



Weatherizing Town Buildings

What Local Officials and Energy Committees Need to Know

Windham Regional Commission | 2012

Introduction: Energy, Money, and Your Community

Many of Vermont's municipal buildings – town halls, town offices, libraries, etc. – are unique, historic buildings that contribute to the character of the state's downtowns and villages. Unfortunately, because of their age and outdated construction, the heating costs of many of these municipal buildings also contribute to a large line item in the municipal budget and elevated local taxes.

One effective way to reduce the impact of these costs is a whole-building weatherization retrofit. Weatherization retrofits include methods such as air sealing buildings, increasing insulation, weather-stripping leaky joints, and window and door upgrades. The concept of weatherizing a building may not be a new idea, but rising energy costs are making it an increasingly attractive option for many towns. Now more than ever, weatherization can help municipalities save money and be more resilient to future price shocks. Just as importantly, weatherization helps make buildings more comfortable, offering enjoyable, usable space for town employees and ensuring they remain a key part of the community for years to come.

From 2010 through 2012 the Windham Regional Commission (WRC) worked with towns throughout the region to help identify areas where savings could be obtained through weatherization projects. Through both state and federal Energy Efficiency and Conservation Block Grants (EECBG), the WRC's Energy Committee distributed funding to successfully complete fourteen energy audits in seven of the region's towns, and awarded grants for weatherization retrofits to seven towns. The projects included the Newfane Town Office, Londonderry Town Offices, Grafton Town Hall, Marlboro Town Offices, Weston Town Garage, Putney Town Hall, Windham County Sheriff's Office, and the Windham County Superior Courthouse. The estimated annual energy savings for the recommended improvements for these projects ranged from \$1,200 to \$5,000.

FACT: In 2009, Nationwide 5.7% of households used fuel oil or kerosene for heating. That same year, 49.1% of Vermont households used fuel oil or kerosene as a source of heat.

Source: U.S. Energy Information Administration, Annual Energy Review Released Oct. 19, 2011 & U.S. Census Bureau Selected Housing Characteristics 2009

The benefits of a weatherized building are clear, but getting started may seem daunting. Even without outside funding, weatherization of municipal buildings may, in many cases, be a sound investment for local municipalities through favorable payback periods from reduced heating costs. This guide is designed to help demystify the process for town officials, energy committees, and others working on municipal building retrofits. It is based on the Windham Regional Commission's experience with town weatherization projects from 2010-2012. This guide is meant to go beyond the basic weatherization process by providing information about working with historic buildings, identifying common obstacles found, and offering

tools and strategies for dealing with these obstacles. It is also meant to complement an existing resource, the *Guide to Improving Energy Efficiency in Vermont Municipal Buildings*¹. The information contained in this guide is broken out into four sections, roughly following the traditional process for completing a weatherization project. In addition to providing guidance on how to complete a weatherization project for municipal buildings, this document also provides highlights and vignettes of specific experiences encountered during the WRC's project oversight. The following sections will address:

1. Getting Started in your Town
2. Assessing Weatherization Options for your Town
3. Example Projects for your Town to Consider
4. Keeping your Town's Investment Successful

This document should help your town better understand what to expect if it chooses to pursue weatherization projects in the future and how you can save tax dollars in the process.

Getting Started in your Town

Before any savings for your community can be realized, it is important to undertake a few key steps in order to understand the building's requirements, gather support, and decide on funding options. Taking the extra time to develop a project based on good information and build solid community support can help ensure the success of the project from start to finish.

The process of getting started with municipal energy efficiency projects is effectively summarized in the article *Guide to Improving Energy Efficiency in Vermont Municipal Buildings*. This guide details a comprehensive approach to energy efficiency projects, including weatherization. The "getting started" steps are thus only briefly recapped in this guide. The above guide is extremely helpful, full of additional detail, and should also be consulted when starting a project. It can be found at: http://windhamregional.org/images/docs/energy/markowitz_guide-to-improving-energy-efficiency.pdf.

To briefly summarize, the recommended steps for getting started are:

1. **Form a team** – Forming a team committed to reducing municipal energy costs is a critical first step in tackling municipal energy use. This may be a town energy committee, formally established by the Selectboard, or a less formal, project-specific committee. This team may have many functions, but especially for municipal building projects, they should work closely with local decision makers right from the start.

