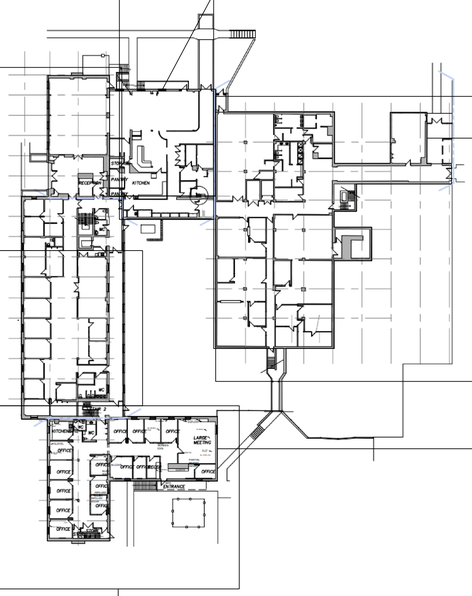
VRF ZONE I
51 MBH COOLING
72 MBH HEATING
PUHY-P72ZKMU-B (-BS)

VRF ZONE D
67 MBH COOLING
144 MBH HEATING
PUHY-P144ZKMU-B (-BS)

GROUND FLOOR ZONE 3
364 m2
39.3 MBH COOLING
55.2 MBH HEATING

VRF ZONE H
157 MBH COOLING
269 MBH HEATING
PUHY-P264ZSKMU-B (-BS)

NORTH
ROUGH
DIRECTION



GROUND FLOOR ZONE 2
1180.84 m2
120.7 MBH COOLING
207 MBH HEATING

GROUND FLOOR ZONE 1
1439.21 m2
172.7 MBH COOLING
370.3 MBH HEATING

VRF ZONE C
90 MBH COOLING
192 MBH HEATING
PUHY-P192ZSKMU-B (-BS)

VRF ZONE B
67 MBH COOLING
144 MBH HEATING
PUHY-P144ZKMU-B (-BS)

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

NOTES:

SEAL:

PRELIMINARY
NOT FOR CONSTRUCTION

ORIENTATION:

PROJECT NORTH
N

The contractor shall check and verify all dimensions and report any errors or omissions to the consultant before commencing or proceeding with work.

Do not scale this drawing.

NO.	ISSUANCE	DATE	BY
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EFFICIENCY ENGINEERING
A Kontrol Technologies Company

JOB NAME: ----
ADDRESS: ----
DWN: ----
CHK: ----
DWG TITLE: GROUND FLOOR ZONING
DATE: MM/DD/YYYY
SCALE: AS SHOWN
JOB NO. ----
DWG NO. M-3
ARCH D

2/19/2025 3:08 PM

APPENDIX C

CALCULATIONS

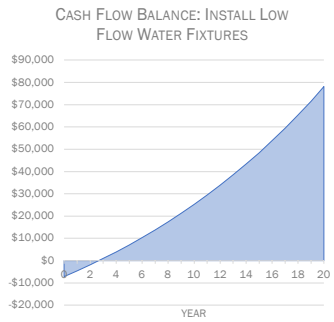
Energy Conservation Measure 1

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

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

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

Utility Savings	
Demand (kW):	0
Electricity (kWh):	17,400
Natural Gas (m³):	0
Water (m³):	113
():	0
():	0
missions (Tonnes of CO₂e):	0.5
Financials	
Annual Utility Savings:	$2,460
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$5,768
Engineering & PM:	$865
Contingency:	$577
Project Costs:	$7,210
Simple Payback:	2.9
Capital Payback:	2.7
NPV:	$32,212
IRR:	40.7%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	3,038,469	3,055,982
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Low Flow Water Fixtures

			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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Low-Flow Fixtures			Savings					
	Electricity (MWh)	Natural Gas (MMBTU)	Combined (kWh)	Electricity (MWh)	Natural Gas (MMBTU)	Combined (kWh)	Electricity (kWh)	Natural Gas (m3)		Water Savings - m3		
Space Cool	33.9	0.0	33,880.0	33.9	0.0	33,880.0	0	0		113		
Heat Reject.	0.2	0.0	160.0	0.2	0.0	160.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.8	3,389.9	994,282.9	0.8	3,389.9	994,282.9	0	0				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	37.5	0.0	37,450.0	20.1	0.0	20,050.0	17,400	0				
Vent. Fans	167.3	0.0	167,260.0	167.3	0.0	167,260.0	0	0				
Pumps & Aux	18.0	0.0	18,030.0	18.0	0.0	18,030.0	0	0				
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0				
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0				
0	**547**	**3,390**	**1,540,963**	**496**	**3,390**	**1,489,683**	**17,400**	**0**	**0**	**113**	**0**	**0**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	M04	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Install Low Flow Water Fixtures

Cost Breakout: Install Low Flow Water Fixtures

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				Washroom Faucets	1.0 GPM	Each	Web Estimate	$200	$50		No	Project	20	$4,000	$1,000	$0	$5,000
111	22	40	Plumbing	Plumbing Fixtures	Showerhead, 1.5 GPM	Showerhead	1.5 GPM	Each	Web Estimate '20	$50	$50	$0	Yes	Project	5	$384	$385	$0	$768
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:	**$4,384**	**$1,385**	**$0**	**$5,768**

Escalation Rates: Install Low Flow Water Fixtures

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity ($/kWh):	0.1262	0.1327	0.1396	0.1469	0.1545	0.1626	0.1710	0.1799	0.1893	0.1991	0.2095	0.2203	0.2318	0.2439	0.2565	0.2699	0.2839	0.2987	0.3142	0.3305	0.3477
Natural Gas ($/m³):	0.4066	0.4270	0.4486	0.4712	0.4950	0.5200	0.5463	0.5740	0.6030	0.6335	0.6655	0.6991	0.7344	0.7714	0.8103	0.8512	0.8941	0.9391	0.9864	1.0360	1.0882
Water ($/m³):	2.3396	2.4098	2.4821	2.5565	2.6332	2.7122	2.7936	2.8774	2.9637	3.0526	3.1442	3.2385	3.3357	3.4358	3.5388	3.6450	3.7544	3.8670	3.9830	4.1025	4.2256
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GHG Emissions (tCO_2e):	0.000031	0.000043	0.000047	0.000054	0.000071	0.000072	0.000075	0.000069	0.000077	0.000083	0.000079	0.000079	0.000079	0.000077	0.000081	0.000082	0.000087	0.000088	0.000093	0.000093	0.000093

Cash Flow Balance: Install Low Flow Water Fixtures

	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:	-$7,210	$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):		$2,309	$2,430	$2,556	$2,689	$2,829	$2,976	$3,130	$3,293	$3,464	$3,645	$3,834	$4,033	$4,243	$4,464	$4,696	$4,940	$5,197	$5,467	$5,752	$6,051
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):		$273	$281	$290	$299	$307	$317	$326	$336	$346	$356	$367	$378	$389	$401	$413	$426	$438	$452	$465	$479
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:	-$7,210	$2,583	$2,711	$2,846	$2,987	$3,136	$3,292	$3,457	$3,629	$3,810	$4,001	$4,201	$4,412	$4,633	$4,865	$5,109	$5,366	$5,635	$5,919	$6,217	$6,530
Cash Balance:	-$7,210	-$4,628	-$1,917	$929	$3,916	$7,052	$10,344	$13,801	$17,430	$21,240	$25,241	$29,443	$33,854	$38,487	$43,352	$48,461	$53,827	$59,462	$65,381	$71,597	$78,127
Undepreciated Amount:	-$7,210	-$6,129	-$5,210	-$4,428	-$3,764	-$3,199	-$2,719	-$2,312	-$1,965	-$1,670	-$1,420	-$1,207	-$1,026	-$872	-$741	-$630	-$535	-$455	-$387	-$329	-$279

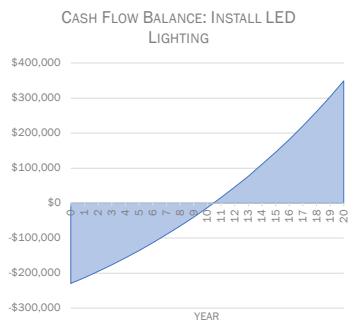
Energy Conservation Measure 2

Opp Cat:	Lighting
Opp Desc:	Upgrade to LED Fixtures
Opp Name:	Install LED Lighting

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):	300
Electricity (kWh):	167,900
Natural Gas (m³):	-12,226
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	-18.9
Financials	
Annual Utility Savings:	$16,214
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$183,920
Engineering & PM:	$27,588
Contingency:	$18,392
Project Costs:	$229,901
Simple Payback:	14.2
Capital Payback:	10.45
NPV:	$36,189
IRR:	9.0%



Write-ups	
Existing:	This facility is
Retrofit:	We recommend

QC Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	3,048,365	3,204,339
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install LED Lighting

			Meter Selection				Occupancy	Eff. Profile
Avg Temp (°F)	Avg Temp (°C)	Total Hours	Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			LED Lighting			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)		Demand - kW			
Space Cool	33.9	0.0	33,880.0	24.6	0.0	24,630.0	9,250	0		300			
Heat Reject.	0.2	0.0	160.0	0.1	0.0	90.0	70	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.8	3,389.9	994,282.9	0.9	3,820.5	1,120,624.5	-140	-12,226					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,470.0	-20	0					
Vent. Fans	167.3	0.0	167,260.0	165.3	0.0	165,320.0	1,940	0					
Pumps & Aux	18.0	0.0	18,030.0	18.0	0.0	18,020.0	10	0					
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0					
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	209.1	0.0	209,050.0	52.3	0.0	52,260.0	156,790	0					
0	**547**	**3,390**	**1,540,963**	**380**	**3,821**	**1,499,265**	**167,900**	**-12,226**	**0**	**300**	**0**	**0**	
Main Meter:	Select	Select	Select	Select	Select	Select	M02	M03	Select	M01	Select	Select	
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	

General Requirements: Install LED Lighting

Cost Breakout: Install LED Lighting

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				LED Retrofit	LED Fixtures	ft2	EE Database	$1.00	$0.80	$0	No	Project	102178	$102,178	$81,742	$0	$183,920
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:	**$102,178**	**$81,742**	**$0**	**$183,920**

Escalation Rates: Install LED Lighting

Cash Flow Balance: Install LED Lighting

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$229,901	$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):		$22,284	$23,443	$24,662	$25,945	$27,294	$28,713	$30,206	$31,777	$33,429	$35,168	$36,996	$38,920	$40,944	$43,073	$45,313	$47,669	$50,148	$52,756	$55,499	$58,385
Annual Savings (M03):		-$5,221	-$5,484	-$5,761	-$6,052	-$6,358	-$6,680	-$7,018	-$7,373	-$7,745	-$8,136	-$8,547	-$8,979	-$9,432	-$9,907	-$10,407	-$10,931	-$11,482	-$12,060	-$12,667	-$13,304
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:	-$229,901	$17,063	$17,959	$18,901	$19,893	$20,936	$22,034	$23,189	$24,404	$25,684	$27,031	$28,449	$29,942	$31,512	$33,166	$34,906	$36,738	$38,667	$40,696	$42,832	$45,081
Cash Balance:	-$229,901	-$212,837	-$194,878	-$175,977	-$156,084	-$135,149	-$113,115	-$89,926	-$65,522	-$39,838	-$12,806	$15,643	$45,584	$77,097	$110,263	$145,169	$181,907	$220,574	$261,270	$304,103	$349,184
Undepreciated Amount:	-$229,901	-$195,415	-$166,103	-$141,188	-$120,009	-$102,008	-$86,707	-$73,701	-$62,646	-$53,249	-$45,262	-$38,472	-$32,701	-$27,796	-$23,627	-$20,083	-$17,070	-$14,510	-$12,333	-$10,483	-$8,911

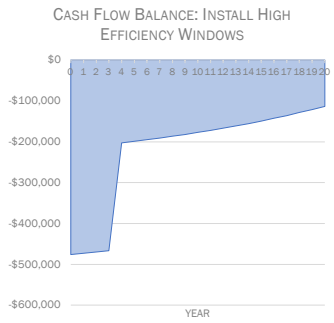
Energy Conservation Measure 3

Opp Cat:	Space_Heating
Opp Desc:	Install High Efficiency Windows
Opp Name:	Install High Efficiency Windows

Costing Setup		
Engineering & PM:	**15%**	
Contingency:	**10%**	
Additional Annual Costs:		
Additional Annual Savings:		
Tax Rebate (Capital Projects):	**No**	
Avoided Capital Costs:	**$238,547**	**$209,921**
Avoided Capital Year:	**4**	
Financial Analysis Term (years):	**20**	

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

Utility Savings	
Demand (kW):	0
Electricity (kWh):	2,970
Natural Gas (m³):	6,323
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	12.3
Financials	
Annual Utility Savings:	$2,944
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$381,052
Engineering & PM:	$57,158
Contingency:	$38,105
Project Costs:	$476,315
Simple Payback:	161.8
Capital Payback:	30.6
NPV:	-$232,516
IRR:	-3.9%



