Energy Efficiency Opportunities
For
Meriden Town Hall
Plainfield, New Hampshire

Preliminary Assessment

December 31, 2011

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Provided by:

New Hampshire's Office of Energy and Planning

Energy Technical Assistance & Planning
For New Hampshire Communities
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1.0 Introduction and Executive Summary

Peregrine Energy Group, Inc. ("Peregrine") has prepared this preliminary energy efficiency and renewable energy investment assessment for the facility we visited on Friday, December 9, 2011 in Plainfield, NH. We've prepared this report on behalf of the New Hampshire Office of Energy and Planning's Energy Technical Assistance & Planning for New Hampshire Communities program ("ETAP"). Funding for this project comes from the American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant program of the U.S. Department of Energy. Peregrine gratefully acknowledges the assistance that Paul Roberts, Steve Halleran, and Nancy Mogielnicki provided with answering questions on site for our assessment.

The primary goal for this report is to identify cost-effective energy efficiency and renewable energy investments that Plainfield should consider as part of its long-term energy management plan. The report includes Peregrine's recommendations for energy cost reduction projects that Plainfield may want to pursue and also a summary of building energy use and cost information we were able to collect.

Findings and Recommendations

In order to generate our list of recommendations, Peregrine's site visit and staff interviews focused on:

- Observations of existing facility conditions
- Current operating practices and facility uses
- Short term and long term facility plans
- Potential building and mechanical equipment energy efficiency upgrades
- Potential renewable energy upgrades

After our site visit, Peregrine reviewed utility bill information for the facility to corroborate our site visit observations and ground our recommendations against actual energy consumption.

Drawing on our site visit observations and discussions with town staff, Peregrine has identified several energy saving opportunities in facilities at the Meriden Town Hall that the Town can implement within existing town budgets, using existing staff resources.

More capital intensive energy efficiency recommendations that Peregrine identified include:

- Install energy efficient lighting upgrades.
- Install a direct air intake for the boiler

Table 1. Energy Reduction Program Potential Results[1]

Facility	Approximate Installed Cost ($)	Utility Incentive Available[1]	Potential Utility Savings			Annual Cost Avoidance ($)	Simple Payback Yr
			Other Benefits	Electric kWh/yr	Oil Gallons/ yr		
Town Hall	1,490	100	B	1,982	168	811	2
Notes				*Current Utility Budget:*		*$6,387 /yr*	
(1) Subject to Utility Incentive Policy and Screening Analysis				*Percent Reduction:*		*13%*	
(2) A - Better Comfort; B - Improved Reliability; C - Reduced Maintenance; D - Enhanced Appearance							

Summarizing our Major Findings and Recommendations:

- **Town volunteers performed a terrific job air sealing and insulating the building**
- **More aggressive temperature setback is the most cost effective measure for the Town to consider.**
- **Plainfield should install more energy efficient lighting in the building.**

Suggested Next Steps

Within the context of the ETAP program, Peregrine can only provide limited additional support the Town to help plan and execute these recommendations. All projects identified in this report will require further development and analysis to obtain firm pricing and confirm savings projections.

Immediate next steps include:

- Select which measures the Town would like to proceed with and establish an implementation schedule.
- Authorize further engineering or prototype installation activity, if necessary, to develop detailed specifications and/or generate more accurate savings projections.
- Develop request for proposal documents and/or select preferred lighting and equipment vendors.
- Secure quotes for projects and select lighting and equipment contractors.

[1] This table does not include renewable energy or replacement window costs and savings

2.0 Utility Cost and Consumption

Energy Cost and Use

The total energy cost for the Meriden Town Hall is about $6,387. Total energy use for the Meriden Town Hall is about 13,648 kWh for electricity and 1,404 gallons for oil. The total energy intensity units are expressed in site[2] kBtu[3] per square foot. Table 4 in Section 4.0 compares the energy use intensity of the Meriden Town Hall to similar buildings that Peregrine has assessed as part of the NH ETAP program[4].

