

SECTION 1. CRITERION 3: ENERGY REDUCTION PLAN ('ERP')

1.1 DOER Requirement

Criterion 3 requires municipality (including both the general government and school district) to accomplish the following:

- I. Establish an Energy Use Baseline
- II. Develop and implement a comprehensive program designed to reduce this baseline by 20% within the 5-year period following the Baseline Year

1.2 Town Compliance

a) Purpose and Acknowledgements

- I. Letters from both General Government and School Department verifying adoption of the ERP.
 - i. Please refer to Needham-CR3-Attachment 1 – Needham Select Board ERP Adoption.
 - ii. Please refer to Needham-CR3-Attachment 2 – Needham School Committee ERP Adoption.
- II. List of Contributors that Participated in the Baseline and ERP Process

The Town acknowledges the following individuals that participated in the development of the Energy Use Baseline and the ERP Process:

- i. Kate Fitzpatrick, Town Manager
- ii. Carys Lustig, Director of Finance and Administration for Public Services
- iii. Cecilia Simchak, Acting Director of Finance and Administration for Public Services
- iv. Barry Dulong, Director of Building Maintenance
- v. Nick Hill, Hill Energy Services
- vi. Beth Greenblatt, Beacon Integrated Solutions

b) Executive Summary

I. Narrative Summary of the Town

The Town of Needham is located on rocky uplands within a loop of the Charles River in Eastern Massachusetts. The Town is bordered by Wellesley on the west and northwest, Newton on the north and northeast, the West Roxbury section of Boston on the east, Dedham on the southeast and south, and Westwood and Dover on the south. Needham is

ten miles southwest of Boston, twenty-nine miles east of Worcester, and about 208 miles from New York City. Needham is situated in the greater Boston area, which has excellent rail, air, and highway facilities. Principal highways are State Routes 128 (the inner belt around Boston) and 135, and Interstate Route 95, which shares the same roadway as State Route 128. Commuter rail service is available via four stations to Back Bay Station and South Station in Boston. Needham is a member of the Massachusetts Bay Transportation Authority (MBTA), which provides fixed bus route service between Needham Junction and Watertown Square.

The Town provides full-service police, fire and emergency medical services. It operates its own water treatment and distribution system and provides sewer services through the Massachusetts Water Resources Authority. Other services include a Free Public Library, aging services located at the Center at the Heights, Youth and Family Services, Public Health, Public Works including Building Maintenance, Highway, Parks and Forestry, Engineering, Recycling and Solid Waste (including the recycling and transfer station), Administration, Fleet and Park and Recreation programming and pools at the Rosemary Recreation Complex. The School Department operates five elementary schools, two middle schools, and a high school educating approximately 5,800 students.

Needham at a Glance

Name:	Town of Needham
Incorporated:	1711
Total Area:	12.61
Elevation:	The low elevation is 68 feet above sea level and the high is 298 feet above sea level.
Road Miles:	138
County:	Norfolk
Population:	28,886 (2010 census)
Form of Government:	Representative Town Meeting
School Structure:	K-12
FY2019 Tax Rate:	\$12.39 Residential \$24.42 Commercial
FY2019 Avg. Single Family Home Value:	\$920,256
FY2019 Avg. Single Family Home Tax Bill:	\$11,402
Coordinates:	42° 16' 52" N 71° 14' 11" W

The Town is home to a St. Joseph Elementary School, Monsignor Haddad Middle School, St. Sebastian’s Day School, and Olin College of Engineering. The Beth Israel Deaconess Hospital Needham has a strong presence in Needham Center. The Town has a thriving commercial sector along Route 128 including TripAdvisor, Shark Ninja, NBC Universal, WCVB Channel 5, and many others.

II. Commitment to Energy Savings and Management and Renewable Energy

The Town takes a comprehensive approach to energy management. A few examples include:

- Energy Audit of 10 municipal buildings leading to \$467,370 investment in energy reduction over the past 7 years.
- Geo-thermal heating system at the Public Services Administration Building
- LEED certified Library and Sunita Williams Elementary School
- Pilot program of electric vehicles
- Installation of electric vehicle charging stations
- Inclusion of hybrid vehicles in the fleet
- Installation of 155.1 kW DC photovoltaic array on Sunita Williams School installed behind-the-meter
- Construction of 3,593 kW DC Photovoltaic array at the closed landfill generating approximately 4,771,000 kilowatt-hours per year
- Conversion of streetlights from mercury vapor to high pressure sodium (Note: LED conversions substantially complete)
- Participant in the Bike Share program

III. Community Supported Energy Savings and Renewable Energy Programs

In 2014, the Town sponsored Solarize Needham, resulting in ninety-nine residential solar installations. There are currently over 400 residential solar arrays in Needham. During the Fall of 2019, Needham launched Solarize Needham Plus which encourages and facilitates with homeowners the opportunities and benefits of solar photovoltaic installations, promotes the adoption of electric vehicles purchases and offers cost-effective air-source heat pump technologies for home heating and cooling solutions. The Town is currently partnering with Eversource on a residential weatherization and insulation program.