Write-ups	
Existing:	Visual
Retrofit:	We recommend

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	3,021,335	3,030,628
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install High Efficiency 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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			HE Windows			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)					
Space Cool	33.9	0.0	33,880.0	33.8	0.0	33,810.0	70	0					
Heat Reject.	0.2	0.0	160.0	0.2	0.0	170.0	-10	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.8	3,389.9	994,282.9	0.8	3,167.2	929,013.2	0	6,323					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,450.0	0	0					
Vent. Fans	167.3	0.0	167,260.0	164.4	0.0	164,390.0	2,870	0					
Pumps & Aux	18.0	0.0	18,030.0	18.0	0.0	17,990.0	40	0					
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0					
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0					
0	**547**	**3,390**	**1,540,963**	**544**	**3,167**	**1,472,723**	**2,970**	**6,323**	**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 High Efficiency Windows

Cost Breakout: Install High Efficiency 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				HE Windows	Tripple pane, low e argon filled	ft2	Pinpoint	$68	$23	$0	Yes	Project	2726.2528	$285,650	$95,403	$0	$381,052
111	0	0											Yes	Project		$0	$0	$0	$0
112	0	0				Double Glazed		per sqft of window area	Hamilton work	$70			No	Avoided	2,726	$190,838	$0	$0	$190,838
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:	**$285,650**	**$95,403**	**$0**	**$381,052**

Escalation Rates: Install High Efficiency Windows

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity ($/kWh):	0.1262	0.1327	0.1396	0.1469	0.1545	0.1626	0.1710	0.1799	0.1893	0.1991	0.2095	0.2203	0.2318	0.2439	0.2565	0.2699	0.2839	0.2987	0.3142	0.3305	0.3477
Natural Gas ($/m³):	0.4066	0.4270	0.4486	0.4712	0.4950	0.5200	0.5463	0.5740	0.6030	0.6335	0.6655	0.6991	0.7344	0.7714	0.8103	0.8512	0.8941	0.9391	0.9864	1.0360	1.0882
Water ($/m³):	2.3396	2.4098	2.4821	2.5565	2.6332	2.7122	2.7936	2.8774	2.9637	3.0526	3.1442	3.2385	3.3357	3.4358	3.5388	3.6450	3.7544	3.8670	3.9830	4.1025	4.2256
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GHG Emissions (tCO2e):	0.000031	0.000043	0.000047	0.000054	0.000071	0.000072	0.000075	0.000069	0.000077	0.000083	0.000079	0.000079	0.000079	0.000077	0.000081	0.000082	0.000087	0.000088	0.000093	0.000093	0.000093

Cash Flow Balance: Install High Efficiency 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:	-$476,315	$0	$0	$0	$260,242	$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):		$394	$415	$436	$459	$483	$508	$534	$562	$591	$622	$654	$688	$724	$762	$802	$843	$887	$933	$982	$1,033
Annual Savings (M03):		$2,700	$2,836	$2,980	$3,130	$3,288	$3,455	$3,629	$3,813	$4,006	$4,208	$4,421	$4,644	$4,878	$5,124	$5,382	$5,653	$5,938	$6,237	$6,551	$6,881
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:	-$476,315	$3,094	$3,251	$3,416	$263,831	$3,771	$3,963	$4,164	$4,375	$4,597	$4,830	$5,075	$5,332	$5,602	$5,886	$6,184	$6,497	$6,825	$7,170	$7,533	$7,913
Cash Balance:	-$476,315	-$473,221	-$469,970	-$466,554	-$202,723	-$198,952	-$194,989	-$190,825	-$186,450	-$181,853	-$177,023	-$171,948	-$166,616	-$161,014	-$155,128	-$148,944	-$142,448	-$135,623	-$128,452	-$120,920	-$113,006
Undepreciated Amount:	-$476,315	-$404,868	-$344,138	-$292,517	-$248,640	-$211,344	-$179,642	-$152,696	-$129,791	-$110,323	-$93,774	-$79,708	-$67,752	-$57,589	-$48,951	-$41,608	-$35,367	-$30,062	-$25,553	-$21,720	-$18,462

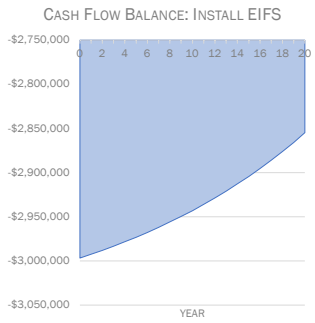
Energy Conservation Measure 4

Opp Cat:	Space_Heating
Opp Desc:	Install EIFS System
Opp Name:	Install EIFS

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

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

Utility Savings	
Demand (kW):	0
Electricity (kWh):	-890
Natural Gas (m³):	10,281
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	19.8
Financials	
Annual Utility Savings:	$4,066
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$2,397,369
Engineering & PM:	$359,605
Contingency:	$239,737
Project Costs:	$2,996,711
Simple Payback:	737.0
Capital Payback:	73.3
NPV:	-$2,931,195
IRR:	-18.7%



Write-ups	
Existing:	The exterior
Retrofit:	We recommend

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,984,204	2,993,595
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install EIFS

			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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			EIFS			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)					
Space Cool	33.9	0.0	33,880.0	35.2	0.0	35,150.0	-1,270	0					
Heat Reject.	0.2	0.0	160.0	0.2	0.0	170.0	-10	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.8	3,389.9	994,282.9	0.7	3,027.8	888,137.4	20	10,281					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,450.0	0	0					
Vent. Fans	167.3	0.0	167,260.0	167.2	0.0	167,200.0	60	0					
Pumps & Aux	18.0	0.0	18,030.0	17.7	0.0	17,720.0	310	0					
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0					
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0					
0	**547**	**3,390**	**1,540,963**	**548**	**3,028**	**1,435,727**	**-890**	**10,281**	**0**	**0**	**0**	**0**	
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	Select
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Install EIFS

Cost Breakout: Install EIFS

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	0	0				EIFS	Whole Building	per sqft	MTE Quote	$69			Yes	Project	22556.6972	$2,397,369	$0	$0	$2,397,369
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:	**$2,397,369**	**$0**	**$0**	**$2,397,369**

Escalation Rates: Install EIFS

Cash Flow Balance: Install EIFS

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$2,996,711	$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):		-$118	-$124	-$131	-$138	-$145	-$152	-$160	-$168	-$177	-$186	-$196	-$206	-$217	-$228	-$240	-$253	-$266	-$280	-$294	-$309
Annual Savings (M03):		$4,390	$4,612	$4,845	$5,089	$5,347	$5,617	$5,901	$6,200	$6,513	$6,842	$7,188	$7,550	$7,931	$8,331	$8,751	$9,192	$9,655	$10,141	$10,652	$11,188
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:	-$2,996,711	$4,272	$4,488	$4,714	$4,952	$5,202	$5,465	$5,741	$6,031	$6,336	$6,656	$6,991	$7,344	$7,714	$8,103	$8,511	$8,939	$9,389	$9,862	$10,357	$10,878
Cash Balance:	-$2,996,711	-$2,992,438	-$2,987,951	-$2,983,237	-$2,978,285	-$2,973,083	-$2,967,618	-$2,961,877	-$2,955,846	-$2,949,510	-$2,942,854	-$2,935,862	-$2,928,518	-$2,920,804	-$2,912,701	-$2,904,190	-$2,895,251	-$2,885,862	-$2,876,000	-$2,865,643	-$2,854,765
Undepreciated Amount:	-$2,996,711	-$2,547,204	-$2,165,123	-$1,840,355	-$1,564,302	-$1,329,656	-$1,130,208	-$960,677	-$816,575	-$694,089	-$589,976	-$501,479	-$426,257	-$362,319	-$307,971	-$261,775	-$222,509	-$189,133	-$160,763	-$136,648	-$116,151

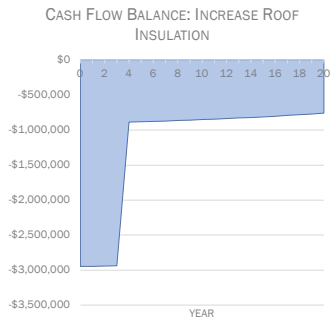
Energy Conservation Measure 5

Opp Cat:	Space_Heating
Opp Desc:	
Opp Name:	Increase Roof Insulation

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$1,873,994**
Avoided Capital Year:	**4**
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):	-70
Natural Gas (m³):	10,369
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	20.0
Financials	
Annual Utility Savings:	$4,205
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$2,359,486
Engineering & PM:	$353,923
Contingency:	$235,949
Project Costs:	$2,949,357
Simple Payback:	701.4
Capital Payback:	49.4
NPV:	-$1,339,834
IRR:	-6.0%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,982,471	2,992,770
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Increase Roof Insulation

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Roof Insulation			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)				
Space Cool	33.9	0.0	33,880.0	34.4	0.0	34,400.0	-520	0				
Heat Reject.	0.2	0.0	160.0	0.2	0.0	160.0	0	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.8	3,389.9	994,282.9	0.7	3,024.7	887,198.9	50	10,369				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,450.0	0	0				
Vent. Fans	167.3	0.0	167,260.0	166.9	0.0	166,860.0	400	0				
Pumps & Aux	18.0	0.0	18,030.0	18.0	0.0	18,030.0	0	0				
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0				
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0				
0	**547**	**3,390**	**1,540,963**	**548**	**3,025**	**1,433,999**	**-70**	**10,369**	**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: Increase Roof Insulation

Cost Breakout: Increase Roof Insulation

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				Roof Replacement	w/ insulation	per ft2	AW Hooker	$126			No	Project	16519	$2,073,519	$0	$0	$2,073,519
111	0	0				Roof Replacement	w/o insulation	per ft2	AW Hooker	$103			No	Avoided	16519	$1,703,631	$0	$0	$1,703,631
112	0	0											Yes	Project		$0	$0	$0	$0
113	0	0				BUR with Increased Insulation	Per Sq.Ft.	Total	Means '17	$15	$4	$0	Yes	Project	10138	$228,684	$57,283	$0	$285,967
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:	**$2,302,203**	**$57,283**	**$0**	**$2,359,486**

Escalation Rates: Increase Roof Insulation

Cash Flow Balance: Increase Roof Insulation

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$2,949,357	$0	$0	$0	$2,044,428	$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):		-$9	-$10	-$10	-$11	-$11	-$12	-$13	-$13	-$14	-$15	-$15	-$16	-$17	-$18	-$19	-$20	-$21	-$22	-$23	-$24
Annual Savings (M03):		$4,428	$4,651	$4,886	$5,133	$5,392	$5,665	$5,952	$6,253	$6,569	$6,901	$7,249	$7,615	$7,999	$8,403	$8,826	$9,271	$9,738	$10,228	$10,743	$11,283
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:	-$2,949,357	$4,419	$4,642	$4,876	$2,049,551	$5,381	$5,653	$5,939	$6,240	$6,555	$6,886	$7,234	$7,599	$7,982	$8,385	$8,807	$9,251	$9,717	$10,206	$10,720	$11,259
Cash Balance:	-$2,949,357	-$2,944,938	-$2,940,297	-$2,935,421	-$885,870	-$880,489	-$874,836	-$868,897	-$862,657	-$856,102	-$849,216	-$841,983	-$834,384	-$826,402	-$818,017	-$809,210	-$799,959	-$790,242	-$780,036	-$769,317	-$758,058
Undepreciated Amount:	-$2,949,357	-$2,506,953	-$2,130,910	-$1,811,274	-$1,539,583	-$1,308,645	-$1,112,349	-$945,496	-$803,672	-$683,121	-$580,653	-$493,555	-$419,522	-$356,593	-$303,104	-$257,639	-$218,993	-$186,144	-$158,222	-$134,489	-$114,316

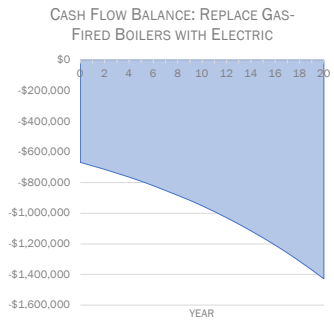
Energy Conservation Measure 6

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace Gas-Fired Boilers with Electric

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$185,115**
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):	-332
Electricity (kWh):	-277,950
Natural Gas (m³):	34,103
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	58.1
Financials	
Annual Utility Savings:	-$21,208
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$534,130
Engineering & PM:	$80,119
Contingency:	$53,413
Project Costs:	$667,662
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$1,017,342
IRR:	No IRR



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	3,019,018	2,774,840
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace Gas-Fired Boilers with Electric

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Electric Boilers			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	Month	Existing Demand	Retrofit Demand	Savings - kW
Space Cool	33.9	0.0	33,880.0	33.9	0.0	33,880.0	0	0	Jan	141	214	-73
Heat Reject.	0.2	0.0	160.0	0.2	0.0	160.0	0	0	Feb	141	206	-65
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Mar	141	182	-40
Space Heat	0.8	3,389.9	994,282.9	279.4	2,188.8	920,890.6	-278,630	34,103	Apr	141	182	-41
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0	May	140	145	-6
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,450.0	0	0	Jun	197	197	0
Vent. Fans	167.3	0.0	167,260.0	167.3	0.0	167,260.0	0	0	Jul	220	220	0
Pumps & Aux	18.0	0.0	18,030.0	17.4	0.0	17,350.0	680	0	Aug	214	213	0
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0	Sep	191	190	0
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0	Oct	137	158	-21
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Nov	138	171	-33
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0	Dec	140	194	-54
0	**547**	**3,390**	**1,540,963**	**825**	**2,189**	**1,466,891**	**-277,950**	**34,103**	**0**	**1,941**	**2,273**	**-332**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	M01
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Replace Gas-Fired Boilers with Electric

