

Meredith Library

Energy Audit



Prepared for:
Town of Meredith, NH

Prepared by:



August 31, 2011

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INTRODUCTION

This energy audit report was prepared for the Town of Meredith with funding provided by the American Recovery and Reinvestment Act of 2009 (ARRA) distributed through the New Hampshire Office of Energy and Planning (OEP), and administered by TRC Environmental Corporation.

Integrated Building Energy Associates LLC (IBEA) presents this report to the Town of Meredith with great pleasure and gratitude for the assistance provided by Town staff. Without their support this report would not be possible. Without their support this report would not be possible. This report discusses the findings and recommendations for energy efficiency improvements and cost reductions at the Library. It includes details regarding the building audit, existing building conditions, and energy conservation measures (ECM), which will reduce energy consumption and cost if implemented.

THE AUDIT

This audit is the second step toward lowering energy costs, reducing consumption, and freeing our communities from reliance on foreign energy. Prior to the audit an energy inventory determines which buildings have the greatest potential for energy reductions. The Library was one of five selected for auditing. (The other four buildings are: Town Hall, Town Annex, Department of Public Works, and Water and Sewer Department.) All of Meredith's buildings are bench marked in STOCC (see Appendix A)

This energy audit evaluates the building's envelope, mechanical systems, lighting, and domestic hot water. The resulting analysis herein provides a host of recommendations along with their economic implications.

BUILDING DESCRIPTION

The Meredith Library is a two-story, 8,100 s.f., brick building with a gable/hip roof located at 91 Main Street. The original structure was built in 1901 and an addition was built in 1988. The building is heated with forced hot water and the fuel type is oil.

CURRENT ENERGY CONSUMPTION ANALYSIS (2008)

Figure 1: Annual Energy Consumption

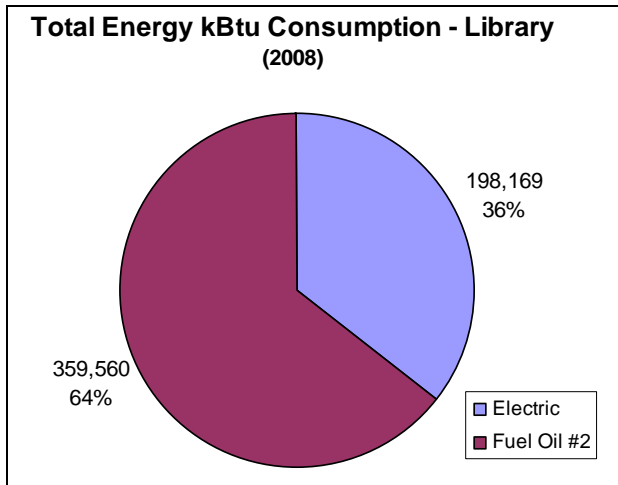
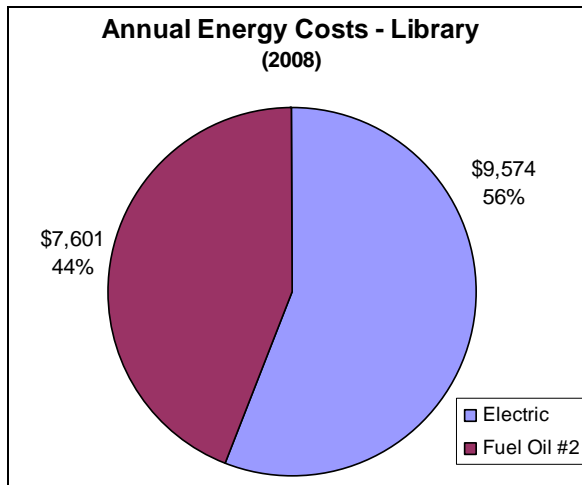


Figure 2: Annual Energy Expenditures



The Library consumes 198,169 thousand Btu's (kBtu's) of electric energy and 359,560 thousand Btu's of heating oil energy. The total yearly cost for electricity is \$9,574 and heat is \$7,601.

The Figure below shows the highest 30 minute average demand per month in kilowatts (kW). This graph is most closely associated with the number lights, appliances, and other electrical equipment consuming energy at the same time. The more equipment plugged in the higher the demand. This graph does not indicated how long lights and other equipment are consuming electricity.

The energy use for the Town Library Building is roughly allocated in the categories as shown below:

Total Annual Energy by Category

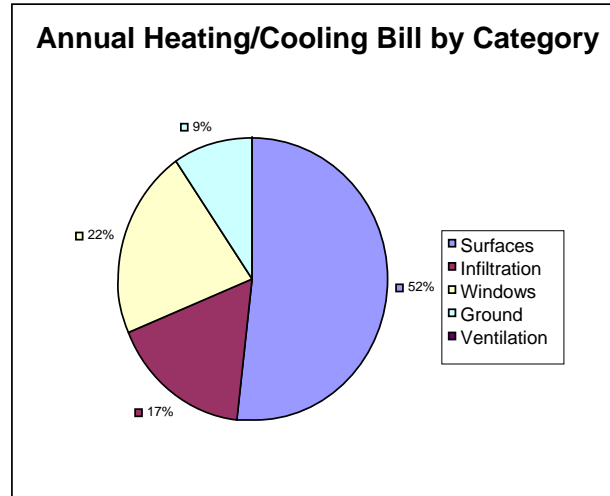
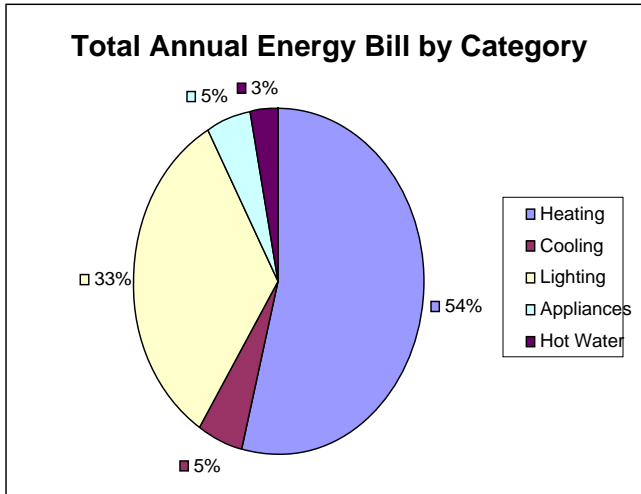
	Base Building
Heating	\$9,888
Cooling	\$901
Lighting	\$6,104
Appliances	\$923
Hot Water	\$539
Total	\$18,355

