Town of Belmont, Massachusetts

ENERGY REDUCTION PLAN

In fulfillment of the

MASSACHUSETTS GREEN COMMUNITIES GRANT PROGRAM
CRITERIA 3

Prepared by

Town of Belmont, Massachusetts

With support from

Guardian Energy Management Solutions
Marlborough, Massachusetts

October 17, 2014

TABLE OF CONTENTS

Purpose and Acknowledgements

The Town of Belmont has completed and adopted this Energy Reduction Plan (“ERP”) for submission to the Massachusetts Department of Energy Resources in fulfillment of Criteria 3 of the requirements for Green Community designation.

The Town views the formulation of this Energy Reduction Plan as an important component of the Town’s ongoing program to maintain and update a 5-Year Capital Plan for Town and School Buildings. As part of that effort, Town staff is conducting a Facilities Condition Assessment for several Town and School buildings and preparing condition reports that identify operational issues and opportunities for improvement and infrastructure renewal needs. Energy use and energy systems are an important component of this effort.

In 2013, Town Meeting approved the consolidation of Town and School facilities maintenance operations into a single department. This consolidation has been highlighted by an improved understanding of the common issues faced in both Town and School buildings, including staffing, regulatory requirements, managing contract services, and energy use. Concurrently, the development of the Energy Reduction Plan has provided the Town with the opportunity to engage a number of separate departments that are responsible for their own energy use in a more comprehensive understanding and approach to potential energy conservation efforts. We acknowledge that the Town in the past has not been particularly systematic in its treatment of energy as an operating expense. A historic silo-oriented mentality has left individual departments to track and manage energy use and cost and there has been no comprehensive accounting of energy consumed by the Town for buildings, water and wastewater pumping, vehicle use by multiple departments, and street lighting. An additional dividend of creating this plan has been making use of the MassEnergyInsight tool provided by the Department of Energy Resources to match utility accounts to buildings, etc., to develop a comprehensive understanding of the Town’s very significant energy use and expense, and to track our progress toward reducing energy use across our portfolio.

We attach, as Appendix A, a letter from our Town Administrator David Kale verifying the Board of Selectmen’s adoption of this Energy Reduction Plan, as well a letter from the School Superintendent John Phelan confirming endorsement of the Plan.

Preparation of this Plan has been a collaboration of Town and School Department officials and consulting energy professionals. They include:

- **David Kale,** Town Administrator
- **Phyllis Marshall**, Assistant Town Administrator
- **John Phelan**, Superintendent of Schools
- **Gerald Boyle,** Director of Facilities
- **Anthony DiCologero,** Director of School Finance, Business and Operations
- **Peter Castanino,** Public Works Director
- **Kevin Looney**, Building Services Manager
- **Alfred Domenici,** School Supervisor of Buildings & Grounds
- **Cindy Papa**, Facilities Department Administrative Coordinator
- **Lauri Mancinelli**, Belmont Municipal Light Department
- **Ed Crisfari,** Belmont Municipal Light Department
- **Kate Bowen**, Sustainable Belmont
- **Rebecca Rosen**, Sustainable Belmont
- **Roger Colton**, Belmont Energy Committee
- **Andrew Machado**, The Cadmus Group
- **Chip Goudreau**, Guardian Energy Management Solutions
- **Charles S. Ehl**, Guardian Energy Management Solutions

Executive Summary

About the Town of Belmont

Belmont, also known as "The Town of Homes", is located approximately 8 miles west of Boston in the County of Middlesex. It measures 4.655 square miles and borders Watertown to the south, Waltham to the west, Arlington to the north and Cambridge to the east. Belmont is governed by a three member Board of Selectman, and Town Meeting Members elected from each of its eight precincts.

Belmont is accessible via Route 2 and is also served by both the Massachusetts Bay Transportation Authority Commuter Rail service from Fitchburg to North Station and many bus routes. Belmont grew and became a popular residential destination due to the rail service running through town on its way to Boston.

According to the United States Census from 2014, the town's population is 25,520 consisting of many diverse ethnicities. The Belmont Public School system was ranked # 3 in the Commonwealth for the 2011-2012 school year by U.S. News and World Reports. Recently upgraded to a Level 1 School District, Belmont also offers many award winning athletic and fine and performing art programs for students.

Belmont is also the home of The Belmont Hill School, a private boy's school for grades 7-12 and Belmont Day school, a private school for grades PK-8. Other private institutions include McLean Hospital, a world renowned psychiatric hospital and research center and the Massachusetts Audubon Society's well known "Habitat" sanctuary.

A busy place to live and work, Belmont also enjoys many conservation open spaces for relaxation such as Rock Meadow and Lone Tree Hill with walking trails and wooded areas.

A Tradition of Involvement in Sustainable Activities

In July of 2006, the Town entered into Energy Services Agreement (ESCO) with NORESCO to implement Energy Conservation Measures (ECMs) in twelve Town and School buildings. These measures included energy efficient lighting and controls, installation of energy management systems, Water conservation measures, installment of a pool cover, boiler controls, vending machine controls, steam trap repairs and replacement of rooftop HVAC units. NORESCO's Reconciliation Report for Year 8, August 1, 2013 – July 31, 2014 indicates that total verified savings for the past year amounts to $266,231, exceeding the projected Year 8 savings by $27,120.

Sustainable Belmont is a task force of the Town's permanent Vision 21 Implementation Committee and was begun in 2003. It consists of Belmont residents whose task is "to develop and implement a variety of activities and initiatives to assist Belmont's government, residents, and businesses in becoming a more environmentally responsible community." Its many accomplishments are highlighted by the following:

- The development, adoption and implementation of a Belmont Climate Action Plan (CAP);
- The collection of data to establish a greenhouse gas (GHG) emissions baseline for town;
- Working with the Belmont Health Department, the launch of a recycling program for Belmont households and businesses to properly dispose of compact fluorescent light (CFL) bulbs and tubes;
- The development and adoption of a Sustainable Building Design Policy, which was passed by the Belmont Board of Selectmen to encourage sustainable design of new construction and renovations for both municipal and private development, declaring that the "Town of Belmont "both as a matter of principle and as a cost-saving measure, supports efforts that will achieve the following benefits of sustainable design as applied to new construction and major renovation of all municipal and school district buildings, to the extent practical",
- The continued and ongoing effort of public education and outreach to the residents of Belmont, including partnerships and collaborations with other organizations such as Massachusetts Climate Action Network and Safe Routes to Schools, to support healthy homes and a healthy community on a variety of environmental topics and an initiative on local foods and sustainability;
- Launched a website as an educational environmental resource for the community. www.sustainablebelmont.net.

The Belmont Energy Committee is a permanent town committee appointed by the Board of Selectmen, charged with facilitating, enabling, and helping the Town and its residents, businesses, and institutions to work toward achievement of the Climate Action Plan Resolution (Article 6) adopted by Town Meeting on November 18, 2009. It counts among its many accomplishments the following:

- Supporting the use of alternatives to automobile transportation by securing grant funding for bike racks and developing a biking and walking map for the town;
- Proposed and helped secure the adoption of the Massachusetts Stretch Energy Code by Town Meeting;
- The development and adoption of a zoning bylaw for solar energy systems, co-authored with the Belmont Planning Board;
- Entered into a partnership with Sagewell, Inc. to promote MassSave energy audits to Belmont residents who heat with natural gas through the Town's Better Homes Belmont program. Later worked with the Belmont Municipal Light Department to fund an expansion of that program to homes heating with fuel oil also. By the end of December 2013, the program had generated more than 1,200 energy assessment requests, the highest percentage of assessments of any town in the Commonwealth.

Summary of Municipal Energy Uses

Buildings

With a population of just over 25,000, the Town of Belmont has a moderately sized portfolio of buildings. The Town has 33 buildings that are regularly occupied, in addition to seasonal and unoccupied special purpose structures (e.g. pool bath houses and filter house) that are included under the pumping and open space categories. Buildings account for 86.1% of Town energy use on an MMBtu basis. Town buildings are described below. The Town is including 16 buildings in its Energy Reduction Plan.

Like most cities and towns, Belmont's municipal building stock and building uses have evolved over time as population segments have grown and new municipal responsibilities have emerged. The Town has been diligent in modernization, upkeep and replacement of its facilities. Within the last ten years, the Town has constructed a new elementary school, two fire stations, and a senior center and renovated three administration buildings at its Town Hall complex. Like many other municipalities however, the Town continues to face challenges with a number of older facilities that are in need of significant renovation or replacement. A corresponding challenge in implementing the Energy Reduction Plan will be to select Energy Conservation Measures that have a payback period commensurate with the Town's long-range plan for a particular building.

The main seat of Town government is Town Hall in Belmont Center. Dating to 1881, Town Hall includes offices, meeting rooms, and a large auditorium used for performances and large meetings. The Town's School Department has 7 buildings, including 4 buildings that house elementary school classrooms, one middle schools a high school, , and an administration building.

There are two fire stations, including the Fire Department Headquarters, and one Police Department Headquarters. There is a large Town yard that is home to the Department of Public Works including the Highway, Water and Sewer Divisions.

Currently, there are two active libraries, one of which is a branch library operated by volunteers.

There is a large and active Parks and Recreation Department in town that operates many parks, an outdoor pool, a skating arena (Viglirolo), and a modern High School athletic field with grandstands (Harris Field).

All Town and school buildings are heated with natural gas, except for the Town Hall, Police Headquarters, DPW main Building #1, DPW Sign Shop, the Cemetery Garage, Vigilirolo Skating Rink and the White Field House. A number of school buildings are capable of dual fuels usage, but operate exclusively on natural gas.

The performance of Town buildings has more room for improvement, and the opportunities identified in this plan will result in significant additional energy reductions over the remaining years covered by this Plan. Reductions identified come from building assessments completed by Guardian Energy Management Solutions as part of the ERP development process.

Vehicles

The Town of Belmont has a combined total of 125 vehicles, of which 86 were exempt and 39 were non-exempt. Non-exempt vehicles by department: Facilities (2); Council on Aging (1); Fire Department (6); Health Department (1); Public Works Department ((9); Belmont Municipal Light Department (10); and Police Department (9). Vehicles account for 8.7% of Town energy use during the baseline year. Vehicles used just over 24,000 gallons of unleaded gasoline and 32,325 gallons of diesel fuel, which represent 4,493 MMBtu and 2,977 MMBtu respectively.

Water and Wastewater

Belmont does not operate either water or wastewater treatment plants. Belmont is an MWRA community and uses the MWRA for both water supply and wastewater treatment.

The Water Division administration is responsible for managing the administrative functions that maintain the water distribution system and reinvest in the water infrastructure as well as to provide reliable, safe drinking water in adequate quantities for domestic and business use as well as for public safety firefighting to the community. In addition, the Water Division is responsible for compliance with the USEPA Safe Drinking Water Act and Mass DEP regulations.

The Water Distribution and Maintenance program performs all maintenance and repair functions for the Towns' 93 miles of water main pipes and 2,743 gate valves in the water distribution system, 742 fire hydrants and about 7,670 individual water service pipes on both a scheduled and emergency basis maintaining a 24-7-365 emergency response capability. The Water Division is not responsible for any drinking water treatment facilities or pumping stations.

There are 3 active sewage pumps, I stormwater pump and 2 seasonal irrigation pumps. Electrical use for these pumps is only 35 MMBtu, less than 1% of total energy use.

