

Vermont Energy Efficiency Guidance: Homeowners DIY Energy Efficiency Tips

INTRODUCTION

The sustainability of our communities relies heavily on adapting our older buildings to meet the growing and changing demands of the present. When we reuse, adapt, and protect our older buildings we are valuing the embodied energy and craftsmanship and making an investment in our future and the future of the homes we love. This guide offers a way to unite our collective need to lower our energy usage while living comfortably, keeping waste out of our landfills, and saving the buildings that make Vermont such a unique and special place to live.

With roughly half of Vermont's housing being built before 1970, our older housing stock needs to be part of our plan to reduce our collective carbon footprint and our reliance on fossil fuels. Weatherizing and maintaining our older houses should be the first step in reducing energy usage and lowering operating costs. These small, low-cost/low-impact measures can have large results.

Embodied Energy is the amount of energy consumed in the process of making building products. This includes the harvesting, manufacturing, transport, and installation. Measured in Megajoules per Kilogram, the more processed a material is, the higher amount of energy needed to produce it. For example; plywood is 10.4 MJ/kg, cement is 5.6 MJ/kg, PVC is 80 MJ/kg, and hardwood is 2 MJ/kg. This energy usage can be converted to BTUs to show the energy equivalent, such as one gallon of gasoline is equivalent to the average production, transportation, and installation of eight bricks.

As with anything in preservation, we always want to start with the least intrusive methods and work up from there. We want to find the most cost effective and impactful methods and do those first before doing irreversible and costly upgrades. It is important to remember that this work can be done in stages, monitoring progress, and assessing the potential impact of further action.



FRAME OF MIND

When weatherizing or altering your older building it is important to think about three main topics:

Reversibility- How will the alterations made today permanently impact the building and the materials? We have to think about the long-term effects of alterations and products used in weatherizing our buildings. For example: applying waterproofing or spray foam on masonry will permanently alter the way the material breathes and dries—expediting decay and potentially causing health risks for occupants. Most materials in older buildings are infinitely repairable but adding irreversible treatments could limit continued repairs and therefore starting the clock on when they will need to be replaced. **Always start with the least intrusive measure and work up and do a small test patch before applying widespread.** Remember, these buildings were here long before you, and will hopefully be here long after.

Breathability- Older buildings were meant to breathe. The movement of air insured the drying of materials and the circulation of healthy air for inhabitants. When vents and walls are improperly sealed, water and humidity is commonly trapped. This trapped moisture can expedite the decay of structural materials and cause mold to form—leading to what is commonly called **Sick House Syndrome**. Before sealing vents or applying vapor barriers be sure to understand how your building breathes. When in doubt, contact an expert in HVAC and building construction. For more information on Sick Building Syndrome: https://www.epa.gov/sites/production/files/2014-08/documents/sick_building_factsheet.pdf

Maintenance- When getting recommendations on weatherizing and making energy upgrades to your older house, it is important to question what is being sold. Recommendations for new

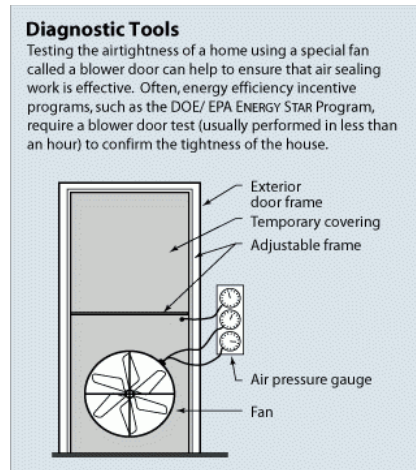
windows and new materials may just be an attempt to sell you something new, not necessarily better. Older windows were not designed to be leaky but to be infinitely repairable. A restored single-pane window with a properly installed storm window is as efficient as a double-pane window, it just requires periodic upkeep. The same can be said for a number of historic materials in your house. **Learn to repair before you replace. Learning to properly care for your older building will ultimately cost less, retain the building's historic features, save energy, and keep materials out of the landfills.** A guide for maintenance: <https://www.nps.gov/tps/how-to-preserve/briefs/47-maintaining-exterior.htm>

PLANNING

Measure twice, cut once applies to more than you might think.

Before beginning any weatherization project, it is best to have a plan. Background information on your building and an understanding of what steps will save on costs and time.

