Nova Group

Inspired Solutions by Nova Group

MERP Level 2 Energy Audit

Prepared For

Department of Buildings & General Services - State of Vermont
133 State Street
Montpelier, VT 05633

Brandon - Brandon Town Offices
49 Center Street
Brandon, VT 05733

Nova Group Carbon Neutral Report

novagroupgbc.com/carbonneutral

July 15, 2024

Department of Buildings & General Services - State of Vermont
133 State Street
Montpelier, VT 05633

Re: MERP Level 2 Energy Audit
Brandon - Brandon Town Offices
49 Center Street
Brandon, VT 05733
Nova Project No.: SE24-3891

Nova Group, GBC has completed a MERP Level 2 Energy Audit in accordance with the State of Vermont ACT 172 at Brandon - Brandon Town Offices located at 49 Center Street in Brandon, VT. Nova Group, GBC visited the site on May 24, 2024.

The assessment was performed at the Client's request using methods and procedures consistent with and using methods and MERP Level 2 Energy Audit procedures as outlined in Nova Group, GBC Proposal.

This report has been prepared for and is exclusively for the use and benefit of the Client identified on the cover page of this report. The purpose for which this report shall be used shall be limited to the use as stated in the contract between the client and Nova Group, GBC.

This report, or any of the information contained therein, is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance written consent of Nova Group, GBC. Any reuse or distribution without such consent shall be at the client's or recipient's sole risk, without liability to Nova Group, GBC.

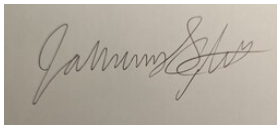
Estimated installation costs are based on Nova Group, GBC experience on similar projects and industry standard cost estimating tools including *RS Means*. Since actual installed costs may vary widely for particular installation based on labor & material rates at time of installation, Nova Group, GBC does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein. We strongly encourage the owner to confirm these cost estimates independently. Nova Group, GBC does not guarantee the costs savings estimated in this report. Nova Group, GBC shall in no event be liable should the actual energy savings vary from the savings estimated herein.

Nova Group, GBC certifies that Nova Group, GBC has no undisclosed interest in the subject property and that Nova Group, GBC employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

Respectfully submitted,

NOVA GROUP, GBC

Reviewed by:



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Technical Reviewer

Keely Felton, CEA
Chief Sustainability Officer

Table of Contents

1.0 EXECUTIVE SUMMARY

1.1 General Description

1.1.1 Purpose

The purpose of this MERP Level 2 Energy Audit is to provide the State of Vermont - Building and General Services and Brandon - Brandon Town Offices with energy efficiency opportunities at the facility and specific recommendations for Energy and Conservation Measures (ECM's). Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Utility grants towards energy conservation, or as a basis for replacement of equipment or systems.

1.1.2 Scope of Work

1.1.2.1 Energy Audit Scope of Work

The purpose of this Energy Assessment is to provide the State of Vermont - Building and General Services and Brandon - Brandon Town Offices with a baseline of energy usage, the relative energy efficiency of the facility, and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal and Utility grants towards energy conservation, as well as support performance contracting, justify a municipal bond-funded improvement program, or as a basis for replacement of equipment or systems.

The energy assessment consisted of an onsite visual assessment to determine current conditions, itemize the energy consuming equipment (i.e. Boilers, Make-Up Air Units, DWH equipment); review lighting systems both exterior and interior; and review efficiency of all such equipment. The study also included interviews and consultation with operational and maintenance personnel. The following is a summary of the tasks and reporting that make up the Energy Assessment portion of the report.

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Energy and Water Using Equipment

Nova Group, GBC has surveyed the tenant spaces, common areas, offices, maintenance facilities and mechanical rooms to document utility-related equipment, including heating systems, cooling systems, air handling systems and lighting systems.

Building Envelope

Nova Group, GBC has reviewed the characteristics and conditions of the building envelope, checking insulation values and conditions where accessible. This review also includes an inspection of the condition of walls, windows, doors, roof areas, insulation and special use areas.

Recommendations for Energy Savings Opportunities

Based on the information gathered during the on-site assessment, the utility rates, as well as recent consumption data and engineering analysis, Nova Group, GBC has identified opportunities to save energy and provide probable construction costs, projected energy/utility savings and provide a simple payback analysis.

Energy Assessment Process

- Interviewing staff and review plans and past upgrades
- Performing an energy assessment for each use type. Performing a preliminary evaluation of the utility system
- Making preliminary recommendations for system energy improvements and measures
- Estimating initial cost

Reporting

The Nova Group, GBC Energy Assessment Report includes:

- A comprehensive study identifying all applicable Energy Conservation Measures (ECMs) and priorities, based on initial cost.

1.2 Findings

1.2.1 Energy Conservation Measure Sorting

Simple Payback Period – The number of years required for the cumulative value of energy cost savings less future non-fuel costs to equal the investment costs of the building energy system, without consideration of discount rates. ECMs with a payback period greater than the Expected Useful Life (EUL) of the project are not typically recommended for loan-funded energy projects, as the cost of the project will not be recovered during the lifespan of the equipment; however they will be considered for energy projects funded by the MERP Implementation Grant. These ECMs are recommended for implementation during future system replacement. At that time, replacement may be evaluated based on the premium cost of installing energy efficient equipment. The ECMs presented in the table below are presented in order of priority of payback, however ECM's involving resilience components will be prioritized accordingly.

$$\textit{Simple Payback} = \frac{\textit{Initial Cost}}{\textit{Annual Savings}}$$

Interactive Energy Conservation Measures - This analysis excludes the interactive effects of Energy Conservation Measures. Due to the significant interactive effects between the ECMs that include the replacement or modification of the Heating Ventilation and Air Conditioning Systems and the other recommended ECM's, the HVAC ECMs are presented independently of the ECMs that do not include the replacement or modification of HVAC equipment. Furthermore, a 10% discount in energy savings was applied to account for the interactive effects amongst the ECMs. In addition to the consideration of the interactive effects, Nova Group, GBC has applied a 15% contingency to the implementation costs to account for potential cost overruns during the implementation of the ECMs.

Interactive Energy Conservation Measures - The change in resultant energy saving estimates due to implementing multiple Energy Conservation Measure's that have indirect impacts on one another.

1.2.2 Assumptions

Nova Group, GBC has made the following assumptions in calculation of the Energy Conservation Measures.

- Building operating hours are assumed to be 40 hours per week.
- The facility occupancy is assumed to be twelve (12) people.
- Annual Heating Equipment Operating Hours are derived from actual consumption and equipment input rates to be 3,900 hours/year.

- Annual Cooling Equipment Operating Hours are derived from actual consumption and equipment input rates to be 4,868 hours/year.

1.2.3 Recommendations

Nova Group, GBC has recommended one (1) HVAC Energy Conservation measure options and eight (8) Energy Conservation Measures (ECMs) that do not modify or replace the existing HVAC.

The HVAC option includes replacing the existing boiler with a new condensing boiler in addition to adding a mini-split heat pump system.

The savings for each measure is calculated using standard engineering methods followed in the industry.

The following table summarizes the recommended ECMs in terms of description, investment cost, energy consumption reduction, and cost savings.

Evaluated Energy Conservation Measures: Financial Impact		
	HVAC Option #1 - Heat Pumps and Condensing Boiler	**ECM Package Excluding HVAC**
Total Projected Initial ECM Investment	$ 52,900	$ 43,319
Estimated Annual Cost Savings Related to all ECMs	$ (120)	$ 1,870
Estimated Annual Cost Savings- Electricity	$ 862	$ 802
Estimated Annual Cost Savings- Propane	$ (5,928)	N/A
Estimated Annual Cost Savings- Natural Gas	N/A	N/A
Estimated Annual Cost Savings- Fuel Oil	$ 4,946	$ 1,068
Net Effective ECM Payback	N/A	24 Years
Estimated Annual Energy Savings	13%	20%
Estimated Annual Utility Cost Savings (excluding water)	-1%	19%

Solar and Battery Analysis

Nova Group, GBC has evaluated the site for a two (2) potential combined solar and battery systems, estimated at $174,530 and $296,750 respectively (Total Investment Cost).

Option one (1) includes a 18.13 kW rated solar panel system and a 115.2 kWh storage battery system, sized for the current electric demand.

Option two (2) includes a 25.9 kW rated solar panel system and a 275 kWh storage battery system, sized for the future electric demand if HVAC ECM were to be implemented. The size of this option is limited by the size of the roof.

The roof is assumed to be older than ten (10) years and will need to be replaced with new slate shingles before the system is installed.

The current electrical panel will also need to be upgrades, a licensed electrical engineer should be consulted to verify.

The system was designed with a depth of discharge at 50% and a cold weather factor of 1.3 to provide energy for one (1) full day of power. The system assumes that net metering will be available as an option if the building needs are met. For additional information please see Appendix D.

On Site RENEWABLE GENERATION Solar Photovoltaic Analysis with Battery		
	Option One (1) - Current Electric Demand	Option Two (2) - Future Demand with Heat Pump System
Estimated number of panels	49	70
Estimated kW Rating	18.13 kW	25.9 kW
Potential Annual kWh Produced	21,617 kWh solar system with a 115.2 kWh battery storage system	30,881 kWh solar system with a 275 kWh battery storage system
% of Current Electricity Demand	85%	64%
New Roof Cost	$34,500	$34,500
New Electrical Panel Cost	$5,000	$5,000
System Investment Cost (System + Battery)	$135,030	$257,250
Federal Investment Tax Credit (FITC)	$40,509	$77,175
Total Investment Cost (Solar+ Battery + Electrical Panel + Roof)	$174,530	$296,750
Estimated Annual Energy Cost Savings	$2,191	$2,447
Payback without Incentives	79.6 Years	121.3 Years
Payback with all Incentives	61.2 Years	89.7 Years

1.2.4 ECM Recommendations

HVAC Energy Conservation Measures

Evaluated HVAC Energy Conservation Measures with Savings												
ECM #	Description of ECM	Projected Initial Investment ($)	Natural Gas (Therms)	Propane (gal)	No. 2 Oil (gal)	Wood Pellets (Tons)	Electricity (kWh)	Energy Savings (kBTU)	% Savings (Energy)	Estimated Annual Maintenance Savings	Total Estimated Annual Cost Savings ($)	Simple Payback (Years)
Evaluated Measures												
1	Option 1a: Replace existing heating system boiler with a new Condensing Gas boiler rated at 95% AFUE or higher.	$ 15,000	N/A	(1,877)	1,394	N/A	N/A	22,044	7.9%	N/A	$ (983)	(15.25)
2	Option 1b: Replace existing heating system and cooling system with new ENERGY STAR rated cold climate mini-split heat pump with a minimum HSPF of 10 and SEER of 21.	$ 31,000	N/A	N/A	N/A	N/A	5,076	17,320	6.2%	N/A	$ 958	32.36
Totals		$ 46,000	N/A	(1,877)	1,394	N/A	5,076	39,365	14.1%	N/A	$ (26)	N/A
Interactive Savings Discount @ 10%		N/A	N/A	(1,877)	1,394	N/A	4,569	37,633	13.4%	N/A	$ (120)	N/A
Total Contingency Expenses @ 15%		$ 52,900	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Totals for Improvements		$ 52,900	N/A	(1,877)	1,394	N/A	4,569	37,633	13.4%	N/A	$ (120)	N/A

Energy Conservation Measure Options Excluding HVAC

Evaluated Energy Conservation Measures with Savings												
ECM #	Description of ECM	Projected Initial Investment ($)	Natural Gas (Therms)	Propane (gal)	No. 2 Oil (gal)	Steam (ML)	Wood (Tons)	Electricity (kWh)	Energy Savings (kBTU)	% Savings (Energy)	Estimated annual Maintenance Savings	Total Estimated Annual Cost Savings ($)	Simple Payback (Years)
Evaluated Measures													

Evaluated Energy Conservation Measures with Savings													
1	Replace the existing bathroom aerators with new WaterSense certified 1.0 GPM aerators.	$ 20	N/A	N/A	N/A	N/A	N/A	232	793	0.3%	N/A	$ 44	0.46
2	Improve air sealing by reducing the ACH50 rate to 15.3.	$ 1,074	N/A	N/A	117	N/A	N/A	842	19,092	6.8%	N/A	$ 574	1.87
3	Install learning thermostats to control the heating and cooling systems.	$ 800	N/A	N/A	64	N/A	N/A	267	9,733	3.5%	N/A	$ 276	2.89
4	Upgrade lighting with ENERGY STAR or DLC certified LED technologies. Please see the lighting tool for specific recommendations.	$ 475	N/A	N/A	N/A	N/A	N/A	712	2,429	0.9%	N/A	$ 134	3.54
5	Insulate the electric storage tank water heater with R-8 tank-wrap insulation.	$ 50	N/A	N/A	N/A	N/A	N/A	52	178	0.1%	N/A	$ 10	5.08
6	Replace the current single-paned windows with new ENERGY STAR rated double pane windows, minimums U-value .35, minimum SHGC .50. Improve ACH50 reading to 16.1.	$ 22,000	N/A	N/A	154	N/A	N/A	2,499	29,805	10.6%	N/A	$ 1,017	21.64
7	Replace the existing 10 cubic feet refrigerator with a new ENERGY STAR rated refrigerator.	$ 850	N/A	N/A	N/A	N/A	N/A	32	109	0.0%	N/A	$ 6	140.77
8	Replace the current DHW heater with new point of use hot water heaters rated at 0.98 EF.	$ 2,400	N/A	N/A	N/A	N/A	N/A	84	287	0.1%	N/A	$ 16	151.36
9	Install a new level two electric vehicle charger.	$ 10,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0%	$ (100)	N/A	N/A
Totals		$ 37,669	N/A	N/A	334	N/A	N/A	4,720	62,427	22.3%	$ (100)	$ 2,077	19.05
Interactive Savings Discount @ 10%		N/A	N/A	N/A	301	N/A	N/A	4,248	56,184	20.1%	$ (100)	$ 1,870	N/A
Total Contingency Expenses @ 15%		$ 43,319	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Totals for Improvements		$ 43,319	N/A	N/A	301	N/A	N/A	4,248	56,184	20.1%	$ (100)	$ 1,870	24.48

1.2.5 Measures that Warrant Further Study

The following items are presented for consideration in operational and capital planning:

- A toilet with a large-capacity tank (3+ gallons per flush) was observed. This unit can be replaced with high efficiency 1.6 GPF unit for water savings.

ENERGY CALCULATIONS AND ASSUMPTIONS

A property energy model was created using spreadsheet calculations based on appropriate and industry-accepted engineering formulas and standards for organizations such as ASHRAE. Nova cost estimates are based on construction cost data from sources such as RS-Means and technical discussions with equipment manufacturers and local contractors. The property owner may wish to solicit competitive bids from qualified contractors to ensure the most accurate pricing. Nova's cost estimates are general industry standards and may not account for all variations and specificities related to this site.

The building's historical energy consumption and the data collected on site were analyzed and "trued-up" in order to create energy models of the building systems. These models were used to predict energy and cost savings for the recommended measures. For this audit, Nova used proprietary spreadsheet models to estimate savings for the proposed retrofits.

Key information on building systems, including the results of performance tests conducted onsite are included in the tables on the following pages.

2.0 PROPERTY OVERVIEW

This 1828 building was heavily renovated in 2016 after a five (5) year period of vacancy that was caused by flooding during a 2011 storm. The property is now in a recently updated condition with most mechanical equipment being no more than eight years old. The building bridges and is built over a river. The southeast wall of the building is attached to another privately owned building.

Facility Schedule	
Building Type/Name	Office
# of Stories	Two (2) stories
Year Built/Renovated	1828
Building Size	4,296 square feet
Hours of Operations/Week	40 hours
Operational Weeks/Year	52 weeks
Estimated Facility Occupancy	Twelve (12) people

Property Contact	
Point of Contact Name	Seth Hopkins
Point of Contact Title	Town Manager
Point of Contact - Contact Number	(802)247-3300

3.0 SITE VISIT

The objective of the Document Review and Interview process is to augment the walk-through survey and to further assist in understanding the Site's latent physical components, physical deficiencies as well as preceding or on-going efforts toward energy and water conservation and/or waste diversion. The information obtained as a result of the Document Review and Interview process is assumed to be true and correct, provided that such information appears to be reasonable.

3.1 Site Visit Information

SITE VISIT INFORMATION	
Date of Site Observation	May 24, 2024
Weather Conditions	Sunny, 73°F
Nova Field Associate	Johanna Stuz, BPI-BA
Nova Reviewers	Jay Hrivnatz, RA, CEM Keely Felton, CEA Morgan Carson, CEM

3.2 Interviews

PROVISION OF INFORMATION	
	Property Management did not provide us with service provider information as requested in our Pre-Survey Questionnaire.
✔	Property Management did provide us with some information regarding service providers.

Based upon the Pre-Survey Questionnaire and the interview process, the individuals and organizations listed below were contacted and/or interviewed:

INTERVIEWS					
Service Provider/Property Rep.	**Title / Organization**	**Contact Information**	**Contact Attempted**	**Contact Made**	**No Reply / No Response**
Seth Hopkins	Town Manager, Town of Brandon	(802)247-3300		✔	

4.0 ENERGY AUDIT - HISTORIC UTILITY CONSUMPTION

4.1 Utility Consumption

A preliminary end use analysis was performed on the subject property to understand how the property is using energy, to understand its performance relative to similar properties and to establish baseline GHG Emissions.

4.1.1 Historical Energy Consumption and Costs

Site Utilities	
Facility Electric Service Size	200 AMPS
Onsite Transformer	There is no transformer on site.
Electric Meter Location	The electric meter is located next to the back door to the second floor.

Utility Analysis

Utility Type	Utility Provider	Meter Quantity	Energy/Water Uses	Annual Consumption	Est./Act.	Annual Cost
Electric (Grid)	Green Mountain Power	One (1)	Air conditioning, Lightng, Water Heating, Plug Loads	18,991 kWh	Actual	$3,666 (calculated using Green Mountain Power rate of $0.19306 per kWh)
Propane	Suburban	None	Space Heating	1,394 Gal	Actual	$4,944 (calculated using EIA rate of $3.548 per gallon)

4.1.2 On-Site Utility Storage

Propane is stored on site.

