

The ALLIANCE REVIEW

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NEWS from the NATIONAL ALLIANCE of PRESERVATION COMMISSIONS

INSIDE THIS ISSUE

How Old Buildings Were Designed to Work

Bob Yapp

Whole House Considerations: Why Today's Decisions Compound Tomorrow's Problems

Robert Cagnetta

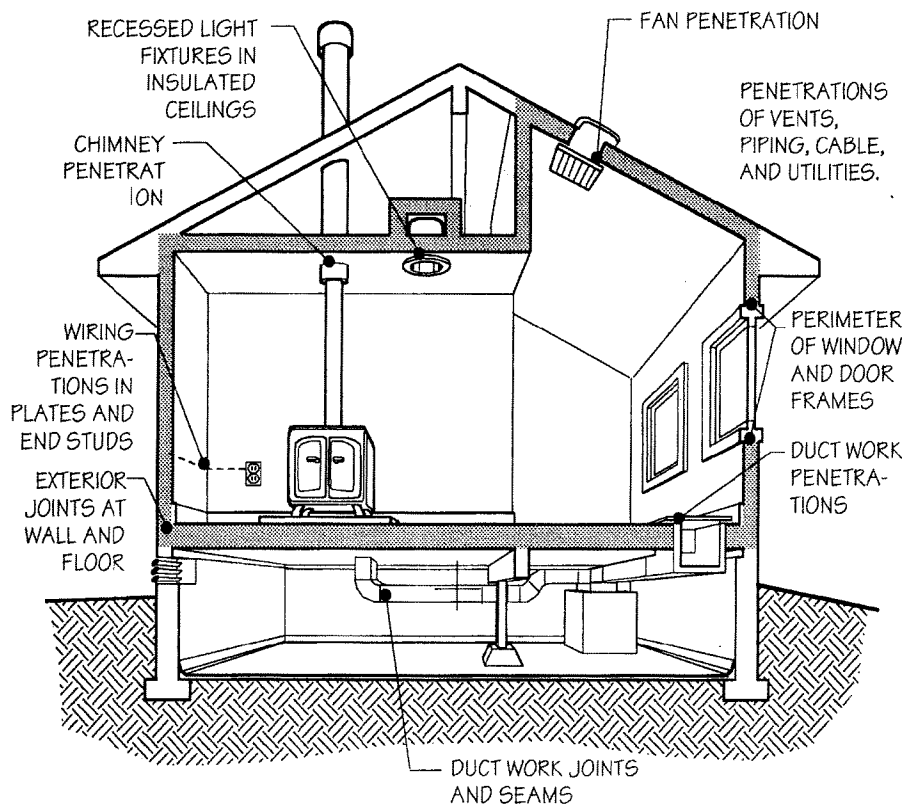
Energy Efficiency and Historic Homes are Not Enemies

Joy Sears

Incentive Programs for Weatherization

Caitlyn Oshida

Weatherization



What every Commissioner Should Know

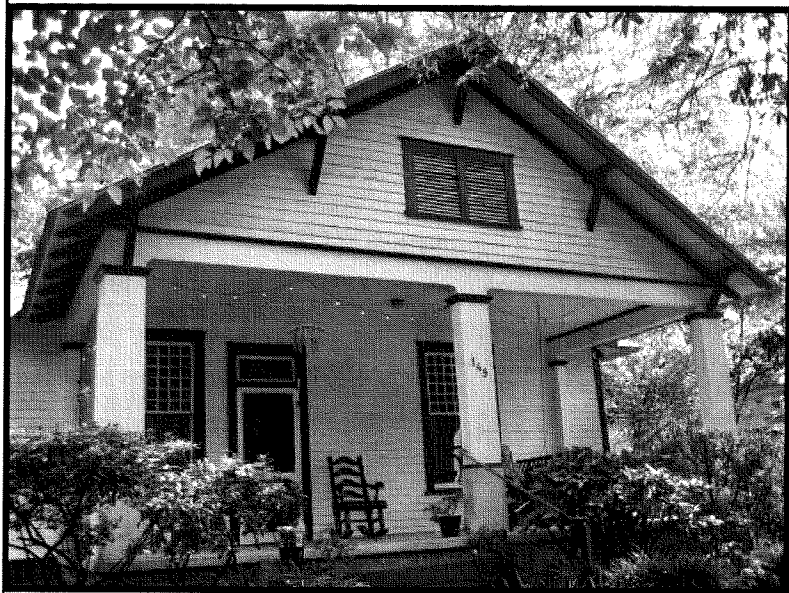
...and IN EVERY ISSUE:

Heads Up!