¹ Markowitz, Paul (VT Chapter Sierra Club). "Guide to Improving Energy Efficiency in Vermont Municipal Buildings." Windham Regional Commission Energy Page. March 15, 2012. Web. March 17, 2012. http://windhamregional.org/images/docs/energy/markowitz_guide-to-improving-energy-efficiency.pdf

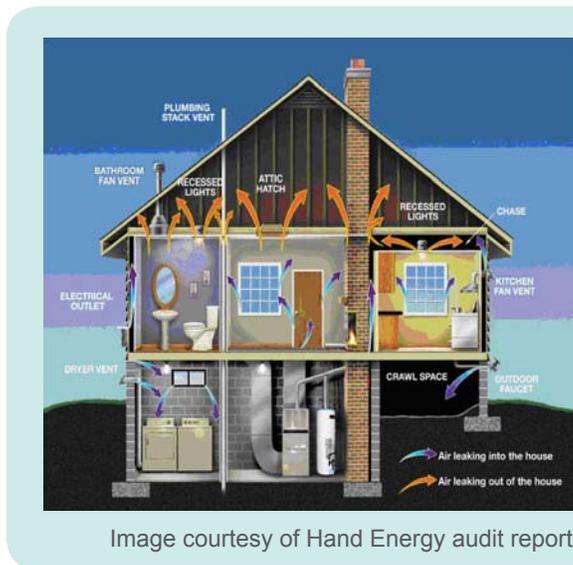
2. **Build support among elected officials and residents** – This may happen concurrently with the formation of the group who will be working on the project. The whole process must be a collaborative effort between the people responsible for a town’s buildings (the Selectboard) and the people interested in helping (the Committee). It is absolutely critical to build support and a sense of shared purpose before asking for funds.

3. **Compile data on your “municipal energy bill”** – Talking with the Selectboard and researching past bills and other records is a way to see how energy usage and costs have changed over time. Collecting data will also help reveal where work needs to occur. The info box on page six provides more in depth guidance on this step.

4. **Perform a walkthrough assessment of your building** – During a walk-through assessment, simple characteristics like the age of the heating and distribution system, the sealing system for the windows, and existing insulation materials are reviewed to get a better understanding of where opportunities lie. If you are unsure of what to look for in this step, contact a local energy auditor to speak with him/her about what some common issues are for the region.

5. **Have an energy audit performed on the building** –

An energy audit is an evaluation, conducted by a building professional, that takes a whole system approach to a building’s efficiency. This “whole building” approach to weatherization means that the building is evaluated as more than just a collection of windows, doors, attics, and basements to be replaced one by one. Instead, the audit looks at how the various parts are working (or not working) together, and what kind of building “envelope” they create. An image depicting this system is displayed at the right. The auditor can then make recommendations about improvements that get the system working as efficiently as possible so that both energy and money are saved. Also, keep in mind that

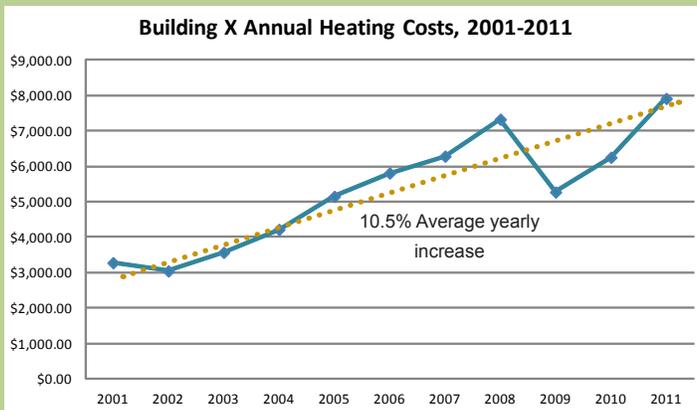


there are very different characteristics to assess when performing an audit on an commercial building versus a residential one, so be sure to hire an auditor with the experience you need.

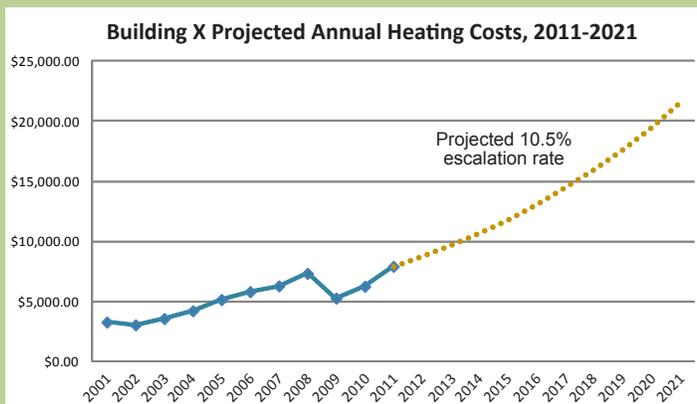
6. **Finding Funding** – As of March, 2012, Efficiency Vermont funded weatherization rebates through the Building Performance Program. This program offers rebates of up to \$7,500 to wood-framed, commercial buildings less than 10,000ft² in area, which includes municipal buildings with those characteristics as well. The improvements must be completed by a Building Performance Institute certified contractor who participates in Efficiency Vermont’s program. It is through this program that the Windham Regional Commission earned rebates on comprehensive energy retrofits funded

