

Paul Fleckenstein, BPI Building Analyst, Energy Co-op of Vermont
73 Prim Rd, Ste. 1, Colchester, VT 05446
802. 373. 0329, paul@ecvt.net



Energy Audit Report

Fairfield Common School, 52 Soule Drive

Thank you for choosing the Energy Co-op of Vermont for your energy audit.

Next Steps.

1. We can schedule a time to review the report by phone to answer questions.
2. I recommend getting an estimate for vermiculite abatement in the attics.
3. Some measures, like the windows, you will need to get additional recommendations and pricing for.
4. I have provided budget pricing for most measures, but not the windows or vermiculite abatement. There are options for improving the existing windows through air sealing and maybe better storm windows. There should be contractors in the area who know more about window restoration techniques. New windows will be a large expense.
5. There are incentives, rebates, possibly other state funding, and loans available for energy upgrade work. I have indicated some of those.
6. I didn't include an analysis of electricla usage. But it is low, and there are options for more efficient lighting going forward. Contact Efficiency Vemront for more information on that.

Here is a link to our other resources: overview of our energy upgrade work, and information on incentives, home energy loans, building science, heat pumps, etc.

<https://www.ecvt.net/home-performance-resources>

References available on request

Energy Audit

4/27/23
16534
Fairfield Common School
52 Soule Drive
Fairfield, VT 05455

Attn: Cathy Ainsworth, Town of Fairfield, 25 North Fairfield Road. 05455
802 752 8000
Email: townadmin@fairfieldvermont.us

Overview

The school building uses a lot of fuel for heating. There is no insulation in the walls, and only a small section of the basement is partially insulated. The windows are large, and low R-value. Leaky too. The attic is insulated to about R-25 with a mix of vermiculite and cellulose insulation. The vermiculite is a problem because it contains trace amounts of asbestos. It has to be removed before upgrade work can be done on the walls (blown in cellulose) and attic of the building. Because of the vermiculite I couldn't do a blower door test, but I'm confident that the building is leaky. There would be lots of benefit to better insulating and air sealing the building.

Existing Conditions

Air Leakage

- Basement ■ Bulkhead door is leaky and needs to be upgraded, rim joist and penetrations not air sealed.
- Attic ■ Not air sealed. And tongue and groove ceiling needs to be air sealed with thin drywall on the attic side after vermiculite abatement.
- Windows ■ Double pane windows mostly with storms. Leaky. More could be done to tighten up existing window and storm assemblies (weatherstripping, sash locks, gaskets, etc)
- Doors ■ Not in great shape. Leaky.
- Walls ■ Various materials (metal, wood, tongue and groove) continuous and not big leaks. Tongue and groove boards are not an air barrier. Dense packing walls with cellulose can significantly reduce air leakage.
- Other ■

Insulation

- Basement ■ Mostly no insulation. 1.5 inches of EPS foam board (R-6) on above grade section of west wall.

- Attic ■ Insulated with about 8 inches of vermiculite and loose fill cellulose. R-25.
- Walls ■ Not insulated. 5 inch cavities.
- Windows ■ Very large, double hung single pane on first floor plus storm windows. (R-2 assembly value). Small double pane windows elsewhere. And a couple double pane windows in basement. Most basement window openings are filled in with batt insulation and plywood.

Heating and Cooling

- Oil boiler, 80% efficient

Domestic Hot Water

- Electric tank. 90% efficient.

Ventilation

- Bath fans ■ Fan/light--duct to outside not fully connected. Needs to be upgraded.
-
- Other ■

Moisture

- OK

Health & Safety

- Vermiculite in attic contains trace amounts of asbestos (a health hazard). Not a danger if not disturbed. Needs to be treated as hazardous.
- Also there is some fiber board labeled as asbestos in the boiler room.
- There are some buckets of tar material in the basement oil tank room. Looks like one has spilled or leaked.