Total Heating/Cooling by Category

	Base Building
Surfaces, Doors	\$5,569
Infiltration	\$1,835
Windows	\$2,370
Ground	\$1,015
Mechanical Ventilation	\$0
Total	\$10,789

Actual energy consumption in buildings is typically different from predictions generated from energy modeling software. The effect of behavioral differences can result in changes in usage characteristics over time. Energy use from area lighting, task lighting, water-heating and miscellaneous equipment such as computers, printers and personal devices tend to be driven by occupant behavior. While differences in occupant energy usage plays an important role in this variation, actual energy modeling software does not account for these factors. Several other limiting factors such as complexity of buildings, weather and variations in building schedules and occupancy can result in variations in energy estimates from actual energy use.

Figures 3 & 4 Base Energy



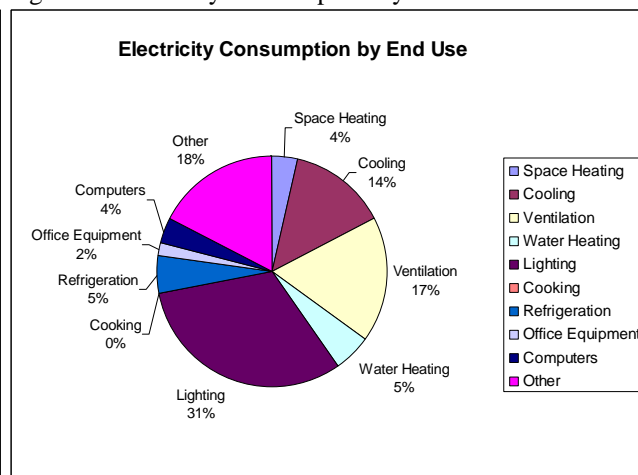
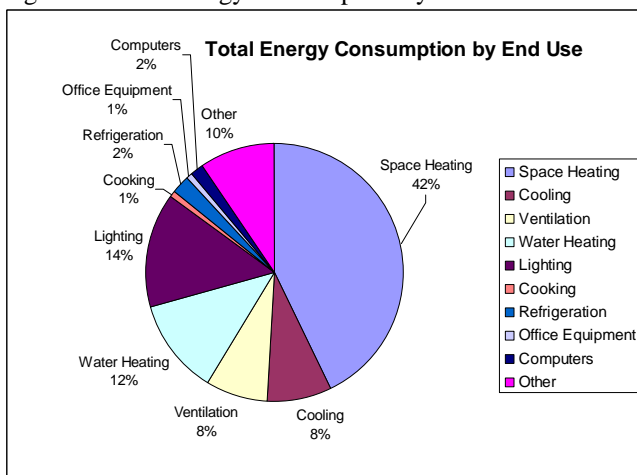
Note: Due to rounding, figures may not add up to 100

Energy Consumption by End Use

Figures 5 and 6 below illustrate the percentage of energy consumed by end use for municipal buildings in the US. This data was extracted from the Commercial Building Energy Consumption Survey (2003). The installation of data loggers to track energy use was not a part of the scope of services for this audit, but based on Figure 1 above, we believe the Meredith Library consumption closely mimics the national trend.

Figure 5: Total Energy Consumption by End Use

Figure 6: Electricity Consumption by End Use



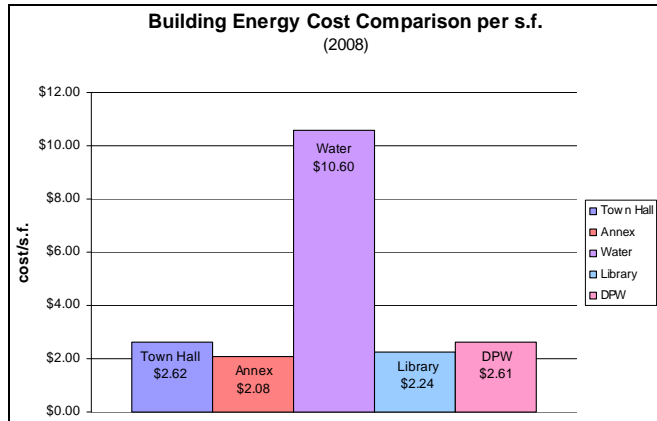
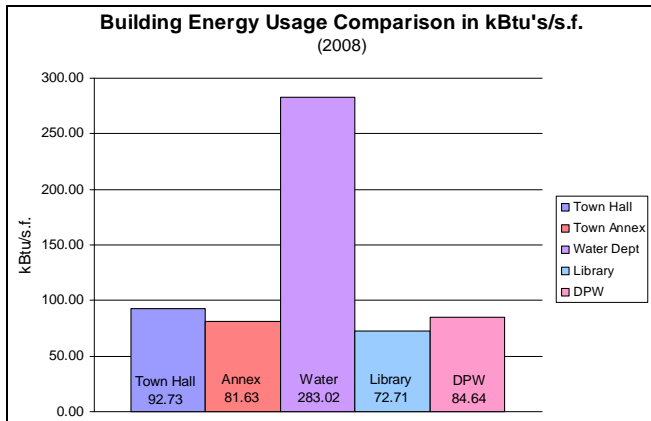
Data in the above graph originate from the Commercial Building Energy Consumption Survey (<http://www.eia.doe.gov/emeu/cbecs/>)

Building Energy Usage Comparison

Figures 7 and 8 show comparisons between each of Meredith's buildings. The Library has an annual energy usage of 72.71 kBtu's per square foot and an annual cost of \$2.24 per square foot.

Figure 7: Building Energy Usage Comparison, kBtu/s.f.

Figure 8: Building Energy Cost Comparison per s.f.



UTILITY RATE SCHEDULE

The Town Currently purchases electricity from New Hampshire Electric Cooperative (NHEC) under the general service rate.

