Energy Conserving Features Inherent to Older Buildings

White Paper, May 2021
Prepared in cooperation by the Preservation Trust of Vermont and Vermont State Historic Preservation Office.

Before automated temperature controls and oil furnaces became the norm, Vermonters relied on manual and passive tools to regulate heat, manage moisture, and conserve energy. This guide is intended to remind us of the inherent energy saving features of older buildings and how those features could be used today to reduce our carbon footprint.

- ***Inherent Energy Efficient Features:*** *Existing characteristics of design and construction that play a role in how buildings perform, such as operable shutters, porches, roof overhangs, window blinds/curtains, exposed masonry walls, shade trees and landscaping, interior floor layout, and roof venting.*

From the monumental architecture of Greece in the 9th century to the contemporary modern house of the second half of the 20th century, whether its folk housing or high styled, the built environment has traditionally responded to regional energy efficiency needs through architectural design, material choices, construction methods, siting, and landscaping. The classic New England Saltbox with its long rear roof were intentionally oriented to face the warm southern sun, allowing the cold northern wind to move up the sloping rear roof and travel over the building. Coniferous evergreens at the rear helped block the winds. The large hearth standing in the middle of the house served as a thermal mass, holding the heat within the surrounding rooms. Shutters acted as solar dampers by allowing sunlight in during the winter and blocking the direct heat of the sun during the summer, as well as providing protection during storms. The Queen Anne-style dwellings of the late 19th century were wrapped in porches providing sheltered outdoor living, while also protecting windows and interior fabrics from direct sunlight. The tall brick chimneys provided warming fireplaces to multiple rooms on several stories. The 20th-century ranch house was compact with the single roof trimmed by wide overhanging eaves to shield expansive picture windows from the sun's heat. Private spaces like bedrooms and bathrooms were darkened by small windows that allowed less cool evening air to disturb one's sleep. Landscaping was intrinsic to the ranch house design with deciduous shade trees planted to offer shade while allowing sunlight to filter through.

Historic building types and style, like the classic saltboxes of New England, were designed and oriented to maximize solar gain and reduce wind chill. Printed in "Energy Efficiency, Renewable Energy and Historic Preservation: A Guide for Historic District Commissions."

Understanding and preserving the energy efficient features fundamental to the original design and construction methods of older buildings can save money, energy, effort, and time. Before making major changes, or investing in efficiency upgrades, it is best to understand how older buildings historically managed energy consumption and occupant comfort, especially because one positive

change can negatively affect other systems. Taking a whole-building approach to construction projects and weatherization will boost comfort and lower energy bills in a safe and healthy way.

The National Park Service provides guidance for improving energy efficiency in older buildings. https://www.nps.gov/tps/how-to-preserve/briefs/3-improve-energy-efficiency.htm

Vegetation

Shade trees and bushes block direct sunlight in the summer, providing an inexpensive way to cut down on air conditioning.

- Place plants on the southern and/or western sides of the building to block the hot afternoon sun.
- Ensure that vegetation is placed at an adequate distance from the building to allow airflow between the structure and the plant. Plantings too close to buildings can deny wet siding the opportunity to dry naturally and will accelerate paint loss and cause wood rot.
- Shade trees and bushes should be deciduous with the shedding of leaves annually to allow sunlight to heat buildings during the winter.

This large sugar maple and wrap-around porch provide shade. Courtesy of the Preservation Trust of Vermont.

- Evergreens can be planted to block cold winds.
- For a Vermont Tree Selection Guide, please visit: https://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Community_Forests_and_Trees/Library/VTTree%20Guide.pdf

This deep covered porch provides shade for the family and the interior. Courtesy of the Library of Congress LC-H824- 2867-002-x

Porches, Awnings, and Overhanging Roofs

Porches, awnings, and overhanging roof eaves are not merely architectural details but are time-tested elements designed to allow the lower winter sun to penetrate windows while blocking the intense high summer sun. Prior to air conditioning, sleeping porches were a common way to escape the stifling heat of upper-floor bedrooms. Interior rooms were sheltered by the deep roofs of porches and awning, hiding them from the direct sunlight that can intensely heat spaces and quickly fade fabrics. The depth of a porch, size of an awning, and overhang of the eaves should be considered before making any alterations.