State News

HOW OLD BUILDINGS WERE DESIGNED TO WORK

Robert Yapp, Belvedere School for Hands-on Preservation



Above: Wide eaves and deep porches were designed to manage the sun in both the summer and winter.

Below: The moveable upper and low sash in traditional double-hung windows draw heat out of the house and let cool breezes in.
NAPC file photos



As I work with and train historic preservation commissions I find that many, if not most, are unintentionally buying into the replacement product industry's mantra that the only way to be energy efficient is to replace the old systems. I call this the big lie. Remember, they call them replacement products because you have to keep replacing them over and over again.

Contrary to what most folks believe about energy efficiency, most old houses and buildings were designed to take advantage of the weather.

Eaves

From the early Victorian era Italianate and Second Empire styles through the Arts & Crafts era (1900 to 1930), wide overhanging eaves were the norm. This feature even continued into the recent past with California ranches. While this element is attractive and allowed for brackets, corbels and later, exposed rafter tails, the original idea was

strictly to manage the sun. In the winter, when the sun is lower in the horizon, sunlight bypasses the wide eaves and comes in through the windows. In the summer, when the sun is high in the sky, the wide eaves help keep the blazing sun from directly bearing down on the inside of the structure. Brilliant? Well, not really. For thousands of years enlightened builders have understood this concept.

Windows

Early builders and architects knew that creating good ventilation was critical to the success of any building. Without cross-ventilation these early structures would have been unbearable to live or work in. Air conditioning as we know it was not available or affordable in this country until the late 1950s and early 1960s. In a way, this introduction was the beginning of the end for our collective knowledge about how our homes were intended to be used.

Double hung windows (one window sash on top and one on the bottom) are the most popular type in the United States and it appears they started showing up in Europe in the late 1400s, primarily as an early air conditioning system. Vintage double hungs have two window sashes that move up and down utilizing a counter balance system with a cast iron weight, and a pulley and rope to connect the weight to the side of the window sash. If you lower the top window sash three inches and raise the lower sash three inches a very interesting thing happens. The heat and humidity leaves the house through the top gap and cooler breezes enter the house through the lower gap.

Now, most of us wouldn't give up our air conditioning, but in most climates when we use our windows in this fashion, we really don't have to turn on the air conditioning until July and it goes off in mid-August. Most property owners can save between 10% and 25% on summer electricity bills without sacrificing much comfort to do so.

In most pre-1960 homes with wood windows, there is also a storm window that protects them. Part of the reason we don't use our windows as air conditioning systems is that we replaced the original wooden storm windows with aluminum, self-storing storms. Folks just got tired of climbing up and down ladders in the spring and fall to switch out glass storms with screen storms. Whoever invented these aluminum storms did so because of this fact.

The problem with this design is that there is only a screen on the bottom and so everyone painted their top window sashes shut. Not only did this stop people from using their double-hung windows as air conditioning, the windows got much less use and people didn't pay much attention to maintenance issues.

One of the primary problems I have with new double paned (insulated glass) windows—wood or vinyl—is they have no storms. Your interior double hung units, old or new, were never intended to take a direct hit from the weather. From the 1400s until around the 1870s most windows had wooden storm shutters. Then wooden storms windows and screens were invented in favor of shutters. These were more practical than hassling with closing the shutters every time a storm was coming.

The good news is that there are now combination wooden storms that are either self-storing or have glass that can be taken out of the wood frame from inside the house. No more trudging up and down the ladder to change storms and screens twice a year. These storms also have full screens so your windows can be used as they were intended.