The following information was taken from the NHEC “Summary of Rates” document that can be found at http://www.nhec.com/rates_summaryofrates_scheduleoffees.php

UNDERSTANDING THE CHARGES ON YOUR BILL

NHEC's bill typically consists of charges for Delivery Service and Energy Service. The following summary of rates is based on a monthly billing cycle.

New Hampshire Electric Cooperative Schedule of Rates								
Rates	Block	Delivery Charges	Stranded Cost Charge	Regional Access Charge	System Benefit Charge	Co-op Power	NH Consumption & BET Tax	Effective Billing Rate
Basic [\leq 400 Amp Service]								
B, B2, BH	All KWH Member Service Charge	\$0.03437 \$22.35	\$0.01032	\$0.01884	\$0.00330	\$0.07831	\$0.00082	\$0.14596 \$22.35
BC, BC2, BCH	First 600 KWH	\$0.03437	\$0.01032	\$0.01884	\$0.00330	\$0.07831	\$0.00082	\$0.14596
	Next 400 KWH	\$0.03437	\$0.01032	\$0.00101	\$0.00330	\$0.07831	\$0.00082	\$0.12813
	Over 1000 KWH	\$0.03437	\$0.01032	\$0.01884	\$0.00330	\$0.07831	\$0.00082	\$0.14596
	Member Service Chg.	\$22.35						\$22.35
<i>Only Available at existing locations</i>								
BW, BW2	All KWH Meter Chg.	\$0.03537 \$6.71	\$0.01032	\$0.01884	\$0.00330	\$0.07831	\$0.00082	\$0.14696 \$6.71
<i>Only Available at existing locations</i>								
BWC, BWC2	All KWH Meter Chg.	\$0.03537 \$6.71	\$0.01032	\$0.00101	\$0.00330	\$0.07831	\$0.00082	\$0.12913 \$6.71
OPB, OPB2, OPBH	All KWH Meter Chg.	\$0.02687 \$5.03	\$0.01032	\$0.00101	\$0.00330	\$0.05857	\$0.00082	\$0.10189 \$5.03
TDN, TDN2 TDF, TDF2	All On Peak	\$0.05170	\$0.01032	\$0.03888	\$0.00330	\$0.11358	\$0.00082	\$0.21638
	Off Peak	\$0.03137	\$0.01032	\$0.00101	\$0.00330	\$0.05184	\$0.00082	\$0.08876
	Member Service Chg. Meter Chg.	\$22.35 \$4.75					\$0.00082	\$22.35 \$4.75

http://www.nhec.com/rates_summaryofrates_scheduleofees.php

NH ELECTRIC COOP TERMS

Member Service Charge:

A fixed monthly fee charged whether or not any kilowatt-hours are delivered

Delivery Charge:

The price per kWh for delivering electricity to your home or business

Stranded Cost Charge:

A per kWh charge that pays for part of the costs related to the Seabrook Station nuclear power plant and the cost of terminating a long-term power supply contract with PSNH.

System Benefit Charge:

A per kWh charge that consists of two components: energy efficiency programs for Co-op members (\$0.0018 per kWh); and the State of New Hampshire's Statewide Electric Assistance program (\$0.0012 per kWh) which provides bill relief for residential members who meet income qualifications.

NH Consumption and BET Taxes:

A State of New Hampshire tax charged on all accounts.

Regional Access Charge

A per kWh charge for the cost of accessing the regional transmission grid and related expenses.

Co-op Power:

A per kWh charge that represents the cost of electric energy the Cooperative purchases for its members on the competitive wholesale market.

Electricity Consumption Tax

This is a state-mandated tax on energy consumption.

Source of Terms:http://www.nhec.com/memberservices_understandingyourbill.php

Recommendation:

When considering contract renewal with your electric energy supplier, contact a broker, or several competitive suppliers to learn their price and conditions. For a list of all energy suppliers and buying groups registered with the NH PUC to sell electricity in New Hampshire, go to the website:

<http://www.puc.nh.gov/Consumer/energysuppliers.htm>.

Compare the competitive energy cost with the NHEC cost, which is published here:

http://www.nhec.com/rates_summaryofrates_scheduleoffees.php.

BUILDING ENVELOPE

The building envelope is the separation between the interior and exterior environments of a building. It serves as the outer shell to protect the indoor environment as well as to facilitate its climate control. Following are two sections, observations and recommendations for the Meredith Library. The observation section includes photographs that show building detail with a corresponding infrared image.

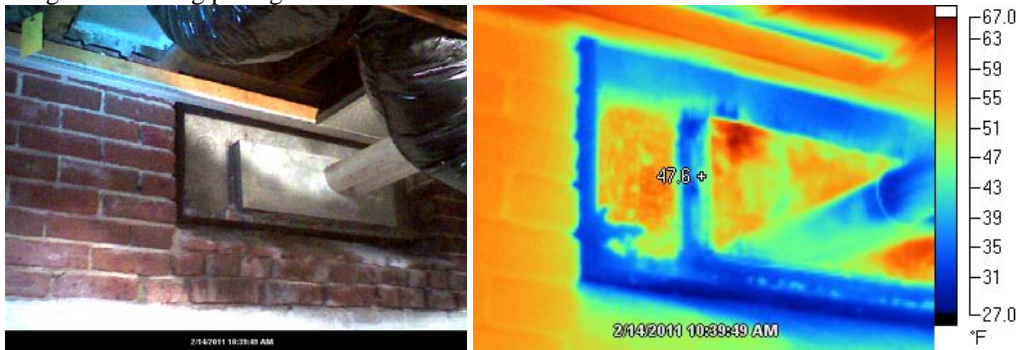
Note: Infrared cameras capture heat information. The resulting images show contrasting areas of heat and cold in the building envelope, identifying areas in need of remediation. For example, an infrared photograph of a well-insulated exterior door will show the door in hues of orange and red (indicating little heat loss), but if the perimeter of the door appears in blue tones (indicating cold temperatures) then heat loss and cold penetration is occurring around the door.

Observations

Foundation/Slab:

1. (B1) The foundation walls and band joists in the basement of the original library are uninsulated. Some of the basement window panes have been replaced with plywood to create passages for plumbing and mechanicals and most of these passages leak. There is also some efflorescence at the back of the building.