IV. Summary of Municipal Energy Uses

- i. The Town is served by Eversource Energy for both electricity and natural gas delivery. While the Town mainly relies on natural gas for space heating, the Hillside Elementary School also uses heating oil for space heating. The Town further uses both gasoline and ultra-low sulfur diesel for vehicle use.
- ii. Two solar photovoltaic arrays have been installed in the Town. The largest is at the capped landfill, which serves as a fully net metered facility. The second solar photovoltaic array is owned by the Town and directly provides solar generated electricity in a behind-the-meter installation.

The following table presents the Summary of Needham’s Energy Uses:

Table 1: Summary of Municipal Energy Users

CATEGORY	TYPE	QUANTITY	OWNERSHIP
Buildings	Electricity	12	Town
	Electricity	9	Schools
	Natural Gas Heat	8	Town
	Natural Gas Heat	7	Schools
	Fuel Oil Heat	1	Town
	Fuel Oil Heat	2	Schools
	Electric Heat	1	Town
	Geothermal	1	Town
Vehicles	Exempt	100	Town
	Non-Exempt	39	Town
	Exempt	13	Schools
	Non-Exempt	2	Schools
Streetlights		0	Utility-Owned
		2908	Town
Traffic Signals	Traffic/Hawk/Flashing	25	Town
Water/Sewer	Drinking Water Electricity	5	Town
	Drinking Water Natural Gas Heat	3	Town
	Wastewater Electricity	6	Town
	Wastewater Natural Gas	3	Town

V. Summary of Energy Use Baseline and Plans for Reductions

Table 2: Summary of Municipal Energy Use Baseline

BASELINE FISCAL YEAR 2018	MMBTU Used in Baseline Year	% of Total MMBTU Baseline Energy Consumption	Projected Planned MMBTU Savings	Savings as % of Total MMBTU Baseline Energy Consumption
Buildings	82,715	72.6%	14,621	17.7%
Vehicles	16,100	14.1%	663	0.8%
Street/Traffic Lights	3,451	3.0%	1,825	2.2%
Water/Sewer	11,334	10.0%	74	0.1%
Open Space	281	0.2%	0	0.0%
TOTAL BASELINE	113,882	100%	17,183	15.09%

c) Energy Use Baseline Inventory

I. Identification of the Inventory Tool Used

- i. The Town of Needham inventory tool is MassEnergy Insight (MEI).

II. Identification of the Baseline Year and ERP Timeframe

- i. The Town of Needham’s Energy Use Baseline Year is fiscal year 2018 (July 2017-June 2018).

III. Municipal Energy Consumption for the Baseline Year

A copy of this table is provided in Excel format in Needham-CR3-Attachment 3 – Needham Baseline Energy Data.

Table 3: Annual Municipal Consumption

Table 3: Annual Municipal Energy Use in Native Units and MMBTU - Fiscal Year 2018																	
	Electricity		Natural Gas		#2 Distillate Fuel Oil		Propane		Gasoline		Diesel		Electric Renewable Energy		Thermal Renewable Energy		Total MMBtu
	kWh	MMBtu	Therms	MMBtu	Gallons	MMBtu	Gallons	MMBtu	Gallons	MMBtu	Gallons	MMBtu	kWh	MMBtu	Therms	MMBtu	
Town Buildings	2,130,941	7,271	76,155	7,616	3,959	550	0	0	0	0	0	0	0	0	0	0	15,437
School Buildings	6,771,645	23,105	410,534	41,053	22,450	3,121	0	0	0	0	0	0	0	0	0	0	67,279
SUBTOTAL FOR BUILDINGS	8,902,586	30,376	486,689	48,669	26,409	3,671	0	0	0	0	0	0	0	0	0	0	82,715
Drinking Water and Wastewater Treatment Plant	2,216	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Pumping in Aggregate	2,585,355	8,821	25,051	2,505	0	0	0	0	0	0	0	0	0	0	0	0	11,326
Open Space*	82,440	281	0	0	0	0	0	0	0	0	0	0	0	0	0	0	281
Vehicles in Aggregate	0	0	0	0	0	0	0	0	73,194	9,076	50,535	7,024	0	0	0	0	16,100
Street and Traffic Lights in Aggregate	1,011,532	3,451	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,451
TOTAL ENERGY CONSUMPTION	12,584,129	42,937	511,740	51,174	26,409	3,671	0	0	73,194	9,076	50,535	7,024	0	0	0	0	113,882

d) Energy Reduction Plan

I. Narrative

i. Overview of Goals for Years 1-3

With Fiscal Year 2018 as the Town's Baseline Year, the Goals for Years 1-3 are as follows:

Year 1: Fiscal Year 2019:

- Lighting upgrades to LED fixtures in corridors, performance center, auditoriums and media centers.
- Replacing domestic hot water heating system at Broadmeadow Elementary School.
- Replacing the boiler at the Library with a high efficiency boiler.
- Comprehensive street lighting conversion to LEDs (Substantially complete).
- Retro-commissioning.
- Energy efficient motor replacements.
- Variable frequency drive upgrades.
- Utilization of Fleetio, a software program to track vehicle and fuel usage by vehicle and target those higher-use vehicles for reduction.

