The Town of Boxborough Energy Reduction Plan

Prepared by the Metropolitan Area Planning Council in collaboration with the Town of Boxborough

In fulfillment of the
Massachusetts Green Communities Grant Program
Criterion 3
Adopted by the Selectboard June 19, 2024
Adopted by School Committee June 7, 2024

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Purpose and Acknowledgements

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June 19, 2024

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street, Suite 1040
Boston, MA 02114

To Whom It May Concern,

The Town of Boxborough Select Board has voted unanimously to adopt the Energy Reduction Plan addressing energy conservation measures for town buildings and facilities in an effort to reduce energy consumption by 20% within 5 years. This adoption is intended to satisfy Criterion 3 as part of the Town's Green Communities designation.

Sincerely,

Michael Johns
Town Administrator

Michael C. Johns, Town Administrator
townadmin@boxborough-ma.gov

ACTON-BOXBOROUGH
REGIONAL SCHOOL DISTRICT
15 Charter Road, Acton, MA 01720
978-264-4700 | www.abschools.org

Peter J. Light
Superintendent of Schools

DEVELOPING ENGAGED, WELL-BALANCED LEARNERS THROUGH COLLABORATIVE, CARING RELATIONSHIPS

June 7, 2024

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street, Suite 1040
Boston, MA 02114

To Whom It May Concern:

Please be advised that ABRSD adopts the Energy Reduction Plan addressing energy conservation measures for Blanchard Memorial School in the Town of Boxborough. This adoption is intended to satisfy Criterion 3 as part of the Town of Boxborough application for Green Community designation.

Sincerely,

Peter Light
Superintendent of Schools

Wellness Equity Engagement

A. List of Contributors:

The collaborative efforts of the Town Planner, Alec Wade and MA Department of Energy Resource's Green Communities Regional Coordinator Kelly Brown were vital to produce this plan. Additionally, the partnership with Kate Crosby and Acton-Boxborough Regional School District were a critical piece in this effort.

Much of the information in this plan was derived from energy audits performed by Energy Source led by Crystal Hamlin, Rich Finn, and Brett Olesky. Additional technical assistance was provided by the Metropolitan Area Planning Council (MAPC), for the development of this plan.

II. Executive Summary

A. Narrative Summary of the Town

Located in Middlesex County, the Town of Boxborough was incorporated on February 25, 1785 and covers an area of 10.39 square miles. As of the 2020 census, the Town has a population of approximately 5,506. Known as a picturesque town in the hills with cobblestone streets downtown, it borders the towns of Littleton, Acton, Stow, and Harvard and is on the crossroads of Interstate 495 and Route 11. The Town is governed by an Open Town Meeting with a 5-member Select Board, 3 who are elected for a three-year term. The Boxborough school district includes 9 facilities, including two regional schools with Acton. The Town is connected by the commuter rail service in South Acton and Littleton, as well as a van service run by the Council on Aging for seniors and residents with disabilities.

The Town is served by Littleton Electric (LELWD) and Hudson Light and Power located in the southeast part of Town for electricity service. LELWD's service territory also includes the neighboring town of Littleton. National Grid is the natural gas service provider.

The Town has a number of sustainability efforts, such as Energize Boxborough and Bay State Textile Recycling.

In 2017, a Sustainability Committee was formed with a vision to promote a culture of sustainability that is integrated into the community for the benefit of present and future generations. The Town has also completed an MVP (Municipal Vulnerability Preparedness) Designation.

Currently, the Town is completing the criteria for the Green Communities Designation and most notably, adopted the Stretch Code in 2020. The Town is working on their Hazard Mitigation Plan with plans to pursue FEMA Building Resilient Infrastructure Communities (BRIC) grant funding, which would provide dollars for the Town to implement climate change resiliency and mitigation measures.

B. Summary of the Green Communities Program

Municipalities in Massachusetts must meet five criteria to earn Green Communities Designation from the Massachusetts' Department of Energy Resources:

- Pass zoning in designated locations for as-of-right siting of renewable or alternative energy generating facilities, research and development facilities, or manufacturing facilities.
- Adopt expedited process and permitting (maximum 1 year) under which facilities interested in locating their facility in a designated renewable zone may be sited within the municipality.
- Establish a baseline energy use inventory for municipal buildings, open spaces, streetlights and traffic lights, and water infrastructure and adopt a plan to reduce municipal energy use by 20% over 5 years.
- Adopt a fuel-efficient vehicle policy, develop an inventory of all municipal vehicles, and provide a plan for replacing non-exempt vehicles meeting certain fuel efficiency requirements.
- Adopt the Stretch Code.

Once a municipality meets these five requirements, the municipality is eligible for grants to finance energy efficiency and renewable energy projects in municipal facilities. Green Communities grants help municipalities increase energy efficiency, reduce energy bills, and reduce carbon emissions. By creating this Energy Reduction Plan, the Town of Boxborough commits to work towards reducing municipal energy usage by 20% over the next five years (2024-2029). The Town of Boxborough will actively pursue this goal through competitive grants, energy conservation measures (ECMs), and updates to its vehicle fleet. This Energy Reduction Plan is meant to serve as an outline for the Town to achieve its goal.

The Town is not bound to implementing all ECMs identified in the plan and has flexibility to change which ECMs it pursues after designation. This may especially be the case if the municipality conducts additional audits. The Town will not direct budgeted funds to a potential energy reduction project at the expense of school or municipal services. If the Town does not meet its energy reduction goal within the five-year timeframe, the Town will remain focused on advancing energy reduction initiatives and working toward more sustainable and efficient operation of its facilities.