Table 2. Annual utility cost and energy use

Plainfield	Average Price	$0.13	$3.29		
Energy Cost					
Facility	Square Feet	Electric Cost ($)	Oil Cost ($)	Total Cost ($)	Cost ($) per Square Foot
Town Hall	2,800	1,773	4,614	6,387	2.28
Energy Use					
Facility	Square Feet	Electric kWh	Oil Gallons	Total kBTU	Site kBtu per Square Foot
Town Hall	2,800	13,648	1,404	245,949	88

[2] Site energy = All non-electric fuel consumption in the building plus electric energy measured at the meter.
[3] kBtu = 1,000 British Thermal Units. 1 kilowatt hour of electricity = 3,413 Btus, 1 gallon of #2 oil = 140,000 Btus, 1 gallon of Propane = 92,000 Btus.
[4] The score is based on total energy use per square foot (1,000 Btus per Square Foot or kBtu/ SF). The higher the energy use per square foot the more inefficient the building is. In addition to total use, the chart includes the energy use per square foot for each major utility.

3.0 Meriden Town Hall

Plainfield's Meriden Town Hall (1895) was extensively restored in 1996. The facility includes about 2,800 square feet and is used for Town administrative services in the front of the building and the Police Department in the back of the building. Administration offices are open 4-1/2 days per week and the Police station is open 24 hours a day, 7 days per week.

Figure 1. Meriden Town Hall

Building Envelope

The building envelope consists of a shallow brick foundation built on ledge, wood frame walls with plaster and lathe interior finish, dense pack cellulose insulation, and wood clapboard siding, and a wood roof assembly slate shingles and is heavily air sealed and insulated. Windows are original wood frame with single pane glass and interior storms. As figure 4 indicates the floor above the crawlspace is insulated and air sealed. The level of air sealing performed in the building is impressive. Town staff did identify an exterior wall with insulation missing and signs of air leakage under the baseboard.

Figure 2. Looking for heat loss

Figure 3. Missing wall insulation in wall cavity and air leaks under the baseboard

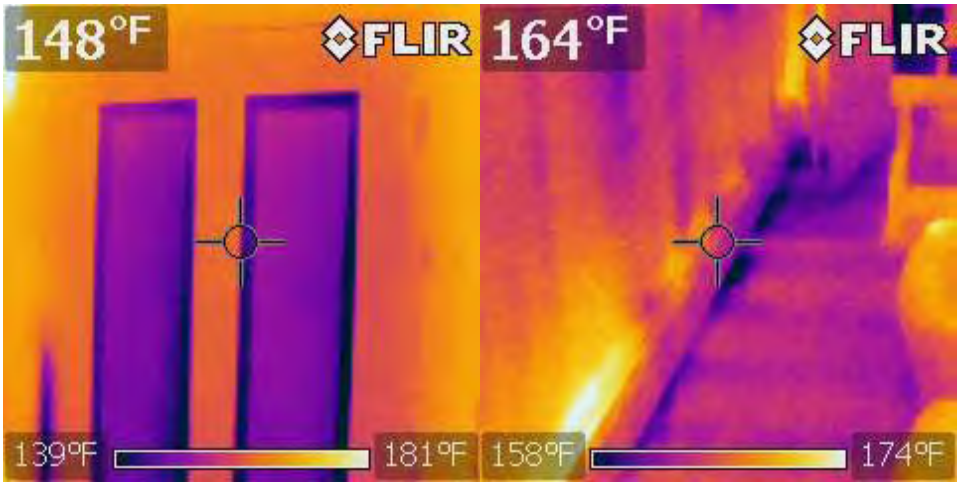

Figure 4. Attic and crawlspace insulation

Figure 5. Interior storm window detail and Police Department window

Mechanical Systems

The mechanical systems in Town Hall include an oil-fired forced hot water heating system with a copper pipe distribution and supply to the building. The heating system operation includes five zones and five circulation pumps. Individual room temperature control includes digital thermostats that are setback occasionally. The building is not air conditioned. Two industrial grade Lifebreath air-to-air heat exchangers installed just above the dropped ceiling are not used. An electric storage tank provides domestic hot water (DHW) for the Police Station and the kitchen, and on-demand electric water heater provides DHW for the sink located in the front of the building.

