Bellingham Energy Reduction Plan

Prepared by the Metropolitan Area Planning Council with support from the Town of Bellingham

In fulfillment of the
Massachusetts Green Communities Grant Program
Criterion 3

Adopted by Board of Selectmen/City Council
[Insert Date], 2019
Adopted by School Committee October
[Insert Date], 2019

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I. Purpose and Acknowledgements

A. Letters from Both General Government and School District Verifying Adoption of the ERP

B. List of Contributors:

The collaborative efforts of the Town of Bellingham, Bellingham Public Schools, and MA Department of Energy Resource's Green Communities Regional Coordinator Kelly Brown were vital to produce this plan.

Much of the information in this plan was derived from energy audits performed by Horizon Solutions. Additional technical assistance was provided by the Metropolitan Area Planning Council (MAPC), the author of this plan.

II. Executive Summary

A. Narrative Summary of the Town

Bellingham is a vibrant community of 16,000 residents. The Town is eight miles long, two miles wide at its South end and three miles wide at the North end with an area of 18.55 square miles. It is surrounded by seven Massachusetts towns and Woonsocket, Rhode Island to its South end. The Town has a mix of industry, major distribution centers, as well as nearly 1,000,000 sq. ft. of retail which is located off exit 18 of Interstate 495. Thanks to the aggressive development of the 1990's, Bellingham maintains a very modest residential tax rate and boasts some of the best services in the region.

The Town continually seeks ways in which to reduce energy consumption and cost. The Town has multiple agreements with large ground-mounted solar entities reducing energy cost, sought LED lighting upgrades to the street light network to reduce both cost and consumption and are currently engaged in a building audit to understand how best to strategically further reduce energy across town.

B. Summary of Municipal Energy Uses

Total Number of Municipal Buildings: 18

The Town owns 18 municipal buildings all of which are included in the energy use baseline. Bellingham Public Schools includes five buildings, including Bellingham High School, Bellingham Memorial Middle School, Stall Brook Elementary School, and South District Elementary School. These buildings account for more than 50% of Bellingham's energy use baseline and are therefore high priority buildings to target with energy conservation measures.

Building Additions and New Construction

There are no plans for building additions or new construction at this time.

Total Number of Municipal Vehicles: 141

The Town owns 141 vehicles, all of which currently use gasoline or diesel. The Town seeks to investigate opportunities for at least one EV charging station at town hall and if successful at several locations across town.

Total Number of Street Lights and Traffic Lights: 31 street lights, 4 field lights, 10 traffic lights

Bellingham has 1196 street lights, all of which are utility-owned and therefore exempt from the energy use baseline. Of these lights, 943 are located in National Grid service territory and owned by National Grid, and 253 of them are located in Eversource territory and owned by Eversource.

Water and Sewer: 2 drinking water treatment plants, 8 drinking water pumping stations, 8 waste water pumping stations

The Town owns two water treatment plants, on at Hartford Ave and one at Wrentham Road. North Bellingham pumps its wastewater to the Charles River Pollution Control District's treatment facility in Medway and south Bellingham pumps its waste water to a treatment facility in Woonsocket.

Table 1: Municipal Energy Use Summary		
	Number	**Ownership**
Buildings	18	Muni
Oil Heat		
Natural Gas Heat	11	Muni
Propane Heat	3	Muni
Biomass Heat		
Other Heat Type		
Electric or No heat	4	Muni
Vehicles		Muni
Gasoline or Diesel	141	Muni
Hybrid		
Electric		
Street Lights & Traffic Lights		
Street Lights	0	Muni
Street Lights	1196	Utility
Field Lights	4	Muni
Traffic Lights	10	Muni
Water and Sewer		Muni
Drinking Water Treatment Plant	2	
Drinking Water Pumping Station	8	Muni
Wastewater Treatment Plant	0	
Wastewater Pumping Station	8	Muni

C. Summary of Energy Use Baseline and Plans for Reduction

This Energy Reduction Plan commits Bellingham to reduce energy use in municipal facilities by at least 20% compared to Fiscal Year 2019 over five years. In the baseline year, the Town used 54,172 MMBTUs of energy. Bellingham's 20% energy reduction goal will be measured against the baseline of 54,172 MMBTUs. This means the Town must reduce usage by at least 10,834 MMBTUs.

As shown in **Figure 1**, buildings made up more than 67% of the usage by facility type (i.e. building, vehicles, street/traffic light, water/sewer, and open space). As shown in **Figure 2**, the School Department made up 54% of the usage by department (i.e. School dept., DPW dept., Recreational dept., Water dept., Library, Fire dept., Police dept., and Misc.).