It will take a consumer 20 to 50 years to get any payback (saving enough energy to pay for the new windows) from replacement windows with double paned glass. A restored and weather-stripped original wood window with a wood or aluminum storm will be more energy efficient than a replacement double hung with double paned (insulated) glass. Considering the following statements in the window industries trade magazine, *Glass Magazine*, they make the case for restoration.

July 2001, *Glass Magazine*, By Editor, Charles Cumpston:

"The consumer's perception of glass is significantly different from the industry's. While some in the industry think a 15-year life is adequate, it is the rare homeowner who envisions replacing all his windows in 15 years."

Another *Glass Magazine* article from 1995 by Ted Hart states:

"Remember our industry, with rare exception, has chosen to hide the fact that insulating glass does have a life expectancy. It is a crime that with full knowledge and total capability to build a superior unit, most of the industry chooses to manufacture an inferior single-seal unit."

Single seal units are still the norm in plastic/vinyl and most stock wood windows with an average seal life of two to six years according to accelerated testing by the flat glass manufacturer, IG Cardinal. About 12 million replaced window sashes end up in our landfills every year. While most of these are original old growth wood sashes, more and more are windows less than 15 years old.

Consider that heat and air conditioning loss through windows accounts for only 12% to 15% of energy loss in a structure. This is a small percentage when you understand

Storm Windows: Wood versus Metal

Even though wood storm windows are more historically accurate for buildings constructed before the advent of aluminum storm windows, and even though they may provide greater energy efficiency because of wood's greater insulating properties, it may not always be realistic to require property owners to use them instead of aluminum models. Wood storm windows usually have to be custom-made, putting them outside of many property owners' budgets. Additionally, even if removable glass and screen inserts are used, wood storm windows require more maintenance than readily available aluminum models and some property owners may not be physically capable of doing it themselves and unable to afford to hire someone to do it for them.

Property owners who see wood storm windows as a long term investment, but are unable to make the financial commitment without taking out a second mortgage have some options. Local high school or community college vocational education programs may have woodworking classes whose instructors are willing to have them make the windows for a lower price than a craftsman in order to give their student valuable experience. Property owners with sufficient spare time and skills can make the windows themselves, thus greatly reducing the cost. The investment can also be spread out over several years, replacing two or three aluminum storm win-

dows a year until all of them have been changed gets the job done, but avoids a major hit to the wallet all at once.

Making the Most of Aluminum

If aluminum storm windows are used, they should be sealed with caulk, with care being given to not closing the ventilation points that prevent moisture condensation between it and the sash. Aluminum storm windows can also be painted a compatible color to make them less obtrusive. Property owners should be advised to keep them in good operating condition with regular cleaning and lubricating moving parts.

Below: Improper insulation techniques can trap moisture and act as an air filter, reducing the effectiveness of insulation. Photo courtesy of Robert Cagnetta



how air moves in a house. For most homes and buildings, you will never find a simpler, more cost effective and energy efficient window unit than an original weatherized, single paned, double hung window with a traditional or combination wood storm.

Walls

If your goal is to continue loving your old house or building and make it energy efficient while keeping your costs down, then you absolutely **don't** want to blow insulation into the sidewalls.

One of the top reasons for exterior paint failure, mortar deterioration, termites, mold, and structural damage to old buildings is cellulose insulation blown into the sidewalls. "Hey, wait a minute Bob, if we can't insulate the sidewalls, how can we afford to heat our old house?" That's a valid question, but you need to think of air movement in your house as if the house were a chimney. Heat loss happens primarily in an upward movement, like a chimney. So, I want you to insulate your attic space to the highest R-value for your region and be sure to allow eave ventilation. You should also friction fit craft-faced (paper faced) fiberglass batting—insulation or foam board into the box sills in your basement (the area where the beams or floor joists rest on top of the foundation). The craft face acts as a vapor barrier and should face the inside.