Image 1a: Leaking passages



IR002154

Image 1b



IR002139

Image 1c:



IR002161

2. In the basement level function room there is a ventilation fan in the corner through which cold air enters the building. Water stains on the wall below the fan opening also indicate a possible location for water entry or condensation in addition to air leakage.

Image 2a: Cold entering at ventilation fan location

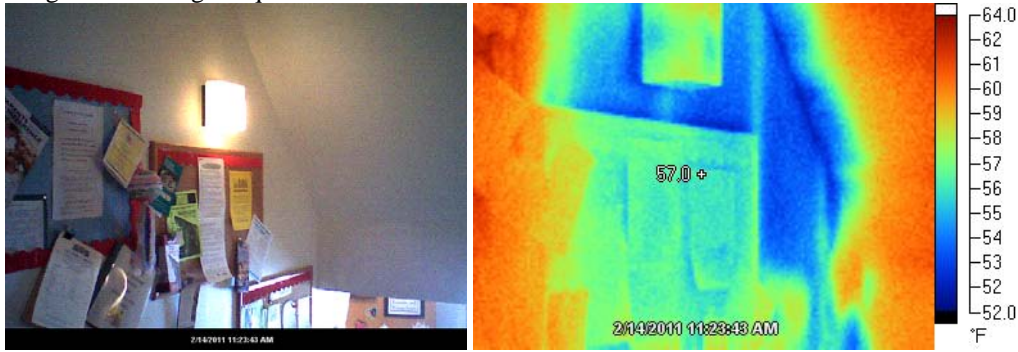


IR002112

Exterior and Interior Walls:

3. The above grade walls of the main library 1st floor, 2nd floor young adult section, and the emergency stairs are plaster and wood lathe with wood studs on solid brick. There is no insulation between the wood studs. It was not possible to determine the thickness of the wood studs but the renovation plans show a wall that has a total thickness of 15.” Assuming the solid brick is 12” thick and the lathe and plaster is about 1” thick the balance would be 2” for the thickness of the woods studs.

Image 3a: Lacking adequate insulation in walls



IR002377

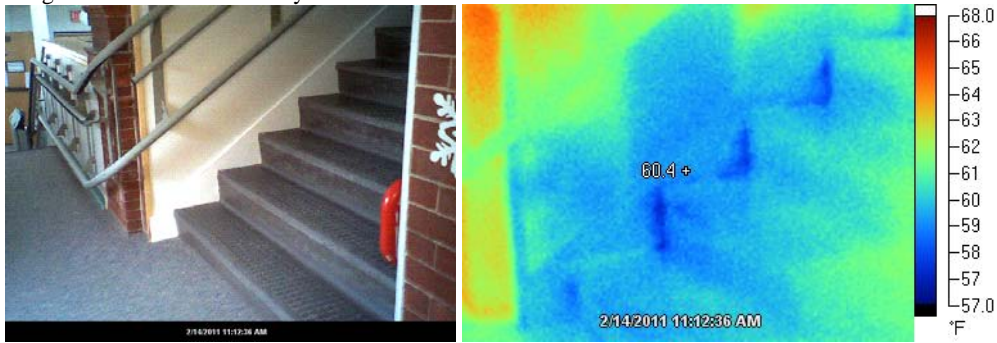
Image 3b: Emergency stairs, inadequate insulation



IR002366

4. The walls of the 2nd floor stairway and corridor leading to the children's section have many air leaks. This is a location where the addition meets the original building.

Image 4a: Air leaks in stairway and corridor



IR002302

Image 4b: Air leaks in stairway and corridor



IR002314

5. There is inadequate sealing behind the wood trim at the gable end of the children's section, where the wall meets the ceiling.

Image 5a. Gable end, children's section



IR002381

6. Many of the exterior doors are lacking sweeps at the door base and there are numerous gaps in the weather-stripped perimeters.

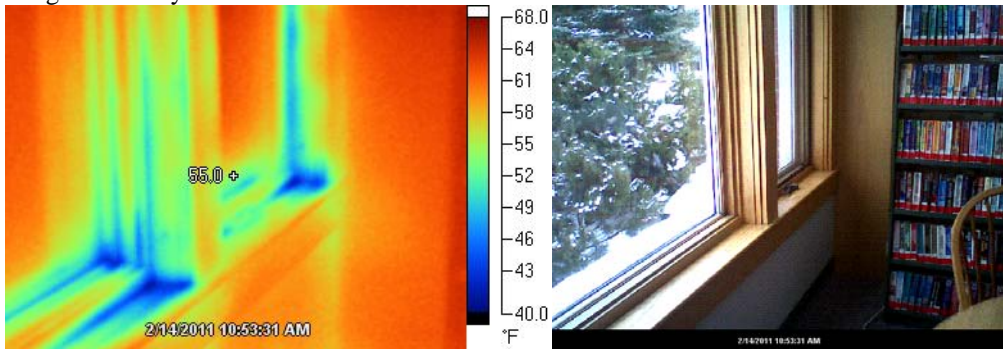
Image 6a: Leaky door



IR002256

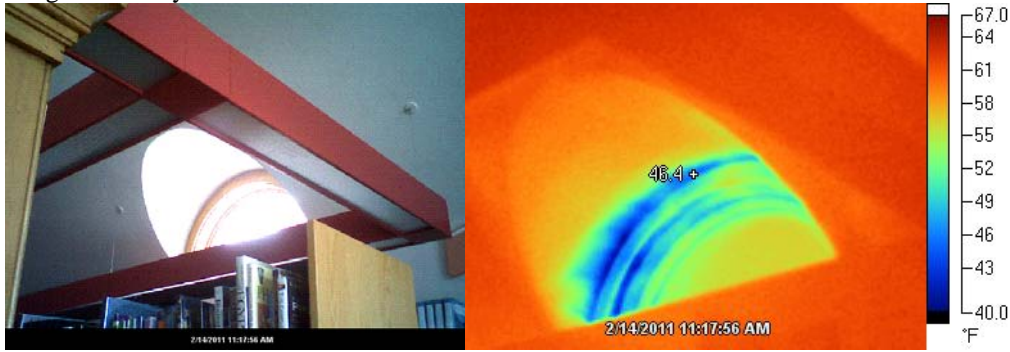
7. The windows in the addition are mostly double pane, gas filled, wood framed windows with aluminum spacers. The windows typically leak at the wood trim. The addition plans show foam sealant between the window frames and the rough openings but it may not have been installed or it doesn't appear to have worked because most of the addition windows leak at the trim.