C. Summary of Municipal Energy Uses

Total Number of Municipal Buildings: 8 buildings, see table 1

The Town has 8 buildings including one DPW (Department of Public Works) building, a Fire Station, the Sargent Memorial Library, Boxborough Historical Museum, a Police Station, a transfer station, and Town Hall. Boxborough students are part of the Acton-Boxborough Regional School District where one of the nine schools, Blanchard Memorial School, is physically located in Boxborough.

Total Number of Municipal Vehicles: 27 vehicles, see table 1

The Town's fleet consists of both gasoline and diesel fuel vehicles. The Town has 26 exempt vehicles and 1 non-exempt vehicles. Exempt vehicles are exempt from the Town's Vehicle Procurement Policy (Criteria 4 of the Green Communities program).

Total Number of Street Lights and Traffic Lights: 3 traffic lights

The 3 traffic lights are owned by the Town.

Water and Sewer: 2 drinking water pumping stations

There is one well pump for the school and one pump station for the library.

Open Spaces/Recreation: 3 Recreational Spaces

There are 2 ballfields and one soccer field.

D. Summary of Energy Use Baseline and Plans for Reduction

This Energy Reduction Plan commits The Town of Boxborough to reduce energy use in municipal facilities by at least 20% compared to Fiscal Year 2023 over five years. In the baseline year, the Town used 11,345 MMBTUs of energy. The Town of Boxborough's 20% energy reduction goal will be measured against the non-weather normalized baseline of MMBTUs. This means the Town must reduce usage by at least 2,269 MMBTUs.

Table 1: Municipal Energy Use Summary

	Number	Ownership
Buildings		-
Natural Gas Heat	7	Municipal
Natural Gas Heat	1	RSD
Electric Heat		Municipal
Electric Heat		RSD
Oil or Propane Heat		Municipal
Vehicles		-
Non-Exempt	26	Municipal
Exempt	1	Municipal
Street Lights & Traffic Lights		-
Street Lights		Municipal
Field Lights		Municipal
Traffic Lights	3	Municipal
Water and Sewer		-
Drinking Water Treatment Plant		Municipal
Drinking Water Pumping Station	2	Municipal
Wastewater Treatment Plant		Municipal
Wastewater Pumping Station		Municipal

As shown in **Figure 1**, buildings made up over 64% of the usage by facility type (i.e. building, vehicles, street/traffic light, water/sewer, and open space). As shown in **Figure 2,** the Regional School District's school located in Boxborough made up 37% of the usage by building.

Figure 1. Municipal Energy Use Baseline (FY 2023) by Facility Category

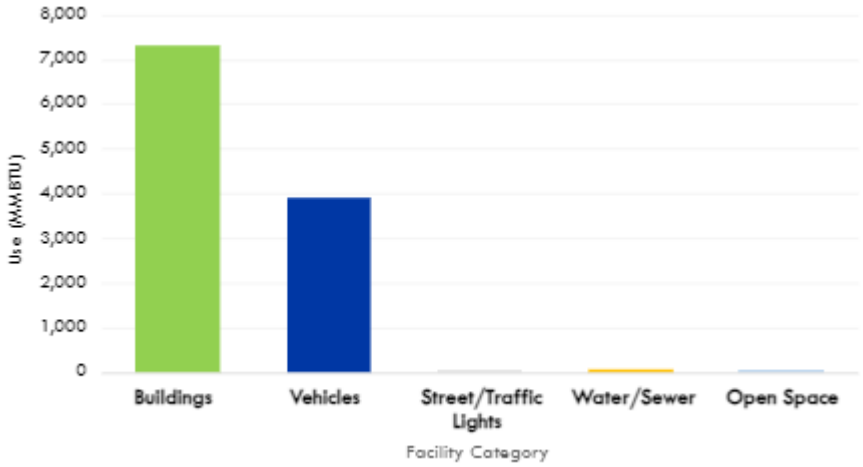
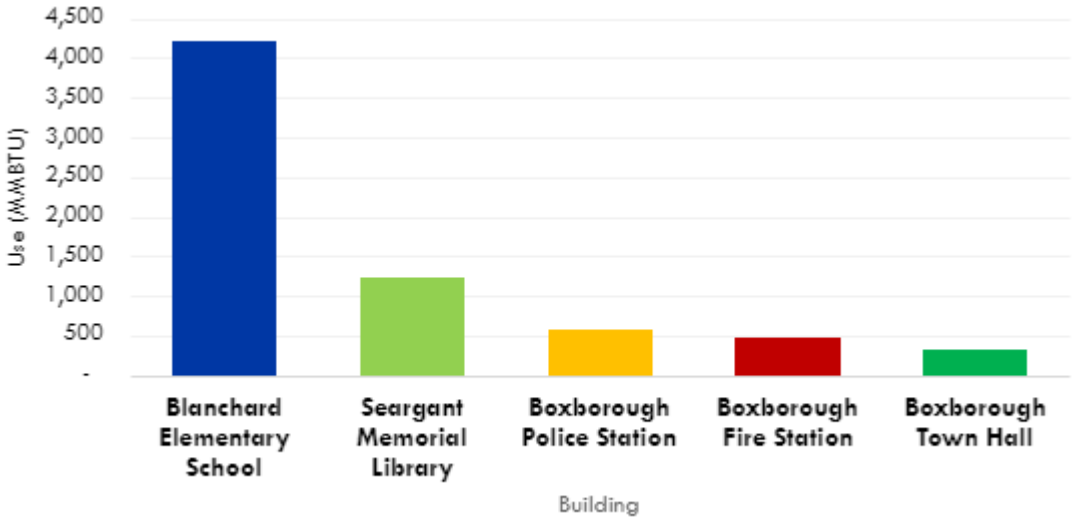


Figure 2. Municipal Energy Use Baseline (FY 2023) by Building



The Town of Boxborough has identified energy savings measures in each facility category to reduce energy use 18.7% % based on the total **non-weather normalized** usage, as illustrated in **Table 2**.