Maintenance

-
-

Overview

Year Built: 1820

Volume (cf): 34560

Temp Set 60

Heated Area (sf) 3456

No. of Stories: 2

Ttl Area (sf) 4456

Annual Energy Use

Appliance /Efficiency	Usage	Fuel Type	Price	Cost
Oil Boiler/80% Heating	2700	gals, Fuel Oil/Kero	\$4.00	\$10,800

Total Annual Heating Fuel Usage (BTUs/sf)	108,594
Total Annual Energy Heating Usage (BTUs/sf)	108,594

Total Annual Heating Fuel Usage (BTUs/sf)108,594high

Typical upgraded wood framed building: 40,000 BTUs/sf

Domestic Hot Water Type: Electric----->Efficiency: 90%

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Air Tightness

Blower Door (CFM50)10,000Estimated

Leakage Rate or Air Changes per Hour natural (ACHn)1.52

ACHn represents the proportion of the building's air that leaks out every hour during the heating season. A good goal is to reduce air leakage below 0.3 air changes per hour (ACHn).

Bathroom Fan Ventilation

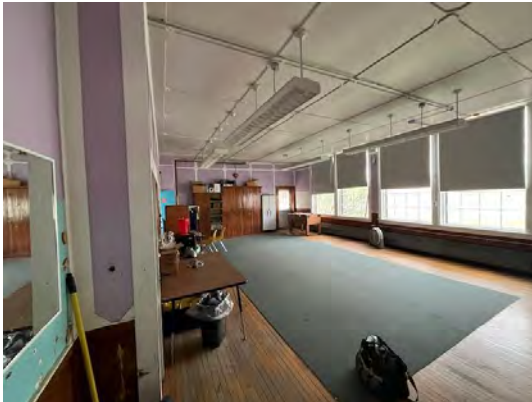
Location	Type		
basement	Fan/Light		Vent Needs Repair

-

-

-

Photos



1st floor



Top floor



Photos



Heated basement section



Unfinished basement section. Foundation and rim joist not insulated.



Attic flat insulation, combination of cellulose covering vermiculite.



Vermiculite from the attic.



Asbestos hazard sticker in boiler room



Example of air leak.

Photos



Example of air leak.



Example of air leak.



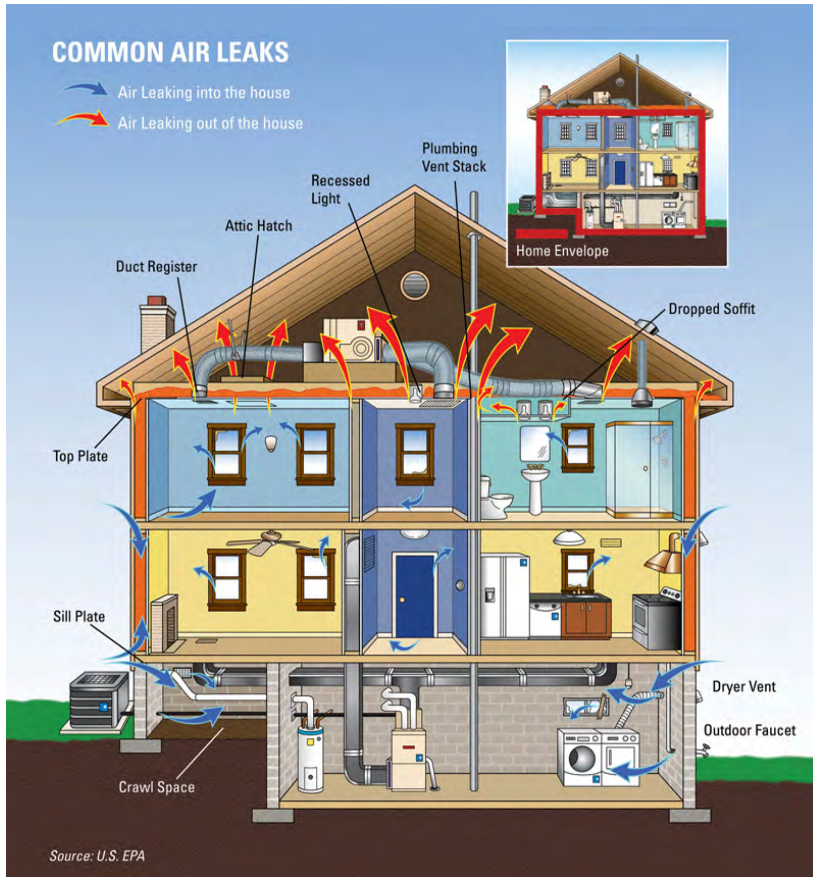
Example of air leak.



