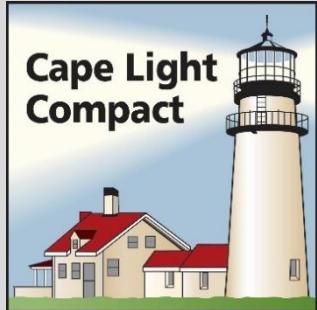


Town Of Truro – Community Center



Climate Leader Communities Decarbonization Roadmap Report

7 Standish Way, Truro MA

Prepared on November 5th, 2024



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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 Community Center in Truro, Massachusetts.

Summary of Findings

Year	EUI (kBtu/sf/yr)	CEI (MTCO2e/sf/yr)
2022	53.1	0.0015
Current (2023 Usage)	60.1	0.0017
2030 Target	39.9	0.0010
2030 Projected	17.4	0.00001

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 (\$)	Incentive (\$)	Net Cost (\$)
Lighting	2,500	-	\$550	-	\$1,340
HP DHW	6,861	-	\$1,509	\$1,000	\$8,000
ECM Pump Motors	4,297	-	\$945	\$1,400	\$8,750
Weatherization	-	18	\$63	\$209	\$133
Electrification – HVAC	(15,234)	2,265	\$4,577	\$75,000	\$375,000
Electrification – Kitchen Equipment	(10,748)	168	\$(1,777)	\$4,000	\$73,000
Solar	43,363		\$9,540	\$29,520	\$68,880
TOTAL:	31,039	2,451	\$15,408	\$111,129	\$535,103

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
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Facility Overview

General Facility Information

Building Use

The Truro Community Center building was constructed in 2007 and opened in 2009. Based on the site assessment performed, there have been no major additions or renovations to the facility. The core use of this building is devoted to the Truro community to be used as a senior center and a recreation department. The space is comprised of various areas which includes offices, an open area, a gym/gathering space, some small classroom-like spaces, and a kitchen. The typical hours of use of this facility are 5 days per week, 8AM-4PM. The facility is sometimes used over the weekend and the gathering space can be rented out by residents.

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	9,245 Square Feet
1st Floor	9,245 Square Feet

Table 3: Floor Area & Square Footage

Building Overview

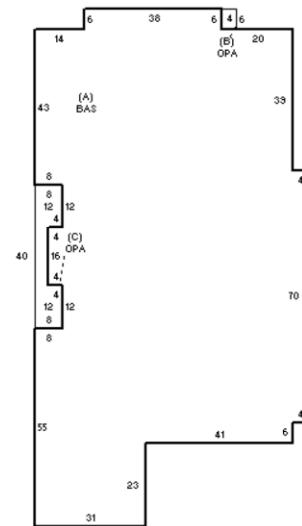
Year of Construction: 2007

Number of Stories: 1

Structure Material: Wood Frame

Building Type: Community Center

Conditioned Floor Area: 9,245 sq. ft.



General Conditions of Facility

This facility is in very 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 includes new LED lighting. Some areas are not yet 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 documentation found on-site, the insulation is up to 2008 building code and sufficiently creates thermal barriers where intended including fiberglass batt and blown spray foam in the ceiling. Some exterior doors have end-of-life weatherstripping that can be repaired. There are no renewables on-site. The hydronic infrastructure is well insulated. There are two buried propane tanks serving the HVAC system.

System	Condition	Approximate Age	Useful Life (years)	Remaining Life (years)
HVAC - AHUs	Good	16	25	9
HVAC - Boilers	Good	14	20	6
DHW	Good	8	13	5
Windows	Fair	16	20	4+
Envelope	Good	16	-	-
Lighting Systems	Good	5	10	5
Renewable Energy Systems	N/A	-	-	-

