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ENERGY AUDIT REPORT – Moretown Library

This report was prepared under contract with the ***Central Vermont Regional Planning Commission****, 29 Main Street, Suite 4, Montpelier, VT 05602.* ***CVRPC*** *can be contacted via email at cvrpc@cvregion.com , on their website at www.centralvtplanning.org, or by phone at 802/229-0389.*

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ENERGY AUDIT REPORT – Moretown Library

Date: 7/19/10

Weather: 68°F, cloudy, rain showers, calm wind

Executive Summary:

This energy audit was conducted with the goal of reducing the heating and electrical usage of the building. While the report details a number of findings, the key conclusions are as follows:

1. Air seal and insulate the attic and slanted ceilings and save 23% of heat costs.
2. Air seal and insulate the basement and save 13% of heat costs.
3. Air seal and insulate the walls and save 33% - 36% of heat costs.
4. Carry out additional air sealing measures and save +/- 2% of heat costs.
5. In the future, consider adding a pellet stove to provide supplemental heat with a renewable and cost effective fuel source.

Building Features:

- Built +/- 1900, not listed on the National Register of Historic Places
- 1,183 square foot floor area of heated space
- Basement: Poured concrete foundation and floor slab with no visible insulation, nominal R-1.5. Timber sill is also un-insulated, nominal R-5.
- Exterior Walls: Rough cut 2x4 wall construction with un-insulated 4" cavity, nominal R-5.
- Slanted Ceilings: 7" cavity with no insulation, nominal R-5.
- Attic: The attic floor has no insulation, nominal R-5. The attic hatch is not insulated or weather stripped.
- Windows: Single pane with exterior storms, nominal U-0.49 (R-2.04). Windows compose +/- 10% of the wall area, which is an acceptable percentage.
- Doors: One wood panel door, nominal U-0.57 (R-1.75).

Heating System and Fuel Consumption:

Heating System:

- Rinnai propane direct vent wall unit, 36,500 BTUH, 1 unit.
- Hot air distribution with fan
- Unit is located on the first floor and is used to heat both floors.
- Thermostat set at 65°F and adjusted as needed.
- 83% efficiency
- CO 15 ppm which is an acceptable level

Fuel Consumption:

- 2007 = 556.2 gallons of propane
- 2008 = 877.7 gallons of propane
- 2009 = 691.8 gallons of propane
- Average = 708.6 = 64.9 million BTU

- This is equivalent to 54,891 BTU/square foot floor area

Data collected by Building Energy for buildings of similar use in Vermont indicates that the fuel oil usage is generally above average:

Building	Square Foot Heated Area Of Building	BTUs Used Per Square Foot
Orange Town Hall	4,632	21,809
Moretown Library	1,183	54,981

Hot Water: None.

Air Conditioning:

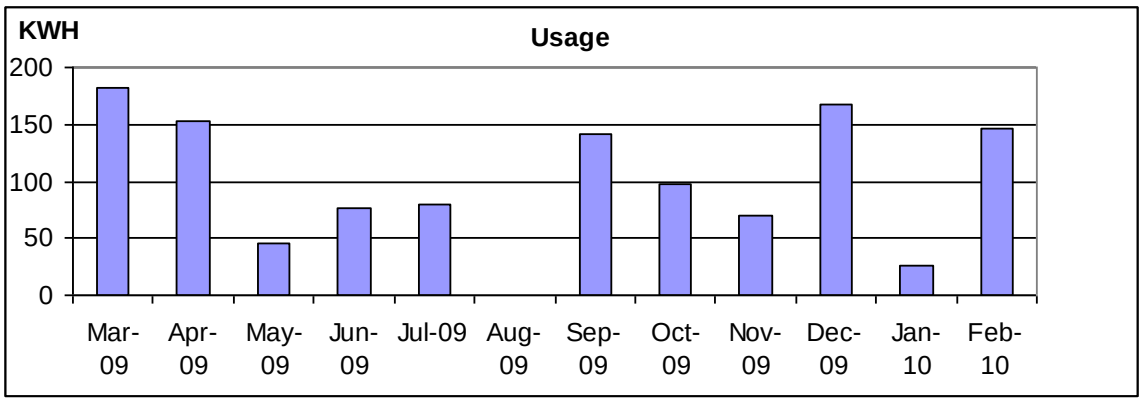
None.

