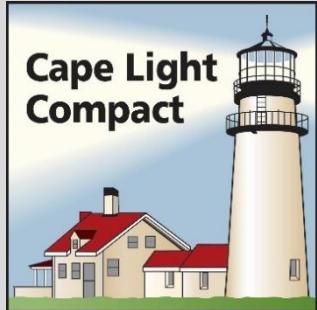


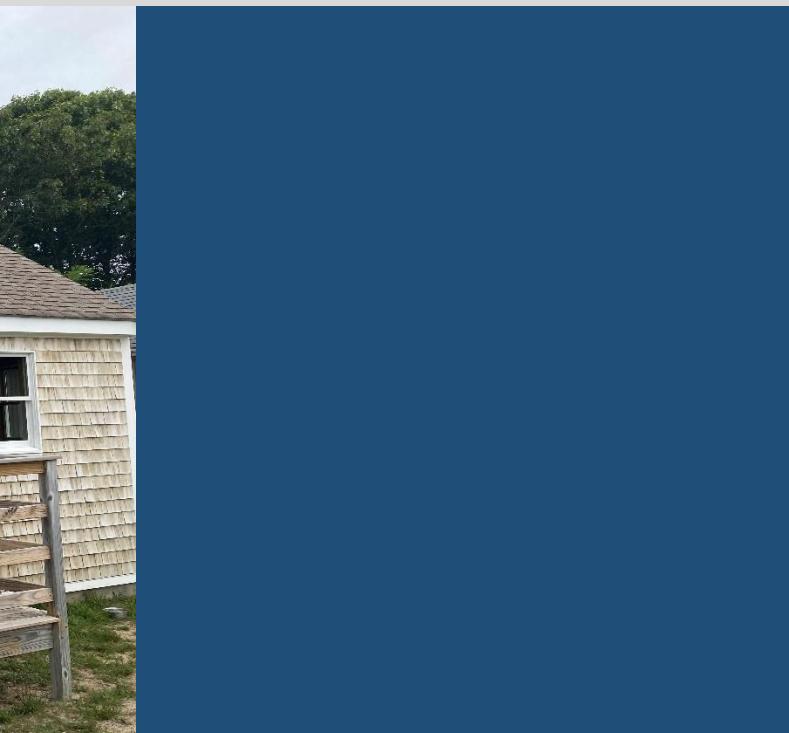
Town Of Truro – Recreational Field House



Climate Leader Communities Decarbonization Roadmap Report

14 Snows Field Rd, Truro MA

Prepared on November 4th, 2024



Contents

Contacts	2
Executive Summary.....	3
Overview	3
Summary of Findings.....	3
Facility Overview.....	4
General Facility Information	4
Building Use	4
Gross Floor Area.....	4
General Conditions of Facility	5
Site Summary	5
Energy Use Overview	7
Electricity Consumption.....	7
Deliverable Fuel Consumption (Propane).....	8
Energy Usage & Carbon Emissions Benchmarking	9
Energy Usage Intensity (EUI).....	9
Carbon Emissions Index (CEI).....	9
EUI & CEI Benchmarking	9
Decarbonization Overview.....	10
Proposed Measures	11
Renewables.....	12
Resiliency	14
Backup Power Sources.....	14
Coastal Flooding.....	14
Next Steps	15
THREE EASY STEPS TO PARTICIPATE	15

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Executive Summary

Overview

Cape Light Compact has retained RISE to evaluate the energy consumption and a potential decarbonization pathway that includes standard efficiency, load reduction, and electrification measures for multiple buildings owned and operated by the Town of Truro, MA. The intent of this review is to summarize and benchmark the site's existing energy consumption with respect to the policies set forth by the Massachusetts Department of Energy Resources (DOER) and to create a Municipal Decarbonization Roadmap to meet 2030 and 2050 net-zero goals. These measures will help offset the site's reliance on fossil fuels, improve efficiency levels, and move toward the town's overall decarbonization goals. All costs, savings, and incentives¹ are representative of findings observed on site.