Table 4: Facility and System Conditions

Site Summary

The Truro Community Center was built in 2007 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 new spray foam ceiling insulation. Double-paned windows original to construction are in okay condition. Exterior door weather stripping requires some updating in a few locations. Shingles on the roof appear to be in good condition.
Electrical Infrastructure	The main distribution panel is rated for 400A. There are several sub-panels providing downstream service to HVAC equipment, lighting, and plug loads. A transfer switch located in the main electrical room provides the necessary operation to power the facility with the backup generator. Although the 400A service is sufficient for the current operation, it was noted that all breakers were in the on-position, implying that all breakers were loaded and that there is no additional space within the panels. When the site moves forward with the electrification of their HVAC systems, additional electric panels and/or service may be needed and so a further study into the capacity and loading constraints on the existing electrical infrastructure will be required.
Carbon-Based Fuel Sources	There are two underground propane tanks fueling the gas-fired condensing boilers and kitchen equipment. There is a 50kW diesel backup generator on site. The only other carbon-based fuel source used on-site is the kitchen equipment which has minimal use.
Lighting Systems	The lighting fixtures within the space are primarily LED consisting of a mix of linear LED tubes in surface wraps and troffers in addition to LED downlights. There are still a few areas that have not been upgraded to LED which includes back of house areas like electrical, mechanical, and storage spaces. Exterior parking lot pole lighting is

	<p>all LED. There are a few building-mounted wall packs with compact fluorescent plug-in lamps that can be converted to LED.</p>
HVAC	<p>The HVAC system at this facility is comprised of multiple pieces of equipment including (4) AHUs, (2) 266MBH high efficiency condensing boilers, (3) AC Condensing Units, and (1) small dedicated mini split for the kitchen.</p> <p>The hydronic boilers operate in a lead-lag manner and provide hot water that is circulated by pumps (that are not speed controlled) to perimeter hydronic baseboards and several fan coil units located in back of house spaces. The hydronic baseboards have TRVs that are rarely adjusted but are adjusted manually as needed. Hot water piping within the mechanical space is effectively insulated to reduce system losses.</p> <p>The (4) large AHUs, all located in the mechanical penthouse. AHUs 1, 2, and 3 have the capability to utilize the hot water from the boilers but have had the HW valves closed to avoid over-heating within the space. AHU-4 serving the kitchen is not associated with any of the (3) outdoor condensing units for cooling and has its own standard efficiency propane fired heating section which can provide a maximum output of 120MBH. Each of the AHUs serve (4) main dedicated spaces which are the Offices, Multipurpose room, the activities/hallway space, and the kitchen. AHUs 1, 2, and 3 have recently been outfitted with dehumidifiers. The outdoor DX condensing units that serving AHUs 1, 2, 3 are original to construction and are rated for 20 Tons, 6 Tons, and 7.5 Tons, respectively.</p>
Domestic Hot Water	<p>The domestic hot water load is provided by (1) 52-gallon, 8-year-old electric water heater located in the mechanical room. This electric resistance heater, however, can be upgraded to a heat-pump DHW heater for increased efficiency levels. Furthermore, this water heater has a 1/8HP return water circulation pump motor which does not feature variable speed control.</p>
Building Controls	<p>There is no central BMS system, but all AHUs and main spaces are each controlled by a single controller. There are Tekmar heating controls for the boilers which have an outdoor air temperature (OAT) cutoff set at 55 degrees. CO₂ sensors were seen within the space implying demand control ventilation is utilized within an equipment level sequence of operations.</p>
Other Equipment	<p>This facility has a small kitchen that has some gas fired equipment and a kitchen hood. This equipment is not used often.</p>
Renewable Energy Systems	<p>There are no existing renewable energy systems on-site. The southwest facing roof above the multi-purpose space is a desirable location that can potentially accommodate a solar array that can significantly off-set the sites electric consumption.</p>
EV-Charging	<p>The town has plans to implement two EV-charging stations at this facility in the near future.</p>