Building codes today require that when a new house or addition is built, it must have a vapor barrier. When a new house is going up, they frame the sidewalls and install exterior sheathing. Typically, the next step is to go inside and install fiberglass, batting insulation between the 2" x 4" or 6" studs. Before the drywall can be installed over this wall, 4 mm thick plastic sheeting must be laid over the insulation on the entire wall. That plastic sheeting acts as the vapor barrier. (Note: In most of the deep south, the vapor barrier generally goes on the outside of the house because of extreme exterior humidity.)

We create warm, moist air in our homes by cooking, taking showers, having plants, breathing, etc. That warm, moist vapor is attracted to the exterior walls. This vapor enters the wall through hairline cracks, outlets, switches, and window trim. In an un-insulated wall cavity, the moisture may condensate when it hits the cold surfaces in the wall. However, there is nothing to hold the moisture and there's enough airflow to dry it out quickly. In new construction, the plastic vapor barrier under the drywall stops the wet air from getting to the insulation and condensating.

In old buildings with plaster walls, there is no vapor barrier under the plaster so the wet interior air hits the insulation and condensates. This moistens the blown-in insulation making it a wet mass at the bottom of the wall cavity, and creating an inviting place for termites, mold, and dry rot. The moisture enters the exterior sheathing and wood siding causing

permanent exterior paint failure. Since the homeowner, for some "unexplained" reason, can't keep paint on the house anymore, they call the vinyl siding salesman. This makes the problem even worse as you now have a vapor barrier on the outside of the wall that stops the free exchange of air, trapping the moisture.

The other factor that must be examined is payback. Let's say you spend \$6,000 to have your old house walls insulated. In my experience you would probably save about \$200 per year on heating and air conditioning costs. So, it would take 30 years to recoup the money you spent on the insulation. Results and pricing can vary and this doesn't take into account the termites, dry rot, mold, mortar, or paint failure.

Foam insulation, whether closed cell, open cell, soy based, etc. is unproven. They claim "it won't shrink" but I have witnessed shrinkage in all of them after opening the walls a year after installation. The foam industries claims just aren't credible. Much of the formaldehyde-based foam that was installed in houses during the 1970s is now dust at the bottom of the wall when we open them today. The risk of foam expanding in the walls during and right after installation is real. This can cause the plaster walls and siding to bow and potentially cause structural damage. I've inspected thousands of old houses with blown-in insulation and over 80% of them have a wet insulation problem.

If your house is drafty then tighten it up. Weather-strip your windows and doors, keep the house painted and caulked well, insulate the attic and box sills. This will stop the air infiltration, make you more comfortable and **really** save money on utilities.

Again, the primary issue for energy efficiency is stopping air infiltration. There is no reasonable payback to blowing insulation into your sidewalls. This practice has truly been the ruination of many of our historic central city homes and buildings.

For more information go to the National Park Service website www.nps.gov and check Preservation Briefs No. 3 Conserving Energy in Historic Buildings and No. 24, *Heating, Ventilating, and Cooling Historic Buildings: Problems and Recommended Approaches*

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WHOLE HOUSE CONSIDERATIONS

WHY TODAY'S DECISIONS COMPOUND TOMORROW'S PROBLEMS

Robert Cagnetta, Heritage Restoration, Inc.

Historic buildings are each uniquely built, used, and worn. Property owners, designers, and builders manipulate and upgrade in their own way, where structures evolve and become their own. How we intervene in historic buildings needs to be individually assessed and individually remedied, using a diversity of professional input, so the best solutions are developed. The level of craftsmanship, maintenance, and quality of materials determine the longevity of a building, and many historic buildings have survived the true test of hundreds of years of operation. Modern materials and technologies each have their specific applications, where their application solely depends on the nature of the retrofit, reversibility, and long-term effectiveness. This article reviews and evaluates existing building dynamics, air-flow and moisture, insulation, efficiency retrofits, window and door restoration and replacements, liquid "permanent" coating and synthetic materials, and how they all apply to historic buildings.

Air Flow and Insulation

Historic homes have their own dynamic of airflow and moisture migration. Compounding issues of direct water and air infiltration, as well as a lack of properly designed air and moisture escape routes, make insulation retrofits challenging and potentially hazardous. Various types of insulation each have their advantages and disadvantages in their efficiency as well as their potential for reversibility. Increased efficiency of a house can be achieved through systematic retrofits, where the impact to the building's design and aesthetics can be minimal, and the energy savings and pay back maximized.