Year 2-3: Fiscal Years 2020 and 2021:

- Upgrading existing Building Management Software to Struxeware to enable consistent and more comprehensive building and systems control and management. This new software is open architecture, provides a common interface to all users and allows remote monitoring and control of facilities. Additionally, the new software provides alarming features alerting Town staff to system operational problems. The software further supports exception reporting which will allow building maintenance staff to properly maintain required building temperatures and settings designed to increase performance and reduce energy usage.
- Retro-commissioning buildings include studying the existing conditions of the mechanical systems, making a comparison to original design specifications, calculating the difference in performance, and making necessary corrections to return the systems to its original design specifications.
- Comprehensive energy audit on the Charles River Water Treatment Plant to identify energy specific improvements to be made in a building with constant use.
- Replacing the boiler at the DPW garage with high efficiency boiler.

- Conducting a facility assessment for sustainable building management at various Schools will focus on the entire building structure and will recommend additional energy efficiency improvements.
- Replacing diesel mid-size trucks with gasoline trucks.
- LED Streetlighting optimization. The Town has the ability to automatically dim the lights throughout Town. The dimming schedule can be based on time, season, events, or can be a manual change. This allows more control over the amount of energy being used during non-peak hours.
- In addition to the project listed above, the Town will continue to monitor energy consumption and work on behavioral changes to decrease usage. Space temperatures are closely monitored for optimal conditions. Setbacks are designed to decrease cooling and heating needs when buildings are unoccupied by increasing or decreasing temperature setpoints.
- Preventative maintenance will be re-evaluated to improve the efficiency of the mechanical equipment.

ii. Overview of Goals for Years 4-5

- As presented in Needham-CR3-ERP DOER Table 4, the Town has many anticipated projects focused on energy efficiency upgrades, including but not limited to: upgrading classroom lighting to LED, retro-commissioning High Rock Elementary School and Needham High School, conducting a study on potential energy upgrades in buildings throughout Town, replacing the roof and windows at the Emery Grover, replacing the boiler at the Hillside Elementary School, installing anti-idling technology on vehicles, replacing police cruisers with hybrid vehicles, and removing inflow from the sewer system.
- Conducting a study on energy upgrades for buildings town wide will help plan for additional projects the Town may undertake in the upcoming years to continue its commitment to energy reduction. Continuing to retro-commission additional buildings ensures that the mechanical systems perform more efficiently. Installing anti-idling technology will help decrease fuel usage on vehicles that are used daily.

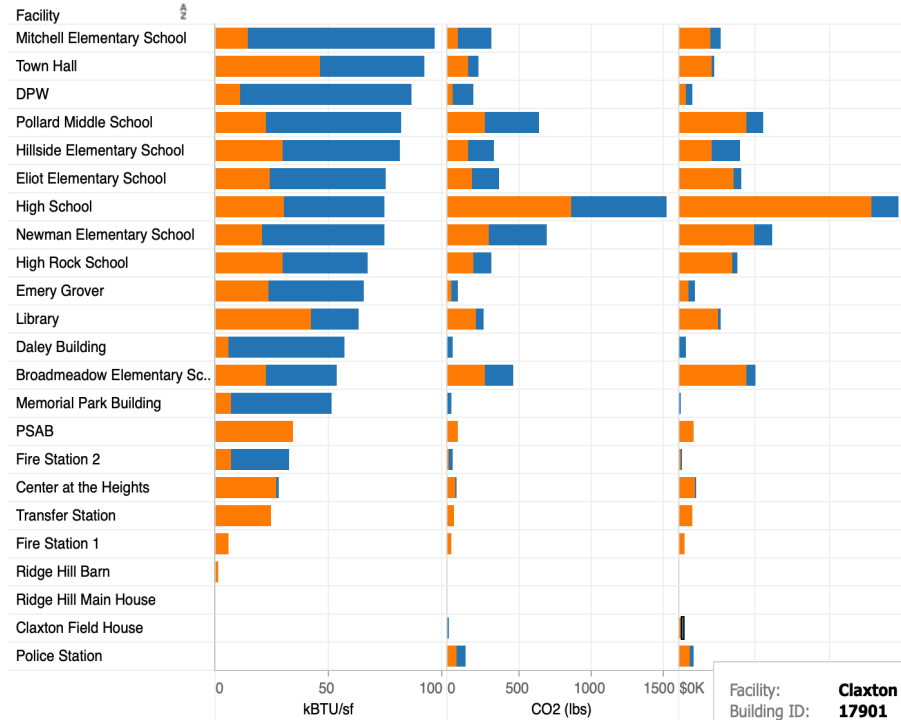
iii. Identify Areas of Least Efficient/Greatest Waste (MEI-Buildings to Target)

- As shown in the following MEI Graphic, the Town's buildings and facilities presenting the greatest opportunity for energy savings are:
 - Needham High School
 - Newman Elementary School
 - Pollard Middle School
 - Mitchell Elementary School
 - Hillside Elementary School
 - High Rock Elementary School
 - Town Hall