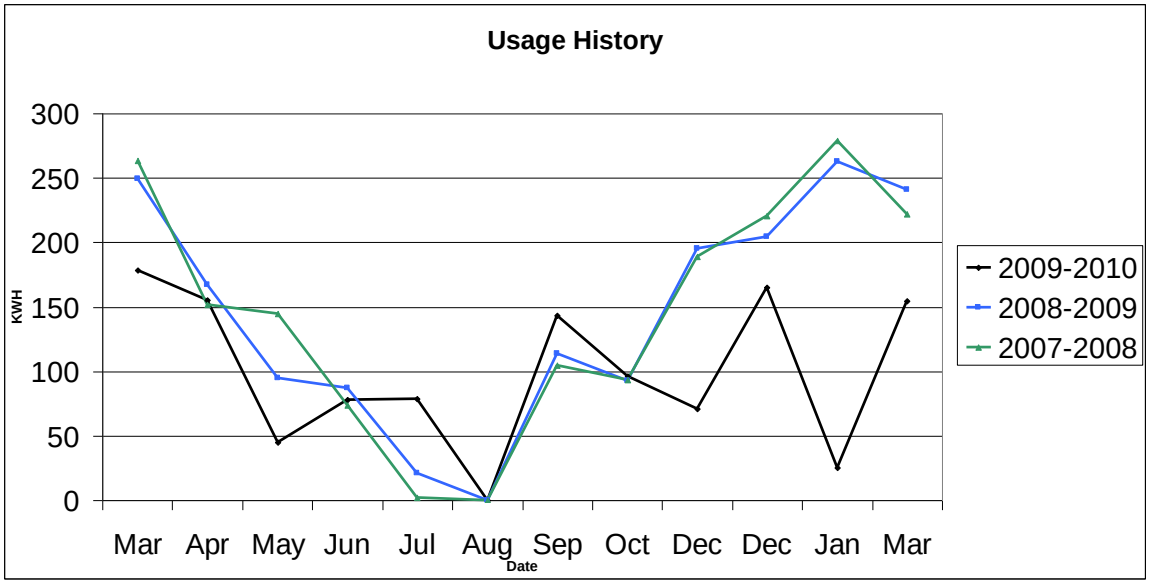
Electricity:

The Moretown Library used 1,184 kWh of electricity over the past year. Data collected by Building Energy for buildings of similar use in Vermont indicates that this electric usage is generally below average:

Building	Square Foot Heated Area Of Building	kWh Used Per Square Foot
Orange Town Hall	4,632	+/- 1.5
Moretown Library	1,183	1.0

Average base load is 35 kWh per month. Usage is higher in the winter which is most likely due to the shorter daylight hours and the Rinnai fan operating. Refer to the charts below:





Lighting Efficiency Measures:

Several light bulbs have already been converted to compact fluorescent (CFL) bulbs. We recommend converting lights that are used most frequently to CFLs. CFL's come in many shapes and sizes to fit most, if not all, of your needs (including candelabra CFLs): http://www.newbulbintown.com/

The DOE has passed new regulations that ban the manufacture of T12 fluorescent lamps for sale in the U.S. after July 14, 2012. Replacement lamps for these fixtures will be difficult to find after this date. Efficiency VT is offering increased rebates to replace these lighting systems before December 31, 2010 through a program called newLIGHT.
http://www.efficiencyvermont.com/stella/filelib/2010_newLIGHT_CustomerFactSheet_FINAL.pdf
http://www.efficiencyvermont.com/stella/filelib/newLIGHT_IncentiveSheet_FINAL.pdf

There is one T12 4' 40W 2 lamp fixture in the back room of the first floor. Replacing this with a High Performance T8 (HPT8) fixture can yield +/- 48% energy savings over the current fixture. Adding an occupancy sensor will further increase this savings. The newLIGHT program is designed so the rebates offset the cost of the fixtures and installation labor to create a +/- 1 year payback. Electrical contractors that are registered with Efficiency Vermont can submit your project to determine eligibility. Contact Efficiency Vermont for a list of registered contractors or contact Cummings Electric (www.cummingselectric.com or 802-658-1292).

Other electrical savings measures:

- Turn computers off when not in use. Enable screen savers and hard drive sleep software to save energy when computers are not attended during the workday.
- Reduce or eliminate latent loads by installing advanced power strips on televisions, VCRs, DVD players, etc.

http://www.efficiencyvermont.com/pages/Residential/SavingEnergy/home_electronics/Advanced_Power_Strip/

Blower Door and Air Leakage Testing:

The building tested 3,150 CFM50. This translates to 1.14 CFM50/shell square foot (entire surface area of building, including slab), indicating a below average level of air tightness.

Building	**CFM50/shell square foot**
New "superinsulated" building	0.10 or less
Typical older building	1.00
Orange Town Hall	0.37
Calais Town Hall	1.26
Moretown Library	1.14

Smoke testing was performed during building depressurization and clearly shows air leakage pathways. Air leaks and areas in need of thermal repairs are shown in the photographs below and listed in the Recommendations section.





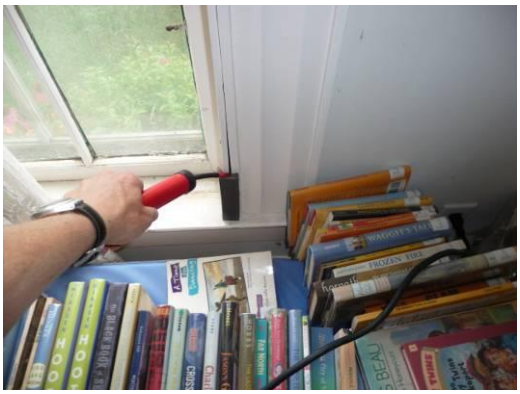

The attic floor and ceiling slants are not insulated or air sealed. Heated air can move through penetrations and openings in the ceiling plane and leak into the attic. Air sealing and insulating the attic and ceiling slants is a top priority.

