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 Hall & Community Center
1 Connant Square
Brandon, VT 05733

Nova Group Carbon Neutral Report

novagroupgbc.com/carbonneutral

July 22, 2024

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

Re: MERP Level 2 Energy Audit
Brandon - Brandon Town Hall & Community Center
1 Connant Square
Brandon, VT 05733
Nova Project No.: SE24-3893

Nova Group, GBC has completed a MERP Level 2 Energy Audit in accordance with the State of Vermont ACT 172 at Brandon - Brandon Town Hall & Community Center located at 1 Connant Square in Brandon, VT. Nova Group, GBC visited the site on May 23, 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.

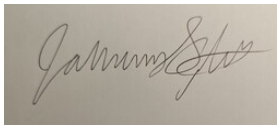
Estimated installation costs are based on Nova Group, GBC experience on similar projects and industry standard cost estimating tools including *RS Means*. Since actual installed costs may vary widely for particular installation based on labor & material rates at time of installation, Nova Group, GBC 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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Chief Sustainability Officer

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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 Hall & Community Center 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 Hall & Community Center 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.

The following is a summary of the tasks and reporting that make up the Energy Assessment portion of the report.

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 38 hours per week.
- The facility occupancy is assumed to be ten (10) people during normal business hours. The theater seats 160 people and events are held about every other month.

- Annual Heating Equipment Operating Hours are derived from actual consumption and equipment input rates to be 6,059 hours/year.
- Annual Cooling Equipment Operating Hours are derived from actual consumption and equipment input rates to be 2,701 hours/year.
- The savings calculations assume that the new mini-split system will supply enough heat to eliminate the use of the secondary propane systems.

1.2.3 Recommendations

Nova Group, GBC has recommended one (1) HVAC Energy Conservation measure options and nine (9) Energy Conservation Measures (ECMs) that do not modify or replace the existing HVAC.

HVAC option includes replacing the existing boiler and furnace with a new cold climate mini-split heat pumps.

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 - Cold Climate Mini-Split Heat Pumps	**ECM Package Excluding HVAC**
Total Projected Initial ECM Investment	$41,400	$63,164
Estimated Annual Cost Savings Related to all ECMs	$5,474	$3,094
Estimated Annual Cost Savings- Electricity	$(4,672)	$1,484
Estimated Annual Cost Savings- Propane	$10,146	$1,610
Estimated Annual Cost Savings- Natural Gas	N/A	N/A
Estimated Annual Cost Savings- Fuel Oil	N/A	N/A
Net Effective ECM Payback	7.56 Yrs.	20.42 Yrs.
Estimated Annual Energy Savings	44.4%	16.8%
Estimated Annual Utility Cost Savings (excluding water)	34.8%	19.7%

Solar and Battery Analysis

Nova Group, GBC has evaluated the site for a two (2) potential combined solar and battery systems, estimated at $180,210 and $281,940 respectively (Total Investment Cost).

Option one (1) includes a 25.16 kW rated solar panel system and a 90.2 kWh storage battery system, sized for the current electric demand.

Option two (2) includes a 48.10 kW rated solar panel system and a 153.6 kWh storage battery system, sized for the future electric demand if the HVAC ECM were to be implemented.

Due to the roof being made of slat shingles, the roof will need to be replaced with new asphalt shingles before the system is installed.

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 Eletrical Demand	Option Two (2) - HVAC Option - Cold Climate Mini-Split Heat Pumps
Estimated number of panels	68	130
Estimated kW Rating	25.16 kW	48.1 KW
Potential Annual kWh Produced	28,911 kWh solar system with a 90.2 kWh battery storage system	55,291 kWh solar system with a 153.6 kWh battery storage system
% of Current Electricity Demand	100%	104%
New Roof Cost	$54,170	$54,170
New Electrical Panel Cost	N/A	N/A
Battery Investment Cost	$63,140	$107,520
Solar Investment Cost	$62,900	$120,250
Federal Investment Tax Credit (FITC)	$37,812	$68,331
Total Investment Cost (Solar+ Battery + Electrical Panel + Roof)	$180,210	$281,940
Estimated Annual Energy Cost Savings	$5,582	$10,674
Payback without Incentives	32.28 Years	26.41 Years
Payback with all Incentives	25.51 Years	20.01 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	Install new Mini-Split Heat Pumps with an efficiency of at least 21 SEER and 10 HSPF to minimize the use of the secondary propane systems. Negative electricity savings is due to the added cooling load.	$ 36,000	N/A	2,860	N/A	N/A	(21,999)	186,467	46.3%	N/A	$ 5,899	6.10
	Totals	$ 36,000	N/A	2,860	N/A	N/A	(21,999)	186,467	46.3%	N/A	$ 5,899	6.10
	Interactive Savings Discount @ 10%	N/A	N/A	2,860	N/A	N/A	(24,199)	178,961	44.4%	N/A	$ 5,474	7.56
	Total Contingency Expenses @ 15%	$ 41,400	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Totals for Improvements	$ 41,400	N/A	2,860	N/A	N/A	(24,199)	178,961	44.4%	N/A	$ 5,474	7.56

Energy Conservation Measure Options Excluding HVAC

Evaluated Energy Conservation Measures with Savings													
ECM #	Description of ECM	Projected Initial Investment ($)	Natural Gas (Therms)	Propane (gal)	No. 2 Oil (gal)	Steam (ML)	Wood (Tons)	Electricity (kWh)	Energy Savings (kBTU)	% Savings (Energy)	Total Estimated Annual Cost Savings ($)	Estimated annual Maintenance Savings	Simple Payback (Years)
Evaluated Measures													
1	Insulate exposed domestic hot water lines with R-4 or greater insulation.	$ 125	N/A	N/A	N/A	N/A	N/A	688	2,346	0.6%	N/A	$ 133	0.94
2	Insulate exposed domestic hot water tanks with R-8 or greater insulation.	$ 200	N/A	N/A	N/A	N/A	N/A	434	1,481	0.4%	N/A	$ 84	2.39

Evaluated Energy Conservation Measures with Savings													
3	Install low flow, 1.0 GPM WaterSense certified aerators in the bathroom.	$ 90	N/A	N/A	N/A	N/A	N/A	133	453	0.1%	N/A	$ 26	3.51
4	Replace the existing refrigerator with a new ENERGY STAR rated refrigerator.	$ 1,900	N/A	N/A	N/A	N/A	N/A	1,530	5,220	1.3%	N/A	$ 295	6.43
5	Improve air sealing by sealing entry doors, wall seams, baseboards, and windows.	$ 10,834	N/A	227	N/A	N/A	N/A	1,516	25,922	6.4%	N/A	$ 1,098	9.87
6	Add loose fill roof insulation to the original building roof to achieve a uniform R-49 coverage.	$ 8,126	N/A	128	N/A	N/A	N/A	848	14,625	3.6%	N/A	$ 619	13.13
7	Replace the current DHW with a new heat pump water heater, 3.2 UEF	$ 3,500	N/A	N/A	N/A	N/A	N/A	956	3,263	0.8%	N/A	$ 185	18.96
8	Upgrade lighting with ENERGY STAR or DLC certified LED technologies. Please see the lighting tool for specific recommendations.	$ 4,950	N/A	N/A	N/A	N/A	N/A	974	3,323	0.8%	$ 2	$ 188	26.05
9	Replace the current single-paned windows with new ENERGY STAR rated double pane windows, minimums U-value .35, minimum SHGC .50.	$ 25,200	N/A	149	N/A	N/A	N/A	1,463	18,610	4.6%	N/A	$ 811	31.08
Totals		$ 54,925	N/A	504	N/A	N/A	N/A	8,542	75,244	18.7%	$ 2	$ 3,438	15.98
Interactive Savings Discount @ 10%		N/A	N/A	454	N/A	N/A	N/A	7,687	67,719	16.8%	$ 2	$ 3,094	20.42
Total Contingency Expenses @ 15%		$ 63,164	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		$ 63,164	N/A	454	N/A	N/A	N/A	7,687	67,719	16.8%	$ 2	$ 3,094	20.42

1.2.5 Measures that Warrant Further Study

The stage lighting type should be confirmed. Nova made the assessment based on observations that they are LED lights.

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

Facility Schedule	
Building Type/Name	Town Hall
# of Stories	Two (2) story
Year Built/Renovated	1861
Building Size	10,834 square feet
Hours of Operations/Week	38 hours
Operational Weeks/Year	52 weeks
Estimated Facility Occupancy	The facility occupancy is assumed to be ten (10) people during normal business hours. The theater seats 160 people and events are held about every other month.

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 23, 2024
Weather Conditions	Sunny, 79 degrees F
Nova Field Associate	Johanna Stuz, BPI-BA
Nova Reviewers	Naushad Amlani, BPI-MFBA Morgan Carson, CEM Keely Felton, CEA

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	Outside mounted to the wall of the west side first floor glass entry door.

Utility Analysis						
Utility Type	**Utility Provider**	**Meter Quantity**	**Energy/Water Uses**	**Annual Consumption**	**Est./Act.**	**Annual Cost**
Electric (Grid)	Green Mountain Power	One (1)	Primary Heat, Air Conditioning, Water Heating, Lighting, Plug Loads	25,726 kWh	Actual	$4,967 (calculated using Green Mountain Power rate of $0.1931)
Propane	Suburban	None	Backup Heat for extreme cold conditions	1,428 Gal	Actual	$5,067 (calculated using EIA rate of $3.548)
No. 2 Oil	None	N/A	N/A	1,232 Gal	Actual	$5,095 (calculated using EIA rate of $4.133)

4.1.2 On-Site Utility Storage

Propane and heating oil are stored on-site. The heating oil is no longer needed. The oil tank will be emptied and removed.

Onsite Utility Storage	
Battery Storage	
Storage Capacity	None
Year Installed	N/A
Location Installed	N/A
Space Served	N/A
Fossil Fuel Storage	

Onsite Utility Storage	
No. 2 Oil	One (1) 275 gallon above ground tank
Propane Gas	One (1) 500 gallon above ground tank
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 two (2) electric vehicle charging stations on-site.

Onsite Electric Vehicle Charging	
Installed Chargers	Two (2)
Electrical Charger Type	Chargepoint CT4000
Location Installed	Parking Lot
Charger Manufacturer	Chargepoint
Electric Metering to Chargers	Separate meters
Recommendations	N/A

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. The 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 charts show propane consumption annually from 2022-2024 and month to month from 1/1/2023 to 12/31/2023. The heating oil boiler was replaced in 2024 with a propane boiler and the utility consumption shown below does not represent the current utility consumption. A modeled estimation of the propane usage for the year 2024 is shown in the chart below to accurately estimate the total propane usage before any ECM implementation and to accurately estimate energy savings through ECM implementation. Due to the heating oil boiler's replacement, Nova has opted to model the current utility loads.

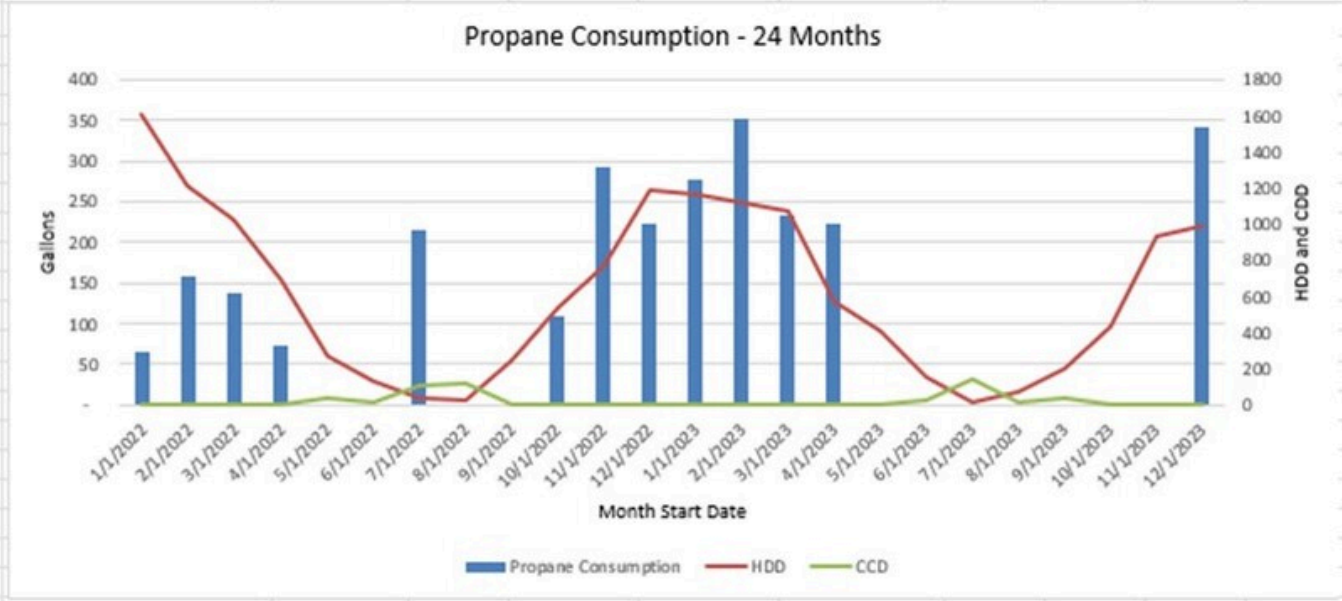
4.2.1 Provision of Data

ANNUAL CONSUMPTION FOR PROPANE					
Start	**End**	**Consumption**	**Cost (calculated using EIA rate)**	**Estimated**	**Days**
1/1/2022	12/31/2022	1,271	$4,509	Actual	365
1/1/2023	12/31/2023	1,428	$5,067	Actual	365
1/1/2024	12/31/2024	3,075*	$10,911	Estimated	365
**2024 propane usage was modeled*					