Graphic 1: MEI Buildings to Target [1]

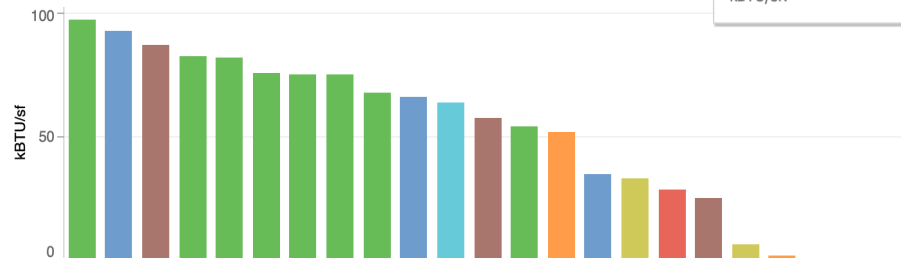
Building Efficiency, Emissions and Cost

Emissions factors updated 1/4/2012 using Massachusetts-specific greenhouse gas emissions factors.

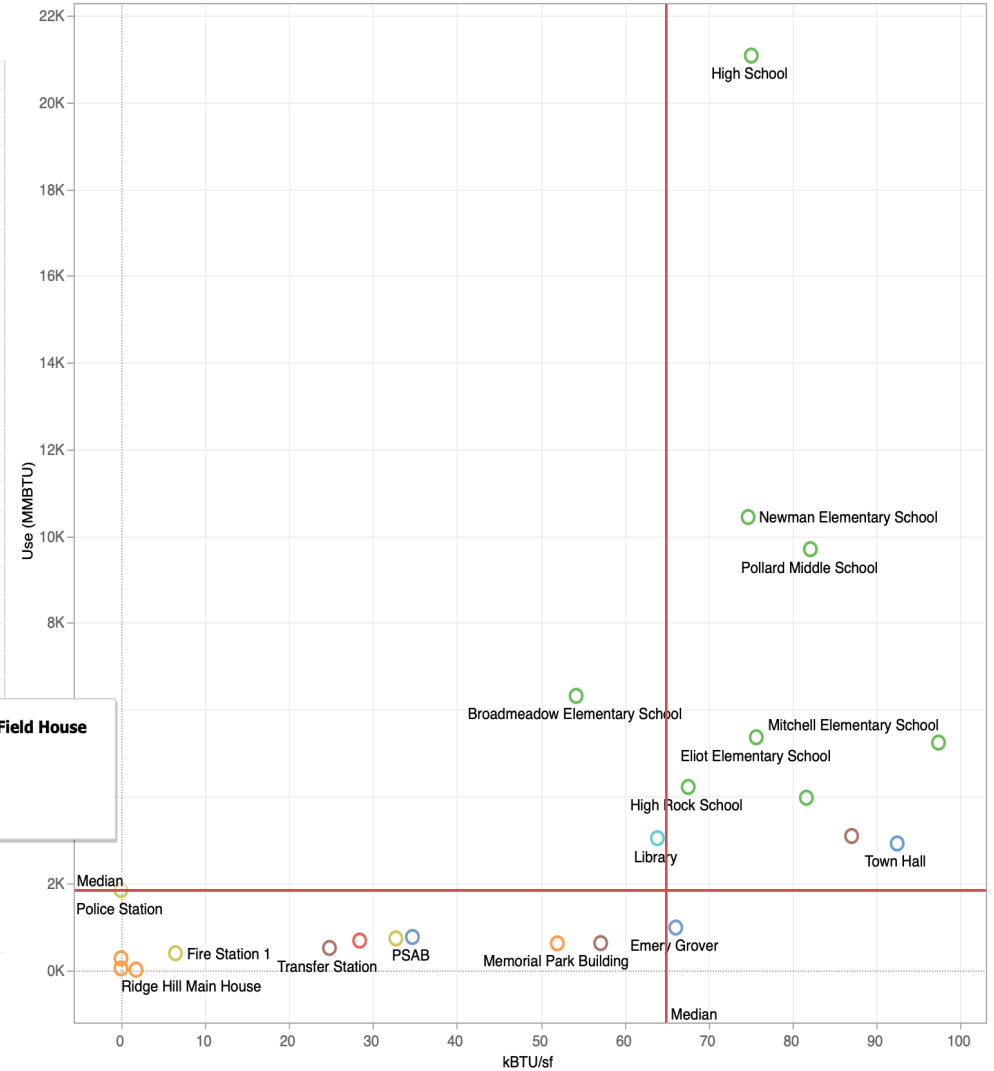


Facility: **Claxton Field House**
 Building ID: **17901**
 CO2 Emissions: **13.1**
 Cost: **\$1K**
 kBTU/sf:

Select a building name above to see how efficient it is compared to your other buildings. Lower efficiency.



Efficiency and Use



[1] Ridge Hill Barn and Main House accounts are in the same building. Fire Station 1 and Police Department accounts are in the same building.