Table 2: Summary of Municipal Energy Use & Reductions				
Facility Category	**MMBTU Used in Baseline Year**	**% of Total MMBTU Baseline Energy Consumption**	**Projected Planned MMBTU Savings**	**Savings as % of Total MMBTU Baseline Energy Consumption**
Building	7,305	64.4%	2,037	18.0%
Vehicles	3,907	34.4%	84	0.7%
Street & Traffic Lights	14	0.1%	-	0.0%
Water & Sewer	83	0.7%	-	0.0%
Open Space	36	0.3%	-	0.0%
Total Non-Weather Normalized	11,345	100.0%	2,121	18.7.1%

III. Energy Use Baseline Inventory

A. Identification of the Inventory Tool Used

The Town of Boxborough used the Department of Energy Resources' (DOER) MassEnergyInsight (MEI) web- based energy inventory and analysis tool. Energy use is measured in British thermal units (MMBTUs), which allow all fuel types (e.g. electricity, natural gas, diesel, etc.) to be converted to a common unit. See Appendix F for the conversions used.

B. Identification of the Baseline Year

Fiscal Year 2023 will serve as the baseline year. Fiscal Year 2023 ran from July 1, 2022, to June 30, 2023. This will give the Town until July 1, 2029 (FY2024 – FY2029) to reach its 20% energy reduction goal.

C. Municipal Energy Consumption for the Baseline Year (FY 2023)

Appendix A presents **Table 3A** showing energy use for each municipal facility in native units and MMBTUs in the Baseline year. Note that Appendix A shows **non-weather normalized** data, because MEI only provides weather-normalized data for total town usage and fuel type. In the baseline year, the Town used MMBTUs of energy.

As shown in **Figure 3**, natural gas was the fuel type that contributed to the most energy use in the Town's energy use baseline.

Figure 3. Energy Usage in FY 23 By Fuel Type

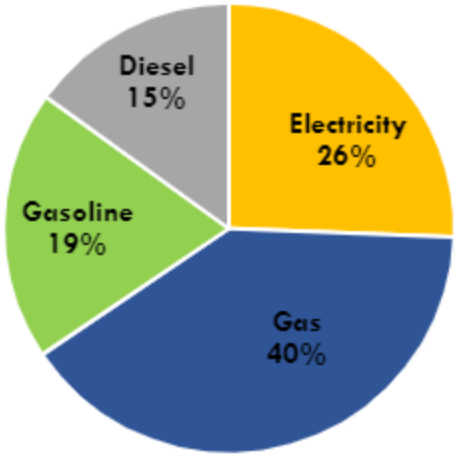
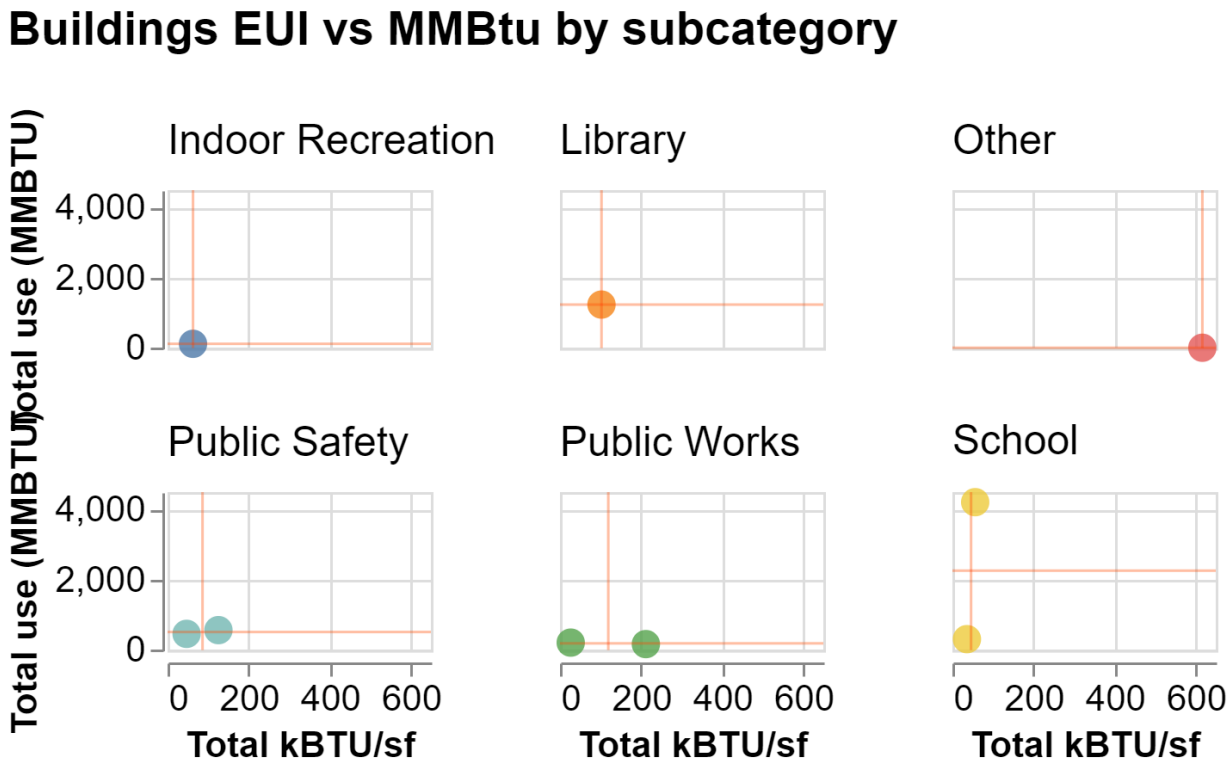


