FINAL ENERGY AUDIT REPORT

JANUARY 8, 2024

Milton Police Department
40 Highland Street
Milton, MA

Town of Milton:

Josh Eckart-Lee, Assistant Town Planner
Jack Turner, Environmental Coordinator

Report Prepared By:

Clean Energy Solutions, Inc. (CESI)
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Purpose – (from April 2023 RFP):

> "The Town of Milton has been actively engaged in work to address climate change and its effects on municipal services, energy use, and utilities. This project, "Energy Resilience in Milton: Winter Valley Microgrid" envisions a district-level microgrid composed of the Winter Valley senior housing community, Milton Town Hall, and the Milton Police Department to protect our most vulnerable residents alongside our critical municipal services when we are faced by climate-driven disasters. The Town intends to connect these three locations through a microgrid system that will allow for continued power in times of need through a system that is sustainable and locally controlled. This feasibility study will explore the current demand load of the proposed project area, as well as the timelines for installing the necessary energy generation, storage, and grid operations infrastructure, grid maintenance and ownership structure, and potential for expansion or replication throughout other areas of the town."

Site Inspection

CESI performed a site inspection at the Milton Police Department on May 15, 2023. During the visit, CESI was accompanied by Josh Eckart-Lee and noted existing conditions throughout the building. Subsequently, Milton has provided CESI with the information required to issue this final report (equipment specifications, energy and water billing data, and responses to a CESI questionnaire).

Summary of Recommendations and Draft Proforma

To date, our efforts have not revealed the need for any significant energy efficiency (EE) improvements.

An exception may be select installations of air-source heat pumps (ASHPs) to replace the split and mini-split air conditioners in certain areas. Given the very generous subsidies and tax credits available in the federal IRA legislation, the capital expenditure would be substantially discounted. Detailed engineering and financial analysis are recommended early in the Design Phase.

As the feasibility analysis evolves, we may recommend other energy and/or water efficiency improvements such as new windows, replacement toilets and aerators in all rest rooms. These and other possibilities are listed under “Other Potential Recommended ECMs” at the end of this draft report. Although they are unlikely to have short paybacks, they may be advisable for other reasons.

Our primary recommendation is to install several solar PV arrays: three rooftop, two parking lot canopy and one ground mount as well as a “battery energy storage system” (BESS), sized to meet the current (or anticipated future) peak monthly coincident electricity demand of the Police Department (as historically recorded on the two master electric meters).

<u>Rationale for sizing Solar PV and BESS installations:</u>

We generally start by maximizing the amount of solar PV that will fit at each facility. Referring to the aerial image below, the rooftop arrays would occupy space on each of the three south/southeast facing roof slopes. Due to significant tree and building shading, A canopy would be placed over the eight parking spaces to the left of the main entry from Highland Street. The ground mount array would be set back from the street in the grass field to the left of the building as you enter from the property. It would be roughly the shape of a half football field. The combined kW of the three PV location types is 214: (15kW roof, 20kW canopy and 142 kW ground). They would provide almost 150% of the Police Department’s current annual kWh energy usage allowing for net metering and community solar/sharing opportunities. Without the ground mount array about 28% of the annual kWh would be provided.

To size the BESS power rating (kW), we generally try to serve the full peak electrical load of the facility, or at least its critical circuits (the ones already served by the existing diesel generator). To size the BESS energy capacity (kWh), we start by recommending four hours of resilience at the predicted coincident average demand for each building. In

the rare case where grid power is lost for more than four hours and the solar energy is unable to keep the BESS charged, the backup generator would automatically assume the load. The kWh capacity of the BESS is the principal cost driver. We have used the most recent bid prices for mid-size systems in similar installations as a starting point for cost estimates, to be conservative.

The table below displays the estimated 10-year Cash Flow resulting from the installation of the recommended solar PV parking lot array, BESS, and new controls. The installation would cost approximately $484,000, of which a loan of $288,000 (net of the 30% investment tax credit) would be amortized with savings/revenues over a 10-year period. First year savings/revenues would be approximately $74,500 against expenses of $44,300. A funding shortfall (or Resiliency Gap) of $72,500 would have to be filled with grant or other financial sources.