COMMUNICATING YOUR ENERGY COSTS

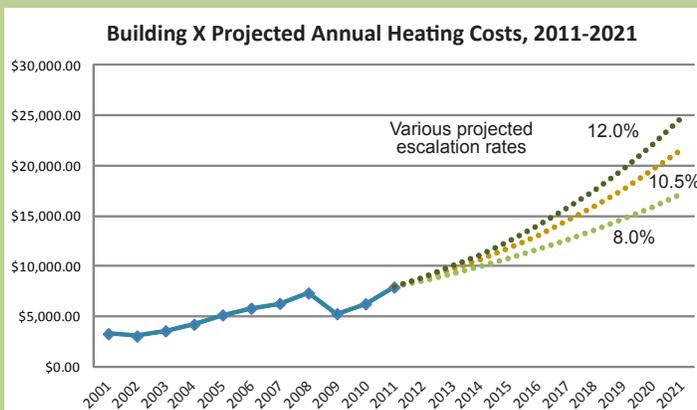
Displaying your past and projected energy costs in a graph form is a quick and effective way to identify a need for weatherization retrofits. The graphs below show a quick example of how calculating a trend in past energy use costs can help predict future budget requirements.



The first graph displays a typical cost trend over the previous decade. While the building used in this example is fictional, the U.S. Energy Information Administration's reported average price of oil was used to determine a "cost of heating" for each year. As such, the upward trend is very similar to what other buildings using fuel oil for heat would have seen since 2001.



This second graph displays a projection line for annual heating costs calculated out for ten years into the future. This projection line was determined by the overall average increase in fuel prices from the previous decade. While there is no guarantee that prices will increase at this exact rate, it still helps municipalities plan for future utility costs.



Finally, this last graph displays a range of escalation rates, providing the local government with a broader picture of what to expect based on different price changes. Other factors may also be considered in these calculations, including heating degree days, potential building expansions, and building upgrades. It is up to your committee to decide how thorough a picture you want to depict.

² Information collected from the Efficiency Vermont website: <http://www.encyvermont.com/Index.aspx>. For more detailed information about these methods, please visit this site or talk to a building weatherization professional.

through its Energy Efficiency and Conservation Block Grants, further leveraging the federal EECBG funds. Additional suggestions for funding can be found in the *Guide to Improving Energy Efficiency in Vermont Municipal Buildings*.

Following these six steps will help your project gain the momentum it needs to be a successful weatherization project. Many towns successfully complete energy audits, but then are unsure of how to proceed and make the most of their investment. The following sections help clarify the steps for completing weatherization projects for older town buildings and give insight into typical challenges of which to be aware.



The pictures above display a typical blower door test apparatus and thermal imaging comparison, both of which are important components of the energy audit. The thermal images above clearly identify where heat is escaping through penetrations in the existing insulation at the Windham Elementary School.

Assessing Weatherization Options for your Town

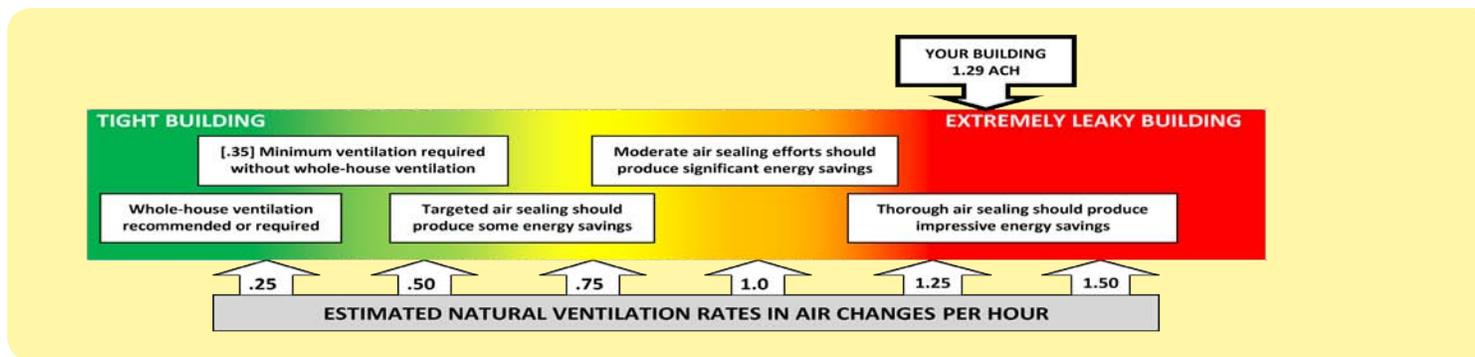
The audit is the first step, but it is implementing the retrofit that will ultimately lead to savings for your town. Once the audit is in hand, town officials and energy committees can sit down to discuss energy saving priorities, and review how to approach the project. The major areas to look for savings begin with the attic, followed by the basement (including boxesills and mudsills), and then living/working space. Just like any investment that yields a return, a building weatherization requires an up front capital investment. Deciding how to make this investment is a critical piece for making the overall effort successful.