Table 5: Description of Systems

Energy Use Overview

Electricity Consumption

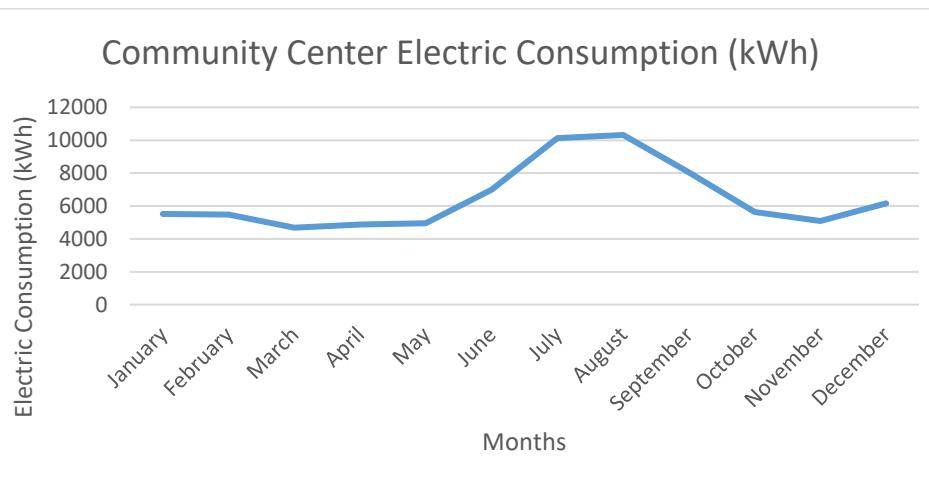
The site has one electric account, Acct# 27516490011, that serves the entire facility. There is one electric meter (Meter# 5089871) feeding the 400A, 120/240V main distribution panel to energize the facilities sub-panels and downstream loads. The facility utilizes a gas-powered generator capable of providing 50kW to one transfer switch.

Site Electric Usage

Month	2022 Electricity Consumption (kWh)	2023 Electricity Consumption (kWh)
January	5,520	6,240
February	5,480	6,640
March	4,680	6,000
April	4,880	5,400
May	4,960	5,000
June	7,000	5,920
July	10,120	11,160
August	10,320	10,520
September	8,040	10,240
October	5,640	7,440
November	5,080	6,360
December	6,160	6,600
Totals:	77,880	87,520

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

Table 6 above and the associated usage graph below shows consumption data rather than normalized usage. Weather-normalizing the usage would consider space heating (which does not exist at this site) and would also inaccurately represent the cooling load.



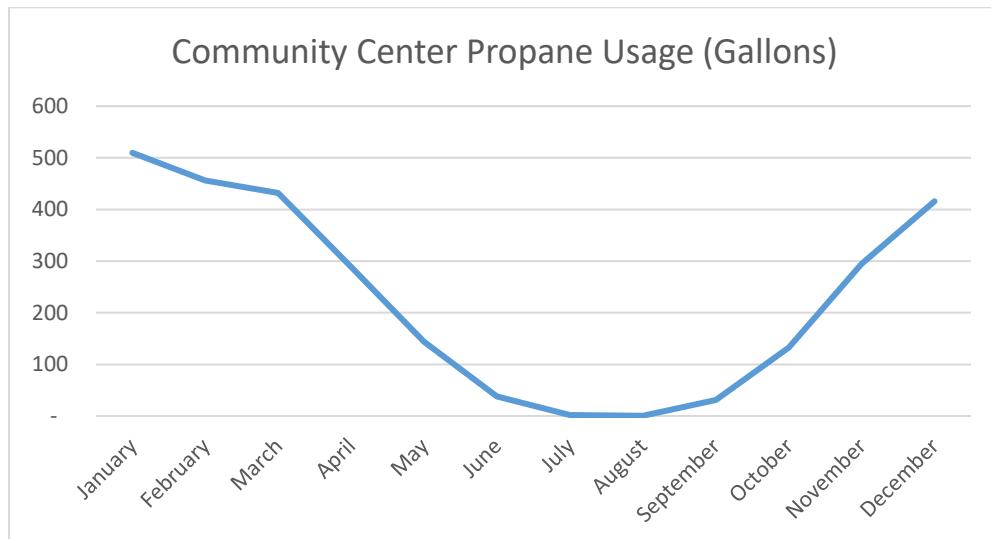
Deliverable Fuel Consumption (Propane & Diesel)

The site utilizes propane for the condensing hydronic boilers and for the kitchen equipment. The backup generator uses diesel fuel, but there is no available or reported diesel usage for this site.