Table 1- Police Department Parametric Model ProForma Cash Flow

Total Investment Estimate:	Output value	Units	Questions?
Total investment estimate in EE	$0	Dollars ($)	i
Total investment estimate in BESS and microgrid controller	$129,600	Dollars ($)	i
Total investment estimate in Solar	$354,000	Dollars ($)	i
Total investment	$483,600	Dollars ($)	i
Investment Tax Credit available in IRA	30%	Percent (%)	
Upfront or Imputed Present Value of Annual Resilience Gap or Cash Flow Shortfall	$72,540	Dollars ($)	

Annual Emissions Reduction Calculation	Output value	Units
EE savings, electric	0	kWh per year
Emission reduction from electric EE	0	metric tons per year
Solar savings, electric	212,400	kWh
Emission reduction from solar displ.	113	metric tons per year

MILTON POLICE DEPARTMENT

	Annual Energy Savings from EE Improvements	Annual energy savings from solar energy production [3] i	T&D Demand Savings	Connected Solutions "Active Demand" Response Savings	ICAP Savings	Clean Peak Standard Certificate (CPS) Revenue [1] i	SMART Revenue PV + BESS	Less: Annual System Maintenance (2% est.)	Less: Curtailment Service Provider (CSP) charge	Less: Debt Service	Annual Cash Flow [2] i	Cumulative Cash Flow	Carbon reduction (metric tons/year)
									Total investment:		$ (287,742)	$ (287,742)	
Year 1	$ -	$ 27,612	$ 9,688	$ 9,000	$ 1,620	$ 1,096	$ 25,488	$ (5,755)	$ (3,029)	$ (35,476)	$ 30,244	$ (257,498)	113
Year 2	$ -	$ 28,164	$ 9,881	$ 8,730	$ 1,620	$ 1,064	$ 24,723	$ (5,870)	$ (2,938)	$ (35,476)	$ 29,899	$ (227,599)	113
Year 3	$ -	$ 28,728	$ 10,079	$ 8,468	$ 1,620	$ 1,032	$ 23,982	$ (5,987)	$ (2,850)	$ (35,476)	$ 29,595	$ (198,004)	113
Year 4	$ -	$ 29,302	$ 10,281	$ 8,214	$ 1,620	$ 1,001	$ 23,262	$ (6,107)	$ (2,764)	$ (35,476)	$ 29,332	$ (168,672)	113
Year 5	$ -	$ 29,888	$ 10,486	$ 7,968	$ 1,620	$ 971	$ 22,564	$ (6,229)	$ (2,682)	$ (35,476)	$ 29,110	$ (139,562)	113
Year 6	$ -	$ 30,486	$ 10,696	$ 7,729	$ 1,620	$ 942	$ 21,887	$ (6,354)	$ (2,601)	$ (35,476)	$ 28,929	$ (110,634)	113
Year 7	$ -	$ 31,096	$ 10,910	$ 7,497	$ 1,620	$ 913	$ 21,231	$ (6,481)	$ (2,523)	$ (35,476)	$ 28,786	$ (81,847)	113
Year 8	$ -	$ 31,718	$ 11,128	$ 7,272	$ 1,620	$ 886	$ 20,594	$ (6,611)	$ (2,447)	$ (35,476)	$ 28,683	$ (53,164)	113
Year 9	$ -	$ 32,352	$ 11,351	$ 7,054	$ 1,620	$ 859	$ 19,976	$ (6,743)	$ (2,374)	$ (35,476)	$ 28,619	$ (24,545)	113
Year 10	$ -	$ 32,999	$ 11,578	$ 6,842	$ 1,620	$ 834	$ 19,377	$ (6,878)	$ (2,303)	$ (35,476)	$ 28,593	$ 4,048	113
Total	$ -	$ 302,344	$ 106,077	$ 78,773	$ 16,200	$ 9,597	$ 223,084	$ (63,014)	$ (26,511)	$ (354,760)	$ 291,790		1,126

Results	Output value	Units
Total Savings Year 11 (no debt payment)	$ 65,350	Dollars ($)
Approximate total years to $0 cumulative cash flow	9.9	Years
Cumulative cash flow over 15 years	$ 618,540	Dollars ($)

Existing Conditions

The Milton Police Station is located at 40 Highland Street. The main office building is a two-story structure with a full basement. It contains roughly 4,500 square feet of conditioned space. There are two smaller single-story additions containing 3,000 square feet of space to the rear of the main building and a separate 600+ square foot, single-story garage/storage building to the rear of the lot. The property has paved parking for sixty-plus automobiles, many trees and a large green lawn space separating it from Highland Avenue.