Several options are available for typical weatherization projects. The majority of the projects funded by the WRC completed air-sealing and insulation improvements to the buildings. The following provides a description of typical weatherization options²:



AIR SEALING

About half of all heat loss happens from air flow. This air leakage is well beyond what the occupants or building require for health. The places that get air sealed are underneath the insulation, so the air sealing needs to happen before additional insulation. Some insulation materials, such as spray foam, air seal and insulate at the same time. Air sealing is the process of closing up air leaks in the building's envelope. Typical air-sealing components include sealing around vertical shafts, such as chimneys, sealing around windows and door casings, installing weatherstripping around exterior doors, and sealing utility penetrations through floors and into attics, such as wire and plumbing penetrations. Typical air sealing materials includes rope caulk and/or spray foam. A picture of a spray foam application that was recommended for the Weston Town Garage is shown above on the left. Another way of understanding the benefits of air sealing is through determining your buildings ACH, or "Air Changes per Hour." The graphic below shows a range of ACH values and their associated meanings. This particular graphic came from the Grafton Town Hall audit report, and demonstrates just how leaky this old building was prior to its weatherization improvements.



INSULATION

The typical insulation projects completed for projects administered by the WRC were attic and basement insulation improvements. Depending on the insulation product chosen, the insulation material may serve as a vapor barrier as well as insulation. Typical materials used in this weatherization component are pink/blue board, closed or open cell spray foam, and bio-based foams. While insulating of attic and basement portions of the building were generally the most cost effective solutions, improving insulation of exterior walls is also an option. The images

AIR SEALING vs. REPLACING WINDOWS AND DOORS

WRC found during its municipal weatherization projects that counter to conventional wisdom, none of the eight projects selected (in fact, none of the fourteen projects reviewed) called for the replacement of windows or doors as a first priority. They primarily addressed air sealing (to reduce the air flow through the building) and insulation. In fact, the greatest returns on investment were realized from simple air sealing. In one particularly striking case, \$542 worth of air sealing led to energy savings of approximately 39.2 MMBTU, which translated into an estimated \$922 in annual savings.

Though windows and doors may seem like the most obvious and tangible choice for making a building more comfortable, town officials will probably find that their energy dollars stretch farther with other improvements. An energy audit is an important first step to determining the most valuable investments.

above on the right show how siding was removed on the Grafton Town Hall building in order to dense pack cellulose into the exterior wall cavities.

ELECTRICAL UPGRADES

This step can be as simple as replacing incandescent light bulbs with compact florescent (CFL) bulbs within the building. This part of the process may also include replacing inefficient T12 linear fluorescent lights with T8 bulbs, or replacing older exit and signage lights with LED lights. The energy audit will be able to tell you which replacements will provide the most effective savings.

REPLACING OLD REFRIGERATORS OR HEATING SYSTEMS

Refrigerators and heating systems have become much more efficient in recent years, and the savings realized from upgrading your system may pay for itself in a matter of just a few years. The town officials overseeing the Windham Superior Courthouse weatherization project decided to have a hot water heater replaced during the course of its weatherization upgrades. Make sure the auditor your hire provides an assessment for these elements as well.

INSTALLING WATER HEATER JACKETS, LOW-FLOW SHOWER HEADS, AND FAUCET AERATORS

While none of these types of improvements were recommended for the projects completed by the WRC, water efficiency improvements can help reduce both water utility and water heating bills. While insulation and electricity use may be higher priorities for savings, it is also good to consider even small improvements to your buildings water use efficiency. Generally, savings calculations are included on the packaging for these products, so they are easy to consider and install after your buildings initial weatherization improvements have been completed.

Special Considerations with Historic Buildings

Many of Vermont’s municipal buildings are historic structures, which in itself offers several benefits. This fact allows towns to continue using existing buildings rather than building new. It also helps maintain the traditional settlement pattern of the town, since historic buildings are often located in downtown and village centers. New buildings are often built on dispersed, undeveloped land. Additionally, the reuse (or continued use) of a building is considered by many to be inherently “green.”



Despite the benefits, weatherizing a historic building comes with its own set of considerations and challenges. Of the eight weatherization and efficiency projects undertaken by the Windham Regional Commission, seven of the buildings were historic. Three of those buildings are pictured above: the Grafton Library, the Grafton Town Hall, and the Londonderry Town Offices. Some of the issues that WRC had to manage with regards to buildings like these were:

- Requirement for review of the project from a historic preservation authority – If a project is state or federally grant-funded, recommended weatherization improvements may need to be approved by the State Historic Preservation Officer (SHPO). Review by the SHPO helps ensure that improvements do not undermine the historic integrity of the building. This can be accomplished by having the auditor’s recommendations reviewed by a historic preservationist. Getting a historic preservationist on board with the project early in the process can make the project more streamlined later.
- “Reversibility” – In the historic preservation community, one of the ways to help maintain the historic integrity of a building is to design changes so that they are reversible. In the projects undertaken by WRC, one way this was accomplished was by installing a layer of Tyvek between a rubble foundation and the spray foam insulation. While this somewhat decreases the efficacy of the spray foam insulation, it was a compromise that helped maintain the historic integrity of the building while also ensuring that weatherization improvements could be approved and completed. See the sidebar on the next page for more information.

