



Ryegate Town Clerk's Office Thermal Energy Audit

Building Description: 1628 SF one-story building, occupied sporadically about 25 hours and 5 days a week during the heating season. Basement is a poured concrete slab and walls with 7' foot ceiling. Back addition is a slab on grade. Exterior walls are conventionally framed with 4" fiberglass insulation. First floor ceilings are about 8' tall. Second floor attic is currently used for storage and not heated. Attic floor is insulated with 6" fiberglass and covered with decking. Originally built in 1946, with an addition in 1980s.

Please read entire audit prior to undertaking any weatherization measures. Efficiency Vermont is currently providing cash incentives for energy upgrades to municipal buildings. Please contact us with any questions.

ENERGY AUDIT SUMMARY:

LEVEL ONE PRIORITIES (pay back less than 2 years)

- Install set back thermostat.
- Perform simple air-sealing: Exterior doors, chimney and attic hatch.

LEVEL TWO PRIORITIES (pay back 2-6 years)

- Insulate foundation with foam.

LEVEL THREE PRIORITIES (pay back over 6 years)

- Insulate attic with loose cellulose.
- Perform general blower door directed air-sealing.

Heating system:

Oil furnace uses an average 758 gals/year. Efficiency is OK @ 81 %; CO in flue is slightly elevated @ 39 ppm (should be serviced before next heating season); flue draft is good @ -10 pa. No CO leaks were observed at time of audit.

Lighting:

No incandescent bulbs were changed. All bulbs are fluorescent.

ENERGY AUDIT DETAILS:

Install a seven-day programmable thermostat saving **2.1 MMBTUs/year** or about **\$52/year** and paying for itself in about a year. Cost is **\$50**.

- A seven-day thermostat can be programmed for each day of the week. The heat can come on several hours before occupancy and fall back to unoccupied temperature an hour before the space closes. This will maintain a comfortable work environment while saving considerable energy. The unoccupied temperature can be 50° so long as areas with water pipes are kept warm enough to prevent freezing. This will require investigation during cold periods of the winter to identify minimum set back temperatures allowable.
- It is critical that the thermostat be set up properly to achieve desired energy savings. A simple temporary override is suggested to deter people from altering the program for un-scheduled occupancy.

Initial blower door air leakage test was **3970 cfm50**; equal to 1.34 ACH nat. (Air Change/Hr natural). The improved leakage rate should be about **3000 cfm50** or 1.02 ACH nat for a minimum of 24 % reduction in air leakage.

- The blower door numbers are the cubic feet of air per minute that it takes to depressurize the building to a standard limit of fifty Pascal's (a condition that mimics a twenty mile an hour wind on all exterior surfaces of the building). With the blower door on, we go around and feel for actual air leaks. The initial blower door number gives us a quantitative baseline number for the air leakiness of the building.
- This is a fairly drafty building that can be tightened up somewhat. Because of the building's construction and use pattern, there are few available measures that will tighten up the structure in an economical manner.

Suggested Air Sealing

Energy saved is **7.1 MMBTUs/year** or about **\$177/year** and pays for itself in about 4 years. Cost is **\$685**.

- Much of the savings from air-sealing comes from completing the air-sealing for insulation improvements. Exterior doors should be weather-stripped, attic hatch built, and chimney sealed before the next heating season. These are inexpensive measures and easy to do. Remaining measures should be done when attic is insulated.
 - Exterior doors: Weather-strip (3) doors with Q-lon weather-stripping
 - Attic horizontal hatch: Build plywood hatch at attic floor level. Weather-strip with Q-lon weather-stripping and insulate top of the hatch with 4" of rigid foam.
 - Chimney in attic: Air-seal to the decking with aluminum flashing and high temperature caulk. Create an insulation dam in the floor cavity 2" from chimney with aluminum flashing.
 - Prepare attic for insulation: Drill holes in floor decking and plug after insulation.
 - As a health and energy issue, the furnace ductwork should be sealed with duct mastic. Unsealed ductwork will pull air from the basement into the heated air-stream, exposing occupants to questionable air quality. Sealing the supply ducts will also bring more heat to the areas where occupants need heat instead of just heating the basement. Any basement insulation should be done first, and care needs to be taken to prevent freezing pipes.
- Perform blower door assisted air-sealing after general insulation upgrades. With a blower door exhausting the space, air leaks can be detected from the air flow and sealed with clear caulk or spray foam.

Suggested Insulation Improvements

Insulate full basement foundation. Existing R-value of 1 will increase to 14, saving **20.7 MMBTUs/year** or about **\$518/year** -- pays for itself in about 3 years. Cost is **\$1680**.

- Full foundation: 300 SF of 2" rigid foam board (Tuff-R or equivalent polyisocyanurate with foil face out) can be glued to the foundation wall from floor joists down to one foot below grade.
- 120 SF of spray urethane foam can be applied from the foam board up the rim joist to the flooring underlayment.
- Insulating to just one foot below grade maximizes the energy savings while not containing seasonal moisture or letting the soil against the walls freeze so hard it could damage the foundation.
- In most building codes, all foam insulation needs a fifteen-minute fire barrier. This applies to spray foam and most sheet foam materials. For some municipalities, the exception is 'Tuff R' foil covered insulation that does not need to be covered. This is specified above. Also, some municipalities consider spray foam between the floor joists as an air-sealing measure that does not need to be covered.
- Check with an appropriate code official for your area.

Insulate attic floor. Existing R-value of 8 will increase to 30, saving **17.2 MMBTUs/year** or about **\$431/year** -- pays for itself in about 8 to 9 years. Cost is **\$3663**

- 1628 SF of 6" dense pack cellulose can be added around and on top of existing fiberglass.
- Although the payback on investment is longer term, simple return on investment is still about eleven percent. This would be worth doing if funds are available.

Exterior walls are insulated with fiberglass. Existing R-value of about 6 to 8, and cannot be upgraded in an economical fashion. Sometimes cellulose can be blown into a cavity that has been filled with fiberglass, but the result is usually uneven and not cost effective at this time.

SUMMARY

Total cost of energy upgrades is **\$6078**. Heating load should decrease by **25 to 35 %**, saving about **47.2 MMBTUs/year** or **\$1179/year** for a payback of about 5 to 6 years.

- Some of the energy savings will be used to keep the building more comfortable. This can reduce the monetary savings significantly, while increasing occupant comfort and worker satisfaction.
- All costs are based on current pricing of both fuel and insulation and will change over time.

NOTES:

- Any health or safety problems must be addressed before any insulation measures are performed. These include removing knob and tube wiring, asbestos abatement for any vermiculite insulation, and controlling moisture or standing water problems
- Value of air-sealing savings depends on number of insulation measures completed. Insulation of the walls and foundation areas will both help reduce air-leakage of the building and increase R values. Air-sealing alone will accomplish about half to two-thirds of the projected savings for this measure.
- Energy savings are based on \$0.17/KWh, \$3.50/gallon of oil and \$2.50/gallon of LP gas. Savings will go up as prices increase in the future.
- Energy savings are estimated on average HDD (heating degree days) for the town.
- Actual savings will vary based on quality of weatherization work performed, actual final air-leakage rate, building temperature settings, and seasonal variations in HDD.
- The savings amounts are for reference to help with planning and not a guarantee of return.

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If you have any questions about our audits, please contact me at **249-2839, 479-5882** or **malcolm@montpelierconstruction.com**. Our website is **montpelierconstruction.com**

Thanks for your cooperation,

for Montpelier Construction, **Malcolm Gray**.