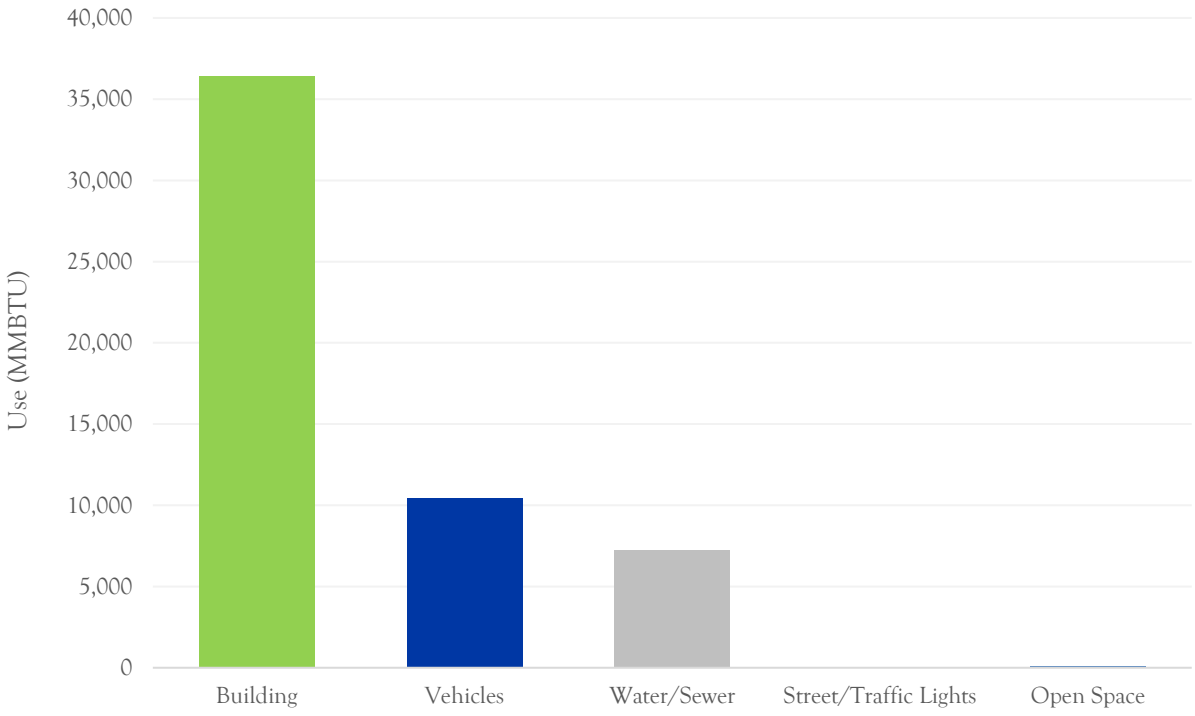

Figure 1. Municipal Energy Use Baseline (FY 2019) by Facility Category

**Misc includes unaccounted for accounts.*

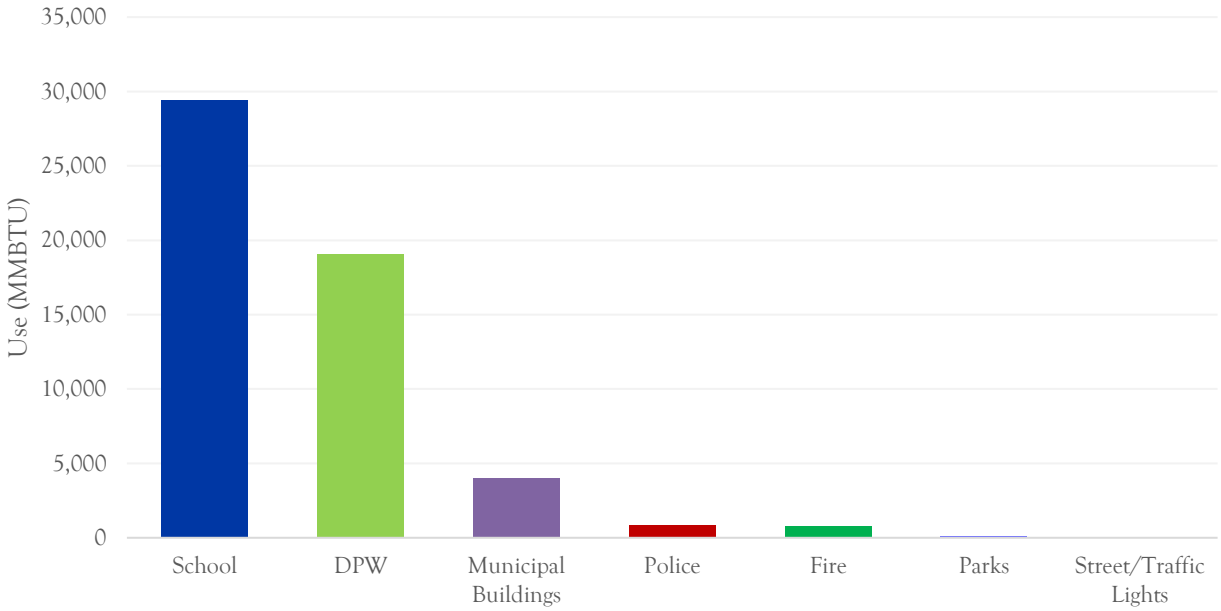

Figure 2. Municipal Energy Use Baseline (FY 2019) by Department Category.

The Town of Bellingham has identified energy savings measures in each facility category to reduce energy use 22.9% based on the total usage, as illustrated in **Table 2**.