Cost Breakout: Replace Gas-Fired Boilers 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		Each	EE Est	$0	$4,500	$0	Yes	Project	1	$0	$6,922	$0	$6,922
111	0	0				Structural Analysis		Each	EE Est	$0	$5,500	$0	Yes	Project	1	$0	$8,460	$0	$8,460
112	0	0				Structural Reinforcement		Each	EE Est.	$5,000	$1,000	$0	Yes	Project	0	$0	$0	$0	$0
113	0	0											Yes	Project	0	$0	$0	$0	$0
114	0	0				Storage Tanks	AO Smith 200 USG	Each	Web Search	$10,699	$2,675	$0	Yes	Project	6	$98,551	$24,686	$0	$123,236
115	0	0				Electric Backup Boiler	300 kW	Each	Means '23	$21,400	$2,650	$0	Yes	Both	3	$98,560	$12,229	$0	$110,789
116	0	0											Yes	Project	0	$0	$0	$0	$0
117	0	0				Piping to/from Header							Yes	Project	0	$0	$0	$0	$0
118	0	0				In-Line Pump	Cast Iron 3" 1 hp	Each	Means '23	$4,575	$260	$0	Yes	Both	3	$21,071	$1,200	$0	$22,270
119	0	0											Yes	Project	0	$0	$0	$0	$0
120	0	0				Sched 40 Pipe	3" Threaded	Lin. Ft.	Means '23	$44	$24	$0	Yes	Both	60	$4,053	$2,215	$0	$6,268
121	0	0				90 ° Elbow	3" Threaded	Each	Means '23	$161	$104	$0	Yes	Both	12	$2,966	$1,920	$0	$4,886
122	0	0				Tee	3" Threaded	Each	Means '23	$231	$173	$0	Yes	Both	12	$4,256	$3,193	$0	$7,449
123	0	0				Fibreglass Pipe Insul. w/serv jacket	3" Pipe, 1" Ins	Lin. Ft.	Means '22	$4	$5	$0	Yes	Both	168	$944	$1,215	$0	$2,159
124	0	0				Butterfly Valve - Iron - Lever	3" Lug Type	Each	Means '22	$655	$130	$0	Yes	Both	12	$12,067	$2,400	$0	$14,466
125	0	0											Yes	Project	0	$0	$0	$0	$0
126	0	0				Boiler Electrical: 300 KW							Yes	Project	0	$0	$0	$0	$0
127	0	0				Cu-XHHW	#750, 1 Wire, 115A, 96kW	100 LF	Meas '23	$3,650	$490	$0	Yes	Project	24	$134,484	$18,089	$0	$152,573
128	0	0				PVC Conduit	4" (3x1/0, 4x#2)	LF	Meas '23	$28	$15	$0	Yes	Project	600	$25,791	$13,844	$0	$39,635
129	0	0				Circuit Breaker - NEMA 1	600V, 400A	Each	Meas '23	$4,525	$675	$0	Yes	Project	3	$20,840	$3,115	$0	$23,955
130	0	0				Pull Box	10"x10"x6" diam	Each	Meas '23	$20	$85	$0	Yes	Project	3	$90	$390	$0	$480
131	0	0											Yes	Project	0	$0	$0	$0	$0
132	0	0				Pump Electrical							Yes	Project	0	$0	$0	$0	$0
133	0	0				Cu-XHHW	#8, 1 Wire, 50A, 42kW	100 LF	Meas '23	$53	$68	$0	Yes	Project	12	$976	$1,255	$0	$2,232
134	0	0				PVC Conduit	3/4" (3x#6,4x#6)	LF	Meas '23	$3	$6	$0	Yes	Project	300	$1,382	$2,769	$0	$4,150
135	0	0				Circuit Breaker - NEMA 1	600V, 30A	Each	Meas '23	$535	$168	$0	Yes	Project	3	$2,464	$775	$0	$3,239
136	0	0				Pull Box	10"x10"x6" diam	Each	Meas '23	$20	$85	$0	Yes	Project	6	$181	$780	$0	$960
137	0	0											Yes	Project		$0	$0	$0	$0
138	0	0				Controls							Yes	Project		$0	$0	$0	$0
139	0	0				Existing to Remain							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:	**$428,674**	**$105,455**	**$0**	**$534,130**

Escalation Rates: Replace Gas-Fired Boilers with Electric

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity ($/kWh):	0.1262	0.1327	0.1396	0.1469	0.1545	0.1626	0.1710	0.1799	0.1893	0.1991	0.2095	0.2203	0.2318	0.2439	0.2565	0.2699	0.2839	0.2987	0.3142	0.3305	0.3477
Natural Gas ($/m³):	0.4066	0.4270	0.4486	0.4712	0.4950	0.5200	0.5463	0.5740	0.6030	0.6335	0.6655	0.6991	0.7344	0.7714	0.8103	0.8512	0.8941	0.9391	0.9864	1.0360	1.0882
Water ($/m³):	2.3396	2.4098	2.4821	2.5565	2.6332	2.7122	2.7936	2.8774	2.9637	3.0526	3.1442	3.2385	3.3357	3.4358	3.5388	3.6450	3.7544	3.8670	3.9830	4.1025	4.2256
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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 Gas-Fired Boilers with Electric

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Implementation Cost:	-$667,662	$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):		-$36,891	-$38,809	-$40,827	-$42,950	-$45,184	-$47,533	-$50,005	-$52,605	-$55,341	-$58,218	-$61,246	-$64,431	-$67,781	-$71,306	-$75,013	-$78,914	-$83,018	-$87,335	-$91,876	-$96,654
Annual Savings (M03):		$14,563	$15,298	$16,070	$16,882	$17,735	$18,632	$19,575	$20,565	$21,604	$22,696	$23,842	$25,045	$26,308	$27,635	$29,028	$30,490	$32,026	$33,639	$35,332	$37,110
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:	-$667,662	-$22,327	-$23,511	-$24,757	-$26,069	-$27,449	-$28,901	-$30,430	-$32,040	-$33,737	-$35,523	-$37,404	-$39,386	-$41,473	-$43,671	-$45,986	-$48,424	-$50,992	-$53,696	-$56,544	-$59,544
Cash Balance:	-$667,662	-$689,989	-$713,501	-$738,258	-$764,327	-$791,775	-$820,676	-$851,107	-$883,147	-$916,884	-$952,406	-$989,811	-$1,029,196	-$1,070,669	-$1,114,340	-$1,160,325	-$1,208,749	-$1,259,740	-$1,313,436	-$1,369,981	-$1,429,524
Undepreciated Amount:	-$667,662	-$567,513	-$482,386	-$410,028	-$348,524	-$296,245	-$251,808	-$214,037	-$181,932	-$154,642	-$131,446	-$111,729	-$94,969	-$80,724	-$68,615	-$58,323	-$49,575	-$42,138	-$35,818	-$30,445	-$25,878

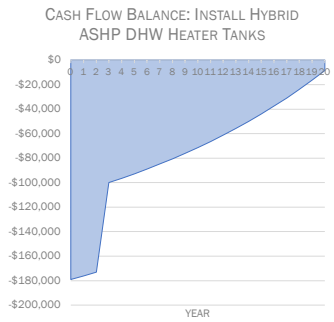
Energy Conservation Measure 7

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Hybrid ASHP DHW Heater Tanks

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$65,515**
Avoided Capital Year:	**3**
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	107
Electricity (kWh):	22,470
Natural Gas (m³):	0
Water (m³):	0
():	0
():	0
missions (Tonnes of CO2e):	0.6
Financials	
Annual Utility Savings:	$2,835
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$143,376
Engineering & PM:	$21,506
Contingency:	$14,338
Project Costs:	$179,220
Simple Payback:	63.2
Capital Payback:	21.0
NPV:	-$76,296
IRR:	-0.6%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	3,071,083	3,093,660
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Hybrid ASHP DHW Heater Tanks

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			ASHP DHW Heater			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	Month	Existing Demand	Retrofit Demand	Savings - kW
Space Cool	33.9	0.0	33,880.0	33.9	0.0	33,880.0	0	0	Jan	141	131	10
Heat Reject.	0.2	0.0	160.0	0.2	0.0	160.0	0	0	Feb	141	131	10
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Mar	141	131	10
Space Heat	0.8	3,389.9	994,282.9	0.8	3,389.9	994,282.9	0	0	Apr	141	131	10
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0	May	140	130	9
Hot Water	37.5	0.0	37,450.0	15.0	0.0	14,980.0	22,470	0	Jun	197	189	9
Vent. Fans	167.3	0.0	167,260.0	167.3	0.0	167,260.0	0	0	Jul	220	213	8
Pumps & Aux	18.0	0.0	18,030.0	18.0	0.0	18,030.0	0	0	Aug	214	206	8
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0	Sep	191	183	8
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0	Oct	137	130	8
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Nov	138	130	9
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0	Dec	140	131	9
0	**547**	**3,390**	**1,540,963**	**525**	**3,390**	**1,518,493**	**22,470**	**0**	**0**	**1,941**	**1,834**	**107**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	M01
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Install Hybrid ASHP DHW Heater Tanks

Cost Breakout: Install Hybrid ASHP DHW Heater Tanks

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				ASHP DHW Heater Tank			AW Hooker	$47,792			No	Project	3	$143,376	$0	$0	$143,376
111	0	0											No	Project	3	$0	$0	$0	$0
112	0	0											Yes	Project		$0	$0	$0	$0
113	0	0				Standard DHW Heater Tanks			AW Hooker	$19,853			No	Avoided	3	$59,559	$0	$0	$59,559
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
																$143,376	**$0**	**$0**	**$143,376**

Escalation Rates: Install Hybrid ASHP DHW Heater Tanks

Year:	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Demand ($/kW):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity ($/kWh):	0.1262	0.1327	0.1396	0.1469	0.1545	0.1626	0.1710	0.1799	0.1893	0.1991	0.2095	0.2203	0.2318	0.2439	0.2565	0.2699	0.2839	0.2987	0.3142	0.3305	0.3477
Natural Gas ($/m³):	0.4066	0.4270	0.4486	0.4712	0.4950	0.5200	0.5463	0.5740	0.6030	0.6335	0.6655	0.6991	0.7344	0.7714	0.8103	0.8512	0.8941	0.9391	0.9864	1.0360	1.0882
Water ($/m³):	2.3396	2.4098	2.4821	2.5565	2.6332	2.7122	2.7936	2.8774	2.9637	3.0526	3.1442	3.2385	3.3357	3.4358	3.5388	3.6450	3.7544	3.8670	3.9830	4.1025	4.2256
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
($/):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GHG Emissions (tCO2e):	0.000031	0.000043	0.000047	0.000054	0.000071	0.000072	0.000075	0.000069	0.000077	0.000083	0.000079	0.000079	0.000079	0.000077	0.000081	0.000082	0.000087	0.000088	0.000093	0.000093	0.000093

Cash Flow Balance: Install Hybrid ASHP DHW Heater Tanks

	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:	-$179,220	$0	$0	$69,935	$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):		$2,982	$3,137	$3,301	$3,472	$3,653	$3,843	$4,042	$4,253	$4,474	$4,706	$4,951	$5,209	$5,480	$5,764	$6,064	$6,380	$6,711	$7,060	$7,427	$7,814
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:	-$179,220	$2,982	$3,137	$73,235	$3,472	$3,653	$3,843	$4,042	$4,253	$4,474	$4,706	$4,951	$5,209	$5,480	$5,764	$6,064	$6,380	$6,711	$7,060	$7,427	$7,814
Cash Balance:	-$179,220	-$176,238	-$173,100	-$99,865	-$96,393	-$92,740	-$88,897	-$84,855	-$80,602	-$76,128	-$71,422	-$66,471	-$61,262	-$55,782	-$50,018	-$43,954	-$37,574	-$30,863	-$23,803	-$16,375	-$8,561
Undepreciated Amount:	-$179,220	-$152,337	-$129,486	-$110,063	-$93,554	-$79,521	-$67,593	-$57,454	-$48,836	-$41,510	-$35,284	-$29,991	-$25,493	-$21,669	-$18,418	-$15,656	-$13,307	-$11,311	-$9,615	-$8,172	-$6,946

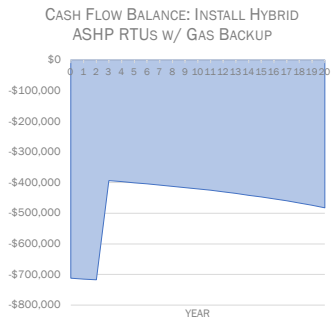
Energy Conservation Measure 8

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Hybrid ASHP RTUs w/ Gas Backup

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$306,591**
Avoided Capital Year:	**3**
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	-111
Electricity (kWh):	-82,820
Natural Gas (m³):	19,350
Water (m³):	0
():	0
():	0
:missions (Tonnes of CO₂e):	35.1
Financials	
Annual Utility Savings:	-$2,585
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$569,899
Engineering & PM:	$85,485
Contingency:	$56,990
Project Costs:	$712,374
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$491,530
IRR:	No IRR