PROPANE CONSUMPTION					
Start	End	Consumption (Gallons)	Cost (calculated using EIA rate)	Estimated?	Days
1/1/2023	1/31/2023	278	$ 986	Yes, Cost	31
2/1/2023	2/28/2023	353	$ 1,252	Yes, Cost	28
3/1/2023	3/31/2023	233	$ 827	Yes, Cost	31
4/1/2023	4/30/2023	223	$ 792	Yes, Cost	30
5/1/2023	5/31/2023	-	$ -	Yes, Cost	31
6/1/2023	6/30/2023	-	$ -	Yes, Cost	30
7/1/2023	7/31/2023	-	$ -	Yes, Cost	31
8/1/2023	8/31/2023	-	$ -	Yes, Cost	31
9/1/2023	9/30/2023	-	$ -	Yes, Cost	30
10/1/2023	10/31/2023	-	$ -	Yes, Cost	31
11/1/2023	11/30/2023	-	$ -	Yes, Cost	30
12/1/2023	12/31/2023	341	$ 1,209	Yes, Cost	31
		1,428	$ 5,067	Yes, Cost	365

4.2.2 Analysis

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



4.3 Delivered Fuel

Nova was provided with twenty-four (24) months of heating oil #2 usage history in Excel format. Total consumption was provided. Cost data was not provided. The most recent twelve (12) months of historical data was considered in Nova's analysis.

The following charts show heating oil #2 consumption annually from 2022 to 2023 and month to month from 1/1/2023 to 12/31/2023. The heating oil boiler was replaced in 2024 with a propane boiler and the utility consumption shown below does not represent the current utility consumption.

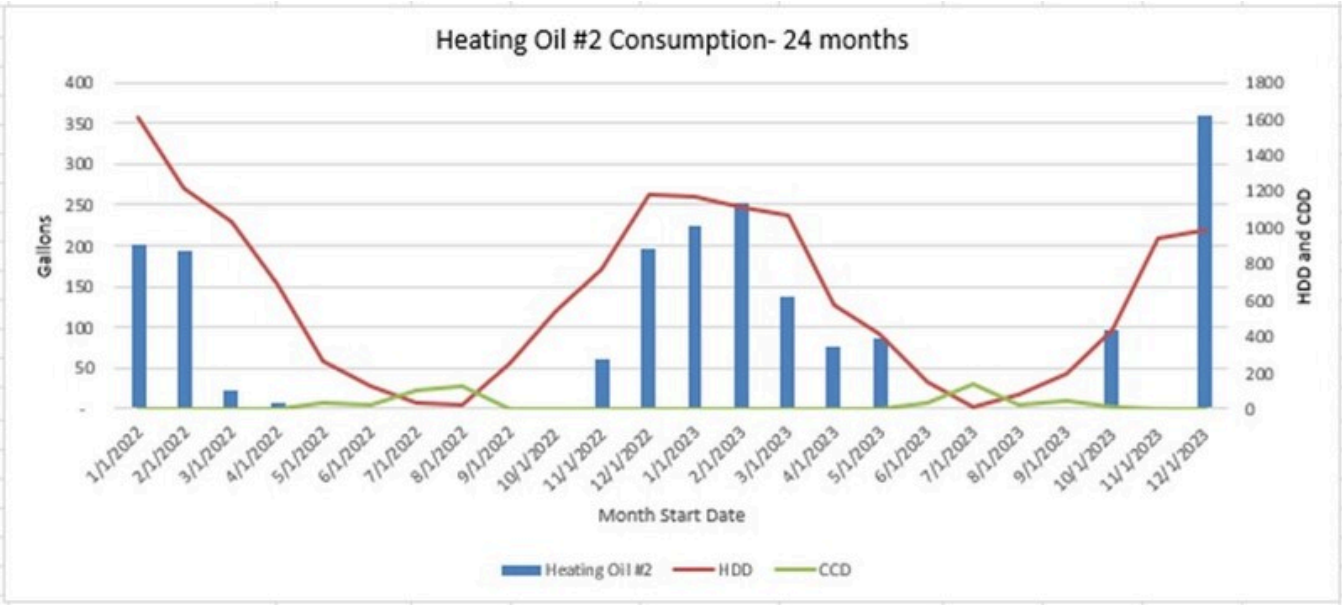
4.3.1 Provision of Data

ANNUAL CONSUMPTION FOR HEATING OIL #2					
Start	**End**	**Consumption**	**Cost (calculated using EIA rate)**	**Estimated**	**Days**
1/1/2022	12/31/2022	678	$ 2,802	Actual	365
1/1/2023	12/31/2023	1,233	$ 5,095	Actual	365

HEATING OIL #2 CONSUMPTION					
Start	**End**	**Consumption (Gallons)**	**Cost (calculated using EIA rate)**	**Estimated?**	**Days**
1/1/2023	1/31/2023	224	$ 925	Yes, Cost	31
2/1/2023	2/28/2023	251	$ 1,038	Yes, Cost	28
3/1/2023	3/31/2023	138	$ 569	Yes, Cost	31
4/1/2023	4/30/2023	76	$ 313	Yes, Cost	30
5/1/2023	5/31/2023	87	$ 358	Yes, Cost	31
6/1/2023	6/30/2023	-	$ -	Yes, Cost	30
7/1/2023	7/31/2023	-	$ -	Yes, Cost	31
8/1/2023	8/31/2023	-	$ -	Yes, Cost	31
9/1/2023	9/30/2023	-	$ -	Yes, Cost	30
10/1/2023	10/31/2023	98	$ 405	Yes, Cost	31
11/1/2023	11/30/2023	-	$ -	Yes, Cost	30
12/1/2023	12/31/2023	360	$ 1,486	Yes, Cost	31
		1,233	$ 5,095	Yes, Cost	365

4.3.2 Analysis

When charted against heating degree days, it is evident that whole property heating oil #2 consumption peaks during the colder months, likely due to increased heating load.



4.4 Electricity

4.4.1 Provision of Data

Nova was provided with twenty-four (24) months of electricity usage history in Excel format from the property. Total consumption was provided and cost was calculated with Green Mountain Power's rate. Data for 2023's electric consumption were missing the consumption volumes for each month from April to June. The most recent and complete annual twelve (12) months of historical data was considered in Nova's analysis.

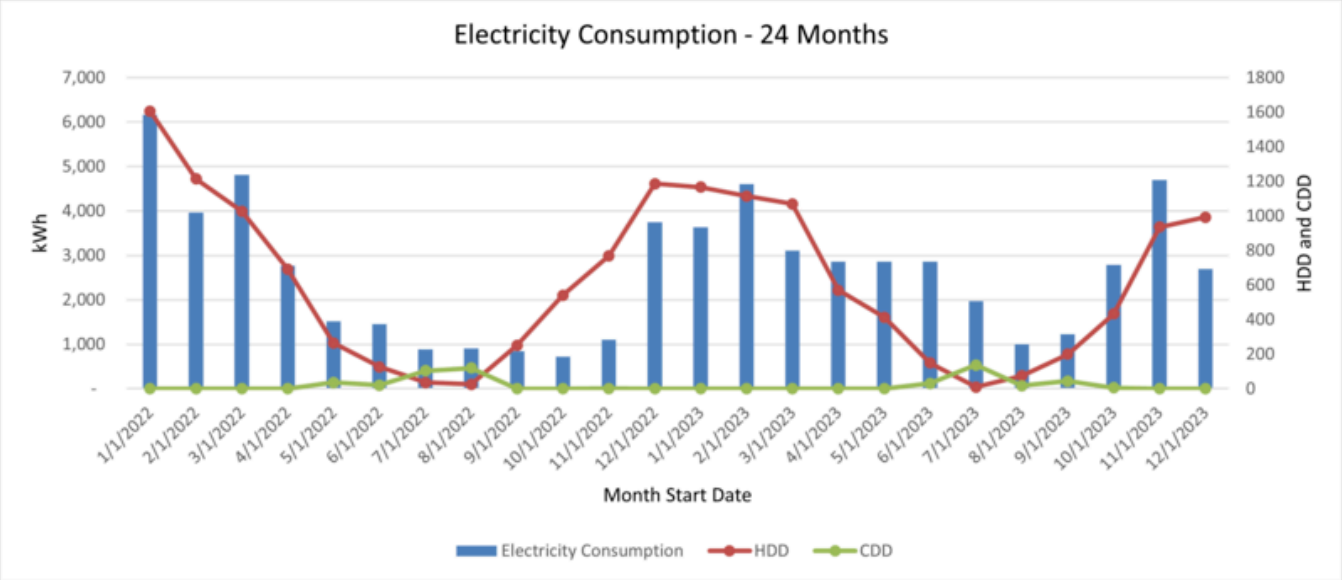
The following charts show electricity consumption totals annually from 2022 to 2024 and month to month from 1/1/2022 to 12/31/2022. A modeled estimation of the electric usage for the year 2024 is shown in the chart below to accurately estimate the total electric consumption prior to any ECM implementation and to accurately estimate energy savings through ECM implementation. Due to the heating oil boiler's replacement, Nova has opted to model the current utility loads.

Annual Consumption of Electricity					
Start	**End**	**Consumption**	**Cost (calculated using EIA rate)**	**Estimated**	**Days**
1/1/2022	12/31/2022	28,882	$5,576	Actual	365
1/1/2023	12/31/2023	34,300*	$6,622	Actual	365
1/1/2024	12/31/2024	30,599**	$5,907	Estimated	365
**Months of April through June 2023 did not consist of consumption or cost data. Cost was calculated with known Green Mountain Power rate.* ****2024 electric usage was modeled.*					

ELECTRICITY CONSUMPTION					
Start	**End**	**Consumption (kWh)**	**Cost (calculated using EIA rate)**	**Estimated?**	**Days**
1/1/2023	1/31/2023	3,635	$ 1,190	No	31
2/1/2023	2/28/2023	4,609	$ 765	No	28
3/1/2023	3/31/2023	3,110	$ 929	No	31
4/1/2023	4/30/2023	2,858	$ 552	Yes	30
5/1/2023	5/31/2023	2,858	$ 552	Yes	31
6/1/2023	6/30/2023	2,858	$ 552	Yes	30
7/1/2023	7/31/2023	1,971	$ 172	No	31
8/1/2023	8/31/2023	1,001	$ 175	No	31
9/1/2023	9/30/2023	1,225	$ 162	No	30
10/1/2023	10/31/2023	2,788	$ 139	No	31
11/1/2023	11/30/2023	4,695	$ 214	No	30
12/1/2023	12/31/2023	2,692	$ 723	No	31
		34,300	$ 6,622		
**Missing data for April through June.*					

4.4.1.1 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.



4.4.1.2 Renewable (Green Power) Energy Sources

No renewables or energy generation systems were observed on site.

4.5 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
Heating Oil #2	Delivery company varries	Rates vary	NA	No	$4.003 per gallon	$4.003 per gallon

4.5.1 Billing Irregularities

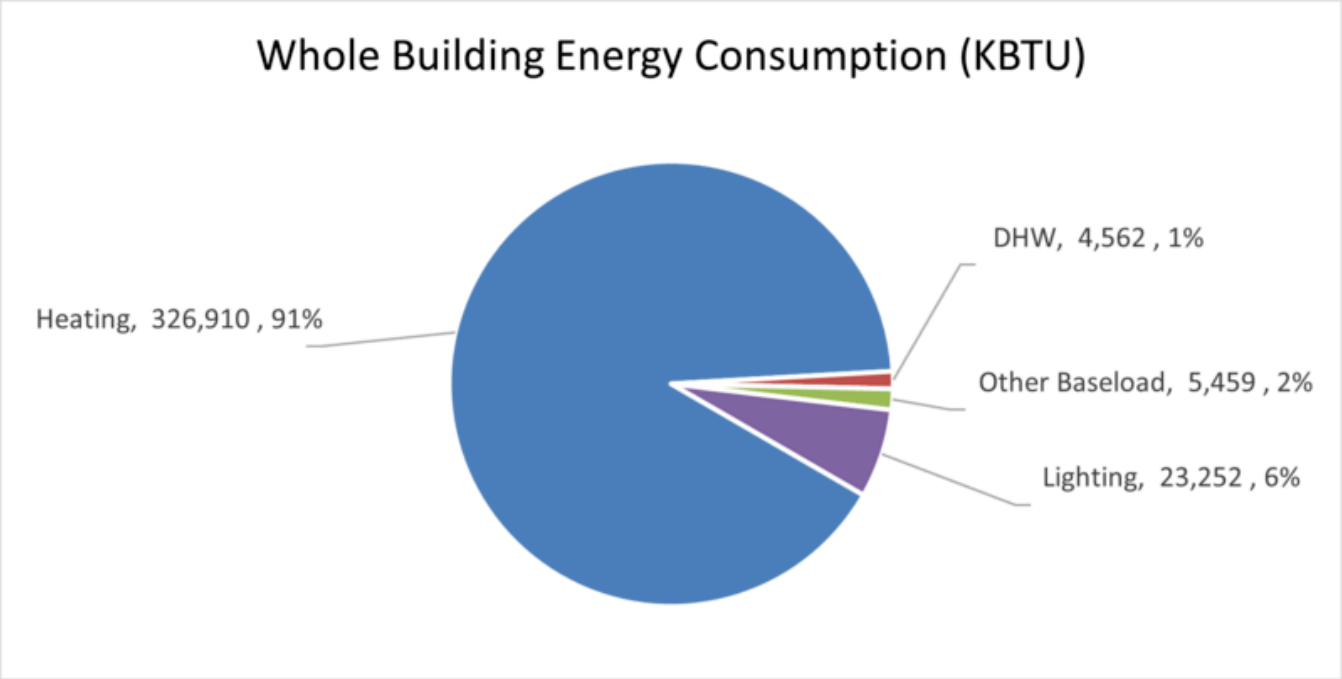
Electric consumption was not provided for April, May and June of 2023. Consumption was estimated based on previous consumption, building envelope, HVAC equipment and building occupancy.