Table 2: Summary of Municipal Energy Use & Reductions

Facility Category	MMBTU Used in Baseline Year (FY19)	% of Total MMBTU Baseline Energy Consumption	Projected Planned MMBTU Savings	Savings as % of Total MMBTU Baseline Energy Consumption
Building	36,399	67.2%	9,817	18.1%
Vehicles	10,426	19.2%	2,590	4.8%
Water/Sewer	7,226	13.3%	-	0.0%
Street/Traffic Lights	42	0.1%		0.0%
Open Space	79	0.1%		0.0%
Total	**54,172**	**100.0%**	**12,407**	22.9%

III. Energy Use Baseline Inventory

A. Identification of the Inventory Tool Used

The Town of Bellingham 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.

B. Identification of the Baseline Year

Fiscal Year (FY) 2019 will serve as the baseline year. FY 2019 ran from July 1, 2018 to June 30, 2019. This will give the Town until June 30, 2024 (FY 2020 – FY 2024) to reach its 20% energy reduction goal.

C. Municipal Energy Consumption for the Baseline Year (FY 2019)

Appendix A presents **Table 3A** showing energy use for each municipal facility in native units and MMBTUs in the Baseline year. In the baseline year, the Town used 54,172 MMBTUs of energy.

As shown in **Figure 3**, consumption of gas accounts for 42% of the Town's FY 2019 energy use baseline.

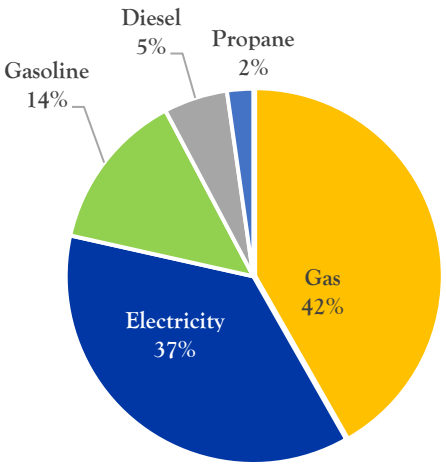

Figure 3. Energy Usage in FY 2019 By Fuel Type

Table 3B shows that of the municipality's 18 buildings just five comprise 56% of baseline energy use.

Table 3B. Top Five Energy Consuming Buildings in Bellingham		
Facility	**MMBTUs**	**Percent of FY19 Baseline**
Bellingham HS	17,246	32%
Bellingham Memorial MS	6,757	12%
Stall Brook ES & Annex	3,810	7%
South District ES	1,413	3%
New Bellingham Library	1,406	3%
Total FY 2019 Usage for Top Three	**30,631**	**57%**
Total FY 2019 Usage Baseline	**54,172**	**100%**

Bellingham High School and Bellingham Memorial Middle School account for more than 40% of the town's total baseline energy use. Bellingham High School was built in 2001, so there are likely ample energy saving opportunities including LED lighting retrofits and retrocommissioning of mechanical systems, some of which are nearly 20 years old.

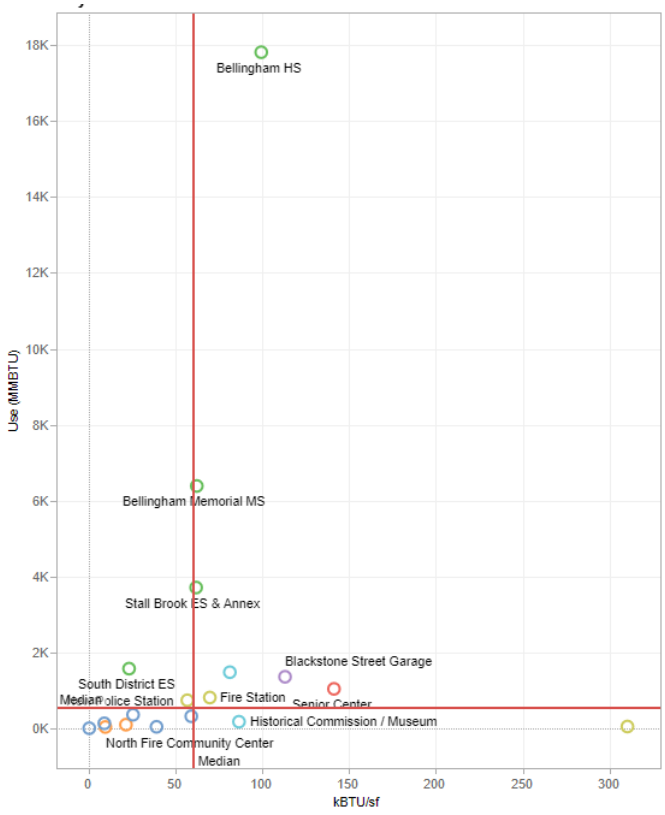

Figure 4. Energy Use Intensity (kBTU/sf) and Total Energy Use (MMBTU) for Buildings.

Points further to the right have a higher energy use per square foot (i.e. less energy efficient). Points higher up use more total energy. Bellingham Memorial Middle School, for example, uses the second most energy of any building but has a relatively average usage per square foot. Red lines show the medians for the Town's buildings.

