Roadmap to a Secure Energy Future

Community Energy Plan

Prepared for the

Town of Wolfeboro, New Hampshire

Photo: Bob Ness

by:

INTEGRATED BUILDING ENERGY ASSOCIATES LLC

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Executive Summary

In March 2010, the Town of Wolfeboro, NH received funds from the Energy Efficiency Community Block Grant (EECBG) of the American Recovery and Reinvestment Act (ARRA) to assist with the development of a strategic Community Energy Plan (CEP). Integrated Building Energy Associates (IBEA) was hired to develop the CEP to assist the Town in its efforts to reduce energy consumption and greenhouse gas emissions. The scope of the CEP encompasses municipal energy use and specifically addresses:

1. The identification of energy efficiency, conservation, and renewable energy opportunities;
2. The establishment of a prioritized list of clear goals for short, middle, and long term reductions in energy consumption and expenditures and a road map for achieving these goals;
3. Level I and Level II audits of municipal buildings as deemed appropriate, this scope to be determined at the design charrette.

About Wolfeboro

Considered the "oldest summer resort in America" Wolfeboro, New Hampshire is located in Carroll County on the shores of Lake Winnipesaukee. Wolfeboro was incorporated in 1770. As of the 2010 census it has a year-round population of 6,269, with an average population density of 126 inhabitants per square mile. The village center has a population of approximately 2,800 residents with a population density of 426 people per square mile.

The Town of Wolfeboro is governed by a select board with the assistance of a Town Manager. The municipal portion of the budget is approximately $28 million, excluding the school appropriations, with approximately $600k spent annually on energy. Along with five surrounding towns, Wolfeboro is part of the Governor Wentworth Regional School District and has four public schools: Kingswood Regional High School, Kingswood Middle School, as well as Carpenter and Crescent Lake elementary schools. Wolfeboro is also home to Brewster Academy, a private preparatory secondary school.

The master plan was last revised in 2007. In addition to the typical departments serving a community of this size, Wolfeboro is unique in having a municipal electric department (MED). The MED does not generate power, but rather distributes and supplies electrical power to the residents of the town.

The Town Energy Committee

In March of 2007 the Town of Wolfeboro passed a warrant article mandating the creation of an official town energy committee of the Selectmen. The Wolfeboro Energy Committee (WEC) was formed by the Selectmen in August 2007. Since that time, the Wolfeboro Energy Committee, town employees and committed officials, have achieved several milestones from securing funding for this project to reducing energy demand in town facilities.

Highlighted Achievements of the Committee:

- The Energy Committee has made strides educating Wolfeboro residents and visitors on energy conservation.

- In partnership with the Wentworth Economic Development Corporation, the Energy Committee hosted the Lakes Region Energy Expo in November 2010 which was attended by approximately 400 attendees who participated in energy efficiency and renewable energy workshops hosted by industry experts.
- The Energy Committee received funding for and completed an energy inventory for tracking municipal energy and costs which is maintained by Town staff.

Analysis shows there has been an 18% reduction in overall energy usage from 2007 through 2010, an average of 4.5% annually. This has resulted in a 15% reduction in CO2 emissions. Unfortunately during that same period energy costs rose an average of over 5% annually resulting in a 6% total increase in energy costs.

Annual Municipal Energy use in the Town of Wolfeboro occurs in 4 basic categories as shown below. This is consistent with the NH averages.

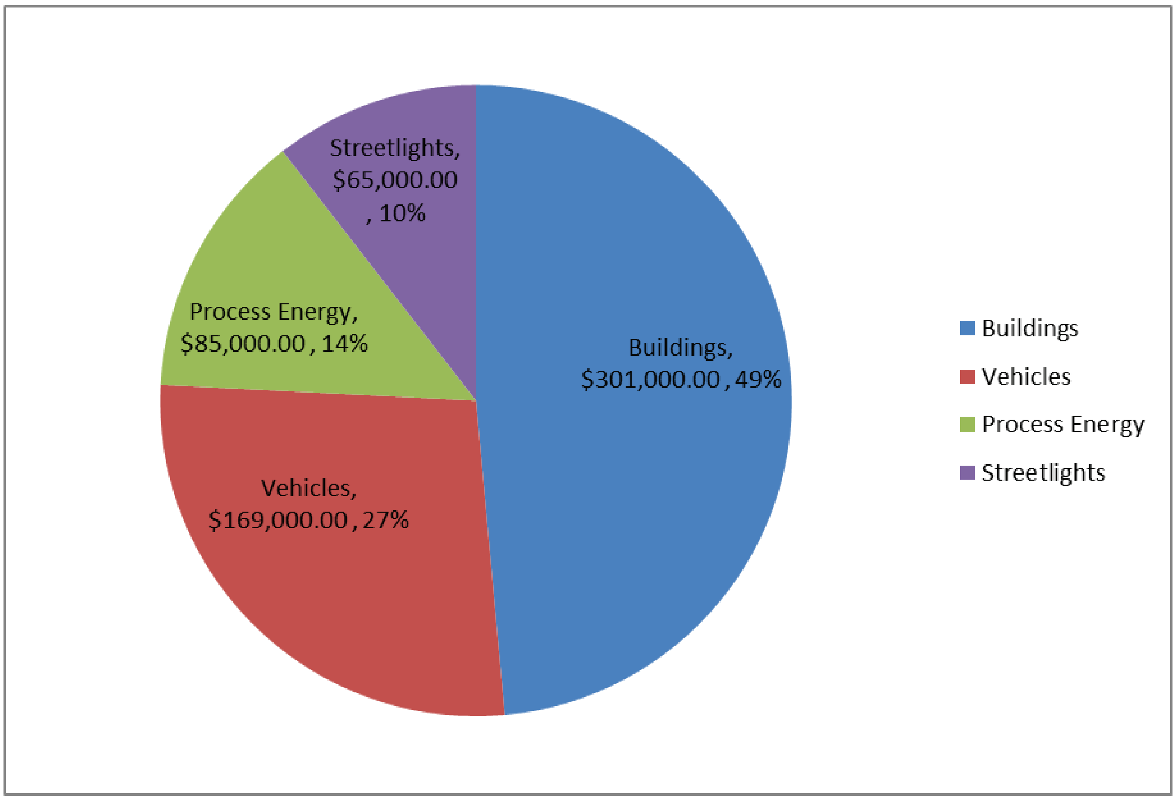

Figure 1, Wolfeboro Municipal Average Energy Use 2007-2009

Energy Planning for the Town of Wolfeboro

Upon analysis of Town energy use, it was decided for the purpose of this project scope to prioritize focusing on town buildings where energy usage is highest and potential for improvements are greatest. Overall, a quick look at Energy Use Intensity (EUI) for each of the buildings tells us that there is plenty of opportunity to reduce energy costs. We review the Town's buildings and opportunities for energy savings in the Observations and Recommendations section of the report. Particular emphasis was placed on the Water Treatment Plant as a site with the greatest need and most accessible opportunities for improvement.

The Town of Wolfeboro has numerous opportunities for savings of both energy and energy costs, depending on what recommendations are acted upon.

Process

The IBEA Team, town staff and energy committee members met numerous times between January and March 2011. Over a period of two days in February 2011, the town Energy Committee and consultant team met as a group to study Wolfeboro's municipal energy usage with the goal of finding ways to significantly reduce consumption. The group toured town facilities listed below and interviewed building users. A daylong brainstorming session to discuss each building in detail and develop guidelines for addressing future retrofit strategies concluded the event. Several follow-up visits ensued. In February a public forum was held to present initial recommendations and to gain input from the community.

Recommendations

A series of energy efficiency and conservation measures and renewable energy opportunities were identified and are listed below. These recommendations, if implemented over a period of years, could result in a reduction of 30 % in Wolfeboro municipal energy use.