- Knowing what style, approximate age, and condition of your building and its materials will help inform what steps should be taken. For example: insulating a balloon-framed house is done differently than a platform-framed house.
 - For more information on learning about your building:
 - Vermont Division for Historic Preservation
<https://accd.vermont.gov/historic-preservation/identifying-resources>
 - University of Vermont-Historic Preservation Program-
https://www.uvm.edu/landscape/dating/residential_architecture/architectural_styles.php
 - Historic New England-
<https://www.historicnewengland.org/preservation/for-homeowners-communities/your-old-or-historic-home/architectural-style-guide/>
 - *A Field Guide to American Houses*-Virginia and Lee McAlester
- One of the earliest steps in increasing the efficiency of your older home is creating a roadmap to energy upgrades. Contacting a professional to conduct an energy audit of your home will help highlight the problem areas that should be tackled first.
 - Efficiency Vermont-
<https://www.efficiencyvermont.com/services/energy-assessments/home-energy-assessments>

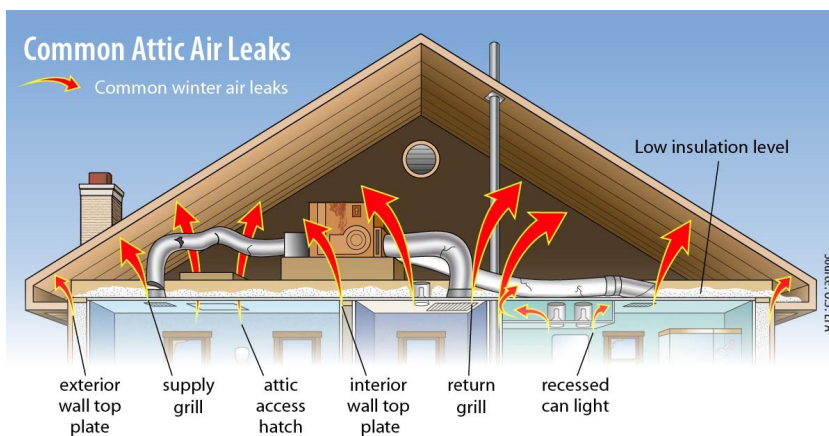


WEATHERIZING

Always start with the small and non-invasive steps and move up as needed.

Always test a new material or product on a small section or on a sample before applying widespread.

Sealing air drafts and gaps is an easy way to reduce the loss of conditioned air and increase the comfort of your home. Simple tasks like applying a bead of caulking or adding weather stripping can save an estimated 10% on your heating and cooling bill.



- Apply caulking to gaps around windows and doors, where the bottom sill meets the foundation, and around utility penetrations (gas, electric, dryer vents, cable, telephone, etc.). Spray foam should be used sparingly and in select situations due to its potential to cause irreversible damage to historic materials or diminish the drying potential in wall cavities.
- Insulate or block unused mail chutes.

- Install or replace weather stripping on exterior doors. Most weatherstripping is intended to be replaced as the material deteriorates. Inspecting and replacing weatherstripping as needed should be part of a routine maintenance schedule.
- Seal chimney flues if not being used.
- Add backer-rod or insert fiber insulation in larger gaps.
- Install foam socket seals behind electrical outlets.
- For more information on air sealing:
 - <https://basc.pnnl.gov/checklist-focus/air-sealing>
 - https://www.energy.gov/sites/prod/files/guide_to_air_sealing.pdf

INSULATION

Before adding insulation or a vapor barrier, be sure to know how your building breaths and where moisture will condense. The health of your building and your family depends on it!

Older buildings can have no insulation or be loosely insulated with anything from newspaper, corn cobs, or bricks. Properly insulating an older house can have the greatest impact on your energy loss, but there are several things to consider before starting an insulation job.

- Begin insulating your house in areas that are easily accessible and do not require destroying building materials like plaster, wallboard, or siding. Some of the easiest places to begin are in unfished attics and crawl spaces.
- There are several types of insulation and they can all serve different purposes. It is recommended that owners of older buildings are cautious when considering using spray foam due to its permanence and possible negative effects on building materials.
 - For information on the types of insulations:



<https://www.energy.gov/energysaver/weatherize/insulation/types-insulation>

- Always air seal gaps and cracks before installing insulating. A quick trick to finding air leaks under old fiberglass is to look where the fiberglass is dirty and has acted like a filter.