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,976,278	2,912,697
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Hybrid ASHP RTUs w/ Gas 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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			ASHP RTUs w/ Gas Backup			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	Month	Existing Demand	Retrofit Demand	Savings - kW
Space Cool	33.9	0.0	33,880.0	33.4	0.0	33,410.0	470	0	Jan	141	166	-26
Heat Reject.	0.2	0.0	160.0	0.2	0.0	160.0	0	0	Feb	141	167	-26
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Mar	141	155	-14
Space Heat	0.8	3,389.9	994,282.9	84.0	2,708.4	877,746.6	-83,200	19,350	Apr	141	156	-15
HP Supp.	0.0	0.0	0.0	8.5	0.0	8,460.0	-8,460	0	May	140	139	1
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,460.0	-10	0	Jun	197	196	2
Vent. Fans	167.3	0.0	167,260.0	159.6	0.0	159,610.0	7,650	0	Jul	220	220	1
Pumps & Aux	18.0	0.0	18,030.0	17.3	0.0	17,300.0	730	0	Aug	214	213	1
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0	Sep	191	190	1
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0	Oct	137	137	0
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Nov	138	150	-12
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0	Dec	140	164	-24
0	**547**	**3,390**	**1,540,963**	**630**	**2,708**	**1,424,047**	**-82,820**	**19,350**	**0**	**1,941**	**2,051**	**-111**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	M01
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

General Requirements: Install Hybrid ASHP RTUs w/ Gas Backup

Cost Breakout: Install Hybrid ASHP RTUs w/ Gas 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				ASHP RTU	5 Ton Nominal c/w Electric Backup	each	Means '23	$36,000.00	$7,200.00	$0	Yes	Project	4	$221,069	$44,300	$0	$265,369
111	0	0				Structural Analysis		Each	EE Est	$0.00	$7,500.00	$0	Yes	Project	1	$0	$11,537	$0	$11,537
112	0	0				Demolition	Demo Existing	Each	Means '23	$0.00	$2,750.00	$0	Yes	Both	4	$0	$16,920	$0	$16,920
113	0	0				Craning	Craning - 40 ton truck mounted	Per Day	Means '23	$0.00	$475.44	$3,286	Yes	Both	4	$0	$2,925	$20,217	$23,142
114	0	0				Structural Reinforcement		Each	EE Est.	$5,000.00	$1,000.00	$0	Yes	Project	4	$30,704	$6,153	$0	$36,857
115	0	0				Roof Curb		Each	EE Est.	$15,000.00	$3,000.00	$0	Yes	Project	4	$92,112	$18,458	$0	$110,570
116	0	0				Controls							Yes	Project		$0	$0	$0	$0
117	0	0				Analog Inputs	Duct Temperature	Each	Means '22	$348.75	$116.25	$0	Yes	Both	16	$8,566	$2,861	$0	$11,427
118	0	0				Analog Outputs	Electric (Not incl. Device)	Each	Means '22	$285.00	$95.00	$0	Yes	Both	8	$3,500	$1,169	$0	$4,669
119	0	0				Digital Inputs	Current Sensor	Each	Means '22	$326.25	$108.75	$0	Yes	Both	8	$4,007	$1,338	$0	$5,345
120	0	0				Digital Outputs	Start/Stop	Each	Means '22	$255.00	$85.00	$0	Yes	Both	8	$3,132	$1,046	$0	$4,178
121	0	0				DDC Controller	16 Point Controller	Each	Means '22	$2,456.25	$818.75	$0	Yes	Both	3	$11,313	$3,778	$0	$15,091
122	0	0				DDC Front End	Calibration Labour	Point	Means '22	$90.00	$30.00	$0	Yes	Both	43	$5,941	$1,984	$0	$7,926
123	0	0				DDC Front End	Start-up Labour	Point	Means '22	$90.00	$30.00	$0	Yes	Both	43	$5,941	$1,984	$0	$7,926
124	0	0				Electrical							Yes	Project		$0	$0	$0	$0
125	0	0				Cu-XHHW	#3/0, 1 Wire, 200A, 166kW	100 LF	Means '23	$495.00	$216.00	$0	Yes	Project	24	$18,238	$7,974	$0	$26,212
126	0	0				PVC Conduit	1 1/2" (3x3/0, 4x1/0)	LF	Means '23	$6.00	$5.40	$0	Yes	Project	600	$5,527	$4,984	$0	$10,510
127	0	0				Circuit Breaker - NEMA 1	600V, 200A	Each	Means '23	$1,525.00	$360.00	$0	Yes	Project	4	$9,365	$2,215	$0	$11,580
128	0	0				Pull Box	10"x10"x6" diam	Each	Means '18	$19.60	$84.50	$0	Yes	Project	4	$120	$520	$0	$640
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0				Gas-Fired RTU	2000 CFM	Each	Means Online	$27,900	$1,750		Yes	Avoided	4	$171,328	$10,767	$0	$182,096
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:	**$419,535**	**$130,147**	**$20,217**	**$569,899**

Escalation Rates: Install Hybrid ASHP RTUs w/ Gas Backup

Cash Flow Balance: Install Hybrid ASHP RTUs w/ Gas 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:	-$712,374	$0	$0	$327,275	$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):		-$10,992	-$11,564	-$12,165	-$12,798	-$13,463	-$14,163	-$14,900	-$15,675	-$16,490	-$17,347	-$18,249	-$19,198	-$20,197	-$21,247	-$22,352	-$23,514	-$24,737	-$26,023	-$27,376	-$28,800
Annual Savings (M03):		$8,263	$8,680	$9,118	$9,579	$10,063	$10,572	$11,107	$11,668	$12,258	$12,877	$13,528	$14,210	$14,927	$15,680	$16,470	$17,300	$18,172	$19,086	$20,047	$21,056
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:	-$712,374	-$2,729	-$2,884	$324,228	-$3,219	-$3,400	-$3,592	-$3,793	-$4,006	-$4,232	-$4,470	-$4,722	-$4,988	-$5,269	-$5,567	-$5,881	-$6,214	-$6,565	-$6,936	-$7,329	-$7,744
Cash Balance:	-$712,374	-$715,103	-$717,987	-$393,759	-$396,978	-$400,379	-$403,970	-$407,763	-$411,770	-$416,001	-$420,471	-$425,193	-$430,181	-$435,450	-$441,017	-$446,898	-$453,111	-$459,676	-$466,613	-$473,942	-$481,685
Undepreciated Amount:	-$712,374	-$605,518	-$514,690	-$437,486	-$371,863	-$316,084	-$268,671	-$228,371	-$194,115	-$164,998	-$140,248	-$119,211	-$101,329	-$86,130	-$73,210	-$62,229	-$52,895	-$44,960	-$38,216	-$32,484	-$27,611

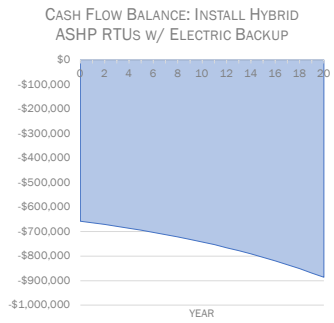
Energy Conservation Measure 9

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install Hybrid ASHP RTUs w/ Electric Backup

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$306,591**
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):	-161
Electricity (kWh):	-134,450
Natural Gas (m³):	26,269
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	47.0
Financials	
Annual Utility Savings:	-$6,287
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$525,671
Engineering & PM:	$78,851
Contingency:	$52,567
Project Costs:	$657,088
Simple Payback:	No Payback
Capital Payback:	No Payback
NPV:	-$762,213
IRR:	No IRR



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,956,341	2,848,000
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install Hybrid ASHP RTUs w/ 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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			ASHP RTUs w/ Electric Backup			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	Month	Existing Demand	Retrofit Demand	Savings - kW
Space Cool	33.9	0.0	33,880.0	33.4	0.0	33,410.0	470	0	Jan	141	183	-42
Heat Reject.	0.2	0.0	160.0	0.2	0.0	160.0	0	0	Feb	141	177	-36
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Mar	141	159	-17
Space Heat	0.8	3,389.9	994,282.9	84.0	2,464.7	806,322.3	-83,200	26,269	Apr	141	156	-15
HP Supp.	0.0	0.0	0.0	60.1	0.0	60,090.0	-60,090	0	May	140	139	1
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,460.0	-10	0	Jun	197	196	1
Vent. Fans	167.3	0.0	167,260.0	159.6	0.0	159,610.0	7,650	0	Jul	220	220	1
Pumps & Aux	18.0	0.0	18,030.0	17.3	0.0	17,300.0	730	0	Aug	214	213	1
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0	Sep	191	190	1
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0	Oct	137	137	0
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Nov	138	150	-12
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0	Dec	140	183	-43
0	**547**	**3,390**	**1,540,963**	**682**	**2,465**	**1,404,252**	**-134,450**	**26,269**	**0**	**1,941**	**2,101**	**-161**
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	M01

General Requirements: Install Hybrid ASHP RTUs w/ Electric Backup

Cost Breakout: Install Hybrid ASHP RTUs w/ 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				ASHP RTU	5 Ton Nominal c/w Electric Backup	each	Means '23	$30,000.00	$6,000.00	$0	Yes	Project	4	$184,224	$36,917	$0	$221,141
111	0	0				Structural Analysis		Each	EE Est	$0.00	$7,500.00	$0	Yes	Project	1	$0	$11,537	$0	$11,537
112	0	0				Demolition	Demo Existing	Each	Means '23	$0.00	$2,750.00	$0	Yes	Both	4	$0	$16,920	$0	$16,920
113	0	0				Craning	Craning - 40 ton truck mounted	Per Day	Means '23	$0.00	$475.44	$3,286	Yes	Both	4	$0	$2,925	$20,217	$23,142
114	0	0				Structural Reinforcement		Each	EE Est.	$5,000.00	$1,000.00	$0	Yes	Project	4	$30,704	$6,153	$0	$36,857
115	0	0				Roof Curb		Each	EE Est.	$15,000.00	$3,000.00	$0	Yes	Project	4	$92,112	$18,458	$0	$110,570
116	0	0				Controls							Yes	Project		$0	$0	$0	$0
117	0	0				Analog Inputs	Duct Temperature	Each	Means '22	$348.75	$116.25	$0	Yes	Both	16	$8,566	$2,861	$0	$11,427
118	0	0				Analog Outputs	Electric (Not incl. Device)	Each	Means '22	$285.00	$95.00	$0	Yes	Both	8	$3,500	$1,169	$0	$4,669
119	0	0				Digital Inputs	Current Sensor	Each	Means '22	$326.25	$108.75	$0	Yes	Both	8	$4,007	$1,338	$0	$5,345
120	0	0				Digital Outputs	Start/Stop	Each	Means '22	$255.00	$85.00	$0	Yes	Both	8	$3,132	$1,046	$0	$4,178
121	0	0				DDC Controller	16 Point Controller	Each	Means '22	$2,456.25	$818.75	$0	Yes	Both	3	$11,313	$3,778	$0	$15,091
122	0	0				DDC Front End	Calibration Labour	Point	Means '22	$90.00	$30.00	$0	Yes	Both	43	$5,941	$1,984	$0	$7,926
123	0	0				DDC Front End	Start-up Labour	Point	Means '22	$90.00	$30.00	$0	Yes	Both	43	$5,941	$1,984	$0	$7,926
124	0	0				Electrical							Yes	Project		$0	$0	$0	$0
125	0	0				Cu-XHHW	#3/0, 1 Wire, 200A, 166kW	100 LF	Means '23	$495.00	$216.00	$0	Yes	Project	24	$18,238	$7,974	$0	$26,212
126	0	0				PVC Conduit	1 1/2" (3x3/0, 4x1/0)	LF	Means '23	$6.00	$5.40	$0	Yes	Project	600	$5,527	$4,984	$0	$10,510
127	0	0				Circuit Breaker - NEMA 1	600V, 200A	Each	Means '23	$1,525.00	$360.00	$0	Yes	Project	4	$9,365	$2,215	$0	$11,580
128	0	0				Pull Box	10"x10"x6" diam	Each	Means '18	$19.60	$84.50	$0	Yes	Project	4	$120	$520	$0	$640
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0				Gas-Fired RTU	2000 CFM	Each	Means Online	$27,900	$1,750		Yes	Avoided	4	$171,328	$10,767	$0	$182,096
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:	**$382,690**	**$122,764**	**$20,217**	**$525,671**