Streetlights and Traffic Signals

There are 2,392 cobra-style streetlights in Belmont, a combination of high pressure sodium and LED. All streetlights are owned by the Belmont Municipal Light Department, but electrical consumption is the responsibility of the Town. . 1,999 (83.6%) of streetlights are equal to or less than 100 watts. The remaining 393 (16.4%) are equal to or more than 100 watts.

The Town has 30 signalled intersections it is responsible for, many of which have multiple ground-based and hanging signal heads, as well as PED signals. Streetlights and traffic signals are combined for metering purposes and consumed a total of 1,250,193 kWh for baseline year 2013-2014. This figure represents 5% of total energy use.

Table 1: Summary of Municipal Energy Users

Buildings	**Number**	**Ownership**
Oil Heat	8	Muni
Natural Gas Heat	17	Muni
Electric Heat	1	Muni
Unheated	5	Muni
Water and Sewer		
Wastewater Treatment Plant	0	Muni
Drinking Water Treatment Plant	0	Muni
Pumps	6	Muni
Vehicles	125	
Non-Exempt	39	Muni
Exempt	86	Muni
Streetlights	2,392	Muni
Traffic Signals (intersections)	30	Muni
Open Space & Infrastructure*	7	Muni

*Open Space & Infrastructure includes:

DPW Highway Department Gate
DPW Water Department Gate
Harris Field Lighting
Belmont High School Sign Lighting
Concord Avenue Softball Field Lighting
Concord Avenue Baseball Field Lighting
Claflin Street Parking Lot Lighting

Summary of Energy Use Baseline and Plans for Reductions

Belmont has selected FY2014 as its baseline year.

5-Year Building Plan. The Town has initiated a detailed survey of certain Town buildings to assess their existing condition and near-term and long-term capital needs. The goal of this process is combine this information with previous studies of other facilities to identify immediate necessary improvements, to anticipate and budget for future building needs, and to secure information relevant to decisions about long-term use or disposition of buildings. The Facilities Department, which includes senior tradespersons, have been touring each building and preparing these analyses. In the course of this effort, immediate energy savings opportunities can been identified and pursued in many buildings, much as has been done in Belmont's schools for many years. At the same time, the Town has hired a new Facilities Director responsible for the consolidation of Town and School maintenance departments that is taking the lead in execution of plans that are being developed.

In August 2014, Belmont executed a Memorandum of Understanding with Guardian Energy Management Solutions ("Guardian"), a certified National Grid Project Expediter (PEX) as its consulting engineer to identify specific opportunities for energy reduction in Town and school buildings and to help prepare the Town's Green Community Energy Reduction Plan.

Guardian conducted its own site visits of major facilities to be included in Belmont's energy reduction plan, assessed the relative operating efficiency of buildings and systems, identified and quantified energy reduction opportunities.

These recommendations, summarized in this document, will result in energy reductions in buildings of 15.3% against the FY2014 baseline consumption.

Other planned energy reductions include:

- For Vehicles, anti-idling devices will be proposed for Police cruisers and selected diesel vehicles with an anticipated reduction in fuel consumption of 5%, a 15% improvement in fuel efficiency through replacement of older vehicles with new, more fuel efficient models, better fleet maintenance, and reduced idling and other operational adjustments.
- For Street lighting, conversion of all streetlights to LED will result in a 55% reduction in electricity consumption for this end use.

In total, anticipated energy reductions under Belmont's proposed 5-year plan, ending in FY2020 will equal 15% of the FY2014 baseline in specific energy consumption. Plans to achieve the remaining 5% are indicated in the "**Getting to a 20% Energy Use Reduction within 5 Years"** section.

Table 2 below summarizes Belmont's plans for energy reduction.

Table 2: Belmont Energy Use Baseline and Plans for Reduction

BASELINE YEAR: July 1, 2013 to June 30, 2014	MMBtu Used in Baseline Year	% of Total MMBtu Baseline Energy Consumption	Projected planned MMBtu Savings	Savings as % of Total MMBtu Baseline Energy Consumption
Buildings	73682	86.1%	10087	11.8%
Vehicles	7470	8.7%	636	0.7%
Street/Traffic Lights	4263	5.0%	2346	2.7%
Water/Sewer/Pumping	35	0.0%	0	0.0%
Open Space	164	0.2%	0	0.0%
Undocumented ECMs	0	0.0%	4310	5.0%
Total	**85613**	**100.0%**	**13069**	**20.3%**

Energy Use Baseline Inventory

Inventory Tool Used

The Town of Belmont will be using MassEnergyInsight as its inventory tool. Initial MEI set ups of all Town buildings and other accounts have been completed.

Because comprehensive energy use data has never been available to Town departments for the buildings and facilities they manage, there is great interest in having access to MEI. Anticipated users include: Town Facilities Director, Department of Public Works, and the Main Library.

Baseline Year

As noted earlier, Belmont will use FY 2014 as its baseline year.

Municipal Energy Consumption for the Baseline Year

Table 3 below, based on energy use information extracted from MassEnergyInsight, shows the Town of Belmont's energy use during FY2014 (our baseline year) in native units and MMBtus.

Table 3: Belmont Energy Use Baseline FY2014

			FY2014											
			Electric KWH		Gas (therms)		Gasoline		Diesel		Propane		Total	
	Facility	Year Built	Use	MMBtu	Use	MMBtu	Use	MMBtu	Use	MMBtu	Use	MMBtu	Cost	MMBtu
Building	Belmont HS	1971	1829040 2786 40304 36321	6236.1 9.5 137.4 123.8	149	14.9	111081	15405.8					$ 615,421	21928
Building	Winthrop L Chenery MS	1997	1170432	3990.6	107047	10704.7							$ 197,939	14695
Building	Roger E Wellington ES	2011	647392	2207.3	31096	3109.6							$ 127,079	5317
Building	Daniel Butler ES		200480	683.5	39251	3925.1							$ 54,362	4609
Building	Winn Brook ES	1934	294880	1005.4	35543	3554.3							$ 81,322	4560
Building	Mary Lee Burbank ES	1931	233328	795.5	32372	3237.2							$ 49,996	4033
Building	Fire Headquarters	2006	273504	932.5	12532	1253.2							$ 65,284	2186
Building	Main Library	1964	160530	547.3	13490	1349.0							$ 40,222	1896
Building	Fire Station 2	2006	199864	681.4	11288	1128.8							$ 51,021	1810
Building	Police Headquarters	1930	238239	812.3			6907	957.9					$ 59,368	1770
Building	Town Hall	1881	171940	586.2			8310	1152.5					$ 52,732	1739
Building	Homer Municipal Building	1898	299992	1022.8	6402	640.2							$ 50,990	1663
Building	DPW Building #1 - Office	1930	57362	195.6			10438	1447.6					$ 44,518	1643
Building	Skip Vigliriolo Skating Rink	1971	285624	973.8			2329	323.0					$ 47,248	1297
Building	School Administration Building	1901	93576	319.0	5990	599.0							$ 25,446	918
Building	Beech Street Center	2009	211272	720.3	375	37.5							$ 37,015	758
Building	White Field House	1932	14851	50.6			3862	535.6					$ 15,568	586
Building	DPW Building #5 - Garage	1930	6934	23.6	5486	548.6							$ 8,723	572
Building	Cemetery Garage	1954	3370	11.5			1672	231.9					$ 5,985	243
Building	DPW Building #2 - Sign Shop		138	0.5			937	130.0					$ 3,281	130
Building	DPW Building #6 New Garage		19197	65.5							592.0	53.9	$ 5,625	65
Building	Cemetery Office	1925	7673	26.2	759	75.9							$ 3,052	102
Building	Underwood Pool Filter House		25615	87.3									$ 4,426	87
Building	Benton Branch Library	1892	4238	14.4									$ 951	14
Building	Underwood Pool Bathhouse	1954	1305	4.4									$ 406	4
Building	Mill Street Barn/Warehouse		1189	4.1									$ 395	4
Building	DPW Highway Salt Shed		299	1.0									$ 192	1
Building	DPW Water Department	1963	38820	132.4	9173	917.3							$ 19,090	1050
												Buildings Total		73682
Gate	Infrastructure		26	0.1									$ 211	0
Gate	Infrastructure		4	0.0									$ 191	0
open Sapce	Infrastructure		26505	90.4									$ 4,665	90
Open Space	School Infrastructure		309	1.1									$ 246	1
open Space	Infrastructure		15903	54.2									$ 2,924	54
open Space	Infrastructure		2	0.0									$ 191	0
Parking lot	Infrastructure		5301	18.1									$ 1,196	18
												Total Open Space		164
Streetlights	Streetlights		1250193	4262.5									$ 284,215	4263
				Total Street Lights										4,263
Vehicles	Diesel								32325	4493.2			$ 103,522	4493
Vehicles	Gasoline						24005	2976.6					$ 75,515	2977
												Total Vehicles		7470
Water	School Infrastructure		3020	10.3									$ 768	10
Water	Infrastructure		2548	8.7									$ 622	9
Water	Infrastructure		1638	5.6									$ 471	6
Water	Infrastructure		33	0.1									$ 196	0
Water	Infrastructure		389	1.3									$ 256	1
Water	Infrastructure		2545	8.7									$ 650	9
												Total Water/Sewer/Pumping		35

Energy Reduction Plan for Belmont

Narrative Summary

Having chosen FY2014 as our baseline year, Belmont is anxious to initiate the five year implementation period for our Energy Reduction Plan.

Looking forward, Belmont's plan is to:

- Focus on specific ECMs that can be funded with the initial Green Communities grant (est. $150,000) and a recently approved State grant for energy improvements ($50,000). These funds are earmarked in Section 2200-0100 of the Department of Environmental Protection's budget for "environmental programs in Belmont". The proposed ECM's in this face have favorable payback periods allowing for re-investment for additional ECMs;
- Develop a written Facilities Maintenance Manual that will identify and plan regular equipment inspections and preventive maintenance schedules ensuring all existing and replacement building equipment is operating at maximum efficiency;
- Proceed with conversion of streetlights to LED over the next five years, including expenditure of a $25,000 Municipal Light Plant - Municipal Energy Efficiency Program in FY15;
- Improve our vehicle fleet management with an eye toward reducing fuel use, including installing anti-idling devices in selected vehicles, reinforcement of energy reduction objectives with vehicle users, adoption of energy savings maintenance practices and materials where practical, and replacing end-of-life vehicles with more energy efficient models.

Overview of Years 1 – 3 [FY2015 – FY2017]

During the initial 3-year period of the Green Communities Energy Reduction Plan, the Town will rely upon Energy Conservation Measures (ECMs) noted in Table 4 and the increased use of Mass Energy Insight information for prioritization of ECMs to be implemented.

It is intended to use grant and funds to, "pick the low-hanging fruit" as it were, to implement ECMs that have rapid payback periods. Representative of these would be retro-commissioning and lighting control projects. Table 4 indicates an annual budget savings that will reach $432,995 after 5 years. The initial annual savings of approximately $80,000 will be cumulative as subsequent ECMs are implemented, resulting in the anticipated annual savings of $432,995 from FY19 onward. The Town will look to conservatively re-invest this annual savings to fund additional ECM's as identified in Table 4. See Appendix D.

In addition, the Facilities Department will look to implement recommendations from the current Facilities Condition Assessment ("FCA") that would have resultant energy efficiency benefits. For instance, the FCA may recommend a boiler replacement as the particular piece of equipment is nearing the end of its expected useful life. Therefore, although the primary motivation for such a measure is useful life expectancy, and not payback period from reduced energy consumption, it will add to the Town's overall goal.