D. Existing Energy Management Processes

- **Description of who manages energy use in the school department and town side, with focus on largest buildings. Include mention of any involvement of students or volunteer committees.**

  The Director of Finance manages the financial monitoring of energy use in the school department. The Director of Facilities manages the implementation and maintenance of systems that have an impact on the usage. The School Department has a contract with Honeywell to manage off-hours temperature controls. Currently, there are no students or volunteer committees involved in the energy management. The Town Administrator manages the oversight of town public buildings.

- **How set points are managed (i.e. who has access) and if/when they are reviewed and adjusted, with focus on largest buildings.**

  The goal of this plan is to establish this management structure, but the town and school does not have a set program in place at this time.

- **How supplies purchasing decisions are made (e.g. all through a central person for town and schools, by each department), whether purchasing policies exist, and if energy efficiency is included currently.**

  For schools, purchasing is initiated at the school/department level, and then approved by the building principal and/or the Director of Maintenance. Then the request is forwarded to the Business Office for final approval by the Director of Finance. The Town has a similar process in which a supply budget is requested once a year and reviewed by applicable staff and committees before voted on at town meeting. Energy Efficiency is a factor in the decision-making process, more so in new additions or upgrades than in repairs.

- **Description of how vehicle purchasing decisions are made**

  Vehicle purchasing decisions are made by request of the individual departments to the Superintendent or the Finance Committee which then must go to Town Meeting for final approval. Once approved, the vehicle is purchased (either through the bid process or through a vendor that participates in the State Bid List). The type of vehicle purchased is dependent upon the needs of the department (bus, van, plow, etc.) The Town does not purchase non-emergency vehicles or DPW vehicles. Other departments re-use older vehicles currently.

- **Known behavior/management issues that should be flagged either to maintain or to change (e.g. perhaps a school generally does not set back thermostats over school breaks)].**

  The schools reported their biggest issue to flag is to have staff and management that understand the importance of continuous monitoring and maintenance of efficiencies - especially as more technology is introduced. This has the potential to create challenges with some staff members who do not have strengths in these areas.

E. Energy Reduction Goal

The Town of Bellingham's 20% energy reduction goal will be measured against the baseline of 54,172 MMTBUs. The Town will need to reduce its energy consumption by at least 10,834 MMBTUs.

Based on the results of the baseline analysis the town will prioritize energy reduction efforts in the high school and middle school buildings, implementing LED lighting retrofits as well thermal efficiency measures. The schools will also explore opportunities to save reduce energy waste through behavior-based conservation campaigns. The Town will also attempt to reduce vehicle energy use through a combination of energy efficient vehicle purchasing and fuel conservation measures such as a no-idling policy.

IV. Energy Reduction Plan

A. Narrative Summary

As shown in Table 4, the Town has identified energy savings measures to reduce energy usage from FY 2019 by 10,909 MMBTUs or 20%. Another 1,498 MMBTUs of energy savings has been identified through behavior change measures such as participating in Building Operator Certification training and engaging students and staff at the four largest school buildings to reduce energy use by as much as 5%. Combined, these measures amount to energy savings of 22.9% compared to the FY 2019 baseline. This is an example plan, for discussion purposes only, to show how energy conservation measures may be structured and paid for. It is non-binding and expected to change based upon further discussion. See Appendix B for a full breakdown of energy conservation measures, estimated costs, and payback years.

i. Funding

Bellingham will use a mix of Green Communities grant funding, utility rebates and other incentives, and capital funds to finance the energy conservation measures outlined below. The Town will also consider financing mechanisms such as contracting with an Energy Services Company (ESCO). The Town will develop a clear financing plan within the first year after being designated a Green Community.

ii. Overview of Goals for Years 1-3:

Energy Management Processes

- The Town of Bellingham will build on the information provided in the energy audits conducted by Horizon Solutions and the data available in MassEnergyInsight to track its progress toward meeting its energy reduction goals and to further refine its energy conservation efforts.

Energy Conservation Measures

The Town plans to implement the following energy conservation measures:

- Replace interior lighting with LED lighting at Keough Administration Building, Municipal Center, Senior Center, Fire Station, Parks Department Building, Highway Department Garage, Town Hall, Bellingham Library, Bellingham High School, Bellingham Memorial Middle School, Stall Brook Elementary School and Annex, South District Elementary School, School Administration Building
- Replace 45-year-old boilers at Stall Brook Elementary School and Annex
- Install occupancy sensors for bathroom fans at Senior Center
- Replace 40-year-old boiler at Keough Building
- Install new air conditioning units at Keough Building
- Replace water heater at South District Elementary School
- Replace 30-year-old boilers at South District Elementary School
- Install temperature control-based VFDs for circulation pumps at Bellingham Memorial Middle School
- Install temperature control-based VFDs for circulation pumps at South District Elementary School
- Convert oil-fired unit heaters at DPW Highway Garage with propane or natural gas heaters
- Implement an Anti-Idling Policy for town vehicles
- Closely monitor tire air pressure and use fuel-efficient tires
- Use 100% synthetic oil
- Replace ageing (>10 years old) and inefficient (<20 mpg) vehicles with electric vehicles, hybrid models, or more efficient newer models
- Upgrade boilers at Bellingham High School and install demand controlled ventilation and a building management system.

iii. Overview of Goal for Years 4-5:

Energy Conservation Measures

- Replace ageing (>10 years old) and inefficient (<20 mpg) vehicles with electric vehicles, hybrid models, or more efficient newer models

iv. Energy Efficiency Identification Measures:

- The Town of Bellingham will continue to use 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 www.masscec.com.