II. 20 Percent Energy Reductions:
 i. ERP Energy Savings Goals Summary:

A summary of the ERP Goals by ECM category is presented below:

Table 4: Summary of ERP Savings, Costs and Simple Paybacks

ENERGY MEASURES	ESTIMATED MMBTU SAVINGS	ESTIMATED COST SAVINGS	ESTIMATED NET INSTALLED COST **	SIMPLE PAYBACK	PERCENT CONTRIBUTION OF BASELINE CONSUMPTION	
Building Control	4,125	\$125,373	\$468,126	3.7		
Exterior Lighting	1,851	\$122,061	\$371,548	3.0		
Hot Water	56	\$990	\$75,049	75.8		
HVAC	2,623	\$85,095	\$940,693	11.1		
Interior Lighting	1,280	\$84,413	\$617,477	7.3		
Retrocommission	5,817	\$205,698	\$546,534	2.7		
Vehicles	663	\$17,931	\$15,000	0.8		
Weatherization	695	\$13,251	\$654,172	49.4		
Other-Water/Sewer	74	\$4,904	\$0	0.0		
SUB-TOTAL	17,183	\$659,716	\$3,688,599	5.6		15.09%

** Estimated Net Installed Cost includes a cost offset of \$147,000 for Green Communities Designation grant plus an estimate for utility incentives.

- ii. As shown in the table above, the Town has identified 15.09% estimated energy. For additional detail, please refer to the provided Excel workbook, Needham-CR3-Attachment 4 – ERP DOER Table 4.
- iii. To achieve the projected 5 percent additional estimated energy savings, the Town will undertake three key efforts:
 - Installation of anti-idling technology in its fleet vehicles. These systems are designed to allow vehicles to be parked with equipment operating continuously – radios, warning lights, etc., while minimizing engine idle time and decreasing fuel consumption. The anti-idling technology senses battery condition and turns vehicles on to idle only when necessary. While idling at an emergency or construction scene, a typical police cruiser uses about 0.9 gallons of gasoline per hour. Fuel savings from anti-idling systems vary by vehicle type and usage, though they tend to be greatest for diesel and police vehicles.
 - Conduct comprehensive audits/surveys to reduce stormwater Infiltration and Inflow (“SWI/I”) in the existing sewer systems. Infiltration is defined as groundwater or storm water runoff that enters the system through

deteriorated pipe or manhole structures that need to be repaired. When sewer flow is reduced, wastewater pumping requirements will also be reduced, thereby reducing energy consumption associated with wastewater pumping.

- Conduct facility assessments for sustainable building management. It is expected that the assessments will generate recommendations to improve operations and maintenance practices designed to reduce energy consumption and promote best practices for operations.

iv. Program Management Plan for Implementation, Monitoring and Oversight

While the Town utilizes best industry practices and relies on its entire workforce to ensure all investment in physical assets, the following staff will assume lead responsibilities with respect to program management, implementation, monitoring and oversight.

Table 5: Responsibility Matrix

	RESPONSIBILITY MATRIX	
REQUIREMENT	PRIMARY	SECONDARY
Oversight of ERP Implementation	Carys Lustig	Cecilia Simchak
Implementation of ECMs - Town	Barry Dulong	Shift Supervisors
Implementation of ECMs - Schools	Barry Dulong	Shift Supervisors
Implementation of ECMs - WTP	Sean Harrington	Steve Cusick
Annual Green Communities Reporting	Carys Lustig	Cecilia Simchak

v. Identify for each Energy Conservation Measures (ECM”):

Please refer to the provided Needham-CR3-ERP DOER Table 4 Microsoft Excel workbook which includes the following required information:

- Status and projected timeline
- Projected energy savings in native units
- Projected cost savings
- Total cost
- Any utility incentives projected or received
- Any planned use of Green Communities grant funds (if designated)
- Funding source (capital budget, operating budget, debt and type or other grants)
- Source of the calculated energy and cost savings in the reference column