Years 1-3 will also see the initiation of anti-idling installations for selected Town vehicles. A monitoring program to compare the benefits of this ECM will guide the Town in considering future installations. The Town will also begin the implementation of the Fuel Efficient Vehicle Policy for instances where non-exempt vehicles are replaced.

It is anticipated that streetlight conversions to LED will be a phased process with the goal of replacing high pressure sodium fixtures at a pace of 20%, or 400 fixtures, per year.

Overview of Goals for Years 4 – 5 [FY2018 – FY2019]

Years 4 and 5 of the Belmont's ERP will continue to be implementation years for energy reduction projects, guided primarily from the results of successful ECMs of Years 1-3. One challenge the Town will face in considering prioritization of ECMs is the long range plan for major replacement or upgrades to some older Town facilities. The development of such a plan will be useful in considering effective payback periods of identified ECMs.

The Town will also examine retro-commissioning of buildings not noted for such in Table 4. Town Hall, the Homer Building, and the two fire stations will reach the ten year anniversary of the renovation/construction during Years 4-5. It is generally recommended to conduct retro-commissioning at those times in a building's life cycle.

If the proposed phased streetlight LED conversion is implemented, it should be complete in FY2020.

The Water Division of Public Works may consider installation of variable frequency drives in its 3 sewer pumps and one stormwater pump.

Savings Justifications

Lighting

- Unless a facility has converted to LED's, minimum 40% savings are achievable assuming just the simple one for one replacement of a 32Watt T8 lamp with 17 Watt LED tube
- Even greater savings are available as 3 lamp and 4 lamp (90-120 watts typical) T8 fixtures can be retrofit with LED's consuming as little as 34 Watts.
- More so than commercial building K-12 in gymnasiums & cafeterias have higher intensity fixtures where the savings are even greater with LED. Since these facilities tend to be used more frequently (weekends / nights) in relation to classroom lighting the savings possible in a school are proportionately greater. Hence the 65 % estimation for schools.

- National Grid will pay rebate/incentive based upon 24% reduction in kwh usage with use of simple occupancy sensors. In custom lighting projects the 24% calculation is embedded in National Grid's custom lighting project calculator that Guardian must submit as part of the technical review to receive incentive.

EMS , ECM motors, Destrat Turbines

- The savings estimated for Belmont's ERP are conservative percentage estimations based upon the savings Guardian calculated for EMS, ECM motors, and Destrat turbine projects.

Steam Traps

- Without a proper steam trap audit like one that would be conducted in an ASHRAE Level II it's impossible to estimate savings from repaired or replaced steam traps. However, if there is not a regular steam trap maintenance program, then steam traps will fail. Heat losses due to failed steam traps are very large. Guardian's experience is that on average 30% heating savings are possible when steam traps are repaired or replaced.

Areas of Least Efficiency / Greatest Waste

<u>Buildings</u>

An examination of energy use per square footage in public buildings in Belmont confirms the expected conclusion that newer buildings operate more efficiently than older ones. For instance, the calculation of MMBtu/SF for the 5-year old Beech Street Center is 0.038. A similar calculation for the 40-year old Belmont High School indicates a score of 0.105. However, an anomaly such as the 0.102 score for the 8-year old Fire Headquarters indicates this building requires further study. That being said, we believe that having a formal Energy Reduction Plan, achieving Green Community designation, and proceeding with the projects that have been identified will help Belmont address outlying performers and better manage building energy use.

<u>Lighting</u>

The rapid improvements in LED technology and deep reductions in the cost of retrofitting streetlights with LED makes using high pressure sodium lights very "old school." Converting to LED in the next five years will result in 50% energy reductions in this end use.

<u>Vehicles</u>

Town vehicles, exempt and non-exempt, and the amount of fuel used to operate them are probably typical for cities and Towns in the State. We will implement policies and procedures which we hope will result in reductions to what is a very significant portion of the Town's overall energy consumption.

Getting to a 20% Energy Use Reduction within 5 Years

All of the proposed projects listed in this report represent a strategy to achieve 20% savings over 5 years. This strategy is subject to change depending on municipal needs and availability of funding. The specific details about the proposed measures to achieve a 15.3% reduction are listed in Table 4 starting on the next page of this report. Projected energy savings in Table 4 were obtained from various sources and each record contains a calculation method and details about the source.

The general strategy to achieve the remaining 5% reduction is shown below.

- The Facilities Department, working with the inspection and maintenance schedule developed for the written manual check all electronic/heating/lighting/HVAC equipment for energy efficiency (and optionally conduct auditing for opportunities of improvement);
- Each town department should establish and promote a set of best practices that is appropriate for its businesses and employees. The following are a sample of recommended best practices
    - Identify computers that do not need to run all the time, and set up automatic standby/hibernate options so that the monitor, hard disk, and the system will be put into standby or hibernate mode at a set time;
    - Encourage employees to have available warmer clothes so that the heating can be set a lower level, rather than forcing some others to open windows to cool down;
    - Set cooling to the highest temperature as long as it is still comfortable;
    - Establish guidelines for open-window air exchange;
    - Check to confirm if any public buildings are unnecessarily lighted when they're not in use;
    - When feasible, upgrade to automatic light switches and thermostats, and encourage employees to turn off the lights and dial down cooling/heating when leaving the room/building;
- Evaluate/implement energy efficient cooling strategies for IT computer rooms.
- Turn off equipment not in use during the summer at school buildings;
- Seek creative collaborative energy conservation programs for schools, such as the recent Green Cup Challenge that was successful at the Wellington Elementary School;
- Regularly review recommendations from the Facilities Condition assessments that will add to the 20% goal, such as building envelope improvements and weatherization and insulation measures. 13.6%

Program Management Plan for Implementation, Monitoring, Oversight

Implementation

Belmont's Town Administrator will have ultimate responsibility for implementing this energy reduction plan, with responsibility for specific elements assigned to individual departments and personnel. The appointment of a Belmont Green Communities Team will be established consisting of representatives from the Facilities Department, Public Works Department and the Belmont Municipal Light Department, with assistance from the Belmont Energy Committee and Sustainable Belmont. This team will be responsible for managing specific implementation measures. This team will also develop annual reports to DOER and will recommend to the Town Administrator which measures can be implemented in a particular fiscal year.

Monitoring

Belmont will use MassEnergyInsight to track ongoing energy use and report on actual changes in energy use.

The Belmont Green Communities Team members will be responsible for supporting building owners and operators (i.e., the respective Town departments) to ensure that energy reduction strategies that are instituted under the plan continue to deliver savings. This will include:

- Checking in with building users regularly to identify building comfort or performance issues that could be indicators of equipment issues,
- Frequent confirmation of proper temperature settings and scheduling on programmable thermostats and other building management systems
- Preventative maintenance of building systems and timely replacement of worn components
- Issuing work orders for necessary repairs

Oversight

The Belmont Green Communities Team will track progress toward goals and the status of project implementation. Quarterly and annual reports on activities and accomplishments under the Energy Reduction Plan will be disseminated to stakeholders and filed with the Department of Energy Resources' Green Communities program.

Energy Conservation Measures

The attached Table 4 (Attachment A) summarizes specific improvements, by technology or end use that the Town plans to pursue.

Long-Term Energy Reduction Goals – Beyond 5 years

Municipal Buildings

As the Town continues to renovate, add to, and replace facilities in the context of the continually evolving 5-Year Building Plan, it intends to reduce the energy required per square foot of building area to carry on government and school functions. Our adoption of the stretch code will ensure that this efficiency improvement occurs as part of all major building construction.

Vehicles

We anticipate that all future vehicle purchases will be more efficient than our existing fleet. The Town will make both vehicle energy efficiency and life cycle cost key criteria for selecting new vehicles. We will ensure that new vehicles are well matched to the purposes for which they are intended so that operating efficiency is not sacrificed. Further, we will continue to encourage all vehicle users to operate their vehicles to minimize energy use to the greatest extent practical. And finally, the Town will enhance tracking systems for vehicle fueling and scheduled maintenance.

Street and Traffic Lighting

Having converted all street lighting to LED within the period of the plan, the Town has no further plans for this end use, other than to continue to ensure that any new lights that are added also use best available technology.

Perpetuating Energy Efficiency

The Town plans to integrate energy efficiency and additional reduction strategies where practical into future construction, purchasing, planning, and policy making. Older structures will be renovated or give way to newer ones over time, and our plan is to make energy efficiency and renewable energy development a part of future buildings to the full extent practical.

Onsite Renewable Energy Projects and Renewable Energy

Belmont intends to look for opportunities for self-generation with photovoltaics on both Town and school buildings, coordinating this activity with roof replacement schedules. There are currently no specific proposals for the installation of photovoltaics on roofs being considered by the Facilities Department.

About Guardian Energy Management Solutions

Guardian Energy Management Solutions is pleased to provide the following energy audit report to help support the Green Community initiatives. Guardian specializes in working with municipalities that are positioned to identify and implement energy efficiency solutions through the Green Community process, and has worked with dozens of cities and towns in Massachusetts to help drive down energy usage.

This report was designed under the assumption that specific projects will be chosen for implementation over the course of time. Guardian will continue to support your Green Communities initiatives by assessing additional energy efficiency opportunities and ensuring that you take full advantage of the utility incentive program available from your local Gas and/or Electric utilities.

Guardian Energy Management Solutions provides comprehensive **energy efficiency solutions** for non-residential buildings throughout New England. Our energy reduction solutions include:

- ASHRAE Level 1, 2 and 3 Energy Audits designed to document energy reduction solutions
- Energy Data Logging to identify energy efficiency solutions
- Energy Metering & Sub Metering to track energy use
- Lighting Retrofits for Indoor Lighting and Outdoor Lighting
- Energy Conservation Solutions for HVAC (Heating, Ventilation and Air Conditioning) Equipment
- Energy Management and Building Automation Software
- Building Envelope & Weatherization Solutions
- Installation of Energy Efficient Motors
- Variable Frequency Drives or Variable Speed Drives
- Freezer and Refrigeration Controls

• Solutions for Water Reduction

• Utility Incentive Funding combined with energy efficiency solutions.

Guardian Energy Management Solutions works closely with NStar, National Grid, Western Mass Electric (WMECO) and other utility companies throughout New England to identify and implement **energy reduction solutions**. Guardian's process is designed to save energy while driving down energy costs. We combine energy conservation solutions with available utility incentive funding to reduce project costs for our clients. By offering a wide variety of energy reduction solutions, Guardian ensures that all of your bases are covered when it comes to developing cost reduction strategies.

Guardian Energy Management Solutions is a division of J. Lee Associates, Inc. We are a Massachusetts based company that was established in 2002. Guardian provides services and solutions that are designed to help building owners, facility directors and financial managers reduce energy usage, operational and maintenance costs.

Our Qualifications:

• DCAM Certified, Electrical Services (MA)

• Experience working with the Massachusetts Green Communities Act

• Guardian is licensed to perform work in MA, NH, RI, VT and ME

• Registered Small Veteran Owned Business

• Federal Contractor registered with the Department of Defense

• Master Electricians, Journeyman Electricians, Controls Electricians, Field Technicians and Project Managers on staff.

• Key partnerships with firms that specialize in energy reduction solutions.

Please contact us directly with any questions or if we can be of any assistance as you review each project and consider the funding opportunities.