Table 3b shows that of the municipality's 8 buildings, just 5 comprise of 60% of building energy use in the Town.

Table 3b. Top 5 Energy Consuming Facilities in Boxborough

Facility	MMBTUs	Percent of FY23 Baseline
Blanchard Elementary School	4,214	37%
Seargant Memorial Library	1,239	11%
Boxborough Police Station	568	5%
Boxborough Fire Station	461	4%
Boxborough Town Hall	310	3%
Total FY 2023 Usage for Top Five	**6,792**	**60%**
Total FY 2023 Usage Baseline	**11,345**	**100%**

Figure 4. Energy Use Intensity (kBTU/sf) vs MMBtu by Building Subcategory



Points further to the right on each chart have a higher energy use per square foot (i.e. less energy efficient). Points that are more vertical use more total energy. Blanchard Memorial School (School subcategory), for example, uses the most energy of any building but has a relatively low usage per square foot.

Red lines show the medians for the Town's buildings.

D. Existing Energy Management Processes

Energy use for the Town is managed by the Department of Public Works. Energy Use for the Elementary School is managed by the regional school district's Energy Manager. The Littleton Electric Light & Water Department provides expertise on projects involving electricity and the Town's usage. Vehicles and equipment are purchased by each department individually, subject to funding available or approved at Town Meeting.

E. Energy Reduction Goal

The Town of Boxborough's 20% energy reduction goal will be measured against the non-weather normalized baseline of 11,345 MMTBUs. The Town of Boxborough will need to reduce its non-weather normalized energy consumption by at least 2,269 MMBTUs over a five-year period.

The Town will focus on reducing energy consumption in its least efficient and top energy consuming buildings through a combination of mechanical, lighting, and weatherization and building envelope measures. The Town is also considering behavioral measures such as a School Behavior Based Savings Program.

IV. Energy Reduction Plan

A. Narrative Summary

As shown in Table 4, the Town has identified energy savings measures to reduce **non-weather normalized** usage from FY 2023 by 2,121 MMBTUs or 18.7%. These measures are also summarized below.

This Energy Reduction Plan is meant to serve as a guide and provide a roadmap for the Town to work on to achieve its goal. The Town is not bound to implementing all selected ECMs identified in the plan. After becoming a Designated Green Community, the Town has the flexibility to change its pursued ECMs, especially after doing deeper audits with a selected vendor. These measures will also translate to reduced operations and maintenance costs. Behavioral and policy measures related to Boxborough's public schools and vehicle fleet have been calculated to provide additional savings for the Town's consideration throughout the five-year plan. All these measures are summarized below.

The following sections provide a building-level summary of planned energy conservation measures.

i. Funding

The total amount of funding needed, after incentives, to complete the projects identified in this ERP is $1,337,134.00. After the Town's Designation Grant funding is expended, the Town may be eligible for up to $250,000.00 annually through Green Communities Competitive Grant program. All prior projects must be completed before applying for additional funds each year – which may mean the Town does not apply for funding each consecutive year, depending on project timelines. The Town will need to complement the grant funding with local investments and other grant funding sources in order to achieve its goal over the next five year. The funding recommendations are based on past programmatic structure and timing for the Green Communities Competitive Grant program.

The Town will also need to leverage supplemental grant funding to support achieving its 20% reduction over the five years. The Town may consider pursuing MSBA (Massachusetts School Building Authority - https://www.massschoolbuildings.org/programs) funding to support energy conservation measures implemented at the schools. Another funding source that the Town intends to pursue, due to its standing as an MVP community, is Municipal Vulnerability Preparedness Action Grant Funds. Where there is overlap between preparedness and energy conservation measures, the Town will seek to support its energy reduction goals in this way. The Town will actively pursue other applicable grants when they become available and utilize resources available from MAPC and DOER to identify viable opportunities over the course of the five years.

ii. Overview of Goals for Years 1-3:

Energy Management Processes

The scheduling of projects and buildings to focus on provides a guideline, but will be reevaluated on a year to-year basis to determine the Town and School's best course of action to take as well as unforeseen factors that could push back or move forward a project. The Town and School Department will manage the order and timing of implementing energy reduction projects by taking the following measures on a year-to-year basis:

- Create a process and schedule to regularly review and check set points, particularly in largest buildings;
- Plan to develop energy efficient purchasing policy;
- Plan to amend certain job descriptions with Green Communities implementation responsibilities;
- Coordinate implementation items with all essential personnel and evaluate all potential School Department projects with their capital expenditure plan.