The rear of lot abuts the Beth Israel Hospital property, is on the opposite side of Canton Ave. from the Milton Town Hall and is one residential parcel removed from the Milton City Library location.

<u>Current building use patterns</u>

The building is continuously occupied by a variable number of police officers and administrative staff. Exact occupancy by hour and day has not been made available for this report. The basement contains an approximate 16 x 32-foot conference room with a large table, chairs, and several file cabinets. The basement also has a mall kitchen that sees limited use. It has a refrigerator, sink and an electric stovetop/oven. The comprehensive lighting fixture list in Appendix B illustrates that there are at least 16 separate use spaces or rooms, a hallway, two stairwells, a gym/locker room and holding cells. Importantly, the building houses the Town's Emergency Communications Center (ECC) and the Emergency Operations Control Center (EOC).

Building Shell / Exterior

The full exterior foundation is poured concrete. Interior structural walls in basement and stairwells are concrete block. The interior floors appear to be "flexicore" concrete slabs. The walls are steel frame and concrete block construction with cedar clapboard exterior siding.

Roof

The sloped roofs are wood framed with asphalt shingles of undetermined age.

Windows

The windows are in good condition. They are double hung style with either a vinyl or fiberglass frame. Glazing is double pane. Exact U-value type and age are undetermined.

HVAC

Heating

Space heating is supplied by two seven-year-old Lochinvar Model WHN hydronic condensing boilers (155 MBtu input, 144 MBtu output each). Heated water is pumped through two heating zones in the building.

Heat is provided to each room/space by a mix of hydronic baseboard heaters, recessed horizontal wall registers, and some cabinet heaters. (Photos 1602, 1610, 1598, 1674).

There is no building management system control of the system. The heat (and air conditioning) is manually turned on/off. Each room has a Daikin digital heat/air conditioning thermostat. There is no day/night/weekend scheduling.

Some areas (such as the meeting room in the basement) (Photos 1651, 1607) have wall or ceiling mounted air source heat pump terminal units that may also be providing some heating in addition to air conditioning.

Air Conditioning

Air conditioning is supplied to various sections of the building by several split systems (York mini-split system Model # GAW14L18C23S and split system Model # TCD60B31SA (Photos 1688-1692). Interior evaporator terminal units are mounted on ceilings and walls in office spaces photos (Photos 1607 and 1608). All terminal units are controlled by individual wall-mounted thermostats. Average SEER of existing equipment is 14.

Domestic Hot Water

The Lochinvar boilers described in the HVAC section also provide domestic hot water to the entire building. The boiler water is circulated through a heat exchanger in a 113-gallon storage tank. Hot water is not recirculated throughout the building.

Ventilation

Ventilation in the basement area is supplied by a Life Breath energy recovery unit Model ERV 1230. There are ceiling fans in stairwells with high ceilings. (Photos 1599,1600, 1665) as well as ceiling registers (Photos 1600, 1678). The building does not have any make up air systems. Bathroom ventilation is undermined but assumed to be by roof- or attic-located exhaust fans.

Emergency Electricity Generation

The building has a Katolight Corp., 100 kW natural gas-powered generator (Photo 1681) located at the rear of the building. Its age is undetermined. An automatic transfer switch (ATS) is used to direct the generator output to emergency loads throughout the building. Exactly which loads are served is undetermined, but it is assumed the EOC and ECC are included loads.

Solar P V/Renewable Energy Systems

The property currently does not have any renewable energy systems.

Lighting

There is a mix of LED fixtures and lamps throughout the building. Appendix B contains a full list as provided by Milton's Facilities Department staff.

Potable Water

The number of bathrooms, toilets, shower heads and sink aerators is undetermined at present. Irrigation use is also undetermined.