Guardian Energy Management Solutions

753 Forest Street – Suite 100

Marlborough, MA 01752

Contacts:

Charles S. Ehl	Chip Goudreau	Martin Stowell
Energy Management Specialist	Director, Energy Mgmt. Solutions	Engineer
cehl@guardian-energy.co	chipg@guardian-energy.com	mstowell@guardian-energy.com
781-640-9017	774-285-1294	

Attachment A

Table 4: Proposed ERP Activities with Energy Reductions

Table 4

Energy Conservation Measure

Square Ft	Category / Building	Energy Conservation Measure	Status (Completed with month/year or planned Qtr/year)	Projected Annual Electricity Savings (kWh)	Projected Annual Gas Savings (therms)	Projected Annual Oil Savings (Gallons)	Projected Annual Propane Savings (Gallons)	Projected Annual Gasoline (Gallons)	Projected Annual Diesel Savings (gallons)	MMBtu Savings	Projected Annual Cost Savings ($)	Total Installed Cost ($)	Payback	Green Community Grant ($)	Utility Incentives ($)	Net Cost ($)	Funding Source(s) for Other Grants and Net Town Costs	Source for Projected Savings
		Measure	Status	Energy Data							Financial Data						Reference Data	
208650	Belmont HS	Retro-Commissioning	FY15	137178	11	8331				1627	$ 44,874	$ 30,000	0.7	$ 30,000	$ -	$0	N/A	See Appandix B
		Energy Mgmt. System		182904		11108							#DIV/0!		$ -	$0		See Appandix B
		Boilers				11108							#DIV/0!		$ -	$0		See Appandix B
		Variable Frequency Drive Motors	TBD	45000						154	$ 5,717	$ 45,733	8.0		$ -	$45,733	TBD	See Appandix B
		Interior Lighting	TBD	309108									#DIV/0!		$ -	$0	TBD	See Appandix B
		Electronically Commutated Motors	TBD	10000						34	$ 1,270	$ 6,352	5.0		$ -	$6,352	TBD	See Appandix B
		Lighting Control	TBD	71333						243	$ 9,062	$ 58,902	6.5		$ -	$58,902	TBD	See Appandix B
		Vending Misers	TBD	7500						26	$ 953	$ 2,000	2.1		$ -	$2,000	TBD	See Appandix B
182000	Winthrop L Chenery MS	Retro-Commissioning	FY15	87782	8029	0				1125	$ 19,783	$ 20,000	1.0	$ 20,000	$ 8,029	-$8,029	N/A	See Appandix B
		Energy Mgmt. System	TBD	117043	10705					1500	$ 26,377	$ 211,018	8.0		$ 10,705	$200,314	TBD	See Appandix B
		Variable Frequency Drive Motors	TBD	30000						102	$ 4,017	$ 32,138	8.0		$ -	$32,138	TBD	See Appandix B
		Piping Insulation	TBD							0	$ -		#DIV/0!		$ -	$0	TBD	See Appandix B
		Building Envelope	TBD							0	$ -		#DIV/0!		$ -	$0	TBD	See Appandix B
		Destratification Turbines	TBD		1000					103	$ 1,000	$ 10,000	10.0		$ 1,000	$9,000	TBD	See Appandix B
		WalkIn EC Motors		10000						34	$ 1,339	$ 6,695	5.0		$ -	$6,695	TBD	See Appandix B
		Interior Lighting		197803						675	$ 26,487	$ 172,166	6.5		$ -	$172,166	TBD	See Appandix B
		Lighting Control		45647						156	$ 6,112	$ 39,731	6.5		$ -	$39,731	TBD	See Appandix B
57300	Daniel Butler ES	Retro-Commissioning	FY15	15036	2944					354	$ 5,549	$ 10,000	1.8	$ 10,000	$ 2,944	-$2,944	N/A	See Appandix B
		Boiler Replacement	TBD		3925					404	$ 3,914	$ 58,713	15.0		$ 3,925	$54,788	TBD	See Appandix B
		Burner Controls	TBD		1963								#DIV/0!		$ 1,963	-$1,963	TBD	See Appandix B
		Variable Frequency Drive Motors	TBD	7500						26	$ 1,304	$ 10,429	8.0		$ -	$10,429	TBD	See Appandix B
		Interior lighting	TBD	33881						116	$ 5,889	$ 38,278	6.5		$ -	$38,278	TBD	See Appandix B
		Lighting Control	TBD	7819						27	$ 1,359	$ 8,833	6.5		$ -	$8,833	TBD	See Appandix B
		Vending Misers	FY15	1500						5	$ 261	$ 1,000	3.8	$ 1,000	$ -	$0		See Appandix B
103263	Winn Brook ES	Retro-Commissioning	FY15	22116	2666					349	$ 6,099	$ 10,000	1.6	$ 10,000	$ 2,666	-$2,666	N/A	See Appandix B
		Piping Insulation								0	$ -		#DIV/0!		$ -	$0		See Appandix B
		Burner Controls			1777										$ 1,777	-$1,777		See Appandix B
		AHU replacement		23001											$ -	$0		See Appandix B
		Variable Frequency Drive Motors	TBD	12500						43	$ 1,782	$ 14,258	8.0		$ -	$14,258	TBD	See Appandix B
		Interior lighting	TBD	49835						170	$ 7,105	$ 46,185	6.5		$ -	$46,185	TBD	See Appandix B
		Lighting Control	TBD	11500						39	$ 1,640	$ 10,658	6.5		$ -	$10,658	TBD	See Appandix B
85107	Mary Lee Burbank ES	Retro-Commissioning	TBD	17500	2428					309	$ 4,964	$ 10,000	2.0		$ 2,428	$7,572	TBD	See Appandix B
		Destratification Turbines	TBD		1000					103	$ 1,001	$ 10,000	10.0		$ 1,000	$9,000	TBD	See Appandix B
		Air Handling Unit Replacement	TBD	6067						21	$ 878	TBD	#VALUE!		$ -	$0	TBD	See Appandix B
		Boiler Replacement	TBD		3237					333	$ 3,240	$ 48,597	15.0		$ 3,237	$45,360	TBD	See Appandix B
		Burner Controls	TBD		1619					166	$ 1,620	$ 70,000	43.2		$ 1,619	$68,381	TBD	See Appandix B
		Piping Insulation								0	$ -		#DIV/0!		$ -	$0		See Appandix B
		Interior Lighting	FY15	39432						135	$ 5,709	$ 37,112	6.5	$ 37,112	$ -	$0	N/A	See Appandix B
		Lighting Control	TBD	9100						31	$ 1,318	$ 8,564	6.5		$ -	$8,564	TBD	See Appandix B
		Building En velope								0	$ -		#DIV/0!		$ -	$0	TBD	See Appandix B
21373	Fire Headquarters	Interior Lighting	TBD	27350						93	$ 5,036	$ 32,737	6.5		$ -	$32,737	TBD	See Appandix B
		Lighting Control	TBD	8205						28	$ 1,511	$ 9,821	6.5		$ -	$9,821	TBD	See Appandix B
23850	Main Library	Boiler Replacement	TBD		1349								#DIV/0!		$ 1,349	-$1,349	TBD	See Appandix B
		Burner Controls	TBD		675								#DIV/0!		$ 675	-$675	TBD	See Appandix B
		AC Condensers Replacement	TBD	2247									#DIV/0!		$ -	$0	TBD	See Appandix B
		Variable Frequency Drive Motors	TBD	21000						72	$ 3,080	$ 24,643	8.0		$ -	$24,643	TBD	See Appandix B
		Building Envelope	TBD								$ -		#DIV/0!		$ -	$0	TBD	See Appandix B
		Interior Lighting	TBD	16053						55	$ 2,355	$ 15,306	6.5		$ -	$15,306	TBD	See Appandix B
		Lighting Control	TBD	4816						16	$ 706	$ 4,592	6.5		$ -	$4,592	TBD	See Appandix B
13364	Fire Station 2	Interior Lighting	TBD	19986						68	$ 3,728	$ 24,231	6.5		$ -	$24,231	TBD	See Appandix B
		Lighting Control	TBD	5996						20	$ 1,118	$ 7,269	6.5		$ -	$7,269	TBD	See Appandix B
18800	Town Hall	Interior Lighting	FY15	17194						59	$ 2,588	$ 16,823	6.5	$ 16,823	$ -	$0	N/A	See Appandix B
		Boiler Replacement	TBD			831				116	$ 2,685	$ 45,000	16.8		$ 4,000	$41,000	TBD	See Appandix B
		Burner Controls				416							#DIV/0!			$0		See Appandix B
		Variable Frequency Drive Motors	TBD	17000						58	$ 2,559	$ 20,472	8.0			$20,472	TBD	See Appandix B
		Lighting Control	TBD	5158						18	$ 776	$ 5,047	6.5		$ -	$5,047	TBD	See Appandix B
22900	Homer Municipal Building	Interior Lighting	TBD	29999						102	$ 4,257	$ 27,670	6.5		$ -	$27,670	TBD	See Appandix B
		Lighting Control	TBD	9000						31	$ 1,277	$ 8,301	6.5			$8,301	TBD	See Appandix B
13560	DPW Building #1 - Office	Steam Traps Repairs	TBD			3131				435	$ 10,159	$ 30,000	3.0		$ 2,500	$27,500	TBD	See Appandix B
		Boiler Replacement	TBD			1044				145	$ 3,386	$ 50,000	14.8			$50,000	TBD	See Appandix B
		Interior Lighting	TBD	5736						20	$ 1,066	$ 15,983	15.0			$15,983	TBD	See Appandix B
28800	Skip Vigliriolo Skating Rink	Interior Lighting	TBD	5100						17	$ 706	$ 4,589	6.5		$ -	$4,589	TBD	See Appandix B
		Variable Frequency Drive Motors	TBD	25000						85	$ 3,461	$ 27,687	8.0		$ -	$27,687	TBD	See Appandix B
8000	DPW Water Department		TBD							0			#DIV/0!		$ -	$0		See Appandix B
11000	School Administration Building	Retro-Commissioning	TBD	4679	300					47	$ 1,272	$ 10,000	7.9		$ 300	$9,701	TBD	See Appandix B
		Interior Lighting	TBD	9358						32	$ 1,732	$ 12,122	7.0			$12,122	TBD	See Appandix B
		Lighting Control	TBD	2807						10	$ 520	$ 3,637	7.0			$3,637	TBD	See Appandix B
19747	Beech Street Center	Interior Lighting	FY15	21127						72	$ 3,617	$ 23,510	6.5	$ 23,510	$ -	$0	N/A	See Appandix B
		Lighting Control	TBD	6338						22	$ 1,085	$ 7,053	6.5		$ -	$7,053	TBD	See Appandix B
		Destratification Turbines	TBD		50					5	$ 500	$ 5,000			$ 50	$4,950	TBD	See Appandix B
			TBD															
			TBD															
			TBD															
Square Ft	Category / Building	Energy Conservation Measure	Status (Completed with month/year or planned Qtr/year)	Projected Annual Electricity Savings (kWh)	Projected Annual Gas Savings (therms)	Projected Annual Oil Savings (Gallons)	Projected Annual Propane Savings (Gallons)	Projected Annual Gasoline (Gallons)	Projected Annual Diesel Savings (gallons)	MMBtu Savings	Projected Annual Cost Savings ($)	Total Installed Cost ($)	Payback	Green Community Grant ($)	Utility Incentives ($)	Net Cost ($)	Funding Source(s) for Other Grants and Net Town Costs	Source for Projected Savings
4500	White Field House	Boiler Replacement	TBD			386				54	$ 1,265	$ 25,000	19.8			$25,000	TBD	Guardian Audit
Buildings SubTotal				**1772234**	**43675**	**36355**	**0**	**0**	**0**	**10087**	**$ 261,069**	**$ 1,483,855**		**$ 148,445**	**$ 50,164**	**$1,285,245**		
	Diesel		TBD						2392	332	$ 7,661				$ -		TBD	
13950	Police Headquarters									0					$ -			
	Gasoline		TBD					2449		304	$ 7,947				$ -		TBD	
Vehicles SubTotal								**2449**	**2392**	**636**	**$ 15,608**	**$ -**						
	Streetlights		FY16 - FY20	687606						2346	$ 156,318	$ 703,432	4.5		$ -		TBD	
Street & Traffic Lights SubTotal				**687606**						**2346**	**$ 156,318**	**$ 703,432**			$ -	**$703,432**		
Total										**13,069**	**432,995**	**2,187,287**		**148,445**	**50,164**	**$1,988,677**		