Energy Conservation Measures

During years 1-3 the Town has identified the following buildings and associated energy conservation measures for implementation.

Year 1

Fire Department:

- LED Lighting
    - Replace existing interior lighting or retrofitted with LED lighting technology.

Library:

- LED Lighting
    - Retrofit LED lighting, which would include new fixtures and/or retrofits for the interior spaces. The exterior pole lights and floods should be replaced with new LED fixtures. The building-mounted fixtures could be a mix of retrofit or fixture replacement.

Blanchard Elementary:

- Weatherization
    - Tighten building envelope by air sealing sections of the roof-wall intersection as well as install door weather-stripping

DPW:

- LED Lighting
    - Replace existing fluorescent light fixtures with new LED light fixtures with integrated controls

Town Hall:

- LED Lighting
    - Replace existing fluorescent light fixtures with new LED light fixtures

Year 2

Police Department:

- Weatherization
    - Install an air barrier and blowing 8" cellulose insulation on top. Add an attic hatch for access.

Fire Department:

- Weatherization
    - Install door weather-stripping on regular doors and the overhead garage door. Caulk an 84 linear feet section of the door.

Library:

- Weatherization
    - Install door weather-stripping on three doors and air seal on 240' at the roof-wall intersection

DPW:

- Weatherization
    - Weatherize the building with door weather-stripping

Town Hall:

- Weatherization
    - Add attic insulation with additional blow in cellulose to reduce heating and cooling loads

Years 2-4

Blanchard Elementary:

- LED Lighting
    - Replacing existing fluorescent light fixtures with new LED light fixtures with integrated controls.

Year 3

Police Department:

- Air Source Heat Pumps
    - Replace the existing furnaces with a heat pump air handler unit and each of the existing condensing units should be replaces with a cold climate heat pump condenser.

Fire Department:

- Pipe Insulation
    - Insulate pipes in the boiler room so that more heat reaches the intended spaces.

DPW:

- Heat Pump Garage & Office
    - A new 4-Ton air handler hear pump should be installed to replace the existing natural gas fired handler. Install three new air source heat pumps in the garage area, two in the main garage, one in the old dyno room.

iii. Overview of Goal for Years 4-5:

Energy Management Processes

The same philosophy behind the goals of years 1-3 remain with project goals in years 4-5. All projects and buildings will be reevaluated on a year-to-year basis to determine immediate need and compliance with the direction of essential personnel and committees. Logically, projects in years 4-5 are those that may take a longer time to implement either in scope or cost and therefore have been pushed back for the purpose of this Energy Reduction Plan. However, circumstances are open to change depending on the direction and year-to-year reevaluation by the Town.

Energy Conservation Measures

During years 4-5 the Town has identified the following buildings and associated energy conservation measures for implementation.

Year 4

Library:

- EMS Upgrades
    - Upgrade the BMS to control the existing HVAC equipment more effectively. Include energy-savings strategies such as demand control ventilation, optimal start/stop, and scheduling.

Fire Department:

- Air Source Heat Pumps
    - Install air source heat pumps for the 2nd floor living area and kitchen.

Town Hall:

- Air Source Heat Pumps
    - Remove and replace the existing natural gas furnace with DX cooling to four 4-Ton heat pump air handlers. Install a single zone heat pump to replace the baseboard electric heaters

Blanchard Elementary:

- Heat Pumps RTU's in Front Office & Café
    - Replace existing rooftop units with 2 15 Ton heat pump RTU's.

Year 5

Blanchard Elementary:

- Heat Pumps in Classes with Window AC's
    - Replace the 15 classrooms with window AC units with single zone heat pump systems

iv. Energy Efficiency Identification Measures:

- The Town of Boxborough should continue to utilize MEI to review data and identify if year over year trends are occurring as expected. Unexpected increases or the failure of some categories to decrease despite known interventions/retrofits should prompt further inquiry.
- Use MEI's building "Buildings to Target" tab to identify underperforming and/or wasteful

buildings based on Energy Use Intensity (see Figure 4 above).

- Conduct research and talk with experts such as energy auditors, DOER, MAPC, Massachusetts Clean Energy Center and others to find out if new technologies have come to market that could provide new savings in existing facilities. MAPC recommends exploring Massachusetts Clean Energy Center's Commercially Ready Technology's list. See http://www.masscec.com/.

B. Path to 20% Energy Use Reduction by the end of FY 2030

i. Program Management Plan for Implementation, Monitoring, and Oversight

Document Tracking

The Town of Boxborough will store all files for Green Communities, including this Energy Reduction Plan, audits, and MEI login credentials, in a cloud-based folder on the Town's computer server. Once designated, the Town will also store its annual reports, grant closeout paperwork, and grant application materials in this folder.

Green Communities Administration Lead & Point of Contact

The Town's Planner, Alec Wade, will be the Town's Administrative Lead/Point of Contact for Green Communities activities. Alec will be responsible for preparation and submission of the Town's annual reports, grant applications, and grant project related reporting. He will also be responsible for providing annual updates to the Select Board and the Sustainability Committee on the Town's progress towards the 20% reduction goal over the next five years.

MEI Maintenance Lead

The Town's Planner and contacts at LEWLD will be responsible for maintaining and updating the Town's MEI data.

Energy Conservation Measure Implementation Lead

The Facilities Department and the Town's Planner will be responsible for implementation of energy conservation measures, quarterly updates, and coordination of additional necessary building audits. The School's Energy Manager will also be responsible for leading implementation at the school.