- Other considerations like how much insulation, what to do with old insulation, and limiting moisture problems can depend on your specific situation.
 - Efficiency Vermont is a great resource for all weatherizing and insulation question: <https://www.efficiencyvermont.com/tips-tools/guides/a-homeowner-s-buying-guide-to-insulation>
 - A brief guide to insulating you house can be found here: <https://www.oldhouseonline.com/repairs-and-how-to/7-insulation-tips>
- Contact a professional before adding insulation to walls, sealing vents, or adding vapor barriers, all of these actions could have serious repercussions.
 - There is testing and modeling available that can make specific recommendations regarding insulation and breathability. For more information, contact Efficiency Vermont.
- Before removing or disrupting existing insulation, know what type of insulation it is. Many older houses can have vermiculite with asbestos or other harmful materials.

Picking the right insulation and where to apply it can be a difficult decision. The following guide provides a brief overview of the options and where they are best suited for.

INSULATION TYPE / MATERIAL		COST	PERFORMANCE & COMMENTS
RIGID / BOARD	Polyiso (Polyisocyanurate)	High	High insulating value for relatively little thickness.
	EPS (Expanded Polystyrene)	High	Can block thermal short circuits when installed continuously over frames or joists.
	XPS (Extruded Polystyrene)*	High	An effective vapor barrier.
	Mineral wool (semi-rigid board, rock or slag)**	High	Foil-faced mineral wool and fiberglass when taped provide an interior vapor barrier.
BLOW-IN (loose or dense-fill)	Cellulose	Low to Moderate	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
	Mineral wool (rock or slag)**	Low to Moderate	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
	Fiberglass (formaldehyde-free recycled content)	Low to Moderate	Energy performance of cellulose fill is comparable to high-density fiberglass batts, and more effective than batts at controlling air leakage and convective and radiant heat. Cellulose can have high recycled content, very low embodied energy, and low/no-toxicity fire retardants.
SPRAY FOAM (low density)	Icynene™ Soy Cementitious foam (Aircrete) Polyurethane Foam (closed-cell)*	Moderate to High	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
BLANKET (batts & rolls)	Mineral wool (rock or slag)**	Low	Suited for standard stud and joist spacing, which is relatively free from obstructions.
	Cotton	Low	Suited for standard stud and joist spacing, which is relatively free from obstructions; low- or no-toxicity fire retardant.
	Cellulose	Low	Can have high recycled content, very low embodied energy, and low- or no-toxicity fire retardants.
	Fiberglass (formaldehyde-free recycled content)	Low	Does not provide the degree of air seal that blown cellulose does.

Source: Based on DOE EERE EnergySavers.gov

WINDOWS AND DOORS

Repair before you replace and keep your building's historic features out of the landfill.

Reglazing windows was once considered a routine homeowner maintenance task. Now homeowners are quick to remove 100-year old solid wood windows for vinyl replacements with a 20-year life expectancy. Before replacing windows, it is best to know all of your options.

Windows

Older solid wood windows require maintenance but are infinitely repairable. Even without proper care and protection, the lifespan of some window putties is equal to that of new replacement windows.

- Learning just a few basics of window maintenance can prolong the life of your windows indefinitely.
 - For a step-by-step guide to reglazing windows:
 - <https://www.nps.gov/tps/how-to-preserve/briefs/9-wooden-windows.htm>
 - <https://www.popularmechanics.com/home/interior-projects/how-to/a8043/how-to-reglaze-a-window/>.
 - <https://thecraftsmanblog.com/how-to-restore-old-windows/>
- Most heat loss occurs around the perimeter of a window, through infiltration rather than through the actual glass. Therefore, keep seals tight and in good repair. Also, check sealant at all window muntins.
- Keep exterior surfaces painted, including putty, with durable, low VOC [volatile organic compounds] exterior grade, paints.
- Add weather stripping to your windows to increase efficiency as much as 50%.
- Use exterior or interior storm windows in the winter as studies show that a window fitted with a storm window can last longer and be just as energy efficient as replacement windows. Note: Interior storm windows need to be monitored at the start of winter for trapped humidity between the panels.
- Check the lock on the window – the lock is important in ensuring that the rails and sashes are held together tightly, reducing air infiltration.
- If glass in historic windows needs to be replaced, consider Low-E glazing that reduces heat transfer through glass and can be more energy efficient than regular glazing.
- Those pieces of wood on the sides of the jamb that abut the lower sash are called window stops, they may even have screws and washers to easily manipulate the stop. Stops were intended to be moved in or out to allow the sash to move freely or to form a tight seal against the parting bead. In the winter, push the stop tightly against the sash to air seal the window.
- Draft blockers or window snakes are a cheap way to limit air leaks and drafts.
- Safety Note: Always practice lead safety when working with older windows or painted materials. http://www.leadSAFEvermont.org/download/Field_Guide.pdf