Escalation Rates: Install Hybrid ASHP RTUs w/ Electric Backup

Cash Flow Balance: Install Hybrid ASHP RTUs w/ 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:	-$657,088	$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):		-$17,845	-$18,773	-$19,749	-$20,776	-$21,856	-$22,993	-$24,188	-$25,446	-$26,769	-$28,161	-$29,626	-$31,166	-$32,787	-$34,492	-$36,286	-$38,172	-$40,157	-$42,245	-$44,442	-$46,753
Annual Savings (M03):		$11,218	$11,784	$12,379	$13,004	$13,661	$14,352	$15,078	$15,841	$16,642	$17,482	$18,365	$19,292	$20,265	$21,287	$22,360	$23,487	$24,670	$25,912	$27,216	$28,585
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$657,088	-$6,627	-$6,989	-$7,370	-$7,772	-$8,195	-$8,641	-$9,110	-$9,605	-$10,128	-$10,679	-$11,261	-$11,874	-$12,522	-$13,205	-$13,926	-$14,686	-$15,488	-$16,334	-$17,226	-$18,168
Cash Balance:	-$657,088	-$663,715	-$670,704	-$678,074	-$685,846	-$694,042	-$702,682	-$711,792	-$721,398	-$731,525	-$742,205	-$753,465	-$765,340	-$777,862	-$791,067	-$804,992	-$819,678	-$835,166	-$851,499	-$868,726	-$886,894
Undepreciated Amount:	-$657,088	-$558,525	-$474,746	-$403,534	-$343,004	-$291,554	-$247,821	-$210,647	-$179,050	-$152,193	-$129,364	-$109,959	-$93,465	-$79,446	-$67,529	-$57,399	-$48,790	-$41,471	-$35,250	-$29,963	-$25,468

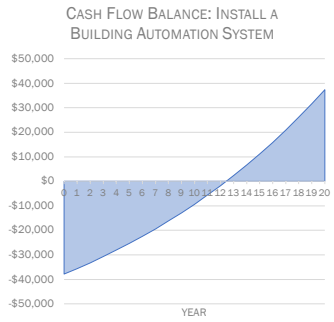
Energy Conservation Measure 10

Opp Cat:	Select
Opp Desc:	
Opp Name:	Install a Building Automation System

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

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

Utility Savings	
Demand (kW):	0
Electricity (kWh):	1,580
Natural Gas (m³):	4,798
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	9.3
Financials	
Annual Utility Savings:	$2,149
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$30,274
Engineering & PM:	$4,541
Contingency:	$3,027
Project Costs:	$37,842
Simple Payback:	17.6
Capital Payback:	12.4
NPV:	-$3,150
IRR:	6.4%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	3,038,519	3,044,897
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Install a Building Automation System

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			Building Automation System			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)					
Space Cool	33.9	0.0	33,880.0	32.3	0.0	32,300.0	1,580	0					
Heat Reject.	0.2	0.0	160.0	0.2	0.0	170.0	-10	0					
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Space Heat	0.8	3,389.9	994,282.9	0.7	3,220.9	944,711.8	40	4,798					
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,480.0	-30	0					
Vent. Fans	167.3	0.0	167,260.0	167.3	0.0	167,260.0	0	0					
Pumps & Aux	18.0	0.0	18,030.0	18.0	0.0	18,030.0	0	0					
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0					
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0					
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0					
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0					
0	**547**	**3,390**	**1,540,963**	**546**	**3,221**	**1,489,852**	**1,580**	**4,798**	**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 a Building Automation System

Cost Breakout: Install a Building Automation System

Row	Division #	Section #	Division	Section	Item Description	Item	Description	Units	Source	Unit Costs			Gen Req?	Avoided Cost/ Project Cost	Qty	Material	Labour	Equipment	Total
										Materials	Labour	Equipment							
110	23	09.23	HVAC	Controls	DDC Front End-Computer and software	DDC Front End	Computer and software	Each	Means '22	$4,763	$1,588	$0	Yes	Project	1	$7,311	$2,442	$0	$9,753
111	23	09.23	HVAC	Controls	DDC Front End-Engineering Labour	DDC Front End	Engineering Labour	Point	Means '22	$71	$24	$0	Yes	Project	40	$4,329	$1,446	$0	$5,775
112	23	09.23	HVAC	Controls	DDC Front End-Calibration Labour	DDC Front End	Calibration Labour	Point	Means '22	$90	$30	$0	Yes	Project	40	$5,527	$1,846	$0	$7,373
113	23	09.23	HVAC	Controls	DDC Front End-Start-up Labour	DDC Front End	Start-up Labour	Point	Means '22	$90	$30	$0	Yes	Project	40	$5,527	$1,846	$0	$7,373
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:	**$22,694**	**$7,579**	**$0**	**$30,274**

Escalation Rates: Install a Building Automation System

Cash Flow Balance: Install a Building Automation System

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$37,842	$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):		$210	$221	$232	$244	$257	$270	$284	$299	$315	$331	$348	$366	$385	$405	$426	$449	$472	$496	$522	$549
Annual Savings (M03):		$2,049	$2,152	$2,261	$2,375	$2,495	$2,622	$2,754	$2,894	$3,040	$3,193	$3,355	$3,524	$3,702	$3,888	$4,084	$4,290	$4,506	$4,733	$4,971	$5,221
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:	-$37,842	$2,259	$2,373	$2,493	$2,619	$2,752	$2,892	$3,039	$3,193	$3,354	$3,524	$3,703	$3,890	$4,087	$4,294	$4,511	$4,739	$4,978	$5,230	$5,494	$5,771
Cash Balance:	-$37,842	-$35,583	-$33,210	-$30,717	-$28,097	-$25,345	-$22,453	-$19,415	-$16,222	-$12,868	-$9,344	-$5,641	-$1,751	$2,336	$6,630	$11,141	$15,880	$20,858	$26,087	$31,581	$37,352
Undepreciated Amount:	-$37,842	-$32,166	-$27,341	-$23,240	-$19,754	-$16,791	-$14,272	-$12,131	-$10,312	-$8,765	-$7,450	-$6,333	-$5,383	-$4,575	-$3,889	-$3,306	-$2,810	-$2,388	-$2,030	-$1,726	-$1,467

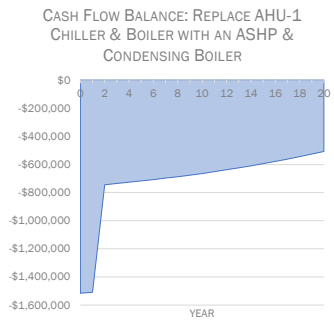
Energy Conservation Measure 11

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace AHU-1 Chiller & Boiler with an ASHP & Condensing

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$723,862.94**
Avoided Capital Year:	**2**
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	-25
Electricity (kWh):	8,560
Natural Gas (m³):	15,037
Water (m³):	0
():	0
():	0
Emissions (Tonnes of CO2e):	29.3
Financials	
Annual Utility Savings:	$7,191
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$1,212,312
Engineering & PM:	$181,847
Contingency:	$121,231
Project Costs:	$1,515,390
Simple Payback:	210.7
Capital Payback:	36.6
NPV:	-$742,669
IRR:	-6.9%



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,929,393	2,952,964
% Reduction	#DIV/0!	#DIV/0!

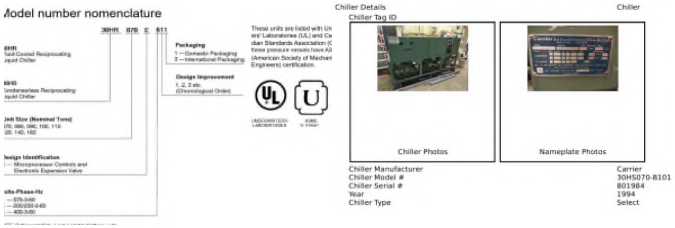
Electrical Capacity Impact (Amps): for Ele Service Upgrades			
Base	Summer	Winter	Peak

Savings: Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler

Avg Temp (°F)	Avg Temp (°C)	Total Hours	Meter Selection				Occupancy	Eff. Profile
			Select	Select	Select	Select	Select	Select
-33	-36	0						0%
-28	-33	0						0%
-23	-30	0						0%
-18	-28	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			AHU-1 (Aud) Heat Pump			Savings					
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	Month	Existing Demand	Retrofit Demand	Savings - kW
Space Cool	33.9	0.0	33,880.0	28.6	0.0	28,590.0	5,290	0	Jan	141	150	-9
Heat Reject.	0.2	0.0	160.0	0.0	0.0	0.0	160	0	Feb	141	148	-7
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Mar	141	144	-3
Space Heat	0.8	3,389.9	994,282.9	2.1	2,860.3	840,366.0	-1,300	15,037	Apr	141	142	-1
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0	May	140	138	2
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,450.0	0	0	Jun	197	197	0
Vent. Fans	167.3	0.0	167,260.0	167.3	0.0	167,260.0	0	0	Jul	220	221	0
Pumps & Aux	18.0	0.0	18,030.0	13.6	0.0	13,620.0	4,410	0	Aug	214	214	-1
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0	Sep	191	191	-1
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0	Oct	137	136	2
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Nov	138	140	-2
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0	Dec	140	145	-6
0	**547**	**3,390**	**1,540,963**	**539**	**2,860**	**1,377,186**	**8,560**	**15,037**	**0**	**1,941**	**1,966**	**-25**

Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	M01
kout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select



Notes:

Replace 70 ton chiller w/ 70 ton ASHP
Refrigerant to Water HX

General Requirements: Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler

Cost Breakout: Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler

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	Boiler	Each	Means '25		$3,000		Yes	Both	1	$0	$4,615	$0	$4,615
111	0	0				Demolition	Chiller	Each	AWH		$3,000		Yes	Both	1	$0	$4,615	$0	$4,615
112	0	0				Demolition	Fluid Coolers	Each	AWH		$2,500		Yes	Both	1	$0	$3,846	$0	$3,846
113	0	0											Yes	Project		$0	$0	$0	$0
114	0	0				Allowance	Modifications to existing equipment pads	Each	AWH	$2,000	$500	$0	Yes	Both	2	$6,141	$1,538	$0	$7,679
115	0	0				Allowance	Patch & make good existing roof penetrations	Each	AWH Int	$5,000	$1,250	$0	Yes	Both	1	$7,676	$1,923	$0	$9,599
116	0	0				Like for Like Boiler	1200 MBH Near Cond	Each	Means '25	$24,000	$7,025	$0	Yes	Avoided	1	$36,845	$10,806	$0	$47,651
117	0	0				Condensing Boiler	1200 MBH Condensing	Each	Means '25	$41,300	$5,475	$0	Yes	Project	1	$63,404	$8,422	$0	$71,825
118	0	0				Allowance	Piping modifcations	Each	EE Est	$10,000	$2,500	$0	Yes	Project	1	$15,352	$3,846	$0	$19,198
119	0	0				Allowance	Dist Pump Replacements	Each	AWH	$30,000	$7,500	$0	Yes	Both	2	$92,112	$23,073	$0	$115,185
120	0	0				Allowance	Circ Pump Relacements	Each	AWH	$9,000	$2,250	$0	Yes	Both	1	$13,817	$3,461	$0	$17,278
121	0	0				Venting	Double Wall Cat IV	Each	AWH	$20,000	$5,000	$0	Yes	Both	1	$30,704	$7,691	$0	$38,395
122	0	0				ASHP	Aermec NYK: 25 ton Modular	Each	AWH	$103,125	$34,375	$0	Yes	Project	3	$474,953	$158,627	$0	$633,579
123	0	0				Heat Exchanger	1000 MBH/200 GPM	Each	Means '25	$105,000	$5,250	$0	Yes	Project	1	$161,196	$8,076	$0	$169,272
124	0	0				Like for Like Chiller	70 ton Scroll	Each	Means '25	$63,500	$8,825	$0	Yes	Avoided	1	$97,485	$13,575	$0	$111,060
125	0	0				Like for Like Fluid Coolers	75 ton	Each	Means '25	$64,850	$1,550	$0	Yes	Avoided	1	$99,558	$2,384	$0	$101,942
126	0	0				Refrigeration Piping	CW expansion valves	Each	AWH	$15,000	$5,000	$0	Yes	Both	1	$23,028	$7,691	$0	$30,719
127	0	0				Allowance	Noise & Vibration Isolation	Each	AWH	$5,000	$1,250	$0	Yes	Both	1	$7,676	$1,923	$0	$9,599
128	0	0				Allowance	Testing & Balancing	Each	EE Est		$20,000		Yes	Both	1	$0	$30,764	$0	$30,764
129	0	0				Allowance	Commissioning	Each	EE Est		$30,000		Yes	Both	1	$0	$46,146	$0	$46,146
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:	**$896,058**	**$316,254**	**$0**	**$1,212,312**

Escalation Rates: Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler

Cash Flow Balance: Replace AHU-1 Chiller & Boiler with an ASHP & Condensing Boiler

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$1,515,390	$0	$756,063	$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):		$1,136	$1,195	$1,257	$1,323	$1,392	$1,464	$1,540	$1,620	$1,704	$1,793	$1,886	$1,984	$2,087	$2,196	$2,310	$2,430	$2,557	$2,690	$2,829	$2,977
Annual Savings (M03):		$6,421	$6,745	$7,086	$7,444	$7,820	$8,215	$8,631	$9,068	$9,526	$10,007	$10,512	$11,043	$11,600	$12,185	$12,799	$13,444	$14,121	$14,832	$15,579	$16,363
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$1,515,390	$7,558	$764,004	$8,343	$8,766	$9,211	$9,679	$10,171	$10,688	$11,230	$11,800	$12,399	$13,027	$13,688	$14,381	$15,109	$15,874	$16,678	$17,522	$18,408	$19,339
Cash Balance:	-$1,515,390	-$1,507,832	-$743,828	-$735,485	-$726,719	-$717,508	-$707,828	-$697,657	-$686,970	-$675,739	-$663,939	-$651,541	-$638,513	-$624,826	-$610,445	-$595,335	-$579,461	-$562,783	-$545,261	-$526,853	-$507,513
Undepreciated Amount:	-$1,515,390	-$1,288,081	-$1,094,869	-$930,639	-$791,043	-$672,386	-$571,529	-$485,799	-$412,929	-$350,990	-$298,341	-$253,590	-$215,552	-$183,219	-$155,736	-$132,376	-$112,519	-$95,641	-$81,295	-$69,101	-$58,736