FY2014

Category / Building	Electric KWH Use	Electric Cost	Electric Cost/Unit	Electric MMBtu	Gas (therms) Use	Gas Cost	Gas Cost/Unit	Gas MMBtu	Oil Gallons/Propane/Diesel/Gasoline Use	Oil Cost	Oil Cost/Unit	Oil MMBtu	Total Cost	Total MMBtu
Belmont HS	1829040	$ 232,353	$ 0.127	6236.1	149	$ 1,378	$ 9.247	14.9	111081	$ 365,964	$ 3.295	15405.8	$ 615,421	21928
	2786	$ 662	$ 0.238	9.5										
	40304	$ 8,319	$ 0.206	137.4										
	36321	$ 6,745	$ 0.186	123.8										
Winthrop L Chenery MS	1170432	$ 156,728	$ 0.134	3990.6	107047	$ 41,211	$ 0.385	10704.7					$ 197,939	14695
													$ -	0
Daniel Butler ES	200480	$ 34,845	$ 0.174	683.5	39251	$ 19,516	$ 0.497	3925.1					$ 54,362	4609
Winn Brook ES	294880	$ 42,044	$ 0.143	1005.4	35543	$ 39,278	$ 1.105	3554.3					$ 81,322	4560
Mary Lee Burbank ES	233328	$ 33,784	$ 0.145	795.5	32372	$ 16,212	$ 0.501	3237.2					$ 49,996	4033
Fire Headquarters	273504	$ 50,365	$ 0.184	932.5	12532	$ 14,920	$ 1.191	1253.2					$ 65,284	2186
Main Library	160530	$ 23,547	$ 0.147	547.3	13490	$ 16,675	$ 1.236	1349.0					$ 40,222	1896
Fire Station 2	199864	$ 37,279	$ 0.187	681.4	11288	$ 13,742	$ 1.217	1128.8					$ 51,021	1810
Town Hall	171940	$ 25,882	$ 0.151	586.2					8310	$ 26,850	$ 3.231	1152.5	$ 52,732	1739
Homer Municipal Building	299992	$ 42,570	$ 0.142	1022.8	6402	$ 8,420	$ 1.315	640.2					$ 50,990	1663
DPW Building #1 - Office	57362	$ 10,656	$ 0.186	195.6					10438	$ 33,862	$ 3.244	1447.6	$ 44,518	1643
Skip Vigliriolo Skating Rink	285624	$ 39,541	$ 0.138	973.8					2329	$ 7,707	$ 3.309	323.0	$ 47,248	1297
DPW Water Department	38820	$ 7,307	$ 0.188	132.4	9173	$ 11,784	$ 1.285	917.3					$ 19,090	1050
School Administration Building	93576	$ 17,317	$ 0.185	319.0	5990	$ 8,129	$ 1.357	599.0					$ 25,446	918
Beech Street Center	211272	$ 36,170	$ 0.171	720.3	375	$ 846	$ 2.256	37.5					$ 37,015	758
White Field House	14851	$ 2,916	$ 0.196	50.6					3862	$ 12,652	$ 3.276	535.6	$ 15,568	586
Diesel									32325	$ 103,522	$ 3.203	4489.1	$ 103,522	4489
Police Headquarters	238239	$ 36,950	$ 0.155	812.3					6907	$ 22,418	$ 3.246	957.9	$ 59,368	1770
Gasoline									24005	$ 75,515	$ 3.146	3329.3	$ 75,515	3329
Streetlights	1250193	$ 284,215	$ 0.227	4262.5									$ 284,215	4263
Street & Traffic Lights SubTotal	1250193	$ 284,215	$ 0.227	4262.5									$ 284,215	4263
Total	0	0											$ 1,493,796	66,847

Appendix A

Authorizations and Endorsements of Belmont's Energy Reduction Plan

Office of the Board of Selectmen
Town of Belmont
Massachusetts
selectmen@belmont-ma.gov

455 CONCORD AVENUE
BELMONT, MASSACHUSETTS 02478
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SELECTMEN
ANDRÉS T. ROJAS, Chair
SAMI S. BAGHDADY, Vice-Chair
MARK A. PAOLILLO

TOWN ADMINISTRATOR
DAVID J. KALE

ASSISTANT TOWN ADMINISTRATOR
PHYLLIS L. MARSHALL

October 17, 2014

Ms. Lisa Capone, Acting Director
Massachusetts Department of Energy Resources
Green Communities Division
100 Cambridge Street, Suite 1020
Boston, MA 02114

Ms. Capone:

Belmont's Board of Selectman met on October 17, 2014 and, as part of the agenda at that public meeting, reviewed and considered the Energy Reduction Plan being proposed by the Town of Belmont as part of our Green Community Application.

Belmont will be establishing FY2014 as its baseline year to capture energy reductions implemented over the last two years. We have developed a plan to achieve the remainder of our 20% reduction by the end of FY2019.

The Board of Selectman endorsed and adopted this Energy Reduction Plan at the October 17, 2014 meeting and has authorized me to submit the plan as part of Belmont's Green Community Application.

We look forward to working with the Department of Energy Resources as we move forward with energy reduction plan implementation and other Green Community activities.

Sincerely,

David J. Kale
Town Administrator

BELMONT PUBLIC SCHOOLS

JOHN P. PHELAN
SUPERINTENDENT OF SCHOOLS
(617) 993-5401

JANICE G. DARIAS
ASSISTANT SUPERINTENDENT
FOR CURRICULUM & INSTRUCTION
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BUSINESS & OPERATIONS
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MARY PEDERSON
DIRECTOR OF HUMAN RESOURCES
(617) 993-5425

October 15, 2014

Department of Energy Resources
Green Communities Division
100 Cambridge Street, 10th Floor
Boston, MA 02114
ATTN: Lisa Capone, Acting Director

Re: Town of Belmont acceptance of Green Communities Designation

Dear Ms. Capone:

On behalf of the Belmont School Department we are committed to achieving the 20 percent energy use reduction goal of the Town of Belmont. The School Department has worked in collaboration with the Belmont Facilities Department and other town departments to develop the Belmont energy use reduction plan and will continue to collaborate on the implementation of the plan.

We are also committed to complying with the Green Communities vehicle efficiency guidelines.

Sincerely,

John P. Phelan
Superintendent of Schools

Appendix B

Calculations and Methodologies for Energy Reduction Projections

Energy Conservation Measure	Calculation	Explanation	Source
RCx	Use (Gas, Electric, Oil) * 7.5%	The 2007 Energy Star Retrocommissioning manual reference several projects with payback as short as 0.7 years and savings as great as 15%. 7.5% was chosen as a conservative estimate.	http://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH5_RetroComm.pdf
Interior Lighting K-12	Electric Use * 0.26 *0.65	Energy Star K-12 schools manual page 3 identfies 26% of a typical schools electric consumption is consumed by Interior lighting. The efficacy of LED's has increased significantly as the availability of hightly cost effective packages has increased. 65% savings is very achievable.	http://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH10_Schools.pdf
Lighting Control K-12	Electric Use * 0.26 *0.15	Energy Star K-12 schools manual page 3 identfies 26% of a typical schools electric consumption is consumed by Interior lighting. National Grid Lighting recognizes minimum 24% operating hours reduction due to simple occupancy sensors. 15 % is a conservative estimate of savings.	http://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH10_Schools.pdf
Interior Lighting	Electric Use * 0.2 * 0.5	Figure 10.6 in cited document shows 20% lighting loads in commercial buildings. In commercial buildings Guardian typically achieves 50% or greater savings.	http://www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/GEA_Chapter10_buildings_hires.pdf
Lighting Control	Electric Use * 0.2 * 0.15	Figure 10.6 in cited document shows 20% lighting loads in commercial buildings. National Grid Lighting recognizes minimum 24% operating hours reduction due to simple occupancy sensors. 15 % is a conservative estimate of savings.	http://www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/GEA_Chapter10_buildings_hires.pdf
EMS	Use (Gas, Electric, Oil) * 7.5%	Guardian Energy Management Solutions has implemented numerous EMS systems in schools and commercial facilities. Savings are quite frequently much greater than 10%.	

VFD's		Guardian uses a VFD savings calculator based upon multiple variable; motor HP, motor efficiency, annual operating hours with and without VFD, load profile, etc. Guardian assumed 2000 hours current operation, 3000 hours with VFD installed, 91% efficient motor and 80% load profile if controlled by VFD.	
Burner Controls	(Gas, Oil) Use * 0.05	Burner controls enable users to achieve significant fuel and emission savings over conventional systems. Typically fuel savings of 8-12% are seen where replacing linkage control systems, with some users reporting even greater savings.	http://www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/steam24_burners.pdf
Boiler Upgrade	(Gas, Oil) Use * 0.10	Most boilers are at end of life 25-30 years after installation. Boilers of this vintage are usually 70-75% efficient. High efficiency condensing boilers now are greater than 90 efficient.	http://energy.gov/energysaver/articles/furnaces-and-boiler
Vending Misers		There are numerous case studies citing savings in excess of 2000 kwh annually. Guardian's calculations typically show 1250 to 1500 kwh annually per vending machine which is more conservative	https://michigan.gov/documents/CIS_EO_Vending_Machine_05-0042_155715_7.pdf
ECM Motors		Estimated savings are typical Guardian experience	
DeStrat Turbines		Estimated savings are typical Guardian experience	
Steam Traps		Failed steam traps are a major source of heat loss. Savings in excess of 30% is typical by repairing or replacing failed steam traps.	

Appendix C

Guardian Energy Management Solutions Building Assessments

Belmont High School:

Belmont High School was constructed in 1970 with 208,650 square feet. Its occupancy is approximately 1200 Students and 100 faculty and administration. Beyond its educational purposes it's used for various community activities in the summer and nights and weekends. It is in good condition for a building its age.

Recommended Improvements

RetroCommissioning (RCx) - Over time a facility's performance changes as the building and equipment ages and as varying maintenance and replacement strategies are employed in accordance to the needs of the building owner, its maintenance staff, and the occupants. RCx is a process whereby a building's systems are assessed and remediated with the goal of returning them to the condition and setting when the building was originally commissioned. Frequently an RCx will reveal other energy saving opportunities that were not available when the building was originally constructed.

Energy Management System (EMS) - Currently there is not an EMS installed in the school. An EMS allows for the scheduling of equipment for occupied and unoccupied modes, e.g. nights & weekends. Additionally it provides the infrastructure for other energy savings strategies, for example demand control ventilation. Demand control ventilation saves energy by venting conditioned air only when CO_2 sensor input to the EMS indicates the need to vent the CO_2. In large spaces like auditoriums or cafeterias the venting system has to be sized for full occupancy, yet it's more common for these spaces to have little or no occupancy.

The cost of the installation is high but offers a significant opportunity for energy savings, non-energy savings due to the information it provides as well as increased occupant comfort and improved building performance. Given the initial cost a phased approach makes sense with initial emphasis on controlling the major mechanical equipment.