The efficiency measures listed within this report as energy conservation measures (ECMs) will decrease the site's energy consumption and support the decarbonization pathway. Further measures such as load reduction, renewables, and electrification, will also support the reduction of on-site fossil fuels and grid-based energy consumption. Incentives and tax credits may be available to help defer the cost of implementation. These tax credits and incentives are subject to change based on programs sponsored by the government, the utilities, or other parties involved in determining eligibility. The energy savings and project costs presented below are based on preliminary data and are subject to change pending confirmation of existing conditions and formal proposals being developed for the identified energy efficiency measures. The building management team is interested in pursuing electrification measures to reduce emissions and operating costs while maintaining or increasing occupant comfort within the space(s).

This report details potential decarbonization measures found at the Town Recreational Field House in Truro, Massachusetts.

Summary of Findings

Year	EUI (kBtu/sf/yr)	CEI (MTCO2e/sf/yr)
2022	49.0	0.0004
Current (2023 Usage)	38.1	0.0010
2030 Target	36.8	0.0003
2030 Projected	5.3	0.0000

Table 1: EUI & CEI Summary (Target Values Based on a 25% EUI and 35% CEI Reduction from 2022 Consumption Values)

¹ Further site review may be necessary to develop final incentive approval.

Measure Type	Estimated Electric Savings (kWh)	Estimate Propane Savings (Gallons)	Savings (\$) ²	Incentive (\$)	Net Cost (\$)
LED Lighting	1,034	-	\$228	\$-	\$1,075
Electrification	151	42	\$180	\$3,750	\$6,250
Solar	4,858	-	\$1,069	\$3,159	\$7,371
TOTAL:	6,043	42	\$1,477	\$6,909	\$14,696

Table 2: Measures, Savings, and Cost Summary

Cost Savings are based on the estimated cost \$0.22/kWh for electricity and \$3.50/Gallon for propane.

Efficiency Measures	Load Reduction Measures	Electrification Measures	Renewables

Facility Overview

General Facility Information

Building Use

The Truro Recreational Field House building was constructed in 2003. Based on the site assessment performed, there have been some upgrades to the facility which included spray foam insulation and doors. The core use of this building is devoted to the Truro community to be used as a small office space and storage for sports equipment. The space is comprised of one main space with a single restroom. The typical hours of use of this facility are about 6 hours per day during the school year and only about 10-15 hours per week during the summer. There are usually only two people working within the space.

Gross Floor Area

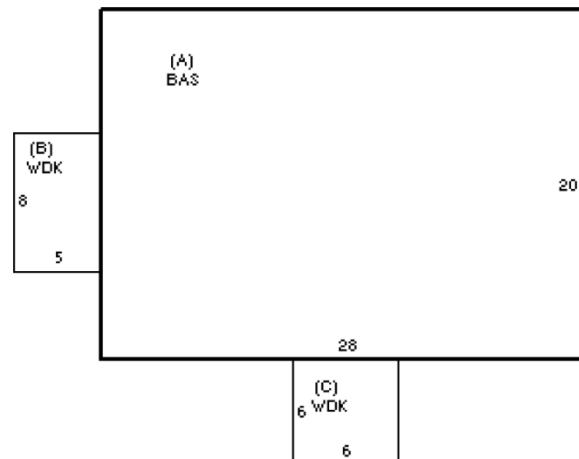
Below is a summary of the building areas which notes the size of each floor and size of the space occupied:

Area Description	Floor Area
Full Building	560 Square Feet
1st Floor	560 Square Feet

Table 3: Floor Area & Square Footage

Building Overview

Year of Construction:	2003
Number of Stories:	1
Structure Material:	Wood Frame
Building Type:	Residential Style Office
Conditioned Floor Area:	560 sq. ft.