Image 7a: Leaky windows



IR002203

Image 7b: Leaky windows



IR002342

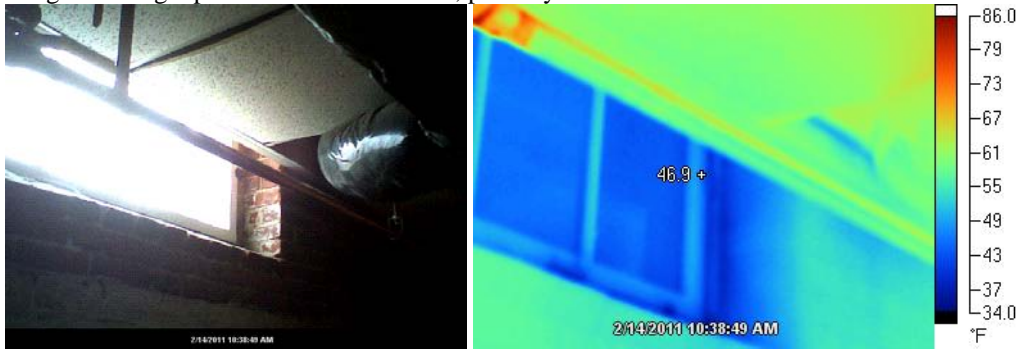
Basement windows are single pane resulting in a low R-value. Some of the windows are partially blocked so the daylight they provide to the basement is minimal.

Image 8a: Single pane basement windows



IR002134

Image 8b: Single pane basement windows, partially blocked

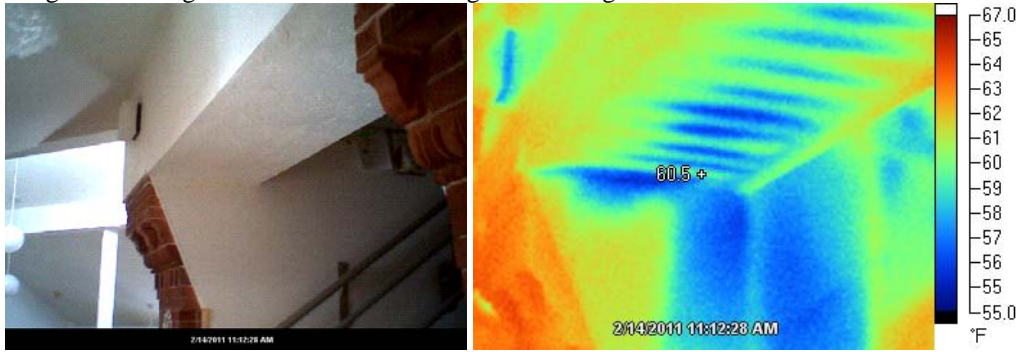


IR002147

Ceiling/Roof:

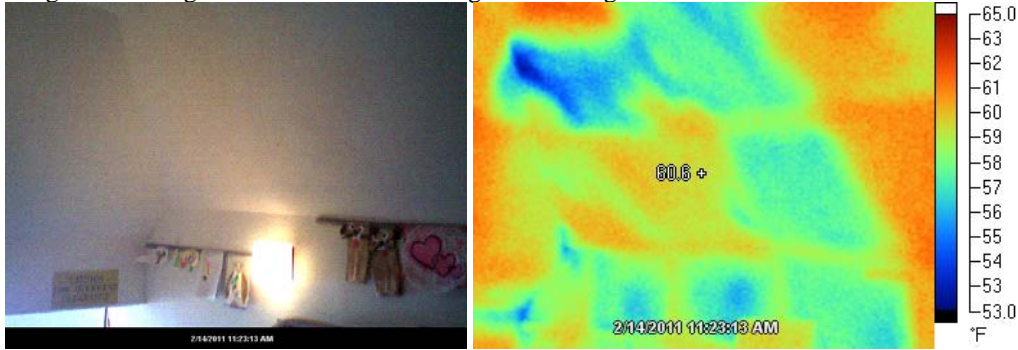
8. The ceilings of the 2nd floor stairway and corridor leading to the children's section have many air leaks. This is a location where there are many changes in the roof plane where the addition meets the original building. It appears that cold air is being allowed into the walls and ceilings where the new roof partially covers the original roof. The plans also show a skylight above the corridor that is not there. In the location where the skylight should be the vaulted ceiling is cold indicating that insulation is missing. This area corresponds to a roof area where ice dams frequently form.

Image 9a: Ceiling where addition meets original building



IR002301

Image 9b: Ceiling where addition meets original building



IR002372

9. The attic over the young adult section has only 6” of cellulose over a lathe and plaster ceiling. There is HVAC equipment and ducts in this attic. The attic hatch is uninsulated and has no weather stripping and the wall between this attic and the children’s section is poorly insulated, some of the batts are falling off the wall. This attic space and its connections to the adjoining attic over the children’s section will be complex to remediate.