Boilers - There are three large oil-fired boilers. These boilers consume 69.8 Gallons of Oil/hr. or 8369 MBH at around 86% efficiency however due to age this may be assumed to be closer to 80%. These boilers serve several functions. They feed the baseboard hydronic heating system and domestic hot water, produce steam which heats the pre-heat coils in the 9 RTUs, and they provide heat to the heat exchange for the pool.

The boilers have Dual Fuel capability equipped with burner controls including parallel positioning fire eye controls and O2 trim packages.

Consideration should be given to replacing the boilers with natural gas fired high efficiency condensing boilers. Typically boiler replacements have a long payback, but due to the fact that this would be an oil to gas conversion the financial payback is much faster.

Vending Misers - There are 4 beverage vending machines and 2 snack vending machines that currently run 24/7. Vending miser controls could save energy by shutting these off at night.

Variable Frequency Drives (VFD's) - Electric induction motors are commonly applied in the fans and pumps that are integral to a building's HVAC system pumps and fans. Electric motors can be switched on & off like a light. However in doing so there is large inrush current in the windings of the motor as it overcomes its inertia. The current decreases to its rated current as it comes to 100% of its rated speed. Soft starters avoid the inrush current but ultimately will run at 100% of its rated speed. VFD's much like a reduced voltage starter or "soft starter" control the initial start, but more importantly control the speed of the motor in accordance with the application requirements. It's here excellent savings can be realized.

There are twenty (20) motors that are excellent candidates for VFD's. They are the fan and condenser motors for nine (9) Mammoth RTU with 26 tons cooling each as well as the quantity (2) two 10HP pump motors connected to the hydronic heating system.

Building Envelope – A building this age should be assessed for building envelope. It's common for the insulation system to be compromised at the roof wall intersection, and the seals between doors and windows.

Interior Lighting – The classrooms have suspended indirect T8 fluorescent light fixtures, the halls have multi lamp square luminaires. All ballasts were converted to electronic ballasts during the ESCO project that occurred some years back. Also observed were ceiling mounted wrap fixtures. In the auditorium there are hard to reach lamps. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen

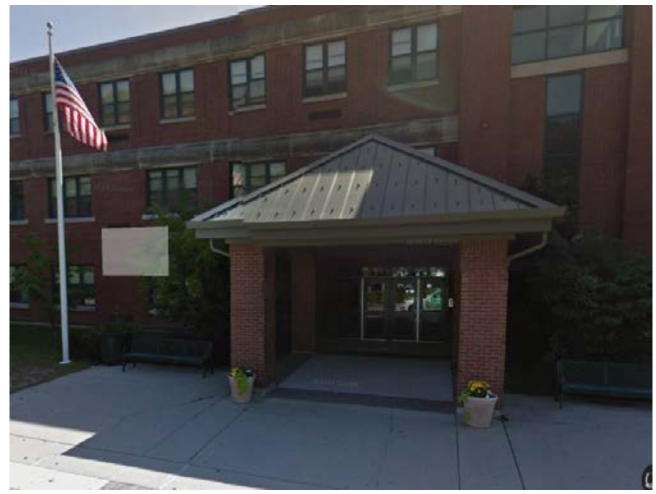
- Relamp / Reballast with energy efficient lamps and electronic ballast.
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

ECM Motors – In walk in refrigerators and freezers the evaporator fans run 24/7. It is very common for the evaporator fan motors to be AC induction type. As such they are an excellent candidate to be retrofit with Electronically Commutated Motors (ECM). Energy savings are achieved by controlling the speed of the motors and the inherent construction of these motors which is permanent magnet and on average 10% more efficient than induction motors.

Chenery Middle School

The Chenery Middle School is located at 95 Washington Street. The school was constructed in 1997 and is 182,000 square feet in area. It serves over 1100 students from grade 5-8 with 120 faculty and administration. The school is in good condition for a building its age.



Recommended Improvements

RetroCommissioning (RCx) - Over time a facility's performance changes as the building and equipment ages and as varying maintenance and replacement strategies are employed in accordance to the needs of the building owner, its maintenance staff, and the occupants. RCx is a process whereby a building's systems are assessed and remediated with the goal of returning them to the condition and setting when the building was originally commissioned. Frequently an RCx will reveal other energy saving opportunities that were not available when the building was 1st constructed.

Energy Management System (EMS) - Currently, there is not an EMS installed in the school. An EMS allows for the scheduling of equipment and provides the infrastructure for other energy savings strategies such as demand control ventilation. For example there are many exhaust fans that run constantly. This is a major waste of energy. If an EMS was installed these fans could be scheduled.

The cost of the installation is high but offers a significant opportunity for energy savings, non-energy savings due to the information it provides as well as increased occupant comfort and improved building performance. Given the initial cost a phased approach makes sense with initial emphasis on controlling the major mechanical equipment.

VFD's – In the mechanical room there are 6 pumps with motors not controlled by VFD's. They are two each at 10, 15, and 20 HP. Additionally, the RTU compressor and fan motors may benefit from the installation of VFD's to control their speed. VFD's save energy by controlling motors speed specific to the application rather than full speed.

Piping Insulation -Domestic Hot Water (DHW) is provided by a 1,480,000 BTUH Gas-fired boiler for hot water with 80% efficiency. It was observed that some of the insulation around the tank was torn and pulled away. This should be repaired.

Building Envelope – The hallway adjacent between the cafeteria and the internal courtyard has a metal roof and only a suspended ceiling. In the winter pipes are freezing. **There are major heat loss issues here.** The roof needs to be insulated or an air barrier above the suspended ceiling with its own insulation needs to be constructed. *The* roof is made of metal supported by metal beams and only a suspended ceiling.

Destratification Turbines – The Gymnasium and Auditorium should be assessed for destratification turbines during the heating season. Areas with high ceilings have the potential for warm air to rise and settle or stratify at the top of the space. Destratification turbines push the warm air to occupant level creating a flow that reduces the demand for heat.

Walk-In's EC Motor – The school walk-in freezer and refrigerator should be assessed for the installation of Electronically Commutated Motors for the Fan motors. In these applications fans are running 24/7/365. ECM motors are of permanent magnet construction and are greater than 10% more efficient than induction motors.

Interior Lighting – The classrooms have suspended indirect T8 fluorescent light fixtures, the halls have multi lamp square luminaires. Also observed were ceiling mounted wrap fixtures. In the auditorium there are hard to reach lamps. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

Burbank Elementary School

The Burbank Elementary School was originally constructed in 1931. From 1987-1989 it was completely renovated and enlarged to its current area of 85,107 square feet. It serves grades K-4. It has approximately 360 students and 20 teachers plus administrative staff.

Recommended Improvements

RetroCommissioning (RCx) - Over time a facility's performance changes as the building and equipment ages and as varying maintenance and replacement strategies are employed in accordance to the needs of the building owner, its maintenance staff, and the occupants. RCx is a process whereby a building's systems are assessed and remediated with the goal of returning them to the condition and setting when the building was originally commissioned. Frequently an RCx will reveal other energy saving opportunities that were not available when the building was originally constructed. This is especially so since it appears the building has a Metasys BAS system. However its status is unknown as the users don't have password or access. It should be assumed that the building is not being controlled as originally intended.

Destratification Turbines – The Gymnasium should be assessed for destratification turbines during the heating season. Areas with high ceilings have the potential for warm air to rise and settle/ stratify at the top of the space. Destratification turbines push the warm air to occupant level creating a flow that reduces the demand for heat.

Air Handling Units (AHU's) - The four (4) AHU"s in the building are estimated to be over 20 years old. At this point they should be considered to be near end of life and should be replaced. As it should be new units will be more efficient but really this is a capital expenditure.

Boiler Upgrade – The Weil McLain Boilers were installed during the aforementioned renovation 25 + years ago. As such they are nearing end of life and moreover units of this era have an efficiency of 70-75%. These should be replaced with high efficiency (>90%) condensing boilers sized for the school.

Burner Controls - A less expensive option would be to boiler replacement is the installation of burner controls that save energy by modulating the air intake.

Piping Insulation – In the mechanical room there is exposed hot water piping. Insulating piping is a simple way to insure that the heat is delivered to the spaces that need it and not wasted.

Interior Lighting – The classrooms have suspended indirect T8 fluorescent light fixtures. Also observed were ceiling mounted wrap fixtures. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits

- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

Building Envelope – A building this age should be assessed for building envelope. It's common for the insulation system to be compromised at the roof wall intersection, and the seals between doors and windows. For example door weather stripping is needed as there were several visible gaps.

Butler Elementary

The Butler Elementary School is the oldest town building still in service. The building was originally constructed in 1900 and has been renovated several times most recently in the early 1980's. Its current size is 57,300 square feet. Its occupancy is 400 with approximately 370 students and with the balance being teachers and administrative staff. It serves grade K-4

Recommended Improvements

RetroCommissioning (RCx) - Over time a facility's performance changes as the building and equipment ages and as varying maintenance and replacement strategies are employed in accordance to the needs of the building owner, its maintenance staff, and the occupants. RCx is a process whereby a building's systems are assessed and remediated with the goal of returning them to the condition and setting when the building was originally commissioned. Frequently an RCx will reveal other energy saving opportunities that were not available when the building was 1st constructed. This is especially so since it appears the building has a Metasys BAS system. However its status is unknown as the users don't have password or access. It should be assumed that the building is not being controlled as originally intended.

Boiler Upgrade – The Boilers were installed during the aforementioned renovation 30 + years ago. As such they are nearing end of life. Boiler is running at 79% efficiency. These should be replaced with high efficiency (>90%) condensing boilers sized for the school.

Burner Controls - A less expensive option to boiler replacement is the installation of burner controls that save energy by modulating the air intake.

VFD's – There are 4 pump motors, (1) 3HP, (1) 5 HP, and (2) 7.5 HP units that run start stop. These should be assessed to be retrofitted with VFD's.

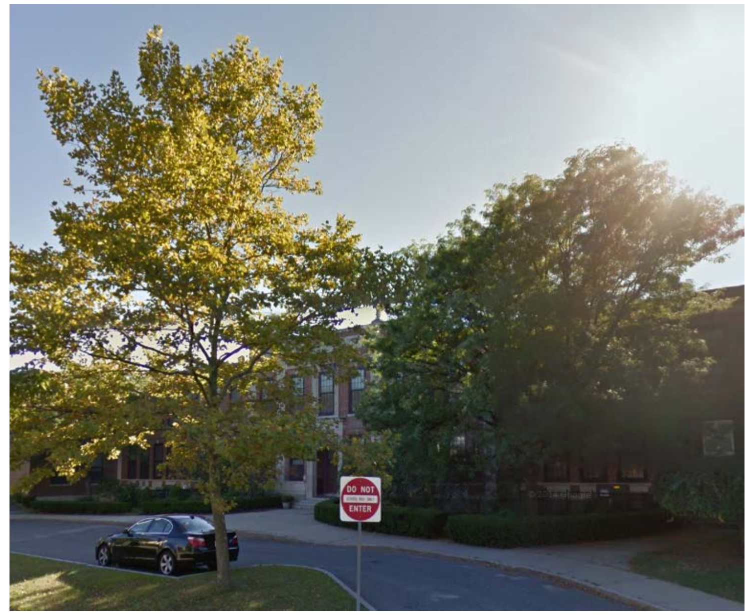
Interior Lighting – The classrooms have suspended indirect T8 fluorescent light fixtures. Also observed were ceiling mounted wrap fixtures. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

There are existing fixture mounted occupancy sensors in the classrooms, but they were installed wrong and the light fixture is blocking them rendering them a nuisance at times.