B. Path to 20% Energy Use Reduction by the end of Fiscal Year 2024

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

- The Green Communities Committee, in collaboration with the Town Administrator's office, Building Department and the School Superintendent, will be responsible both for oversight of the Energy Reduction Plan and for implementation of energy conservation measures within the Town. The Green Communities Committee will spearhead the efforts to complete the annual reporting requirements to DOER to maintain designation and eligibility for annual competitive grant funding.

- The Green Communities Committee will work with users of the Town's buildings to determine thermostat set point and set back schedules and plan for future infrastructure improvement projects.

    - Set points refer to the temperatures that thermostats are set at during normal usage hours. Setbacks would occur during off-hours, such as evenings and weekends in most municipal facilities, when buildings do not need to be heated or cooled to the same levels.

    - The desired set points and schedules may differ by season and will be documented in writing. The parties will then agree to a schedule for updates, at which the appropriate staff will provide written confirmation that the buildings are operating with the agreed upon set points and setbacks. This process is intended to minimize the chance that set points and setbacks get overridden or forgotten.

    - The set point reporting will be included as part of a behavior-based energy reduction program, recommended for Braintree's school.

- The Green Communities Committee will provide an annual update to the Board of Selectmen and the School Committee following the submission of the Annual Report to DOER. The presentation will include:
    - The trend for town-wide energy usage

        - Show the baseline, current year and any years in between
    - The trend for energy usage in at least the largest energy using buildings identified above.
        - Show the baseline, current year and any years in between
    - A summary of the major efficiency measures implemented over the past year
    - An explanation or hypothesis of the cause of the trends town-wide and in the largest buildings
    - Update on Green Communities competitive grant applications

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

Building audits were provided by Horizon Solutions in 2019 and identify energy conservation measures which provide 15.5% energy savings (8,318 MMBTUs). The Audit Report is included in **Appendix B**.

Vehicle replacements and policy and maintenance measures targeting overall vehicle usage will provide another 4.8% energy savings (2,590 MMBTUs). The supporting documentation for these vehicle replacements and 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 2.77% additional energy savings (1,498 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 9,598 MMBTUs.

Table 4: Estimated Energy Savings in Bellingham Municipal Facilities.

Table 4 Energy Conservation Measures Data																
ECMs			Status		Energy Data					Financial Data					Reference Data	
Building/Site Name	Energy Conservation Measure Name	ECM Type (select one from drop-down)	Status (select one from drop-down)	Status Date (Completed with month/year or planned month/year)	Projected Annual Electricity Savings (kWh)	Projected Annual Natural Gas Savings (therms)	Projected Annual Oil Savings (gallons)	Projected Annual Gasoline Savings (gallons)	Projected Annual Diesel Savings (gallons)	Projected Annual Cost Savings ($)	Total Installed Cost ($)	Green Community Grant ($)	Utility Incentives ($)	Net Cost ($)	Funding Source(s) for Net Costs	Source for Projected Savings
Building Measures																
School- Stall Brook School & Annex	45 year old boiler Replacements	HVAC	Planned	12/31/2020		12,800				$12,800	$360,000			$360,000	Green Communities Grant	Horizon Solutions Audit Report
School- Keough Building	Lighting	Interior Lighting	Planned	12/31/2020	18,610					$4,263	$24,235		$1,815	$22,420	Town Capital Funds	Horizon Solutions Audit Report
Town- Municipal Center	Lighting	Interior Lighting	Planned	12/31/2020	27,900					$5,580	$72,000		$5,580	$66,420	Town Capital Funds	Horizon Solutions Audit Report
Town- Bellingham Senior Center	Lighting	Interior Lighting	Planned	12/31/2020	24,949					$5,767	$47,565		$10,935	$36,630	Town Capital Funds	Horizon Solutions Audit Report
Fire- Fire Station	Lighting	Interior Lighting	Planned	12/31/2020	40,000					$8,000	$40,000		$8,000	$32,000	Town Capital Funds	Horizon Solutions Audit Report
Parks- Parks Department Building	Lighting	Interior Lighting	Planned	12/31/2020	9,750					$1,950	$30,000		$1,950	$28,050	Town Capital Funds	Horizon Solutions Audit Report
DPW- Hgy- Highway Department Garage	Lighting	Interior Lighting	Planned	12/31/2020	17,754					$4,210	$46,630		$7,320	$39,310	Town Capital Funds	Horizon Solutions Audit Report
Town- Town Hall (Old)	Lighting	Interior Lighting	Planned	12/31/2020	2,356					$637	$6,210		$0	$6,210	Town Capital Funds	Horizon Solutions Audit Report
Town- Bellingham Library	Lighting	Interior Lighting	Planned	12/31/2020	45,427					$9,085	$112,000		$9,085	$102,915	Town Capital Funds	Horizon Solutions Audit Report
School- Bellingham High School	Lighting	Interior Lighting	Planned	12/31/2020	266,709					$53,342	$339,969		$0	$339,969	Town Capital Funds	Horizon Solutions Audit Report
School- Bellingham Memorial Middle School	Lighting	Interior Lighting	Planned	12/31/2020	109,589					$31,861	$557,303		$117,300	$440,003	Green Communities Grant/ Town Capital Funds	Horizon Solutions Audit Report
School- Stall Brook School & Annex	Lighting	Interior Lighting	Planned	12/31/2020	41,735					$20,174	$84,123		$9,185	$74,937	Town Capital Funds	Horizon Solutions Audit Report
School- South District Elementary School	Lighting	Interior Lighting	Planned	12/31/2020	90,042					$24,046	$99,992		$3,135	$96,857	Town Capital Funds	Horizon Solutions Audit Report
School- School Administration Building	Lighting	Interior Lighting	Planned	12/31/2020	7,045					$1,574	$21,338		$5,775	$15,563	Town Capital Funds	Horizon Solutions Audit Report
Town- Bellingham Senior Center	Fans in bathroom are on constantly, control based on occupancy.	Building Control	Planned	12/31/2021	4,655	500				$1,431	$4,500			$4,500	Green Communities Grant	Horizon Solutions Audit Report
School- Keough Building	Boiler is around 40 years old, DHW is made by natural gas hot water heater in boiler room that has been recently upgraded. Boiler replacement estimated to use 33 Therms per hours X 1,500 FLH with savings of around 20% or $10k/year	Hot Water	Planned	12/31/2021		10,000				$10,000	$99,999		$0	$99,999	Green Communities Grant	Horizon Solutions Audit Report
School- Keough Building	21 Window shakers for cooling.	HVAC	Planned	12/31/2021	10,500	3,000				$5,103	$138,923			$138,923	Green Communities Grant	Horizon Solutions Audit Report