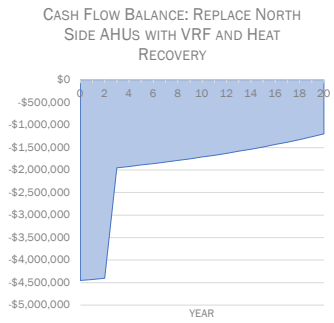
Energy Conservation Measure 12

Opp Cat:	Select
Opp Desc:	
Opp Name:	Replace North Side AHUs with VRF and Heat Recovery

Costing Setup	
Engineering & PM:	**15%**
Contingency:	**10%**
Additional Annual Costs:	
Additional Annual Savings:	
Tax Rebate (Capital Projects):	**No**
Avoided Capital Costs:	**$2,273,865**
Avoided Capital Year:	**3**
Financial Analysis Term (years):	**20**

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

Utility Savings	
Demand (kW):	-40
Electricity (kWh):	-10,290
Natural Gas (m³):	61,474
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	118.5
Financials	
Annual Utility Savings:	$23,685
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$3,561,721
Engineering & PM:	$534,258
Contingency:	$356,172
Project Costs:	$4,452,152
Simple Payback:	188.0
Capital Payback:	33.2
NPV:	-$2,106,407
IRR:	-5.1%
LCC/tCO2e	-$888.94



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

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,467,303	2,518,446
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Replace North Side AHUs with VRF and Heat Recovery

			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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	Existing			VRF Only			Savings						
	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (MWh)	Propane (MMBTU)	Combined (kWh)	Electricity (kWh)	Propane (L)	Month	Existing Demand	Retrofit Demand	Savings - kW
Space Cool	33.9	0.0	33,880.0	29.3	0.0	29,320.0	4,560	0	Jan	141	161	-21
Heat Reject.	0.2	0.0	160.0	0.2	0.0	170.0	-10	0	Feb	141	155	-14
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Mar	141	155	-14
Space Heat	0.8	3,389.9	994,282.9	70.7	1,224.8	429,688.3	-69,960	61,474	Apr	141	156	-15
HP Supp.	0.0	0.0	0.0	4.3	0.0	4,310.0	-4,310	0	May	140	137	3
Hot Water	37.5	0.0	37,450.0	37.5	0.0	37,450.0	0	0	Jun	197	190	7
Vent. Fans	167.3	0.0	167,260.0	113.3	0.0	113,330.0	53,930	0	Jul	220	206	15
Pumps & Aux	18.0	0.0	18,030.0	12.5	0.0	12,530.0	5,500	0	Aug	214	196	17
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0	Sep	191	178	12
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0	Oct	137	140	-3
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0	Nov	138	151	-13
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0	Dec	140	155	-15
0	**547**	**3,390**	**1,540,963**	**558**	**1,225**	**916,698**	**-10,290**	**61,474**	**0**	**1,941**	**1,981**	**-40**
Main Meter:	Select	Select	Select	Select	Select	Select	Select	M02	M03	Select	Select	Select	M01
Breakout Meter:	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select	Select

Notes from Call w/Jonas

VRF outdoor unit has a limitation of around 150m total length for refrigerant runs

General Requirements: Replace North Side AHUs with VRF and Heat Recovery

Cost Breakout: Replace North Side AHUs with VRF and Heat Recovery

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				Selective Demolition							Yes	Project		$0	$0	$0	$0
112	0	0				Demolition	Boiler	Each	AWH		$4,000		Yes	Both	1	$0	$6,153	$0	$6,153
113	0	0				Demolition	AHUs	Each	AWH		$10,000		Yes	Both	5	$0	$76,910	$0	$76,910
114	0	0											Yes	Project		$0	$0	$0	$0
115	0	0											Yes	Project		$0	$0	$0	$0
116	0	0				Zone A	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	424	$567,936	$189,312	$0	$757,248
117	0	0				Zone B	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	144	$192,884	$64,295	$0	$257,179
118	0	0				Zone C	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	192	$257,179	$85,726	$0	$342,905
119	0	0				Zone D	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	144	$192,884	$64,295	$0	$257,179
120	0	0				Zone E	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	40	$53,579	$17,860	$0	$71,439
121	0	0				Zone F	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	53	$70,992	$23,664	$0	$94,656
122	0	0				Zone G	VRF	MBH	EE Est	$1,339	$446	$0	No	Project	40	$53,579	$17,860	$0	$71,439
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				HRU-1	Heat Recovery Unit, Hydronic	per CFM	AWH	$26	$9	$0	Yes	Project	4000	$161,196	$53,837	$0	$215,033
128	0	0				HRU-2	Heat Recovery Unit, Hydronic	per CFM	AWH	$26	$9	$0	Yes	Project	1800	$72,538	$24,227	$0	$96,765
129	0	0											Yes	Project		$0	$0	$0	$0
130	0	0				HRU Distribution & Ductwork							Yes	Project		$0	$0	$0	$0
131	0	0				Ductwork, Rectangular, galvanized steel	Over 5,000 lbs	per lb	Means Online	$2.97	$17.97		Yes	Both	16000	$72,953	$442,263	$0	$515,216
132	0	0				Ductwork, Rectangular, galvanized steel	Over 5,000 lbs	per lb	Means Online	$2.97	$17.97		Yes	Both	9391	$42,821	$259,594	$0	$302,415
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				Lab RTU							Yes	Project		$0	$0	$0	$0
146	0	0				ASHP RTU	20 Ton Nominal c/w Electric Backup	each	HTS 2023	$117,590	$8,033	$0	Yes	Project	1	$180,524	$12,357	$0	$192,881
147	0	0				Structural Analysis		Each	EE Est	$0	$7,500	$0	Yes	Both	1	$0	$11,537	$0	$11,537
148	0	0				DeMeans '23ition	Demo Existing	Each	Means '23	$0	$2,750	$0	Yes	Both	1	$0	$4,230	$0	$4,230
149	0	0				Craning	Craning - 40 ton truck mounted	Per Day	Means '23	$0	$475	$3,286	Yes	Both	1	$0	$731	$5,054	$5,785
150	0	0				Structural Reinforcement		Each	EE Est.	$12,500	$2,500	$0	Yes	Project	1	$19,190	$3,846	$0	$23,036
151	0	0				Roof Curb		Each	EE Est.	$30,000	$6,000	$0	Yes	Both	1	$46,056	$9,229	$0	$55,285
152	0	0				Controls							Yes	Project		$0	$0	$0	$0
153	0	0				Analog Inputs	Duct Temperature	Each	Means '22	$349	$116	$0	Yes	Both	4	$2,142	$715	$0	$2,857
154	0	0				Analog Outputs	Electric (Not incl. Device)	Each	Means '22	$285	$95	$0	Yes	Both	2	$875	$292	$0	$1,167
155	0	0				Digital Inputs	Current Sensor	Each	Means '22	$326	$109	$0	Yes	Both	2	$1,002	$335	$0	$1,336
156	0	0				Digital Outputs	Start/Stop	Each	Means '22	$255	$85	$0	Yes	Both	2	$783	$261	$0	$1,044
157	0	0				DDC Controller	16 Point Controller	Each	Means '22	$2,456	$819	$0	Yes	Both	1	$3,771	$1,259	$0	$5,030
158	0	0				DDC Front End	Calibration Labour	Point	Means '22	$90	$30	$0	Yes	Both	11	$1,520	$508	$0	$2,027
159	0	0				DDC Front End	Start-up Labour	Point	Means '22	$90	$30	$0	Yes	Both	11	$1,520	$508	$0	$2,027
160	0	0				Electrical							Yes	Project		$0	$0	$0	$0
161	0	0				Cu-XHHW	#4/0, 1 Wire, 230A, 191kW	100 LF	Means '23	$560	$245	$0	Yes	Project	6	$5,158	$2,261	$0	$7,419
162	0	0				Circuit Breaker	Enclosed, 200 Amp	each	Means '23	$1,150	$360	$0	Yes	Project	1	$1,765	$554	$0	$2,319
163	0	0				Conduit	2" PVC	LF	Means '23	$9	$9	$0	Yes	Project	150	$2,026	$2,077	$0	$4,103
164	0	0				Pull Box	10"x10"	Each	Means '23	$24	$77	$0	Yes	Project	1	$36	$118	$0	$155
165	0	0				Duct Work							Yes	Project		$0	$0	$0	$0
166	0	0				Ductwork, Rectangular, galvanized steel	Over 5,000 lbs	per lb	Means Online	$2.97	$17.97		Yes	Both	416	$1,895	$11,490	$0	$13,386
167	0	0											Yes	Project		$0	$0	$0	$0
168	0	0											Yes	Project		$0	$0	$0	$0
169	0	0											Yes	Project		$0	$0	$0	$0
170	0	0				Gym RTU							Yes	Project		$0	$0	$0	$0
171	0	0				ASHP RTU	7.5 Ton Nominal c/w Electric Backup	each	Means '23	$36,000	$6,000	$0	Yes	Project	1	$55,267	$9,229	$0	$64,496
172	0	0				Structural Analysis		Each	EE Est	$0	$7,500	$0	Yes	Both	1	$0	$11,537	$0	$11,537
173	0	0				Demolition	Demo Existing	Each	Means '23	$0	$2,750	$0	Yes	Both	1	$0	$4,230	$0	$4,230
174	0	0				Craning	Craning - 40 ton truck mounted	Per Day	Means '23	$0	$475	$3,286	Yes	Both	1	$0	$731	$5,054	$5,785
175	0	0				Structural Reinforcement		Each	EE Est.	$5,000	$1,000	$0	Yes	Project	1	$7,676	$1,538	$0	$9,214
176	0	0				Roof Curb		Each	EE Est.	$15,000	$3,000	$0	Yes	Both	1	$23,028	$4,615	$0	$27,643
177	0	0				Controls							Yes	Both		$0	$0	$0	$0

178	0	0				Analog Inputs	Duct Temperature	Each	Means '22	$349	$116	$0	Yes	Both	4	$2,142	$715	$0	$2,857
179	0	0				Analog Outputs	Electric (Not incl. Device)	Each	Means '22	$285	$95	$0	Yes	Both	2	$875	$292	$0	$1,167
180	0	0				Digital Inputs	Current Sensor	Each	Means '22	$326	$109	$0	Yes	Both	2	$1,002	$335	$0	$1,336
181	0	0				Digital Outputs	Start/Stop	Each	Means '22	$255	$85	$0	Yes	Both	2	$783	$261	$0	$1,044
182	0	0				DDC Controller	16 Point Controller	Each	Means '22	$2,456	$819	$0	Yes	Both	1	$3,771	$1,259	$0	$5,030
183	0	0				DDC Front End	Calibration Labour	Point	Means '22	$90	$30	$0	Yes	Both	11	$1,520	$508	$0	$2,027
184	0	0				DDC Front End	Start-up Labour	Point	Means '22	$90	$30	$0	Yes	Both	11	$1,520	$508	$0	$2,027
185	0	0				Electrical							Yes	Project		$0	$0	$0	$0
186	0	0				Cu-XHHW	#3/0, 1 Wire, 200A, 166kW	100 LF	Means '23	$495	$216	$0	Yes	Project	6	$4,560	$1,994	$0	$6,553
187	0	0				PVC Conduit	1 1/2" (3x3/0, 4x1/0)	LF	Means '23	$6	$5	$0	Yes	Project	150	$1,382	$1,246	$0	$2,628
188	0	0				Circuit Breaker - NEMA 1	600V, 200A	Each	Means '23	$1,525	$360	$0	Yes	Project	1	$2,341	$554	$0	$2,895
189	0	0				Pull Box	10"x10"x6" diam	Each	Means '18	$20	$85	$0	Yes	Project	1	$30	$130	$0	$160
190	0	0				Duct Work							Yes	Project		$0	$0	$0	$0
191	0	0				Ductwork, Rectangular, galvanized steel	Over 5,000 lbs	per lb	Means Online	$2.97	$17.97		Yes	Both	339	$1,548	$9,382	$0	$10,929
192	0	0											Yes	Project		$0	$0	$0	$0
193	0	0				Avoided Costs							Yes	Project		$0	$0	$0	$0
194	0	0				AHU	5,000 CFM	Each	Means Online	$37,100	$1,475		Yes	Avoided	12	$683,471	$27,226	$0	$710,697
195	0	0				Boilers	1000 MBH	Each	Means Online	$23,700	$5,175		Yes	Avoided	1	$36,384	$7,960	$0	$44,344
196	0	0				Boilers	650 MBH	Each	Means Online	$18,900	$3,925		Yes	Avoided	4	$116,061	$24,150	$0	$140,211
197	0	0											Yes	Project		$0	$0	$0	$0
198	0	0											Yes	Project		$0	$0	$0	$0
															Totals:	**$2,114,247**	**$1,437,366**	**$10,108**	**$3,561,721**