Figure 6. Oil-fired boiler and circulation pumps

Figure 7. Air-to-air heat exchanger and digital thermostat

Lighting and Other Electric Loads

Lighting includes T12 fluorescent light fixtures in the Police Department and 150 watt incandescent lights installed in restored gas light fixtures in Town Hall. Other electric loads include kitchen appliances, standard office equipment, heating system components, Police Department communication equipment, a water bubbler, and miscellaneous plug loads.

Figure 8. Administration incandescent lighting

Figure 9. Police Department lighting and water bubbler

Recommendations

Table 3. Summary of energy reduction opportunities for Meriden Town Hall

	Description	Approximate Installed Cost ($)	Utility Incentive Available[1]	Other Benefits[2]	Potential Utility Savings		Annual Cost Avoidance ($)	Simple Payback Yr
					Electric kWh/yr	Oil Gallons/ yr		
1	More aggressive temperature setback	$0				140	461	<1
2	Administration lighting upgrade	$140		B	756		98	1
3	Boiler direct air intake	$500				28	92	5
4	Police Department lighting upgrade	$850	$100	B	1,226		159	5
	Estimated Program	***$1,490***	***$100***	***B***	***1,982***	***168***	***$811***	***1.7***

Notes ***Current Utility Budget:*** ***$6,387 /yr***

(1) Subject to Utility Incentive Policy and Screening Analysis ***Percent Reduction:*** ***13%***

(2) A - Better Comfort; B - Improved Reliability; C - Reduced Maintenance; D - Enhanced Appearance

1. More aggressive temperature setback

Given the level of air sealing and insulation that has been added to the building, Town Hall should have very low energy consumption. More aggressive temperature setback in the Administration offices might be possible with the existing digital thermostats.

Next Step: Review and reset the digital thermostat settings in each room.

2. Administration lighting upgrade

Peregrine confirmed that 150 watt equivalent compact fluorescent (CFL) dimmable bulbs are available online for about $20 apiece. They consume about 42 watts and can reduce energy use for lighting significantly. The challenge will be to identify a warm white CFL light bulb that provides the equivalent ambiance of the existing incandescent lighting.

Next Step: Purchase and install a sample CFL light bulb.

3. Boiler direct air intake

A large grille that is directly open to outdoors provides fresh air for boiler combustion. Peregrine recommends replacing the fresh air grille with a direct air intake for the oil burner. This will reduce the amount of uncontrolled air leakage from the rest of the building significantly. Field Controls manufactures several custom boots designed to connect snugly with specific burner models.

Next Step: Request a quote from the Town's service contractor to seal the air intake grille and install a direct air intake kit.

4. Police Department lighting upgrade

T12 Fluorescent lighting is not manufactured anymore and will be taken off the market in July 2012. Plainfield should anticipate this transition and replace the T12 lighting in the Police Department and install more efficient T8 light fixtures and electronic ballasts.

Next Step: Contact PSNH and talk to the utility company's "Smart Start" municipal energy efficiency program regional coordinator for a list of approved contractors. Other town facilities with T12 lighting could benefit from this program as well.