Onsite Utility Storage	
Battery Storage	
Storage Capacity	None
Year Installed	N/A
Location Installed	N/A
Space Served	N/A
Fossil Fuel Storage	
No. 2 Oil	None
Propane Gas	Three (3) 120 gallon above ground tanks.
Wood Chips/Pellet	None

4.1.3 On-Site Generation

There is no on-site generation.

4.1.4 On-site Electric Vehicle Charging

There are no electric vehicle charging stations on-site.

Onsite Electric Vehicle Charging	
Installed Chargers	None
Electrical Charger Type	N/A
Location Installed	N/A
Charger Manufacturer	N/A
Electric Metering to Chargers	N/A
Recommendations	There is both sufficient parking and availability on the current on-site breaker for an on-site electric vehicle charger. A licensed electrical engineer should be consulted to verify.

4.2 Delivered Fuel

Nova was provided with twenty-four (24) months of propane usage totals in Excel format from the property. Total consumption was provided. Cost was calculated using the EIA rate of $3.548 per gallon. The most recent year of historical data was considered in Nova's analysis.

The following chart shows propane consumption month by month for the period from 1/1/2023 to 12/31/2023.

4.2.1 Provision of Data

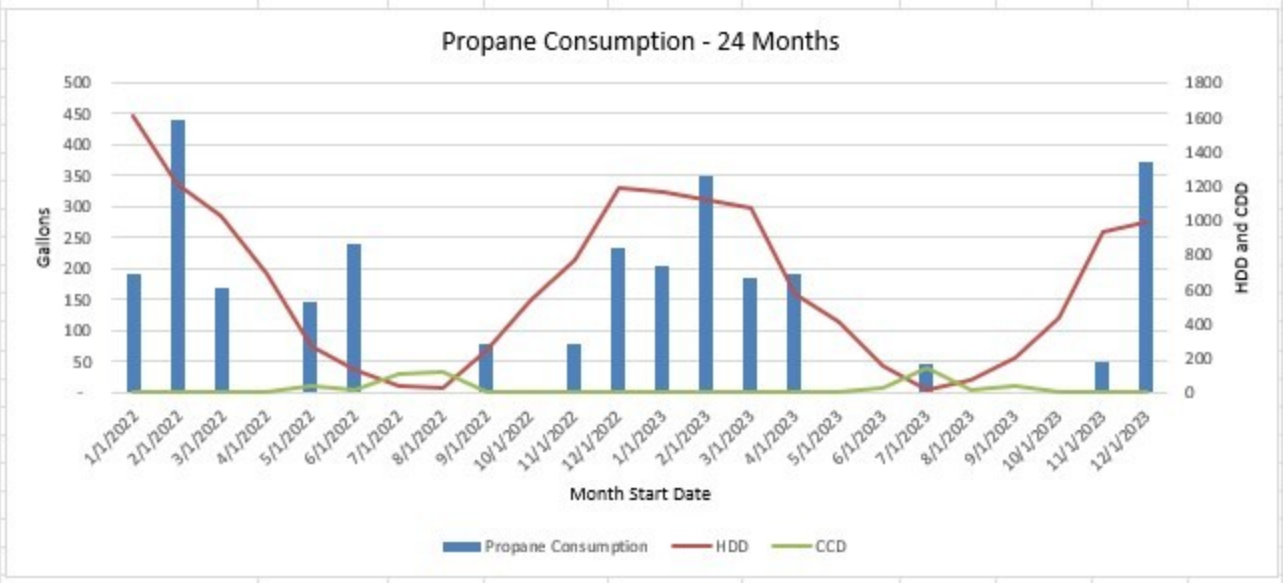
ANNUAL CONSUMPTION FOR HEATING FUEL					
Start	**End**	**Consumption**	**Cost (calculated using EIA rate)**	**Estimated**	**Days**
1/1/2022	12/31/2022	1,578.7	$5,601	Actual	365
1/1/2023	12/31/2023	1,393.6	$4,944	Actual	365

PROPANE CONSUMPTION					
Start	**End**	**Consumption (Gallons)**	**Cost (calculated using EIA rate)**	**Estimated?**	**Days**
1/1/2023	1/31/2023	205	$ 726	No	31
2/1/2023	2/28/2023	349	$ 1,240	No	28
3/1/2023	3/31/2023	184	$ 651	No	31
4/1/2023	4/30/2023	191	$ 676	No	30
5/1/2023	5/31/2023	-	$ -	No	31
6/1/2023	6/30/2023	-	$ -	No	30

PROPANE CONSUMPTION					
Start	**End**	**Consumption (Gallons)**	**Cost (calculated using EIA rate)**	**Estimated?**	**Days**
7/1/2023	7/31/2023	46	$ 162	No	31
8/1/2023	8/31/2023	-	$ -	No	31
9/1/2023	9/30/2023	-	$ -	No	30
10/1/2023	10/31/2023	-	$ -	No	31
11/1/2023	11/30/2023	49	$ 172	No	30
12/1/2023	12/31/2023	371	$ 1,317	No	31
		1,394	$ 4,944		0

4.2.2 Analysis

When charted against heating degree days, it is evident that owner-paid propane consumption peaks during the colder months, likely due to increased heating load.



4.3 Electricity

4.3.1 Provision of Data

Nova was provided with twenty-four (24) months of electricity usage history in Excel format from the property. Total consumption and cost were provided. The most recent twelve (12) months of historical data was considered in Nova's analysis.

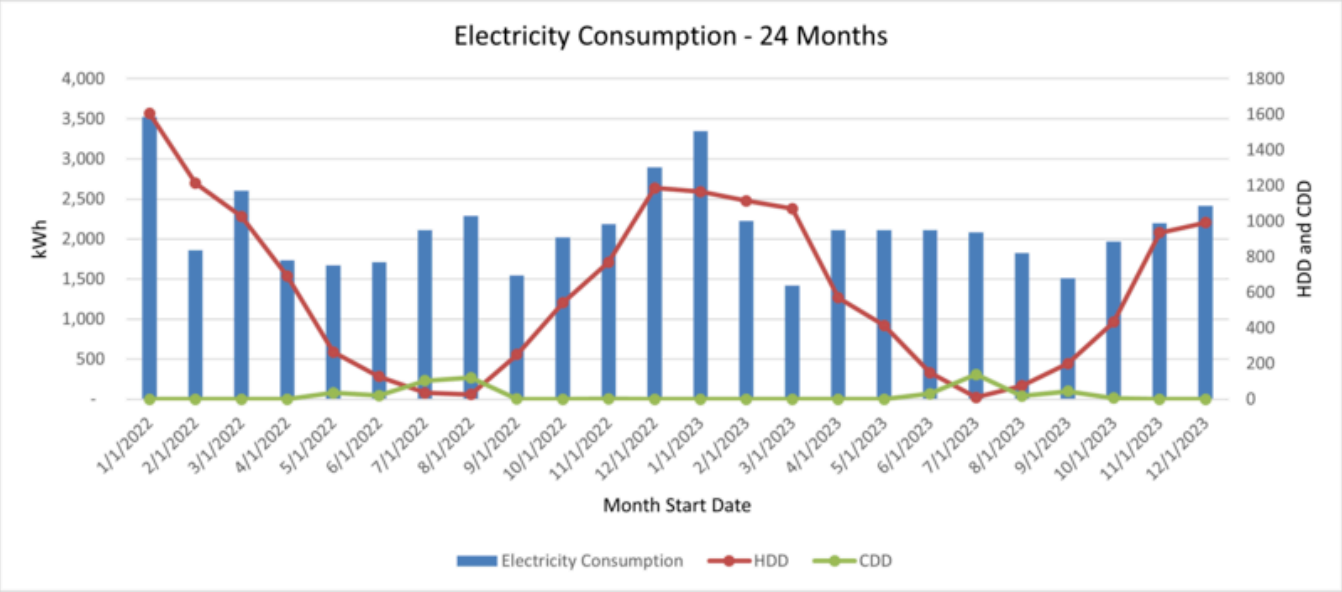
The following charts show electricity consumption totals month by month for the period from 1/1/2023 to 12/31/2023. The April to June data was not available. An average of power consumption from other months was used for energy modeling calculations.

Annual Consumption of Electricity					
Start	**End**	**Consumption**	**Cost**	**Estimated**	**Days**
1/1/2022	12/31/2022	26,152	$5,049	Actual	365
1/1/2023	12/31/2023	25,321	$ 4,888	Actual	365

ELECTRICITY CONSUMPTION					
Start	**End**	**Consumption (kWh)**	**Cost**	**Estimated?**	**Days**
1/1/2023	1/31/2023	3,350	$ 632	No	31
2/1/2023	2/28/2023	2,224	$ 420	No	28
3/1/2023	3/31/2023	1,421	$ 268	No	31
4/1/2023	4/30/2023	2,110	$ 398	Yes	30
5/1/2023	5/31/2023	2,110	$ 398	Yes	31
6/1/2023	6/30/2023	2,110	$ 398	Yes	30
7/1/2023	7/31/2023	2,080	$ 392	No	31
8/1/2023	8/31/2023	1,826	$ 345	No	31
9/1/2023	9/30/2023	1,510	$ 285	No	30
10/1/2023	10/31/2023	1,968	$ 371	No	31
11/1/2023	11/30/2023	2,197	$ 415	No	30
12/1/2023	12/31/2023	2,415	$ 456	No	31
		25,321	$ 4,778		
**Missing data for April through June*					

4.3.1.1 Analysis

When charted against heating degree days, it is evident that whole property electric consumption peaks during the colder months, likely due to increased heating load and during the warmer months, likely due to air conditioning.



4.3.1.2 Renewable (Green Power) Energy Sources

No renewables or energy generation systems were observed on site.

4.4 Utility Rate Structure Analysis

Rates for common area utilities were provided on the utility tariff for each company.

UTILITY RATE STRUCTURE ANALYSIS						
Service	**Utility**	**Rate**	**Service/Customer Charge**	**Demand Charge**	**EIA Rate**	**Rate Used In Calculation**
Electricity	Green Mountain Power (GMP)	$0.19306 per kWh	$0.690 per day	No	$0.1887 per kWh	$0.19306 per kWh
Propane	Suburban	Rates vary	NA	No	$3.548 per gallon	$3.548 per gallon

4.4.1 Billing Irregularities

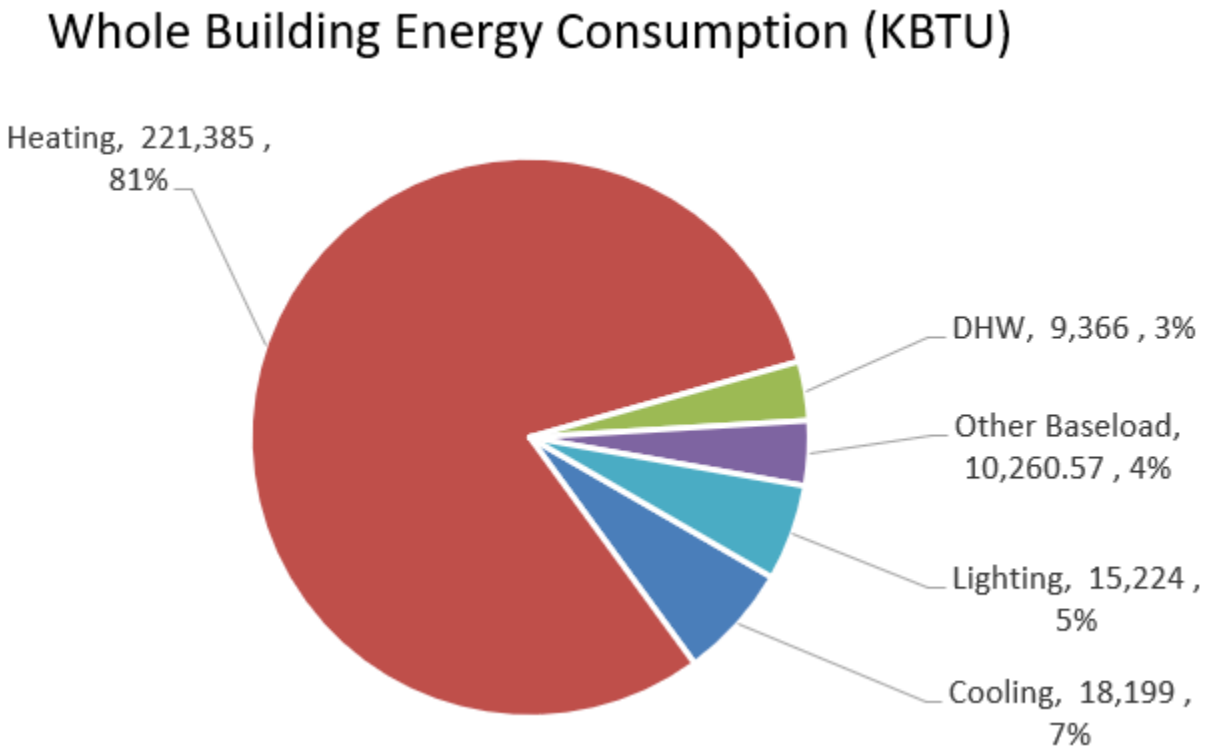
Electric data was not provided for April through June,consumption was estimated.

4.5 Utility End Use Analysis

Utility end use at the subject property was observed to be consistent with other buildings with the similar occupancy and HVAC equipment.

4.5.1 End Use Breakdown

The figure below shows an annual breakdown of energy consumption for the entire facility.



5.0 EXISTING SYSTEMS AND EQUIPMENT - ENERGY

5.1 Existing Conditions

This section includes an inventory of existing systems and equipment and their current conditions.

Detailed equipment tables are included in Exhibit C of this report.

5.2 Building Envelope

The foundation is a bridge over the river built with stone, brick and poured concrete. The first story mechanical room is under the North porch entry to the second story. The walls are brick. The interiors are finished with gypsum drywall over rigid insulation over the old lath and plaster. The ceilings are finished with T bar drop ceiling below the gypsum drywall ceiling. The gabled roof is wood timber framed and covered with slate tile. The first story windows have poor or broken seals.

The back Northeast vault addition has a flat roof with a black rubber roof, brick exterior. The stairway entry that shared with the adjacent building to the East has a flat roof.

5.2.1 Structure

The foundation consists of stone, brick and poured concrete. The walls are made of brick and mortar. The roof is wood timber framed. The additions have brick walls and flat roofs.

STRUCTURE	
Component	**Description**
Construction Drawings	Construction drawings were not made available for review
Foundation Type	Old stone and brick fortified by a slab bridging a river.
Wall Type and Framing	The exterior walls are brick.
Upper Floor Framing	Upper floor framing consists of wood beams supporting wood floors.
Exterior Facade Description	Facades are finished with brick.
Wall Insulation Verification	Insulation was verified via discussions with maintenance staff.
Roof Type	The building is constructed with a gable roof. The stairwell that joins the building to a neighboring building has a flat, practically level roof.
Roof Framing	Roof framing consists wood timber frame, wood plank roof sheathing.
Roofing Material	Building sloped roofs are slate.
Median Roof Age	The slate roof is original with date of last significant repairs unknown. The roof appears weathered and will likely require significant repairs within the next decade.
Roofing Reflectance	Slate is not considered reflective.
Roof Water Intrusion	The site contact reported that there have been leaks in the past, but that roof leaks are repaired as soon as they are reported.
Roof Insulation Verification	Insulation was verified visually.

ENVELOPE INSULATION			
Slab	**Basement Walls**	**Above Grade Walls**	**Roof/Attic**
No Insulation	N/A	2" hard foam between brick and interior sheet rock; R-10	An average of 17 inches of loose fill cellulose; R-60

DOORS AND WINDOWS	
Component	**Description**
Windows	
Window Frame	Windows are wood framed.
Window Operation	Windows are single-hung and non-operable units.
Window Glazing	Upstairs windows are double glazed. Downstairs windows are single glazed except for the large non-operable front windows which are double glazed.
Window Weatherstripping	Weather stripping does not appear to provide an adequate air seal to the exterior downstairs. Upstairs windows do appear to provide an adequate air seal to the exterior.
Window Age	Window age varies. Most upstairs windows date to the 2016 renovation. Downstairs many windows appear very old however, historic photos of the building show that they are not original.
Window Center of Glass (COG) Values	Unknown
Window Tint/Films	Windows are not tinted.
Window to Wall Ratio	28% (2,955 square feet of exterior wall surface area; 833 square feet of window surface area)
Doors	
Main Entry Doors	Entry doors are wood doors in wood frames.
Door Weatherstripping	Weather stripping does not appear to provide an adequate air seal to the exterior.
Door Age	Door age varies. Some doors are very old while others date to the 2016 renovation.
Overhead Doors	There are no overhead doors.

Blower Door Testing	
Blower Door Equipment	Retrotec
Building Volume	Entire Building: 42,407 cubic feet Second Story Alone: 17,023 cubic feet
Leakage Rate @ -50 Pa (CFM50)	4,840 CFM50 Only the second story alone could be tested because downstairs and the stairwell Hall could not be pressurized due to high leakage.
Leakage Rate ACHN50	17 ACHN50
Noted areas of infiltration	The door to the adjacent private building. The holes in the walls for the heat pump refrigerant lines and hydronic pipes especially between the ceilings, fixed and operable windows, and the attic access.

Infrared Imaging	
Infrared Equipment	Flir One Pro
Outdoor temperature	74 degrees F
Indoor space temperature	71 degrees F
Infrared Comments	Flat roof of the back vault addition, the doors and windows, the baseboards and the attic access

5.3 Heating, Ventilation and Air Conditioning (HVAC)

5.3.1 Heating

Primary heat is provided by air source heat pumps defined in section 5.3.2 Cooling. Backup heat for extreme cold conditions is provided by the hydronic boiler defined in the table below with radiators and baseboards.