4.6 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.

4.6.1 End Use Breakdown

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


Whole Building Energy Consumption (KBTU)
DHW, 4,562 , 1%
Heating, 326,910 , 91%
Other Baseload, 5,459 , 2%
Lighting, 23,252 , 6%

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 walk-out basement has been finished with a concrete slab and is a new slab inside the old stone and mortar foundation walls. The second story walls are brick and mortar. The roof is assumed to be stick framed. The exteriors are brick walls on stone foundation walls. The roof is covered with slate tiles.

The first story walls are now gypsum drywall with some older painted wood and exposed stone. The first story ceiling is dropped with T-bars, acoustic tiles and square light fixtures. Spray foam insulation is installed on the stone foundation walls in mechanical chases. The second story walls and ceiling are finished with lath and plaster.

5.2.1 Structure

STRUCTURE	
Component	**Description**
Construction Drawings	Construction drawings were not made available for review
Foundation Type	Building foundations appear to be basements finished as living space
Wall Type and Framing	The superstructure appears to be conventional brick framing.
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	Buildings on site are constructed with gable roofs
Roof Framing	Roof framing consists of wood beams, supporting wood plank roof sheathing.
Roofing Material	Building sloped roofs are slate shingles.
Median Roof Age	Periodic maintenaince and repair to replace shingles is conducted on an as needed basis, typically quarterly. Timeframe of last major repair and maintenance is unknown, but the next major repair is scheduled for 2025.
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 via discussions with maintenance staff.

ENVELOPE INSULATION			
Slab	**Basement Walls**	**Above Grade Walls**	**Roof/Attic**
N/A	Some 3" Closed Cell Spray Foam, R-15 on exposed cut stone foundation; Not Consistent	Assumed R-21	12" Loose Fill Cellulose, R-38; installed in 2019

DOORS AND WINDOWS	
Component	**Description**
Windows	
Window Frame	Windows are wood framed.
Window Operation	Windows are single-hung units.
Window Glazing	Windows are single-glazed.
Window Weatherstripping	Weather stripping does not appear to provide an adequate air seal to the exterior.
Window Age	Most windows appear to be original to the property.
Window Center of Glass (COG) Values	Window U-Value: 1.0
Window Tint/Films	Windows are not tinted.
Window to Wall Ratio	7% (11,520 square feet of exterior wall surface area; 802 square feet of window surface area)
Doors	
Main Entry Doors	Entry doors are wood doors in wood frames except for the glass door at the left side awning which is a metal door in a metal frame.
Door Weatherstripping	Weather stripping does not appear to provide an adequate air seal to the exterior.
Door Age	Doors appear to be original to the property except for the left side Entrance at the awning which appears to be relatively new.
Overhead Doors	There are no overhead doors.

Blower Door Testing	
Blower Door Equipment	Retrotec
Building Volume	199,520 cubic feet
Leakage Rate @ -50 Pa (CFM50)	Unable to pressurize building to -50 Pa. Maximum pressure attainable was -22 Pa.
Leakage Rate ACHN50	Too leaky to determine
Noted areas of infiltration	Infiltration was seen at the balcony door, the second-story front door, the east side door, and the wall seams of drywall.

Infrared Imaging	
Infrared Equipment	Flir One Pro
Outdoor temperature	70 degrees F
Indoor space temperature	73 degrees F downstairs; 75 degrees F upstairs
Infrared Comments	The IR testing showed the entry doors, baseboards, basement stairs, and windows are areas of infiltration.

5.3 Heating, Ventilation and Air Conditioning (HVAC)

5.3.1 Heating

The building's primary heating is provided by ductless heat pumps. Backup heat is provided by two (2) identical ten (10) year-old ducted, propane-fired furnaces in the second story and downstairs, backup heat is provided by a new propane-fired boiler with radiators and a radiant floor in the restroom area. Backup heat is used during extreme cold conditions. Heat pumps meet heating demand during the Spring and Fall.

HEATING SYSTEM SUMMARY			
	Heating Primary System	**Heating Secondary System - Downstairs**	**Heating Secondary System - Upstairs**
Area Served	Entire Building	Basement; Downstairs	Theater; Upstairs
Heating System Type	Air Source Heat Pump - Ductless	Boiler	Furnace
Heating Fuel	Electricity	Propane	Propane
Heating System Configuration	Individual heating systems are installed upstairs and downstairs.	Heating systems are centrally located and shared downstairs.	Heating systems are centrally located and shared upstairs.
Heating Equipment Location	On wall	Central mechanical room	Behind Stage
Typical Range of Efficiency	HSPF 11.0	91.2% AFUE	95% AFUE
Equipment Manufacture Date Range	2022	2024	2014
Quantity	Five (5)	One (1)	Two (2)
Access Issues	None	None	None
Description of Variation in Type, Fuel, Configuration or Location Between Areas	N/A	N/A	N/A

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	Heat pumps are recommended to be installed to meet heating load with limiting set points on the existing boiler and furnace.
Reason for Replacement	Electrification and decarbonization

5.3.2 Cooling

The entire building is cooled by heat pumps.

COOLING SYSTEM SUMMARY	
	Cooling Primary System
Area Served	Entire Building
Cooling System Type	Air Source Heat Pump - Ductless
Cooling System Configuration	Five (5) evaporators; Three (3) condensers
Cooling Equipment Location	Evaporators inside; Condensers outside
Typical Range of Efficiency	SEER 21.0

COOLING SYSTEM SUMMARY	
	Cooling Primary System
Equipment Manufacture Date Range	2011
Quantity	Five (5) evaporators; Three (3) 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	None
Reason for Replacement	N/A

5.3.3 Dehumidification

DEHUMIDIFICATION SYSTEM SUMMARY	
Area Served	Basement
System Configuration	Individual dehumidification systems are installed to serve areas in need
Equipment Location	Basement
Typical Range of Efficiency	1.65-1.9 L/kWh
Equipment Manufacture Date Range	2010-2016
Quantity	Two (2)
Access Issues	None
Description of Variation in Type, Fuel, Configuration or Location Between areas	N/A

5.3.4 Distribution, Controls and Ventilation

DISTRIBUTION & CONTROLS	
Ducted Distribution	
HVAC Duct Location	Behind the stage; air forced through front wall around the stage
Access HVAC to Ductwork	Approximately 25% of ductwork is accessible from backstage.
HVAC Ductwork Air Sealing	Ducts are in conditioned space.
HVAC Duct Insulation	Ducts are in conditioned space.
Affected Systems	Heating
HVAC Blower Fan Motors	
Type of Blower Fan Motors	Multi-Speed
Hydronic or Steam Distribution	
Type of Distribution	Hydronic radiant floor and Radiators
Hydronic or Steam Pipe Insulation	Yes
Affected Systems	Heating
Controls	

DISTRIBUTION & CONTROLS	
Leased Area Thermostats	There are no leased areas.
Common Area Thermostats	Heat pump thermostats are programmable. The furnace and boiler thermostats are non programmable.
Building Automation System	N/A
Heating Setpoints	72 degrees F
Cooling Setpoints	72 degrees F
Opportunity for Improvement	Because downstairs operates on a normal schedule, a programmable thermostat for the boiler is recommended.

VENTILATION	
Kitchen Ventilation Type	There is no kitchen.
Kitchen Exhaust Destination	N/A
Bathroom Ventilation Type	Mechanical exhaust fans - individual
Bathroom Exhaust Destination	Vented to an unknown location

5.4 Domestic Water Heating

5.4.1 DHW Equipment

Two electric water heaters serve the facility. The downstairs DHW tank is so far from the restrooms that the public sink faucet water is not hot or warm.

DOMESTIC HOT WATER SYSTEM SUMMARY	
Area Served	Entire Building
DHW System Type	Tank - Direct
DHW Fuel	Electricity
DHW System Configuration	Three individual DHW systems are installed.
DHW Equipment Location	One (1) Large Unit in Mechanical Room; Two (2) Small Under Sink Units
Typical Range of Efficiency	0.86 EF - Mechanical Room Unit 0.95 EF - Under Sink Units
Equipment Manufacture Date Range	2012 - Mechanical Room Unit 2020 - Under Sink Units
Quantity	Three (3)
Access Issues	None
DHW Lines	Domestic hot water piping was observed to be uninsulated 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)	Seven (7) toilets, three (3) urinals and ten (10) 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	The State water heater in the mechanical room
Reason for Replacement	Equipment is inefficient and has exceeded or is approaching its EUL

WATER FIXTURES - SUMMARY

Fixture Type	Location	Range Rated Flow Rate (GPM or GPF)	Average Rated Flow Rate (GPM or GPF)	Qty	% of Sample
Urinal	Restroom	1.0-1.0 GPF	1.0 GPF	Three (3)	100%
Faucet	Restroom	1.5-1.5 GPF	1.5 GPF	Eight (8)	100%
Faucet	Housekeeping Slop Sink	2.5-2.5 GPM	2.5 GPM	One (1)	100%
Faucet	Theater Concession	Unmeasurable; Temporarily Disconnected	Unmeasurable; Temporarily Disconnected	One(1)	100%
Toilet	Restroom	1.6-1.6 GPF	1.6 GPF	Seven (7)	100%

5.5 Lighting

5.5.1 Interior Lighting

LED light fixtures containing 7.2W to 38W bulbs provide 84% of the interior lighting in the building. Also present are various linear fluorescent lamps with 22W to 96W lamps, one (1) CFL lamp, and one (1) incandescent lamp.

Significant stage lighting was observed on site which is managed by a local theater company. Based on visual inspection, the lighting is assumed to be LED lighting. The theater stage lighting is active for two (2) hours, eighteen (18) times per year.

The facility has automatic lighting controls on internal light fixtures in the first-floor restrooms and the hallway that serves them.

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

Interior Lighting			
Fixture Types	**Wattage**	**% of Total Fixtures**	**Recommended for Replacement**
T-8 Fluorescent	20-28 W	3%	Yes
T-12 Fluorescent	90-110 W	3%	Yes
T-9 Fluorescent	20-25 W	8%	Yes
Incandescent	75-80 W	1%	Yes
CFL	9-13 W	1%	Yes
LED	7-100 W	84%	No

5.5.2 Exterior Site Lighting

The exterior lighting consists entirely of LED fixtures containing 8W to 11W lamps.

Exterior Lighting Lighting			
Fixture Types	**Wattage**	**% of Total Fixtures**	**Recommended for Replacement**
LED	8-11 W	100%	No

5.6 Appliances

5.6.1 Kitchen Appliances

There are two (2) refrigerators on-site. There is no range or dishwasher on-site.

Breakroom Appliances			
Item	**Type**	**Estimated Age & Condition**	**ENERGY STAR Certified**
Refrigerator	18 cubic feet Freezer location: Top Manufacturer/s: Kenmore Estimated Annual Consumption: 750 KWh	Assumed to be over fifteen (15) years old and in poor condition	Not ENERGY STAR Certified
Refrigerator in Library	20 cubic feet Freezer location: Side by Side Manufacturer/s: Kenmore Estimated Annual Consumption: 850 KWh	25 years old and in poor condition	Not ENERGY STAR Certified

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 on-site
Reason for Replacement	Equipment is inefficient and has exceeded or is approaching its EUL

5.6.2 Laundry

No laundry equipment or hookups were observed on site.

5.7 Process Equipment and Loads

There are no additional process equipment or loads.

5.8 Other Systems

There is a wheelchair lift type elevator on-site.

5.9 Onsite Energy Generation

There is no on-site generation.

5.9.1 Solar Energy & Cogeneration

The property has significant potential for a solar photovoltaic (PV) system, however, the facility is not a good candidate currently for rooftop solar because the building has a slate roof. The slate shingles will not allow for solar to be installed on it. The roof will need to be replaced, if solar generation is desired.