Escalation Rates: Replace North Side AHUs with VRF and Heat Recovery

Cash Flow Balance: Replace North Side AHUs with VRF and Heat Recovery

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Implementation Cost:	-$4,452,152	$0	$0	$2,427,265	$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):		-$1,366	-$1,437	-$1,511	-$1,590	-$1,673	-$1,760	-$1,851	-$1,948	-$2,049	-$2,155	-$2,267	-$2,385	-$2,509	-$2,640	-$2,777	-$2,921	-$3,073	-$3,233	-$3,401	-$3,578
Annual Savings (M03):		$26,252	$27,576	$28,968	$30,431	$31,969	$33,586	$35,285	$37,070	$38,944	$40,911	$42,977	$45,146	$47,423	$49,815	$52,326	$54,962	$57,730	$60,637	$63,689	$66,894
Annual Savings (M04):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M05):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Savings (M06):		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Incentives:	$0																				
Add'l Annual Costs:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Add'l Annual Savings:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Tax Rebate:		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Annual Total:	-$4,452,152	$24,886	$26,139	$2,454,722	$28,841	$30,296	$31,826	$33,434	$35,122	$36,895	$38,756	$40,709	$42,761	$44,914	$47,175	$49,548	$52,041	$54,657	$57,404	$60,288	$63,315
Cash Balance:	-$4,452,152	-$4,427,265	-$4,401,126	-$1,946,405	-$1,917,564	-$1,887,267	-$1,855,441	-$1,822,007	-$1,786,884	-$1,749,989	-$1,711,234	-$1,670,524	-$1,627,764	-$1,582,850	-$1,535,675	-$1,486,127	-$1,434,086	-$1,379,429	-$1,322,025	-$1,261,738	-$1,198,422
Undepreciated Amount:	-$4,452,152	-$3,784,329	-$3,216,680	-$2,734,178	-$2,324,051	-$1,975,443	-$1,679,127	-$1,427,258	-$1,213,169	-$1,031,194	-$876,515	-$745,037	-$633,282	-$538,290	-$457,546	-$388,914	-$330,577	-$280,991	-$238,842	-$203,016	-$172,563

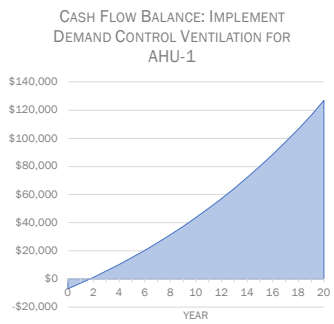
Energy Conservation Measure 13

Opp Cat:	Air_Distribution
Opp Desc:	Implement Demand Control Ventilation
Opp Name:	Implement Demand Control Ventilation for AHU-1

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):	80
Natural Gas (m³):	9,401
Water (m³):	0
():	0
():	0
missions (Tonnes of CO₂e):	18.2
Financials	
Annual Utility Savings:	$3,831
Add'l Annual Savings:	$0
Add'l Annual Costs:	$0
Incentives:	$0
Materials & Labour:	$5,622
Engineering & PM:	$843
Contingency:	$562
Project Costs:	$7,027
Simple Payback:	1.8
Capital Payback:	1.7
NPV:	$54,723
IRR:	62.3%



Write-ups	
Existing:	The air-handling
Retrofit:	We recommend

Work Check	Main Meter	Breakout Meter
	Select	Select
Existing	0	0
Savings	2,992,349	3,001,830
% Reduction	#DIV/0!	#DIV/0!

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

Savings: Implement Demand Control Ventilation for AHU-1

			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	0						0%
-13	-25	1						0%
-8	-22	21						0%
-3	-19	80						0%
3	-16	127						0%
8	-14	169						0%
13	-11	290						0%
18	-8	423						0%
23	-5	460						0%
28	-3	537						0%
33	0	776						0%
38	3	719						0%
43	6	651						0%
48	9	677						0%
53	11	786						0%
58	14	773						0%
63	17	678						0%
68	20	639						0%
73	23	523						0%
78	25	296						0%
83	28	108						0%
88	31	26						0%
93	34	1						0%
98	36	0						0%
103	39	0						0%
Totals		**8,760**	**0**	**0**	**0**	**0**	**0**	**0**

End-Use	**Existing**			**AHU-1 DCV**			**Savings**					
	Electricity (MWh)	**Propane (MMBTU)**	**Combined (kWh)**	**Electricity (MWh)**	**Propane (MMBTU)**	**Combined (kWh)**	**Electricity (kWh)**	**Propane (L)**				
Space Cool	33.9	0.0	33,880.0	35.0	0.0	35,010.0	-1,130	0				
Heat Reject.	0.2	0.0	160.0	0.2	0.0	180.0	-20	0				
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Space Heat	0.8	3,389.9	994,282.9	0.8	3,058.8	897,243.0	0	9,401				
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Hot Water	37.5	0.0	37,450.0	37.4	0.0	37,430.0	20	0				
Vent. Fans	167.3	0.0	167,260.0	167.3	0.0	167,260.0	0	0				
Pumps & Aux	18.0	0.0	18,030.0	16.8	0.0	16,820.0	1,210	0				
Ext. Usage	8.2	0.0	8,150.0	8.2	0.0	8,150.0	0	0				
Misc. Equip	72.7	0.0	72,700.0	72.7	0.0	72,700.0	0	0				
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0	0				
Area Lights	209.1	0.0	209,050.0	209.1	0.0	209,050.0	0	0				
0	**547**	**3,390**	**1,540,963**	**547**	**3,059**	**1,443,843**	**80**	**9,401**	**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: Implement Demand Control Ventilation for AHU-1

Cost Breakout: Implement Demand Control Ventilation for AHU-1

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				Analog Inputs	CO2 Duct Sensor	Each	ITM Website	$461	$154	$0	Yes	Project	2	$1,415	$474	$0	$1,889
111	23	09.23	HVAC	Controls	Analog Outputs-Electric (Not incl. Device)	Analog Outputs	Electric (Not	Each	Means '22	$285	$95	$0	Yes	Project	2	$875	$292	$0	$1,167
112	23	09.23	HVAC	Controls	DDC Front End-Engineering Labour	DDC Front End	Engineering Labour	Point	Means '22	$71	$24	$0	Yes	Project	5	$541	$181	$0	$722
113	23	09.23	HVAC	Controls	DDC Front End-Calibration Labour	DDC Front End	Calibration Labour	Point	Means '22	$90	$30	$0	Yes	Project	5	$691	$231	$0	$922
114	23	09.23	HVAC	Controls	DDC Front End-Start-up Labour	DDC Front End	Start-up Labour	Point	Means '22	$90	$30	$0	Yes	Project	5	$691	$231	$0	$922
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:	**$4,213**	**$1,408**	**$0**	**$5,622**

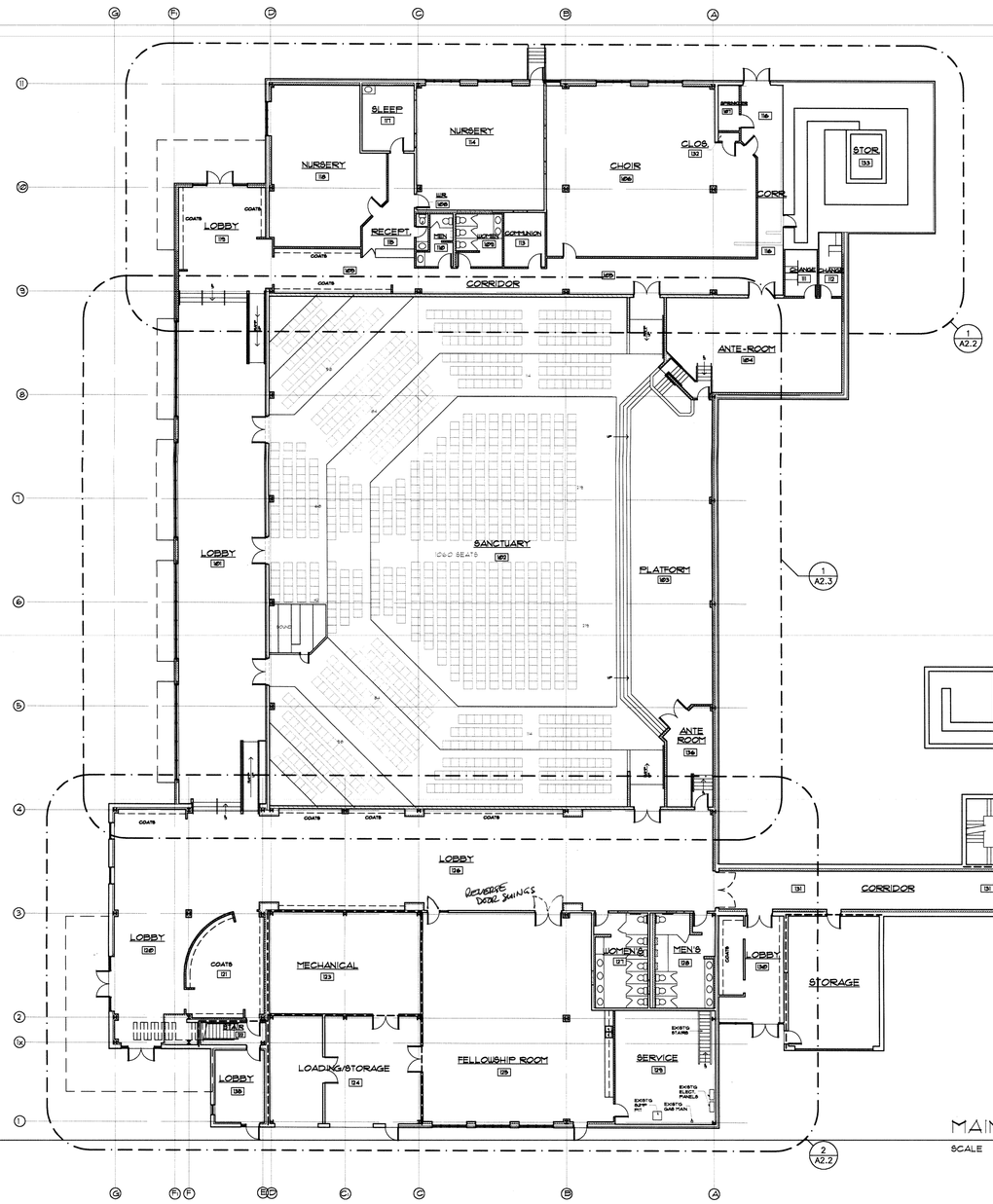
Escalation Rates: Implement Demand Control Ventilation for AHU-1

Cash Flow Balance: Implement Demand Control Ventilation for AHU-1

	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:	-$7,027	$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):		$11	$11	$12	$12	$13	$14	$14	$15	$16	$17	$18	$19	$20	$21	$22	$23	$24	$25	$26	$28
Annual Savings (M03):		$4,015	$4,217	$4,430	$4,654	$4,889	$5,136	$5,396	$5,669	$5,955	$6,256	$6,572	$6,904	$7,252	$7,618	$8,002	$8,405	$8,828	$9,273	$9,740	$10,230
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:	-$7,027	$4,025	$4,228	$4,442	$4,666	$4,902	$5,150	$5,410	$5,684	$5,971	$6,273	$6,590	$6,923	$7,272	$7,638	$8,024	$8,428	$8,852	$9,298	$9,766	$10,258
Cash Balance:	-$7,027	-$3,002	$1,226	$5,668	$10,334	$15,236	$20,386	$25,796	$31,481	$37,452	$43,725	$50,315	$57,237	$64,509	$72,148	$80,171	$88,599	$97,451	$106,750	$116,516	$126,773
Undepreciated Amount:	-$7,027	-$5,973	-$5,077	-$4,315	-$3,668	-$3,118	-$2,650	-$2,253	-$1,915	-$1,628	-$1,383	-$1,176	-$1,000	-$850	-$722	-$614	-$522	-$443	-$377	-$320	-$272