School- South District Elementary School	350,000 btu per hour input hot water heater with 700 gal water storage tank. Remove and install new heat pump or natural gas water heater with between 80 and 100 gallons of storage.	HVAC	Planned	12/31/2021		3,425				$3,425	$20,000			$20,000	Green Communities Grant	Horizon Solutions Audit Report
School- South District Elementary School	Two boilers for heating, around 30 years old, 3103 MBH,	HVAC	Planned	12/31/2021		13,227				$13,227	$150,000			$150,000	Green Communities Grant	Horizon Solutions Audit Report
School- Bellingham Memorial Middle School	Circ pumps (2)-5hp, (4)-7.5hp running 8760 with no controls. One of the 7.5 hp is a backup with no hours. Boilers are condensing from 2014, hot water heaters are natural gas. Temperature control based VFD's for pumps.	Pump/Motor/Drive	Planned	12/31/2021	50,973					$10,195	$75,000		$6,000	$69,000	Green Communities Grant	Horizon Solutions Audit Report
School- South District Elementary School	Circ Pumps for DHW are 1/2 hp running 8760. Install time clock. Destratification fan in gym uncontrolled.	Pump/Motor/Drive	Planned	12/31/2021	1,634					$327	$1,800			$1,800	Green Communities Grant	Horizon Solutions Audit Report
School- Bellingham High School	Boiler upgrade, DCV and BMS	HVAC	Planned	6/30/2022	78,420	11,300				$26,984	$500,000			$500,000	Green Communities Grant/Town Capital Funds	Horizon Solutions Audit Report
Vehicle Measures																
Vehicles	Anti-Idling Policy	Vehicles	Planned	12/31/2020				6,003	2,145						N/A	Table 5 Vehicle Policy
Vehicles	Closely Monitor Tire Air Pressure and Use Fuel Efficient Tires	Vehicles	Planned	12/31/2020				1,264	1,019						N/A	Table 5 Vehicle Policy
Vehicles	Use 100% Synthetic Oil	Vehicles	Planned	12/31/2020				632	509						N/A	Table 5 Vehicle Policy
Vehicles	Vehicle fleet replacements	Vehicles	Planned	6/30/2024				9,410							Green Communities Grant/Town Capital Funds	Table 6 Vehicle Measures
			TOTAL Projected Savings		848,047	54,252	0	17,310	3,673	$ 253,980	$ 2,831,586	$ -	$ 186,081	$ 2,645,505		
		TOTAL MMBtu SAVINGS	10,909		2893.53755	5425.186667	0	2085.422899	504.8694431							

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, Bellingham will work with internal schools and Town staff as well as outside consultants, when necessary, to assess and document the condition of major municipal 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, and the Town will seek to explore even more efficient policies and tracking systems to enable more efficiency.

C. Street and Traffic Lighting

As the Town expects to have all streetlights retrofitted with LED bulbs within the 5-year period, the Town will next look to include wireless controls that can dim to drive further savings.