Vending Misers - There's a drink vending machine in the teacher break room currently runs 24/7. Vending miser controls could save energy by shutting it down at night.



Winn Brook Elementary
The School was originally constructed in 1935. The school has since been renovated twice most recently from 1987-1989 where the current gymnasium and library was added for a current area of 103,263 square feet. The school currently has nearly 450 students, 25 teachers plus the administrative staff.

RetroCommissioning (RCx) - Over time a facility's performance changes as the building and equipment ages and as varying maintenance and replacement strategies are employed in accordance to the needs of the building owner, its maintenance staff, and the occupants. RCx is a process whereby a building's systems are assessed and remediated with the goal of returning them to the condition and setting when the building was originally commissioned. Frequently an RCx will reveal other energy saving opportunities that were not available when the building was 1st constructed. This is especially so since it appears the building has a Metasys BAS system. However its status is unknown as the users don't have password or access. It should be assumed that the building is not being controlled as originally intended.

Piping Insulation – In the mechanical room there is exposed hot water piping. Insulating piping is a simple way to insure that the heat is delivered to the spaces that need it and not wasted.

Burner Controls – The installation of burner controls save energy by modulating the air intake.

Domestic Hot Water – The existing DHW is rated at 160,000 BTUH with 80% Efficiency – could replace with a newer more efficient model.

Air Handling Unit's (AHU's) – These are all over 20 years old and should be replaced. One unit is a YORK Makeup Air Handler 20 MBH = 1.66 Tons Cooling from 1988.

VFD's – There are quantity (5) five pump motors each rated at 7.5HP. These should be assessed to be retrofitted with VFD's.

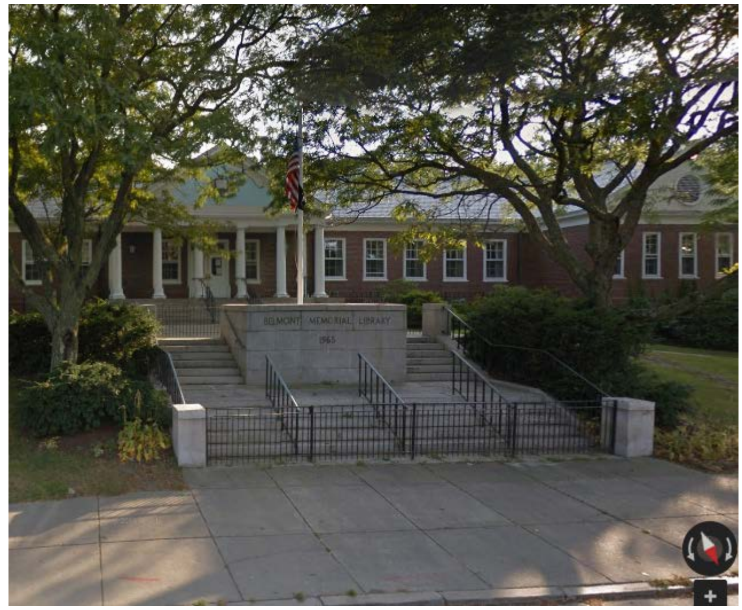
Interior Lighting – The classrooms have suspended indirect T8 fluorescent light fixtures. Also observed were ceiling mounted wrap fixtures. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

They use the stage/cafeteria as a classroom so lighting controls could save money by separating the stage from the cafeteria. Moreover there are numerous high windows that provide ample light making this an excellent daylighting opportunity.

Belmont Library
The Belmont public library was originally constructed in 1964. It occupies 25212 square feet and is in fair condition for a building its age and function. The town was close to replacing the library several years ago, but elected to pursue an alternative project.



Boiler Upgrade - The boiler is a Weil McLain steam boiler that is approximately 70% efficient and at end of life. Near the boiler are two heat exchangers that are approximately 50 gallons each. Heat is supplied by baseboard forced hot water. This boiler should be replaced with a properly sized high efficiency condensing boiler.

Burner Controls - A less expensive option would be to boiler replacement is the installation of burner controls that save energy by modulating the air intake.

AC Condenser's - Condenser Units Cooling is provided by 7 units of various sizes and repair. Older units should be replaced.

VFD's – Condenser & Fan motors should be considered for VFD control.

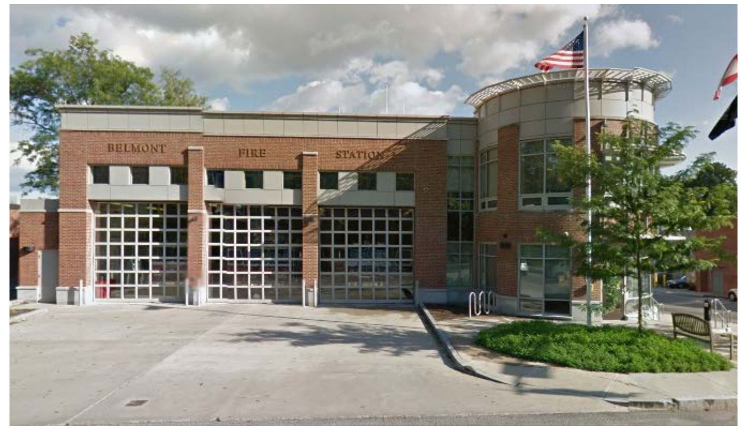
Building Envelope – The attic has original insulation that in many cases is no longer attached to the rafters. The town has plans to remove 1/3 of the old insulation and replace it with R38. However that remains the remainder of the building with very little protection.

Interior Lighting – The library has variety of fluorescent lighting. Mostly it is surface mount T8 linear fixtures in the area accessible by the public and wrap fixtures in the administrative area. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

Lighting controls can offer excellent savings in a library application as the occupancy is inconsistent dependent on the time of day. For example children's areas are largely unoccupied during the school day.



Leonard St Substation
The Leonard St Fire Substation was constructed in 2006 and is 13634 sq. ft. in area. The facility is in good shape for a facility its age and purpose. The facility is operated 24/7.

Heat for the facility is provided by 2 Cleaver Brook gas fired boilers. They are high efficiency boilers but unfortunately are able to operate optimum efficiency due to low gas pressure. This is the likely explanation for the very high gas usage in this facility.

Two 7.5 HP HW pumps operating lead lag provide heat to AHU1 & 2. The building has a Johnson Controls with remote Supervisory Control and Data Acquisition (SCADA) to the Fire HQ. There are two other Air Handlers serving the computer room and the elevator machine room.

The domestic hot water tank at 1st glance would appear to be oversized for the number of occupants. However the tank is necessary per OSHA for Emergency deluge shower for hazmat.

Recommended improvements

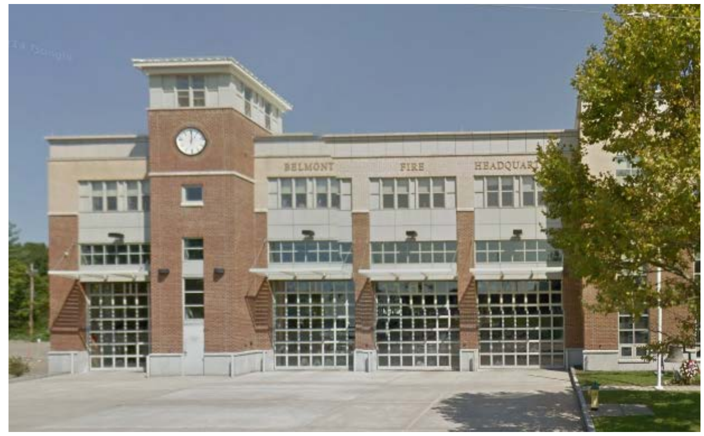
Low Gas Pressure for Boilers - As indicated earlier, this problem needs to be fully investigated for remediation. The use of natural gas in this facility is excessive for a building its size and accounts for nearly 60% of its energy consumption.

Interior Lighting – The Leonard Street Fire Substation has CFL recessed cans, recessed linear fluorescents and high bays in in the garage. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

Fire Station Headquarters



The Fire Station HQ was constructed in 2006 and is 21373 sq. ft. in area. The facility is in good shape for a facility its age and purpose. The facility is operated 24/7. The building was designed for 100 occupants, but at any one time the occupancy is 8-11 people.

Heat for the facility is provided by 2 Cleaver Brooks gas fired boilers. Unfortunately there is not enough gas pressure to achieve the high efficiency for which the boilers are designed. This is the likely explanation for the very high gas usage in this facility.

Two 7.5 HP HW pumps operating lead lag provide heat to AHU1 & 2. The building has a Johnson Controls with remote Supervisory Control and Data Acquisition (SCADA) to the Fire HQ. There are two other Air Handlers serving the computer room and the elevator machine room.

DHW is supplied by a gas fired 250 gallon hot water tank that is vastly oversized for the number of occupants. However the tank is necessary per OSHA for Emergency deluge shower for hazmat.

Recommended Improvements

Low Gas Pressure for Boilers - As indicated earlier, this problem needs to be fully investigated for remediation. The use of natural gas in this facility is excessive for a building its size and accounts for nearly 60% of its energy consumption.

Interior Lighting – The Fire Station HQ has CFL recessed cans, recessed linear fluorescents and high bays in in the garage. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies.

Building Envelope – During construction the windows were not properly installed leaving infiltration issues. This is an area of litigation for the town but one way or another need to be addressed.

DPW Office & Repair #1

The DPW Office & Repair Building was originally constructed in 1928 and occupies 13515 sq. ft. It is of brick construction and is in fair condition given its age and use. Its energy use is very high.

It has an oil fired American Standard Steam boiler without a faceplate. Heat is delivered by steam to space heaters throughout the building. Lighting is fluorescent. Air Conditioning is provided to two offices by split systems.

Recommended Improvements

Steam Traps– It is not known when the last steam trap survey and repair was accomplished. Steam traps are mechanical devices that overtime fail partially or fully open. When that occurs steam is continuously lost. A steam trap survey needs to be conducted and problem steam traps repaired.

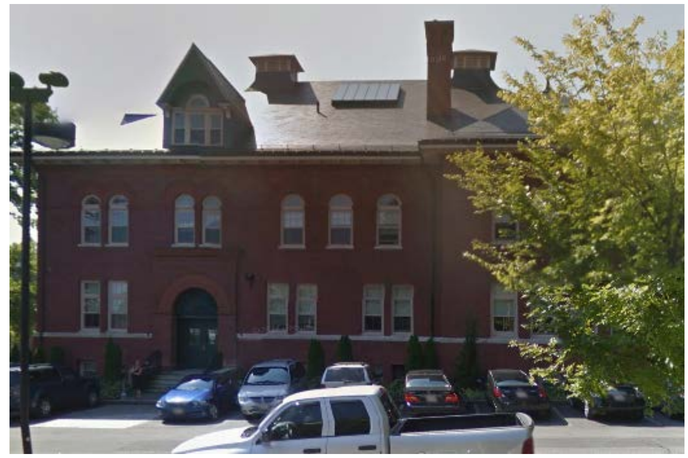
Boiler Upgrade- The oil fired steam boiler is at least 25 years old and needs to be replaced with an energy efficient model. If gas is available a gas conversion should be accomplished.

Infrared Heaters – If Gas is available than Guardian recommends the elimination of the steam space heaters and replace them with infrared heaters. Rather than heating space, infrared heaters heat surfaces. This is advantageous in garage applications where doors frequently open and close leading to conditioned air heat losses. If this measure is to be done it should be done in tandem with the Boiler upgrade so as to ensure the Boiler is properly sized.