- Examine the design of the porch and its seasonal relationship to the sun.
    - Removing a porch could bring the seasonal weather directly into the building.
    - Enclosing an open porch with framing or windows could block the sun in the winter, not allowing for passive solar heat to enter the building and warm the adjacent interior rooms.
    - Traditionally an open space to be used in summer months, a porch requires insulation and heating if enclosed to provide four-season living space.
- Retractable or seasonal awnings temporarily block the sun on hot days but allow for full sunlight in colder seasons.
- Deep roof overhangs and soffits project the drip edge farther away from the house to manage water flow and provides additional shading from the summer sun.
- A history and preservation guide to porches, including considerations for alterations, can be found here: https://www.nps.gov/tps/how-to-preserve/briefs/45-wooden-porches.htm

Thermal Mass and Masonry

Thermal mass is the ability of a material to absorb and store energy. Appropriate use of thermal mass throughout an older building can make a difference in comfort and energy bills. Masonry materials like brick and stone used to construct houses, foundations, and chimneys have incredible thermal properties enabling the absorption and slow release of heat and cold. Acting like a thermal battery, masonry can take in heat from the sun on clear winter days and diffuse that heat throughout the night. Similarly, brick and stone can absorb cold to regulate internal temperatures by averaging day-night extremes. Poor maintenance of natural thermal mass like masonry can exacerbate the worst extremes of the climate and accelerate deterioration of materials. The absorption of water and the inability to dry are the biggest factors to deterioration of masonry.

The stone mantel around this fireplace will retain heat and warm the room long after the fire has gone out. Courtesy of the Library of Congress LC-B2- 5495-17.

- Ensure water cannot get trapped in masonry when insulating or adding a vapor barrier.
- Insulating or covering exposed masonry can deny the dispersal of stored thermal energy.
- Maintain mortar joints and keep vegetation away from exterior masonry.
- Understand where the chimney is located and how it can be utilized to serve as thermal mass for the entire building.
- Open fireplaces and flues are a source of heat loss. Consider upgrading the flue damper, professionally blocking the interior opening, or capping the top of the chimney if not in use.
- Explore installing a wood- or pellet-burning insert that maintains ambience while boosting efficiency.
- More information on the thermal properties of masonry can be found here: https://www.yourhome.gov.au/passive-design/thermal-mass

Operable Shutters

Exterior shutters are integral to the architectural design of many houses. For centuries, operable shutters kept house warm in the winter and well-ventilated in the summer. They protect from rain, sleet, ice and snow, hurricanes, and the hot summer sun. When open, the louvers on the shutters should be facing up, when closed the louvers should be facing down, allowing rainwater to be shed away from the building. With the modern use of air conditioners and storm windows, exterior shutters have become an aesthetic design detail, often inoperable and firmly affixed to siding.

Operable wood shutters with shutter dog, framing removeable storm windows. Courtesy of the Preservation Trust of Vermont.

- Shutters should be closed during hot summer days to block sunlight and on cold winter nights to hamper howling winds.
- Storm shutters are called that for a reason, they can block driving rain and snow that speed up decay and rot from reaching windows.
- Keep or allow shutters to be operable by removing any fasteners that pin them to the building. Replace missing hardware that keeps them open or shut.
- Shutter dogs on the exterior surround of a window signal the one-time existence of operable shutters. Also referred to as stays or tiebacks, shutter dogs are functional (and decorative) fasteners to secure shutters in place when open.
- A guide to caring for wood shutters can be found here: https://architecturaltrust.org/preservation-by-prevention-caring-for-your-historic-wooden-exterior-shutters/

Storm Windows

Used since the 18th century, traditional and well-fitting storm windows when installed and maintained properly can diffuse cold air that accesses aging windows. Storm windows provide a barrier to wind, snow, and anything else winter throws at your house. Typically applied to the exterior of a window, storm windows also protect the glazing and paint on operable windows—providing long-term cost savings. The modern insertion of screens enabled ventilation of fresh air minus the admittance of bugs.

Wood storm windows fit tight around the window opening and can easily be removed. Courtesy of the Preservation Trust of Vermont.

- Properly fitting storm windows and maintained windows can be as efficient as modern replacement windows.
- Ensure that storms are weather-stripped and fastened tightly.
- Removable storm windows should be installed for protection during colder months.

- Some storm windows are hinged on the top and pop out using specialty hardware during the summer.
- Storm windows with a virtually invisible layer of low-e glass reflect infrared heat back into the building, improve the window's insulation ability, and limit damage from ultraviolet rays that cause fading of interior furnishings and fabrics.
- Interior storm windows are an alternative to exterior storms, providing protection against infiltrating cold air. Ensure that interior storms have unobstructed weep holes to allow for airflow in space between windows.
- More information on storm windows can be found here: https://www.ci.independence.or.us/sites/default/files/fileattachments/historic/all_about_storm_windows.napc_.pdf

Roof and Soffit Vents

Before air conditioning, dehumidifiers, and whole-house balanced ventilation systems, homeowners relied on the movement of air to cool their houses. The collection of hot and humid air can be detrimental to building materials, shorten the lifespan of roofing, and make upper floors untenable in warm weather. The rot, mold, and humid air that can accumulate in unvented houses can have serious health repercussion. Warm air lost through air leaks in the attic floor combined with lack of adequate attic ventilation is the leading cause of ice damming in the winter. Builders addressed the situation by installing vents in gables and soffits. The vents allow air to move, providing an escape for hot and humid air and increasing the circulation of cooler air from the lower stories of the house. Soffit vents bring air from under the eaves through the cavity between roof rafters, and out through either a gable vent or a ridge vent.