The roof warranty for the property was requested, but not received as of the date this report was issued. The site contact was not able to provide a verbal estimate of the time remaining on the warranty.

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 the 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 the achn rate by an estimated 10%. 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 ACHn rate is estimated to be .65 based building envelope.
Recommendation	This "green alternative" is recommended based on energy savings.

ECM: IMPROVE ATTIC INSULATION

Green Alternative	Nova recommends adding blown-in insulation to the attic space to total R-49. Before adding the insulation, we recommend air sealing. Site staff should confirm that the roof is in good condition and is leak-free prior to insulation work. Larger openings, such as chases, shall be sealed with rigid foam board or sheet metal. Before insulation is installed, dams should be built around access hatches, chimney flues, and open ventilation shafts. Blocking should be installed around soffit vents to ensure adequate air flow while preventing 'wind washing' through the insulation near the eaves.
Benefits Attained	Improved roof insulation reduces heat loss in the winter and heat gain in the summer.
Assumptions	The following assumptions were made to calculate savings from the proposed roof insulation: › The existing R value of the attic was considered to be 38 based on visual inspection
Recommendation	This "green alternative" is recommended based on energy savings.

ECM: REPLACE WINDOWS

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 0.80. › New windows and glass doors are modeled with a u-value of 0.35 and a SHGC of 0.50
Recommendation	This "green alternative" is recommended based on energy savings.

6.2 HVAC Systems

ECM: INSTALL HIGH EFFICIENCY DUCTLESS MINI-SPLIT HEAT PUMPS

Green Alternative	Install high efficiency, ENERGY STAR® rated ductless mini-split heat pumps (≥10 HSPF, ≥ 21 SEER) to operate at full heating capacity and add limiting setpoints to the existing boiler and furnace to be used only in extreme situations. Suggested outdoor unit locations to consider include the North and East walls. Suggested indoor unit locations to consider include both the upstairs and downstairs heated areas.
Benefits Attained	While replacing heating and cooling systems is an expensive measure, 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 95% and 91.2% AFUE to 11 HSPF for heating for affected areas. Property-owned cooling systems are currently installed in the building but rarely used. For this reason, cooling-related energy consumption may increase after implementing this EWEM. 2024 propane consumption was estimated by converting the 2023 energy use of the heating oil boiler and converting the energy used to gallons of propane utilized. This calculation depicts the fuel use required by the propane furnace and boiler after the replaced boiler is commissioned.
Recommendation	This “green alternative” is recommended based decarbonization and energy savings.

6.3 Domestic Water Systems

ECM: INSULATE DOMESTIC HOT WATER PIPING

Green Alternative	Nova recommends insulating all exposed hot water piping and the first three (3) feet of exposed cold water piping located in mechanical rooms to R4. Installer to ensure compliance with all applicable codes.
Benefits Attained	Exposed pipes in unconditioned spaces are a significant cause of heat loss from domestic hot water systems. Moreover, when their surface temperature exceeds 100 degrees F, they present a health and safety liability. Insulating these pipes will reduce energy consumption by reducing the heat loss through uninsulated piping.
Assumptions	We modeled the savings using spread-sheet based calculations.
Recommendation	This “green alternative” is considered cost-effective for early replacement and is recommended.

ECM: INSULATE DOMESTIC HOT WATER TANKS

Green Alternative	Nova recommends insulating all electric hot water tanks with R-8 tank wrap insulation. Installer to ensure compliance with all applicable codes. The sides and top of each 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 recommended based on energy savings.

ECM: INSTALL HIGH EFFICIENCY HEAT PUMP WATER HEATERS

Green Alternative	Replace existing electric water heaters with a single, high efficiency, ENERGY STAR® rated heat pump water heaters rated at 3.20 UEF or higher.
Benefits Attained	While replacing domestic hot water units for apartments 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 0.86 EF to 3.20 EF. Most heat pump water heaters are larger than electric water heaters; they also require free air flow to function correctly. Heat pump water heaters may cool and dehumidify the indoor air around them. Local codes and manufacturer's specifications should always be consulted to ensure feasibility, legality, and safety.
Recommendation	This “green alternative” is recommended based on energy savings.

6.4 Lighting Systems

ECM: UPGRADE COMMON AREA LIGHTING AND CONTROLS

Green Alternative	Nova recommends the following: › Retrofit existing incandescent, compact and linear-fluorescent technology fixtures with LED technology lamps. › For fluorescent lamps, management should consider replacing the existing ballasts with LED drivers. › 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 recommended based on energy savings.

6.5 Appliances

ECM: REPLACE REFRIGERATORS

Green Alternative	Nova recommends installing approximately two (2) new ENERGY STAR®-qualified refrigerators (designed to consume 10% less than minimum federal efficiency standards) in place of the existing inefficient refrigerators. A full assessment shall be conducted to determine the property sizing and replacement schedule. 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 1,600 kWh and proposed consumption at 835 kWh annually.
Recommendation	This “green alternative” is recommended based on energy savings.

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 48.1 kW of installed solar capacity. A complete solar evaluation and design by a qualified contractor should be completed as part of this work scope.
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 type of the current roofing systems, if a photovoltaic system is installed, it is required that prior to work starting the affected roof section be re-roofed.
Benefits Attained	The building has a slate shingles roof. The slate shingles will not allow for solar to be installed on it. The roof will need to be replaced, if solar generation is desired.
Assumptions	Nova estimates that based on the optimal location and size of the photovoltaic system that approximately 5,417 square feet of roof space be replaced with a solar-viable roofing material.
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						
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						
Use fan hood only when cooking						
Purchase ENERGY STAR commercial cooking equipment						
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						
Replace boiler burners	Y					
Unblock air flow from unit ventilators						
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	Y					
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	Y					
Perform boiler tune-ups						
Clean filters and fans	Y					
Clean air conditional evaporator and condenser coil fins						
Align and adjust belts						

	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	Y					
Ensure proper operation of air damper						
Clean condenser and evaporator coils	Y					
Properly charge refrigerant						
Install VFDs and energy efficient motors						
FANS						
Clean fan blades						
Inspect bearings						
Adjust/change belts						
Check fan current						
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						
Periodically flush fixtures to prevent bacteria growth						
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

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E-mail: energystarbuildings@epa.gov

EXHIBIT A: PHOTOGRAPHIC RECORD

Photographs

Elevation South

Northwest Corner Stone Foundation

Elevation West

Elevation East

East Wall Theater Back Stage Exit

North Foundation

Elevation North

East Wall

Attic Access

First Story West Side is the Main Entry to the Lower Hall; Entry Closet with Electrical Service Panel

First Story West Back Exit Door

Second Story Front Entry Doors and Foyer Windows

Second Story East Back Exit Door is Very Drafty

Second Story Balcony Emergency Exit Door to the Metal Exterior Stairs

Single Glazed Window

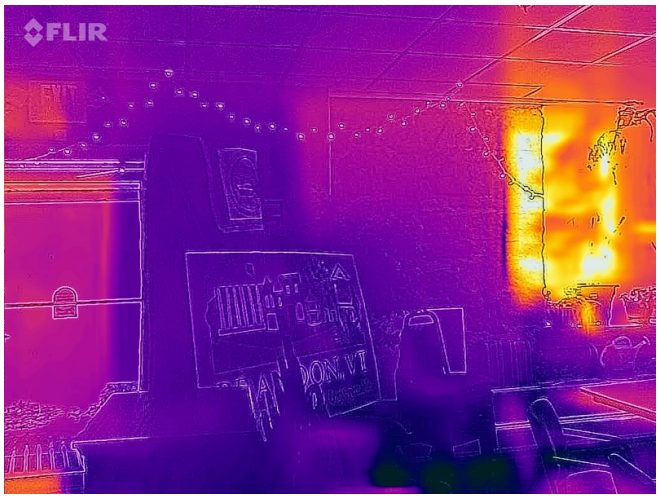
Draft from Window Chain

Window

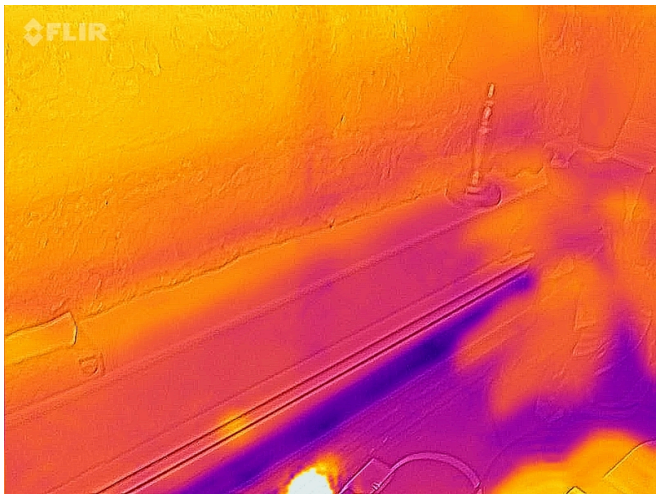
Window

Blower Door at -18.5 PA

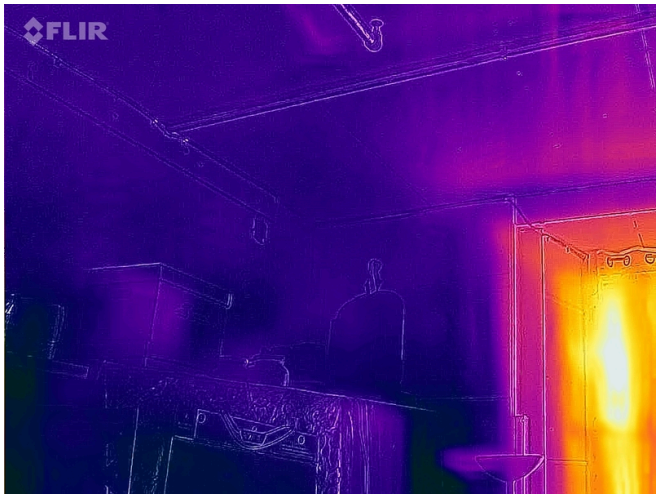
IR First Story West Wall Store Front Glass Main Entry Door and Window