	Prioritized Energy Reduction Projects	Capital Investment $$	Annual Energy Cost savings	CO2 reduction @ ave 17.5 lbs. per 100 Kbtu	Comments
1	**Deep Energy Retro-fit at Water Treatment Plant.** Water treatment Plant Envelope improvements including strategic air sealing and attic cap insulation	$ 48,500	$ 4,925	26,075	There are considerable opportunities at the Water Treatment plant. It has the highest EUI index and largest investment of equipment capital.
2	**Mechanical System Replacement at Water Treatment Plant.** Installation of HVAC improvements at the Water Treatment Plant (High perf, forced hot water, ERV, Optimize ventilation)	$ 105,000	$ 8,433	44,275	
3	**Mechanical system replacement at MED/Armory Building.** Replace the oil fired steam boiler at the MED/Armory building with a Bio-mass, wood-pellet FHW boiler system with new controls.	$ 95,000	$ 7,100	26,950	Wood pellets for heating are considered to be carbon neutral by many. They also contribute to a local, sustainable economy.
4	**MED/Armory Building Envelope work.** Energy improvements at the MED/Armory building including strategic air sealing.	$ 6,000	$ 800	10,150	Finish the job that was started in 2010
5	**Deep Energy Retro-fit at Public Works Garage.** Implement envelope improvements at the Public works garage with a minimum goal of 30% energy reduction.	$ 75,000	$ 7,600	48,858	See comments about Bio-mass projects above. This work will have long term value even if the Town builds a new facility and this building is repurposed.
6	**Replace existing Mechanical System at Public Works Garage.** Install a new Bio-mass, wood pellet boiler at the Public Works garage and associated FHW fan-coil units. Remove existing electric resistance heaters throughout.	$ 105,000	$ 6,950	25,609	

	Prioritized Energy Reduction Projects	Capital Investment $$	Annual Energy Cost savings	CO_2 reduction @ ave 17.5 lbs. per 100 Kbtu	Comments
7	**Replace existing Public Works Facility**. Build new Public works facility with high performance features including envelope values meeting IEEC 2012, high efficiency mechanical systems, LED lighting.	N/A		-	The current facility has made upgrades to address code violations. Some are still in the works but some cannot be achieved in current building.
8	**Reduce the set-point temperature at the Highway department garages.** Heating improperly insulated garages to keep trucks warm between uses is an unnecessary waste of energy.	Zero cost	$ 1,500	26,250	Will require education and managing worker expectations.
9	**Public Safety Building envelope improvements.** Implement additional Envelope improvements at the Public Safety offices resulting in an additional 10% reduction in annual energy load.	$ 3,000	$ 600	10,063	
10	**Build a new Public Safety Garage Facility.** The existing facility has numerous code and safety issues. There looks to be enough room on site to rebuild the garage in roughly the same configuration. New footprint would likely grow approx. 25-50%.	$1.75 million			New building with larger footprint culd still have a reduced overall energy load.
11	**Create a new Municipal Services complex.** New Public Safety Garage/ Co-locate with Public works resulting in potential shared infrastructure and reduced vehicular use.	$3.5 Million		-	May not work on existing Town owned properties
12	**Implement a Water use reduction initiative**. This will result in multiple energy savings opportunities including pumping energy, waste water treatment energy reductions, maintenance reductions and extended time for equipment replacement.	N/A	5% of 85,000 = $4,250	-	This has already been done before. Worth doing it again.
13	**Infiltration and Inflow reduction**. Continue progress with the infiltration and inflow reduction program which results in reduced energy at the Waste Water Treatment plant.	N/A	5% of 85,000 = $4,250	-	On-going efforts continuing.
14	**Install PICO or Micro-hydro at the pressure reducing station.** This will result in capturing currently wasted energy from within the water distribution system.			-	Current generating capacity appears to be at the PICO-hydro scale.
15	**Implement High performance building features in the upcoming library project**. A deep energy retrofit should be a significant part of the planned Library remodeling project. These measures could result in 30-50% energy savings and improved occupant comfort.	$ 157,000	$ 7,800	62,825	
16	**Town Hall Renovation Project should implement the BSC recommendations.** The upcoming Town Hall renovation project should include the deep energy retrofit measures as recommended by the Building Science Corp. report.	$3-4 million		-	

	Prioritized Energy Reduction Projects	Capital Investment $$	Annual Energy Cost savings	CO2 reduction @ ave 17.5 lbs. per 100 Kbtu	Comments
	Other Projects				
17	**Solar Farm.** Install a large scale Municipal Solar PV installation. There are likely numerous potential sites for a Solar Farm. The Waste Water treatment plant site has good access to Utility infrastructure. There are numerous funding and ownership strategies available for getting these projects into production.				10-50 KW, ground mounted, installed cost is $7.5/w 50-100 KW, ground mounted, installed cost is $6.5/w 100-200 KW, ground mounted, installed cost is $6/w 200-1000 KW, ground mounted, installed cost is $5.5/w See:http://www.ecocivilizationweebly.com/competitively-bid-feed-in-tariff.html
18	**Co-generation/Biomass project at "New" Municipal complex**. Co-location of Municipal services would create a base load scale that would result in good opportunities for Bio-mass Cogen, with waste heat utilized for winter heat			-	
19	**Vehicle Fleet analysis with a goal of 20% reduction**. These measures will include a strict anti-idling policy, appropriate vehicle size for use, car pooling, purchasing more efficient vehicles as part of vehicle replacement plan.		$ 34,000	226,625	
20	**Streetlight replacement**. The town should consider replacing all street and traffic lights with new LED (Light Emitting Diode) street lights and traffic lights.	Capital investment costs for LEDs are going down.	$ 39,000	152,854	This can result in a 60-80% reduction in related energy costs. Annual savings will include labor and material costs for bulb replacement. LED lamps last 10x as long as HPS lamps.
Note:	There are numerous incentive programs. The landscape is continually changing.				
Note:	IBEA, LLC has participated in numerous projects achieving and exceeding these results. 2 current projects on 40,000 ft2 buildings have resulted in 60-75% energy savings.				
Note:	Utilize Guidelines for Energy Retrofits when planning for and implementing any projects.				

In addition to the specific energy efficiency measures, two opportunities were identified that would greatly improve the ability of the Town to reduce energy use and save significant dollars over the long-term:

1. Establish Energy Guidelines for Capital Projects
   Create energy guidelines for all municipal construction and renovation projects to assure that all projects maximize opportunities to minimize energy use.

2. Hire an Energy Manager
   Hire an Energy Manager to develop the energy efficiency measures identified in this report, as well as other opportunities. This position could potentially be shared with another town or institutions within Wolfeboro, for example; Governor Wentworth Regional School District, Brewster Academy, or Huggins Hospital. The current town employee structure with no town facilities manager and where each department manages his or her own facilities and thus the energy use, presents significant challenges.

Department heads do a heroic job managing their facilities, but they simply cannot be expected to have the knowledge and experience to identify and implement deep energy reductions.

The Future

No one can say for sure what the price of energy will be ten or twenty years from now. But for certain, few if any think energy prices will be lower and there is great upside risk. Wolfeboro doesn't have access to natural gas. The lowest cost energy is often the energy that is NOT used. In other words, the dollars spent investing in making buildings, transportation and operations more energy efficient has the potential to save far more that the cost of not investing in efficiency. The Town has a choice. It can wait passively to see if energy prices rise and then react, or be more proactive and integrate energy efficiency and renewables a little bit at a time each year into the capital project portfolio and all construction and renovation projects.

Overview: Municipal Energy Use

In 2008, with a grant from the New England Grassroots Environmental Fund, the Town of Wolfeboro hired an intern to set-up a system for tracking energy use, costs and CO_2 emissions from municipal buildings, vehicle fleet and street lights. The town staff has maintained the tracking system so there is a detailed record of Wolfeboro municipal energy use. **For the purposes of this project, we used 2010 data as the baseline.**

2010 Annual Energy Use:

1.	Diesel fuel for transp./equip./plowing	29,500 gallons	
2.	Gasoline small vehicle use	19,000 gallons	
	No. 1 & 2 above combined cost:		$169k
3.	Building fuel oil	26,512 gallons	$93k
4.	Building propane	9,000 gallons	$22k
5.	Building electricity	1,200,000 kWH	$186k
6.	Process electricity	600,000 kWH	$85k
7.	Streetlights	430,000 kWH	$65k
	Total energy costs:		**$620k**

Wolfeboro municipal buildings consume 49% of annual energy expenditures. As documented in this report, there are good opportunities to find reductions.