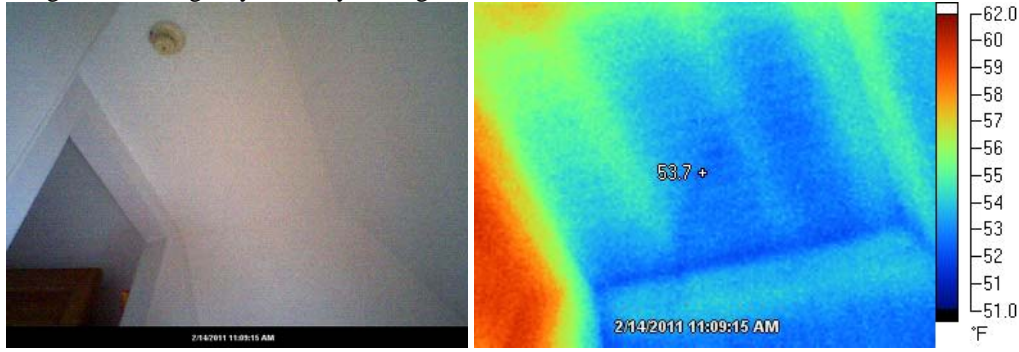
Image 10a: Young adult section



IR002393

10. The ceiling over the emergency stairway in the main library is uninsulated.

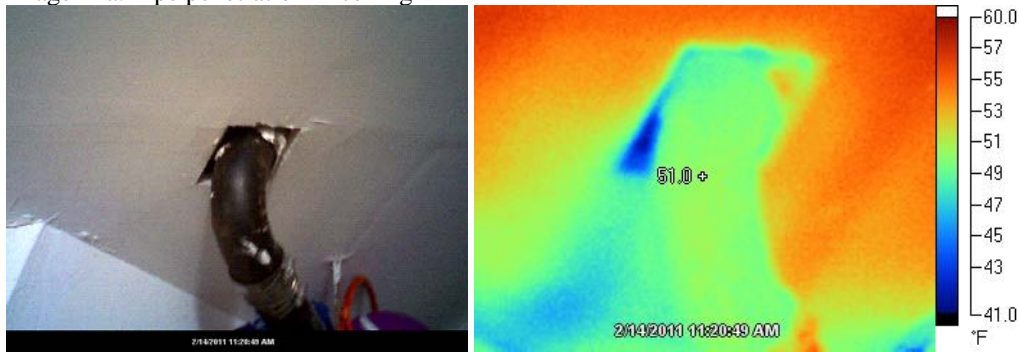
Image 11a: Emergency stairway ceiling



IR002282

11. The ceiling over the connector between the main library and the new addition has many gaps in the insulation. There is also a hole in the ceiling of the second floor storage area for a pipe penetration.

Image 12a: Pipe penetration in ceiling



IR002364

Blower Door Test Results

A blower door test is used to quantify the amount of air leakage in a building. To perform the test a building is placed in winter conditions, all windows shut and latched and exterior doors closed and locked. Adjustable frames and nylon membranes with holes for 20-inch fans are placed in exterior doors. When the fans are operating they pull air out of the building, depressurizing it. The industry standard is to depressurize to a 50 Pascal pressure differential between outside and in. This pressure differential is measured by a manometer which also measures the amount of air passing through the fan. Because of the laws of physics, this test shows how much air is passing *out* of the building and is being replaced by air moving *in* to the building (through all the gaps, cracks and fissures in the exterior of the building).

Table 1: Meredith Library Blower Door Test Statistics

Temperature adjusted CFM @ 50Pa.	Cubic feet of Building Volume	Air changes per hour @ 50Pa.	Square Feet of Building Shell	CFM50/sf of shell
10,016	81,000*	7.42	8,500*	1.18

CFM: Cubic Feet per Minute

Pa: Pascal, a unit of measure for pressure

sf: square foot

The table below shows how Meredith Library compares to other similar construction.

Table 2: Commercial construction air leakage table

	CFM50/sf of shell
Meredith Library	1.18
Brick City Hall circa 1930	0.97
Brick City Hall circa 1900	0.46
Elementary school, block and brick 1960 with 2004 addition	0.54
Jr. High school, block and brick 1940 with 1994 addition	0.94
Elementary School, 1990, block and brick	0.29
Elementary School, 1995, block and brick	0.44
Elementary School, 1955 & 1990, block and brick	0.99
US National Average for Commercial Buildings	0.93
Typical Modern Construction	0.60 to 0.90
Local High Performance Building (major renovation to an art gallery)	0.22
Local High Performance Building (major renovation to a high school)	0.17
Local High Performance Building (new construction, middle school)	0.19
Local High Performance Building (major renovation, student center)	0.23
Local High Performance Building (new construction, student center)	0.31

Notes:

1. All images after IR002101 were under depressurization. The building was depressurized to about -30 Pascals during that part of the imaging. Outside images were under normal pressure.
2. A copy of all infrared and visual images taken can be found on the DVD that goes with this report.

Recommendations

The recommendations for this building reflect the nature of the structure and a longer term view than many audits because the building has been renovated and added to in recent years and will function as Library for the foreseeable future. It is important that this building be cost effectively operable through the transition to a low energy future.

All recommendations, cost estimates, and associated payback values only cover the cost of materials and labor for the prescribed work. They do not include upgrades or changes to utility services, unforeseen conditions, or construction manager/general contractor fees. For budgeting purposes a Fee of 12-20% should cover contracting services and overhead.

Note: Best practices for energy conserving techniques in historic buildings may differ than from the tools and techniques used in modern buildings. Recommendations in this Energy Audit Report may need to be adjusted if property owners are seeking to meet both energy conservation and historic preservation goals, or if a project is using federal funding. Recommendations made in this Energy Audit Report, if and when implemented, may require review by the New Hampshire State Historic Preservation Office (SHPO).

General Recommendation:

This is a complex building and many of the repairs will be challenging. When deciding on the final work scope we suggest building in time to make exploratory cuts in the sheetrock especially for items #1 and #3 below, so that the best approach for repairs can be well planned. We also advise you include quality assurance tests and inspections of the work while it is ongoing. Incorporating these measures will be of high value and avoid unexpected costs and/or ineffective work resulting from a poorly planned approach.

Foundation/Slab:

1. (B1) Insulate the foundation walls and band joists down to 1' below the outside grade with open cell foam to at least R20 thickness (about 6") anywhere that the foundation and band joists are accessible. Foam over the plywood passages for mechanicals so they can have better R-value and seal around the penetrations. Most of the penetrations can be sealed in foam but avoid direct contact between the foam and the boiler and space heater flues. These areas should be insulated with fire rated caulk and rock wool instead and then the foam can be sealed to the perimeter of the rock wool. Since this is occupied space ask the foam installer to provide a 15-minute thermal barrier coating over the foam and make sure the coating is approved by the local fire code before installation. Sealing in the basement will improve the overall air tightness and decrease the stack effect for the building as well as increase the R-value of the foundation walls and band joists. We recommend open cell foam in order to allow vapor transfer through the foam and the masonry walls. These masonry walls have allowed two-way vapor transfer for many years and it is probably best to keep it that way to reduce spalling or efflorescence of the brick (the presence of which we noted at the back of the building. Note that relative humidity may increase with an insulated and tight basement.
2. The purpose of the ventilation fan in the basement level function room isn't clear. Nevertheless it should be covered from outside in the winter. Cold dense air enters through this opening to replace warm air that is leaving through higher parts of the building. Blocking this opening will reduce the stack effect in the building. If the fan is rarely used then permanent removal of it should be considered.