HEATING SYSTEM SUMMARY		
	Heating Primary System	**Heating Secondary System**
Area Served	Heat Pumps serving the Entire Building	Entire Building Backup
Heating System Type	Air Source Heat Pump - Ductless	Boiler
Heating Fuel	Electricity	Propane
Heating System Capacity	Eleven (11) ton; 132 kBTUh	212 kBTUh
Heating Equipment Location	Evaperaters inside; condensers outside	Central Mechanical Room
Typical Range of Efficiency	HSPF 8.2	84.5% AFUE
Equipment Manufacture Date Range	2015	2015
Quantity	Four (4) condensers; Seven (7) evaporators	One (1)
Access Issues	None	None
Description of Variation in Type, Fuel, Configuration or Location Between Areas	The heat pumps are used during Spring and Fall. The boiler is used when it is extremely cold.	The heat pumps are used during Spring and Fall. The boiler is used when it is extremely cold.

COMMERCIAL HEATING EQUIPMENT - PROPERTY WIDE	
Sample Representation	100% of systems on site were observed as part of the sample.
Explanation of Discrepancy	None
Heating Systems Recommended for Replacement	Replace the existing heat pumps with new heat pumps and replace the existing boiler with a new condensing boiler.
Reason for Replacement	Equipment efficiency could be improved to achieve savings goals.

5.3.2 Cooling

The entire building is cooled by air source heat pumps.

COOLING SYSTEM SUMMARY	
	Cooling Primary System
Area Served	Entire Building
Cooling System Type	Air Source Heat Pump - Ductless
Cooling System Capacity	Eleven (11) tons
Cooling Equipment Location	Evaporators inside; Condensers outside.
Typical Range of Efficiency	SEER 14
Equipment Manufacture Date Range	2015
Quantity	Seven (7) evaporaters; Four (4) condensers
Access Issues	None
Description of Variation in Type, Fuel, Configuration or Location Between Areas	N/A

COMMERCIAL COOLING EQUIPMENT - PROPERTY WIDE	
Sample Representation	100% of systems on site were observed as part of the sample.
Explanation of Discrepancy	None
Cooling Systems Recommended for Replacement	Replace the existing heat pumps with new heat pumps .
Reason for Replacement	Equipment efficiency could be improved to achieve savings goals.

5.3.3 Distribution, Controls and Ventilation

Primary heat and all cooling is provided by point source evaporators. Back up heat is delivered by hydronic radiators and baseboards. Bathrooms are mechanically ventilated.

DISTRIBUTION & CONTROLS	
Ducted Distribution	
HVAC Duct Location	N/A
Access HVAC to Ductwork	N/A
HVAC Ductwork Air Sealing	N/A
HVAC Duct Insulation	N/A
Affected Systems	N/A
HVAC Blower Fan Motors	
Type of Blower Fan Motors	N/A
Hydronic or Steam Distribution	
Type of Distribution	Hydronic radiators and baseboards
Hydronic or Steam Pipe Insulation	Yes
Affected Systems	Heating
Controls	
Leased Area Thermostats	There are no leased areas
Common Area Thermostats	Programmable
Building Automation System	N/A
Heating Setpoints	69 degrees F
Cooling Setpoints	72 degrees F
Opportunity for Improvement	None

VENTILATION	
Kitchen Ventilation Type	There are no kitchen ranges.
Kitchen Exhaust Destination	N/A
Bathroom Ventilation Type	Mechanical exhaust fans - individual
Bathroom Exhaust Destination	Vented to the exterior.

5.4 Domestic Water Heating

5.4.1 DHW Equipment

One (1) 19 gallon, electric water heater serves the entire building.

DOMESTIC HOT WATER SYSTEM SUMMARY	
Area Served	Entire Building
DHW System Type	Tank - Direct
DHW Fuel	Electricity
DHW System Capacity	19 gallons; 4,500W
DHW Equipment Location	Central mechanical room
Typical Range of Efficiency	0.95 EF
Equipment Manufacture Date Range	2015
Quantity	One (1)
Access Issues	None
DHW Lines	Domestic hot water piping was observed to be insulated where exposed.
Is a re-circ pump installed?	No
Existing High Rise Water Pressure Boosting System	No
Are Existing Booster(s) Variable Speed?	N/A
Description of Water Fixtures Related to DHW Usage (Faucet Aerators and Showerheads)	Five (5) faucets
Description of Variation in Type, Fuel, Configuration or Location Between Areas	N/A

DHW EQUIPMENT - PROPERTY WIDE	
Sample Representation	100% of systems on site were observed as part of the sample.
Explanation of Discrepancy	None
DHW Systems Recommended for Replacement	None
Reason for Replacement	N/A

WATER FIXTURES - SUMMARY					
Fixture Type	**Location**	**Range Rated Flow Rate (GPM or GPF)**	**Average Rated Flow Rate (GPM or GPF)**	**Qty**	**% of Sample**
Toilet	Restroom	1.6-4.5 GPF	3.05 GPF	Two (2)	100%
Faucet	Restroom	1.5-1.8 GPM	1.65 GPM	Two (2)	100%
Faucet	Kitchen	1.5-1.5 GPM	1.5 GPM	Two (2)	100%
Faucet	Slop Sink	2.2 GPM	2.2 GPM	One (1)	100%

5.5 Lighting

5.5.1 Interior Lighting

LED light fixtures containing 6W to 36W bulbs provide over two-thirds of the interior lighting in the buildings. Also present are ten (10) fixtures with CFL lamps that are obsolete and in need of upgrade and one incandescent ficture with a 75W lamp in the dry Storage area under the vault.

The facility doesn't have any automatic lighting controls on internal light fixtures**.**

The EXIT signs in the facility consist of LED lamp-based fixtures.

Interior Lighting			
Fixture Types	**Wattage**	**% of Total Fixtures**	**Recommended for Replacement**
Incandescent	75 W	4%	Yes
CFL	18-42 W	27%	Yes
LED	18-165 W	69%	No

5.5.2 Exterior Site Lighting

The exterior lighting primarily consists of two (2) LED fixtures with (w and 40W bulbs.

Exterior Lighting Lighting			
Fixture Types	**Wattage**	**% of Total Fixtures**	**Recommended for Replacement**
LED	18-40 W	100%	No

5.6 Appliances

5.6.1 Kitchen Appliances

Breakroom Appliances			
Item	**Type**	**Estimated Age & Condition**	**ENERGY STAR Certified**
Refrigerator	18 cubic feet Freezer location: Top Manufacturer/s: GE Annual Consumption: 383 KWh/yr	Eight (8) years old and in fair condition	Yes
Refrigerator	10 cubic feet Freezer location: Top Manufacturer/s: Vissani Estimated Annual 329 kWh/yr	Ten (10) years old and in fair condition	No

REFRIGERATORS - PROPERTY WIDE	
Sample Representation	100% of appliances on site were observed as part of the sample.
Explanation of Discrepancy	None
Refrigerators Recommended for Replacement	Both refrigerators currently in use.
Reason for Replacement	Equipment is approaching or has exceeded its EUL, and efficiency could be improved to achieve savings goals

5.6.2 Laundry

Observed laundry equipment is summarized in the tables below.

5.7 Process Equipment and Loads

No process equipment was observed on site.

5.8 Other Systems

There is a wheelchair lift on-site.

5.9 Onsite Energy Generation

There is no generation on-site.

5.9.1 Solar Energy & Cogeneration

There is currently no on-site energy generation at the Property.

The property has significant potential for a solar photovoltaic (PV) system, with a large unshaded pitched roof area with minimal mechanical equipment; however, there is currently a slate roof and a solar system is not recommended until the slate roof requires replacement.

Nova bases solar sizing calculations on the following considerations:

1. Maximize available roof space
2. Only use the orientations that will be the most profitable (aiming for <15 year paybacks)
3. Offset more than 100% of owner paid electricity after factoring in the kWh reduction of the recommended ECMs. The 100% value helps ensure that the property is more likely to over-produce electricity during cyclical periods of lower electricity consumption throughout the year to feed battery storage system.
4. Any additional electricity produced will be fed back into the grid for net metering credits.

6.0 RECOMMENDED ENERGY CONSERVATION MEASURES (ECMS)

6.1 Building Envelope

ECM: IMPROVE AIR SEALING

Green Alternative	Engage a BPI-accredited air sealing contractor to reduce air leakage by an estimated 10% to ACH50 of 15.3. Recommended areas of focus include penetrations and transitions between the attic and top floor units, as well as penetrations through exterior walls. Electrical outlets on exterior walls should be sealed with foam gaskets. Attic hatches should be sealed with weather stripping and insulated with rigid foam. Exterior door weather stripping should be replaced as needed.
Benefits Attained	Air sealing reduces heat loss in the winter and heat gain in the summer. Air sealing can reduce the risk of fire, and stop interior moisture from reaching attics. Comfort may improve as the air sealing reduces the transfer of odors, noise and animal pests between different parts of the building.
Assumptions	The ACH50 rate is estimated to be 17.0 based on visual inspection and building vintage.
Recommendation	This "green alternative" is considered cost-effective for early replacement and is recommended.

ECM: REPLACE WINDOWS AND SLIDING GLASS DOORS

Green Alternative	Nova recommends replacing existing original, single-pane windows with new, high-efficiency ENERGY STAR® certified units. Select window and glass door units that are appropriate for this climate zone in order to optimize heating and cooling savings. Air seal the rough opening around each unit during install with low-expanding foam. Flash each unit appropriately to prevent water damage.
Benefits Attained	Replacing windows and doors is an expensive measure, and the utility savings associated with this improvement is not enough to fully offset the install cost. However, many of the units will need replacement in the coming years as they are reaching the end of their useful life. Replacing now with high efficiency alternatives provides significant cost savings and comfort benefits and reduces large future capital expense.
Assumptions	The following assumptions were made to calculate savings from the proposed window and glass door replacement: › The existing windows are modeled with a u-value of 1.0 and a SHGC of 1.0. › New windows are modeled with a u-value of 0.35 and a SHGC of 0.5. › Air leakage is estimated to be reduced by 5% (ACH50 of 16.1) by replacing windows.
Recommendation	This "green alternative" is not considered cost-effective for early replacement but is recommended as the replacement option when the equipment is replaced based on capital need.

6.2 HVAC Systems

ECM: INSTALL LEARNING THERMOSTATS

Green Alternative	Nova recommends installing four (4) ENERGY STAR certified smart thermostats with occupancy sensing capabilities to control the operation of the heating and cooling systems.
Benefits Attained	Replacing the existing thermostats with ENERGY STAR certified learning thermostats will reduce overheating. It will also allow occupants to control the heating, improving comfort. These thermostats achieve high levels of savings through the use of setbacks, occupancy sensors and advanced communication controls.
Assumptions	We modeled the savings using common engineering practices. We based a load profile on engineering practices and property staff interviews. The savings baseline assumes that overall temperature in the apartments will be adjusted by at least 5 degrees F.
Recommendation	This "green alternative" is considered cost-effective for early replacement and is recommended.

ECM: INSTALL HIGH EFFICIENCY CENTRAL BOILERS - SPACE HEATING

Green Alternative	Install a high efficiency condensing gas boiler rated at 95% AFUE or higher to provide supplemental hydronic heat to the building.
Benefits Attained	While replacing a central boiler is an expensive measure, this unit will need replacement in the coming years as it is reaching the end of its useful life. Replacing now with high efficiency alternatives provides significant cost savings and comfort benefits and reduces large future capital expense.
Assumptions	We modeled the savings using spreadsheet-based calculations. To calculate heating savings we assumed an improvement in efficiency from 84.5 to 95% AFUE. In determining feasible exterior wall vent locations, proximity to windows, doors and walkways should be considered. Venting for this type of system is pressurized and cannot be vented into a chimney which is utilized by atmospherically vented appliances. If vented into an existing chimney, positive pressure venting should be extended to the building exterior. Local codes and manufacturer's specifications should always be consulted to ensure feasibility, legality, and safety.
Recommendation	This "green alternative" is not considered cost-effective for early replacement but is recommended as the replacement option when the equipment is replaced based on capital need.

ECM: INSTALL HIGH EFFICIENCY SPLIT SYSTEM HEAT PUMPS

Green Alternative	Install high efficiency, ENERGY STAR® rated heat pumps (≥10 HSPF, ≥21 SEER) to provide heating and cooling.
Benefits Attained	While replacing heating and cooling units is an expensive measure, many of the systems will need replacement in the coming years as they are reaching the end of their useful life. Replacing now with high efficiency alternatives provides significant cost savings and comfort benefits and reduces large future capital expense.
Assumptions	We modeled the savings using spreadsheet-based calculations. To calculate heating and cooling savings we assumed an improvement in efficiency from 8.2 HSPF to 10 HSPF for heating and from 14 to 21 SEER for cooling for affected systems.
Recommendation	The option is recommended for decarbonization and resiliency reasons. This option will provide to cooling the portion of the building that is not currently cooled.

6.3 Domestic Water Systems

ECM: INSULATE DOMESTIC HOT WATER TANKS

Green Alternative	Nova recommends insulating the electric hot water tank with R8 tank wrap insulation. Installer to ensure compliance with all applicable codes. The sides and top of the tank should be insulated but electrical components should not be covered.
Benefits Attained	While hot water tanks are manufactured to have some insulating value, there is still standby heat loss. This results in the use of more energy to keep the water hot. Savings are greater for older tanks, or tanks located in unconditioned spaces.
Assumptions	We modeled the savings using spread-sheet based calculations. Existing tanks were assumed to have an R-value of 8.5.
Recommendation	This "green alternative" is considered cost-effective for early replacement and is recommended.

ECM: INSTALL HIGHER EFFICIENCY ELECTRIC WATER HEATERS

Green Alternative	Replace existing electric water heater with higher efficiency point of use electric water heaters rated at 0.98 EF or higher.
Benefits Attained	While replacing domestic hot water units is an expensive measure, many of the units will need replacement in the coming years as they are reaching the end of their useful life. Replacing now with high efficiency alternatives provides significant cost savings and comfort benefits and reduces large future capital expense.
Assumptions	We modeled the savings using spreadsheet-based calculations. To calculate domestic hot water savings we assumed an improvement in efficiency from 0.95 to 0.98 EF.
Recommendation	This "green alternative" is not considered cost-effective for early replacement but is recommended as the replacement option when the equipment is replaced based on capital need.

6.4 Lighting Systems

ECM: UPGRADE COMMON AREA LIGHTING AND CONTROLS

Green Alternative	Nova recommends the following: › Retrofit existing incandescent and compact-fluorescent technology fixtures with LED technology lamps. › Existing LEDs lamps and fixtures to remain in place. › Property staff shall be trained on the operation and maintenance of the new high-efficiency lighting system.
Benefits Attained	Installing high-efficiency lighting will significantly reduce the property's electrical consumption while maintaining equivalent or better light levels. Also, many of the recommended bulbs and fixtures have longer lifespans. This measure will reduce the number of bulbs replaced at the property as well as maintenance costs.
Assumptions	We modeled the savings using spreadsheet-based calculations. We based light runtime hours on observations from our site visit and on discussions with property staff and residents.
Recommendation	This "green alternative" is considered cost-effective for early replacement and is recommended.

6.5 Appliances

ECM: REPLACE REFRIGERATORS

Green Alternative	Nova recommends installing approximately one new ENERGY STAR®-qualified refrigerators (designed to consume 10% less than minimum federal efficiency standards) in place of the existing inefficient 10.0 cubic feet refrigerator. Refrigerators shall possess top-mounted freezers and be appropriately sized. Ice-maker and dispenser models are not recommended because they use 15% more energy than standard ENERGY STAR-qualified models and will increase the purchase price.
Benefits Attained	ENERGY STAR qualified refrigerators are equipped with high-efficiency compressors that have improved insulation; they also consume approximately 25% less energy than similar non-ENERGY STAR models. Models with top-mounted freezers use 10-25% less energy than bottom or side-by-side models.
Assumptions	We based the costs for this measure on common costs of equivalent sized ENERGY STAR-qualified refrigerators. The savings calculations assume existing refrigerator consumption at 329 kWh and proposed consumption at 297 kWh annually.
Recommendation	This “green alternative” is not considered cost-effective for early replacement but is recommended as the replacement option when the equipment is replaced based on capital need.

6.6 Resilience Options

ECM: INSTALL SOLAR PHOTOVOLTAIC SYSTEM

Green Alternative	We analyzed the property for a potential solar PV system based on available roof space, and found the property may be a good candidate for up to 18.13 kW of installed solar capacity for existing conditions or 25.9 kW for future electric demand after installation of a heat pump HVAC system. A complete solar evaluation and design by a qualified contractor should be completed as part of this work scope. Because the roofing material is greater than 15 years old on average, the roof replacement ECM must be selected in conjunction with this improvement measure.
Benefits Attained	By cleanly generating electricity onsite, a solar electric system would significantly reduce the property's utility electric purchase, eliminating associated carbon emissions, and reduce the property's exposure to future electric price swings. A PV system could also be paired with onsite battery storage to provide additional resilience in the case of an extended blackout (for additional cost and design considerations).
Assumptions	The solar PV system feasibility and size was assessed given available roof space, pitch and orientation and typical electricity production We modeled this EWEM using OpenSolar.
Recommendation	This "green alternative" is recommended for decarbonization and resiliency reasons.

ECM: REPLACE SECTION OF ROOF FOR PHOTOVOLTAIC INSTALLATION

Green Alternative	Based on the age of the current roofing systems, if a photovoltaic system is installed, it is suggested that prior to work starting the affected roof section be re-roofed.
Benefits Attained	Since roofing will likely need to be replaced within the next 25 years (the expected useful life of a photovoltaic system), re-roofing now will save costly removal and re-installation fees and prevent solar credit losses from down-time that the system is not producing during future re-roofing.
Assumptions	Nova estimates that based on the optimal location and size of the photovoltaic system that approximately 2.300 square feet of roof space be replaced with a solar-viable roofing material.
Recommendation	This "green alternative" is recommended for decarbonization and resiliency reasons.

ECM: LEVEL TWO ELECTRIC VEHICLE CHARGER

Green Alternative	We analyzed the property for a potential electric vehicle charging station based on available parking space, and found the property has availability for one (1) charging station.
Benefits Attained	By providing onsite electric charging station, the site will promote the use of EV chargers in the area, reducing vehicle emissions in the area. Additionally, the chargers will likely increase foot traffic in the area, providing economic benefits to the town.
Assumptions	The charger installed would be a level two (2) electric vehicle charger.
Recommendation	This "green alternative" is recommended for decarbonization and resiliency reasons.