SPRAY FOAM INSULATION ON RUBBLE FOUNDATIONS

Relating to the issue of “reversibility,” one of the issues that may arise with a historic building is whether to put spray foam insulation* on rubble foundations (examples of rubble foundations pictured below). There are different opinions about this issue. Some historic preservationists strongly recommend against the application of spray foam to rubble foundations because of uncertainty about its impacts on water infiltration and the freeze/thaw cycle. By contrast, other historic preservationists may approve the application of spray foam to the rubble, with certain specifications. WRC funded at least two projects where spray foam was applied directly to rubble foundations, with the approval of the State Division for Historic Preservation. Spray foam is difficult to undo, so any existing structural issues must be addressed before application of spray foam insulation. This is a project specific issue depending on the particular drainage issues and foundation structure of your building, and is something to address with your weatherization professional.

*This example refers to closed cell spray foam insulation, which can serve as a vapor barrier as well as an insulation material



With these considerations in mind, there are several resources available for towns wishing to undertake careful weatherization that will preserve these important historic resources:

- The organization Clean Air, Cool Planet has published a detailed guide called *Energy Efficiency, Renewable Energy, and Historic Preservation: A Guide for Historic District Commissions*. This contains information on both process (how to get projects done in collaboration with community groups) and technique (siting of renewable energy structures, dealing with moisture, etc.). The guide is available here: http://www.cleanair-coolplanet.org/for_communities/HDCGuide.pdf.
- The Preservation Trust of Vermont is a charitable, non-profit organization that initiates and assists local and statewide efforts to preserve Vermont’s historic, architectural, and community resources. Through educational programs and technical and financial assistance, the Preservation Trust works to protect and

restore significant historic properties, downtowns and community centers. The Preservation Trust of Vermont (<http://www.ptvermont.org/>) can help with technical assistance, structural audits, etc. for historic buildings that are prime candidates for weatherization improvements.

- A historic preservationist can help walk you through the considerations of your weatherization project. Towns may choose to hire a historic preservationist to review an audit's recommendations with an eye toward their compatibility with the historic nature of the building. A list of historic preservationists can be found at <http://www.historicvermont.org/programs/consult.pdf>.

Commonly Encountered Issues

Because of their age and historic nature, many municipal buildings are in need of anything from minor repairs to major building renovations. Towns do their best to maintain municipal buildings, but inevitably, limited budgets, limited time, and complexity issues of approving upgrades to a building (especially an older one) means that it is easy to fall behind on building maintenance.

Weatherization projects may bring to light maintenance issues that previously were not considered a major problem, or that were being managed. For example, a damp basement (while never ideal) is less of a problem when a building is drafty – the benefit of a draft is that a building can dry itself out. Once insulated and sealed up, however, the moisture that was not originally a problem can now start causing mold, dampness, and other problems.

CASE STUDY: DRAINAGE ISSUES IN LONDONDERRY

Problem: Auditors determined that the basement of the Londonderry Town Office was too damp to weatherize without causing risk of moisture build up. A full fix would involve re-grading and the installation of a perimeter drain – a solution that was not affordable for the town, and still may not have been effective, since it was known that there was an old (but active) spring beneath the parking lot.

Solution: Insulation was needed, but air leakage was a major problem. As a compromise until a better external drainage solution could be found, the auditor recommended air sealing the box sills. This reduced air infiltration and moisture infiltration noticeably, without trapping moisture and damaging the historic building.



³"Vermiculite." US Environmental Protection Agency. 18 Apr. 2011. Web. 18 Jan. 2012. <http://www.epa.gov/asbestos/pubs/verm.html>

And so, just as assembling funding is a major part of getting started, so too is figuring out what other, non-weatherization improvements will need to be tackled so that weatherization upgrades can proceed. Thinking about non-weatherization improvements early in the process can help town officials and energy committees budget appropriately and set realistic expectations about what a project will involve. A good energy audit will help identify some issues, but institutional knowledge about a building should also be a part of the conversation.

During its work on municipal buildings, the Windham Regional Commission encountered several common issues. Below is a brief description of each issue, along with how the issue was addressed. Though these examples are illustrative, every building is a unique circumstance and should be approached with that in mind – there is not a “one size fits all” solution, and towns should consult with weatherization professionals, historic preservationists, and building engineers before making a definitive determination.