Regular Evaluation and Tracking

The Town will convene a team to help prioritize measures. The team will consist of representatives from the regional school district and DPW and will consult the Sustainability Committee.

ii. Summary of Energy Audit(s) or Other Sources for Projected Energy Savings

Building audits were provided by EnergySource in April 2024 and provide 18.1% energy savings (2,056 MMBTUs). The Audit Report is included in **Appendix B**.

Vehicle policy and maintenance measures targeting overall vehicle usage will provide another 6.1% energy savings (696 MMBTUs). The supporting documentation for these policy and maintenance

measures are available in **Appendix C**.

MAPC developed estimates for energy savings through building operator certification trainings and **behavior-based energy programs** in schools, based on published research from the report Powering Down from the US Green Building Council's Center for Green Schools. These supplementary measures identify 1.18% additional energy savings (131 MMBTUs). The supporting documentation is included in **Appendix D**.

iii. Energy Conservation Measures

Table 4 lists recommended energy conservation measures. References for each measure is included in the table and these references are included as appendices to the Energy Reduction Plan. Projected annual MMBTU savings for each category (buildings, vehicles, water and sewer) are subtotaled to arrive at a municipal grand total of 2,121 MMBTUs.

Table 4. Estimated Energy Savings in Boxborough Municipal Facilities

Measure		Status	Energy Data				Financial Data						Reference	
			Projected Annual Energy Savings											
Category/Building	Energy Conservation Measure	Status (Completed with month/year or Planned Quarter/year)	Electricity Savings (kWh)	Natural Gas Savings (therms)	Vehicle Gasoline (gallons)	Diesel Savings (Gallons)	Projected Annual Cost Savings ($)	Estimated Total Project Cost ($)	Green Communities Grant* ($)	Estimated Utility Incentives ($)	Estimated Cost After Utility Incentives ($)	Estimated Payback After Incentives (years)	Funding Source	Source for Energy Savings
	NATIVE UNIT TOTALS:		851,539	45,340	17,725	1,709	58,373	$ 1,630,839		$ 283,705	$ 1,337,134	22.9		
Police Department	Air Source Heat Pumps	Year 3	-8,157	936			-$951	$90,024		$26,250	$63,774	-67.1	GC Grant Funding	Energy Source Energy Reduction Plan
Police Department	Weatherization	Year 2	1,376	234			$650	$55,484		$8,233	$47,251	72.7	GC Grant Funding	Energy Source Energy Reduction Plan
Fire Department	Air Source Heat Pumps	Year 4	-409	354			$336	$36,137		$7,500	$28,637	85.2	GC Grant Funding	Energy Source Energy Reduction Plan
Fire Department	Weatherization	Year 2	0	992			$1,240	$8,428		$2,976	$5,452	4.4	GC Grant Funding	Energy Source Energy Reduction Plan
Fire Department	Pipe Insulation	Year 3	0	353			$441	$8,169		$1,059	$7,110	16.1	GC Grant Funding	Energy Source Energy Reduction Plan
Fire Department	LED Lighting	Year 1	2,286	0			$594	$31,255		$0	$31,255	52.6	GC Grant Funding	Energy Source Energy Reduction Plan
Library	EMS Upgrades	Year 4	14,855	571			$4,576	$55,714		$4,124	$51,590	11.3	GC Grant Funding	Energy Source Energy Reduction Plan
Library	Weatherization	Year 2	50	168			$223	$7,660		$504	$7,156	32.1	GC Grant Funding	Energy Source Energy Reduction Plan
Library	LED Lighting	Year 1	27,364	0			$7,115	$48,775		$0	$48,775	6.9	GC Grant Funding	Energy Source Energy Reduction Plan
Blanchard Elementary	Weatherization	Year 1 (summer 2025)	2,336	2,614			$3,875	$24,834		$7,842	$16,992	4.4	GC Grant Funding	Energy Source Energy Reduction Plan
Blanchard Elementary	LED Lighting	Years 2-4	117,772	0			$30,621	$266,018		$0	$266,018	8.7	GC Grant Funding	Energy Source Energy Reduction Plan
Blanchard Elementary	Heat Pumps in Classes with Window AC's	year 5	-8,816	3,542			$2,135	$374,166		$75,000	$299,166	140.1	GC Grant Funding	Energy Source Energy Reduction Plan
Blanchard Elementary	Heat Pumps RTU's in Front Office & Cafe	Year 4	-25,843	3,542			-$2,292	$292,617		$75,000	$217,617	-94.9	GC Grant Funding	Energy Source Energy Reduction Plan
DPW	Weatherization	Year 2	0	587			$734	$4,094		$2,100	$1,994	2.7	GC Grant Funding	Energy Source Energy Reduction Plan
DPW	LED Lighting	Year 1	5,734	0			$1,491	$40,984		$0	$40,984	27.5	GC Grant Funding	Energy Source Energy Reduction Plan
DPW	Heat Pump Garage & Office	Year 3	-5,605	708			-$572	$95,940		$30,000	$65,940	-115.3	GC Grant Funding	Energy Source Energy Reduction Plan
Town Hall	Weatherization	Year 2	538	414			$657	$21,712		$1,242	$20,470	31.2	GC Grant Funding	Energy Source Energy Reduction Plan
Town Hall	LED Lighting	Year 1	10,279	0			$2,673	$22,870		$0	$22,870	8.6	GC Grant Funding	Energy Source Energy Reduction Plan
Town Hall	Air Source Heat Pumps	Year 4	-6,839	984			-$548	$130,958		$41,875	$89,083	-162.6	GC Grant Funding	Energy Source Energy Reduction Plan
Blanchard Elementary	School Behavior Based Savings Program	Years 2 -3	1,310				$5,375	$15,000		$0	$5,000	0.9	GC Grant Funding	MAPC Calculations, Appendix D
Buildings Subtotal	**MMBTU Saved:**	2,037	128,231	15,999	-	-	$ 58,373	$ 1,630,839	$ -	$ 283,705	$ 1,337,134	22.91		
Vehicle Fleet	Hybrid Vehicle Replacements		-3826.99	.	806	-	$2,163	$35,830		$0	$ 35,830	16.6	Grant Funding/Capital Investment	MAPC Calculations, Appendix C
Vehicle Subtotal	**MMBTU Saved:**	84	(3,827)	-	806	-	$ 2,163	$ 35,830	$ -	$ -	$ 35,830	16.56		
	Total MMBTU Saved	2,121	424	1,600	97	-								