A large part of municipal energy use is typically associated with the treatment and pumping of domestic water and wastewater – and the town of Wolfeboro is no different. The Public Works Department has already implemented many strategies to make improvements in this area including an infiltration and inflow reduction program. Graph 2, below indicating Wolfeboro annual energy use totals shows a 17% reduction in energy use. This reduction is largely associated with the water and sewage treatment facilities from 2007 to 2010. Unfortunately, costs to the town's residents still rose because, while energy use has dropped since 2007, the cost of energy to the town has increased by approximately 5%. This is a trend that will likely continue unless the town takes steps to more aggressively manage its energy use.

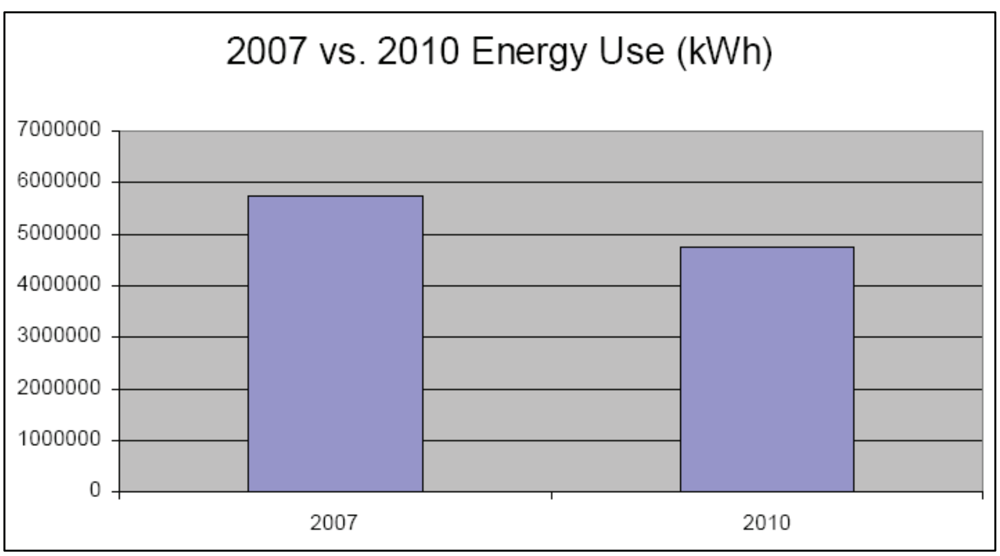

Figure 2, Wolfeboro annual energy use totals 2007 vs. 2009

Observations & Recommendations

I. Buildings

All of the buildings have potential for significant energy improvements, but issues associated with age, code compliance, deferred maintenance and structural integrity raise questions about long-term viability of some of the structures. The Energy Guidelines for Capital Projects, section II, later in the report defines a process that will help the Town develop specific strategies focused on short, medium and long range energy projects.

It was agreed to prepare general summary reports on the building inventory and select one building to analyze in detail. Specific recommendations were to be made regarding building envelope improvements, mechanical and electrical system upgrades, renewable energy feasibility and verification. Because the Town Hall is the subject of in-depth study and review, it was removed from the scope of this project. For several reasons, the Water Treatment Building stood out as the best choice for detailed analysis:

- It is the newest facility (1996) and likely to be in use well into the future.
- There are significant problems with the building envelope causing issues with building maintenance (ice dams) and high energy usage.
- More efficient HVAC equipment and technology can be substituted for existing equipment and “right-sized” to match the improved envelope design.
- Construction drawings of the original building design were available for modeling purposes

Definitions
There are several terms used in charts throughout this report:

Wolfeboro Town Building	Capital Investment ($)	End of Life Adjustment ($)	Rebates & Incentives ($)	Net Energy Investment ($)	Annual Energy Cost Savings ($)	Simple Payback (Yrs)	Est Annual Energy Savings (Kbtus)	CO2 Reduction at Avg 17.5 lbs/100 Kbtu (lbs)
Envelope improvements = Example #1								
Mechanical Improvements = Example #2								

Figure 3, Sample Financial analysis

Capital Investment: The funds required to complete a project.

End of Life Adjustment (EOL): An adjustment in project cost to credit the replacement value of a change that would be necessary regardless. For instance, if an insulation project will require that a roof that is 15 years old is replaced, the EOL adjustment would be calculated as follows:

Assume $20k to replace the roof.
The roof is 15 years of a 20 yr life expectancy.
EOL Calculation:
$20k x 15/20= $15k EOL Adjustment

Net Energy Investment: Capital investment minus EOL adjustment minus rebates and incentives equals Net Energy Investment.

Commissioning: A third party inspection upon completion of a project to assure that the system is working to the design intent and projections.

A. Focus Project: Wolfeboro Water Treatment Plant

The Water Treatment Building, located at 555 North Line Road, is a masonry building with a pitched roof with a front gable entrance. The analysis included a prediction of energy usage based on computer modeling of the intended upgrades. It did not include the process energy associated with the Water Treatment.

Water Treatment Building

Current energy data

Building Size = 6,048 Square Feet
Annual Electrical usage = 156,885 kBtus
Annual Heating fuel usage = 715,907 kBtus
Total energy per square foot = 144.31 kBtus
Total energy cost per square foot = $2.97

The building is heated with an air handler and forced hot air ducting located in the attic. Insulation in that space is in poor condition and does not appear to be well installed. It appears that a significant portion of heating energy goes towards unnecessarily heating the water tanks in the building. There are also serious problems with the building envelope. Both a blower door test and thermography scan were done which confirmed our initial impressions. The photos above clearly show the melt pattern on the roof, a clear indication of heat loss. One way to remediate the problem would be to identify and seal every air leak. Another way is to insulate at the roof level, a renovation that had consensus from the team. This latter solution insures that HVAC equipment in the attic will no longer be cold, and that all air leaks will be sealed. Improving the building envelope means that the HVAC equipment can be downsized when the time comes to replace it.

Overall, we estimate that implementation of the following recommendations will result in an over 70% reduction in energy costs to the Town of Wolfeboro.

Energy Conservation Measures:

Water Treatment Plant	Capital Investment	End of Life Adjustment	Rebates & Incentives	Net Energy Investment	Annual Energy Cost Savings	Simple Payback	Est Annual Energy Savings/Kbtus	CO2 Reduction at Avg 17.5 lbs/100 Kbtu
Envelope Improvements (Air sealing, roof insulation and gable walls)	$24,200	$5,600		$18,600	$4,375	4.25	135,000	23,625
Office walls	$3,500			$3,500	$550	6.36	14,000	2,450
HVAC improvements (High perf, forced hot water, ERV, Minimize ventilation)	$81,000	$35,000		$46,000	$8,433	5.45	253,000	44,275
Air to Air heat pump upgrade	$26,000			$26,000	$2,752	9.45	37,400	6,545

Figure 4, Energy Conservation Measures for Water Treatment Building

- Of the many options available in this facility improving the envelope is the most important place to begin. Investing $24,200 for this measure will yield an annual energy savings of 135 thousand kBtu's and an annual cost savings of $4,375. The payback period on this investment would be 4.25 years.
- Retrofitting the office walls and ceiling would entail an investment of $4,500 and would result in an annual cost savings of $550 and an annual energy savings of 14 thousand kBtu's. The payback period would be 6.36 years.
- HVAC improvements would call for a capital investment of $81k. However the Net Energy Investment would be $46k when an End of Life Adjustment, $35k and a rebate of $5k are considered. Payback on this measure is significant at a period of 5.45 years. Annual cost savings would amount to $2,752 and annual energy savings would be 253 thousand kBtu's.
- An additional investment of $26k would enable the town to upgrade the air-to-air heat pump. Doing so would yield an annual cost savings of $2,752 and energy savings of 37.4 thousand kBtu's. The payback period would be 9.45 years.