Further Discussion

In addition to more aggressive temperature setbacks, the other major investment that Plainfield should anticipate is energy-related window repairs. Two exterior storm window solutions include installing low-e coated triple track storm windows or high performance fixed wood frame windows. Both options would help protect the original window sashes from weather-related damage and improve the thermal comfort of the building. In addition, Plainfield should investigate options to reduce heat loss from around the sash weights. A creative window repair company in Boulder, Colorado installs PVC piping in the window weight boxes for the sash weights to slide up and down in then installs spray foam in the window weight box to insulate and air seal this area. The same company custom builds high performance exterior storm windows with multiple glazing layers and low e coating. Plainfield could install sample window upgrades on the Police Department's office window.

Police Department staff mentioned during our site visit that the back rooms are difficult to keep warm. The back door that serves as the Police Department's main entrance fits loosely in the frame and is a source of air leakage. Door weatherstripping and a high quality storm door might help reduce the discomfort associated with this door. In addition, Department staff prefers to keep the equivalent of the mudroom door open to make the office more inviting. One option is to install a Dutch door in the door frame. This would allow Department staff to leave the upper half open and leave the lower half shut to stop the initial cold draft that comes in when the outside door opens. The other potential issue is the amount of heat that the existing radiators can provide. Fin-tube radiators cool off very quickly and the existing heat output may not be able to keep up with the amount of fresh air that comes in when the door opens frequently. Plainfield could install wall-mounted steel radiators in place of the fin-tube radiators to provide higher output and longer duration heating cycles.

On a smaller scale, Town Energy Committee members could install Kill-a-watt or equivalent plug in energy monitors to document the energy consumption of individual appliances. The water bubbler, for example could be plugged into an occupancy sensor and turned off when the building is unoccupied if the Committee confirms that the energy use for this appliance is high.

4.0 Building Performance

The chart below provides an opportunity for Middleton to compare the performance of its buildings against comparable buildings that Peregrine has assessed as part of the NH ETAP program. The score is based on total energy use per square foot (1,000 Btus per Square Foot or kBtu/ SF). The higher the energy use per square foot the more inefficient the building is. In addition to total use, the chart includes the energy use per square foot for each major utility. As the chart shows, the energy use intensity of the Meriden Town Hall is above average.

Table 4. Building performance use per square foot scores for Town offices

Building	SF	Building Type	Total Site kBtu/ SF	Elec Site kBtu/ sf	Oil Site kBtu/ SF	Propane Site kBtu/ SF	Natural Gas Site kBtu/ SF
Administration	17,500	Office	183				
General Building	4,231	Office	130	61	68		
Town Hall	3,749	Office	128	44	85		
Town Hall	6,887	Office	126	40	86		
Town Hall	2,210	Office	115	16	100		
City Hall/Fire	30,300	Office	114	38	47		30
Town Office	5,550	Office	110	42	68		
Bates Building	2,060	Office	106	22	84		
GBW Building	13,774	Office	103	43	60		
Town Hall	4,800	Office	102	30	71		
Town Hall	14,000	Office	101	17	84		
Municipal Offices	12,778	Office	98	17			80
Town Hall	8,707	Office	95	8	87		
Town Hall	2,259	Office	92	9	83		
Town Hall	4,211	Office	90	26	56	9	
Town Office	2,800	Office	87	17	70		
City Hall	17,285	Office	87	11			77
Registry of Deeds	28,000	Office	86				
Town Hall	8,892	Office	82	11	71		
Town Hall	3,718	Office	82	14	69		
Town Offices	2,788	Office	81	3	78		
Town Hall	5,441	Office	80	41		40	
Town Hall	15,360	Office	73				
Administration	12,000	Office	72				
City Hall	15,872	Office	71	15	56		
Town Hall	6,494	Office	70	9	61		
Town Office	3,825	Office	70	12	58		
Town Office	9,672	Office	69	21	48		
Town Hall	11,520	Office	69	26			43
Municipal Building	6,000	Office	69				
SAU-48 Administration	2,898	Office	67	61		6	
Town Offices	5,366	Office	67	20	47		
Municipal Building	3,622	Office	66	28	38		
Town Hall	2,924	Office	66	14	51		
City Hall	15,750	Office	65				
Town Office	5,616	Office	63	8		55	
Town Hall	7,563	Office	63	17	45	1	
Town Hall	33,907	Office	62	16	32	14	
City Hall	15,300	Office	61				
Town Hall	7,316	Office	60	18	43		
Town Offices	5,449	Office	57	13	44		
Town Hall	5,915	Office	56	5		51	
Town Hall	8,436	Office	55	9	38	4	
Town Hall	6,708	Office	54	11			43
Town Offices	1,944	Office	54	14		40	
Town Hall Annex	3,584	Office	54	25	29		
Town Hall	14,400	Office	50	3	48		
Town Hall	9,500	Office	48				
Town Hall	13,476	Office	48	12	36		
Town Hall	5,843	Office	42	3	36	3	
Town Hall	4,240	Office	41	10		32	
Town Office Main Building	12,384	Office	27	4	23		
Town Offices	4,811	Office	33	19		14	
Academy Hall	3,626	Office	32	3		29	
Town Hall	7,183	Office	29	9	19		
Town Hall	3,684	Office	30	12	18		
Town Office Food Shelf	5,880	Office	16	9	7		