Gable end attic vents hold louvers. Courtesy of the Vermont State Historic Preservation Office.

- Contact an expert in heating/ventilation/air conditioning (HVAC) before altering or remove any vents.
- Understand how your roof is already vented or insulated before covering or removing gable vents.
- Do not paint over soffit vents or obstruct the interior space between rafters.
- Do not cover vents with siding as that minimizes airflow.
- Augmenting gable vents with fans can increase air circulation.
- A guide to properly venting buildings can be found here: https://www.wisconsinhistory.org/Records/Article/CS4284

Interior Design for Energy Efficiency

Interior design and user behavior greatly impact the inherent features of old buildings to provide comfort. Our ancestors utilized seasonal-weight curtains, placed carpets on the walls, opened transoms, closed doors, arranged furniture around warming fireplaces, and moved to porches in the hotter months. Witch windows (also called coffin windows or Vermont windows) are diagonal-

placed window openings commonly found in stairways or over additions to bring light into dark spaces and allow for heat to escape during the summer. Although many of these features may seem antiquated and remnants of the past, we can still learn and utilize their usefulness.

- Interior shutters, blinds, and curtains can be opened and closed to effectively control sunlight in the summer and block heat loss during the winter.
- Transom and interior windows allow natural light and airflow.
- Warm air flues are occasionally found on the sides of chimneys and allow for the movement of air through buildings. Many of these ducts have been converted to mechanical or electrical chase ways. Restoring their function can improve the comfort throughout the house.
- Floor vents that allow heat to rise between levels have long been used to help distribute heat.
- Steam radiators need ample room for heat to circulate.
- In the winter, think about what rooms need to be heated and at what time of day. Use doors to keep heat in the most utilized spaces. In the summer, open doors and windows allow for air circulation.

Further Information and Research

- National Park Service-Technical Preservation Services has a wealth of information on preserving older and historic buildings.
  - https://www.nps.gov/tps/how-to-preserve.htm
  - https://www.nps.gov/tps/sustainability/energy-efficiency.htm
  - https://www.nps.gov/tps/how-to-preserve/briefs/3-improve-energy-efficiency.htm

- In conjunction with the Department for Housing and Urban Development, the National Park Service developed a list of energy conserving features in historic houses. https://www.nps.gov/tps/sustainability/greendocs/conservation-features-older-homes.pdf

- The Secretary of the Interior has produced guidelines for upgrading the energy efficiency of older and historic buildings. https://www.nps.gov/tps/standards/rehabilitation/sustainability-guidelines.pdf

- Advisory Council on Historic Preservation: Energy Conservation & Weatherization. https://www.achp.gov/initiatives/sustainability-climate-resilience/energy-conservation-weatherization

- Advisory Council on Historic Preservation: Sustainability and Historic Preservation. https://www.dahp.wa.gov/sites/default/files/209SustainabilityStudy_ExecutiveSummary.pdf

- *The Source of Sustainability: Inherent Energy Saving Features of Historic Buildings* (Frances L. Britton, 2008). https://getd.libs.uga.edu/pdfs/britton_frances_l_200805_mhp.pdf

- *Changing Mindsets: Sustainable Design in Historic Preservation* (Jennifer L. Buddenborg, 2006). https://ecommons.cornell.edu/bitstream/handle/1813/3388/Buddenborg%20-%20MA%20Thesis.pdf?sequence=1&isAllowed=y

- Energy Efficiency, Renewable Energy and Historic Preservation: A Guide for Historic District Commissions. https://www.thc.texas.gov/public/upload/cacp_enrgyefcnygd_0.pdf

- Efficiency Vermont. https://www.efficiencyvermont.com/products-technologies

- The Vermont Division for Historic Preservation https://accd.vermont.gov/historic-preservation/planning/building-efficiency

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The Improving Energy Efficiency in Vermont's Older Buildings Study, inaugurated in 2020, has been financed in part with federal funds from the National Park Service, U.S. Department of the Interior. The contents and opinions do not necessarily reflect the view or policies of the Department of the Interior.