Infiltration, Insulation and Diagnosis

The following information details the infiltration and insulation effectiveness of the water treatment plant building shell. Infiltration occurs when outside air enters a building through openings in walls, ceilings and foundations. An effective building shell acts as a barrier against outside air and maintains indoor temperatures with little conditioning from the heating or cooling systems. In order to achieve these results, the building shell must have a continuously sealed and insulated barrier against infiltration on all six sides (roof or ceiling, all four walls and under the slab). Professional building analysts can asses the condition of an existing building shell using blower door testing and thermographic (infrared) scanning. A blower door test measures the amount of infiltration across the air barrier (measured in cubic feet per minute, or CFM) while an infrared camera locates gaps along the air barrier and missing or inadequate insulation.

Blower Door Test Results

The blower door test was conducted on March 26, 2011. All exterior doors and windows were locked, interior doors remained opened and the HVAC system was turned off. The following table details the results of the blower door test at the water treatment plant. The results with open duct work (HVAC open) represent real world testing conditions. Converting 9.37 air changes per hour @50 Pa to 0.56 natural air changes per hour (ACHn) represents an air exchange rate of 56% every hour! **That means every hour 56% of the volume of heated or cooled air is recycled with incoming unconditioned air.** To replace this lost air, the heating or cooling system has to condition all that unfiltered incoming air at considerable cost.

Test Condition	Temperature adjusted CFM @50Pa.	Air changes per hour @50Pa.	CFM50/sf of shell
HVAC sealed	10,968	7.1	0.99
Fans covered	13,612	8.81	1.23
HVAC open	14,478	9.37	1.31

Figure 5, Blower Door Test

The following chart compares the water treatment plant to other buildings of similar construction, vintage and use.

Comparison Buildings	CFM50/sf of shell
Wolfeboro Water Treatment – normal winter condition	1.23
Meredith Wastewater – CMU block	0.71
Windsor Wastewater – operations, CMU block	1.18
Windsor Wastewater – pump station, CMU block	1.06
US National Average for Commercial Buildings	0.93
Typical Modern Construction	0.60 to 0.90
Local High Performance Building (major renovation to a high school)	0.17
Local High Performance Building (new construction, middle school)	0.19

Figure 6, Blower Door Comparison

Building Assemblies

Ceiling

Existing Conditions

The insulated ceiling is constructed of 2 x 6" framing 2' on center. With two layers of fiberglass insulation rated at R-35 the ceiling is under insulated. All of the following assemblies lack adequate sealing against infiltration:

- Attic hatch and chimney
- Concrete masonry unit (CMU) exterior walls
- Mating surface of the ceiling and exterior walls
- Interior wall top plates at the ceiling transition as seen from the attic
- Mechanical, electrical and plumbing (MEP) penetrations

Proposed Improvements:

IBEA recommends the following upgrades to reduce conditioned air loss to the attic:

- Install an insulated and weather stripped cover over the attic hatch. The insulation must meet the R-value of the attic insulation. This is best achieved with rigid foam insulation.

- To address ice damming, the chimney should be air sealed to the ceiling with sheet metal and fire rated caulk and covered with R-21 rock wool insulation from the attic to the roof.
- Move the existing fiberglass insulation to expose the tops of the interior and exterior walls. Block all open CMU cores with sheetrock and seal over and to the exterior wall with spray foam.
- Foam all MEP penetrations.
- Consider adding an updraft cap on the front exhaust fan at the roof. There is potential for warm air washing on the roof during winter which exacerbates ice damming.
- Install existing fiberglass insulation in opposing layers and add an additional 10" of cellulose insulation for a total R-60.

Alternatively, the air and thermal barrier could be moved to the roof by spray foaming the gable end walls and the underside of the roof. This would eliminate the need to air seal the aforementioned assemblies, and would bring all the HVAC equipment into the conditioned space for increased performance and virtually eliminate winter ice damming.

Exterior Walls

Existing Conditions

The exterior walls are assembled in the following order from outside to inside: four inch split face block, one inch air space, three inches of rigid foam and eight inches of concrete block. The wall assembly is rated at R-18.

Proposed Improvements:

To increase the effectiveness of the walls against heat loss, IBEA recommends the following measures:

- Block and seal all exterior vent louvers with four inches of rigid foam and spray foam. For those vents that must remain open year round, we recommend installing mechanically actuated ultra-low leakage dampers. However, these dampers are fairly expensive as compared to the rigid foam board.

- All generator louvers should have the armature checked and adjusted every year to ensure tight seals when not in use.

- The door to the generator room must have robust weather stripping and a door sweep. The door should remain closed at all times. This room should be isolated from the surrounding area by sealing the room against infiltration.

- Remove the combustion air intake from the attic and seal at immediate penetration. Install a boot directly to the burner and direct the intake air duct through an exterior wall. This will remove any potential heat source – and possible ice damming from the attic.

Doors and Windows

Existing Conditions

All exterior doors are institutional grade metal doors with insulated foam cores rated at R-7. The garage bay doors are typical metal construction with little thermal protection. All windows are double-paned, gas filled glass with aluminum frames rated at R-2.

Proposed Improvements:

- The front door needs new weather stripping and a door sweep. It's best to replace all exterior door weather stripping and door sweeps at the same time to ensure air sealing continuity. Commercial grade weather stripping can be order from the original manufacturer or from www.draftseal.com.

- A large gap along the topside of the garage bay door is visible and should be adjusted to connect the seal. Ensure that the weather stripping and sweep is robust and functional. When it is time to replace a garage bay door install one that is R-15 or better with four inches of insulation.

- It's difficult to achieve an adequate return on investment when replacing windows. Provided the existing windows functionality is maintained, all windows are closed and locked during the winter – and summer if the building is cooled, they should perform to manufacturers recommendations. At this time, we are not making recommendations for the windows.

Foundations

Existing Conditions:
While the building drawings report two inches of extruded polystyrene insulation (R-11) along the frost walls, we could not confirm that this measure was actually installed during construction. Based on the dimensions of the frost wall and exterior walls, we suspect the frost walls are not insulated.

Proposed Improvements – Option 1, Exterior Insulation

- Excluding paved areas expose 12" of the foundation wall. Wash the wall of all dirt and allow to fully dry. Install a minimum two inches of rigid foam board to the wall with appropriate adhesive for concrete and extruded polystyrene insulation.

- Cover the foam board insulation with stucco, backfill the trench and install flashing under the split faced block and over the stucco.

Proposed Conditions – Option 2, Interior Insulation

- Remove all obstructions and shelves from the exterior walls.

- Install a minimum of two inches rigid foam board insulation to the wall. The insulation will rest on the floor and extend 8-12" up and into the framed wall. Use the appropriate adhesive for wood and extruded polystyrene insulation.

B. Other Buildings

While all buildings were under review, energy inventory data was used to narrow the field of candidates to those operating well above the national average for energy use intensity. Energy use intensity, or EUI, is a measurement of how much energy is consumed by a building relative to its size. The EUI is calculated by dividing the total energy consumed in one year (in kBtu) by the total floor space (in square feet) of the building. The building's EUI can then be compared to the national average EUI for similar buildings. This comparison enables energy professionals and building owners to focus on buildings that are well above – that is, using more energy than– the national EUI average. The Energy Star Portfolio Manager[1] is a web-based tool that allows energy professionals to calculate and analyze energy consumption. See EUI data on some of Wolfeboro's buildings in Charts 7 and 8 below.