5.0 Light Levels

Measured and Target Light Levels

Peregrine and Town Energy Committee members measured light levels on the first floor and confirmed that they were within acceptable levels. Following are sample light levels for several types of buildings and tasks we see in Town portfolios.

Table 5. Measured light levels and recommended target levels

Area	Number of Bulbs	Light Fixture	Measured Lighting Level (foot candles)	Target Lighting Level (foot candles)
PD Office	12	T-12	68	30-50
PD Meeting Rm	6	T-12	58	30
Town Hall Meeting Area	3	150	55	30

Table 6. Sample light level recommendations for municipal facilities

Office private w/o task light level	50 FC
Office open w task light level	35 FC
Office computer work	30 FC
Hallway light level	20 FC
Library reading light level	50 FC
Library stack light level	35 FC
Library circulation light level	75 FC
Garage parking light level	15-30 FC
Garage body work light level	80 FC
Gymnasium General	30 FC
Gymnasium Matches	50 FC

Suggested Strategies for Reducing Energy Use and Increasing Energy Efficiency in Local Operations

Prepared by

Energy Technical Assistance & Planning For New Hampshire Communities

Funded by the ARRA Energy Efficiency Conservation Block Grant

Introduction

Whether you represent a City, Town, or County that is trying to reduce its energy use and expenses, adhering to the simple principles and processes described here will greatly increase the likelihood of both near term and long term success. Sections 2-4 give you specific steps you should take to move the process forward in your community. Section 5 outlines the broad steps for putting together a comprehensive Energy Management Plan.

Getting Organized for Energy Efficiency

The goal of the ETAP program is to assist communities take action to reduce their energy usage. Like any other project you might undertake at work or at home, knowing where you are and where you hope to get to and agreeing on the roles and responsibilities of the members of your team will make your efforts more fruitful.

Decide who is in charge: Designate an Energy Lead

Your community should have a single person responsible for monitoring energy use, tracking your progress in increasing energy efficiency, and measuring progress against goals. Ideally this should be an individual who has both the responsibility and the authority to affect policy and move your goals forward. This will help guarantee that energy efficiency initiatives stay on track and are an integral part of all policy and decision making.

Establish an Energy Committee and Share Information about Energy Use and Cost

A successful energy cost reduction strategy requires the involvement and commitment of elected officials, local government managers and departments, building users, and maintenance staff. Bringing them together to confirm policies, goals, and strategies, to determine resources needed, to establish timelines and responsibilities, and to measure and communicate progress is critical to your success.

You can't manage what you don't measure: Monitor Monthly Energy Use

Track energy use and cost for each building both month to month and year to year. Using the Inventory Tool offered by ETAP is an easy way to get an overview of this use and cost and to measure your progress toward reaching the energy efficiency goals you set.