Exterior and Interior Walls:

3. (B3) Regarding the above grade walls of the main library 1st floor, the 2nd floor young adult section and the emergency stairs: These walls will be difficult and expensive to retrofit from the inside but if it can be done we recommend using a vapor permeable insulation such as open cell foam. Open cell foam can be installed by injecting it through holes in the wall. Actual cavity thickness will determine the number and spacing of the holes. Coordinate this type of retrofit with repainting of the interior walls as all the books and shelving will have to be masked anyway and the holes in the plaster will have to be patched. If the actual cavity is an inch or less we would instead recommend gutting the walls and reframing them with thicker stud walls to allow for more insulation.
4. In terms of the walls in the 2nd floor stairway and corridor leading to the children's section: Improvements in insulation and air tightness will help to improve the area, although the sheetrock would have to be opened up from inside in order to perform the work. This work, if performed, should take place at the same time as the ceiling work in this area, as in #9 below.
5. (B9) Remove the wood trim at the gable end of the children's section so the sheetrock can be caulked to the brick. The contours of the brick and mortar should be carefully followed with flexible caulk in order to make the seal effective. Reinstall the trim once sealing is complete.

Windows/Doors:

6. (B11) Repair weather stripping on all sides of exterior doors. For the best fit on newer doors contact the door manufacturer to get replacement weather-stripping. A properly weather stripped door will have no daylight visible at the perimeter when closed. Focus particular attention on doors that are rarely used so they can be made as airtight as possible.
7. (B9) For windows on the main levels of the building start with the worst, such as the clerestory window by the stairs to the children's section, and remove the trim to see if the seal between the window frame and the rough opening can be resealed with foam and then reinstall the trim. If this test window indicates that other windows may not have been foam sealed originally then this method can be repeated on the other windows. Because this action is labor intensive and the energy savings will be modest for sealing air leaks, and alternative approach would be to seal all the wood trim joints with clear or white caulk. This will not be as effective as foam sealing between the window frame and the rough opening, but it will be a much easier installation.

8. (B10) Install exterior storm windows over the basement windows to increase air tightness and R-value. Use tempered glass to help protect the windows against snow and ice from the roof. Some of the windows are partially blocked by wood framing so the daylight they provide to the basement is minimal. Consider covering those windows from inside with plywood painted black and then insulate behind them with at least R-15 of rigid foam board. Foam seal the insulation in place so warm air can't get around the insulation. This will make the windows act more like walls in terms of R-value.

Ceilings/Roofs:

9. (B4) In terms of the ceilings in the 2nd floor stairway and corridor leading to the children's section: Improvements in insulation and air tightness will help to reduce (but may not eliminate) the formation of ice dams. These spaces do not appear to be accessible from inside the attic, therefore the sheetrock would have to be opened up from inside in order to perform the work. (Also see #4 above.)
10. (B8) Because there is so much mechanical equipment and ductwork in the attic, an option for remediation is to insulate in the plane of the roof with open or closed cell spray foam and bring the mechanicals into semi-conditioned space rather than cold space. However, this approach requires that the attic be separated from the cold (and inaccessible) attic over the children's section and will also require the foam to be covered with a 15 minute thermal barrier for fire protection which increases the expense considerably.
11. (M1) Alternatively, because of the complexity of the space we recommend keeping this a cold attic but with the following improvements: Remove the flex duct in this attic and install hard ducts with copious amounts of duct mastic at every joint. Use much more mastic than suggested – our experience is that when applied in typical amounts the joints still leak. Insulate the ducts with R-11 or better, and insulate the mechanical equipment if possible. Air seal all electrical and plumbing penetrations through the lathe and plaster with can foam. Use rigid and can or spray foam to reinsulate the common wall that separates the children's section from the attic to create an airtight wall of at least R-20. Insulate and weather strip the attic hatch to at least R-20 as well. Add additional cellulose up to a total R-value of 50.
12. (B4) Remediating the uninsulated ceiling over the emergency stairway call for the same recommendations as above, #3, for the above-grade walls.
13. The hole in the ceiling of the second floor storage area is easily repaired with foam sealant. However, work on the remainder of that ceiling area would be too costly to justify, unless there were other reasons to make repairs to that part of the roof or ceiling.

Heat Loss Analysis – Improvement Packages

Below see illustrated improvement package #1. A Savings to Investment Ratio (SIR) of 1 indicates that the improvements will pay for themselves in their useful life. Anything higher than that indicates a quicker return on investment. It is important to recognize that not all of the cost associated with a particular measure goes to energy savings, but they would contribute to durability and may need replacement anyway. A good example of this would be insulation of a new roof, which will have 75% attributed to the roofing and only 25% of the cost associated with insulation or energy savings. We would not necessarily recommend replacing a roof that is less than 10 years old. But if it is older, a good portion of the cost, while adding insulation, would be for general building maintenance.

See Appendix B for further description of how SIR information is calculated

Improvement Package Overview

	Annual Savings		% Savings	Payback Years	Cashflow \$/Year	SIR	
	Cost	MBTU					\$
Improvement Package 1	\$41,043	4.7	\$45	1 %	903.8	(\$3,569)	N/C

Improvement Package 1

Improvement Package 1

	Cost	Annual Savings MBTU	\$	Payback Years	Cashflow \$/Year	Imp. Life Years	SIR in Package
B2 Air Sealing	\$5,969	10.7	\$283	21.1	(\$243)	20	0.71
B1 Basement Wall Measures	\$8,952	-5.0	(\$184)	N/A	(\$973)	40	N/C
B4 Attic Measures	\$7,781	2.2	\$62	125.4	(\$623)	40	0.19
M1 Duct Sealing and Insulation	\$1,763	0.0	\$1	2746.9	(\$155)	20	0.01
B3 Wall Insulation	\$16,578	-3.2	(\$116)	N/A	(\$1,576)	40	N/C
Total for Package	\$41,043	4.7	\$45	903.8	(\$3,569)	N/A	N/C

Non-Energy Benefits:

1. B2 Air Sealing: Reduce drafts.
2. B1 Basement Wall Measures: Improve comfort, increase value of building.
3. B4 Attic Measures: Improve comfort, increase value of building.
4. M1 Duct Sealing and Insulation: Reduce risk of touching hot pipes; added pipe protection; reduce noise.
5. B3 Wall Insulation: Improve comfort, increase value of building.