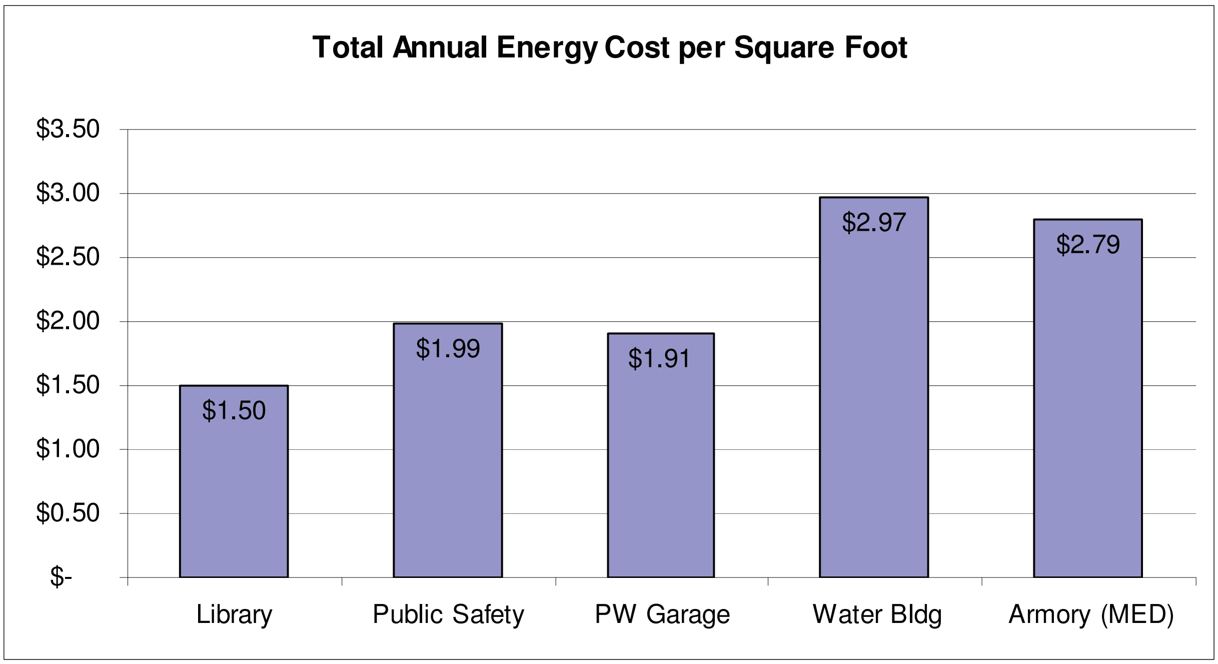

Figure 7, 2007 Annual Energy Cost/s.f.

[1] Energy Star Portfolio Manager: https://www.energystar.gov/istar/pmpam/

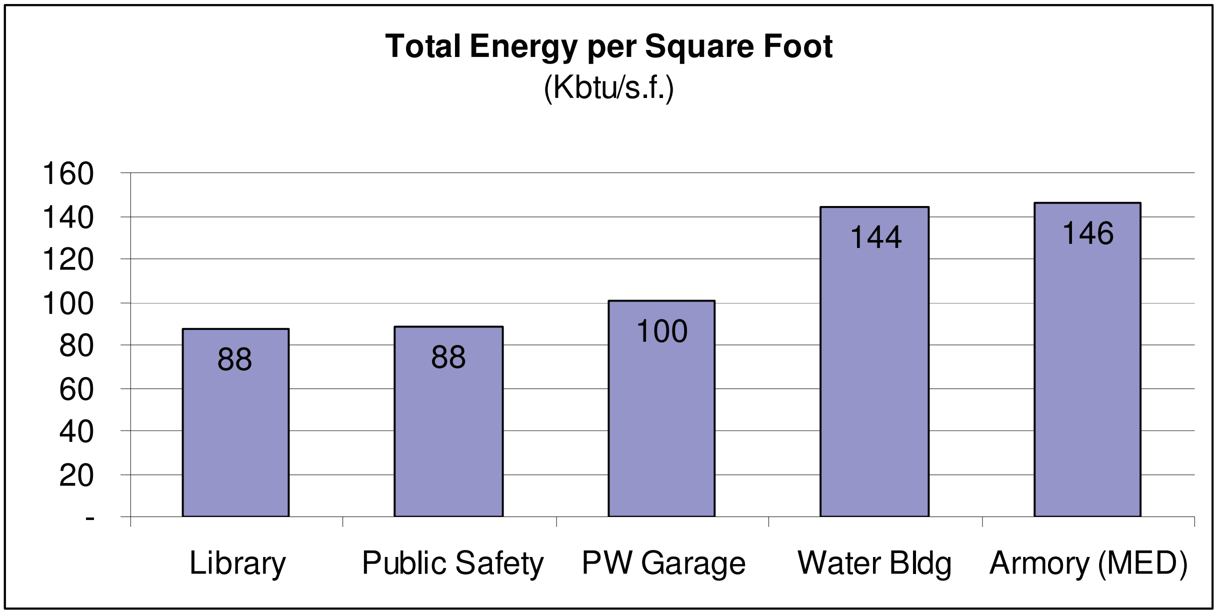

Figure 8, Energy/s.f.

Public Safety Building

Based on 2007 data shown below, IBEA sees the ability to achieve an additional 10% energy reduction, in the front office building alone after the commissioning of the heat pump system.

Current energy data:

Building Size = 13,050 square feet
Electrical usage = 522,817 kBtus
Heating = 627,245 kBtus
Total energy per square foot = 88.15kBtus
Total energy cost per square foot = $1.99

The Police and Fire Departments are in one building at 251 South Main Street. The front section of the building is a two story wood framed, masonry veneer building with a wooden truss roof. It is generally in good repair and recently went through an energy retrofit project funded by a grant written by the Energy Committee. The work included air sealing and insulating the attic and ductwork as well as the installation of a high efficiency air to air heat pump. The rear of the building is a single story masonry garage in poor repair. Aside from the buildings poor thermal performance, there are structural and layout issues, along with other Life & Safety code violations that prohibit ease of use for the fire department.

Energy Conservation Measures:

Public Safety Offices	Capital Investment	End of Life Adjustment	Rebates & Incentives	Net Energy Investment	Annual Energy Cost Savings	Simple Payback	Est Annual Energy Savings/Kbtus	CO2 Reduction at Avg 17.5 lbs/100 Kbtu
Envelope improvements = additional 10% reduction in annual load	$3,000			$3,000	$600	5.00	57,503	10,063
Commission Heat pump system	$500			$500	$200	2.50		

Figure 9, Energy Conservation Measures for Public Safety Building

- Envelope improvements focused on exterior wall to roof connections and air-sealing will result in an additional 10% reduction in the annual energy load. Committing an investment of $3,000 to the building envelope would have a payback period of 5 years and result in an annual savings of $600 and an annual energy savings of 57.5 thousand kBtu's.
- Commissioning a new heat pump system in the Public Safety Offices would require an estimated investment of $500 and would yield an annual energy cost savings of $200 annually. The payback period on the cost would be 2.5 years.

Short-Term Recommendations:

- Determine the current Energy Usage Intensity (EUI) of the building.
- The building should have an updated blower door test and thermography (infrared) scan done to locate building penetrations and opportunities to reduce air infiltration – or air changes per hour (ACH), through the building shell. ACH represents the hourly air exchange within an enclosure. If a building is drafty, the ACH will be high, requiring the HVAC equipment to provide tempered or cooled air at a cost to the building owner. The idea is to build a building tight and ventilate it right. Following a blower door and HVAC review work scopes for corrective action should be developed.
- It is our understanding that a lighting retrofit project has already been completed, but this should be confirmed.

Long-Term Recommendations:

- When the garage portion of the building's future is determined, it should be replaced or repaired with a high performance building, utilizing durable, high performance building materials. Thermal performance goals for new or retrofitted buildings should be R20 for foundation and slab, R40 for walls and R60 for roof. For optimal performance and savings, HVAC systems should be installed within the insulated shell – not in a cold basement or exposed attic. An air change specification of less than .1 ACH is an excellent target for high performance buildings.

- As part of any future capital improvement project, the results of the building audit should be reviewed and incorporated into the overall project planning.
- Future equipment and appliance purchase should be energy efficient and have the ENERGY STAR® logo.
- Another future possibility is to co-locate a new Public Safety Garage with Public Works. **If a new Public Works facility were to be built it would be worth considering the option of "co-locating" on a single site.**

Armory/Municipal Energy Department


The energy use for this building was benchmarked *before* the installation of a new insulated roof system and we expect subsequent data to show improvements.