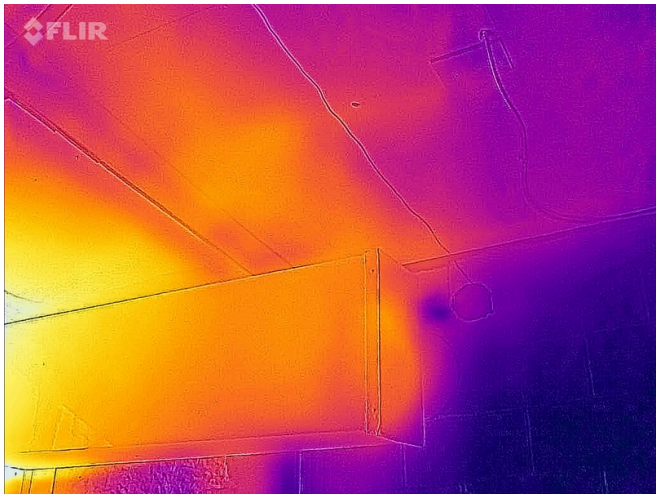
IR First Story West Wall



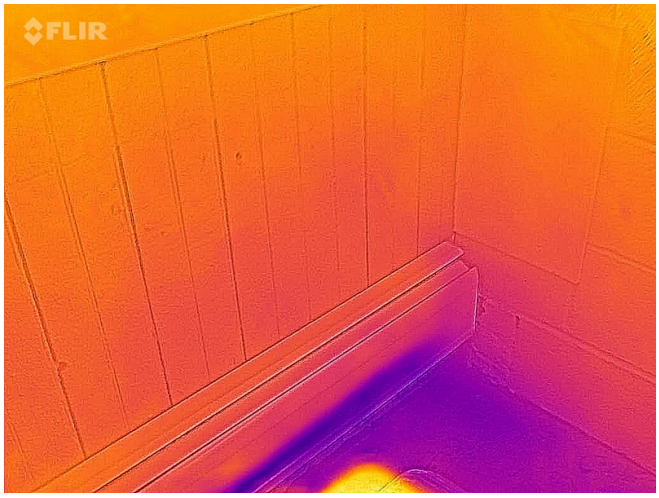
IR First Story Baseboards Below Heaters



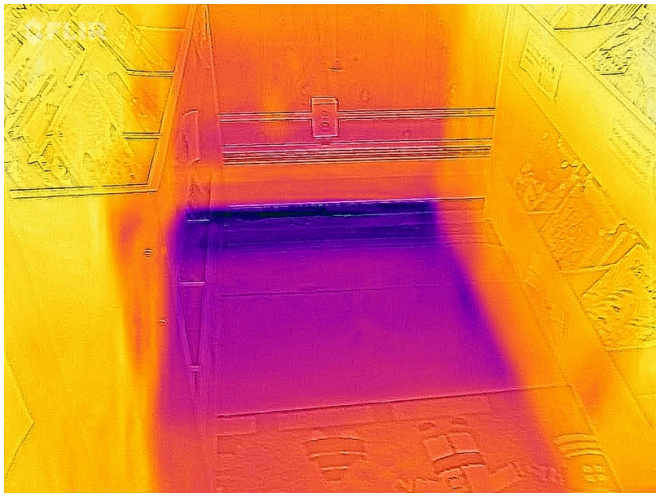
IR First Story West Wall and Window



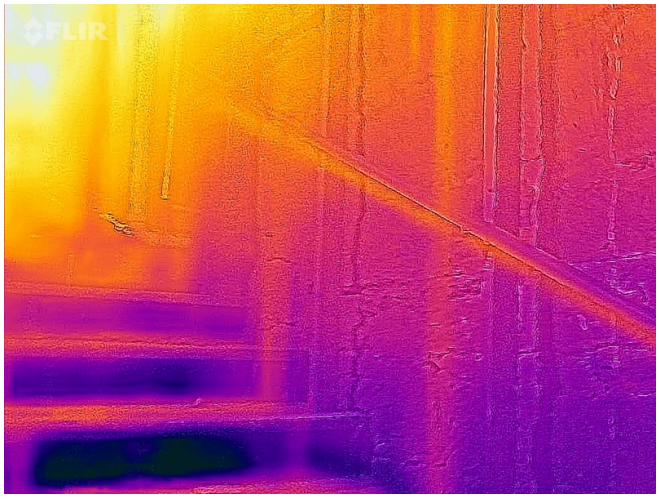
IR First Story



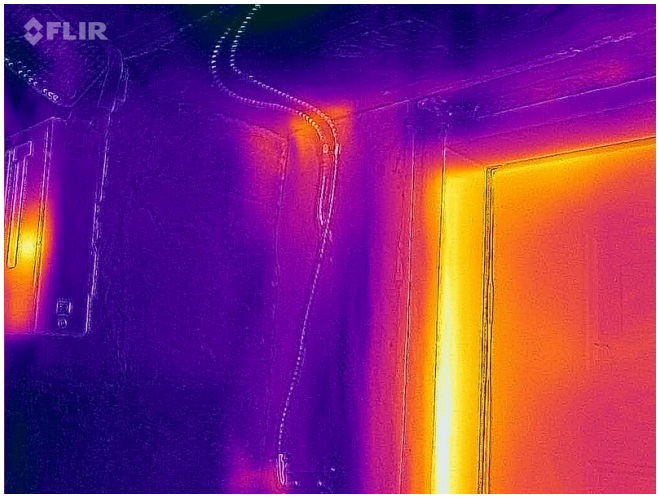
IR First Story West Wall Baseboard Below Heater



IR First Story East Wall Baseboards Under the Heater



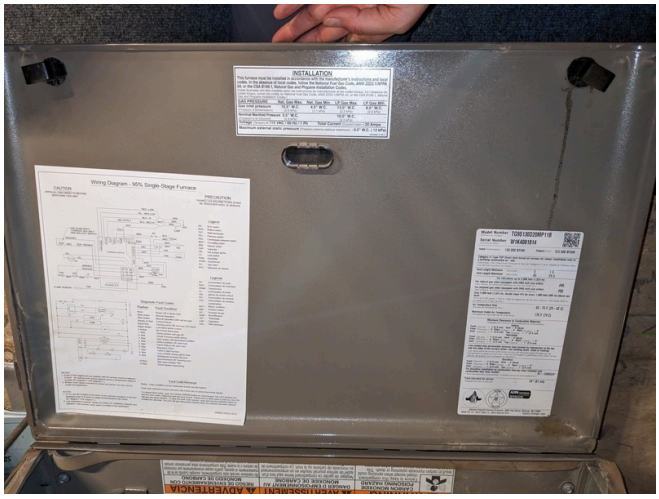
IR First Story East Exit



IR First Story West Wall Back Exit Door

IR Second Story Front Doors

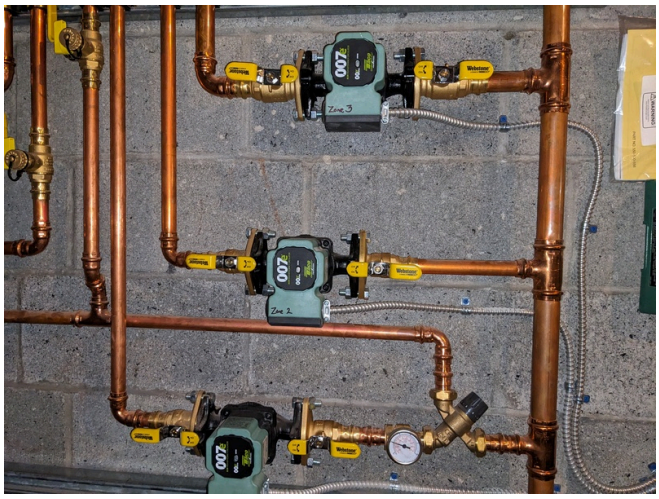
Furnaces by York



Furnace by York

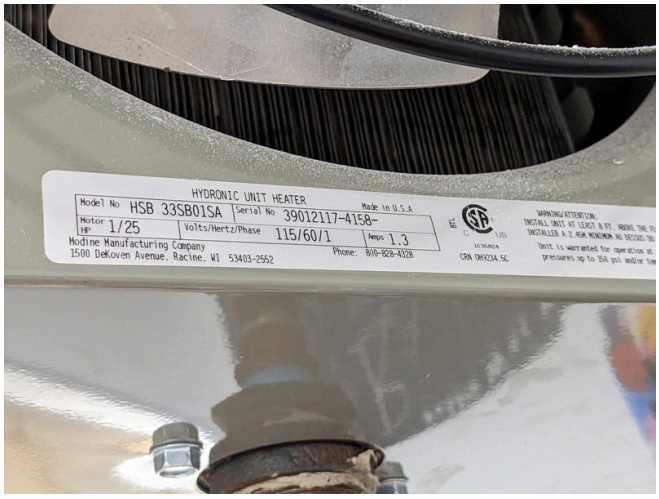
Boiler

Hydronic Boiler by Weil McLain; Models 90+4



ECM Hydronic Pumps by Taco

Hydronic Coil by Modine with Zero Clearance from Acoustic Drop Ceiling in the Back of the First Story Hall Temporary Library

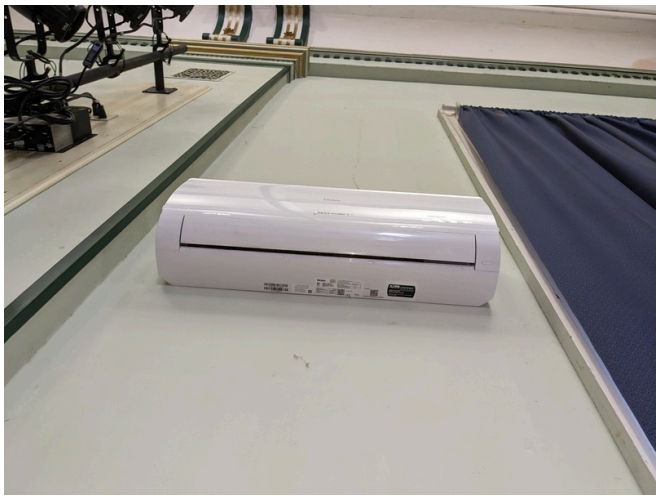


Hydronic Coil by Modine; Model: HSB 33SB01SA; 1/25 HP

Hydronic Baseboards in the First Story Back Hall Temporary Library

First Story Evaporator by Haier

Evaporator by Haier Nameplate



Second Story Evaporator

ASHP Evaporator SE1 by Haier

ASHP Condenser

Multi Split ASHP Condenser by Haier; Model 2U20EH2VHA

ASHP Condensers on the East Wall

Condenser by Haier

ASHP Evaporator 4

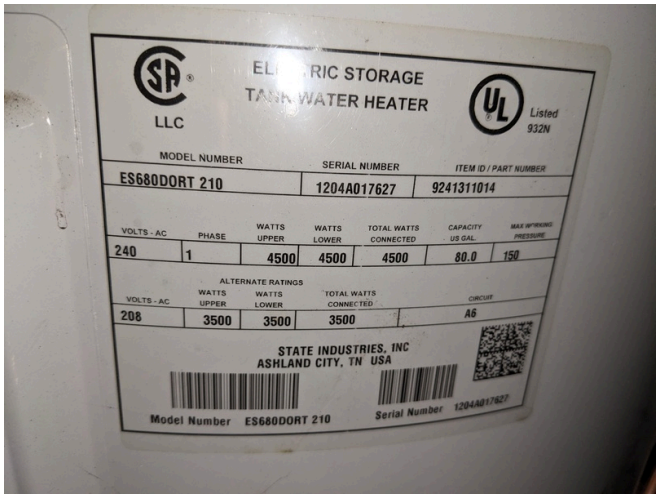
Evaporator

ASHP Evaporator

Evaporator by Haier

Mechanical Room DHW and Oil Tank

Hydronic Boiler and DHW Tank in the Mechanical Room



DHW by State; Model: ES680DORT 210

DHW by Rheem; Model: EGSP15

Small DHW in the Second Story Concession Kitchen

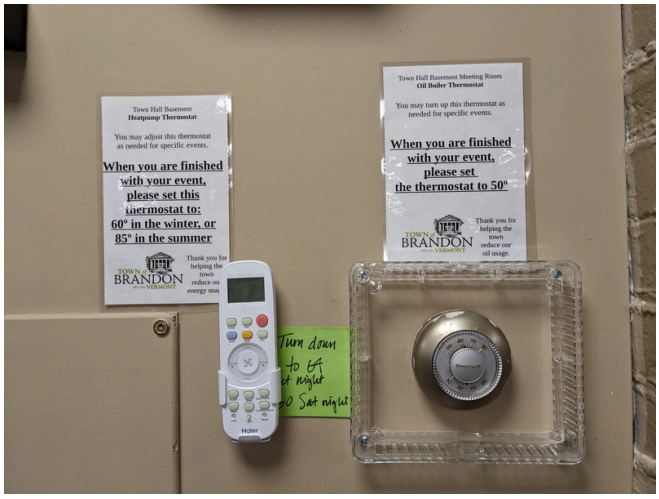
Restroom Sinks

1.5 GPM Faucet

1.5 GPM Measured at the Private Restroom Faucet

Refrigerator by Kenmore; Dated 2000

Lighting 28 W Four Foot T8 LF



Thermostats

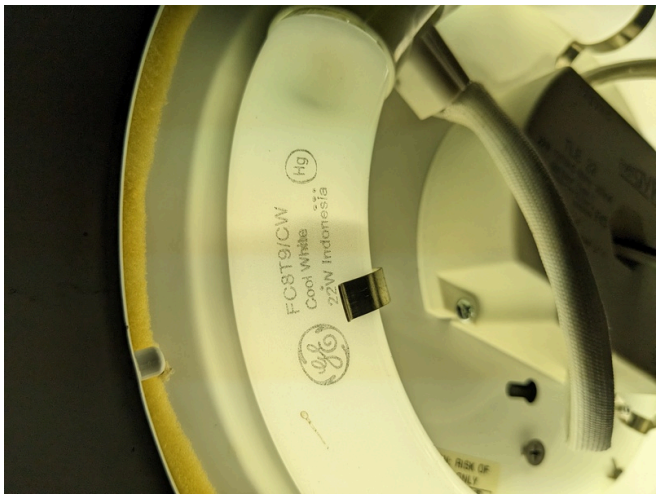
Thermostat

Plumbing and Vents by the First Story West Back Door

Lighting Wall Sconce

Square Lights in the First Story Back Hall Temporary Library

38 W LED Square Light Fixture



22 W T9 Round Fluorescent

7.2 W LED Lamp

LED Four Foot Lights

Second Story Front Entry Foyer

Second Story Hall Chandelier Lighting

Lighting Back Stage

9 W LED Lamp

Second Story Early Exit Sign Light Box

First Story Track Lights

Lighting in the Front Overhang at the Third Story Exit

9 W LED Lamp

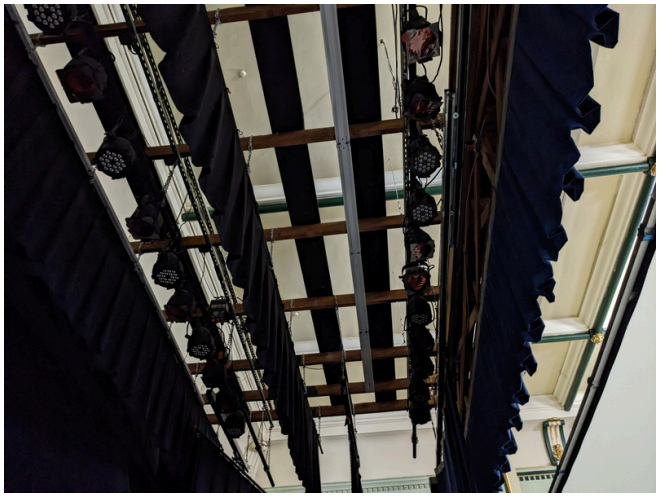
Outside Light

Eight Foot T8 Linear Fluorescent Lamps

Lighting 96 W Eight Foot T12 LF

Strobe Lights

Illuminated Exit Signs with Strobe Lights



Theater Stage Lighting

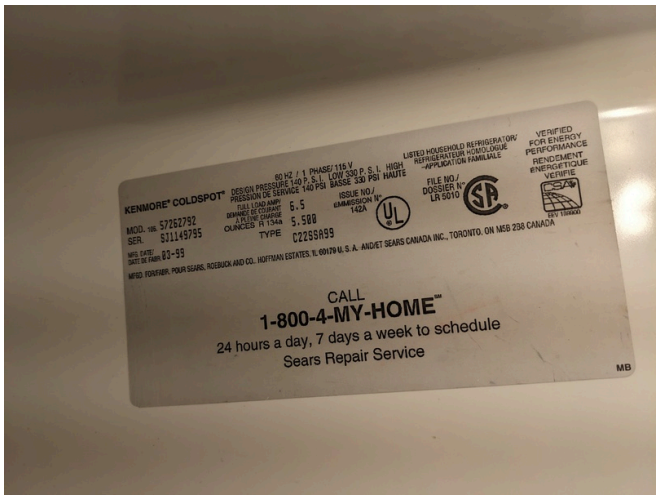
Stage Lighting

Light Switch

Lighting Sensor Switch

Second Story ASHP Evaporators, Window Shades and Curtain, Wall Vents and Theater Lighting