7.0 GLOSSARY OF ABBREVIATIONS

This report may use abbreviations to describe various site or building system components. Not all abbreviations may be applicable to this report. Frequently used abbreviations are listed and defined below.

ABBREVIATIONS			
Acronym	**Description**	**Acronym**	**Description**
AC	Air Conditioner	HRV	Heat-Recovery Ventilator
ACH	Air Changes per Hour	HSPF	Heating Seasonal Performance Factor
ACH50	Air Changes per Hour at 50 Pascals Building Pressure	HUD	U.S. Department of Housing and Urban Development
ACHN	Natural Air Changes per Hour	HVAC	Heating, Ventilation and Air Conditioning
AEE	Association of Energy Engineers	HWS	Hot Water Supply
AFUE	Annual Fuel Utilization Efficiency	IAQ	Indoor Air Quality
AHU	Air Handling Unit	IBC	International Building Code
ANSI	American National Standards Institute	IECC	International Energy Conservation Code
ASHP	Air Source Heat Pump	IES	Illuminating Engineering Society of North America
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers	IMEF	Integrated Modified Energy Factor
ASTM	American Society for Testing and Materials	IPLV	Integrated Part Load Value
BEAP	Building Energy Assessment Professional (ASHRAE)	ISO	Polyisocyanurate
BESA	Building Energy Simulation Analyst (Association of Energy Engineers)	IWF	Integrated Water Factor
BMS	Building Management System	kBTU	One Thousand British Thermal Units
BPI	Building Performance Institute	kW	Kilowatt
BPI-BA	Building Performance Institute Certified Building Analyst	kWh	Kilowatt-Hour
BPI-MFBA	Building Performance Institute Certified Multifamily Building Analyst	LED	Light Emitting Diode
BTL	Building Tightness Limit	LEED	Leadership in Energy and Environmental Design
BTU	British Thermal Unit	LEED AP(BD&C)	LEED Accredited Professional - Building Design & Construction
BTUH	British Thermal Units per Hour	Low-E	Low Emissivity
CAZ	Combustion Air Zone	LPG/LP Gas	Liquefied Petrolium Gas (ex - Propane)
CDD	Cooling Degree Days	MAU	Makeup Air Unit
CEA	Certified Energy Auditor (Association of Energy Engineers)	MEF	Modified Energy Factor
CEC	California Energy Commission	MEP	Mechanical, Electrical and Plumbing
CEER	Combined Energy Efficiency Ratio	MH	Metal Halide

ABBREVIATIONS			
Acronym	**Description**	**Acronym**	**Description**
CEF	Combined Energy Factor	MMBTU	One Million British Thermal Units
CEM	Certified Energy Manager (Association of Energy Engineers)	MTCO2e	Metric Tons Carbon Dioxide Equivalent
CF	Cubic Feet	MVG	Minimum Ventilation Guideline
CFL	Compact Fluorescent Lamp	MVL	Minimum Ventilation Level
CFM	Cubic Feet per Minute	NABCEP	North American Board of Certified Energy Practitioners
CFM50	Measured Air Flow through Blower Door at 50 Pascals	NAHB	National Association of Home Builders
CMVP	Certified Measurement & Verification Professional (Association of Energy Engineers)	NFPA	National Fire Protection Association
CO	Carbon Monoxide	NFRC	National Fenestration Rating Council
CO2	Carbon Dioxide	NRA	Net Rentable Area
CO2e	Carbon Dioxide Equivalent	NREL	National Renewable Energy Laboratory
COP	Coefficient of Performance	NRSF	Net Rentable Square Feet
CPVC	Chlorinated Polyvinyl Chloride	ODS	Oxygen Depletion Sensor
CRI	Color-Rendering Index	OSB	Oriented Strand Board
CUFT	Cubic Feet	OSHA	Occupational Safety and Health Administration
DB	Dry-Bulb (Temperature)	PCA	Property Condition Assessment
DHW	Domestic Hot Water	PCR	Property Condition Report
DLC	DesignLights Consortium	PPM	Parts per Million
DWH	Domestic Water Heater	PSC	Permanent Split Capacitor
DX	Direct Expansion	PSI	Pounds per Square Inch
ECM	Electronically Commutated Motor	PTAC	Packaged Terminal Air Conditioner
EER	Energy Efficiency Ratio	PTHP	Packaged Terminal Heat Pump
EF	Energy Factor	PVC	Polyvinyl Chloride
EIFS	Exterior Insulation and Finish System	R-	R-Value
EMF	Electro Magnetic Field	RAC	Room Air Conditioner
EMS	Energy Management System	RESNET	Residential Energy Services Network
EPA	Environmental Protection Agency	RPM	Revolutions per Minute
EPDM	Ethylene Propylene Diene Monomer	RTU	Rooftop Unit
EPS	Expanded Polystyrene	RUL	Remaining Useful Life
ERV	Energy-Recovery Ventilator	R-Value	Thermal Resistance
EUI	Energy Use Intensity	SC	Shading Coefficient
EUL	Expected Useful Life	SEER	Seasonal Energy Efficiency Ratio
EWEM	Energy and Water Efficiency Measure	SF	Square Feet
FCU	Fan Coil Unit	SHGC	Solar Heat-Gain Coefficient
FHA	Forced Hot Air	SIR	Savings to Investment Ratio
FHR	First Hour Rating	SOG	Slab on Grade
FHW	Forced Hot Water	TE	Thermal Efficiency

ABBREVIATIONS			
Acronym	**Description**	**Acronym**	**Description**
FPM	Feet per Minute	TPO	Thermoplastic Polyolefin
FT	Feet	TRV	Thermostatic Regulator Valve
GA	Gross Area	TTD	Thermostatic Tub Diverter
gal	Gallons	U-	U-Factor (U-Value)
GBA	Gross Building Area	UBC	Uniform Building Code
GFCI	Ground Fault Circuit Interrupter	UL	Underwriters Labaratories
GPC	Gallons per Cycle	USGBC	U.S. Green Buildung Council
GPF	Gallons per Flush	UV	Ultraviolet
GPM	Gallons per Minute	V	Volt
GSHP	Ground Source Heat Pump	VAV	Variable Air Volume
HDD	Heating Degree Days	VFD	Variable Frequency Drive
HERS	Home Energy Rating System	VOC	Volatile Organic Compound
HHW	Heating Hot Water	W	Watt
HID	High-Intensity Discharge (Lighting)	WB	Wet-Bulb (Temperature)
HP	Horsepower	WH	Watt-hour
HPB	High Performance Building	WRT	With Reference to
HPBD	High-Performance Building Design Professional (ASHRAE)	WUI	Water Use Intensity
HPS	High-Pressure Sodium	XPS	Extruded Polystyrene

8.0 RECOMMENDED OPERATIONS AND MAINTENACE PLAN

BEST PRACTICES TO IMPROVE ENERGY PERFORMANCE

LOW-COST O&M CHECKLIST

Use the following checklist of low-cost O&M practice to identify opportunities, assign responsibility and track progress toward goals at your facility.

	Opportunity Exists	Target Reduction	Who is Responsible?	Target Date to Complete	Actual Date Completed	Notes
OPERATIONS & MAINTENANCE						
Ensure all equipment is functioning as designed	Y					
Calibrate thermostats	Y					
Adjust dampers	Y					
Implement janitorial best practices	Y					
Properly maintain existing equipment	Y					
Review ENERGY STAR Registry of Labeled Buildings for ideas	Y					
OCCUPANTS' BEHAVIOR						
Turn off equipment	Y					
Institute an energy awareness program	Y					
Adopt a procurement policy for ENERGY STAR qualified equipment	Y					
Maximize use of daylight	Y					
Install task lighting	Y					
Train staff	Y					
LIGHTING						
Change incandescents to CFLs	Y					
Change T12s to T8 or T5	Y					
Install occupancy sensors in back-of-the house, infrequently used areas						
Install high efficiency LED exit signs						
Periodically clean the bulbs with a dry cloth	Y					
De-lamp where illumination is excessive	Y					
Only use lights that are needed	Y					

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	Opportunity Exists?	Target Reduction	Who is Responsible?	Target Date to Complete	Actual Date Completed	Notes
KITCHENS						
Pre-heat ovens no more than 15 minutes prior to use						
Keep refrigerator coils clean and free of obstructions	Y					
Bleach clean with warm water	Y					
Use fan hood only when cooking						
Purchase ENERGY STAR commercial cooking equipment	Y					
COMPUTERS AND OFFICE EQUIPMENT						
Utilize power down feature on computers	Y					
Purchase ENERGY STAR office equipment	Y					
Install energy control devices on vending machines						
HVAC AND PLANT SYSTEMS						
Adjust thermostats for seasonal changes and occupancy	Y					
Balance air and water systems	Y					
Replace boiler burners	Y					
Unblock air flow from unit ventilators	Y					
Clean centrifugal chiller water tubes						
Clean and repair chilled water plants or package units						
Repair leaking steam traps						
Repair pipe and vessel insulation from steam and hot water distribution lines						
Repair malfunctioning dampers on unit ventilators						
Chemically treat feedwater						
Annually test combustion efficiency	Y					
Clean and lubricate moveable surfaces and check actuator movement and set-points in the damper and economizer						
Perform boiler tune-ups	Y					
Clean filters and fans	Y					
Clean air conditional evaporator and condenser coil fins	Y					
Align and adjust belts	Y					

	Opportunity Exists?	Target Reduction	Who is Responsible?	Target Date to Complete	Actual Date Completed	Notes
HVAC AND PLANT SYSTEMS (CONTINUED)						
Check for air leaks in equipment cabinets and ducts						
Ensure proper operation of air damper	Y					
Clean condenser and evaporator coils	Y					
Properly charge refrigerant	Y					
Install VFDs and energy efficient motors	Y					
FANS						
Clean fan blades	Y					
Inspect bearings	Y					
Adjust/change belts	Y					
Check fan current	Y					
BUILDING ENVELOPE						
Regularly inspect doors and windows for air leaks	Y					
Periodically inspect building for water leaks	Y					
Check the caulking and weather stripping for leaks	Y					
WATER HEATING						
Adjust water temperature to lower legal limit	Y					
Periodically check the hot water systems for leaks	Y					
Test the burners of gas or oil fired water heaters annually	Y					
Periodically flush fixtures to prevent bacteria growth	Y					
Annually flush storage-type hot water tanks	Y					
Periodic maintenance on the hot water system	Y					
Install or repair pipe insulation	Y					

EPA
United States
Environmental Protection
Agency

April 2006
XXX-X-XX-XXX

EXHIBIT A: PHOTOGRAPHIC RECORD

Photographs

Elevation South

Elevation West

Elevation North

Elevation East

Town Offices in Front of the Town hall

Elevation North

Town Clerks Office Sign on the Door

North Entry to the Upstairs Town Managers Office Fan Window

249,129 kWh at the Electric Utility Meter

South Windows Traffic Noise and Pollution Intrusion

First Story West Window

South Windows

Second Story South Wall Windows

Single Glazed Wood Window

Draft from First Story West Windows

First Story West Window Lock is Broken

Attic Access in the North Entry Foyer

First Story Glass Door in the Clerks Office

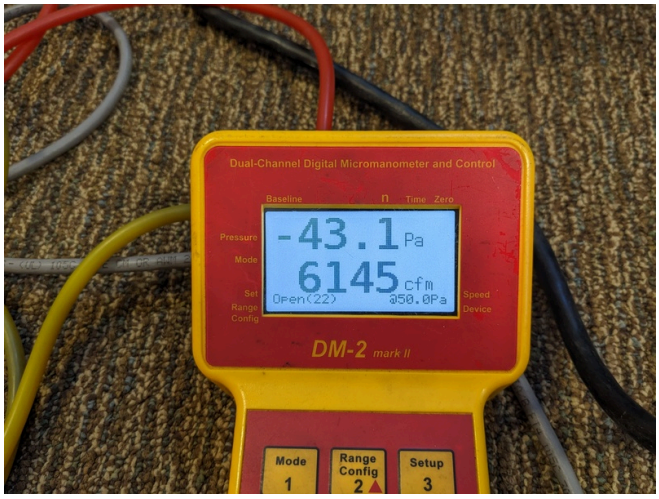
Covered Stairway Entry Shared with the Adjacent Building has a Door to the Right

Attic Insulation

Attic Insulation

Attic Plumbing Vent

Blower Door Setup Second Story with Stairway

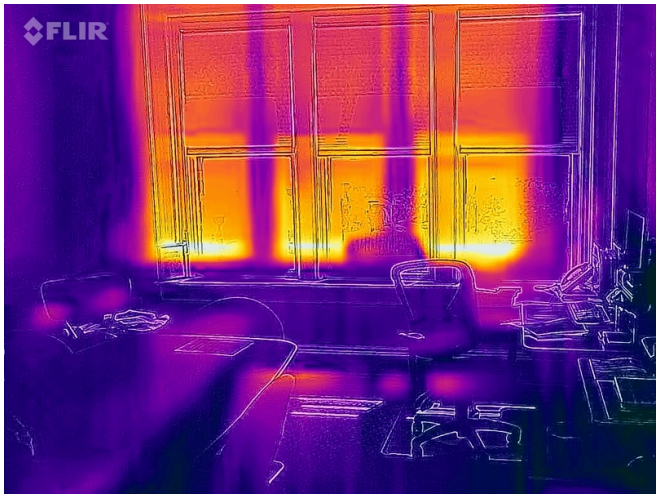


Blower Door Test

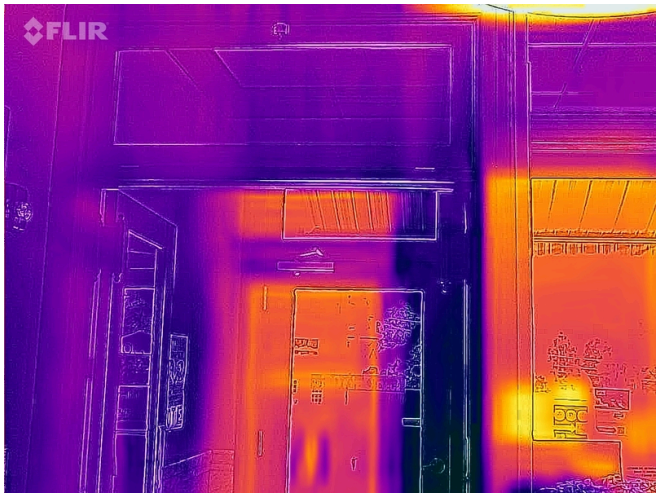
IR Second Story South Wall Window

IR First Story South Entry Foyer Outside Door

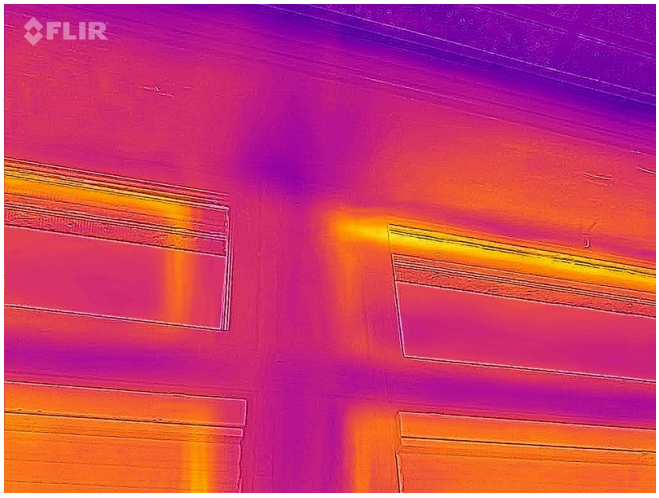
IR First Story East Wall Windows



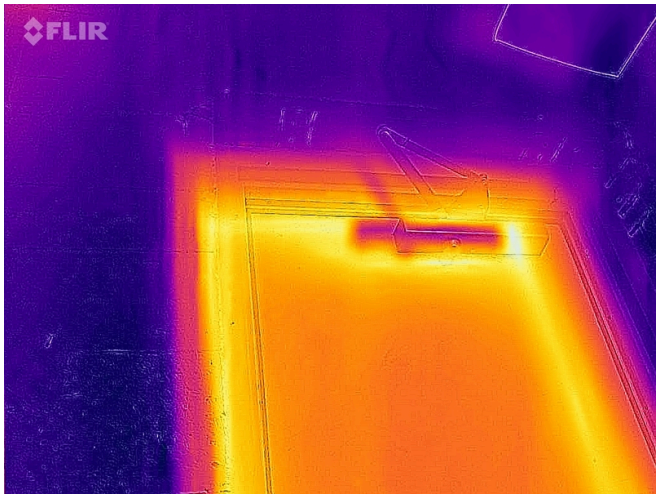
IR Second Story South Wall Windows



IR First Story South Entry Door



IR First Story West Wall and Windows



IR Exit Door in the Mechanical Room

Condensers on the West Wall by the North Porch

Three Propane Tanks

DHW and Hydronic Boiler

Flue and Plumbing

Plumbing Chases

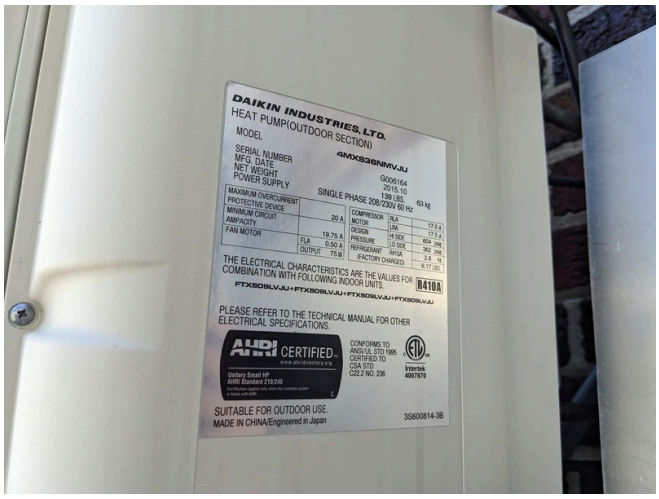
Hydonic Zone Relay

Two (2) Hydronic Pumps by Grundfos

Second Story Lobby

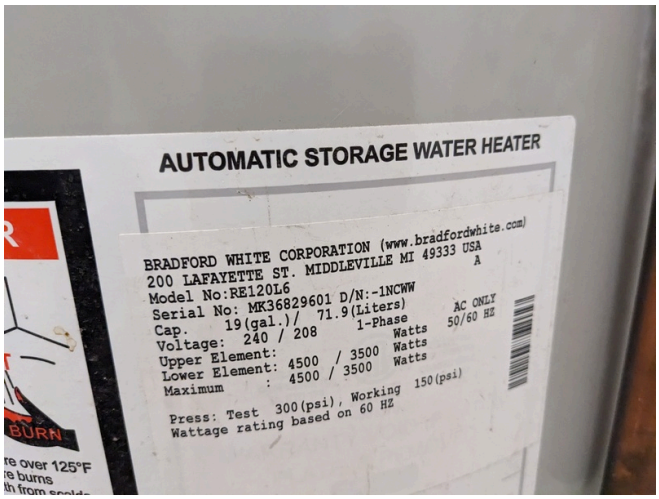
First Story West Wall Hallway Hydronic Baseboard Heater