Current energy data:

Building Size = 6,670 square feet
Annual Electrical usage = 205,710 kBtus
Annual Heating fuel usage = 768,352 kBtus
Total energy per square foot = 146.42 kBtus
Total energy cost per square foot = $2.79

The MED/Armory building, located at 133 Middleton Road, is a 6,670 square foot pre-engineered metal building with a brick masonry veneer. Offices occupy approximately 30% of space, while the rest of the building is used as a maintenance and storage garage for equipment and vehicles. The building is heated by a steam boiler that has control issues and is near the end of its useful life. Recent work includes the installation of 4" of rigid insulation under a new standing seam metal roof. The energy use shown below still has room for improvement and careful consideration should be given to any future retrofit projects following the guidelines that are a part of this report.

Energy Conservation Measures:

Armory/Municipal Energy Department	Capital Investment	End of Life Adjustment	Rebates & Incentives	Net Energy Investment	Annual Energy Cost Savings	Simple Payback	Est Annual Energy Savings/Kbtus	CO2 Reduction at Avg 17.5 lbs/100 Kbtu
Boiler replacement/Biomass	$95,000	$40,000		$55,000	$7,100	7.75	154,000	26,950
Envelope improvements	$8,000			$8,000	$1,250	6.40	77,000	13,475

Figure 10, Energy Conservation Measures for Armory/MED

- Replacing the boiler would involve a $95K investment, but when an End of Life Adjustment is calculated the net investment comes to $55k. The payback would occur over a period of 7.75 years and would annually save the town $7,100 and 154K kBtu's.
- Improving the building envelope of the Armory/Municipal Energy Department would cost $8,000, yield an energy cost savings of $1,250 annually, and save an annual amount of 77 thousand Kbtu's of energy. The payback period on this investment would be 6.4 years.

Short-Term Recommendations:

- Determine the updated EUI of the building.
- The building should have a blower door test and thermography to locate building penetrations and opportunities to reduce air infiltration through the building shell.The results of the blower door test should be reviewed and a scope for corrective work should be developed. Areas for improvement will include but not be limited to air sealing against infiltration along walls and roof system and replacement of the garage doors with a minimum R-value of R14 door with good edge seals. R-value is the measure of a materials resistance to heat flow. The higher the R-value, the better the product and will prevent heat loss.
- The current HVAC system is old and inefficient. The building is a good candidate for a wood pellet boiler with forced hot water fan coil units. Wood biomass or pellets generally cost 35-50% less per Btu output than fossil heating fuels and has a more stable fuel price. The wood-pellet system should be sized for about 65% of the peak load, which will end up covering around 95% of the actual annual load. We would recommend a small high efficiency LP gas back-up boiler to handle the shoulder seasons and provide peak heating on the extremely cold days. This should be zoned for comfort and efficiency. The office space will have fan-coil units with a Dx coil for cooling. All ductwork should be tested for leakage repaired and reinsulated. When the condensers are at the end of their useful life they should be replaced with high efficiency units.

Long-Term Recommendations:

- As part of any future capital improvement project, a building audit or evaluation should be completed and the results should be reviewed and incorporated into the overall project planning.
- Future equipment and appliance purchase should be energy efficient and have the ENERGY STAR® logo.

Public Library


Current energy data:

Building Size = 9,800 square feet
Annual Electrical usage = 157,680 kBtus
Annual Heating fuel usage = 701,208 kBtus
Total energy per square foot = 87.65 kBtus
Total energy cost per square foot = $1.51

The Wolfeboro Public Library, located at 259 South Main St, is a brick masonry building with a flat membrane roof with the exception of the clerestory. It was built in 1978 with minor maintenance and equipment replacement being done since then. The Library building is town owned and is currently under consideration for a major capital project. The consensus at the time of review appeared to be to tear down and replace the building. There are major concerns about the roof structure in addition to meeting the current space needs of a modern library/media resource center. Careful consideration should be given to this from an environmental standpoint as there is significant embodied energy in a building of this type and when all things are considered, even with replacement by a high performance building, it can take up to 50 years to replace the embodied energy. The energy use shown below still has room for improvement and careful consideration should be given to any future retrofit projects following the guidelines that are a part of this report.

Energy Conservation Measures:

Library	Capital Investment	End of Life Adjustment	Rebates & Incentives	Net Energy Investment	Annual Energy Cost Savings	Simple Payback	Est Annual Energy Savings/Kbtus	CO2 Reduction at Avg 17.5 lbs/100 Kbtu
Envelope improvements to include:								
Insulate walls	$24,000			$24,000	$1,400	17.14	85,000	14,875
Replace Clerestory glass with high-R Kalwall	$32,000	$24,000		$8,000	$1,200	6.67	64,500	11,288
Reinsulate roof to R60 including structural reinforcement	$145,000	$100,000		$45,000	$3,200	14.06	85,000	14,875
Library Envelope Improvement - Sub Total:	*$201,000*	*$124,000*		*$77,000*	*$5,800*		*234,500*	*41,038*
Replace mechanical system with VRF system	$190,000	$110,000		$80,000	$5,400	14.81	120,000	21,000

Figure 11, Energy Conservation Measures for Library

- Envelope improvements to the Library would involve three basic areas, as outlined in the chart above. These three areas combined would require a capital investment of $241k. However the net investment comes to $97k when the End of Life Adjustment of $144k is considered. Implementing these three measures would result in an annual cost savings of $5,924 and an annual energy savings of 234,500 kBtu's. Replacing the Clerestory glass would have a payback period of 5.44 years, Insulating the walls would have a payback period of 16.33 years, and re-insulating the roof would have a payback of 21.78 years.
- Replacing the mechanical system would require a capital investment of $190k. However an End of Life Adjustment amount of $110 k means that the Net Energy Investment would be $80k. This work, if done,

would yield and annual cost savings of $5,400 and an annual energy savings of 135 thousand kBtu's. The payback period is estimated to be 14.8 years.

Short-Term Recommendations:

- By reviewing the current utility data, determine energy use intensity. The building should have a blower door test and thermographic scan to find any possible air sealing gaps and opportunities for envelope optimization.
- The results of the blower door test should be reviewed and a scope for corrective work should be developed. Areas for improvement will include but not be limited to air sealing at all transitions and wall penetrations, air sealing at the wall and roof connection, re-weather-stripping of all doors. The roof will require a complete structural assessment and design for repair and improvement before any insulation can be added to the roof. The clerestory glass should be replaced. A great product for this application would be a Kalwall high performance window/wall system utilizing nanogel technology.[2]

Long Term Recommendations:

- As part of any future capital improvement project, the results of the building audit should be reviewed and incorporated into the overall project planning.
- When the future of the building is determined a high efficiency HVAC system should be designed and installed consistent with its planned use.
- It is our understanding that a lighting retrofit project has already been completed, but this should be confirmed.
- Future equipment and appliance purchase should be energy efficient and have the ENERGY STAR® logo.

Public Works Garage

Current energy data:

Building Size = 7,200 Square feet
Annual Electrical usage = 385,085 kBtus
Annual Heating fuel usage = 731,679 kBtus (Does not include waste oil usage)

Total energy per square foot = 155.11 kBtus
Total energy cost per square foot = $2.96 (Does not include waste oil usage)

The Public Works Garage, located at 47 Pine Hill Road, is a pre-engineered steel building of 11,160 square feet with a mezzanine over approximately 35% of the building. The actual foot print of the building is 60' x 120' for 7,200 square feet. The slab is on grade without insulation. The exterior walls have some insulation, but not nearly enough to define them as well insulated. A July 30, 2010 report from Bergeron Technical Services states that an additional 3" of rigid insulation was added to the roof structure when the building received a new roof. The report cites this along with a number of other structural and life safety concerns. This report should be reviewed and the findings should be considered when pursuing future capital improvement projects. It is our understanding that a plan has been put in place to address the concerns cited in the report and some of the issues have already been resolved. The building is being used for numerous vehicle repair and maintenance projects. The building is heated with a combination of a waste oil furnace which burns waste vehicle oil from maintenance of the town's vehicles along with oil that is collected from the local transfer station. However, the supply of waste oil cannot be assured for the long term. A number of supplemental electric resistance heaters are installed throughout the building. These fan and coil heater units are highly inefficient and should be decommissioned immediately and replaced per the recommendations below.