Inform town employees that energy reduction is a priority and solicit suggestions

Town employees often have good ideas for how to reduce energy use. But no one ever asks them for their opinion. Get employees involved in energy efficiency discussions and ask for their ideas on how improvements can be made in your programs and policies.

Finding Resources to Implement Energy Projects

While many energy use reduction opportunities are low cost or even no cost, others will require the investment of funds for major capital projects.

Look for and secure utility rebates and incentives

New Hampshire's utility companies often offer incentives to encourage their customers to adopt and install energy efficiency technologies. Even when you purchase electricity or natural gas from a competitive supplier, you still qualify for incentives offered by the distribution company that delivers your supply to you. Before proceeding with any upgrades or renovations, contact your utility to see what is being offered and how you can qualify. If you've taken advantage of lighting upgrade programs in the past, you may qualify for additional incentives to upgrade lighting again with more efficient fixtures.

Plan for the inevitable replacement of older equipment: Include funding in CIP or in reserve funds for energy systems replacement when equipment is 50% of useful life

It is a typical for a municipality or county to use a piece of equipment, vehicle, or building energy system until it fails and needs to be replaced. But the time to think about improving the energy efficiency of equipment is not that January day when the heating system in the Town Building stops functioning. Bring in contractors to review the condition of your system and research what alternatives might be available. You might find out that it will pay to replace a system sooner with new efficient equipment and and avoid the costly repairs that aging systems can require. Consider putting funds away yearly beginning when equipment gets to its half-life to minimize the budget impacts of its replacement.

Engage citizens in energy efficiency planning and policy making

Where there may not be needed expertise within the town, city or county government to address energy efficiency issues, there may be concerned or interest citizens willing to help and lend their expertise. If your town does not have an Local Energy Committee, reach out to interested citizens to form one. This not only will help you optimize how local government uses energy, but will give you a conduit to citizens when you need to secure their support for capital projects and procurements.

Establishing Policies that Encourage Energy Efficiency

Use building renovations as an opportunity to improve energy efficiency

Every building upgrade should be viewed as a chance to improve how the building operates, including how it uses energy. Consider adding insulation when wall are being opened. Be sure that new doors or windows are purchased with efficiency in mind.

Consider life cycle energy costs when purchasing any new equipment

When purchasing any new system that uses energy to operate (such as boilers, ventilation, air conditioning units, street lights, or vehicles) don't only consider the "first cost" or sticker price of the equipment or system, but compare and consider the "total cost" of different equipment, including it operation and maintenance over its expected life. It may be that the least expensive system will have a far greater impact on annual operating budgets than a more expensive, but energy efficiency alternative. This should be a standard principal in budgeting for any item with uses energy.

Creating an Energy Management Plan

The goal of the ETAP program is to not only to help communities identify specific actions it can take to reduce energy waste, but also to support ongoing energy management and planning to make buildings, systems and processes more energy efficient.

There are general principles and methods that are pertinent to any community to move them along the path towards energy efficiency. These are set forth in *New Hampshire Handbook on Energy Efficiency & Climate Change, Volume II* (2009), developed by the NH Carbon Coalition, Clean Air-Cool Planet, and Sustainable Development & Energy Systems (SDES) along with the Local Energy Committee Working Group of the NH Energy Efficiency and Sustainable Energy (ESSE) Board. These documents lay out an energy efficiency planning "roadmap" that municipalities can follow to understand their energy usage, plan for increased energy efficiency and work with their community to educate and implement effective energy efficiency solutions.

The aspects of this Roadmap are illustrated in Figure 1 briefly described in the following sections. You may already be following some or all of these steps in your community, if so congratulations! If not these steps are a strong foundation to use for thinking and acting on energy efficiency objectives.