Heat Pump for the First Story North Conference Room



Condenser 2S by Daikin; Model: 4MXS36NMVJU

Condenser 2N by Daikin; Model: 4MXS36NMVJU



DHW by Bradford White; Model: RE120L6

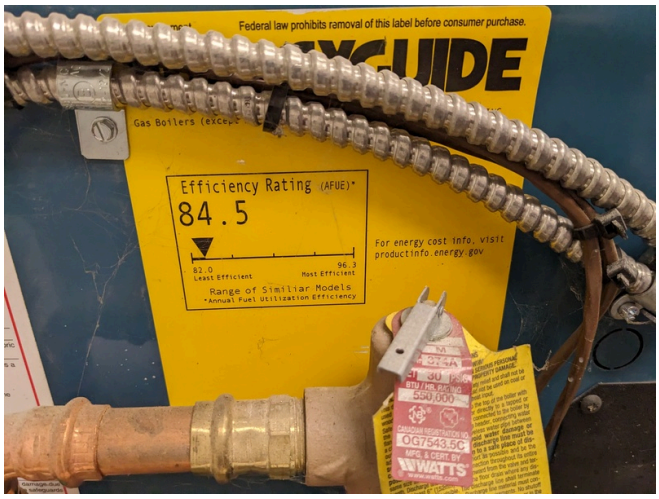
Hydronic Zone Relay

Hydronic Pumps

178 W (1/4 HP) Pump by Grundfos; Model: B; MAGNA1 32-100 F 165;

Boiler by Burnham US Boiler Company

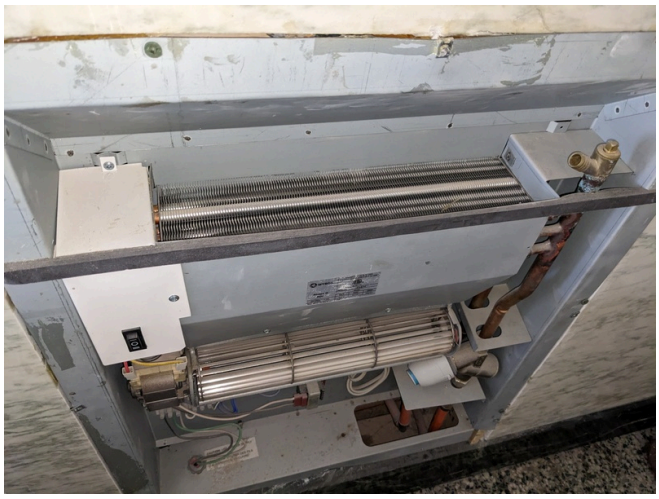
Hydronic Boiler by US Boiler Company; Model: ESC8C



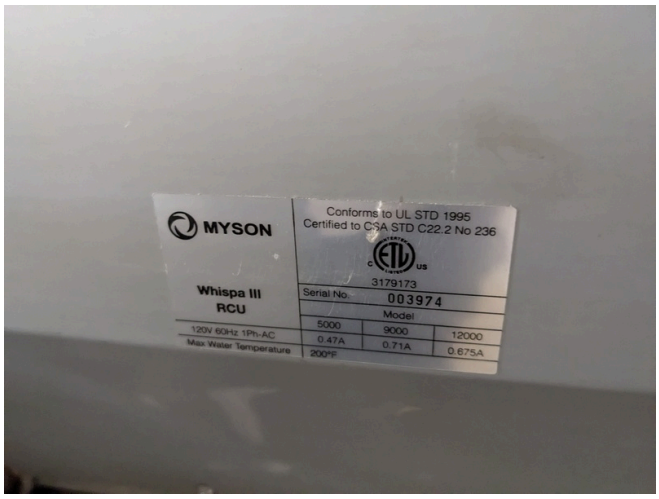
Boiler 84.5 % AFUE Energy Guide

Hydronic Radiator

Radiator



Radiator in the Counter



Counter Radiator by Myson

Second Story North Entry has a Radiator

Counter Radiators

Counter Radiator

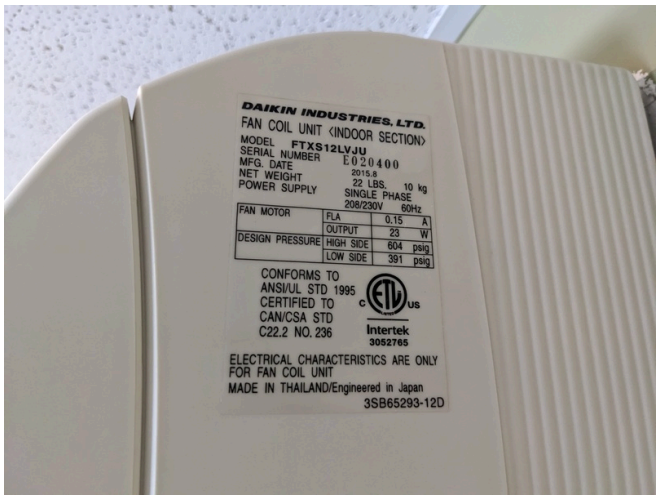
Heating Units in the First Story Service Counter

First Story Hydronic Baseboard Heaters

Second Story Lobby Kitchenette has an Evaporator

Evaporator in the Second Story South Conference Room and Office

Evaporator 12 kBTU



Evaporator by Daikin; Model: FTXS12LVJU

Evaporator 12 kBTU; Hole in the Wall Around Installation

Evaporator by Daikin; Model: FTXS12LVJU; Hole in the Wall Around Installation

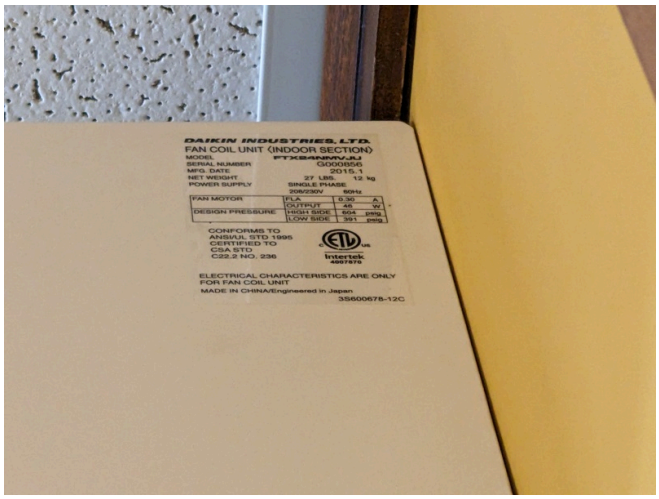
Evaporator in the Second Story Lobby

Hole in the Wall Around Evaporator Installation

Evaporator by Daikin; Model: FTXS24LVJU

Evaporator by Daikin; Model: FTXS12LVJU

Evaporator in the First Story Northeast Corner Conference Room



Evaporator by Daikin; Model: FTS24NMVJU

Evaporator 24 kBTU

Evaporator in the First Story Southwest

Thermostat

Thermostat

Thermostats

DHW Tank

Restroom

1.5 GPM Measured Flow at the First Story

Second Story Kitchenette

First Story Kitchen

1.8 GPM Measured Flow at a Restroom Faucet

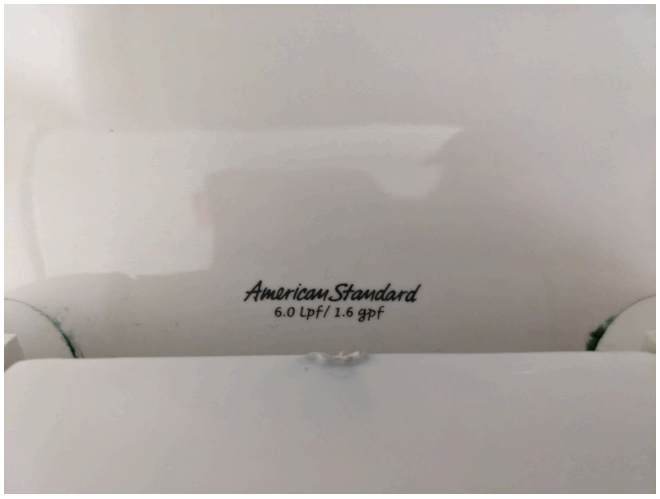
First Story Restroom

Second Story Restroom

Restroom Faucet

1.5 GPM Measured Flow at a Restroom Faucet

1.6 GPF Toilet Tank



1.6 GPF Toilet

Commercial Toilet

North Porch Outside Light

CFL Recessed Can Lighting

Second Story Conference Room has Three (3) Types of Lights

Track Lighting in the Second Story Conference Room

Track Lighting

Restroom Lighting

LED Lighting

Lighting in the Second Story Lobby

LED Lighting in the Record Vault

LED Lighting

Lighting Second Story in the Entry Stairway; South Wall Windows

Lighting CFL in Recessed Can

Lighting in the Second Story Office

Light Switch

Lighting and South Wall Window in the Second Story of the Shared Entry Stairway with Wheelchair Lift

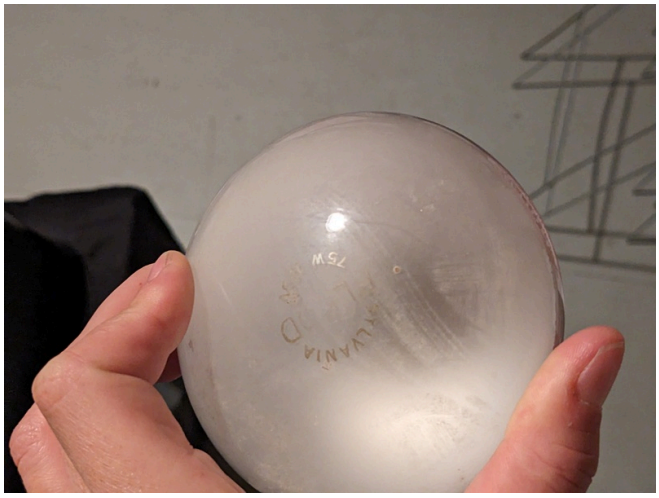
Lighting in the Shared Stairway Entry

LED Lighting

Lighting in the First Story West Hallway

Lighting in the Large Fixtures in the First Story Clerks Office

Pin CFL

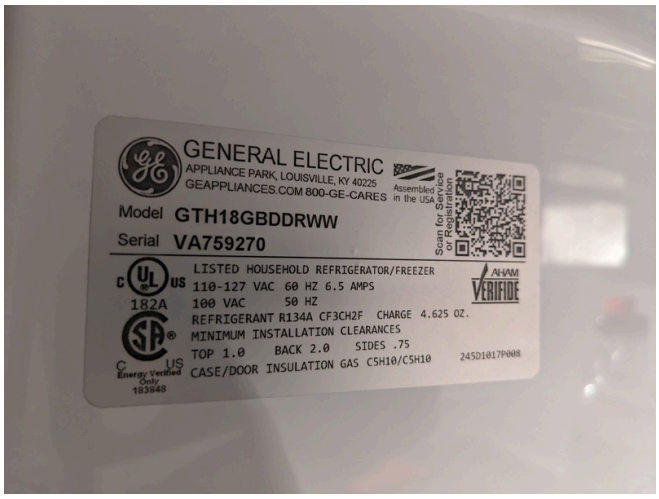


75 W Incandescent Lamp

Lighting and Exhaust Fan in the Housekeeping Closet

Lighting in the Mechanical Room

Refrigerator by GE



Refrigerator by GE; Model VA759270

Kitchen Appliance Light

Refrigerator

Electrical Service Panel

Electrical Sub Panel

Electrical Service Panel

Electrical Sub Panel in the First Story West Wall

EXHIBIT B: SITE AND FLOOR PLANS

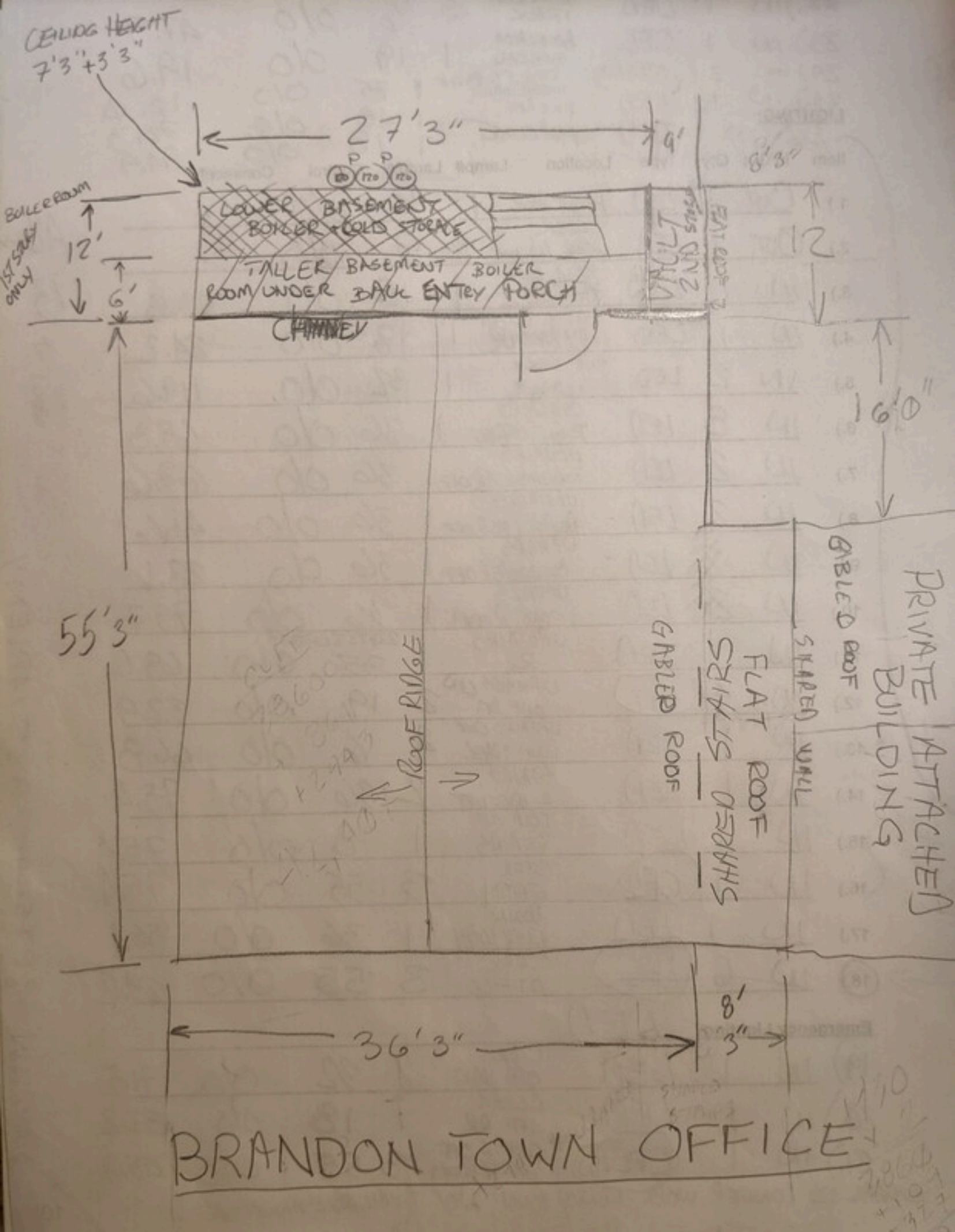

CEILING HEIGHT
7'3" + 3'3"
27'3"
9'
8'3"
BOILER ROOM
1ST STORY ONLY
12'
6'
LOWER BASEMENT
BOILER + COLD STORAGE
TALLER BASEMENT BOILER ROOM UNDER BACK ENTRY PORCH
CHIMNEY
FLAT ROOF
2ND STORY
12'
16'0"
55'3"
ROOF RIDGE
GABLED ROOF
FLAT ROOF
STAIRS OVERHS
SHARED WALL
GABLED ROOF
PRIVATE ATTACHED BUILDING
36'3"
8'3"
BRANDON TOWN OFFICE

EXHIBIT C: MECHANICAL EQUIPMENT INVENTORY

PUMPS AND MOTORS						
Equip. Location	**Service**	**Make**	**Model #**	**Size (HP)**	**Quantity**	**VFD Control (Y/N)**
RECOMMENDED FOR REPLACEMENT						
None						
NOT RECOMMENDED FOR REPLACEMENT						
At Boiler	Hydronic Baseboards and Radiators	Grundfos	Magna 32 100F Model B	1/4 horse	Two (2)	Yes