A house's envelope is designed to protect the occupants from the elements; each layer provides a specific function. The siding protects the frame. The sheathing makes the frame rigid and holds on the siding. The plaster and trim provide an air seal and clean finish for the interior of the house. Each component has an inherent r-value, or measured heat transfer, that resists the amount of heat loss and gain for the interior. Although when air freely migrates through these elements, it brings in moisture and makes the envelope lose or gain heat. The goal of installing insulation is to reduce the heat transfer. Yet insulation's efficiency becomes compromised with the movement of air, where trapped moisture conducts greater heat transfer and can cause mold and exterior paint failure. To ensure a proper insulation retrofit, a house must first be analyzed for excessive moisture and airflow. Issues such as loose siding, failed flashings, and excessive airflow must be mitigated prior to an insulation retrofit.

Many older homes lack an integrally designed air and moisture escape route, relying on cracks and leaks to exchange air. This air exchange allows a house to expel generated interior moisture, exhaust gases, and enable the building frame to dry out or stay dry.

When considering types of insulation, the primary concerns are:

- The building's overall health
- A planned air and moisture escape route
- Accessibility
- Reversibility
- Effectiveness

Existing conditions and accessibility are primary factors in choosing the type of insulation.¹ The most effective and responsible building efficiency solution is to seal air leaks. Exterior siding, trim and fenestration repairs, and storm windows and doors

¹ A great source for the types of insulation on the market today can be found at the U.S. Department of Energy's website: http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11510

can enhance comfort and keep a building healthy. Once the air seal is complete, the attic is the next place to start, then basements, and then walls. Too many buildings have their walls completed first, where airflow and moisture infiltration continues to cause significant reductions in efficiency and potential serious rot and mold damage.

Projects that reduce or eliminate airflow and moisture migration can seem "unproductive" without visible results, yet they are the essential factor towards a proper insulation retrofit. The walls of a house are typically where occupants feel air flow, so the natural reaction is to fill it. Windows suffer the same finger pointing. The industry created the least-effective solutions of fill and replace, with the reasoning that the most cost-effective solution is the best.

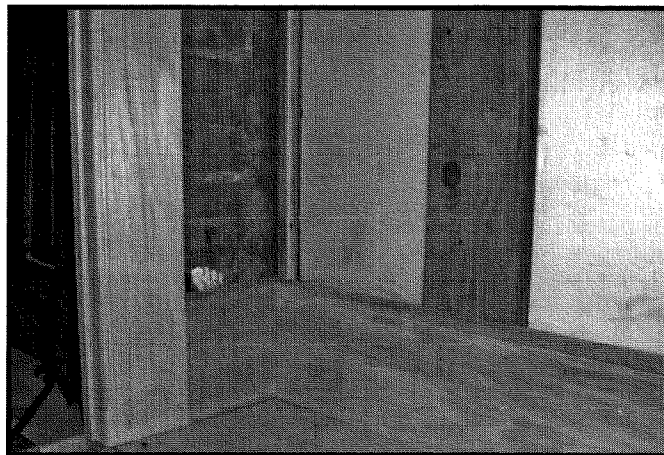
All building components and materials have a finite life cycle. All insulation will eventually lose its efficiency or become ineffective through settling, mold, moisture, vermin, or removal by remodeling. Careful consideration must be made toward the project's methodology, longevity and use. Avoid irreversible spray foams, significant changes to the building's air flow and moisture escape routes, and removing historically significant building components for the sake of improving a building's efficiency. Alternate methods of achieving greater efficiency, such as storm windows, reducing air flow, or reversible attic and basement insulation can be more effective. Emphasis should be on air sealing first, then insulation in the attic, basement, and finally walls.

Weather Stripping, Storm Doors and Windows

Air loss is a significant factor to a building's heat loss, where efficiency starts by reducing airflow. Adding storm windows, storm doors, and weather stripping improves air tightness and creates dead air spaces that increase r-values. Storm doors and windows provide a cost-effective, energy-efficient sacrificial layer. Single-glazed or drafty insulated units can be significantly improved by the addition of a storm unit. Storm door and window units are manufactured primarily from wood, aluminum, or fiberglass, while their applications and operations will vary.