Energy and Water Historic Use

Electricity (air conditioning use not adjusted for cooling degree days)

	Eversource						Costs as of April 2023:		
Tariff	Rate B2/G1 Small General Service DMD						Supply	$ 0.08999	/kWh
Acct.#	2673-768-1002						Dist. Dmd.	$ 18.25	/kW over 10
Meter #	?						Trans. Dmd.	$ 17.63	/kW over 11
	Police Department						Other	$ 0.0429	/kWh
	From	To	Days	kWh	actual kW	billed kW	kWh	kW	Total
A	3/28/22	4/28/22	30	13,280	36.4	26.4	$ 1,765	$ 947	$ 2,712
A	4/28/22	5/28/22	31	10,440	24.0	14.0	$ 1,387	$ 502	$ 1,889
A	5/28/22	6/28/22	30	11,680	31.6	21.6	$ 1,552	$ 775	$ 2,327
A	6/28/22	7/28/22	31	12,840	33.6	23.6	$ 1,706	$ 847	$ 2,553
A	7/28/22	8/28/22	30	12,960	34.4	24.4	$ 1,722	$ 875	$ 2,597
A	8/28/22	9/28/22	31	11,640	28.8	18.8	$ 1,547	$ 675	$ 2,221
A	9/28/22	10/28/22	31	10,240	23.2	13.2	$ 1,361	$ 474	$ 1,834
A	10/28/22	11/28/22	30	13,680	32.4	22.4	$ 1,818	$ 804	$ 2,621
E	11/28/22	12/28/22	31	17,680	40.0	30.0	$ 2,349	$ 1,076	$ 3,426
A	12/28/22	1/28/23	30	16,080	35.2	25.2	$ 2,137	$ 904	$ 3,041
E	1/28/23	2/28/23	31	13,680	38.4	28.4	$ 1,818	$ 1,019	$ 2,837
A	2/28/23	3/28/23	31	17,360	37.2	27.2	$ 2,307	$ 976	$ 3,283
A	3/28/23	4/28/23	28	11,960	29.2	19.2	$ 1,589	$ 689	$ 2,278
	3/28/23		365	160,240			$ 21,291	$ 9,616	$ 30,907

There is an additional Tariff B1 Account 2733-216-0012
which is a non-demand account that records approximately 350 kWh per month year-round and a December peak demand of 3.3 kW in 2022.

Natural Gas (heating use not adjusted for heating degree days)

	National Grid		Costs as of March 2023:			
Tariff	G43 COMM. HEAT		Supply	$ 0.69940	/therm	
Acct.#	52418-27640		Dist.	$ 0.5159	/therm	
Meter #	5863019		Dist. Adj.	$ 0.2038	/therm	
	Police Department		Other	$ -	/therm	
	Main Office Building?				NET OF MIN. FIXED	
	From	To	Days	Therms	Total Marginal Cost	
A	2/23/22	3/24/22	29	233	$	331
A	3/24/22	4/26/22	33	128	$	182
A	4/26/22	5/25/22	29	59	$	84
A	5/25/22	6/24/22	30	48	$	68
A	6/24/22	7/26/22	32	41	$	58
A	7/26/22	8/25/22	30	36	$	51
A	8/25/22	9/23/22	29	40	$	57
A	9/23/22	10/25/22	32	60	$	85
A	10/25/22	11/22/22	28	184	$	261
E	11/22/22	12/23/22	31	89	$	126
A	12/23/22	1/25/23	33	340	$	482
A	1/25/23	2/23/23	29	387	$	549
	2/23/23			-	$	-
			365	1,645	$	2,334

Natural Gas (heating use not adjusted for heating degree days)

	National Grid		Costs as of March 2023:			
Tariff	??		Supply	$ 0.69940	/therm	
Acct.#	??		Dist.	$ 0.5159	/therm	
Meter #	5813301		Dist. Adj.	$ 0.2038	/therm	
	Police Department		Other	$ -	/therm	
	Addition to Rear?				NET OF MIN. FIXED	
	From	To	Days	Therms	Total Marginal Cost	
	2/23/22	3/24/22	29	33	$ 47	
	3/24/22	4/26/22	33	13	$ 18	
	4/26/22	5/25/22	29	1	$ 1	
	5/25/22	6/24/22	30	-	$ -	
	6/24/22	7/28/22	34	-	$ -	
	7/28/22	8/25/22	28	-	$ -	
	8/25/22	9/23/22	29	2	$ 3	
	9/23/22	10/25/22	32	25	$ 35	
	10/25/22	11/22/22	28	94	$ 133	
	11/22/22	12/23/22	31	75	$ 106	
	12/23/22	1/25/23	33	65	$ 92	
	1/25/23	2/23/23	29	68	$ 96	
	2/23/23			-	$ -	
			365	376	$ 534	

This meter likely records space heating gas usage for the rear addition to the main building.