Normalized Propane Usage

Month	2022 Propane Consumption (Gallons)	2023 Propane Consumption (Gallons)	Normalized Propane Consumption (Gallons)
January	528	444	510
February	428	464	456
March	372	429	432
April	234	259	289
May	130	146	144
June	35	39	38
July	2	-	2
August	1	1	1
September	29	7	31
October	115	90	133
November	227	371	294
December	351	539	416
Totals:	2,451	2,791	2,745

Table 6: 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 Community Center had an EUI of approximately 53.1 kBtu/Sqft/yr in 2022 which is below the national median reference value of 56.1 kBtu/Sqft/yr reported for “Social/Meeting Hall” 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 0.0015 MTCO2e/sf/yr. The only on-site fossil fuel use reported at this site is propane. Although the generator requires diesel there is no available or reported usage. 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.>

Community Center - EUI				
Year	Electricity Usage (kWh)	Propane Usage (Gal)	EUI (kBtu/sf/yr)	2030 EUI Compliance
2022	77,880	2,451	53.1	-
2023	87,520	2,791	60.1	-
2030 (Projected)	36,093	0	17.3	Compliant

Table 7: EUI Benchmarking

Community Center - CEI					
	Propane CO2e (MT/yr)	Total CO2e (MT/yr)	CEI (MT/sf/yr)	2030 CEI Target - 35% Reduction (MT/sf/yr)	Compliance
2022	14.12	14.12	0.0015	0.0010	-
2023	16.08	16.08	0.0017		-
2030 (Projected)	0.0	0.0	0.0000		Compliant

Table 8: 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 include 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	\$
Efficiency Measure 2	ECM Pump Motors	Medium	\$\$
Efficiency Measure 3	HP DHW	Medium	\$\$
Load Reduction Measure 1	Door Weatherstripping	Low	\$
Electrification Measure 1	Air-to-Water HP Hydronic Boiler Replacement	High	\$\$\$
Electrification Measure 2	Ducted AHU HP Units / LEV Kit	High	\$\$\$
Electrification Measure 3	Ductless Mini-Splits (Offices)	High	\$\$\$
Renewable Energy	Solar	High	\$\$\$

Table 9: Proposed Emissions Reduction Measures

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

The noted efficiency and load reduction strategies shown in the table above provide an overview of measures that can be explored before electrification options to immediately reduce the facility's consumption. Although some measures are more difficult to implement than others, any of these measures will either reduce the consumption to operate (i.e. Lighting) or will support the HVAC system by reducing envelope losses (i.e. Weatherization) and in turn, reduce the load on the HVAC system that is required to meet desired temperature setpoints.

LED Lighting:

It is recommended to convert the remaining fluorescent lighting equipment to LED. This facility has very few remaining fluorescent fixtures but converting them will provide energy savings that will reduce the energy usage index and support the facility with reaching reduction goals.

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

Heat Pump Domestic Hot Water Heater:

The existing domestic hot water heater is an electric resistance unit that can be replaced with a Heat Pump water heater to improve DHW efficiency. Heat pump water heaters move heat rather than creating it and can provide efficiencies roughly three times higher than that of standard electric resistance units throughout the facility.

Incentives: Mass Save prescriptive incentives based on size of the unit (HP Water Heaters under 80 gallons may qualify for an incentive of \$1,000/unit).

ECM Pump Motors:

The existing pump motors serving the hydronic heating system and the domestic hot water system are not variable speed controlled and can be replaced with Electronically Commutated Motors (ECM) to reduce the energy required to circulate hot water. Using ECMS will reduce the speed of the motor based on the demand for hot water to terminal units and in turn reduce the electricity consumed to do so.

Incentives: Mass Save prescriptive incentives based on type and motor horsepower.