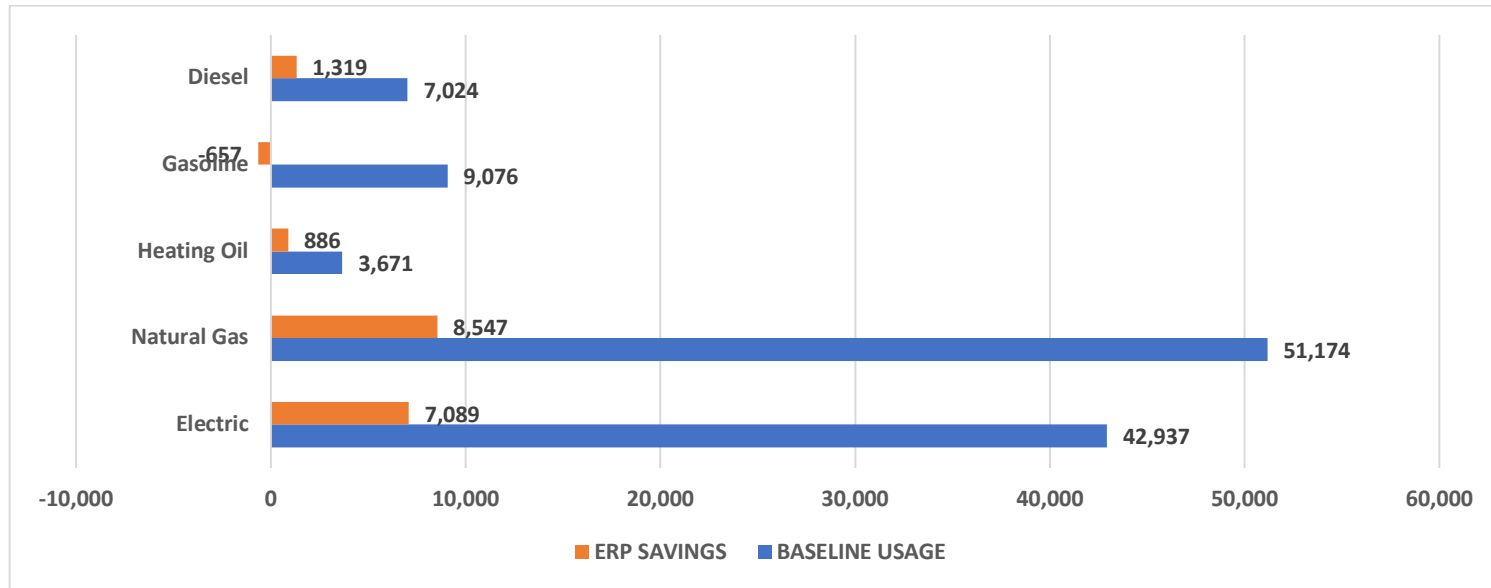
The following Graphics present the ERP as follows:

- Graphic 2: FY2018 Baseline versus Energy Reduction Plan Savings
- Graphic 3: Energy Reduction Plan Goals by ECM Category Percent Contribution
- Graphic 4: Energy Reduction Plan Goals by Energy Type Percent Contribution
- Graphic 5: Energy Reduction Plan Goals by Location Percent Contribution

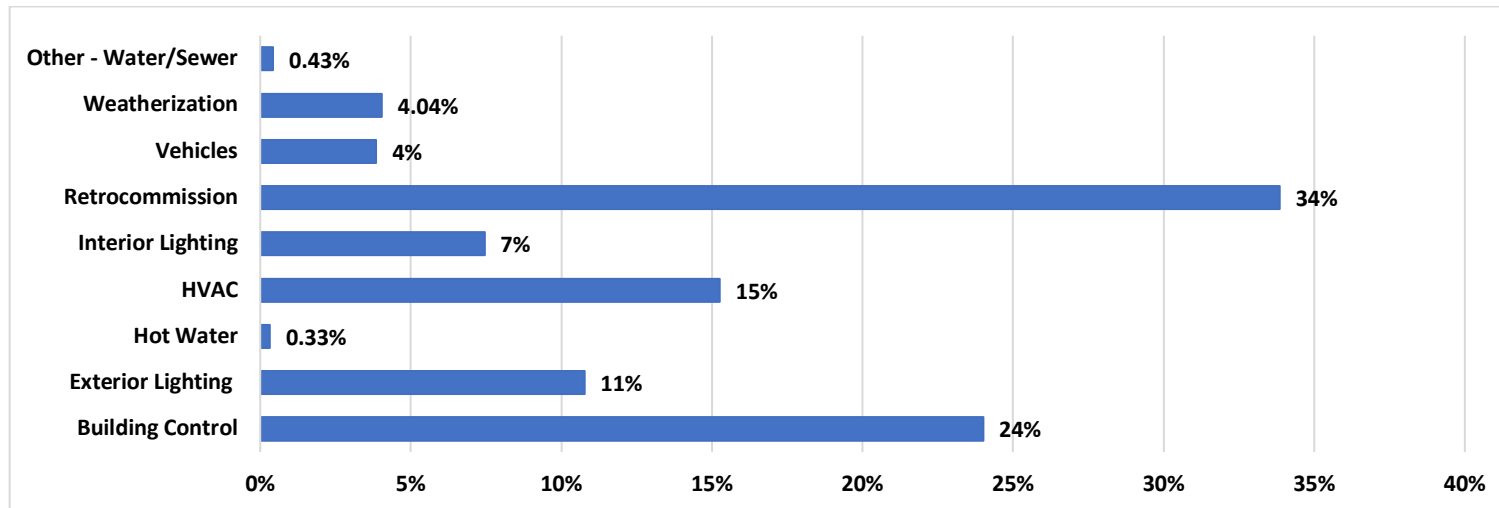
Please refer to the following documentation detailing energy savings reductions methodologies and sources:

- Needham-CR3-Attachment 5 - Energy Savings Reductions: Methodologies and Sources Document.
- Needham-CR3-Attachment 6 – Energy Audit and Other Savings Documentation.