SOURCE OF THIS GAS CONSUMPTION DATA IS AN EXCEL FILE NAMED "2023 May Milton AHIS workbook Pam" RECEIVED FROM JOSH ON 6-7-23. HAVE NOT RECEIVED ANY ACTUAL GAS BILL COPIES.

Water/Sewer

Account #:	2199909-3-003-02199-0000						
Meter #:	61040167						
Actual Readings Dates		Cubic Feet (CFs)	Total Cost	HCFs	Gallons	AVERAGE Gal/Day	
1/3/23	4/1/23	3,400	$ 698.96	34	25,432	279	
		3,400	$ 699	34	25,432	279	average
	Annual EST.	11,900	$ 2,446	119	89,012	244	average
	Quarters Est. Multiplier:		3.5				

CESI received only one bill copy. We estimated annual use from that bill.

Other Potential Recommended ECMs

- EE – Building Management System (BMS), select ASHPs, Windows, Water efficiency.
- BESS energy storage battery, utility's electric service and main switchgear? Potential to add to current critical loads served in grid outage.

- Install Public MG Display in Building

- Resilience- Communications – determine what already exists in the building. Evaluate microwave, satellite, LTE, etc. The EOC and ECC are already located in the Police Department building.

Phase 2 Recommendations:

- The Police Department is near Town Hall, the Fire Station, Milton Library and Winter Valley, and other town facilities. Explore potential for physical inclusion in MG.

- Investigate opportunities at other sites.

Next Steps (Feasibility analysis)

1. Consult Eversource engineers regarding potential changes to electric service.
2. Inspect front-end electric service with BESS in mind.
3. Consider sharing DERs among adjacent town facilities.
4. Develop costs, savings, and recommendations regarding "Other Potential Recommended ECMs."

Appendix A

Photo #:

1602 1610 1598

1674

[photos to come]

Appendix B

List of Existing LED Lighting Fixtures by Office and Common Areas

Locker Room 20 – 1x4 2 Lamp LED on switch 24 Watts each
Kitchen – 12 – 2x4 LED up lights on sensor 20 Watts each.
Basement Hall 6 – 1x4 LED up lights on switch 20 Watts each.
Emergency Operations – 10 – 2x4 LED up lights on switch 20 Watts each.
Gym – 11 1x4 LED on switch 22 Watts each
Stairway 1 – 3 1x4 LED on switch 11 Watts each
1st Floor Office – 6 – six-inch round LED on switch 9 Watts
Museum - 18 – six-inch round LED on switch 9 Watts
Emergency Communications Center
– 9 – 2 lamp LED up lights on switch 22 Watts each
And 6 – six-inch round LED on switch 9 Watts
Cell Area
– 16 1x2 2-lamp LED on switch 22 Watts each
- 8 1x4 1-lamp LED on switch 11 Watts
1st Office –
4 – 2x4 drop in indirect up lights on switch 22 Watts each
4 – 6-inch round recessed LED on switch 9 Watts
Stairway #2 – 3 1x4 LED 11 Watts each
Detective Office – 6- 2x4 drop in uplights on switch 223 Watts each
Projectors- 6- 2x4 drop in uplights on switch 223 Watts each
Detective Division - 3- 2x4 drop in uplights on switch 223 Watts each
Uniformed Division – 2 - 2x4 drop in uplights on switch 223 Watts each
Printer Area – 4 – 1x4 LED on switch 11 Watts each
Chief's Office –
3 – 1x4 uplights on switch 22 Watts each
2 – 1x4 LED on switch 11 Watts each
Administrative Office – 2 – 1x1 LED on switch 11 Watt