General Conditions of Facility

This facility is in good condition and operates sufficiently for the type of occupancy. There have not been any significant upgrades to the structure although some upgrades have been implemented which include some spray foam insulation and new doors. There is a mix of LEDs and fluorescent lighting that should be completely converted to LED. The roof is shingled and in good condition. The foundation is a concrete slab. The flooring is a mix of carpet and tile. Based on the age of construction and the insulation seen on-site, there is a sufficient thermal barrier from the walls to the ceiling and the floor. Exterior door weatherstripping is in good condition. There are no renewables on-site. There is a propane tank serving the small direct vent furnace.

System	Condition	Approximate Age	Useful Life (years)	Remaining Life (years)
HVAC	Okay	21		
DHW	Good	2	13	11
Windows	Okay	16	20	4+
Envelope	Good	21	-	-
Lighting Systems	Okay	21	10	0
Renewable Energy Systems	N/A	-	-	-

Table 4: Facility and System Conditions

Site Summary

The Truro Recreational Field House at Snows Field was built in 2003 and serves the Truro community. The site relies on electricity and propane to operate. However, to align with the local and state electrification goals there will be measures that will need to be implemented to net-zero carbon-based fuel emissions by the year 2050.

System	Description
Building Enclosure	Insulated walls (expected to be R-13 fiberglass batt) are known to have newly added spray foam insulation in the ceiling and below the floor between the main floor and the basement. Double-paned windows original to construction are in okay condition. The exterior doors are new, and the weather stripping is in good condition. Shingles on the roof appear to be in good condition.
Electrical Infrastructure	There is one 200A main distribution panel with a significant amount of additional capacity should additional loads be added. This panel is served directly from the meter which is located on a post just a short distance away from the building.
Carbon-Based Fuel Sources	There is one propane tank on-site that is only serving the small furnace inside the building.
Lighting Systems	The majority of the existing lighting fixtures inside the building have not yet been converted to LED. Although they are in good condition and there is a minimal quantity of 2-lamp fluorescent surface wrap fixtures (small building), the lamps should be retrofitted to LED. The basement storage area is already outfitted with A19 LED lamps.

	There is just one metal halide wall pack remaining outside as the others have been converted to LED.
HVAC	This building does not have any forced air systems and relies on a standard efficiency direct vent, propane burning, wall furnace with a maximum input of 16,560 Btu/h. The restroom has a small baseboard with a dial thermostat set to a constant 50 degrees to avoid pipe freezing. There is a new half-ton window unit AC.
Domestic Hot Water	The domestic hot water load is provided by (1) 2-gallon, 2-year-old electric water heater located in the basement storage area. Based on the occupancy and age of this unit it is not recommended to upgrade to a heat pump water heater.
Building Controls	There are no controls at this building. The furnace relies on its own thermostat for heating and the window AC unit is operated as needed by the occupants.
Process Loads	There is a washer and a drying machine that is used for sports uniforms and other equipment. It is unknown how often laundry is cleaned and how much of the site's total electrical load is consumed by these units.
Renewable Energy Systems	This site does not have any existing renewable energy systems. An initial review of the site yielded that the south-facing sloped roof is a desirable location that can potentially accommodate a solar array.