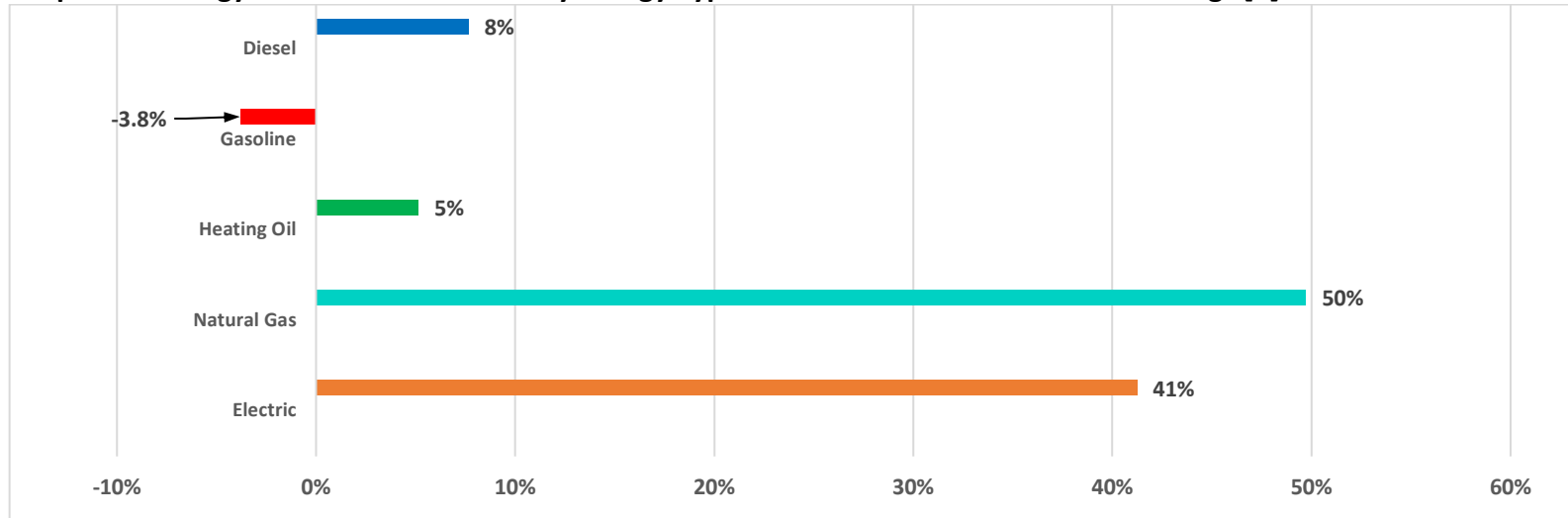
Graphic 2: FY2018 Baseline versus Energy Reduction Plan Savings:



Graphic 3: Energy Reduction Plan Goals by ECM Category - Percent Contribution of ERP Savings:

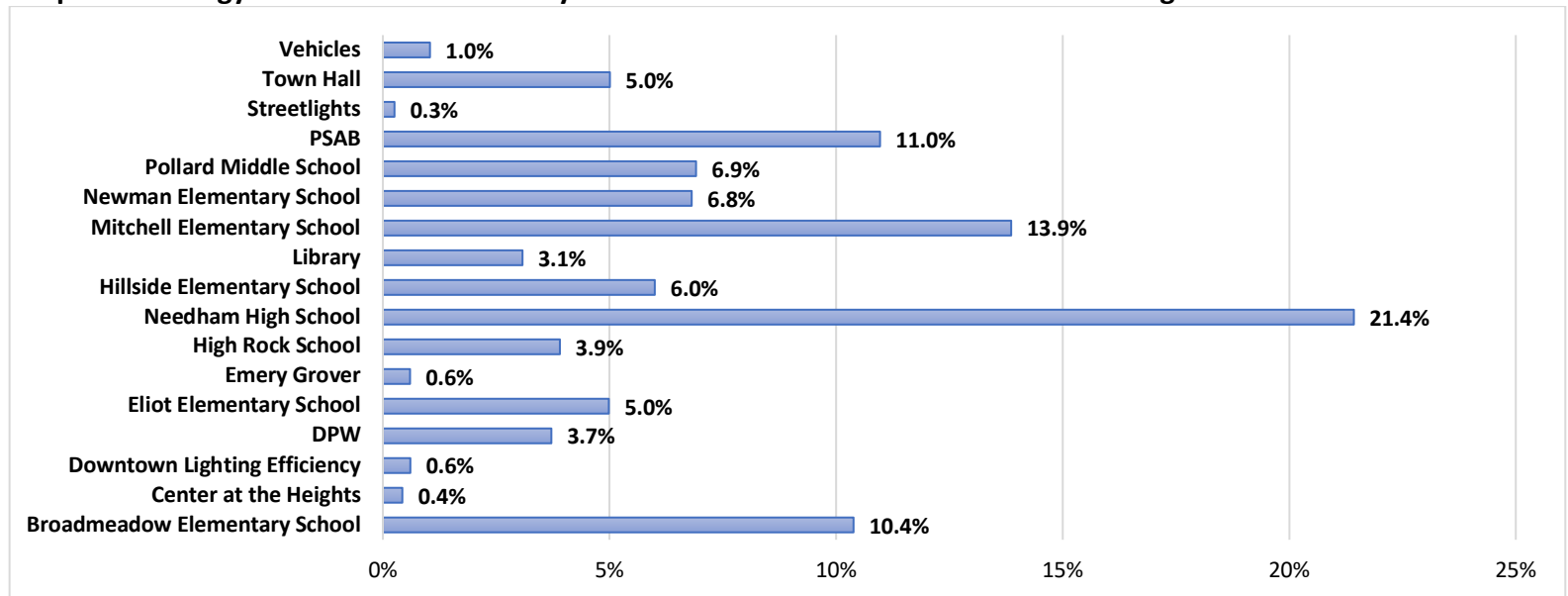


Graphic 4: Energy Reduction Plan Goals by Energy Type - Percent Contribution of ERP Savings [2]:



[2] Negative gasoline savings reflects gasoline usage after conversion from diesel.

Graphic 5: Energy Reduction Plan Goals by Location - Percent Contribution of ERP Savings:



III. ECMs Occurring Before Green Communities Designation

- i. As noted in Needham-CR3-ERP DOER Table 4, the Town has completed a portion of the energy efficiency and capital upgrade projects presented in its ERP. Please refer to column headed “Status”. This achievement is further illustrated in Table 6 below.

Of the total 15.09% MMBTU savings of Baseline consumption, the Town expects to realize 3,548 MMBTU savings from energy conservation measures undertaken in fiscal year 2019. These savings represent approximately 21% of the overall ERP projected savings.

- ii. The Town is also currently pursuing additional energy conservation measures during this current fiscal year 2020. The Town anticipates an additional 3,914 MMBTU of energy savings resulting from active projects in progress. These estimated savings represent approximately 23% of the overall ERP projected savings.

Table 6 below provides a summary of completed (in FY 2019), active (in FY 2020) and planned energy conservation/capital improvement projects included in the ERP.

Table 6: Town’s Energy Reduction Plan Goals by Achievement Status:

	MMBTU Savings	% Contribution of MMBTU Savings	MMBTU Cost Savings	% Contribution of Cost Savings	Net Installation Cost	% Contribution of Net Installation Cost
Completed	3,548	21%	\$187,042	28%	\$653,682	18%
Active	3,914	23%	\$124,738	19%	\$493,626	13%
Planned	9,721	57%	\$347,936	53%	\$2,541,291	69%
TOTAL	17,183	100%	\$659,716	100%	\$3,688,599	100%

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

- i. Municipal and School Buildings
 - The Town will have funded multiple studies during the five-year period post the Fiscal Year 2018 baseline that will help the Building Maintenance Division continue with energy reduction upgrades. These studies will include recommendations for updated technologies and equipment that are more energy efficient.
 - The Town has a system in place to continue making energy reduction upgrades for the foreseeable future as noted below. Each year the Town seeks appropriations to fund not only projects to reduce energy consumption, but also to fund studies as needed to evaluate older buildings and systems and replace or repair them to increase their efficiencies.

- Additionally, the Building Maintenance Division plans to request an overall facility assessment on every building as it approaches its 20-year life cycle to determine whether structural and overall improvements can be made to keep the building in use. This process will help maintain healthy buildings longer, reducing the need to major emergency repairs and decrease energy consumption in the process.
- The Town is not only looking to commit to major repairs. Simple behavioral changes can also decrease energy consumption. During the summers, the Town consolidated summer programming into the same buildings to reduce unnecessary use of energy and more efficiently operate fewer buildings. As Needham becomes a Green Community, additional education will be provided to Town employees on simple energy reduction strategies they can use in their offices.

ii. Vehicles

- The Town replaces vehicles on a life cycle basis, as determined by the type of vehicle. Typically, this occurs every seven to twelve years. Energy reduction strategies implemented in the Town's ERP will be continued into the future in order to capture all vehicles in the fleet. As technologies and efficiencies improve, older vehicles will be retired and replaced with newer, more energy efficient vehicles. The Fleet Division has initiated an investigation of available hybrid and electric vehicles for the various types of vehicles used by the Town.

iii. Street and Traffic Lighting

- The Town will continue to analyze energy consumption of street and traffic lighting and adjust based on needs. Upon completion of the effort to systematically and strategically dim streetlights, the Town will support continuous reasonable adjustments to reduce energy consumption while maintaining appropriate streetlighting levels and safety. The Town will evaluate the benefits of replacing traffic signals with more energy efficient models.

iv. Perpetuation Energy Efficiency

- On an annual basis, the Town submits two warrant articles for approval at Town Meeting. Specifically, each year the Town includes an Energy Efficiency Capital Article ("EECA") and a Facility Maintenance Article ("FMA"). These funding sources have enabled the Town to implement comprehensive energy efficiency and infrastructure upgrade improvements since 2006 under the FMA and 2013 under the EECA.