Weatherization:

Removing gaps, cracks, and other spaces where conditioned air (heated or cooled) can be leaked is typically a low-cost option with immediate benefits to the facility. As air is leaked out or air infiltration makes its way through building fenestrations, it forces the HVAC system to make up for thermal losses and in turn, consume more energy whether it be electricity or a fossil-fuel. It is recommended to upgrade the few locations on exterior doors at this site to reduce the HVAC load and improve overall occupant comfort.

Incentives: Mass Save custom incentive for buildings over 8,000sqft.

Electrification Measures:

Replacing the gas-fired equipment via electrification with Heat Pump technology will reduce the carbon footprint of the facility. Although there may be challenges with implementation due to the nature of retrofitting new equipment to an existing system, the electrification pathway coupled with the previously

noted load reduction strategies will not only support the movement away from fossil fuel, but it will also support decarbonization.

[HVAC Electrification:](#)

Replacing the gas-fired equipment via electrification with Heat Pump technology will reduce the carbon footprint of the facility. Although there may be challenges with implementation due to the nature of retrofitting new equipment to an existing system, the electrification pathway coupled with the previously noted load reduction strategies will not only support the movement away from fossil fuel, but it will also support decarbonization.

There are a variety of opportunities at this facility to electrify the heating system as well as improve the efficiency of the cooling system. It is recommended to replace the existing condensing boilers with an Air-to-Water heat pump system serving the hydronic heating system and the (3) AHUs so that they utilize heat pump technology. The (3) condenser units outside provide the cooling capabilities to these AHUs and can be converted to Heat Pump condenser units.

We recommend approaching HVAC electrification in two phases. Phase 1 is converting AHU 1, 2, and 3 to heat pump since they're two of them are at the end of their useful life. The units can be replaced with new ducted heat pump system coupled with Energy Recovery Ventilator (ERV) with CO2 sensors. The ERV will allow the system to provide building code required ventilation while reducing energy and; heating and cooling peak loads. The new heat pump ducted systems will act as the primary source of heat. AHUs 1 and 2 serving the activities area, hallways, and the offices can utilize standard heat pump equipment. AHU-3 is a 20 Ton unit and would require an alternative, upgraded solution such as an LEV kit as the market does not yet have heat pump units of that size available. LEV kits introduce the ability to connect the existing 20 Ton Trane AHU to a VRF (Variable Refrigerant Flow) unit and implement efficiency improvement measures such as DOAS (Dedicated Outdoor Air System). AHU-4 (serving the kitchen) is a gas fired unit that does not provide any cooling as the cooling in the kitchen is provided by a ductless mini-split. To follow suit with decarbonization and electrification measures, AHU-4 should be upgraded to a heat pump system

Phase 2 will involve replacing the boiler with an air-to-water heat pump when it reaches the end of its useful life. The hydronic system will act as a supplemental source of heat to the Phase 1 ducted heat pumps. The proposed air-to-water system will need careful engineering design by an engineering professional where the existing hydronic infrastructure and distribution will be assessed for conversion. Additionally, it is recommended that the electrical infrastructure and loads are checked by a professional electrical engineer.

Incentives: Heat Pump incentives may vary depending on the current Mass Save program at the time of install but is currently \$2,500/ton for qualified units.

[Kitchen Equipment Electrification:](#)

The existing kitchen equipment utilizes propane as its fuel source. The kitchen has a large cooking range and an oven. To fully displace fossil fuel use at this site, the kitchen equipment will need to be upgraded to electric. The only propane systems at this site other than the HVAC equipment is the kitchen equipment. It is important to note that new and electric powered kitchen equipment will significantly increase the amperage draw on the kitchen subpanel and thus infrastructure upgrades will likely be

required. It is recommended to have an electrical engineer verify power requirements before implementing this measure.

Incentives: Mass Save currently offers incentives for Kitchen equipment but varies based on the type of equipment installed. The incentive for converting the Community Center kitchen equipment will likely range between \$2,000 and \$4,000/unit.