Table 5: Description of Systems

Energy Use Overview

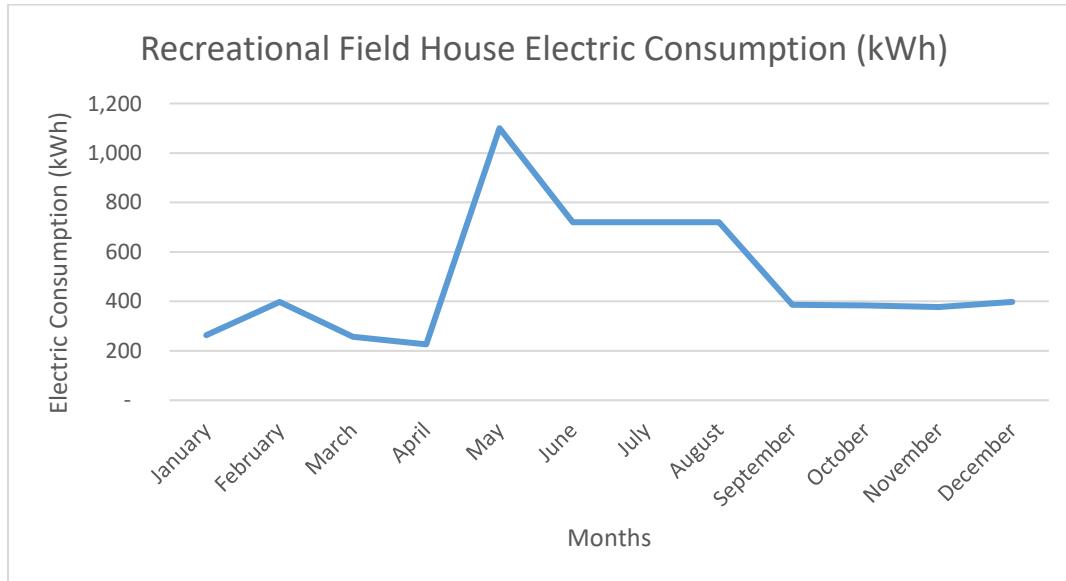
Electricity Consumption

The site has one electric account, Acct# 13828200017, that serves the entire facility. There is one electric meter (Meter# 2347893) feeding the 200A, 120/240V main electrical panel.

Normalized Electric Usage

Month	2022 Electricity Consumption (kWh)	2023 Electricity Consumption (kWh)	Normalized Electricity Consumption (kWh)
January	263	57	263
February	398	41	398
March	257	86	257
April	226	155	226
May	1058	648	1,100
June	894	723	721
July	1392	898	721
August	883	481	721
September	386	329	386
October	383	149	383
November	377	43	377
December	398	108	398
Totals:	6,915	3,718	5,950

Table 6: Electricity Usage (2022 Usage, 2023 Usage, & Weather Normalized to Represent an Average Year)



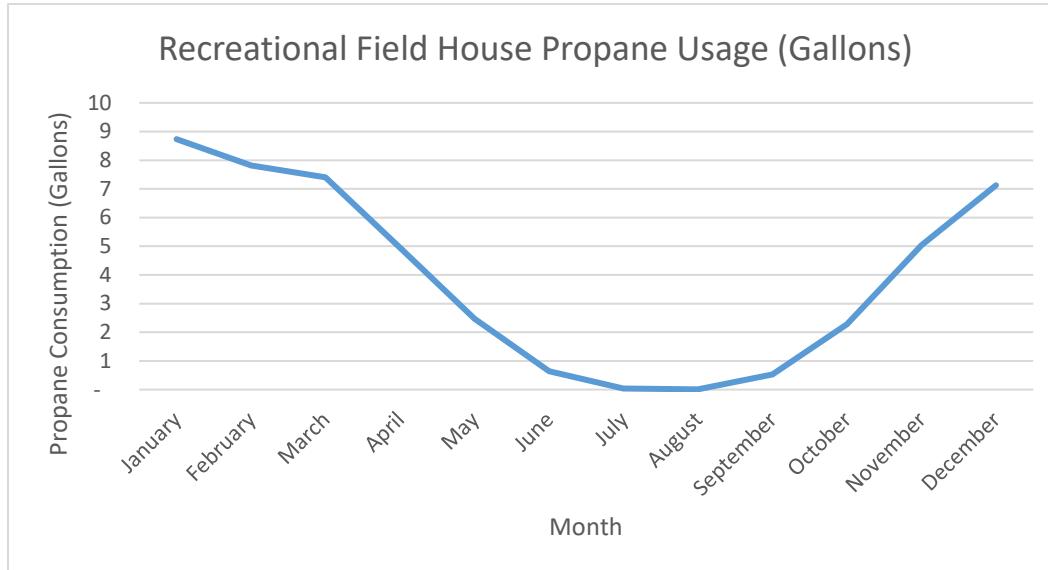
Deliverable Fuel Consumption (Propane)

The site only utilizes propane for the single direct vent furnace.