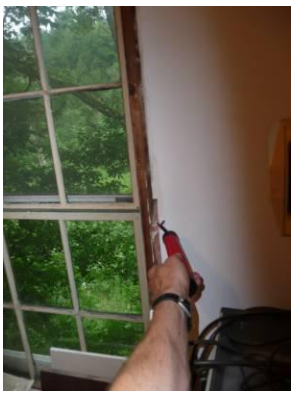

Air can move through penetrations in the un-insulated exterior walls and the interior walls and leak into the attic. The top plates of all interior and exterior walls should be air sealed from the attic to reduce the loss of heated air.




As heated air leaks into the attic, cold air is drawn in through the basement to replace it. The junction of the timber sill and concrete foundation is a source of air leakage. This air can leak into the basement and through the first floor baseboard. The basement windows also leaked air. The timber sill and basement window perimeter need to be air sealed.


The open chimney thimble in the basement is a major source of air leakage. This should be plugged and air sealed. The thimble on the second floor is plugged, but it needs to be air sealed.



Windows are a source of air leakage, however, addressing the heat loss in the attic and basement areas is a much higher priority. Windows should be adjusted so they close tight in the winter. The exterior storm windows do help reduce heat loss. The interior window trim can be removed and the shim space air sealed with low expansion foam sealant. In the future, the windows can be replaced.

RECOMMENDATIONS:
The following list includes both short term and long term solutions to reducing utility costs and the carbon footprint of your building. We have put an asterisk next to the most pressing items. Please email us if you care to discuss priorities or have questions.

1. *Attic: Air seal all wall plates, wire chases, light openings, junction boxes, chimney shafts, and miscellaneous openings. Install 16" of cellulose. Upgrade to R-60. +/-370 square feet. Budget $1,700. Save +/- 14% of heat costs.

2. *Slanted Ceilings: While insulating the attic, install dense pack cellulose in the slanted ceiling cavities. Upgrade to R-26. +/-275 square feet. Budget $700. Save +/- 9% of heat costs.

3. *Basement: Apply 2" of closed-cell spray foam to the first floor timber sill, short wood framed wall at rear, and down 3' around the interior side of the perimeter foundation wall. Upgrade to R-13. +/-410 square feet. Budget $1,100. Save +/- 13% of heat costs. Install fire protection coating over the exposed foam. Budget $650.

4. Exterior Walls:
   a. When re-siding or remodeling, install dense pack cellulose in the wall cavities. Upgrade to R-19. +/-1,350 square feet. Budget $2,500 for insulation only. Save +/- 33% of heat costs.
   b. As an additional heat savings measure to the above, apply R-10 foam board panels sealed with spray foam at all edges over the exterior sheathing. Extend and flash windows and trim. Re-install siding. Upgrade to R-29. +/-1,350 square feet. Budget $3,700 for insulation only. Save an additional +/- 3% of heat costs.

5. *Air Sealing: Use caulk, foam sealant, or other air sealing methods to address the following:
   a. Plug and air seal the open chimney thimble in the basement.
   b. Air seal the two other chimney thimble plugs.
   c. Caulk around the perimeter of the basement windows.
   d. Air seal the shim space of the windows.
   e. Budget $480 for eight man-hours of air sealing labor. Save +/- 2% of heat costs.

6. Windows: In the future, replace the windows with warm edge technology tri-pane units. Energy efficient windows cost $400-$1,000 each depending on

level of efficiency. Air seal the shim space with low expansion foam sealant during installation. Save +/- 7% of heat costs.

7. Door: Replace the wood panel door with an insulated metal or fiberglass door. Upgrade to R-5 or R-7. Budget $400-$1,000 depending on level of efficiency and features. Save +/- 1% of heat costs.

8. Heating System: In the future, consider installing a pellet stove to provide supplemental heat. Pellets provide heat at 50% the cost of propane, are made from a renewable resource, and can be delivered on a regular schedule like petroleum fuels. Library employees can fill the hopper during operating hours, and the propane space heater can provide heat when the building is unoccupied.

Please email if you have any questions.
Thank you for hiring Building Energy.

Information and Resources:

1. www.epa.gov, www.energystar.gov
2. VT Agency of Natural Renewable Energy Project Grants, www.anr.state.vt.us
3. Vermont Energy & Climate Action Network, www.vecan.net
4. www.efficiencyvermont.com / www.veic.com
5. www.10percentchallenge.org
6. VT Clean Energy Development Fund:

   Anne Margolis
   Clean Energy Development Fund Manager
   VT Dep. of Public Service
   112 State Street
   Montpelier, VT 05620-2601
   (802) 828-4017
   anne.margolis@state.vt.us
7. Vermont Economic Development Authority, www.veda.org