Code Triggers:

Replacing the existing systems with electrification measures will trigger the requirement for energy recovery and would therefore require the addition of an Energy Recovery Ventilator (ERV). Not only do ERVs ensure that the proper ventilation rates are met by supplying the proper amount of fresh air to occupied spaces, but they also utilize a heat exchanger allowing for enthalpy (heat energy) within the air exhausted from the space to be re-used. Doing so enables the HVAC system to operate at higher efficiencies while meeting code requirements.

Hydronic Heating System Infrastructure:

The hydronic heating system is comprised of (2) 266MBH high efficiency condensing boilers, constant speed circulation pumps, and terminal units which include baseboard radiators, fan coil units, and the AHUs. However, the facility's staff noted that they have closed the hot water valves feeding AHUs 1, 2, and 3 to avoid overheating the space. Hot water piping is well insulated. The condensing boilers still have useful life remaining but will be reaching the end of their useful lives when the 2030 benchmark year arrives. As the main consumers of fossil fuel on-site, it is recommended to replace these boilers with a heat pump-based system before failure and within the required carbon emissions reduction requirement set forth for the year 2030.

Renewables:

Solar Photovoltaic (PV) Array

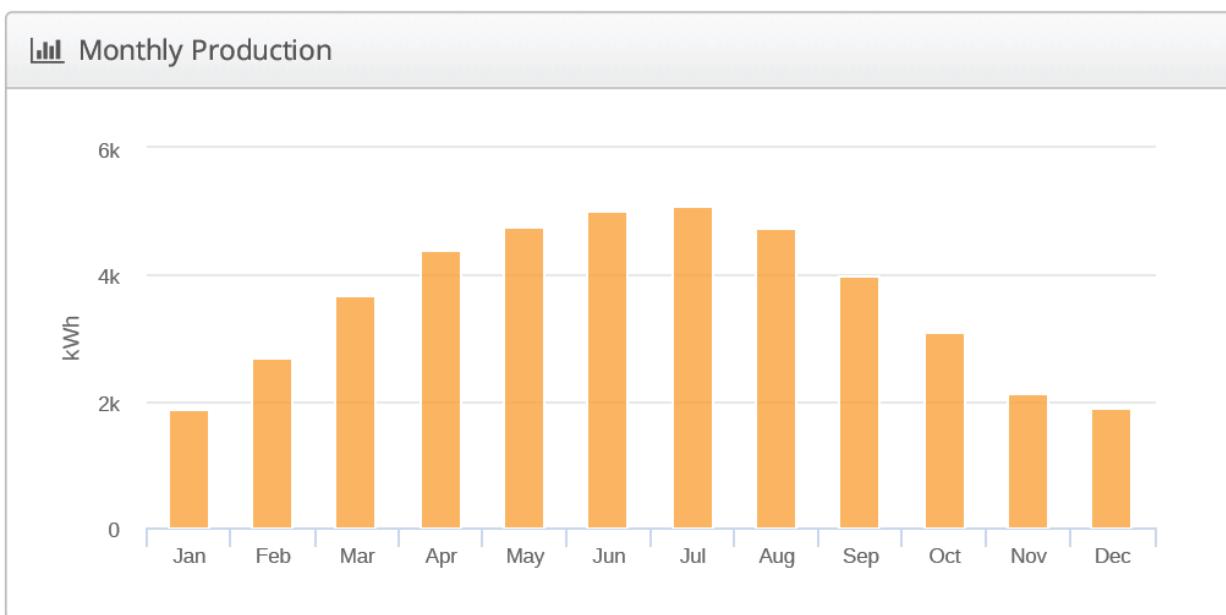
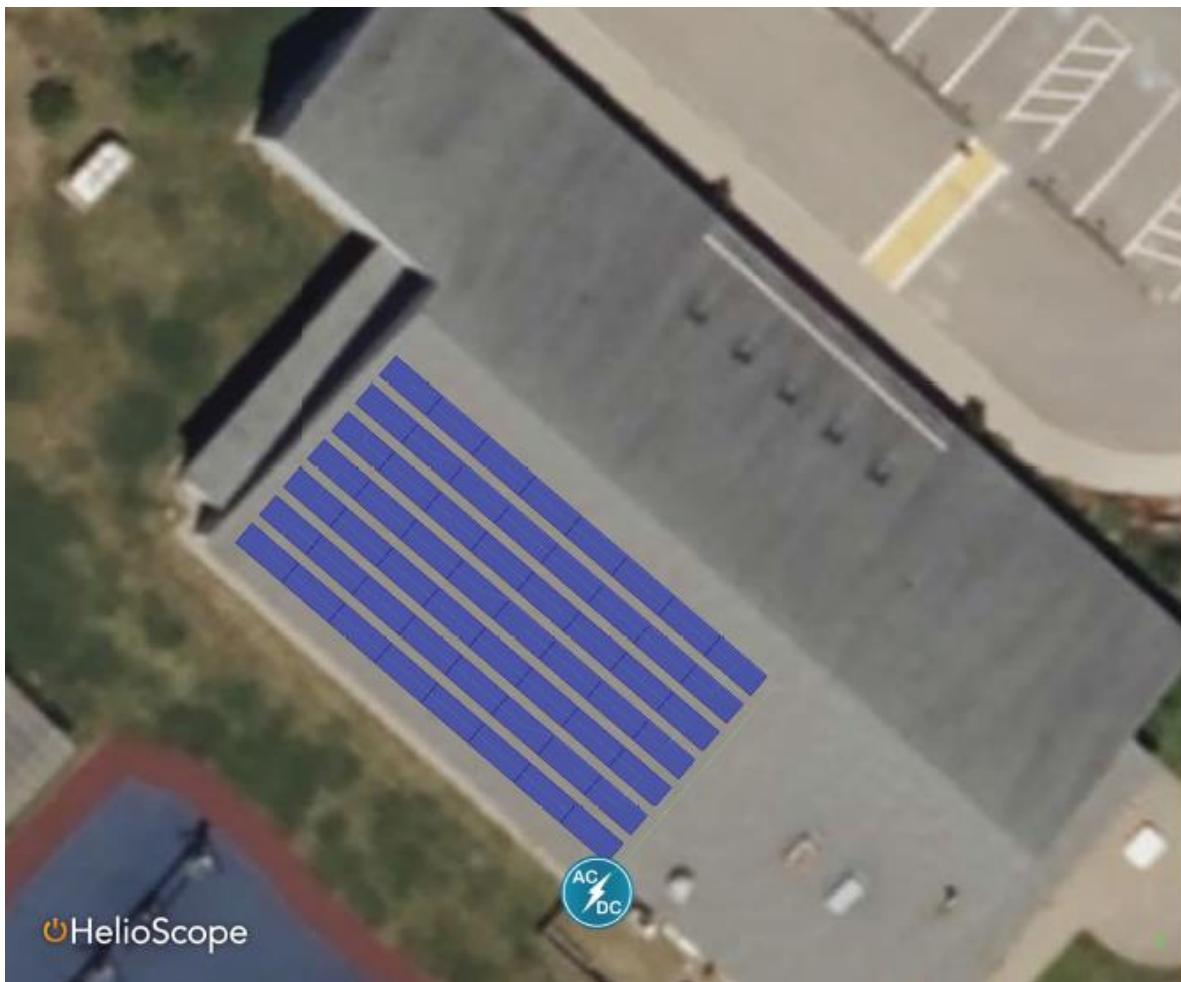
Solar Photovoltaic (PV) systems harness sunlight to generate electricity, where semiconductor materials convert sunlight into direct current (DC) electricity. These systems consist of solar panels made up of interconnected solar cells, inverters to convert DC electricity into usable alternating current (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-west and a north-east facing sloped roof. None of the roof space is by trees or other structures. Based on preliminary solar modeling, this facility has enough roof space to accommodate solar on the south-west facing roof section. 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 not be sufficient to provide the building with all of its electrical needs but could generate almost half of the current annual electric consumption. As electrification measures are implemented and propane use is reduced/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, and more details can be found in it. It is important to note that the values in the table below are preliminary calculations that will likely change given the variability of installation costs, incentives, electricity rates, and any other factors that impact overall performance of the system and the associated economics. It should also be noted that the existing roof is reaching an age at which a new roof would be needed before implementing solar. Although the cost of upgrading the roof is not included in the solar PV economics in the table below, it should be considered within the solar conversation when developing a roadmap to decarbonize and reduce grid-based fuel consumption.