Figure 1 Energy Efficiency Roadmap

Energy Baseline and Benchmarking

An inventory process can help establish a baseline of energy data describing the current performance of each building, as well as other areas needing attention, such as transportation and street lighting. For buildings, this involves collecting and organizing energy use information over a number of years to be able to look at annual, monthly, and seasonal patterns of energy consumption. The ETAP program provides assistance in collecting, maintaining and utilizing this information. If you have not taken advantage of this free ETAP service, contact your Regional Planning Commission for more information.

Establishing Priorities

Reviewing the baseline and benchmarking information can help a community target its energy efficiency initiative. One approach to setting priorities is to focus on buildings that are larger energy users or that have the higher energy use per square foot of floor area. Another approach focuses on buildings that are older or are known to have older systems or systems that have required frequent or costly repairs or have a record of occupant comfort complaints. We recommend a combination of approaches that looks at each building individually, recognizes that different types of building uses result in different energy profiles, and that high energy use can reflect envelope and equipment inefficiencies, poor maintenance practices, conscious choices by building

occupants, opportunities for behavior modification, or the inherent energy requirements of the use to which a building is put.

Buildings Assessments/Audits

Once buildings are identified as being the high priority targets, a building assessment by a qualified specialist should be arranged to determine what steps could be taken to reduce energy use without conflicting with the business for which a building is used.

For buildings with systems which perform like residential buildings (such as former homes converted to office space), there are standards from the Building Performance Institute (BPI) for conducting audits. Commercial buildings have different systems and The American Society of Heating Air Conditioning and Refrigeration Engineers (ASHRAE) has developed standard energy audit levels for these types of buildings. For all such assessments, regardless of building type, the cost will vary with the level of detail and type of information sought. This can range from relatively inexpensive high level "scoping audits" which identify opportunities with ranges of costs and savings to help screen investment alternatives to extensive and expensive "investment grade audits" which provide exact costs and savings estimates and identify replacement equipment to be installed with design requirements.

Prioritizing and Implementing Recommendations

Building assessments will usually generate a range of recommendations that include relatively quick and easy changes or improvements as well as capital intensive projects. Some measures will have relatively quick paybacks on investment, while others will have long paybacks and may be best implemented as part of long term equipment replacement process.

Regardless, it is important to review all the recommendations and understand the implications of acting now or later on each one in terms of cost and savings; and further, to develop a formal plan, with responsibilities assigned and actions identified for proceeding with each recommendation of interest.

In many cases, the limiting factor in proceeding will be securing funding. While it is tempting to look for grant sources and wait until grant money is secured for projects, it may make more sense to commit and invest local funds now to gain efficiencies and savings as well as the peace of mind and greater comfort that new systems will create. If a significant energy cost savings can be documented, consider finding the funding for the work through loans programs such as the Municipal Energy Reduction Fund offered by the Community Development Finance Authority, or bonding. If the audits include lighting, HVAC or motor and drive upgrades, utilities may offer incentives that help pay for improvements.

Measurement/Assessment

Continue to monitor energy usage and savings achieved. If you've spent hard-won taxpayers dollars on these energy saving measures, you want to document how this work made a difference, and if not, determine why expected benefits are not being realized.

Reprioritize and Continue Improvements

Very seldom will one round of energy efficiency upgrades cover all the work that could be done to maximize energy savings. Establish the next set of priorities and begin the process of implementing these changes as well.

References

- New Hampshire Handbook on Energy Efficiency & Climate Change, Volume II (2009), developed by the NH Carbon Coalition, Clean Air-Cool Planet, and Sustainable Development & Energy Systems (SDES) along with the Local Energy Committee Working Group of the NH Energy Efficiency and Sustainable Energy (ESSE) Board. Copies of this document can found at http://www.nhenergy.org
- Information on building audits can be found at http://www.bpi.org and http://www.ashrae.org/
- Information on the Municipal Energy Reduction Fund can be found at http://www.nhcdfa.org/web/erp/merf/merf_overview.html .