Basement Moisture Issues

The issue: Many aged or historic buildings experience poor drainage around their foundations, or leaks in the foundation itself. As a result, moisture is able to enter the building through the basement or crawlspace area. As long as the building allows sufficient air to pass through, this moisture is less of an issue because it is able to dry out quickly. However, as the goal of the weatherization process is to reduce this airflow through the building, the moisture can now develop into a real concern for the integrity of the foundation. Damp conditions can lead to rotting of wood structural elements and mildew development. In this case, weatherization of the building solves one issue while creating another.

Example Solutions: The town of Newfane installed a new sump pump in the basement of its Town Office building to help reduce moisture collection. The town of Putney repaired the corner stone of the foundation and conducted exterior re-grading around the Town Hall to reduce vulnerability to infiltration of moisture. In general, try to reduce the sources of moisture as much as possible, and then consider ventilation to handle any remaining dampness.

Vermiculite

The issue: Vermiculite is “a naturally occurring mineral composed of shiny flakes, resembling mica. When heated to a high temperature, flakes of vermiculite expand as much as 8-30 times their original size. The expanded vermiculite is a light-weight, fire-resistant, and odorless material and has been used in numerous products, including insulation for attics and walls.”³ It was used commonly as an affordable insulation material across the country, and is still in use today. However, some vermiculite is known to be contaminated with asbestos. In fact, at one point over 70% of vermiculite mined came from Libby, Montana, which had been contaminated



with asbestos. As a result, the EPA recommends “you should assume that vermiculite insulation is from Libby and treat the material as if it contained asbestos by not disturbing it or by using a trained professional if it needs to be removed. While you can hire a trained professional to test your attic for asbestos, this may be expensive and, depending on the methods used, might give you erroneous results. We do not recommend that you open your walls to check for vermiculite.” The State of Vermont supports this recommendation and goes further to recommend that all vermiculite insulation be approached as if it contains asbestos and be handled accordingly.

Example Solution: The WRC took a conservative approach with vermiculite, and had it tested by an environmental consulting firm. This was expensive: the cost was over \$1,500. The end conclusion for the building in this scenario was that the vermiculite could be removed following VOSHA standards.



Knob and tube wiring

The issue: Many older buildings used knob and tube wiring at one time. While most knob and tube systems are deactivated by now, some deactivated systems still have segments that are live. When it comes to weatherization, these are problematic for several reasons. First, if they are active but covered with cellulose, there is not enough air circulating around them for the wiring to function. Second, segments of charged wire pose a risk to workers installing the insulation if the wiring is buried in existing insulation. Physical contact could cause some level of electrical shock.

Example Solution: The simplest way to remove all doubt about whether knob and tube wiring is live is to call your electrician and have all segments tested, and to have any live segments deactivated. During WRC’s projects, there were two occasions where wiring that was assumed to be disconnected still carried a charge. In one of these cases, the evaluation of wiring before insulation led to a rewiring solution that was better for the town in the long run.

Insulation selection

The issue: In the course of weatherization efforts, you may encounter materials that were more frequently used in the past. For example, urea-formaldehyde insulation was a commonly used insulation material in the past that was subsequently banned because of health concerns. Some individuals are concerned that current products such as spray foams may have unforeseen issues similar to past materials. It is important to make decisions about product selection based on your best judgement and priorities. While options such as foam board exist as an alternative to spray foams, these products also present their own issues. Pink/blue foam board has very low moisture permeability and excellent air sealing properties, but is also extremely energy intensive to produce. Fiberglass batting is a very common material used in building construction, but it does almost nothing to stop air flow. In this case, there is no suggested solution as the decision will have to be made based the best judgement of your project members and consultants.

Example Projects for your Town to Consider

From 2010-2012, with the help of both State and Federal Energy Efficiency and Conservation Block Grants (EECBG), the WRC's Energy Committee distributed funding to successfully complete fourteen energy audits and nine weatherization retrofits for municipal and county buildings. The tables on the following pages give an overview of the initial audit recommendations for each project and the final improvements made to each of the buildings. The Bellows Falls Middle School retrofit project is not included in the table because it consisted only of a solar hot water panel installation. As shown in the tables, all of the remaining weatherization retrofits included a combination of insulation improvements and air sealing. Some projects included additional work such as removing excess attic hatches, replacing dial thermostats with programmable thermostats, and upgrading electrical fixtures to more efficient fixtures.

In February of 2013, a performance review was conducted on the seven thermal envelope retrofit projects completed in 2011. At final tally, those seven projects combined for a total of approximately \$14,190 in fuel oil cost savings for the first year of performance. This equates to an average savings of \$2,000 per project for 2012 (results will vary from year to year depending on the price of oil). These projects also saw a total energy savings of 570 MMBTUs for 2012, or an avoided 94,392 lbs of CO₂ that would otherwise have been released into the atmosphere¹. Put another way, the avoided CO₂ emissions are equivalent to the amount of CO₂ sequestered in 53.6 acres of forest during the course of a year².