D. 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 Bellingham 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.

Appendix A: Table 3A - Municipal Energy Consumption for FY 2019

Table 3A: Municipal Energy Use Baseline (FY2019)															
	Electric		Gas		Oil		Gasoline		Diesel		Propane		Solar Electric		Total MMBTU
Facility	kWh	MMBTU	therms	MMBTU	gallons	MMBTU	Gallons	MMBTU	Gallons	MMBTU	gallons	MMBTU	kWh	MMBTU	
Bellingham HS	1,952,071	6,660	105,853	10,585											17,246
Bellingham Memorial MS	698,160	2,382	43,745	4,375											6,757
Blackstone Street Garage	72,184	246	11,305	1,131											1,377
Fire Station	71,252	243	5,517	552											795
Historical Commission / Museum	3,181	11	1,907	191											202
Keough Administration	46,240	158													158
Municipal Center	119,600	408													408
New Bellingham Library	162,720	555	8,512	851											1,406
New Police Station			7,745	775											775
North Fire Community Center	10,278	35													35
Old Town Hall	79,296	271	5,344	534											805
Park Department Building	12,714	43													43
Police Annex Building	31	0													0
Senior Center	58,015	198	7,517	752											950
South District ES	414,000	1,413													1,413
South Fire Community Building	51,241	175													175
Stall Brook ES & Annex	324,257	1,106	27,037	2,704											3,810
Transmitting Facility - Police Department	13,633	47													47
Buildings Subtotal	**4,088,873**	**13,951**	**224,482**	**22,448**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**36,399**
Traffic Lights	12,210	42													42
Street Lights/Traffic Lights Subtotal	**12,210**	**42**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**42**
Pumping Stations	155,688	531									541	49			580
Sewage Pumping Stations	220,215	751	1,726	173							585	53			977
Standpipe Pits	47,388	162													162
Treatment Facility/Source	1,285,468	4,386									12,312	1,120			5,506
Water/Sewer Subtotal	**1,708,759**	**5,830**	**1,726**	**173**	**-**	**-**	**-**	**-**	**-**	**-**	**13,438**	**1,223**	**-**	**-**	**7,226**
Arcand Park	-	-													-
Crook's Corner Park	4,387	15													15
Harpen Street Fields	782	3													3
High Street Fields	6,120	21													21
North Fields	-	-													
Town Common	11,978	41													41
Open Space Subtotal	**23,267**	**79**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**79**
Vehicles Subtotal							**60,033**	**7,444**	**21,451**	**2,982**					**10,426**
TOTAL ENERGY USE	**5,833,109**	**19,903**	**226,208**	**22,621**	**-**	**-**	**60,033**	**7,444**	**21,451**	**2,982**	**13,438**	**1,223**	**-**	**-**	**54,172**

Appendix B: 2019 Energy Audit Report – Horizon Solutions

[See attached report]

Appendix C: MAPC Vehicle Calculations

Table 5: Policies that Affect Fleet Gas and Diesel Usage

Anti-Idling Policy*		
All FY 2019 Gasoline Usage (Gallons)*	60,033	
All FY 2019 Diesel Usage (Gallons)	21,451	
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	6,003	
Gallons Diesel Saved per Year	2,145	
MMBTUs Saved per Year	**1,018**	
Closely Monitor Tire Air Pressure and Use Fuel Efficient Tires		
All FY 2019 Gasoline Usage (Gallons)	31,606	
All FY 2019 Diesel Usage (Gallons)	25,466	
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	1,264	
Gallons Diesel Saved per Year	1,019	
MMBTUs Saved per Year	**292**	
Use 100% Synthetic Oil		
All FY 2019 Gasoline Usage (Gallons)	31,606	
All FY 2019 Diesel Usage (Gallons)	25,466	
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	632	
Gallons Diesel Saved per Year	509	
MMBTUs Saved per Year	**146**	
Total MMBTUs	**1,457**	
*http://www.fueleconomy.gov/feg/pdfs/OwnerRelatedFuelEconomyImprovements.pdf		