PV System Summary	
Module DC Nameplate	32.8 kW
Total Estimated Annual Production	43,363 kWh
Performance Ratio	83.8%
Total Estimated Cost (Est. \$3/Watt Installed)	\$98,400
Total Tax Credits (Est. 30% Credit, 179d)	\$29,520
Total Cost Savings (Est. \$0.22/kWh)	\$9,540
Payback (After Tax Credits)	7.2 yrs

Table 10: Proposed PV System Summary



Resiliency

Backup Generator

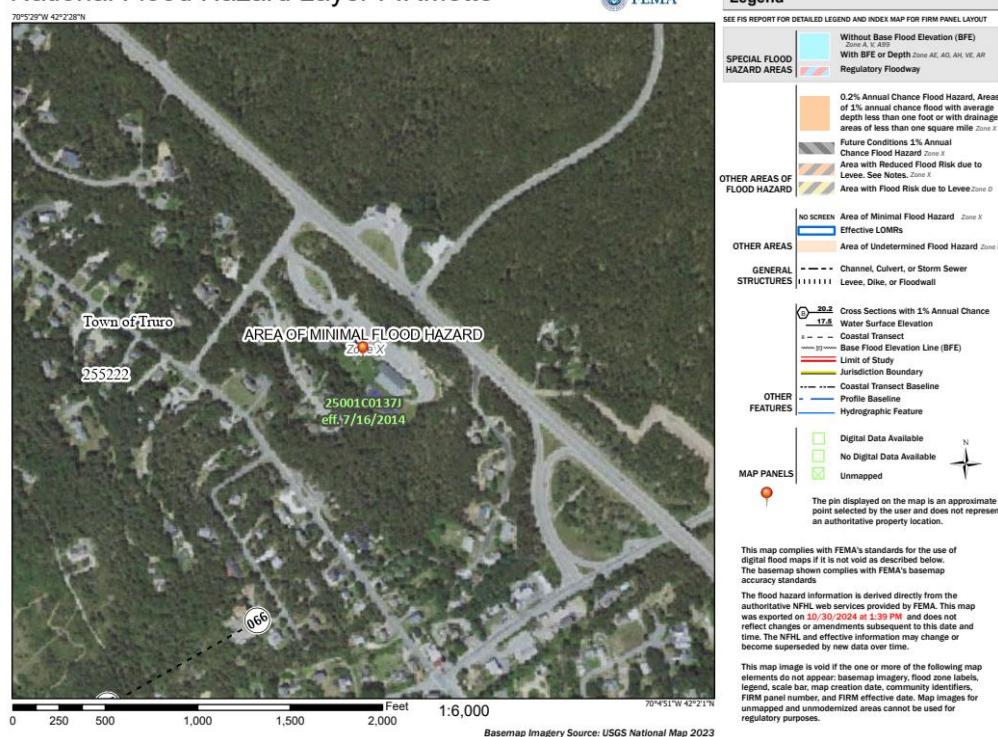
A 50kW diesel backup generator is currently utilized by the facility. This generator is a crucial component to enhance and maintain reliability, resilience, and energy availability. In the event of a power outage or service disruption, the backup generator can quickly and automatically kick in, allowing the facility to operate in brief outage periods. This ensures a continuous and reliable power supply to critical loads, even during emergencies or natural disasters.

The backup generator seems to be in good condition and sufficiently sized for the site. This existing backup generator, while helpful, is still a fossil-fuel consuming piece of equipment. Further studies and development of a Solar PV system in conjunction with a battery storage system would support the facility with phasing out of fossil fuel use.

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.

National Flood Hazard Layer FIRMette



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.