Energy Conservation Measures:

Public Works Garage	Capital Investment	End of Life Adjustment	Rebates & Incentives	Net Energy Investment	Annual Energy Cost Savings	Simple Payback	Est Annual Energy Savings/Kbtus	CO2 Reduction at Avg 17.5 lbs/100 Kbtu
Envelope improvements = 25% reduction in annual load	$75,000			$75,000	$7,600	9.87	279,191	48,858
Boiler Installation/Biomass (replace electric unit heaters w/ FHW modines)	$105,000	$40,000		$65,000	$6,950	9.35	146,335	25,609

Figure 12, Energy Conservation Measures for Public Works Building

- Improving the envelope of the Public Works Garage would require an investment of $75k. The payback period would be 9.87 years. Cost savings per year would be $7,600 and annual energy savings would be 279,191 kBtu's.
- Replacing the electric unit heaters with a biomass (wood pellet) heating system would require a capital cost of $105k. When an end of life adjustment of $40k is considered the net energy investment is only 65k. Investing in a new heating system for this building would have a very good annual savings of $6,950 and the payback period would be just under 9.5 years. This measure would also result in an annual energy savings of 146.3 thousand kBtu's.

Short-Term Recommendations:

- By reviewing the current utility data, determine energy use intensity.
- The building should have a blower door test and thermographic scan to find any possible air sealing gaps and opportunities for envelope optimization.
- The results of the blower door test should be reviewed and a scope for corrective work should be developed. Areas for improvement will include but not be limited to air sealing at all transitions and wall penetrations, air sealing at the wall and roof connection, possible replacement of garage doors with R14

doors and high speed door openers. The roof will require a complete structural assessment and design for repair and improvement before any insulation can be added to the roof.

- This type of building is generally a good candidate for a bio-mass boiler. It is probably, by itself, not a large enough load to qualify for a wood chip boiler, but a wood pellet boiler would work well in this application. The installation of a wood pellet boiler system including fuel storage and delivery system should be in the neighborhood of $105k.

Long-Term Recommendations:

- When the future of the building is determined a high efficiency HVAC system should be designed and installed consistent with its current use.
- As part of any future capital improvement project, the results of the building audit should be reviewed and incorporated into the overall project planning.
- It is our understanding that a lighting retrofit project has already been completed, but this should be confirmed. This building is a good candidate for day lighting. Any retrofit project should include a band of Kalwall window system across the top portion of the eave walls.[3]
- Future equipment and appliance purchase should be energy efficient and have the ENERGY STAR® logo.
- Another option is to build a new high performance Public Works building. It is our opinion that the current building without major renovations and additions cannot function adequately, when considering occupant health and safety, as a Public Works garage.We estimate a $2 to $4 million dollar cost for this option.
- In conjunction with the above bullet to build a new facility, would be to repurpose the existing building as garage-only space. This will take the existing highway department buildings off line and allow for reorganizing the whole site for work flow optimization.

II. Energy Guidelines for Capital Improvement Projects

One thing that became apparent during the course of this study was the lack of a consistent and measured approach to energy on Town projects. The assembled team has been involved in the design and construction of many high performance energy efficient building throughout New England, including working together on the first US Green Building Council LEED Gold certified building in New England. The process used on this and many other successful projects is described below. We recommend that this process be used as a foundation to Town guidelines for Capital Improvement Projects. Further, the Town might consider a facilitated design development process when considering any capital improvement projects. As mentioned earlier in this report, the Town would benefit greatly from retaining the services of an Energy Manager who could guide the Town along the path on a project by project basis.

<u>Energy Retrofit Process</u>

1. Identify and Understand the Problem

- Benchmark all buildings to determine its EUI for comparison to the national average. (completed in 2008 by Energy Intern, but keep the analysis current)
- Analyze thermal and electrical usage data separately.
  a) Thermal – where are the Btu's going?
     - Calculate existing exterior wall and roof R values
     - Conduct blower door test to pinpoint leakage with theatrical fog, thermal imaging or both;
     - Prepare written report with thermal imaging graphics documenting baseline air leakage rate and investigative findings;
     - Evaluate existing HVAC systems and if appropriate recommend efficient replacements as appropriate
  b) Electrical – where are the kWhs going?
     - Measure kWh in each building with data loggers to find out where the electricity is going;
     - Determine annual and peak loads;
     - Evaluate electrical and lighting systems and recommend efficient replacements as appropriate, including fixtures and controls as well as occupant behavior.

2. Select Retrofit Projects
   - Is the building in the right place? Can energy efficiencies by achieved by co-locating buildings in future?
   - Consider best place to spend public money. Will the building be around for the next 10-20 years? Determine cost-effectiveness of immediate, midrange and long-term action items.

3. Set Clear Goals for Projects
   - Establish energy use targets that envision significant and achievable reductions. These should be expressed in specific numbers, ie; annual kWh, annual kBtu, kBtu per square foot, watts per square foot.
   - Set specific goals for air-tightness, day lighting, air quality, comfort, durability, and construction waste recycling. There are programs and grading systems like LEED and Energy Star that can help with this.

4. Pre-Design Strategies
   - Take a close look at energy sources: Is current source appropriate? Consider what effect future price increases will have on energy source. Consider the true cost of the fuel and its long term availability.
   - Explore opportunities for renewable energy production.
   - Select a skilled project team based on past project performance related to EUI with a demonstrated ability to be creative and turn challenges into opportunities. The team needs to consider working within performance-related fee structure; team must be skilled in the construction administration process and dedicated to quality assurance.
   - Include third party commissioning for design and construction. Third party commissioning to be involved during design, construction and post-occupancy
   - Build robust energy model to help analyze beneficial impact of all systems including Envelope, HVAC, Lighting and controls, etc.
   - Establish order-of-magnitude probable costs for implementation; take into account life cycle costs versus initial capital costs.
   - Consider creating a position for a town energy manager who can work with other Wolfeboro facilities (hospital, schools) to seek shared opportunities.
   - Get town buy-in. Tell the whole story. Set budgets based on true costs not what the Town wants to spend.

5. Implement Strategies
   - Project team to pursue an integrated design process involving all parties – Owner / Architect and Engineer/ Construction Management – from design through to construction and post-occupancy phases.
   - Specify additional envelope infiltration testing during construction before drywall to confirm air-tightness goals.
   - Project team to produce biddable construction documents.
   - Project team to provide thorough construction administration – regularly scheduled site visits, document preparation and distribution of meeting minutes.
   - Commission all systems; doggedly pursue _**Quality Assurance**_!

6. Measure Outcomes – Post Occupancy Evaluations
   - Determine energy savings.
   - Conduct survey to determine occupant comfort and worker efficiency in retrofitted workplace.
   - Publicize failures and successes: learn from mistakes!

III. Energy Manager

As mentioned in the Executive Summary, it is recommended that the Town of Wolfeboro consider hiring an Energy Manager to develop the energy efficiency measures identified in this report, as well as other opportunities. This position could be part time and potentially shared with another town or institutions within Wolfeboro, such as the Governor Wentworth Regional School District, Brewster Academy, or Huggins Hospital. The current town employee structure with no town facilities manager and where each department manages his or her own facilities and thus the energy use, presents significant challenges. Department heads do a heroic job managing their facilities, but they simply cannot be expected to have the knowledge and experience to identify and implement deep energy reductions.

IV. Renewable Energy

There are many opportunities for renewable energy projects in the Town of Wolfeboro. These range from solar photovoltaics, to micro hydro in association with the municipal water system.

Biomass Heating

An option that has had a good deal of success for Municipal and School projects throughout New England is the installation of biomass heat plants. These range from large size wood chip fired district systems to individual wood pellet fired boilers for individual buildings. We have already recommended changing out the heating systems at the MED/Armory building and the Public Works garage with wood pellet boiler systems. These systems have many advantages, which include energy cost reduction and supporting of local economies.