Example of air leak.



Hatch in stairway section. Tongue and groove boards are leaky.



This graphic shows where we focus on stopping air leaks. The Red Arrows are in the attic—all the plumbing, electrical, wall tops, hatches, lights and other penetrations. We typically reduce air leakage in a house by over 20-30% just by air sealing the attic.



Example of attic air sealing.



Example of air sealing and insulating a basement or crawl space rim joist.



Example of white face Thermax foundation insulation.

Proposed Improvements

Healthy Homes Principles

Dry * Clean * Pest-Free * Safe * Contaminant-Free * Ventilated * Maintained * Thermally Controlled

Common Upgrade Measures

Air Sealing

Air leakage allows conditioned air to escape destabilizing temperatures and increasing costs. Air sealing measures include caulk and spray foam to seal leaks in the attic and basement, weather stripping, and caulking around window and doorframes.

Attic/Ceiling

A higher insulation R-Value slows heat loss/gain and makes a comfortable and greener home. Upstairs bedrooms are often noticeably cooler in the summer.

Basement

Basements and crawl spaces lose energy during the heating season. Insulating the basement walls and crawl space will prevent most of this heat loss.

Ventilation

Proper ventilation (such as a bathroom exhaust fan) works to provide good air quality, and a safe, comfortable and durable home.

Energy Upgrade Proposal

--See "Proposed Energy Upgrade Work Scope" below--

Health and Safety

In rare cases after a building is tightened up, boilers and furnaces, gas or propane fireplaces, or hot water heaters may not function properly. When there is a problem, it is usually with older appliances. The solution is to add outside combustion air directly to the unit. In other cases, a fan assisted or sealed combustion unit, for instance, may be necessary. If there is a requirement for additional work to ensure safe functioning of combustion equipment, this will be determined at the completion of the project during the final test out.

If not tested already, it is recommended that a test for Radon Gas be completed to ensure this potential hazard is not a problem.

Healthy Homes Principles

Dry * Clean * Pest-Free * Safe * Contaminant-Free * Ventilated * Maintained * Thermally Controlled

Paul Fleckenstein, BPI Building Analyst
Energy Co-op of Vermont, 802.373.0329
Paul@ecvt.net

Fairfield Common School

Energy Upgrade Measures

Air Leakage Reduction

Initial CFM50 10,000
Target CFM50 3,500
Reduction Goal 65%

		Area/ Items	Budget Price	Estimate of percent of overall savings from air sealing and insulation benefits of upgrades
1	Testing/Close Out Includes end-of-project testing and verification of all air sealing, insulation, ventilation appliances, and combustion equipment, and processing for incentives.		\$0	
2	Attic Flat(s): Air seal attic and upgrade insulation with loose fill cellulose. R-value increases to R-60. Includes upgrading attic hatches. This happens after vermiculite abatement by a remediation contractor.	1,728	\$13,000	15%
3	Walls: Insulate with dense pack cellulose. Temporarily remove and replace siding. Drill hole, install cellulose by tubing up and down wall cavity, and plug hole. R-value increases from R-5 to R-20. Also reduces air leakage. Use lead save procedures. This can only be done after the attic vermiculite is abated. The wall tops need to be blocked before dense packing. This work can also be done from the inside of the building depending on other renovations being done.	3,114	\$20,000	30%