C. Summary of Long-Term Energy Reduction Goals – Beyond 5 Years

A. Municipal Buildings (including schools)

To better strategize for the long-term maintenance and management of municipal buildings, Town staff will work with school and town staff as well as outside consultants, when necessary, to assess and document the condition of major municipal and school buildings. In addition to exposing continuing opportunities for energy use reductions, this effort will provide the Town with a clear, long-term asset management strategy for the effective budgeting and maintenance of buildings.

B. Vehicles (including schools)

The Fuel-Efficient Vehicle policy will have become engrained within municipal purchasing practices after 5 years. The Town is committed to exploring and replacing vehicles with comparable battery electric, plug-in hybrid, and hybrid electric models, where feasible. The Town will also seek to explore even more efficient policies and tracking systems to enable more efficiency. Additional measures include implementing an anti-idling policy, closely monitoring tire air pressure and using efficient tires, and 100% synthetic oil to reduce the number of annual oil changes needed. These additional measures, detailed in Table 5, provide more opportunity for energy savings and increase the town's savings from about 18.7% to 24.1%.

C. Perpetuating Energy Efficiency

An annual municipal audit by Town and Schools staff can tap into the knowledge of the employees who use and maintain the building every day. It can empower building staff to develop a detailed repair and management schedule and collect data on problems and inefficiencies that may be missed by traditional third party audits.

The Town of Boxborough will grow its capacity to retrofit and build more efficient facilities, purchase more efficient vehicles, and illuminate the Town through more efficient lighting throughout the 5-year period. These practices will become more engrained in the culture of the Town and will provide opportunities to instill the ethos into additional policies and programs for more dedicated long-term funding streams and strategies.

The Town may consider developing an energy reinvestment plan/mechanism in order to reinvest the savings from energy conservation measures into additional energy efficiency measures.

V. Appendix A: Table 3A - Municipal Energy Consumption for FY 2023.

Table 3a: Municipal Energy Use Baseline (FY2023)

Facility	Electric		Gas		Oil		Gasoline		Diesel		Solar Electric		Total MMBTU
	kWh	MMBTU	therms	MMBTU	Gallons	MMBTU	Gallons	MMBTU	Gallons	MMBTU	kWh	MMBTU	
Boxborough Fire Station	32,367	110	3,510	351									461
Boxborough Police Station	132,089	451	1,171	117									568
Transfer Station (Codman)	8,554	29	1,404	140									169
Boxborough Town Hall	41,761	142	1,682	168									310
Boxborough Historical Museum	6,658	23	989	99									122
Sargent Memorial Library	126,400	431	8,083	808									1,239
DPW garage/office	36,739	125	866	87									212
Blanchard Elementary School	424,900	1,450	27,635	2,764									4,214
Cell Tower	2,893	10											10
Buildings Subtotal	**812,361**	**2,771**	**45,340**	**4,534**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**7,305**
Town Traffic Lights	4,218	14											14
Street Lights/Traffic Lights Subtotal	**4,218**	**14**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**14**
School Well Pump	24,177	82											82
Pump Station for library	200	1											1
Water/Sewer Subtotal	**24,377**	**83**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**83**
Beaverbrook Soccer Field	5,582	19											19
Stow Flerra Ballfield	4,990	17											17
Liberty Square Ballfield	11	-											-
Open Space Subtotal	**10,583**	**36**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**36**
Vehicles Subtotal							**17,725**	**2,198**	**12,293**	**1,709**			**3,907**
TOTAL ENERGY USE	**851,539**	**2,904**	**45,340**	**4,534**	**-**	**-**	**17,725**	**2,198**	**12,293**	**1,709**	**-**	**-**	**11,345**