Normalized Propane Usage

Month	2022 Propane Consumption (Gallons)	2023 Propane Consumption (Gallons)	Normalized Propane Consumption (Gallons)
January	9	15	9
February	7	16	8
March	6	14	7
April	4	9	5
May	2	5	2
June	1	1	1
July	0	-	0
August	0	0	0
September	0	0	1
October	2	3	2
November	4	13	5
December	6	18	7
Totals:	42	94	47

Table 7: Propane Usage (2022 Usage, 2023 Usage, & Weather Normalized to Represent an Average Year)



Energy Usage & Carbon Emissions Benchmarking

Energy Usage Intensity (EUI)

Energy Usage Intensity measures how much energy a facility uses with respect to its size. Based on the noted square footage and the available utility consumption data, the Truro Recreational Field House had an EUI of approximately 49.0 kBtu/Sqft/yr in 2022 which is below the national median reference value of 40.1 kBtu/Sqft/yr reported for “Other – Public Services” by Energy Star Portfolio Manager Data.

<https://portfoliomanager.energystar.gov/pdf/reference/US%20National%20Median%20Table.pdf>

Carbon Emissions Index (CEI)

Benchmarking the carbon emissions of any facility begins with identifying the quantity and types of the fuels used to operate a facility. Organizations such as local, state, and federal governments continue to implement regulatory compliance policies requiring carbon emissions of buildings to be calculated and benchmarked against ordinance defined emission limits.

For Climate Leader Communities in the state of Massachusetts, the carbon emissions index is a measure of Metric Tons (MT) of CO2e/sf/yr which accounts for the different carbon emissions values of each unit of fuel type considered. Based on the noted square footage of the facility and the quantities used of each fuel type, this facility has a CEI of 0.0004 MTCO2e/sf/yr. The only on-site fossil fuel use reported at this site is propane. Based on the size and occupancy profile of the facility is low with respect to most other buildings. The target carbon emissions reduction percentage is based on the total emissions from on-site fossil fuels.

EUI & CEI Benchmarking

The Climate Leader Communities program in Massachusetts requires the use of a greenhouse gas emission baseline in Metric Tons of CO2. This report utilizes DOER’s MassEnergyInsight (MEI) data provided by Cape Light Compact. As noted in the table below, the decarbonization road map required by Climate Leaders lists that both emissions from onsite fossil fuels in buildings and the energy usage intensity must be reduced by the noted percentages in the noted years.

Suggested Emission Reduction Timeline

Targets	2027	2030	2040	2050
Reduce emissions from onsite fossil fuels in buildings	-20%	-35%	-60%	-100%
Zero emission vehicles (ZEVs) in light-duty fleet adoption	5%	20%	75%	100%
Zero emission vehicles (ZEVs) in medium-/heavy-duty fleet adoption	0%	20%	50%	100%
Energy Use Intensity reduction (<i>deep energy retrofits/retro commissioning</i>)	-20%	-25%	-25%	-30%
Total Emissions Reduction Goals (% of 2022 emissions)	>15%	>35%	>65%	>95%

<https://www.mass.gov/doc/climate-leader-communities-municipal-decarbonization-roadmap/download#:~:text=The%202021%20Climate%20Law%2C%20statewide,reduction%20by%20calendar%20year%202030.>

Field House - EUI				
Year	Electricity Usage (kWh)	Propane Usage (Gal)	EUI (kBtu/sf/yr)	2030 EUI Compliance
2022	6,915	42	49.0	-
2023	3,718	94	38.1	-
2030 (Projected)	872	0	5.3	Compliant

Table 8: EUI Benchmarking

Field House - CEI					
	Propane CO2e (MT/yr)	Total CO2e (MT/yr)	CEI (MT/sf/yr)	2030 CEI Target - 35% Reduction (MT/sf/yr)	Compliance
2022	0.24	0.24	0.0004	0.0003	-
2023	0.54	0.54	0.0010		-
2030 (Projected)	0	0	0.0000		Compliant