Table 6. Vehicle Measures

VIN	Make/Model	Vehicle Function	Model Year	Replacement Vehicle	Current MPG	Replacement MPG	Vehicle Class	Average Annual VMT by vehicle class*	Annual Gasoline Savings (gal)	Annual MMBTU Savings	Annual $ Savings
1GCEC14W52Z113667	CHEVROLET SILVERADO PICK UP	DPW	2002	2019 Chevrolet Silverado	16	25	Light Truck	11,712	264	32	$ 675
GBJC34UX7E138608	CHEVROLET SILVERADO PICK UP	DPW	2007	2019 Chevrolet Silverado	17	25	Light Truck	11,712	220	27	$ 565
1B7GL26X4WS625066	DODGE DAKOTA	DPW/PARK	1998	2019 Chevrolet Colorado	20	23	Light Truck	11,712	76	9	$ 196
1B3LC56K78N682904	DODGE AVENGER SEDAN	POLICE	2008	2019 Ford Hybrid Police Responder Sedan	24	38	Car	11,244	173	21	$ 442
1B7HC16Y8XS306827	DODGE RAM	DPW/PARK	1999	2019 Ram 1500	16	22	Light Truck	11,712	200	24	$ 511
1B7HCC16Y45646087	DODGE RAM	DPW/PARK	1999	2019 Ram 1500	16	22	Light Truck	11,712	200	24	$ 511
2FAHP71V19X104440	FORD CROWN VICTORIA	INSPECTION	2000	2019 Chevrolet Bolt EV	18	119	Car	11,244	530	64	$ 1,358
2FAFP71W41X191531	FORD CROWN VICTORIA	DPW	2001	2019 Chevrolet Bolt EV	18	119	Car	11,244	530	64	$ 1,358
2FAFP71V78X112225	FORD CROWN VICTORIA	DPW	2007	2019 Chevrolet Bolt EV	18	119	Car	11,244	530	64	$ 1,358
2FABP7BV8AX102015	FORD CROWN VICTORIA	DPW	2008	2019 Chevrolet Bolt EV	18	119	Car	11,244	530	64	$ 1,358
2FABP7BV8BX180831	FORD CROWN VICTORIA	DPW	2008	2019 Chevrolet Bolt EV	18	119	Car	11,244	530	64	$ 1,358
2FABP7BV5BX172413	FORD CROWN VICTORIA	DPW	2011	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FAFP71W65X118778	FORD CROWN VICTORIA	DPW	2011	2019 Chevrolet Bolt EV	18	119	Car	11,244	530	64	$ 1,358
2FAFP71W47X121004	FORD CROWN VICTORIA	INSPECTION	2005	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FAFP71V88X147694	FORD CROWN VICTORIA	SCHOOL	2005	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FAFP71V38X112223	FORD CROWN VICTORIA	TOWN HALL	2005	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FAFP71W45X118777	FORD CROWN VICTORIA	DPW	2010	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FABP7BV6BX180830	FORD CROWN VICTORIA	DPW	2011	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FAFP71W85X118779	FORD CROWN VICTORIA	POLICE	2011	2019 Ford Hybrid Police Responder Sedan	19	38	Car	11,244	296	36	$ 758
2FAFP71W4YX214428	FORD CROWN VICTORIA	DOG OFF.	2009	2019 Chevrolet Bolt EV	19	119	Car	11,244	497	60	$ 1,274
2FABP7BV1BX100480	FORD CROWN VICTORIA (Under Cover)	POLICE	2008	2019 Ford Hybrid Police Responder Sedan	18	38	Car	11,244	329	40	$ 842
2FTRF17W94CA32062	FORD F150 PICKUP TRUCK	DPW/PARK	2004	2019 Ford F150	16	24	Light Truck	11,712	244	29	$ 625
1FAHP271X7G145868	FORD FIVE HUNDRED	DPW	2007	2019 Chevrolet Bolt EV	21	119	Car	11,244	441	53	$ 1,129
1FMPU16506LA54963	FORD EXPEDITION	SCHOOL	2006	2019 Ford Expedition	14	18	Light-Duty Vehicle	11,346	180	22	$ 461
1FMFU16557LA42028	FORD EXPEDITION (Under Cover)	POLICE	2007	2019 Ford Expedition	15	18	Light-Duty Vehicle	11,346	126	15	$ 323
	TOTAL								**9,410**	**1,134**	**$ 24,100**
	*Source: Alternative Fuels Data Center; https://afdc.energy.gov/data/10309										

Appendix D: MAPC Behavior-Based Energy Savings

A School Behavior-Based Energy Use Reduction Program will allow Bellingham to better understand the inefficiencies in their school building operations and 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 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 Bellingham, MAPC assumed a conservative 5% savings per year for electricity in three schools. These savings are summarized in Table 7 below.

Table 7: School Behavior-Based Savings Program

School	MMBTU Electricity FY 2019	Reduction from Program	MMBTU Saved Electricity (Annual)	kWh Saved Electricity (Annual)	Cost Savings Electricity (Annual)
Bellingham High School	6,622	5%	331.1	97,043	$13,586
Bellingham Memorial MS	2,382	5%	119.1	34,908	$4,887
South District ES	1,413	5%	70.6	20,700	$2,898
Stall Brook ES & Annex	1,106	5%	55.3	16,213	$2,270
Total	**11,523**		**576**	**168,864**	**23,641**

Building Operator Certification

Bellingham Public Schools is considering having its staff attend Building Operator Certification (BOC) training. The BOC suggests that based on evaluated programs, the certification will have an average savings of:

- 140,183 kWh per year
- 2,846 therms per year

This translates to 920 MMBTUs per year.

Source: http://www.theboc.info/wp-content/uploads/2017/02/BOC-Energy-Savings-FAQ-2.0-web.pdf

Appendix E: MMBTU Conversion Chart – DOER

MMBTU Conversion Chart[2]

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[7] 1 gallon of B5 biodiesel = 0.138 MMBTU[7]

1 barrel of residual fuel oil = 6.287 MMBTU

[2] If a conversion factor for a fuel you use is not provided, please contact DOER.
[3] Calculated Values from those of diesel and B100 biodiesel