HEATING EQUIPMENT													
Equip. Location	**Area Served**	**System Type**	**Make**	**Model #**	**Capacity**	**Cap. Units**	**Efficiency**	**Eff. Units**	**Year**	**Qty**	**Fuel**	**Dist.**	**RUL**
RECOMMENDED FOR REPLACEMENT													
Mechanical Room	Entire Building Backup	Boiler	Burnham	ESC 8C	212	kBTUh	84.5 %	AFUE	2015	One (1)	Propane	Hydronic Radiators and Baseboards	16 years
Whole Building except South Side of First Floor	Whole Building except South Side of First Floor	Condenser	Daikin	4MXS36NMVJU	Three (3)	Ton	8.2	HSPF	2015	Three (3)	Electric	Ductless Heat Pump	6 years
South Side of First Floor	South Side of First Floor	Condenser	Daikin	RX24NMVJU	Two (2)	Ton	8.2	HSPF	2015	One (1)	Electric	Ductless Heat Pump	6 years
NOT RECOMMENDED FOR REPLACEMENT													
None													

COOLING EQUIPMENT												
Equip. Location	**Area Served**	**System Type**	**Make**	**Model #**	**Capacity**	**Cap. Units**	**Efficiency**	**Eff. Units**	**Year**	**Qty**	**Dist.**	**RUL**
RECOMMENDED FOR REPLACEMENT												
Second Story West Offices, Conf Room and First Story Conf Room	Second Story West Offices, Conf Room and First Story Conf Room	Evaporator	Daikin	FTXS12LVJU	One (1)	Ton	14.0	SEER	2015	Four (4)	Point Source	Eleven (11) years

COOLING EQUIPMENT												
Equip. Location	**Area Served**	**System Type**	**Make**	**Model #**	**Capacity**	**Cap. Units**	**Efficiency**	**Eff. Units**	**Year**	**Qty**	**Dist.**	**RUL**
First Story Clerk's Office and Second Story Common Area	First Story Clerk's Office and Second Story Common Area	Evaporator	Daikin	FTXS24LVJU	Two (2)	Ton	14.0	SEER	2015	Three (3)	Point Source	Eleven (11) years
Whole Building except South Side of First Floor	Whole Building except South Side of First Floor	Condenser	Daikin	4MXS36NMVJU	Three (3)	Ton	14.0	SEER	2015	Three (3)	Point Source	Eleven (11) years
South Side of First Floor	South Side of First Floor	Condenser	Daikin	RX24NMVJU	Two (2)	Ton	14.0	SEER	2015	One (1)	Point Source	Eleven (11) years
NOT RECOMMENDED FOR REPLACEMENT												
None												

DHW EQUIPMENT												
Equip. Location	**Area Served**	**Make**	**Model #**	**Capacity (BTU or kWh)**	**Efficiency**	**Direct or Indirect**	**Tank Size**	**Recirc. Pump HP**	**Year**	**Qty**	**Fuel**	**RUL**
RECOMMENDED FOR REPLACEMENT												
Mechanical Room	Entire Building	Bradford White	RE120L6	4,500W	EF 0.95	Direct	19 Gallons	None	2015	One (1)	Electric	One year
NOT RECOMMENDED FOR REPLACEMENT												
None												

INTERIOR SITE LIGHTING									
Fixture Location	**Fixture Type**	**Lamp Type**	**Fixture Count**	**Lamp Count Per Fixture**	**Existing Lamp Wattage**	**Proposed Lamp Wattage**	**Control Type**	**Daily Run Hours**	**Type of Upgrade**
RECOMMENDED FOR REPLACEMENT									
Upstairs Conf Room CAN	Edison Socket	CFL	Four (4)	Two (2)	Nineteen (19)	Nine (9)	On/Off	Eight (8)	Lamp
Over Entry	Pin	CFL	One (1)	Three (3)	55	25	On/Off	Eight (8)	Lamp
Clerk's Office	Pin	CFL	Six (6)	Three (3)	55	25	On/Off	Eight (8)	Lamp
Clerk's Office Breakroom	Pin	CFL	One (1)	Three (3)	55	25	On/Off	Eight (8)	Lamp
Breakroom Sink CAN	Edison Socket	CFL	One (1)	One (1)	Nineteen (19)	Nine (9)	On/Off	Eight (8)	Lamp

INTERIOR SITE LIGHTING									
Fixture Location	**Fixture Type**	**Lamp Type**	**Fixture Count**	**Lamp Count Per Fixture**	**Existing Lamp Wattage**	**Proposed Lamp Wattage**	**Control Type**	**Daily Run Hours**	**Type of Upgrade**
Dry Storage Under Vault	Edison Socket	Incan	Two (2)	One (1)	75	Sixteen (16)	On/Off	Eight (8)	Lamp
NOT RECOMMENDED FOR REPLACEMENT									
Back Door to 2nd Floor	Pin	LED	One (1)	One (1)	Eighteen (18)	None	On/Off	Eight (8)	None
Utility Closet by Back Door	Linear Tube	LED	One (1)	One (1)	Eighteen (18)	None	On/Off	Eight (8)	None
Vault 2nd Story	Linear Tube	LED	Two (2)	One (1)	32	None	On/Off	Eight (8)	None
Upstairs Town Offices	Linear Tube	LED	Eight (8)	One (1)	36	None	On/Off	Eight (8)	None
Upstairs Town Mgr Office	Linear Tube	LED	Two (2)	One (1)	36	None	On/Off	Eight (8)	None
Upstairs Deputy Manager Office	Linear Tube	LED	Two (2)	One (1)	36	None	On/Off	Eight (8)	None
Upstairs Bookkeeper Office	Linear Tube	LED	Two (2)	One (1)	36	None	On/Off	Eight (8)	None
Upstairs Conference Room	Linear Tube	LED	Two (2)	One (1)	36	None	On/Off	Eight (8)	None
Upstairs Restroom	Surface Mounted Fixture	LED	One (1)	One (1)	35	None	On/Off	Eight (8)	None
Upstairs Conf Room Track	Track Lighting	LED	One (1)	Four (4)	Six (6)	None	On/Off	Eight (8)	None
Stairs and Wheelchair lift	Linear Tube	LED	One (1)	Two (2)	36	None	On/Off	Eight (8)	None
Top of Stairs	Linear Tube	LED	One (1)	One (1)	Eighteen (18)	None	On/Off	Eight (8)	None
Downstairs Elevator Lobby	Linear Tube	LED	One (1)	One (1)	36	None	On/Off	Eight (8)	None
Clerk's Office Vault	Linear Tube	LED	One (1)	One (1)	32	None	On/Off	Eight (8)	None
Clerk's Office Restroom	Linear Tube	LED	One (1)	One (1)	Eigteen (18)	None	On/Off	Eight (8)	None
Breakroom Track Light	Track Lighting	LED	One (1)	Six (6)	Six (6)	None	On/Off	Eight (8)	None
File Room	Linear Tube	LED	One (1)	One (1)	48	None	On/Off	Eight (8)	None
Mop Closet	Linear Tube	LED	One (1)	One (1)	Eigteen (18)	None	On/Off	Eight (8)	None
Boiler Room	Linear Tube	LED	Three (3)	One (1)	36	None	On/Off	Eight (8)	None

EXTERIOR SITE LIGHTING									
Fixture Location	**Fixture Type**	**Lamp Type**	**Fixture Count**	**Lamp Count Per Fixture**	**Existing Lamp Wattage**	**Proposed Lamp Wattage**	**Control Type**	**Daily Run Hours**	**Type of Upgrade**
RECOMMENDED FOR REPLACEMENT									
None									
NOT RECOMMENDED FOR REPLACEMENT									
Front Door	LED	LED	One (1)	One (1)	40	None	On/Off	Four (4)	None
Under Rear Awning	Edison Socket	LED	One (1)	Two (2)	Nine (9)	None	On/Off	Four (4)	None

REFRIGERATORS							
Location	**Make**	**Model #**	**Year**	**kWh/Year**	**Size (ft3)**	**Qty**	**RUL**
RECOMMENDED FOR REPLACEMENT							
Upstairs	GE	GTH18GBDDRWW	2016	383	18.1	One (1)	0 years
Downstairs	Vissani	HVDR1040B	2014	329	9.9	One (1)	0 years
NOT RECOMMENDED FOR REPLACEMENT							
None							

FLOW RATE SUMMARY - SAMPLE			
Location	**Fixture Type**	**Qty**	**Flow (GPM or GPF)**
RECOMMENDED FOR REPLACEMENT			
Upstairs Restroom	Toilet	One (1)	1.6 GPF (upgrade to 1.28 GPF)
Downstairs Restroom	Toilet	One (1)	Commercial, No Tank, Assumed to be 4.5 GPF
Restroom	Faucet	Two (2)	1.5 and 1.8 GPM (upgrade both to 1.0 GPM)
NOT RECOMENDED FOR REPLACEMENT			
Kitchen	Faucet	Two (2)	1.5 GPM
Slop Sink	Faucet	One (1)	2.2 GPM

EXHIBIT D: SOLAR PROPOSAL

Nova Group, GBC

Proposal for Customer

Prepared by:
morgan.carson@novagroupgbc.com
4047904052
morgan.carson@novagroupgbc.com

For:
49 Center St, Brandon

Quote #: 4683982
Valid until: Jul 14 2024

Solar Energy System Proposal

Dear ,

Thank you for the opportunity to present your Solar Energy System Proposal.

Best Regards,
morgan.carson@novagroupgbc.com
Nova Group, GBC

Recommended System Option

90 %	$61,519	$94,521	$33,002
Consumption Offset	Lifetime Electricity Bill Savings	Net Cost of this solar system	Clean Energy Premium over system lifetime

Your Solution

Solaria PowerXT-370R-PD Series

49 Solaria PowerXT-370R-PD
370 Watt panels
with 25 Year Performance Warranty
Up to **20.5%** Module efficiency
21,617 kWh per year

SOLARIA

Battery

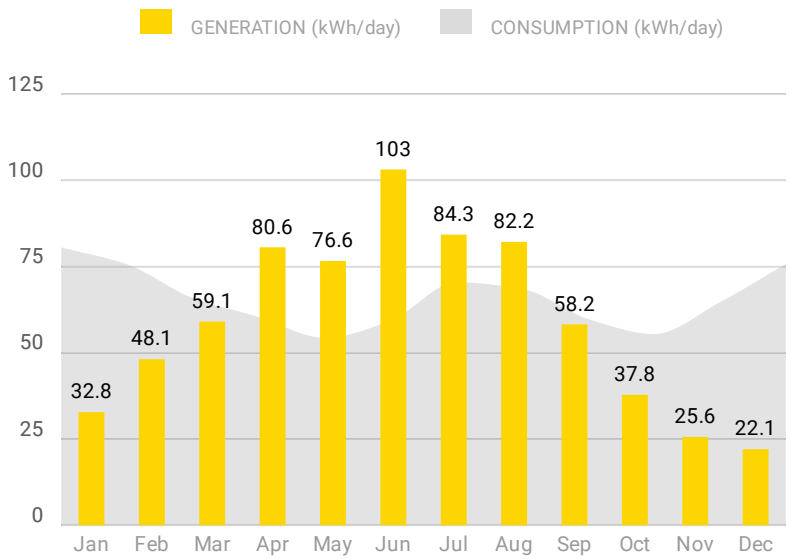
Sungrow Power Supply Co., Ltd.
115.2 kWh Total Battery Storage
1 x ST115CP

Warranties: 25 Year Panel Product Warranty, 25 Year Panel Performance Warranty

System Performance

90%

Energy From Solar



System Performance Assumptions: System Total losses: 15.5%, Inverter losses: 2.5%, Optimizer losses: 0%, Shading losses: 0%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 49 panels with Azimuth 113 and Slope 20.

The solar system(s) quoted in this proposal are not intended to be portable.

Environmental Benefits

Solar has no emissions. It just silently generates pure, clean energy.

Each Year

90% Of CO_2, SO_x & NO_x

592 kg Avoided CO_2 per year

Over System Lifetime

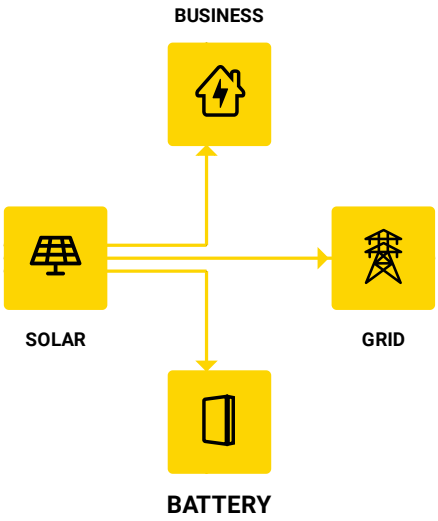
10,866 Car miles avoided

112 Trees planted

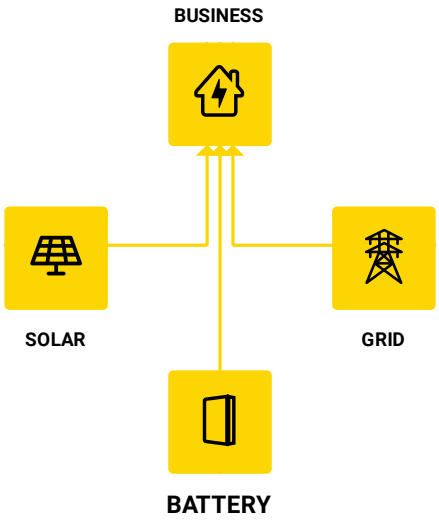
13 Long haul flights avoided

How your system works

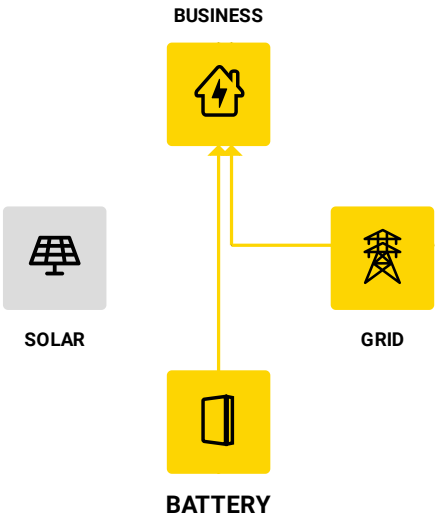
Generating Excess Solar



Partially Offset Usage

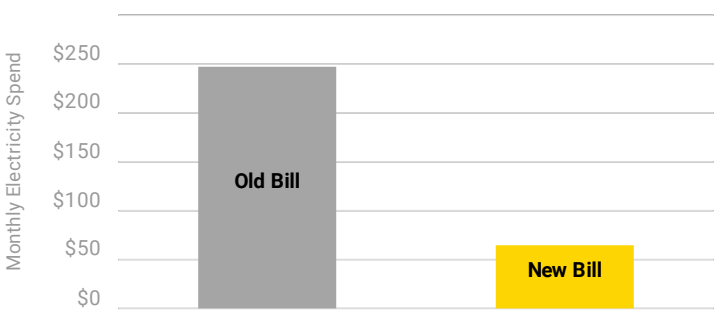


Night

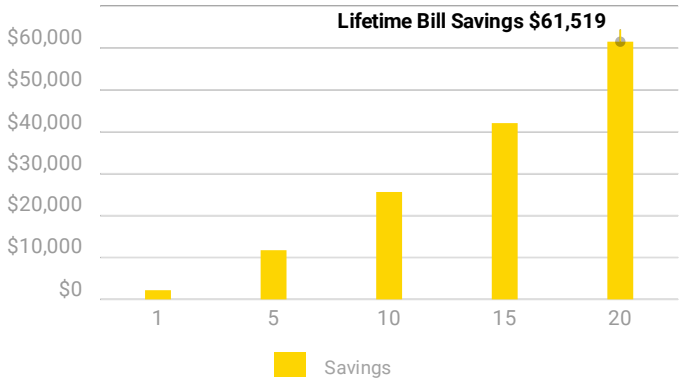


Electricity Bill Savings

First Year Monthly Bill Savings



Cumulative Bill Savings



Month	Solar Generation (kWh)	Electricity Consumption before solar (kWh)	Electricity Consumption after solar (kWh)	Utility Bill before solar ($)	Utility Bill after solar ($)	Cumulative Energy Credit ($)	Estimated Savings ($)
Jan	1,017	2,497	1534	301	196	0	104
Feb	1,348	2,118	866	260	124	0	136
Mar	1,831	2,041	358	251	69	0	183
Apr	2,418	1,811	(385)	226	30	42	196
May	2,376	1,685	(512)	213	30	97	183
Jun	3,095	1,780	(1177)	223	30	225	193
Jul	2,613	2,184	(254)	267	30	253	237
Aug	2,547	2,124	(304)	260	30	286	230
Sep	1,747	1,794	164	225	30	268	195
Oct	1,173	1,719	642	216	30	198	186
Nov	769	1,940	1208	240	30	67	210
Dec	684	2,348	1693	285	146	0	138

Rate not specified specified, using Single Phase Service based on location.

Your projected energy cost is calculated by considering a 4.0% increase in energy cost each year, due to trends in the raising cost of energy. This estimate is based on your selected preferences, current energy costs and the position and orientation of your roof to calculate the efficiency of the system. Projections are based on estimated usage of 24042 kWh per year, assuming Single Phase Service Electricity Tariff.