Table 9: CEI Benchmarking (2030 Projected Emissions are Based on the Implementation of the Proposed Measures)

Decarbonization Overview

The process of decarbonizing a building involves implementing measures to reduce or eliminate carbon dioxide (CO₂) emissions associated with its operation. The goal is to make buildings more energy-efficient, use cleaner energy sources, and overall contribute to a lower carbon footprint. Here are key strategies for decarbonizing a building which includes Energy Efficiency (Foundational), Load Reduction, and Electrification measures.

The start to the decarbonization process takes a whole building approach similar to the energy efficiency process; the site is subject to an energy audit. Opportunities to upgrade the building envelope are identified and implemented. Here, envelope insulation and fenestration deficiencies are rectified to reduce heating and cooling loads. At this point, the site considers installing energy efficient equipment including but not limited to lighting, HVAC systems, appliances and any equipment specific to building use. The transition from fossil fuel-based heating systems to electric heat pumps for space heating and cooling needs to be considered at this part of the process. In concert, smart building technologies like controls based on occupancy or other parameters can be implemented to further reduce energy load.

Installing on-site renewable energy systems such as solar panels or wind turbines to generate clean, renewable electricity needs to be a part of the plan with the goals of electrification and decarbonization in mind. When the site's electric loads are reduced through energy efficiency and optimization, renewable energy systems like solar panels can be properly sized. Energy storage solutions to store excess energy generated by renewable sources, such as batteries, are part and parcel and will improve overall energy resilience.

Decarbonizing a building requires a holistic approach that considers both operational and embodied carbon, as well as the entire lifecycle of the structure. It often involves a combination of technological innovations, design considerations, and policy support to achieve meaningful reductions in carbon emissions.

Proposed Measures

Type	Measure Description	Implementation Difficulty	Cost Implication (\$/\$\$/\$\$\$)
Efficiency Measure 1	LED Lighting	Low	\$
Electrification Measure 1	Ductless Mini-Split Heat Pump	Moderate	\$\$
Renewable Energy Generation	Solar PV	High	\$\$\$

Table 4: Proposed Emissions Reduction Measures

Efficiency Measures	Load Reduction Measures	Electrification Measures	Renewables
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Efficiency & Load Reduction Measures:

LED Lighting:

The only identified efficiency measure from the on-site assessment is to upgrade all light fixtures, interior and exterior, to LED. This strategy should be explored before the electrification options to immediately reduce the facility's consumption. This conversion will allow the facility to provide the same lighting layout and reach the desired illumination levels while consuming about a third less energy than a typical fluorescent system.

Incentives: No available incentives (at this time) as Mass Save lighting program to undergo significant changes in 2025).

Electrification Measures:

Ductless Mini-Split Heat Pump:

Replacing the gas-fired equipment via electrification with Heat Pump technology will reduce the carbon footprint of the facility. The heating system, as previously noted, is a propane fired direct vent furnace operating at standard efficiency (approximately 80%). Removing this propane fired unit and introducing a heat pump mini-split will not only allow this site to reach its goal of complete electrification but it will improve the overall efficiency of heating and cooling the space. This upgrade will also include the removal of the window AC unit as the heat pump will be capable of providing both heating and cooling at higher efficiency levels.