Based on the results of these projects, the WRC is currently seeing a 14.0% return on investment for the total cost of these seven projects, with an average payback period of about 7.1 years. It should be noted that these savings continue even after the payback period is reached, such that after the original investment is paid off, each project will continue to save the town money for many years into the future. Additionally, the payback period is calculated at the current cost of energy, and will decrease as energy costs continue to increase.

Of these projects, the two best performing weatherization improvement projects were the Newfane Town Offices and the Weston Town Garage. For the 2010 heating season, the Newfane Town Offices had used 1,453.5 gallons of fuel oil for heating. After the weatherization improvements were completed, the Newfane Town Offices reported using 679.6 gallons of fuel oil for heating during the entire year of 2012. Adjusting for heating degree days (or the variation in winter temperatures), this equated to a 49.3% improvement in fuel oil usage. This improvement outperformed the auditor's estimate of a 40% improvement in energy usage. This improvement in energy use equated to an annual cost savings for the town of \$2,648 for 2012. At this rate, the payback period for this weatherization project will be less than four years.



¹ CO₂ Emissions Factor for Residual Fuel Oil #6, 165.6 lbs/MMBtu, http://www.epa.gov/chp/documents/fuel_and_co2_savings.pdf

² A 25 year old Northeast maple-beech-birch forest sequesters approximately 1,760 lbs of CO₂ per acre per year, <http://sustainability.tufts.edu/carbon-sequestration/>

TABLE 1: ENERGY AUDIT REPORT RECOMMENDATIONS & ESTIMATES

Town	Building	Audit Recommendations	Estimated Cost of Improvements	Estimated Annual Energy Cost Savings	Estimated Annual Energy Savings (MMBTU)	Estimated Annual Energy Savings (kWh)	Estimated ROI	Estimated Payback Period (yrs)
Grafton	Town Hall	Foundation Walls: R1/R12 to R13/R25 Exterior Walls: R5 to R15 Flat Attic: R5 to R50 Air Sealing	\$32,800	\$2,400	114.0	0	7.3%	13.7
Londonderry	Town Offices	Foundation Walls: R3 to R12/R24 Flat Attic: R8 to R50 Air Sealing	\$15,000	\$2,500	103.0	0	16.7%	6.0
Marlboro	Town Offices	Foundation Walls: R1 to R19 Flat Attic: R25 to R50 Air Sealing: 30%	\$7,800	\$1,279	36.0	0	16.4%	6.1
Newfane	Town Offices	Foundation: R1 to R19 Front Attic: R22 to R63 Back Attic: R15 to R40 Air Sealing	\$14,531	\$2,066	87.8	0	14.2%	7.0
Windham County	Superior Court-house	Foundation: R1/R5 to R19/R23 Attic Floor: R26 to R48 Replace Windows at Door Seal Second Level Windows Install programmable thermostats Air Sealing: 27% reduction (4) T8 Bulbs to CFL Bulbs	\$30,867	\$2,634	132.5	609	8.5%	11.7
	Sheriff's Office Building	Foundation: Insulate Walls: Increase insulation Windows: Install storms on 12 windows Attic: R5 to R49 Air Sealing T-12 fixtures to T-8 fixtures	\$17,567	\$1,487	53.0	-	8.5%	11.8
Putney	Town Hall	Foundation: R2 to R17 Box Sill: R8 to R22 Windows: Restoration (Est of 36 Total) Attic: R10 to R50 Air Sealing: 40% reduction	\$26,920	\$5,184	128.0	0	19.3%	5.2
Weston	Town Garage	Foundation: R1.5 to 15 Walls: R5 to R20 Insulate hot water lines Upgrade Windows Install programmable thermostats Attic: R20 to R60 Roof: R10 to R40 Air Sealing	\$20,700	-	-	-	-	-