Refrigerator on the First Story



Refrigerator by Kenmore; Model: 57262792; Dated 1999

Lighting Wall Scone First Story Hallway of Restrooms; Looking East

Second Story Concession Kitchen

Pair of EV Chargers

EV Charge by Chargepoint

EXHIBIT B: SITE AND FLOOR PLANS

BRANDON TOWN HALL

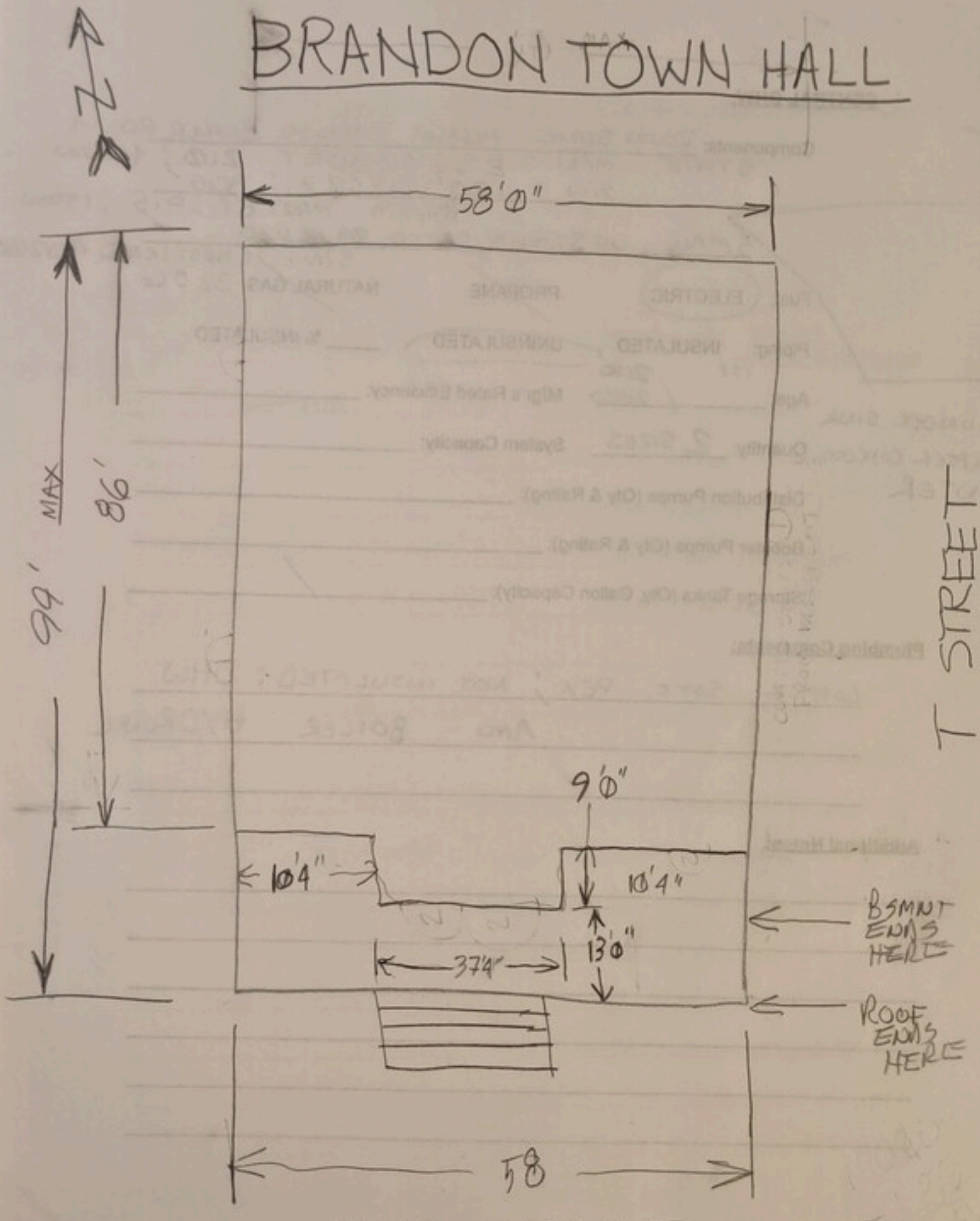


EXHIBIT C: MECHANICAL EQUIPMENT INVENTORY

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 Heat	Taco	007e 2F4	0.06	Three (3) Mfg 2024	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													
None													
NOT RECOMMENDED FOR REPLACEMENT													
Boiler Room	Downstairs	Boiler	Weil McLain	GV90+4	105	kBTUh	91.2%	AFUE	2024	One (1)	Propane	Hydronic Radiator and Radiant Floor	35 years
Backstage	Upstairs	Furnace	York	TG9S130D20M	130	kBTUh	95%	AFUE	2014	Two (2)	Propane	Ducted	Twenty (20) years
Outside	Downstairs	Heat Pump	Haier	1U18AP2VHA	1.5	Ton	11.0	HSPF	2021	One (1)	Electric	Ductless Heat Pump	Twelve (12) years
Outside	Upstairs	Heat Pump	Haier	2U20EH2VHA	1.7	Ton	11.0	HSPF	2021	Two (2)	Electric	Ductless Heat Pump	Twelve (12) years
Downstairs	Downstairs	Heat Pump	Haier	AW18ES2VHB	1.5	Ton	11.0	HSPF	2021	One (1)	Electric	Ductless Heat Pump	Twelve (12) years
Upstairs	Upstairs	Heat Pump	Haier	AW12TC2HDA1	1.0	Ton	11.0	HSPF	2021	Four (4)	Electric	Ductless Heat Pump	Twelve (12) years

COOLING EQUIPMENT												
Equip. Location	**Area Served**	**System Type**	**Make**	**Model #**	**Capacity**	**Cap. Units**	**Efficiency**	**Eff. Units**	**Year**	**Qty**	**Dist.**	**RUL**
RECOMMENDED FOR REPLACEMENT												
None												
NOT RECOMMENDED FOR REPLACEMENT												
Outside	Downstairs	Heat Pump	Haier	1U18AP2VHA	1.5	Ton	21.0	SEER	2021	One (1)	Point Source	Twelve (12) years
Outside	Upstairs	Heat Pump	Haier	2U20EH2VHA	1.7	Ton	21.0	SEER	2021	Two (2)	Point Source	Twelve (12) years
Downstairs	Downstairs	Heat Pump	Haier	AW18ES2VHB	1.5	Ton	21.0	SEER	2021	One (1)	Point Source	Twelve (12) years

COOLING EQUIPMENT												
Equip. Location	**Area Served**	**System Type**	**Make**	**Model #**	**Capacity**	**Cap. Units**	**Efficiency**	**Eff. Units**	**Year**	**Qty**	**Dist.**	**RUL**
Upstairs	Upstairs	Heat Pump	Haier	AW12TC2 HDA1	1.0	Ton	21.0	SEER	2021	Four (4)	Point Source	Twelve (12) years

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	Restrooms and Slop Sink	State	ES680DORT	4,500W	0.86 EF	Direct	80 gallon	None	2012	One (1)	Electric	0 years
NOT RECOMMENDED FOR REPLACEMENT												
Under Sink at Theater Concession	Theater Concession	Rheem	EGSP15	1,500W	0.95 EF	Direct	Fifteen (15) gallon	None	2020	Two (2)	Electric	Eight (8) years

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									
Library Office and Conf Room	LF	T12	Two (2)	Two (2)	96	25	On/Off	7.5	Fixture
Mechanical Room	Edison Socket	CFL	One (1)	One (1)	Thirteen (13)	Nine (9)	On/Off	7.5	Fixture
Library Back Hall	LF Round	T9	Two (2)	One (1)	22	Nine (9)	On/Off	7.5	Fixture
Slop Sink Room	LF	T8	One (1)	Two (2)	28	Eleven (11)	OS	7.5	Fixture
Slop Sink Room	LF Round	T9	One (1)	One (1)	22	Nine (9)	OS	7.5	Fixture
Library Emergency Exit	Edison Socket	Incan	One (1)	One (1)	80	Twelve (12)	On/Off	7.5	Fixture
Ticket Office	LF	T8	One (1)	Three (3)	28	Eleven (11)	On/Off	7.5	Fixture
Back Steps	LF Round	T9	Three (3)	One (1)	22	Nine (9)	On/Off	7.5	Fixture
NOT RECOMMENDED FOR REPLACEMENT									
First Story Front Hall	LED	LED	Four (4)	Three (3)	28	None	OS	7.5	None
Restroom Hallway	Edison Socket	LED	Fourteen (14)	Two (2)	Nine (9)	None	OS	7.5	None
Hallway Ceiling	LED	LED	Three (3)	One (1)	7.2	None	On/Off	7.5	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**
Library	LED	LED	Nineteen (19)	One (1)	38	None	On/Off	7.5	None
Library Restroom	Edison Socket	LED	One (1)	Two (2)	Nine (9)	None	On/Off	7.5	None
Downstairs Elevator Lobby	LED	LED	Two (2)	Two (2)	Fourteen (14)	None	On/Off	7.5	None
Front Stairs	LED	LED	One (1)	Two (2)	Fourteen (14)	None	On/Off	7.5	None
Theater Level Entry Lobby	Edison Socket	LED	One (1)	Two (2)	Nine (9)	None	On/Off	7.5	None
Theater Under Balcony	Edison Socket	LED	Three (3)	Two (2)	Nine (9)	None	On/Off	7.5	None
Theater Chandelier	Edison Socket	LED	Four (4)	Twelve (12)	Nine (9)	None	On/Off	7.5	None
Balcony Lobby Steps	Edison Socket	LED	One (1)	Two (2)	Nine (9)	None	On/Off	7.5	None
Backstage	Edison Socket	LED	Two (2)	Eight (8)	Nine (9)	None	On/Off	7.5	None
Backstage	Edison Socket	LED	One (1)	Two (2)	Nine (9)	None	On/Off	7.5	None
Backstage	Edison Socket	LED	Four (4)	One (1)	Nine (9)	None	On/Off	7.5	None
Backstage	Track Lighting	LED	36	One (1)	50	None	On/Off	Only used 40 hours a year	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 Sconce	Edison Socket	LED	One (1)	One (1)	Nine (9)	None	On/Off	Four (4)	None
Front Second Floor Emergency Exit	Edison Socket	LED	One (1)	One (1)	Nine (9)	None	On/Off	Four (4)	None
Right Side First Floor Door	LED	LED	One (1)	Two (2)	Eight (8)	None	MS	Four (4)	None
Left Side Enterance Awning	LED	LED	Five (5)	One (1)	Eleven (11)	None	MS	Four (4)	None

REFRIGERATORS							
Location	**Make**	**Model #**	**Year**	**kWh/Year**	**Size (ft3)**	**Qty**	**RUL**
RECOMMENDED FOR REPLACEMENT							
Theater Concession	Kenmore	Locked; Can Not ID	Appears to be over fifteen (15) years old	750	Estimated at eighteen (18)	One (1)	0 years assumed
Library	Kenmore Side by Side	106.57262792	1999	850	Twenty (20)	One (1)	0 years
NOT RECOMMENDED FOR REPLACEMENT							
None							

FLOW RATE SUMMARY - SAMPLE			
Location	**Fixture Type**	**Qty**	**Flow (GPM or GPF)**
RECOMMENDED FOR REPLACEMENT			
Restroom	Faucet	Eight (8)	1.5 GPM
Theater Concession Area	Faucet	One (1)	1.5 GPM
Restroom	Toilet	Seven (7)	1.6 GPF
NOT RECOMENDED FOR REPLACEMENT			
Restroom	Urinal	One (3)	1.0 GPF
Housekeeping Slop Sink	Faucet	One (1)	2.5 GPM
Theater Concession	Faucet	One (1)	Unmeasurable; Temporarily Disconnected

EXHIBIT D: SOLAR PROPOSAL

Nova Group, GBC

Proposal for Customer

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

For:
1 Connant Square, Brandon

Quote #: 4676498
Valid until: Jul 13 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