Incentives: Mass Save prescriptive Mini-Split Heat Pump program (\$2,500/Ton)

Renewables

Solar Photovoltaic (PV) Array

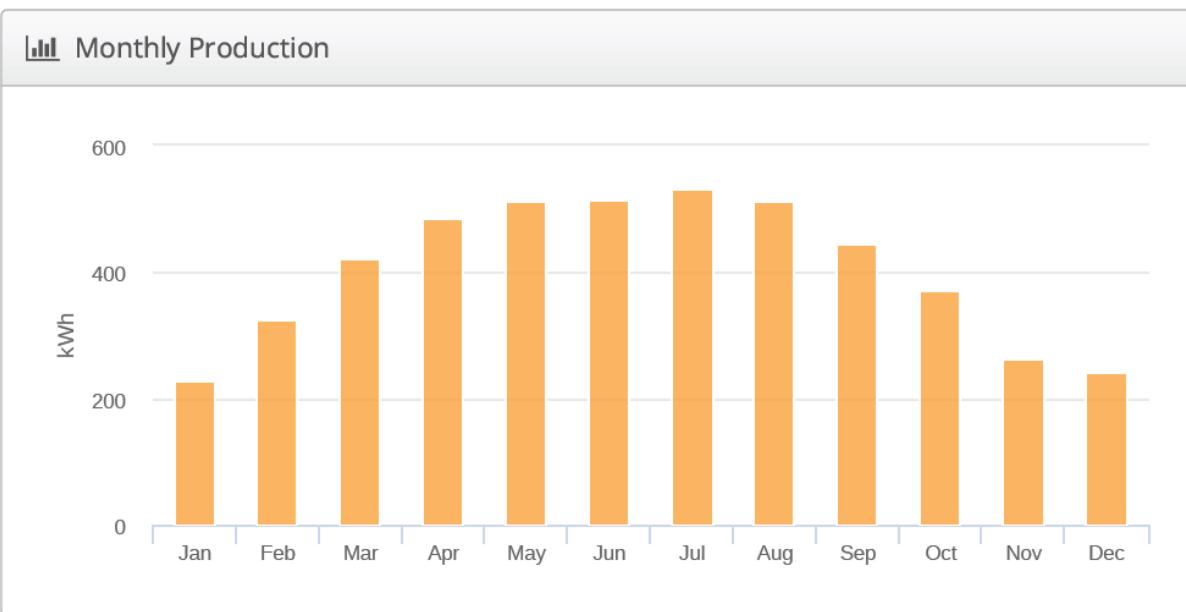
Solar Photovoltaic (PV) systems harness sunlight to generate electricity, where semiconductor materials convert sunlight into direct current (DC) electricity. These systems consist of solar panels made up of interconnected solar cells, inverters to convert DC electricity into usable alternating current (AC), mounting structures, and often include energy storage solutions such as batteries for storing excess energy. Ideally in the northern hemisphere, solar panels are south facing to receive the most direct sunlight.

The main structure's roof has a south-facing sloped roof. None of the roof space is shaded by trees or other structures. Based on preliminary solar modeling, this facility has enough roof space to accommodate several solar panels. Solar PV modules in the north-east United States are most effective and receive the most solar irradiance when facing south-west leading to a high performance ratio seen in the solar simulation performed for this site.

The usable roof space would be able to provide nearly all of the building's electrical needs. As electrification measures are implemented and propane use is eliminated, the site will consume additional electricity to meet the required heating load. In this case, solar generation would significantly support the required reduction of the sites EUI and CEI. Nevertheless, the system was modeled, and a summary of results can be found below.

PV System Summary	
Module DC Nameplate	3.51 kW
Total Estimated Annual Production	4,858 kWh
Performance Ratio	84.3%
Total Estimated Cost (Est. \$3/Watt Installed)	\$10,530
Total Tax Credits (Est. 30% Credit, 179d)	\$3,159
Total Cost Savings (Est. \$0.22/kWh)	\$1,069
Payback (After Tax Credits)	6.9 yrs