VI. Appendix B: 2023 Energy Audit Report – Energy Source

Please find the report here: Boxborough MA Energy Reduction Plan Rev. 8.pdf

VII. Appendix C: MAPC Vehicle Calculations

Table 5: Policies that Affect Fleet Gas and Diesel Usage

Anti-Idling Policy**		
All FY 2023 Gasoline Usage (Gallons)**	17,725	
All FY 2023 Diesel Usage (Gallons)	12,293	
Percent Savings	10%	Idling vehicles contribute significantly to air pollution and waste fuel, increasing fleet management costs. Municipalities across the commonwealth and the nation have seen significant cost and greenhouse gas emission reductions since implementing Town-wide "no idling" policies for municipal vehicles.*
Gallons Gasoline Saved per Year	1,773	
Gallons Diesel Saved per Year	1,229	
MMBTUs Saved per Year	**383**	
Closely Monitor Tire Air Pressure and Use Fuel Efficient Tires		
All FY 2023 Gasoline Usage (Gallons)	17,725	
All FY 2023 Diesel Usage (Gallons)	12,293	
Percent Savings	4%	Maintaining appropriate air pressure in vehicle tires can decrease that vehicles fuel consumption by as much as 4%.*
Gallons Gasoline Saved per Year	709	
Gallons Diesel Saved per Year	492	
MMBTUs Saved per Year	**153**	
Use 100% Synthetic Oil		
All FY 2023 Gasoline Usage (Gallons)	17,725	
All FY 2023 Diesel Usage (Gallons)	12,293	
Percent Savings	2%	The use of 100% synthetic oils reduces fuel consumption, the number of annual oil change and labor costs.*
Gallons Gasoline Saved per Year	355	
Gallons Diesel Saved per Year	246	
MMBTUs Saved per Year	**77**	
Total MMBTUs	**612**	
*http://www.fueleconomy.gov/feg/pdfs/OwnerRelatedFuelEconomyImprovements.pdf		

Table 6: Vehicle Measures

						Current Annual Use			Calculated Replacement Annual Use		Estimated Annual Savings		
VIN	Department	Year	Make/Model	Replacement/Retrofit Type	Combined MPG	Gasoline (FY23)	VMT (Estimated)	Cost	Electricity Use (kWh)	Cost ($0.18/kWh)	Annual Savings (gal)	Annual Savings (MMBTU)	Annual Cost Savings
1FTMF1EM4DKF49048	Town Hall	2013	Ford F-150	**Replace with Full Battery Electric Vehicle**	19	805.68	15,307.95	$2,852.11	3,826.99	$688.86	805.68	84.01	$2,163.26
					TOTALS	**805.68**	**15,307.95**	**$2,852.11**	**3,826.99**	**$688.86**	**805.68**	**84.01**	**$2,163.26**

VIII. Appendix D: MAPC Behavior-Based Energy Savings

A School Behavior-Based Energy Use Reduction Program will allow The Town of Boxborough to not only better understand the inefficiencies in their building operations, but will also help them implement programs that will work synergistically with their existing investments in energy infrastructure in school buildings. Further, this program can support or expand school curriculum by using "buildings as a teaching tool" for students.

While behavior-based energy reduction strategies have been difficult to measure or evaluate in the past, this is no longer the case. The Acton-Boxborough School District has been recognized by both DOER and the U.S. Department of Education as a national leader in implementing behavior-based energy programs that result in significant and measured energy savings. Moreover, schools with established behavior-based energy programs have reduced their energy use by 20 to 37% as a direct result to the behavior-based initiatives.

More information can be found in the Powering Down report the US Green Building Council's Center for Green Schools at http://centerforgreenschools.org/sites/default/files/resource-files/Behavior-based-Efficiency.pdf.

In 2016, four MAPC communities (Hamilton, Wenham, Salem and Swampscott), hired a consultant to oversee the implementation of a behavior-based energy reduction program in one school in each school district. The programs used a faculty lead to work with students that developed programs to ensure everyday energy savings – such as lights being turned off – as well as larger weekly savings, such as powering down all applicable electronics by end of day Friday. The programs also connected students to the facilities staff. In this way, students became an extension of the facilities staff to help monitor issues and check up on set points, etc.

Hiring a consultant is not necessary, but is highly recommended for the first year of implementation. Based on MAPC's program with the four schools, MAPC would recommend budgeting about $15,000 to $20,000 for a consultant. Also, each school would want to set aside about $500 to $1000 per year to pay for materials the students may need to implement their behavioral awareness programs.

For Boxborough, MAPC assumed a conservative 5% savings per year for electricity in one school. See Table 7.

Table 7: School Behavior-Based Savings Program

School	MMBTU Electricity FY 2023	Reduction from Program	MMBTU Saved Electricity (Annual)	kWh Saved Electricity (Annual)	Cost Savings Electricity (Annual)
Blanchard Memorial	1,310	10%	131.0	38,394	$5,375
Total	**1,310**		**131**	**38,394**	**$ 5,375**

IX. Appendix E: MMBTU Conversion Chart – DOER

MMBTU Conversion Chart

Fuel Energy Content of Common Fossil Fuels per DOE/EIA

BTU Content of Common Energy Units – (1 million BTU equals 1 MMBTU)

1 kilowatt hour of electricity = 0.003412 MMBTU 1 therm = 0.1 MMBTU

1 ccf (100 cubic foot) of natural gas = 0.1028 MMBTU (based on U.S. consumption, 2007) 1 gallon of heating oil = 0.139 MMBTU

1 gallon of propane = 0.091 MMBTU 1 cord of wood = 20 MMBTU

1 gallon of gasoline = 0.124 MMBTU (based on U.S. consumption, 2007) 1 gallon of E100 ethanol = 0.084 MMBTU

1 gallon of E85 ethanol = 0.095 MMBTU 1 gallon of diesel fuel = 0.139 MMBTU

1 gallon of B100 biodiesel = 0.129 MMBTU 1 gallon of B20 biodiesel = 0.136 MMBTU[3] 1 gallon of B10 biodiesel = 0.137 MMBTU 1 gallon of B5 biodiesel = 0.138 MMBTU[7]

1 barrel of residual fuel oil = 6.287 MMBTU