100%	$82,735	$88,228	$5,493
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

68 Solaria PowerXT-370R-PD
370 Watt panels
with 25 Year Performance Warranty
Up to **20.5%** Module efficiency
28,911 kWh per year

SOLARIA

Battery

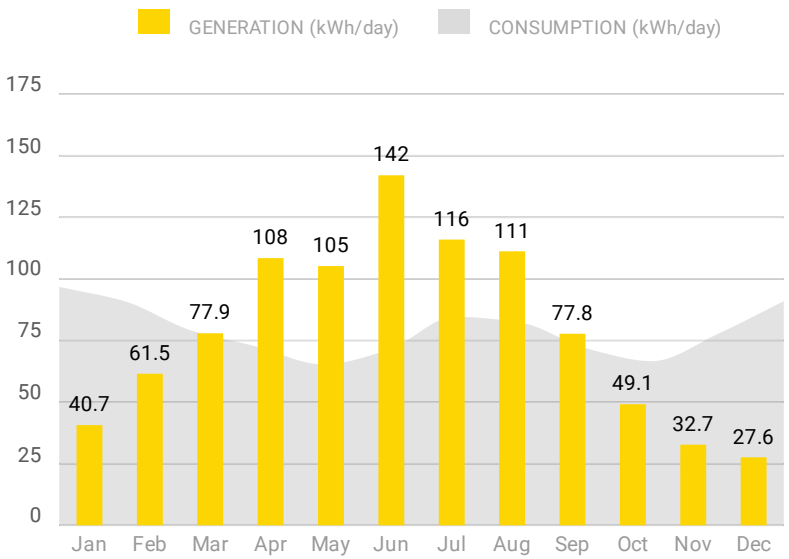
RedEarth Energy Storage
90.2 kWh Total Battery Storage
1 x CopperHead 90.2 kWh

Warranties: 25 Year Panel Product Warranty, 25 Year Panel Performance Warranty, 10 Year Battery Product Warranty

System Performance

100%

Energy From Solar



System Performance Assumptions: System Total losses: 15.6%, Inverter losses: 2.5%, Optimizer losses: 0%, Shading losses: 0%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 68 panels with Azimuth 98 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

100% Of CO_2, SO_x & NO_x

792 kg Avoided CO_2 per year

Over System Lifetime

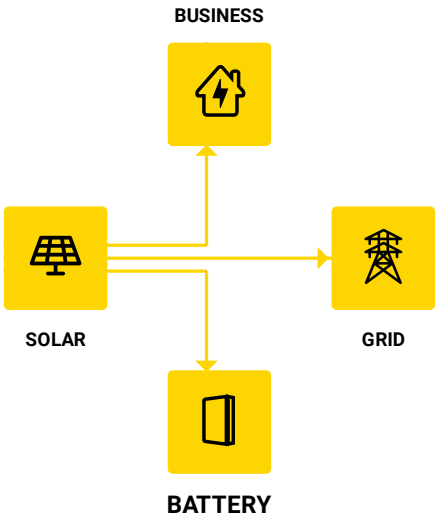
14,532 Car miles avoided

150 Trees planted

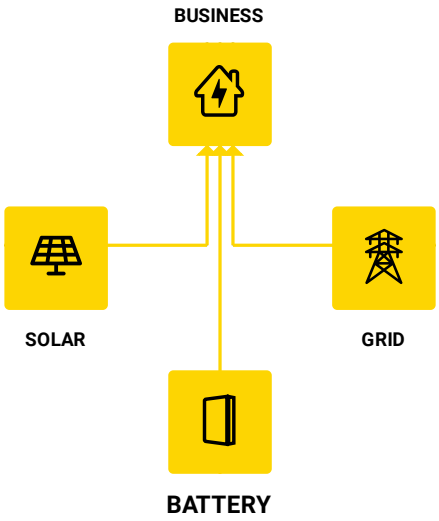
17 Long haul flights avoided

How your system works

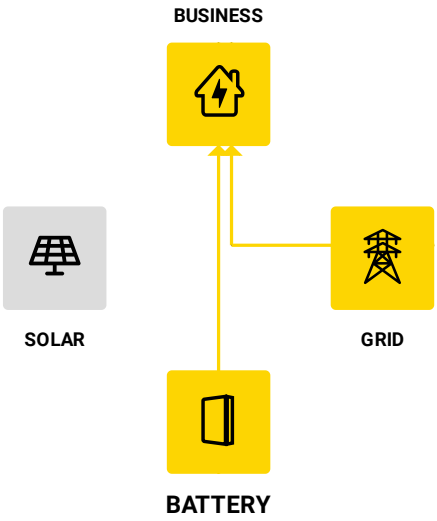
Generating Excess Solar



Partially Offset Usage

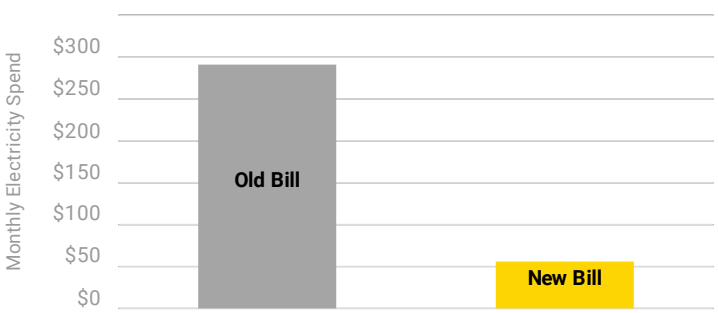


Night

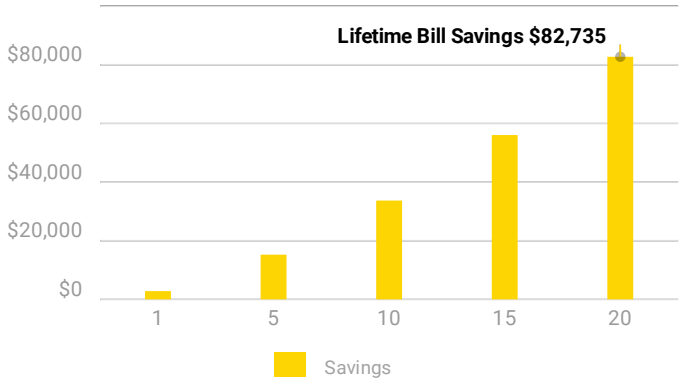


Electricity Bill Savings

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	1,261	3,000	1790	355	224	0	131
Feb	1,722	2,545	924	306	130	0	176
Mar	2,416	2,452	158	296	47	0	249
Apr	3,253	2,176	(932)	266	30	101	236
May	3,262	2,024	(1085)	250	30	219	220
Jun	4,262	2,138	(2007)	262	30	436	232
Jul	3,595	2,624	(831)	315	30	527	285
Aug	3,447	2,552	(759)	307	30	609	277
Sep	2,333	2,155	(89)	264	30	618	234
Oct	1,524	2,065	634	254	30	550	224
Nov	982	2,331	1375	283	30	401	253
Dec	855	2,821	1993	336	30	0	306

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 28882 kWh per year, assuming Single Phase Service Electricity Tariff.

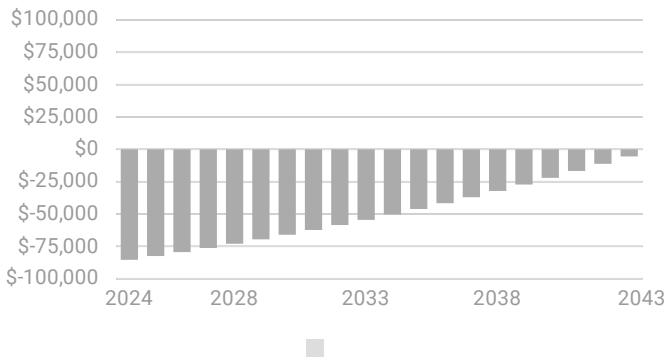
Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

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

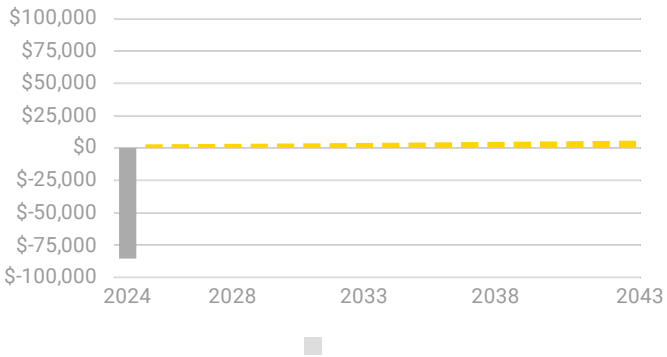
Net Financial Impact Cash

$82,735	-	$88,228	=	$5,493
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

68 x Solaria Corporation 370 Watt Panels (Solaria PowerXT-370R-PD) 1 x CopperHead 90.2 kWh (RedEarth Energy Storage)	
Total System Price	$126,040.00
Purchase Price	**$126,040.00**

Additional Incentives

Federal Investment Tax Credit (ITC) The Federal Solar Tax Credit or The Federal Investment Tax Credit (ITC) for constructions starting in 2023.	$37,812.00
Net System Cost	**$88,228.00**

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 13 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

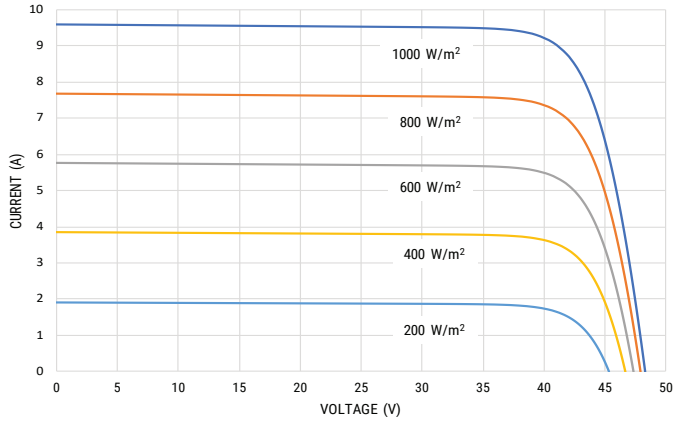
Temperature Characteristics

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

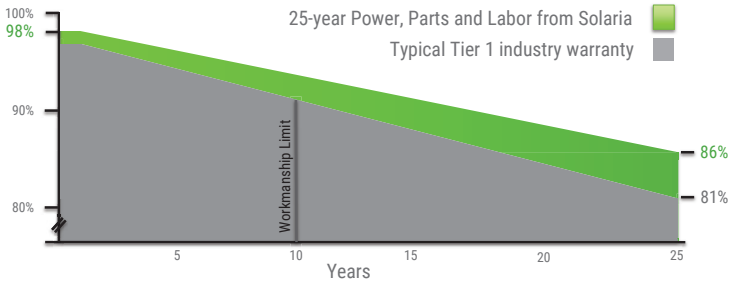
Design Parameters

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

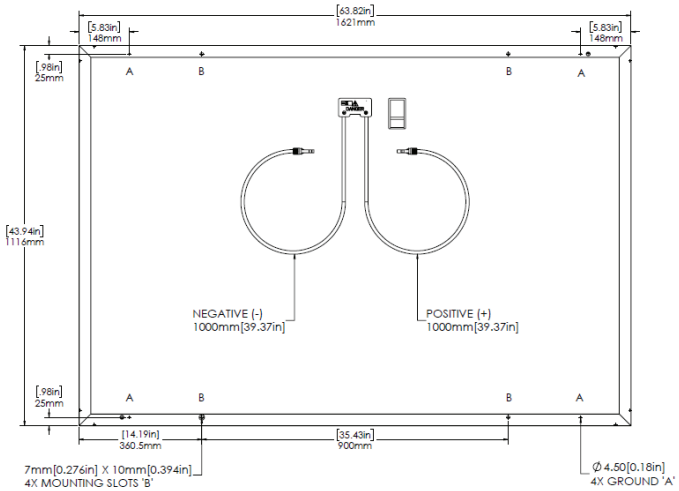
Certifications / Warranty

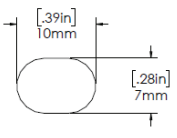
Certifications	UL 1703/IEC 61215/IEC 61730/CEC CAN/CSA-C22.2
Fire Type (UL 1703)	1
Warranty	25 years*

* Warranty details at www.solaria.com

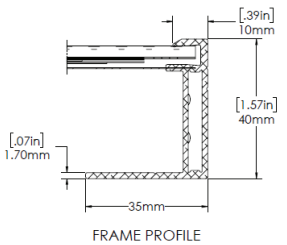
Packaging

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

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

Rev 3D 12-2019

Nova Group, GBC

Proposal for Customer

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

For:
1 Connant Square, Brandon

Quote #: 4676498
Valid until: Jul 13 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

104%	$153,855	$159,439	$5,584
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

130 Solaria PowerXT-370R-PD
370 Watt panels
with 25 Year Performance Warranty
Up to **20.5%** Module efficiency
55,291 kWh per year