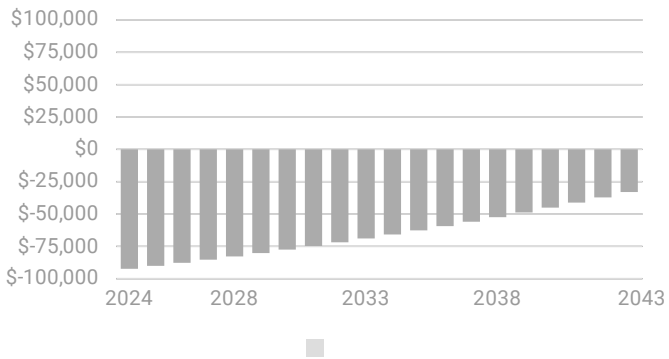
Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

Proposed Tariff Details - High Plains Power Inc Single Phase Service	
Energy Charges	
Usage Charge *All Day*	$0.11 / kWh
Fixed Charges	
Fixed Charge	$30.00 / month

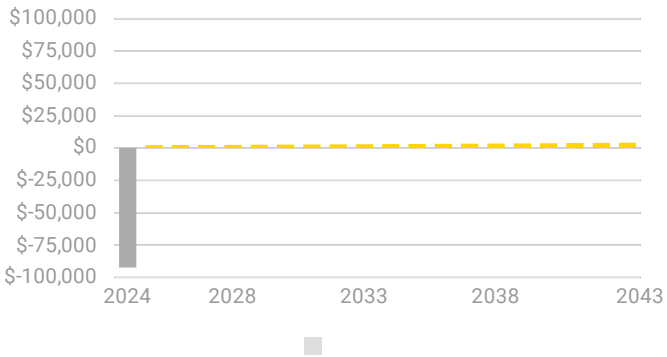
Net Financial Impact Cash

$61,519	-	$94,521	=	$33,002
Utility Bill Savings		Net System Cost		Clean Energy Premium

Cumulative Savings From Going Solar



Annual Savings From Going Solar



Estimates do not include replacement costs of equipment not covered by a warranty. Components may need replacement after their warranty period. Financial discount rate assumed: 6.75%

Quotation

Payment Option: Cash

49 x Solaria Corporation 370 Watt Panels (Solaria PowerXT-370R-PD) 1 x ST115CP (Sungrow Power Supply Co., Ltd.)	
Total System Price	$135,030.00
Purchase Price	**$135,030.00**

Additional Incentives

Federal Investment Tax Credit (ITC) The Federal Solar Tax Credit or The Federal Investment Tax Credit (ITC) for constructions starting in 2023.	$40,509.00
Net System Cost	**$94,521.00**

Price excludes Retailer Smart Meter should you want us to install your Smart Meter it will be an additional cost.
This proposal is valid until Jul 14 2024.

Quote Acceptance

I have read & accept the terms and conditions.

Signature _____

Name _____ Date _____

SOLARIA®

Solaria PowerXT® | DC Panel

Solaria PowerXT®-370R-PD

Achieving 20.5% efficiency, Solaria PowerXT solar panels are one of the highest power panels in the residential and commercial solar market. Compared to conventional panels, Solaria PowerXT panels have fewer gaps between the solar cells; this leads to higher power and superior aesthetics. Solaria PowerXT Pure Black™ panels are manufactured with black backsheet and frames, enhancing a home or building's architectural beauty.

Developed in California, Solaria's patented cell cutting and panel assembly takes processed solar wafers and turns them into PowerXT solar panels. The process starts by creating a highly reliable PowerXT cell where busbars and ribbon interconnections are eliminated. Solaria then packages the cells into the PowerXT solar panel, reducing inactive space between the cells. This process leads to an exceptionally cost effective and efficient solar panel.

Higher Efficiency, Higher Power

Solaria PowerXT panels achieve up to 20.5% efficiency; conventional panels achieve 15% – 17% efficiency. Solaria PowerXT panels are one of the highest power panels available.

Lower System Costs

Solaria PowerXT panels produce more power per square meter area. This reduces installation costs due to fewer balance of system components.

Improved Shading Tolerance

Sub-strings are interconnected in parallel, within each of the four panel quadrants, which dramatically lowers the shading losses and boosts energy yield.

Improved Aesthetics

Compared to conventional panels, Solaria PowerXT panels have a more uniform appearance and superior aesthetics.

Durability and Reliability

Solder-less cell interconnections are highly reliable and designed to far exceed the industry leading 25 year warranty.

About Solaria

Established in 2000, The Solaria Corporation has created one of the industry's most respected IP portfolios, with over 350 issued and pending patents in PV solar cell and module technology. Headquartered in Oakland, California, Solaria has developed a technology platform that unlocks the potential of solar energy.

TOP PERFORMER 2018 DNV·GL PV MODULE RELIABILITY SCORECARD

TÜVRheinland® Precisely Right.

The Solaria Corporation 1700 Broadway, Oakland, CA 94612 P: (510) 270-2500 www.solaria.com

Rev 3D 12-2019

SOLARIA®

Solaria PowerXT®-370R-PD

Performance at STC (1000W/m², 25° C, AM 1.5)

Solaria PowerXT-		365R-PD	370R-PD
Max Power (P_{max})	[W]	365	370
Efficiency	[%]	20.2	20.5
Open Circuit Voltage (V_{oc})	[V]	48.0	48.3
Short Circuit Current (I_{sc})	[A]	9.58	9.60
Max Power Voltage (V_{mp})	[V]	39.9	40.2
Max Power Current (I_{mp})	[A]	9.16	9.20
Power Tolerance	[%]	-0/+3	-0/+3

Performance at NOCT (800W/m², 20°C Amb, Wind 1 m/s, AM 1.5)

Max Power (Pmax)	[W]	269	272
Open Circuit Voltage (V_{oc})	[V]	45.1	45.4
Short Circuit Current (I_{sc})	[A]	7.73	7.74
Max Power Voltage (V_{mp})	[V]	36.7	37.0
Max Power Current (I_{mp})	[A]	7.32	7.35

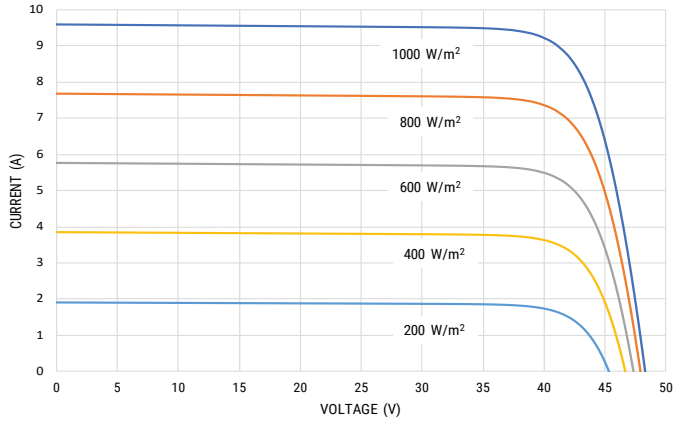
Temperature Characteristics

NOCT	[°C]	45 +/-2
Temp. Coeff. of P_{max}	[% / °C]	-0.39
Temp. Coeff. of V_{oc}	[% / °C]	-0.29
Temp. Coeff. of Isc	[% / °C]	0.04

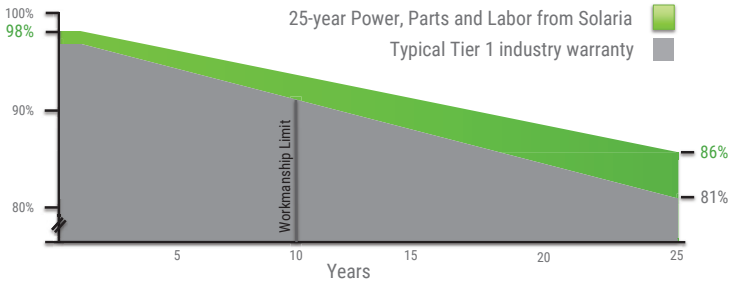
Design Parameters

Operating temperature	[°C]	-40 to +85
Max System Voltage	[V]	1000
Max Fuse Rating	[A]	15
Bypass Diodes	[#]	4

IV Curves vs. Irradiance (370W Panel)



Comprehensive 25-Year Warranty



Mechanical Characteristics

Cell Type	Monocrystalline Silicon
Dimensions (L x W x H)	63.8" x 43.9" x 1.57" 1621mm x 1116mm x 40mm
Weight	21 kg / 46 lbs
Glass Type / Thickness	AR Coated, Tempered / 3.2mm
Frame Type	Black Anodized Aluminum
Cable Type / Length	12 AWG PV Wire (UL) / 1000mm
Connector Type	MC4
Junction Box	IP67 / 4 diodes
Front Load	5400 Pa / 113 psf*
Rear Load	3600 Pa / 75 psf*

* Refer to Solaria Installation Manual for details

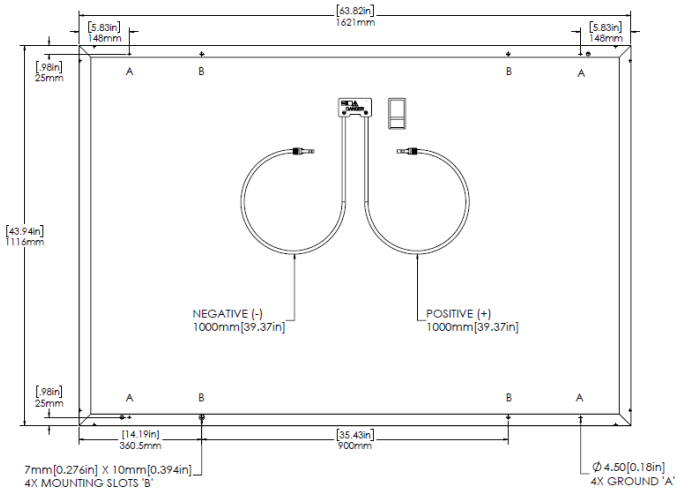
Certifications / Warranty

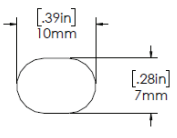
Certifications	UL 1703/IEC 61215/IEC 61730/CEC CAN/CSA-C22.2
Fire Type (UL 1703)	1
Warranty	25 years*

* Warranty details at www.solaria.com

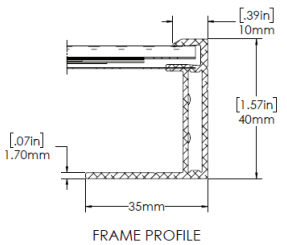
Packaging

Stacking Method	Horizontal / Palletized
Panels/ Pallet	25
Pallet Dims (L x W x H)	65.7" x 45.3" x 48.4" 1668mm x 1150mm x 1230 mm
Pallet Weight	590 kg / 1300 lbs
Pallets / 40-ft Container	28
Panels / 40-ft Container	700





MOUNTING SLOT 'B'



FRAME PROFILE

Nova Group, GBC

Proposal for Customer

Prepared by:
morgan.carson@novagroupgbc.com
4047904052
morgan.carson@novagroupgbc.com

For:
49 Center St, Brandon

Quote #: 4683982
Valid until: Jul 14 2024

Solar Energy System Proposal

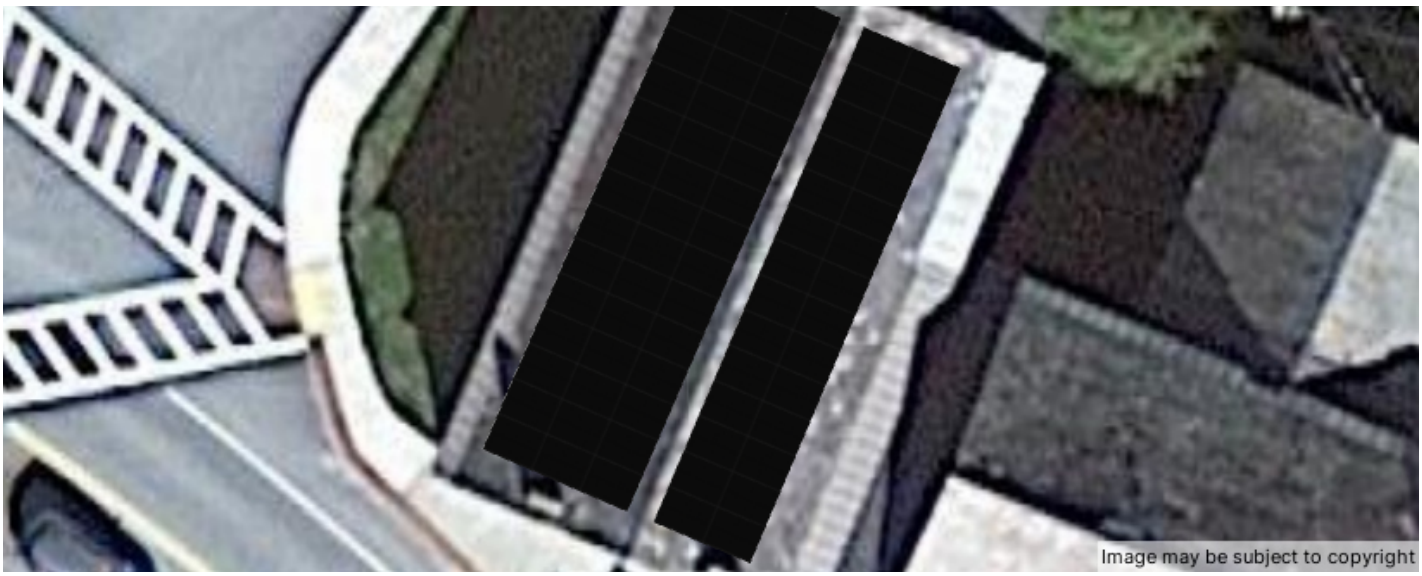
Dear ,

Thank you for the opportunity to present your Solar Energy System Proposal.

Best Regards,
morgan.carson@novagroupgbc.com
Nova Group, GBC

Recommended System Option

128%	$72,365	$180,075	$107,710
Consumption Offset	Lifetime Electricity Bill Savings	Net Cost of this solar system	Clean Energy Premium over system lifetime



Your Solution

Solaria PowerXT-370R-PD Series

70 Solaria PowerXT-370R-PD
370 Watt panels
with 25 Year Performance Warranty
Up to **20.5%** Module efficiency
30,881 kWh per year

SOLARIA

Battery

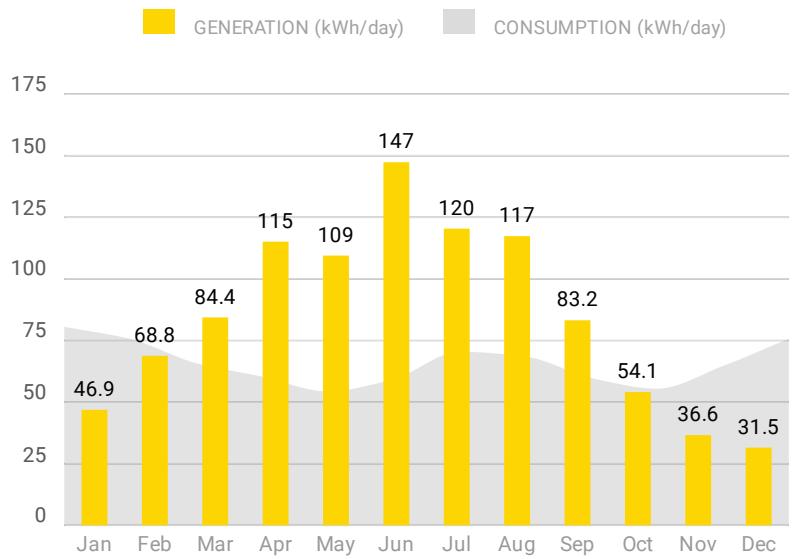
Agreate
275.0 kWh Total Battery Storage
1 x ATEN-250-275R

Warranties: 25 Year Panel Product Warranty, 25 Year Panel Performance Warranty, 5 Year Battery Product Warranty

System Performance

128%

Energy From Solar



System Performance Assumptions: System Total losses: 15.5%, Inverter losses: 2.5%, Optimizer losses: 0%, Shading losses: 0%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 70 panels with Azimuth 113 and Slope 20.

The solar system(s) quoted in this proposal are not intended to be portable.

Environmental Benefits

Solar has no emissions. It just silently generates pure, clean energy.

Each Year

128% Of CO_2, SO_x & NO_x

846 kg Avoided CO_2 per year

Over System Lifetime

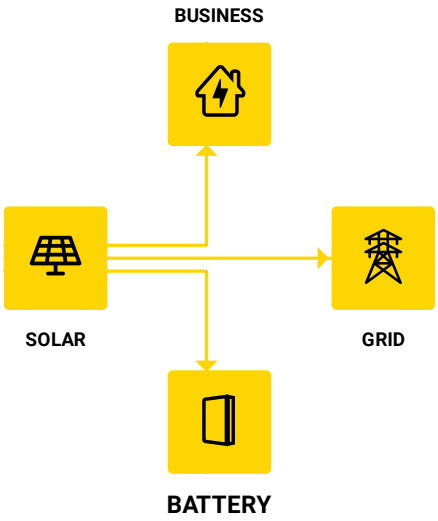
15,523 Car miles avoided

161 Trees planted

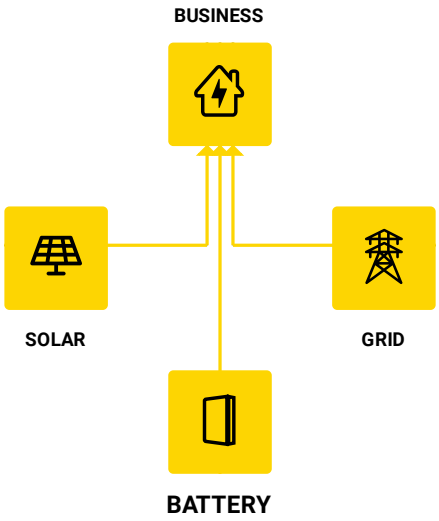
18 Long haul flights avoided

How your system works

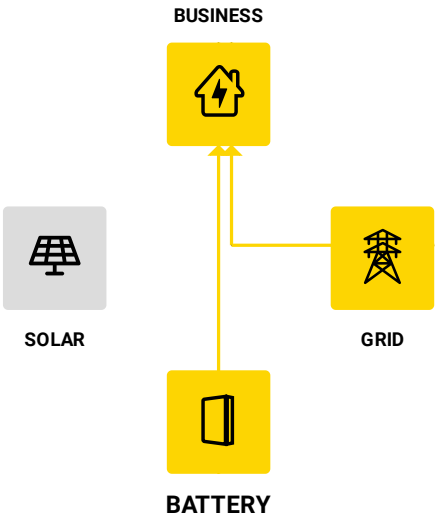
Generating Excess Solar



Partially Offset Usage

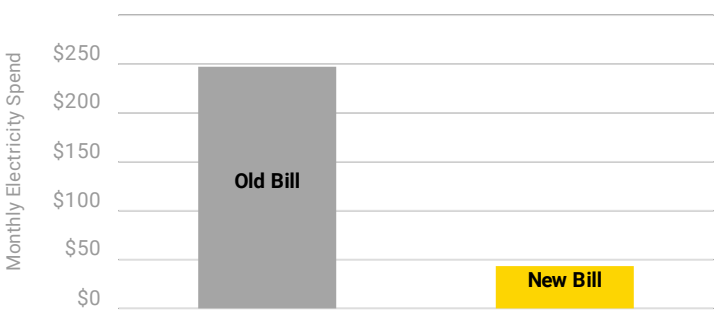


Night

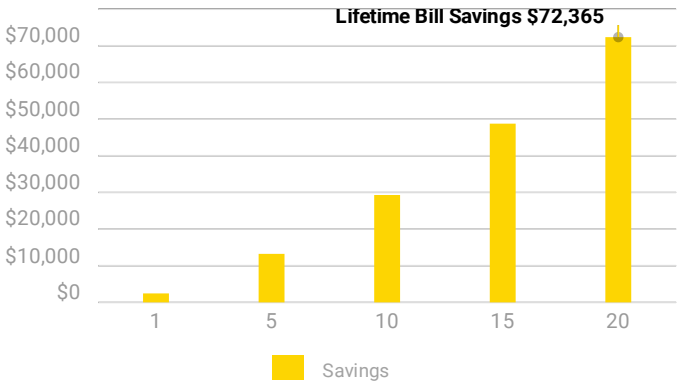


Electricity Bill Savings

First Year Monthly Bill Savings



Cumulative Bill Savings



Month	Solar Generation (kWh)	Electricity Consumption before solar (kWh)	Electricity Consumption after solar (kWh)	Utility Bill before solar ($)	Utility Bill after solar ($)	Cumulative Energy Credit ($)	Estimated Savings ($)
Jan	1,453	2,497	1122	301	152	0	149
Feb	1,926	2,118	352	260	68	0	192
Mar	2,616	2,041	(293)	251	30	32	221
Apr	3,454	1,811	(1504)	226	30	195	196
May	3,393	1,685	(1590)	213	30	367	183
Jun	4,421	1,780	(2547)	223	30	644	193
Jul	3,733	2,184	(1431)	267	30	799	237
Aug	3,638	2,124	(1388)	260	30	949	230
Sep	2,496	1,794	(645)	225	30	1,019	195
Oct	1,676	1,719	59	216	30	1,013	186
Nov	1,098	1,940	820	240	30	924	210
Dec	977	2,348	1415	285	30	0	255

Rate not specified specified, using Single Phase Service based on location.