Interior Lighting – The DPW Office & Repair Building & Garage has CFL Linear fluorescents and high bays in in the garage. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED’s
- LED luminaires

Homer Building



The Homer Municipal Building is a brick structure that was originally constructed in 1898. It has since gone through two renovations in 1996 and 2005. It is in good condition. It is home for various municipal office and is occupied M-F during normal daytime hours. The building's mechanical systems are still within their service life and are in good condition. There is an existing Tridium Honeywell EMS system for the control of the mechanical equipment.

Recommended Improvements

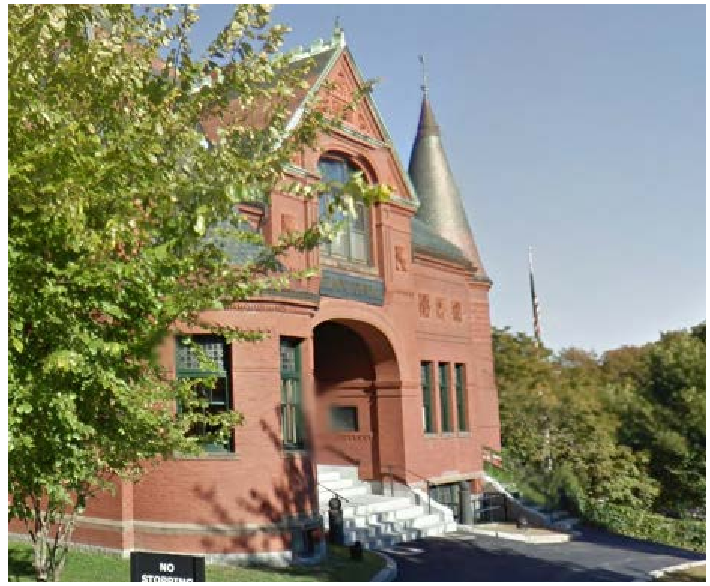
Interior Lighting – The Homer Building has a mix of CFL recessed cans, recessed linear fluorescents, suspended indirect lighting and soffit lights. This building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies
3 AHU's and 3 condensing units for AC

VFD's–There are three pumps in the mechanical room, two for hot water heat and the 3rd for domestic hot water. All the motors are 3 HP and they are all on off without a VFD. They should be assessed to be controlled by VFD's

Belmont Town Hall



The Belmont Town Hall is of Brick construction that was originally built in 1882. It was renovated in 1999 and again in 2005. It occupies 24273 sq. feet and is in good condition.

Heat is provided by a model Burnham V906A Boiler that is 80% efficient and was manufactured in late 2001. Domestic Hot Water is from a Rheem 82V40-2 40 gallon electric water heater.

Air Conditioning is by Trane and amounts to over 50 tons provided by seven condensers and accompanying air handling units.

Recommended Improvements

Boiler replacement – Consideration should be given to the replacement of the boiler with a condensing gas boiler sized properly for the building. If gas is available the conversion should be made to gas.

Burner Controls – A less expensive option to boiler replacement is the installation of burner controls that save energy by modulating the air intake.

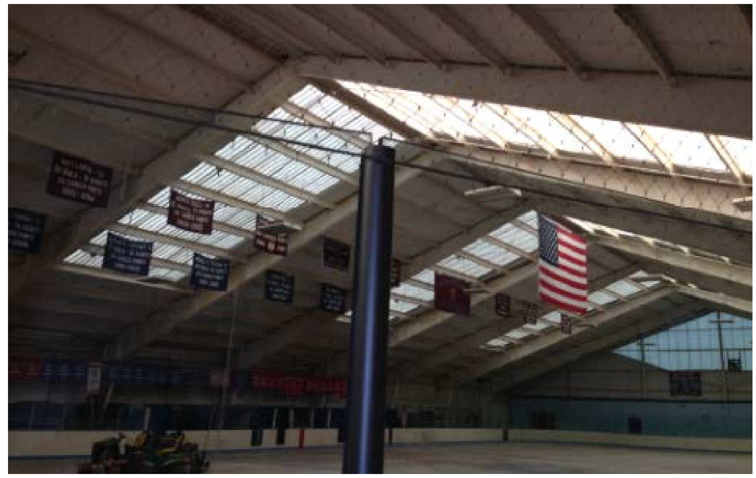
VFD's – Each condensing unit should be fitted with a VFD

Interior Lighting – The Town Hall has a mix of CFL recessed cans and recessed linear fluorescents. Additionally the main hall has suspended incandescent lamps, but the rooms low usage does not warrant a retrofit. Otherwise the building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies
3 AHU's and 3 condensing units for AC

Viglirolo Rink



The Viglirolo Ice Rink was originally constructed in 1963. Its refrigeration system is by RefPlus.

Recommended improvements

Interior Lighting - The rink is uses T5 High Bay luminaires for lighting that is augmented natural light during daytime hours by ceiling large skylights above the rink. The T5's should be replaced with high Bay LED's. Additionally the feasibility of dimming the LED's based on input from a daylight sensor should be investigated.

VFD's - There are several large motors that are integral to the operation of the refrigeration system. These motors appear to be on off. Energy Savings could be achieved by controlling their speed with VFD's.

Belmont Senior Center

The Belmont Senior Center was originally constructed in 2009. It occupies 19,747 sq. feet. It is a modern facility that it in good condition with modern, well maintained equipment. Its HVAC is supplied by a dual source heat pump. That is a combination of a geothermal and air source heat pump.

Recommendations

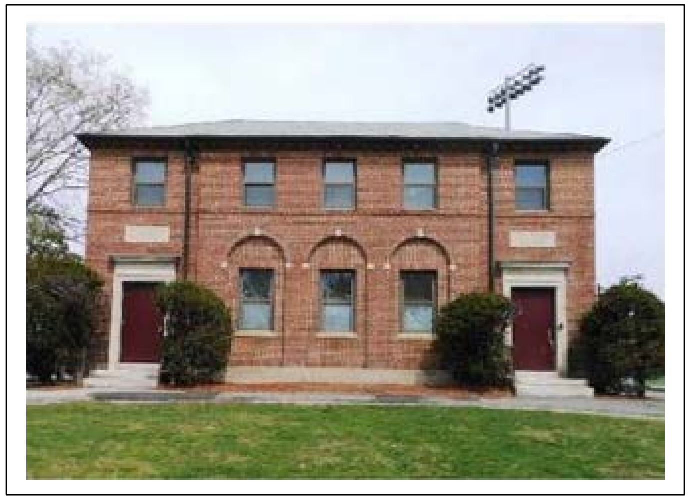
Interior Lighting – The Senior Center has a mix of CFL recessed cans, decorative fixtures, and recessed linear fluorescents. The building should be assessed for a lighting retrofit. The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies
3 AHU's and 3 condensing units for AC

Destratification Turbines – During the heating season the main hall should be assessed for the applicability of destrat turbines.

The White Field House



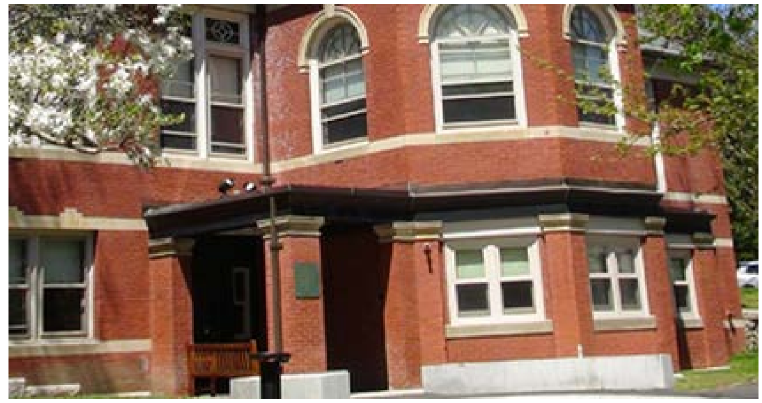
The White Memorial Field House is located at 291 Concord Avenue. Originally build in 1932, the structure is a tow-story building measuring approximately 4,500 square feet. The field house is primarily a load bearing masonry structure that contains team locker rooms and DPW maintenance equipment.

The upstairs recently experienced a renovation with new lighting, lockers, paint and repaired and refinished floors throughout the main building.

Recommendations

Boiler Upgrade - **Boiler Upgrade-** The oil fired steam boiler is at least 25 years old and needs to be replaced with an energy efficient model.

School Administration Building



The School administration was originally constructed in 1901. The building underwent an extensive renovation about 10 years ago. The facility is in good condition and occupies 11,000 square feet in area.

The HVAC system has Hot Water and Chilled Water pumped to Fan Coil Units in the attic and mechanical room. There is an EMS system in the building.

Recommendations

RetroCommissioning (RCx) - Over time a facility's performance changes as the building and equipment ages and as varying maintenance and replacement strategies are employed in accordance to the needs of the building owner, its maintenance staff, and the occupants. RCx is a process whereby a building's systems are assessed and remediated with the goal of returning them to the condition and setting when the building was originally commissioned. Frequently an RCx will reveal other energy saving opportunities that were not available when the building was originally constructed.

Interior Lighting – The School Administration Building lighting is a mix of 6" CFL downlights and linear fluorescent fixtures.
The options for lighting retrofit are several and follow listed from lowest cost to highest cost. Payback varies dependent on the mix of lighting in the building and the strategy chosen.

- Relamp / Reballast with energy efficient lamps and electronic ballast
- Reduce the number of Fluorescent lamps with mirra reflector retrofit kits
- Tube LED's
- LED luminaires

Interior Lighting Control – Lighting controls can be as simple as wall mounted occupancy sensors all the way to individual fixture control with a wireless networked system. Due to the introduction of wireless technologies, the cost of labor to retrofit lighting control is reduced making these systems more feasible financially and enhancing the payback. Moreover, LED luminaires with few exceptions include 0-10V input that a control system will output to thereby commanding the light to dim based upon occupancy or daylight. National Grid recognizes energy savings up to 36% from different light control strategies

Appendix D

Energy Reduction Plan Proposed Funding

Energy Reduction Plan
Proposed Funding

	FY15	FY16	FY17	FY18	FY19	Total
Appendix D						
Total Installed Costs						
$1,073,174	$248,445	$349,710	$469,710	$559,711	$559,711	$2,187,287
Funding Options						
GC Initial Grant	$148,445					$148,445
State Energy Efficiency Grant	$50,000					$50,000
Utility Incentives		$12,541	$12,541	$12,541	$12,541	$50,164
GC Competetive Grants - Not-to-Exceed $250,000 Annually		$200,000	$200,000	$200,000	$200,000	$800,000
ESCO Reprogramming*		$0	$100,000	$200,000	$200,000	$500,000
Capital-TBD		$50,000	$50,000	$50,000	$50,000	$200,000
Reinvested Savings		$20,000	$40,000	$40,000	$40,000	$140,000
Operations	$25,000	$25,000	$25,000	$25,000	$25,000	$125,000
BMLD Streetlight Investment - To Be Determined	$25,000	$0	$0	$0	$0	$25,000
						$0
FY Funding identified	$248,445	$307,541	$427,541	$527,541	$527,541	$2,038,609
Delta to budget	$0	$42,169	$42,169	$32,170	$32,170	$148,678

*Current annual ESCO payments in the amount of $200K annually have one full payment remaining in FY16, and one 50% final payment in FY17.

Town Resources	990,000	148,678	1,138,678	52%
Outside Resources	1,048,609		1,048,609	48%
	2,038,609	148,678	2,187,287	