Weatherstripping can come in many different forms and styles. Some is applied seasonally, and some can be permanent. For more information on the pros and cons of the different types of weatherstripping visit [The Department of Energy's website](#)

Storm Windows

- Properly installed storm windows on the exterior or interior of single-pane windows can have an equal efficiency rating to new windows.
- Storm windows can come in many different types or styles. custom wood storm windows that are weather stripped provide increased protection and are in keeping with the historic character of 19th century homes. There are also high-quality metal storms that are design with low profiles and clean lines for better aesthetics over a standard triple track aluminum storm.
 - For a guide to installing storm windows:
 - <https://www.energy.gov/energysaver/services/do-it-yourself-energy-savings-projects/savings-project-install-exterior-storm>
 - <https://www.encyclopedia.com/energy/savings-projects/savings-project-install-exterior-storm>

Doors

- Doors should be treated similarly to windows, proper maintenance and installing storm doors can greatly increase efficiency.
- Wood stops on door jambs should be adjusted to properly sit against door.
- Install or replace existing weather stripping to form an airtight seal.

- Adjust striker plate and tab/tang to ensure a solid close.
- Add a sweep at the bottom of door to decrease draft.

APPLIANCES and TECHNOLOGY

Upgrading to energy efficient appliances and heating units is an effective way to lower your energy usage while maintaining occupant comfort.

- Before spending thousands on insulating walls, consider investing in an efficient heating unit or water heater.
 - <https://www.encyvermont.com/products-technologies/heating-cooling-ventilation>
- Smart technology like thermostats and lighting can help monitor and lower your energy usage,
 - <https://www.encyvermont.com/products-technologies/smart-homes>
- Replacing florescent light bulbs with LEDs and installing water saving fixtures can incrementally lower energy usage.

DIY HOMEOWNER ENERGY EFFICIENCY CHECKLIST

Air Sealing-Caulk

- ☐ Door and Window Trim-Interior
- ☐ Door and Window Trim-Exterior
- ☐ Utility Penetrations (gas, electric, cable, etc.)
- ☐ Outdoor Faucets and Sill Cocks
- ☐ Soffit Trim
- ☐ Seam of Sill and Foundation

Air Sealing-Other

- ☐ Foam Pad Behind Electrical Outlets
- ☐ Repointing Small Holes in Foundation
- ☐ Gaps in Attic
- ☐ Closed Fireplace Damper when Not in Use

Windows and Doors

- ☐ Applied Weather Stripping or Sweeps
- ☐ Tightened Window Stops
- ☐ Made Window Hardware Operational
- ☐ Installed Storm Windows Tightly with Weather Stripping
- ☐ Reglazed Windows or Door Glazing

Insulation

- ☐ Installed Insulation in Unfinished Attic or Crawlspace
- ☐ Insulated Rim-Joist in Basement

Appliances and Technology

- ☐ Installed Energy Efficient Light Bulbs, Smart Thermostat, and Appliances
- ☐ Upgraded Heating Unit or Water Heater

Safety and Preservation Considerations

- ☐ Identified the Style, Age, and Condition of Building
- ☐ Conducted Energy Audit of Building
- ☐ Utilized Inherently Efficient Building Features (shutters, storm windows, shade trees, etc.)
- ☐ Did Not Seal Roof or Soffit Vents
- ☐ Did Not Insulate Walls Before Contacting Professional
- ☐ Did Not Apply Damaging Products to existing Materials
- ☐ Did Not Apply Vapor Retarder or Waterproof Shield Before Contacting Professional.