Every building has different levels of air loss, regardless of age, style and quality of construction. According to the US Department of Energy, "air sealing is one of the most significant energy efficiency improvements you can make to your home. Air sealing will not just reduce energy costs; it will also improve your home's comfort and durability." For instance, a $\frac{1}{8}$ " gap around a door is a 5" square hole in a wall. A first step is determining the level of air loss and its source(s) is through a blower door test. A proper air sealing strategy can be then be developed. Although with any tightening, a proper air and moisture escape plan may be required, depending on how tight a building becomes.

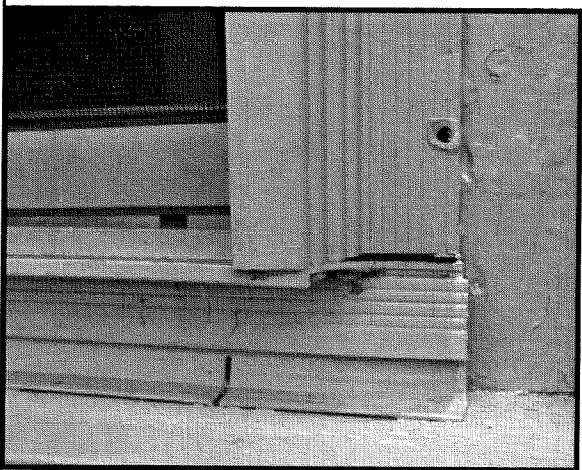
Storm windows and doors are designed to trap air and increase efficiency. The goal should be to install a unit that operates smoothly, yet has sufficient air sealing methods. Units should have low maximum air-leakage standards and be adjustable for proper conformity to out-of-square openings. Storm windows can be interior or exterior. Interior storm win-



*Rigid insulation cut to fit can be used where reversibility is a consideration
Photo courtesy of the author.*

*A Blower Door Test can determine a house's air loss and overall efficiency.
Photo courtesy of the author.*





An ineffective storm window installation, allowing excessive air to move through the joints
Photo courtesy of the author.

dows are efficient, since they trap air that comes through the window sashes and the frame, although they make the sash vulnerable to the elements and can cause condensation on the interior of the primary window. Exterior storm windows protect primary sash, can be fixed or on tracks, and can be made from wood, aluminum or fiberglass. Exterior, single-purpose wood storm windows are historically appropriate, although they provide only adequate air sealing and require maintenance. Other options include wood frames with removable glass and screens or wood with aluminum tracks.

Window Restoration and Window Replacement

Restoring, repairing, and weatherstripping existing historic wood windows in combination with the installation of storm windows is the best possible option with regards to authenticity and integrity, repairability, quality, and sustainability. This option will also match the purported energy savings of replacement windows in most cases.

However, if replacement is the only option, careful evaluation is needed.

Window replacement inserts (where the window frame is left in place) and replacement assemblies (where the entire frame and sash are replaced) are not all created equal. Window replacements range in cost, quality of construction, and materials, types of finishes, as well as a wide range of balance systems. Selecting window replacements should be based on several important factors, including the longevity, assembly and efficiency. The most important factors in the efficiency of replacement windows are the building's existing conditions and the ability of the old window opening to be properly retrofitted.

The general rule of thumb is you get what you pay for. Replacements should come from a reputable manufacturer with a history. Manufacturer's references for units ten years or more can provide a good litmus test for a unit's ability to be long lasting and efficient. Most replacements cannot be easily repaired and replacement parts are difficult to source. Broken strings and springs require new balances. Broken glass or failed seals requires new sash. Excessive over painting can bind or make units inoperable. Higher-quality windows have warranties of about 20 years on materials and parts and ten years on labor, and can last for 50 years with proper maintenance and protection. Yet 30% of insulated replacement windows last only about ten years.²