SOLARIA

Battery

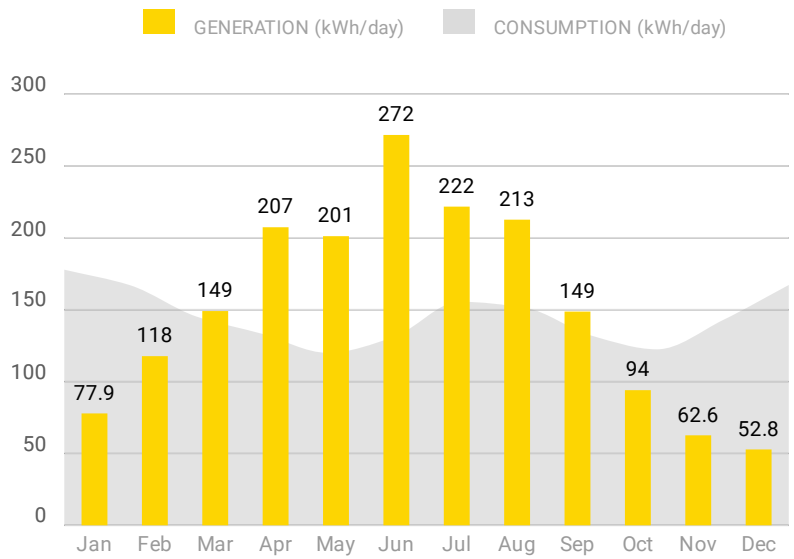
Highon Energy Storage Solutions (Pty) Ltd
153.6 kWh Total Battery Storage
1 x HIGHVOLT-150 COMMERCIAL

Warranties: 25 Year Panel Product Warranty, 25 Year Panel Performance Warranty, 10 Year Battery Product Warranty

System Performance

104%

Energy From Solar



System Performance Assumptions: System Total losses: 15.6%, Inverter losses: 2.5%, Optimizer losses: 0%, Shading losses: 0%, Performance Adjustment: 0%, Output Calculator: System Advisor Model 2020.02.29.r2. Panel Orientations: 112 panels with Azimuth 98 and Slope 20, 18 panels with Azimuth 99 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

104%

Of CO_2, SO_x & NO_x

2 tons

Avoided CO_2 per year

Over System Lifetime

27,792

Car miles avoided

288

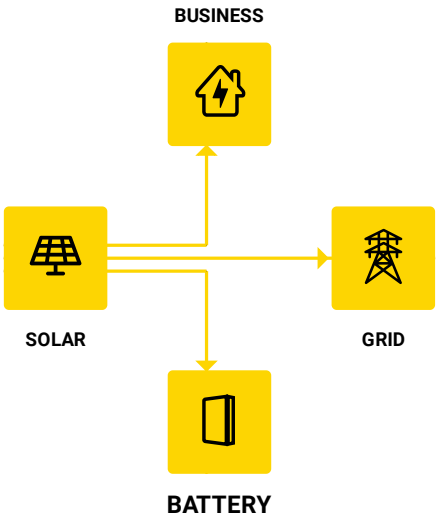
Trees planted

32

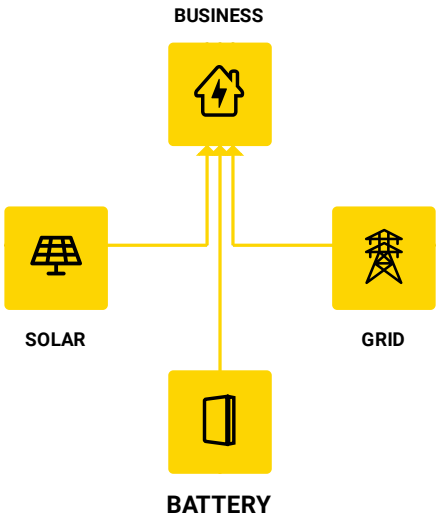
Long haul flights avoided

How your system works

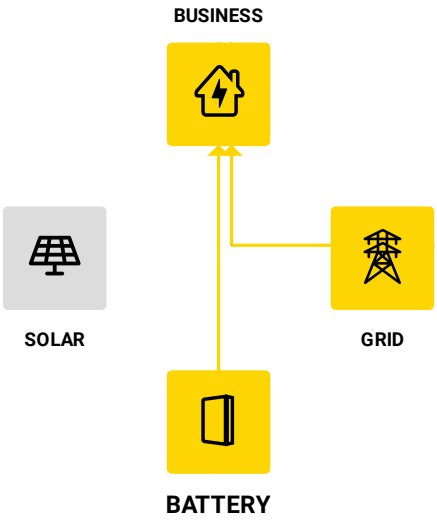
Generating Excess Solar



Partially Offset Usage

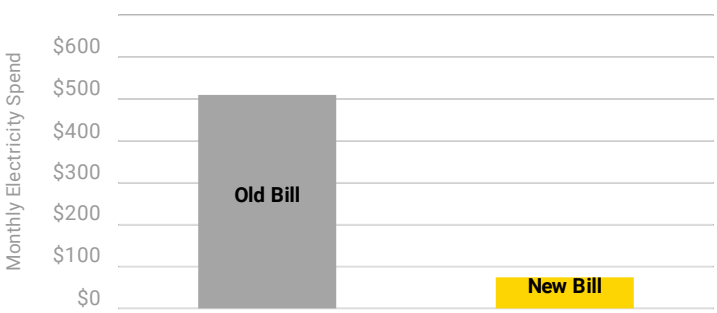


Night

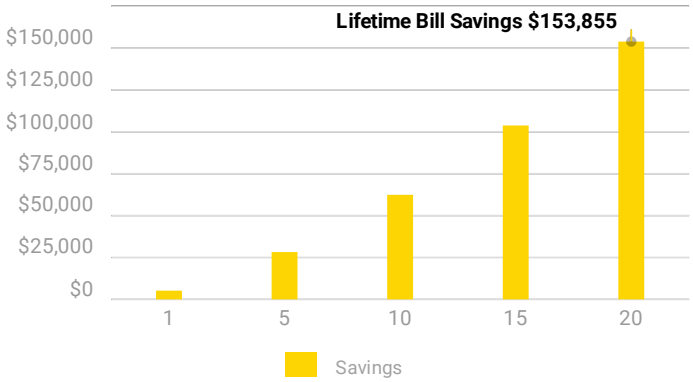


Electricity Bill Savings

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	2,413	5,513	3202	628	377	0	251
Feb	3,295	4,677	1585	537	202	0	335
Mar	4,621	4,506	114	519	42	0	476
Apr	6,221	3,999	(1944)	464	30	211	434
May	6,236	3,720	(2237)	433	30	453	403
Jun	8,147	3,929	(4005)	456	30	888	426
Jul	6,873	4,823	(1791)	553	30	1,082	523
Aug	6,592	4,690	(1643)	539	30	1,260	509
Sep	4,461	3,961	(346)	460	30	1,298	430
Oct	2,915	3,796	1067	442	30	1,182	412
Nov	1,878	4,284	2449	495	30	917	465
Dec	1,636	5,184	3603	592	30	0	562

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 53081 kWh per year, assuming Single Phase Service Electricity Tariff.

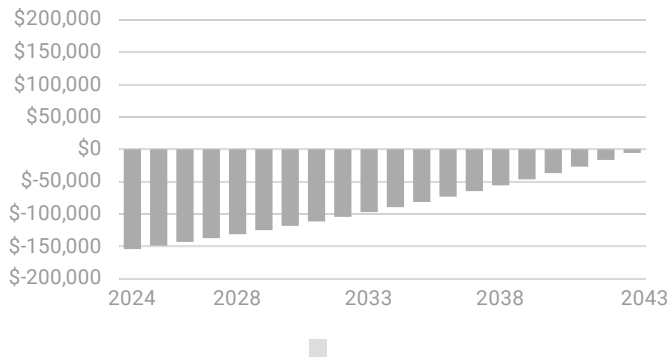
Your electricity tariff rates may change as a result of installing the system. You should contact your electricity retailer for further information.

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

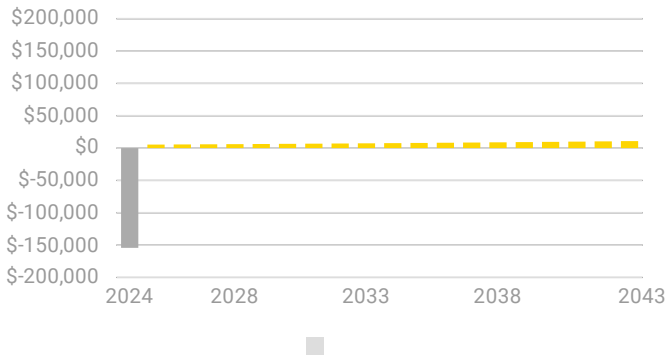
Net Financial Impact Cash

$153,855	-	$159,439	=	$5,584
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

130 x Solaria Corporation 370 Watt Panels (Solaria PowerXT-370R-PD) 1 x HIGHVOLT-150 COMMERCIAL (Highon Energy Storage Solutions (Pty) Ltd)	
Total System Price	$227,770.00
Purchase Price	**$227,770.00**

Additional Incentives

Federal Investment Tax Credit (ITC) The Federal Solar Tax Credit or The Federal Investment Tax Credit (ITC) for constructions starting in 2023.	$68,331.00
Net System Cost	**$159,439.00**

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 13 2024.

Quote Acceptance

I have read & accept the terms and conditions.

Signature _____

Name _____ Date _____

SOLARIA®

Solaria PowerXT® | DC Panel

Solaria PowerXT®-370R-PD

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TÜVRheinland® Precisely Right.

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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

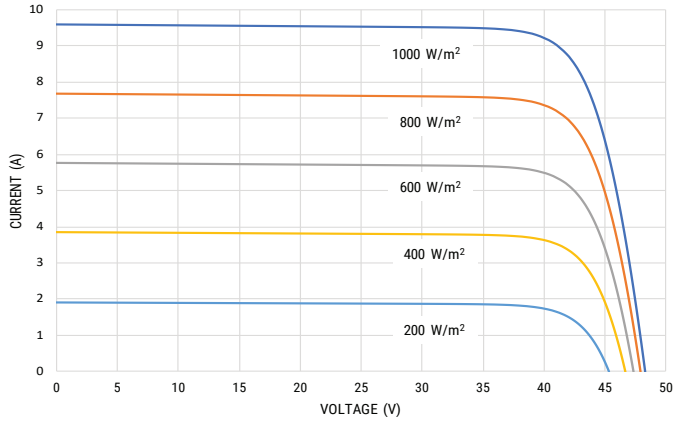
Temperature Characteristics

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

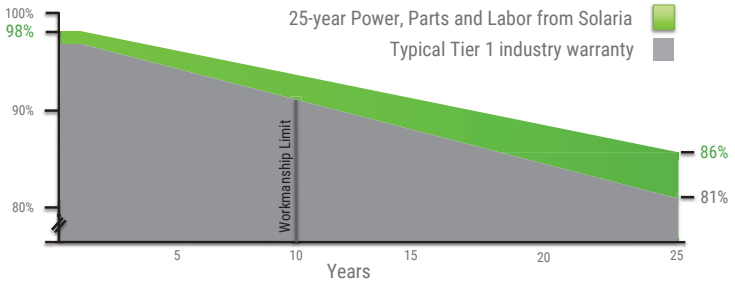
Design Parameters

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

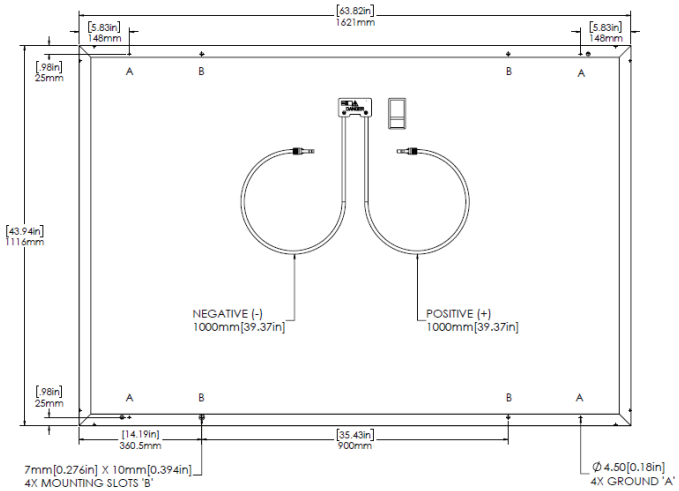
Certifications / Warranty

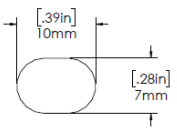
Certifications	UL 1703/IEC 61215/IEC 61730/CEC CAN/CSA-C22.2
Fire Type (UL 1703)	1
Warranty	25 years*

* Warranty details at www.solaria.com

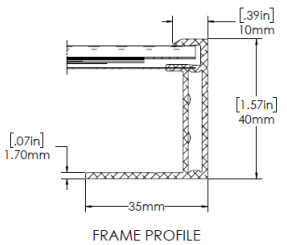
Packaging

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

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

Rev 3D 12-2019

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 Hall & Community Center
1 Connant Square
Brandon, VT
Project Number: SE24-3893

Nova Group


Nova
Group
Carbon
Neutral
Report
novagroupgbc.com/carbonneutral