Your projected energy cost is calculated by considering a 4.0% increase in energy cost each year, due to trends in the raising cost of energy. This estimate is based on your selected preferences, current energy costs and the position and orientation of your roof to calculate the efficiency of the system. Projections are based on estimated usage of 24042 kWh per year, assuming Single Phase Service Electricity Tariff.

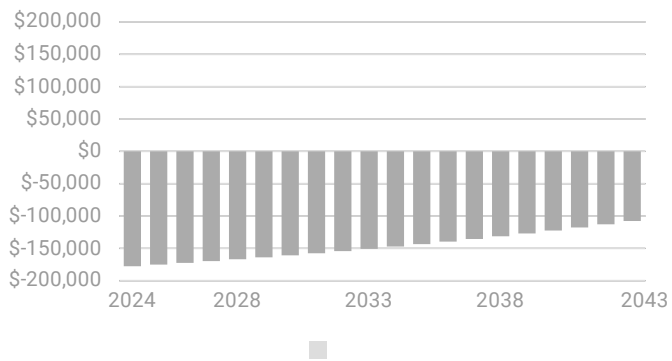
Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

Proposed Tariff Details - High Plains Power Inc Single Phase Service	
Energy Charges	
Usage Charge *All Day*	$0.11 / kWh
Fixed Charges	
Fixed Charge	$30.00 / month

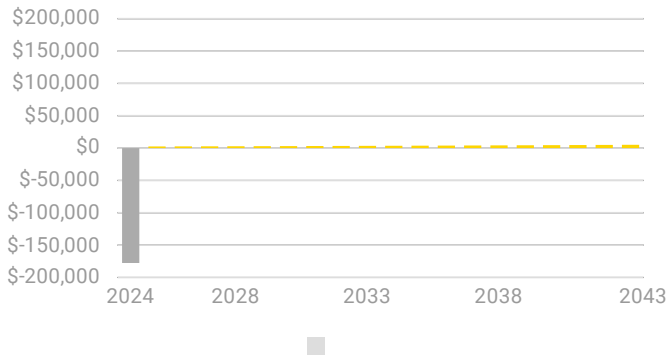
Net Financial Impact Cash

$72,365	-	$180,075	=	$107,710
Utility Bill Savings		Net System Cost		Clean Energy Premium

Cumulative Savings From Going Solar



Annual Savings From Going Solar



Estimates do not include replacement costs of equipment not covered by a warranty. Components may need replacement after their warranty period. Financial discount rate assumed: 6.75%

Quotation

Payment Option: Cash

70 x Solaria Corporation 370 Watt Panels (Solaria PowerXT-370R-PD) 1 x ATEN-250-275R (Agreate)	
Total System Price	$257,250.00
Purchase Price	**$257,250.00**

Additional Incentives

Federal Investment Tax Credit (ITC) The Federal Solar Tax Credit or The Federal Investment Tax Credit (ITC) for constructions starting in 2023.	$77,175.00
Net System Cost	**$180,075.00**

Price excludes Retailer Smart Meter should you want us to install your Smart Meter it will be an additional cost.
This proposal is valid until Jul 14 2024.

Quote Acceptance

I have read & accept the terms and conditions.

Signature _____

Name _____ Date _____

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Solaria PowerXT® | DC Panel

Solaria PowerXT®-370R-PD

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Rev 3D 12-2019

SOLARIA®

Solaria PowerXT®-370R-PD

Performance at STC (1000W/m², 25° C, AM 1.5)

Solaria PowerXT-		365R-PD	370R-PD
Max Power (P_{max})	[W]	365	370
Efficiency	[%]	20.2	20.5
Open Circuit Voltage (V_{oc})	[V]	48.0	48.3
Short Circuit Current (I_{sc})	[A]	9.58	9.60
Max Power Voltage (V_{mp})	[V]	39.9	40.2
Max Power Current (I_{mp})	[A]	9.16	9.20
Power Tolerance	[%]	-0/+3	-0/+3

Performance at NOCT (800W/m², 20°C Amb, Wind 1 m/s, AM 1.5)

Max Power (Pmax)	[W]	269	272
Open Circuit Voltage (V_{oc})	[V]	45.1	45.4
Short Circuit Current (I_{sc})	[A]	7.73	7.74
Max Power Voltage (V_{mp})	[V]	36.7	37.0
Max Power Current (I_{mp})	[A]	7.32	7.35

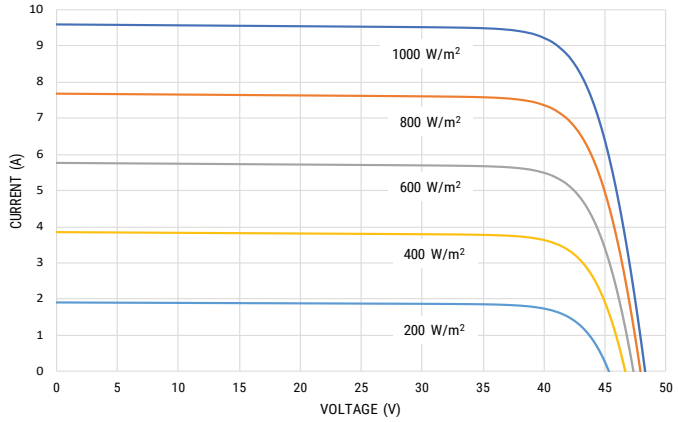
Temperature Characteristics

NOCT	[°C]	45 +/-2
Temp. Coeff. of P_{max}	[% / °C]	-0.39
Temp. Coeff. of V_{oc}	[% / °C]	-0.29
Temp. Coeff. of Isc	[% / °C]	0.04

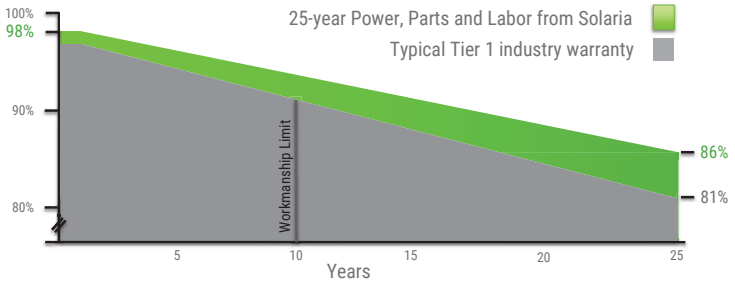
Design Parameters

Operating temperature	[°C]	-40 to +85
Max System Voltage	[V]	1000
Max Fuse Rating	[A]	15
Bypass Diodes	[#]	4

IV Curves vs. Irradiance (370W Panel)



Comprehensive 25-Year Warranty



Mechanical Characteristics

Cell Type	Monocrystalline Silicon
Dimensions (L x W x H)	63.8" x 43.9" x 1.57" 1621mm x 1116mm x 40mm
Weight	21 kg / 46 lbs
Glass Type / Thickness	AR Coated, Tempered / 3.2mm
Frame Type	Black Anodized Aluminum
Cable Type / Length	12 AWG PV Wire (UL) / 1000mm
Connector Type	MC4
Junction Box	IP67 / 4 diodes
Front Load	5400 Pa / 113 psf*
Rear Load	3600 Pa / 75 psf*

* Refer to Solaria Installation Manual for details

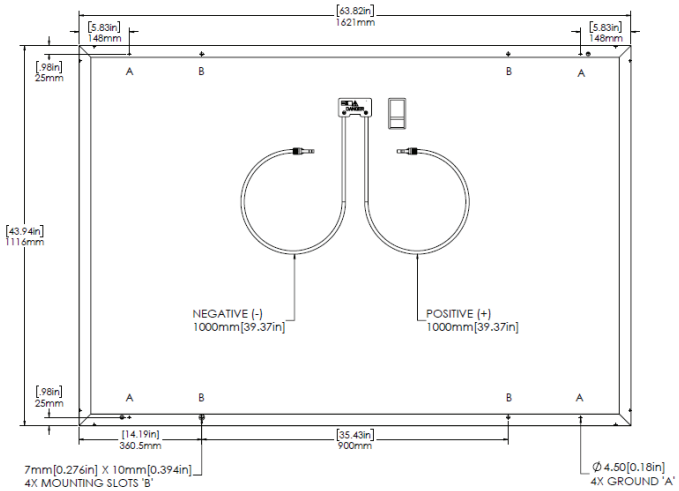
Certifications / Warranty

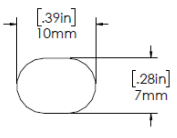
Certifications	UL 1703/IEC 61215/IEC 61730/CEC CAN/CSA-C22.2
Fire Type (UL 1703)	1
Warranty	25 years*

* Warranty details at www.solaria.com

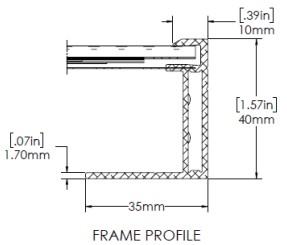
Packaging

Stacking Method	Horizontal / Palletized
Panels/ Pallet	25
Pallet Dims (L x W x H)	65.7" x 45.3" x 48.4" 1668mm x 1150mm x 1230 mm
Pallet Weight	590 kg / 1300 lbs
Pallets / 40-ft Container	28
Panels / 40-ft Container	700





MOUNTING SLOT 'B'



FRAME PROFILE

Nova Group

RESUMES OF PROJECT TEAM

EMPLOYEE RESUME

USING BUSINESS AS A FORCE FOR GOOD

KEELY FELTON, CEA
CHIEF SUSTAINABILITY OFFICER

PROFESSIONAL EDUCATION
Bachelor of Arts, Animal Behavior, Haverford College, Haverford, Pennsylvania, 2001

CERTIFICATIONS/QUALIFICATIONS
- Association of Energy Engineers (AEE) Certified Energy Auditor (CEA)
- AEE Certified Measurement and Verification Professional (CMVP), expired 2019
- Multifamily Building Analyst Training (to BPI-MFBA standard) – 36 hours
- TRUE Advisor Training Program
- Certified Water Efficiency Professional Training Program
- Certificate of Proficiency in Building Benchmarking, Consortium for Building Energy Innovation and the Department of Energy
- Certified Green Globes Professional
- Green Globes Fellow
- Certified GreenPoint Rater, Existing Home Multifamily
- Certified GreenPoint Rated, New Home
- BREEAM USA In-Use Assessor
- ASTM E1527 Environmental Site Assessment (ESA) for Commercial Real Estate Certificate
- HAZWOPER 8-hour Refresher (OSHA 29 CFR, Part 1910.120)

SELECTED EXPERIENCE
Ms. Felton oversees Nova Energy Group, a division within Nova Group, GBC. The group delivers, on average, 30 energy and water audits in addition to other green deliverables per month. In this capacity, she issues and reviews reports for the agency green lending programs (Fannie Mae Green Rewards, Freddie Mac Green Up, and HUD) while working closely with Nova's debt clients to make sure that all pertinent information is communicated throughout the due diligence process.

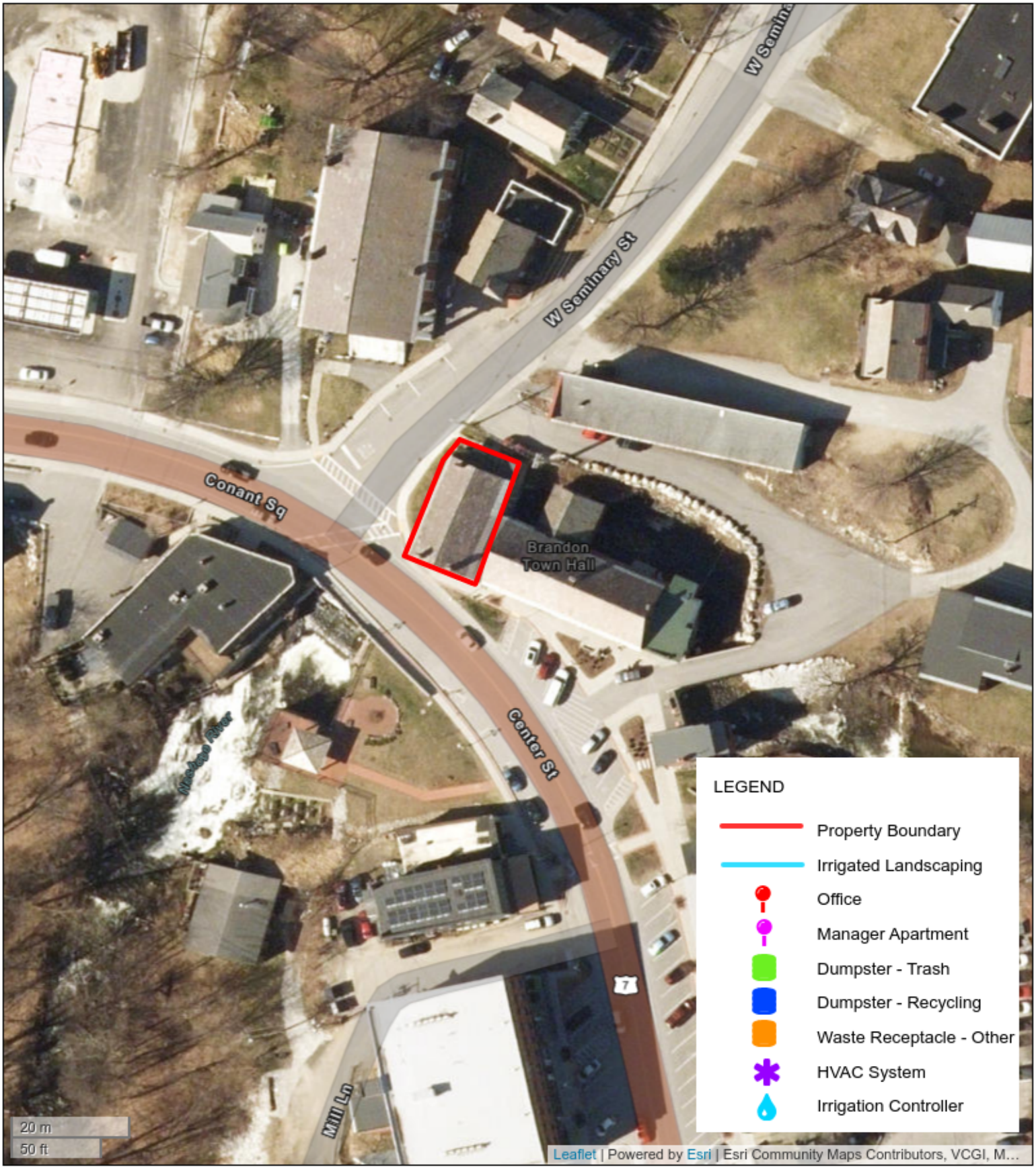
Additionally, Ms. Felton enjoys long-term relationships with property owners meeting more targeted energy and water goals with the group's equity energy work. These services include energy benchmarking and ongoing monitoring of utility consumption, energy modeling, strategic energy planning, project management, measurement and verification of energy savings, and ESG services.

Ms. Felton obtained her Certified Energy Auditor and Certified Measurement and Verification Professional certifications from the Association of Energy Engineers. She is highly experienced with utility data analysis for a broad spectrum of multifamily properties. Additionally, she is proficient in the use of ENERGY STAR's Portfolio Manager for obtaining benchmark scores and certification. Ms. Felton is certified as a Green Globes Professional, GreenPoint Rater, and BREEAM USE In-Use Assessor.

PROFESSIONAL ORGANIZATIONS
- Association of Energy Engineers (AEE)
- Urban Land Institute (ULI)
- Build it Green
- Green Building Initiative (GBI), Board of Directors

Nova Group

PARCEL MAP



Property Details Map

Brandon - Brandon Town Offices
49 Center Street
Brandon, VT
Project Number: SE24-3891

Nova Group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Carbon
Neutral
Report
novagroupgbc.com/carbonneutral