4	Basement rim joist: Air seal and insulate with closed cell foam. R-value increases to R-20.	184	\$3,500	10%
5	Basement foundation wall: Insulate with white-face Thermax foam board. R-value increases to R-18. Mechanically fastened with taped seams. In the partially finished section, foam board covered by drywall would be more durable.	1,132	\$12,000	
6	Cold-climate heat pump. Mitsubishi hyper heat. Heating and cooling. Estimated price includes Efficiency Vermont incentive. There may be federal tax credits available for this purchase. There may be additional bill credits available from your electric utility. These can be substantial. Size: 18,000 Btu on top floor and two 15,000 Btu units on first floor. (leaving basement for boiler for now) Joe Cobb, Energy Co-op Service Manager, will finalize installation and pricing details. jcobb@ecvt.net	3	\$20,000	see chart below, also with upgrading the building shell, this reduces the heating load for the building at coldest temperatures from about 150,000 Btu/hour to 50,000 Btu/hr (which heat pumps can better handle)
7	Upgrade windows from R-2 to R-4 assemblies. Instead of replacement, minimal option would be to install air sealing measures on existing windows to make them tighter and to upgrade some of the storm windows and/or install low-E storm windows.			10%
8	Upgrade exterior doors to air tight assemblies			2%
Maintenance, Health, and Safety Measures				
A	Vent bathroom fan to the outside with rigid duct and new vent cap.	1	\$375	

	<i>Estimated overall savings from air sealing and insulation measures</i>			67%
	<i>Estimated overall savings from air sealing and insulation measures, plus installing air source heat pumps</i>			83%
	Solar electric--it would also make sense to investigate solar electric installation on the roof, which would reduce the cost of electric heating substantially.			

\$5,000 incentive rebate available from Efficiency Vermont for air sealing and insulation upgrades. Financing may be available also.

There may be other funding available for municipal energy upgrade projects from the State of Vermont
Contact Efficiency Vermont at (888) 921-5990 for information on financing.
Efficiency Vermont also offers assistance on lighting and electrical upgrades.

Vermiculite abatement

Rebates Available

Zonolite Trust Fund

<https://www.zonoliteatticinsulation.com/Hm1.aspx>

Removal/Abatement Contractors

EHM

<https://ehmvt.org/>

Alderson

<https://aldersonvt.com/>

Mansfield

<https://www.mansfieldenvironmentalvt.com/>

SCENARIO Moving from 100% oil to 75% heat pumps and 25% oil for heating

OLD SYSTEMS						NEW SYSTEMS						
Existing Fuel	annual usage	Existing MMBtu usage	Existing \$\$/yr	Existing Efficiency	shell %load	NEW Fuel	NEW shell %load	NEW Efficiency	NEW MMBtu usage	NEW \$\$/yr	MMBtu savings	\$\$ Savings
Pellets		0	\$ -	78%	0%	Pellets	0%	78%	0	\$0		
Wood		0	\$ -	65%	0%	Wood	0%	65%	0	\$0		
Oil	2700	373	\$ 10,800	80%	100%	Oil	25%	80%	93	\$2,700		
LP Gas		0	\$ -	80%	0%	LP Gas	0%	95%	0	\$0		
Natural Gas		0	\$ -	88%	0%	Natural Gas	0%	88%	0	\$0		
Electric		0	\$ -	100%	0%	Electric	75%	220%	102	\$5,667		
		373	\$ 10,800	80%	100%		100%	153%	195	\$8,367	178	\$2,433
						195						
	\$/unit											
E	0.19	Electric										
L	3.25	LP										
N	1.6	NatGas										
O	4	Oil										
P	320	Pellet										
W	350	Wood										

Actual usage and savings also depend on weather, and customer behavior and expectations.

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