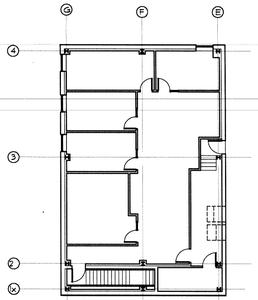
APPENDIX D

FLOORPLANS



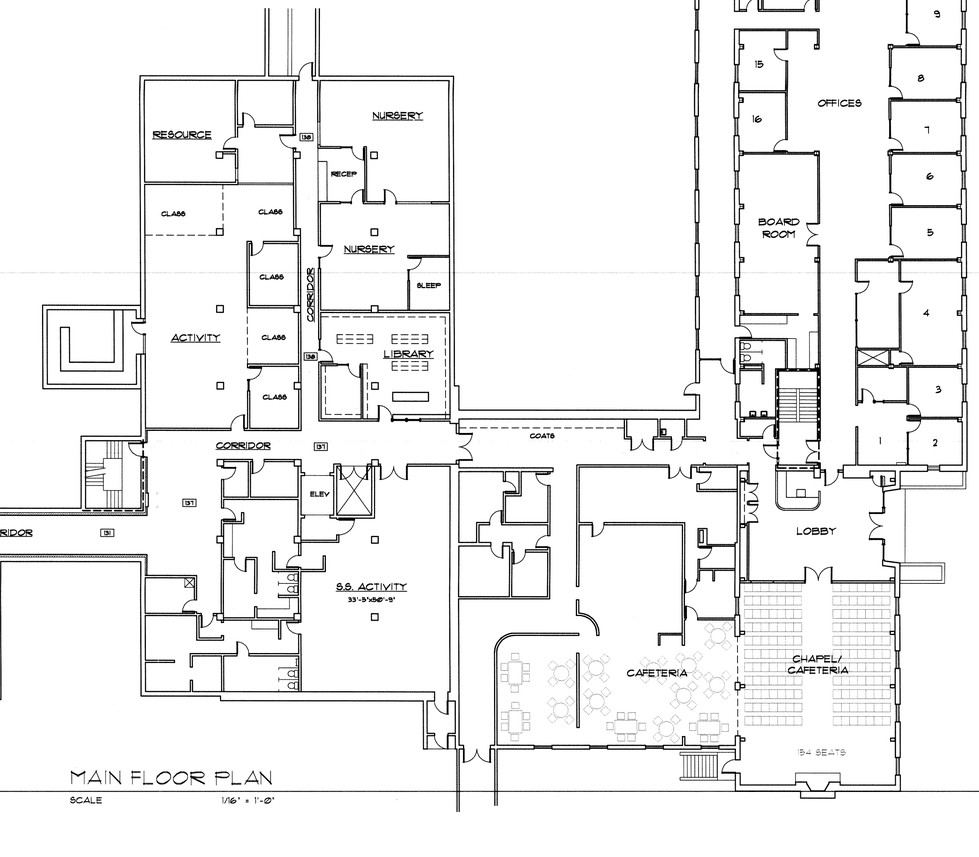
MAIN FLOOR PLAN

SCALE 1/16" = 1'-0"



SECOND FLOOR PLAN

SCALE 1/16" = 1'-0"



LEGEND

- NEW MASONRY
- NEW STUDS
- EXISTING PARTING
- 45 MIN. FIRE SEPARATIONS

OBC ANALYSIS

SCOPE OF WORK: Renovation of the Existing Building and Addition of the New Lobby.

EXISTING BUILDING is sprinklered and constructed of noncombustible construction.
PREVIOUS OCCUPANCY CLASSIFICATION WAS Group F, Division 1

EXISTING GROUND FLOOR AREA ____ 66,178.63 sq. ft.
NEW ADDITION ____ 3,013.98 sq. ft.
EXISTING SECOND FLOOR ____ 1,873.44 sq. ft.
EXISTING BASEMENT ____ 26,936.77 sq. ft.

NEW MAJOR OCCUPANCY is Assembly, Group 'A', Division 2

BUILDING is considered to face TWO STREETS (3.2.1.10.)

BUILDING CONSTRUCTION:
Group 'A', Division 2 shall be of non-combustible construction, (3.2.2.24.)
Floor assemblies are to be fire separations with FRR of 1 hr.
Mezzanines shall have a FRR of hr.
Loadbearing walls columns and arches are to have hr. FRR.

STANDPIPE SYSTEM is NOT required(3.2.9.1.)

EXITS
Travel Distance to at least one exit shall be not more than 30m (98'-5"),
article (3.4.2.5.(1) (f)).
Exit Capacity:
1000 persons @1/4" x 275', which amounts to 8-3'0" wide doors.

FIRE SEPARATION OF SERVICE ROOMS
Service rooms such as Storage rooms, Janitorial Rooms, Mechanical Rooms and vertical service spaces are to be separated from the remainder of the area with Fire Separation, having a FRR of hr.

PUBLIC PLUMBING FACILITIES
The number of water closets required is 4 for each sex, Table 3.7.4.3.(16)
2 urinals may be counted as water closets for males.
2 lavatories are required in each washroom.

BARRIER-FREE DESIGN
BARRIER-FREE access is to be provided from the street level to the BUILDING at 50 % of Pedestrian Entrances, table 3.8.1.2. equipped with power door operators (3.8.3.3.(5))
Where entrance incorporates a vestibule, a door leading from a vestibule to the floor area shall be equipped with power door operator. (3.8.3.3.(6))

1. Barrier-Free public washrooms shall be provided.

2. Lever type hardware in Barrier-Free access areas

3. Assistive Listening Devices shall be provided in each room greater than 1000 sq ft.

FLAME SPREAD RATING of interior wall and ceiling finishes is max 150, and max 25 in EXITS (3.1.13.2.)

HOSE STATIONS shall be provided in each storey of the building and to be located within 5m of each required exit (3.2.9.4.)

FIRE SEPARATION OF SERVICE ROOMS
Service rooms such as Storage rooms, Janitorial Rooms, Mechanical Rooms and vertical service spaces are to be separated from the remainder of the area with Fire Separation, having a FRR of hr.

PANIC BARS are to be installed on exit doors (3.4.6.5.(a.)(b.)).

HANDRAILS shall be not less than 865 and not more than 965mm high, with at least one handrail continuous throughout the length of the stairwell, including landings.
At least one hand rail shall extend horizontally not less than 300 mm beyond the top and bottom of stairway (3.4.6.4.(4)(5)(7.1))

GUARDS shall be not less than 42" high
OPENINGS in guard rail are limited to 4 inches.(3.4.6.5.)

END OF STUDY

NORTH

ONTARIO ASSOCIATION OF ARCHITECTS
DAVID T. PARKER
LICENCE
1502

REVISIONS		
1	ISSUED FOR PERMIT	29/04/02
2		
3		
4		
5		
6		
7		
8		
9		
10		

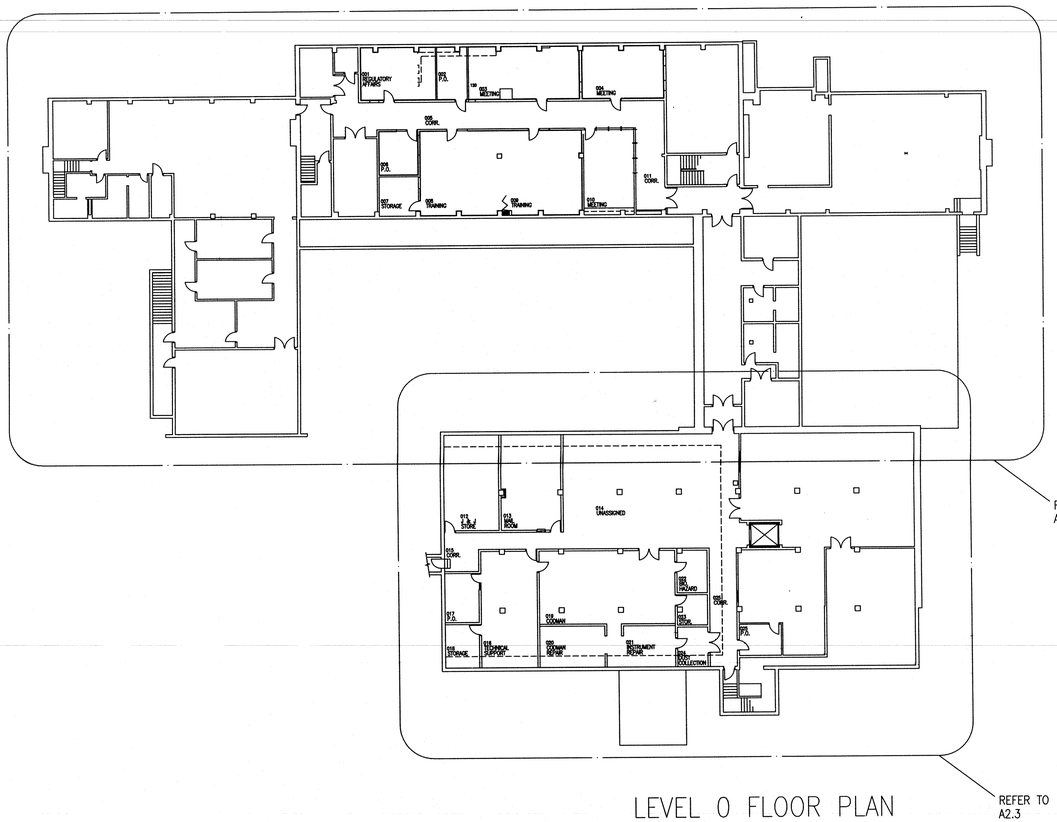
CALVARY PENTECOSTAL CHURCH

PETERBOROUGH, ONTARIO

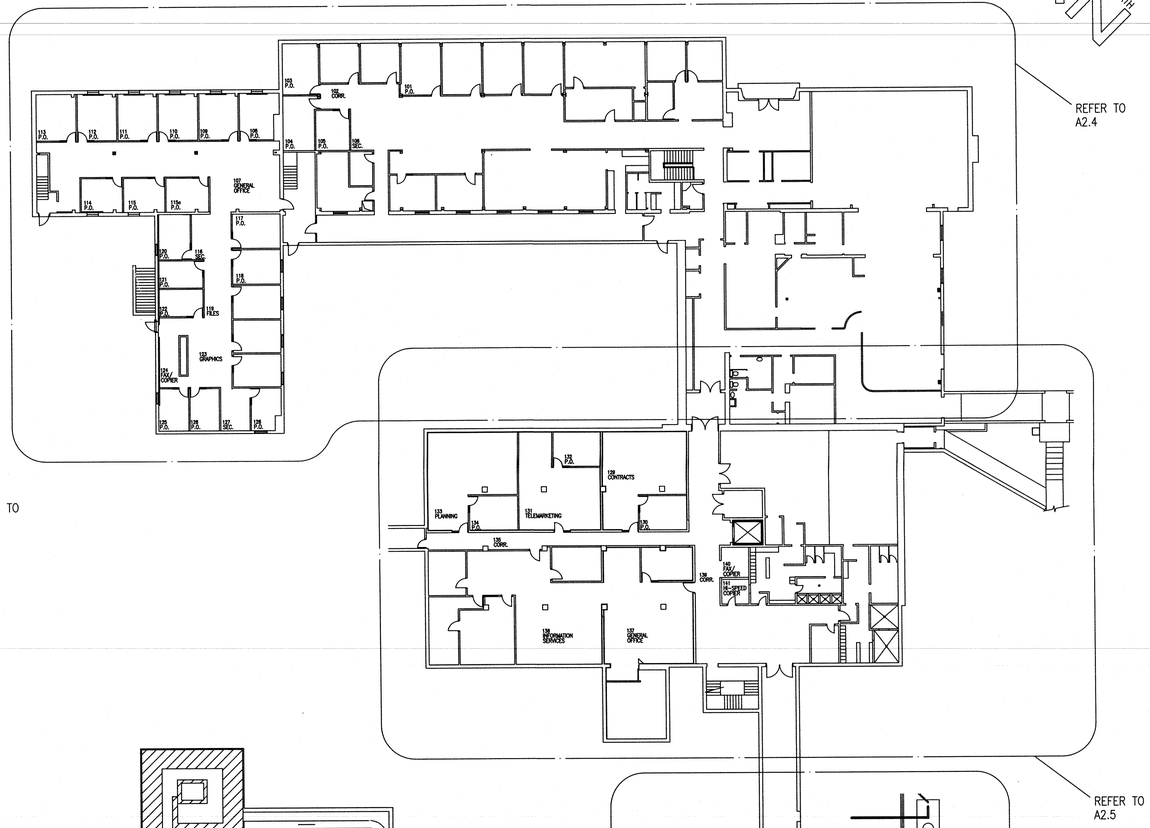
Woods Parker Architects
214 King St., Suite # 1
St. Catharines, Ontario,
tel: (905) 687-8621
fax: (905) 687-8615

A2.1b

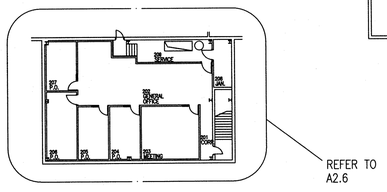
drawing	KEY PLANS
drawn	DTP
checked	
scale	1/16" = 1'-0"
NL01-02	date JAN 28, 2002



LEVEL 0 FLOOR PLAN



LEVEL 1 FLOOR PLAN



MEZZANINE FLOOR PLAN

CONSTRUCTION NORTH

REV.	DESCRIPTION	DATE	BY

CHECK SCALE
(print may be photo-reduced)

0 Inch 1 0 mm 10

Allen & Sherriff Architects, Inc.
4520 Dixie Road, Mississauga
Ontario L4W 1N2
Telephone (905) 624-1607
Fax: (905) 624-4988

Johnson & Johnson

MEDICAL PRODUCTS
FACILITIES CONSOLIDATION
PETERBOROUGH, ONTARIO

Internorth
Internorth Construction Company Limited
4520 Dixie Road
Mississauga, Ontario
L4W 1N2
Telephone (905) 625-7120
Fax: (905) 625-1841

OVERALL
FLOOR PLAN

DATE	MAY 18, 1995
DRAWN BY	
SCALE	1:250
DRWG No.	PROJECT No.
A2.1	