TABLE 2: COMPLETED WEATHERIZATION IMPROVEMENTS AND CALCULATED RESULTS

Town	Building	Weatherization Improvements	Total Cost of Improvements	Energy Cost Savings (2012)	Energy Savings (MMBTU, 2012)	Estimated ROI (Based on 2012 Results)	Estimated Payback Period (Yrs, Based on 2012 Results)	Weatherization Completion Date	Funding Source
Grafton	Town Hall	Exterior Walls: R5 to R15 Flat Attic: R5 to R52 Air Sealing: 27% reduction	\$19,721	\$1,560	62.7	7.9%	12.6	Apr-11	State
Londonderry	Town Offices	Flat Attic: R8 to R50 Replace Bathroom Fan Air Sealing: 30% reduction	\$9,995	\$1,478	59.4	14.8%	6.8	Oct-11	State
Marlboro	Town Offices	Foundation Walls: R1 to R16 Flat Attic: R25 to R50 Air Sealing: 37% reduction	\$7,762	\$757	30.4	9.8%	10.3	Apr-11	State
Newfane	Town Offices	Front Attic: R22 to R63 Back Attic: R18 to R40 Air Sealing: 15.3% reduction	\$9,495	\$2,649	106.3	27.9%	3.6	Oct-11	State
Windham County	Superior Court-house	Foundation: R1/R5 to R19/R23 Attic Floor: R26 to R48 Installed storms on windows at Installed (2) Programmable Air Sealing: Reduce by 40% Replace (4) flourescent fixtures with T8 bulbs New boiler	\$36,192	\$5,572	223.8	15.4%	6.5	Jun-11	Federal
	Sheriff's Office Building	Windows: Install storms on 12 windows Attic: R5 to R49 Air Sealing: 20% reduction T-12 fixtures to T-8 fixtures	\$27,750	-	-	-	-	Jul-12	Federal
Putney	Town Hall	Foundation: R2 to R12 Attic: R10 to R50 Air Sealing: 42% reduction	\$16,470	\$712	28.6	4.3%	23.1	Oct-11	Federal
Weston	Town Garage	Attic: R20 to R60 Air Sealing	\$1,589	\$1,465	58.8	92.2%	1.1	Apr-11	Federal

The Weston Town Garage also saw a significant improvement in heating costs after their weatherization improvements were completed. During 2010, the building used 1,239.2 gallons of fuel. Post-weatherization improvements, this building used 803.3 gallons of heating fuel during 2012. Adjusting for heating degree days, this meant a 31.8% improvement in fuel oil usage for the building. This project nearly tripled its expected annual cost savings, with a total annual cost savings of \$1,465 for 2012. At this rate, the project has already paid for itself!



Keeping your Town's Investment Successful

Once you have completed all the weatherization upgrades and have an improved, energy efficient building, it is important to follow a few steps in order to capitalize on the investment you have made for your town. First and foremost, be sure to bring all of the building users up to speed on the improvements that have been completed. Make them aware of the improved insulation and air sealing measures that have been taken. Encourage building users to keep the heating temperature in a reasonable range given the new improvements. Also, use this update as an opportunity to review common sense energy saving practices such as remembering to close storm windows in the winter and turning down the heat in the building outside of office hours. Consider installing programmable thermostats so that these practices can be handled automatically. These may seem like small details, but these practices could mean big differences for the return you receive on your investment.

Another important step to follow up on is the final test out of the building and utility bill tracking. The final test out simply involves another blower door test and may include additional thermal imaging, like the ones completed in the original energy audit. The blower door test provides data on the measured improvements to the air infiltration rates of the building following the weatherization project. Thermal images can show specific improvements in locations where insulation was installed by showing a reduction in temperature extremes on the outside surface. These tests provide hard data on how well the weatherization project fared for your building. However, it is important to know that this data alone can only help estimate the reductions in utility costs for your building. It is up to your staff to take advantage of these improvements, as noted above, and be conscious of the heating energy bills for the following year. Tracking this information will display the real benefits of your investment, and this information should be shared along with your town's experiences. One website available to help your town track its current and future energy use is the ENERGY STAR Portfolio Manager found at: http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

And that point brings us to the last recommendation for success: Publicize your project's success! Let your community members know what steps you have taken to help reduce both the energy needs of your municipal buildings and the costs they impose on the tax-paying community. Hold informational meetings on what has been accomplished and your town's experience with the weatherization process. Analyze the results of the subsequent year's energy bills to rate the improvements you selected for your building. Perhaps consider making additional weatherization upgrades that will result in even better energy efficiency. But most importantly, use this as an opportunity to educate the community on what options are available to them for weatherizing their buildings, including businesses and private residences. The benefits of the weatherization process do not have to end with a single lower utility bill for the town. They can be snowballed into a series of successful building weatherizations for the whole community.

The Windham Regional Commission would like to thank the following individuals who helped bring this document together by contributing, reviewing, and sharing the benefit of their own experiences:

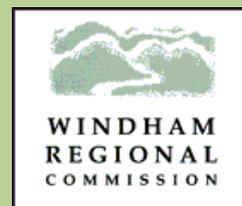
The WRC Energy Committee
Kate McCarthy, Vermont Natural Resources Council
Paul Markowitz, Efficiency Vermont
Bob Rueter, Thermal House
- and -
Chris Ryan, Town Manager of Putney



Completion of this document was possible through the American Recovery and Reinvestment Act. Funding for this project came from the Department of Energy's Energy Efficiency and Conservation Block Grant, via the Vermont Clean Energy Development Fund, Award #02240-AEECBG-MUN-002.



Londonderry Town Office



Windham Regional Commission
139 Main Street
Suite 505
Brattleboro, Vermont 05301
(802) 257-4547
<http://windhamregional.org/>