HVAC SYSTEM

Existing Conditions

The existing HVAC system was replaced when the renovations were done in the mid 90's. It is a hydro-air system with 2 sealed combustion, low-mass, oil fired boilers. Energy Kinetics, System 2000. These boilers supply hot water to airhandlers which are distributed throughout the building to reduce duct runs and enable zoning. Each air handler is also equipped with a DX coil for Air conditioning. These coils are supplied with coolant from the condensing units outside the building. There is also supplemental cast iron baseboard and panel radiation for heating and a small unit heater in the unfinished basement work area. The new work also utilized a few minisplit AC unit's to handle areas where ductwork was hard to place.





DOMESTIC HOT WATER

Domestic hot water is currently supplied by a small electric hot water heater that is located in a closet in the basement. When this unit reaches the end of its useable life, it should be replaced with small point of use units located at the sinks. These units should be a Marathon or Bosch type. This will reduce standby losses and losses that occur with distribution. This is usually calculated to be around 10-15% of total hot water energy use.



LIGHTING

THE TOWN OF MEREDITH EMPLOYED AN INDEPENDENT LIGHTING AUDIT COMPANY TO PERFORM AUDITS ON ALL TOWN BUILDINGS AND SUBMIT RETROFIT PLANS FOR IMPLEMENTATION. CONSEQUENTLY DUPLICATING THESE EFFORTS WAS NOT A PART OF THE SCOPE OF THIS REPORT. THESE AUDITS CAN BE MADE AVAILABLE UPON REQUEST.

POSSIBLE FUNDING SOURCES

Assistance & Grants

ETAP – Energy Technical Assistance and Planning for New Hampshire Communities is a two year program providing energy efficiency technical assistance at no charge to municipalities and counties in NH. ETAP's goal is to advance energy efficiency in all New Hampshire municipalities and provide the tools communities need to monitor energy performance. ETAP is funded by the American Recovery and Reinvestment Act (ARRA) of 2009 and administered through New Hampshire's Office of Energy and Planning.

<http://www.etapnhc.org/node/6>

LCHIP – The New Hampshire Land and Community Heritage Investment Program (LCHIP) is an independent state authority that makes matching grants to NH communities and non-profits to conserve and preserve New Hampshire's most important natural, cultural and historic resources. <http://www.lchip.org/>

Loans/Rebates

SmartSTART

The SmartSTART (Savings Through Affordable Retrofit Technologies) advantage is simple-pay nothing out of pocket to have energy efficiency products and services installed in your business. The cost of the improvements is repaid over time, using the savings generated by the products themselves!

For instance, let's say you've installed energy efficiency products worth \$1,000 and those products save you \$100 per month. You pay for the product in easy monthly payments on your electric bill equal to $\frac{3}{4}$ of the savings, or \$75 per month. You still realize overall savings on your electric bill while paying for energy efficiency improvements that will save you money for years to come. If you move and the installed products stay, your obligation to pay for them ends. The next occupant will "pay as they save."

You can use the SmartSTART program for:

- Weatherization; including air sealing, insulation and recommended through a Whole Building Energy Analysis.
- Lighting and Lighting Controls recommended through a Business Energy Analysis.
- Other verifiable energy savings measures (requires Co-op approval).

Funding and participation is limited for this program.

Large Business Energy Solutions

The Large Business Energy Solutions program assumes that you are replacing existing equipment with more efficient equipment that will save electricity. This rebate offers prescriptive and custom rebates. Any projects with a one-year or less simple payback do not qualify for rebates. All projects must be preapproved by the program coordinator prior to commencing the project. To qualify for rebates, the business must be a non-residential property, an NHEC member, have electricity demand of 100 kilowatts or greater, and the proposed measures will save electricity and pass a benefits/cost test.

Rebates are available for:

- Lighting retrofits and controls
- Energy-efficient motors
- Variable Frequency Drives (VFDs)
- Compressed Air equipment and controls
- LED traffic lights
- Custom HVAC projects (and other non prescriptive measures)

Services include:

- Review of specific energy efficiency projects
- Educational programs and seminars
- Financing may be available



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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).

METHODS

This audit report was generated through a multi-step process of information and data gathering, organization and analysis of data, and reporting.

Data Collection:

Data was collected through onsite visual inspection, utility bill analysis, and statements from occupants and town staff.

Data Analysis:

All conversion factors were taken from the U.S Energy Information Agency. www.useia.gov

All building heat loss calculations were performed with industry standard heat loss calculations taken from “**Residential Energy**” by John Krigger (Appendix A-1) and the New York State Research and Development Agency Building Performance Institute Building Analyst Training Manual (Day 3 Chapter).

Energy Modeling and development of Savings to Investment Ratios (SIR) was done with TREAT modeling software (Targeted Retrofit Energy Analysis Tool). These measures were then cross checked with a proprietary modeling spread sheet.

Sources of energy conservation measure implementation cost include: RS Means Building Construction Cost Data 66th Edition, Builders Installed Products, Bruss Construction Inc., Atlantic Energy Solutions, and various websites for product information.

Some of the energy conservation measures outlined in this report can be performed by town employees to reduce cost and payback time.

SOURCES

- Building Performance Institute Technical Standards for Certified Building Analyst 1
- Building Performance Institute Technical Standards for Certified Shell Specialist
- Residential Energy: Cost savings and Comfort for Existing Buildings 5th Edition by John Krigger & Chris Dorsi. 2009
- U.S. Energy Information Administration. <http://www.eia.doe.gov/>
- Architecture: residential drawing and design by Clois E. Kicklighter. 2000
- RS Means Building Construction Cost Data 66th Edition, Reed Construction Data 2008.
- NH COOP website
- Dsireusa.org
- Data in the above graph originate from the Commercial Building Energy Consumption Survey (2003) (<http://www.eia.doe.gov/emeu/cbecs/>)