Table 11: Proposed PV System Summary



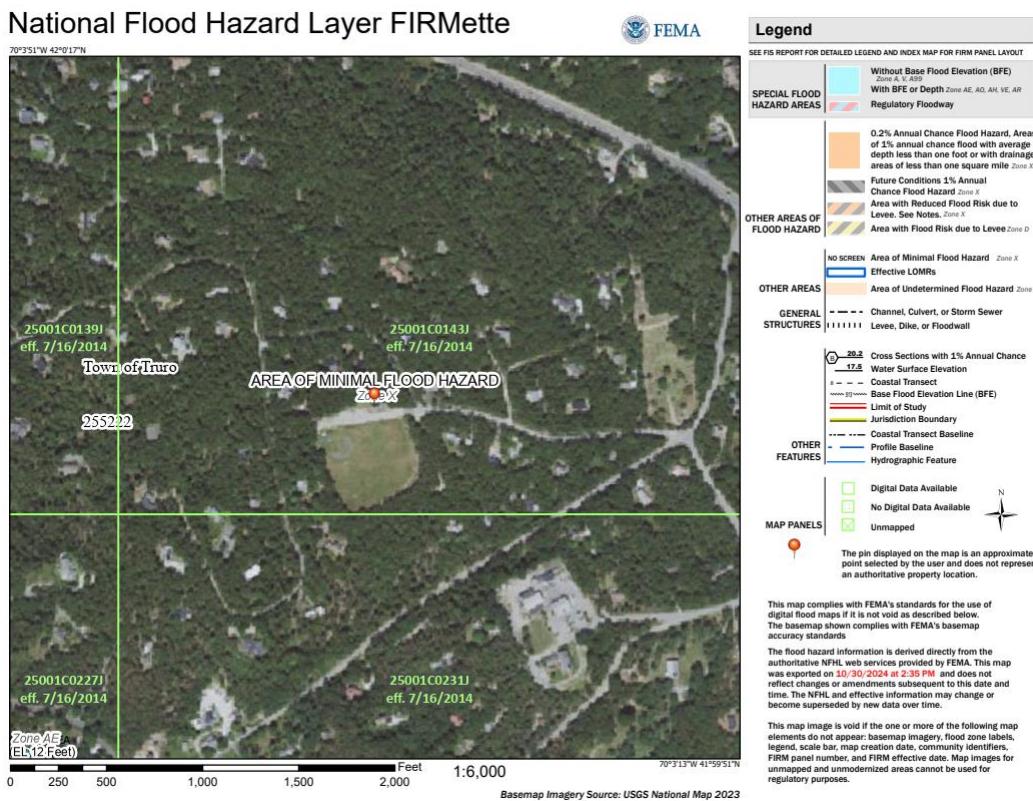
Resiliency

Backup Power Sources

In the event of a power outage or service disruption, there is no on-site backup generator to operate in brief outage periods. If the facility decides that it is necessary or beneficial to have a backup power source, it is recommended to utilize a battery storage system in conjunction with a solar PV system.

Coastal Flooding

The following depicts the National Flood Hazard FIRMette for the site location. The image below shows localized flood hazard data derived from the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs), which can help stakeholders identify flood risk and facilitate informed decision-making to mitigate potential risks. Based on this data, the building is in an area of minimal flood hazard. This indicates a low risk of flooding, with less than 0.2*% annual chance of flood events (500-year flood zone). Properties within this zone generally have a low probability of flood damage, and flood insurance is not typically required but may still be recommended for added protection. Incorporating flood-resistant designs and infrastructure ultimately safeguards lives and property and can reduce design costs when done in conjunction with designing for emission reduction measures.



Next Steps

It is recommended that you consider moving forward with the sustainable measures identified in this report. These measures represent a valuable opportunity to decarbonize the building while reducing energy usage and costs while leveraging available efficiency and sustainability incentives to decrease the overall implementation costs.

THREE EASY STEPS TO PARTICIPATE

- **Step #1:** Review your report with your Engineer and elect which measures to move forward with.
- **Step #2:** Sign proposal and schedule the installation of energy efficiency and microgrid improvements to ensure immediate meaningful energy savings and resiliency.
- **Step #3:** Recognize sustainable energy savings on a monthly basis!

Please be sure to contact Hossam Mahmoud, Sr. Energy Engineer at RISE engineering to take advantage of these opportunities today. I can be reached at hmahmoud@therisegroupinc.com or (774)-994-7269.