Fuel Type	Fuel Unit Cost	Fuel Unit of Meas.	Efficiency of Heating Unit	Price per Million BTU
Coal	330	Ton	78 %	16.98
Fuel Oil (No.2)*	3.592	Gallon	78 %	33.20
Natural Gas*	1.1019	Therm	78 %	14.13
Propane*	3.263	Gallon	78 %	45.80
Wood	210	Cord	60 %	17.50
Electricity*	0.13894	kWh	99 %	41.12
Wood Pellets	240	Ton	80 %	18.18
Kerosene*	4.144	Gallon	80 %	38.37
Geothermal	0.13894	kWh	275 %**	14.81

Source: http://www.nhclimateaudit.org/calculators.php

As shown above, with the exception of natural gas which is not available in Wolfeboro, there is a significant difference in cost per BTU when you move away from fossil fuels.

Solar Energy

There are numerous opportunities for solar PV installations within the Town. The most efficient use of this investment dollar would be to put together a single installation that ties into the power distribution grid. The cost per watt goes down considerably in larger installations.

- 10-50 KW, ground mounted, installed cost is $7.5/w
- 50-100 KW, ground mounted, installed cost is $6.5/w
- 100-200 KW, ground mounted, installed cost is $6/w
- 200-1000 KW, ground mounted, installed cost is $5.5/w

A 100 kW Solar PV system will produce approximately 106,500 kWh annually. This size system would offset approximately 5% of the Town's current annual electrical use for Municipal accounts. This renewable energy production would result in a CO_2 reduction of 168,600 lbs.

Micro-Hydro

There is potential within the Municipal water system for the installation of Pico or Micro Hydro generation at the pressure reducing station. Initial investigation shows that this is a good possibility in the near future. Rentricity (www.rentricity.com) is one of a number of manufacturers that handle this type of installation. Accurate data could be pulled together and a Request for Proposal should be posted to determine competitive installed costs.

Funding Resources

A separate report on funding mechanisms was completed for the Town of Wolfeboro. Included below are several additional opportunities to consider.

Municipal Energy Reduction Fund

Utilizing funds from New Hampshire's Greenhouse Gas Emissions Reduction Fund, the New Hampshire Community Development Finance Authority (CDFA) has developed a revolving loan program for municipal governments to invest in energy efficiency and alternative energy. Typically, loans will be structured so that the payments will be made with money saved by the energy improvements. A wide variety of energy efficiency technologies as well as alternative energy technologies are eligible, the program is customizable depending on a municipality's needs. CDFA will work with municipalities to take advantage of other programs that might be available (utility incentives or other loans, for example).

Competitively Bid Feed In Tariffs (FIT)

See: http://www.ecocivilizationweebly.com/competitively-bid-feed-in-tariff.html

Under a Competitive FIT, the Public Utility Commission, Energy Office, Municipal Utility, Public Power Authority, Energy Cooperative, or other government entity will issue a competitive Request for Proposal (RFP) *periodically (every three to six months) for a specified mixture of efficiency and renewables, subject to measurement and verification.*

The winning bidder has broad choice of efficiency and renewable technologies to accomplish goals specified in the RFP. The Competitive FIT is undertaken on a mass utility scale, addressed to all members of a rate class. The costs for a Competitive FIT are recovered through electric and natural gas utility rates that will include charges for negawatts, nega-therms, renewable energy, and conventional energy . User energy bills should be less than existing charges for similar consumption without negawatts and negatherms.

P4P
NH PAY FOR PERFORMANCE

New Hampshire Pay for Performance
Program Summary

PLAN → BUILD → SAVE

Overview

The Pay for Performance Program (P4P) addresses the energy efficiency needs of the commercial, industrial and municipal sectors by working with participants in a three-step process to improve the energy efficiency of their facilities. P4P is executed through a network of qualified Partners, selected based on their experience and their demonstrated ability to service energy customers throughout the process: plan and develop comprehensive energy efficiency solutions and projects, oversee installation, and verify that the installation will achieve the estimated energy performance.

The New Hampshire Pay for Performance Program is funded through proceeds from the Regional Greenhouse Gas Initiative (RGGI), an effort by 10 Northeastern and Mid-Atlantic states to reduce emissions of greenhouse gases from the electric power sector.

Energy Reduction Plan

The Energy Reduction Plan is more than an audit – it builds both a customized financing plan and construction schedule into a comprehensive building energy audit conducted by a certified experienced professional.

Eligibility

- NH commercial, industrial and municipal facilities with electric demand of ≥ 100 kW and/or annual fuel consumption of ≥ 1,000 MMBTU for space or process heating.
- Universities, K-12 schools, hospitals, and other institutional facilities are eligible.

Requirements

- Projects are required to either:
  - Develop an energy model of the building using an ASHRAE-compliant simulation software program
    OR
  - Follow the non-modeling approach, for those projects that cannot reach 15% reduction and/or are not good candidates for building modeling.
- The proposed work scope must project at least a 15% reduction in total facility source energy consumption, using EPA's Portfolio Manager benchmarking tool to set the baseline.
- Projects must have an overall internal rate of return (IRR) of at least 10%. Individual energy efficiency measures may fall below this cost effectiveness threshold but the overall work scope must have an IRR of 10% or higher.

TRC

New Hampshire Public Utilities Commission

P4P
NH PAY FOR PERFORMANCE

New Hampshire Pay for Performance Program

Get paid up to $340,000 + Save at least 15% of your energy cost = P4P NH PAY FOR PERFORMANCE

FINANCIAL INCENTIVES – Standard Approach

- Eligible participants are paid three times on the following payment schedule, at the beginning, middle, and end of your project.
- The following payment schedule is applicable to projects that reach 15% energy reduction, through developing an energy model of the building using an ASHRAE-compliant simulation software program.

	INCENTIVE # 1	INCENTIVE # 2	INCENTIVE # 3
INCENTIVE AMOUNT	Based on building size: a] <100K sf = **$0.18/sf** b] 100-200K sf = **$0.15/sf** c] >200K sf = **$0.10/sf**	**$0.22/kWh** saved and **$22.00/MMBTU** saved	**$0.08/kWh** saved and **$8.00/MMBTU** saved
PAYMENT TIME	On approval of Energy Reduction Plan & at Beginning of Construction	Construction Completion	1 Year Post-Construction
DETAILS	Designed to to defray the cost of the Energy Reduction Plan.	Payment based on projected energy savings.	Payment based on actual energy savings performance.

Total performance incentives (#2 and #3) are capped at $300,000 or 50% of project cost. In addition, there is an annual entity (e.g., municipality, SAU) cap of $750,000 per year.

Projects that cannot reach a 15% reduction and/or are not good candidates for building modeling can follow the Alternative Approach (see page 3).

TRC

New Hampshire Public Utilities Commission

NH PAY FOR PERFORMANCE

New Hampshire Pay for Performance Program

Alternate Path

This approach is offered to those projects that cannot reach 15% reduction and/or are not good candidates for building modeling. Under the Alternate Path, projects must meet the following requirements:

- Include at least two distinct energy efficiency measures.
- Project a minimum savings of **50,000 kWh or 250 MMBtu.**
- Use Excel-based Application forms for submitting project along with backup information.
- Verify installation of measures as proposed in Application Package.

FINANCIAL INCENTIVES – Alternate Path

	INCENTIVE # 1	INCENTIVE # 2
INCENTIVE AMOUNT	$0.05/sf capped at $5,000	**$0.16/kWh** saved and **$16.00/MMBTU** saved
PAYMENT TIME	Approval of Application Package	Verify Installation of Measures as Proposed
DETAILS	Designed to defray the cost of developing energy savings calculations.	Payment based on projected energy savings.

Incentive 2 is capped at $300,000 per project, not to exceed 50% of project cost. In addition, there is an annual entity (e.g., municipality, SAU, corporation) cap of $750,000 per year.

Contact Information

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