The type of replacement window depends on the energy performance of the entire building and expected final aesthetic. The efficiency of replacement window inserts relies on a tight fit, using weather seals and compression for reducing airflow. Yet, modern windows are vulnerable to deterioration since they have a single layer of protection from the elements. Most windows from the mid-19th century forward had protection from shutters and mass-produced storm windows, and continue to survive today. Direct exposure of modern windows makes all products especially vulnerable to environmental variations and abuse. While most replacement windows claim to reduce energy costs, the final analysis largely depends on the extent of air loss from the entire building envelope, not just the windows. If a building is already airtight and the windows *deteriorated beyond repair*, then choose the highest energy upgrades. If the building is loose, don't waste money.

¹ Donald Rypkema, *Economics, Sustainability, and Historic Preservation*, National Trust for Historic Preservation Conference, Portland, OR, 10/1/05.

The materials used to make the window and the method in which the windows are assembled must be of high quality. The American Architectural Manufacturers Association (AAMA) has developed stringent standards where participating manufacturers can apply labels to their windows (<http://www.aamanet.org/>). Also, the National Fenestration Rating Council (NFRC) administers a uniform, independent rating and labeling system for the energy performance of windows, doors, skylights, and attachment products (<http://www.nfrc.org/>).

Existing conditions determine a window replacement's final efficiency and longevity. A building's total air loss and the degree to which windows contribute to that must be ascertained. Another critical consideration is that certain historic window frames do not retrofit well, requiring significant, irreversible alterations for standard thickness units to fit. If the existing opening is racked, bowed, rotting, or out of level within 1/8", the unit will not perform to the factory tested efficiency standards. Also, develop a cost-benefit analysis, since replacement windows can take anywhere from 20-45 years for savings to pay for their costs.

Liquid Siding & Permanent Coatings

There is no such thing as "permanent" anything on an historic building, where most exposed components eventually fail. It is up to the property owner to determine the best course to protect and maintain a building, considering longevity, reversibility and, especially, removing historic components of a building and replacing with new, irreversible products.

Liquid siding (a spray-on coating of resins and polymers) or permanent coatings do not consider a building's life cycle or natural breathing. For centuries, buildings were built and maintained with products that react with moisture and environmental fluctuations and allow alterations or removal of building components for repair. For the past 30 years, products and techniques have been marketed to make reversibility more challenging. Epoxies, ring-shank nails, screws, adhesives and engineered coatings were designed to enhance performance and speed up the building assembly. Yet these products can be inappropriately applied to historic buildings or applied without consideration of how they will be removed. Owners of historic buildings should seriously consider the reversibility of new treatments and the performance of new products.

Traditional and modern paint finishes fail or wear. They fail from application errors, excessive build-up of finishes, external environmental causes, interior migrating moisture, or direct water infiltration. Finishes reveal problems from failed flashing, poor building envelopes, or rot. Liquid siding or permanent coatings seal envelopes, and despite claims of "breathing," they do not allow excessive moisture to migrate through wood, where it becomes trapped.

The proper use of these building products, which do not need to expel water or migrate moisture, is on metal or in areas where reversibility is not an issue. Wood products are exposed to water, air, and ultra-violet rays, causing expansion and contraction between dissimilar or opposing materials. These areas will always need to expel moisture trapped behind them. Dissimilar or opposing grain products will need to move independently, causing cracks and water infiltration. Permanent finishes do not allow the building to age, are not easily reversible, have not been tested over many decades, and should be used sparingly.

Synthetic Building Products

Synthetic building products have emerged in the market over the last few decades. Depleting resources and lesser-quality wood products have encouraged their mass



Above: 4. Synthetic siding showing some evidence of water infiltration.

Below: Trapped moisture behind the synthetic siding rotted the framing and sheathing significantly faster than the siding. Photos courtesy of the author.



production and use. The use of alternative synthetic building products in historic buildings should be limited, especially where existing original fabric has proven quality and longevity. While "in-kind" limits product selection, there may be instances where alternatives can be properly implemented.

Synthetic building products provide alternatives to traditional wood products. The product materials range from vinyl, to wood pulp and resins, to plastics, to PVC. Many synthetic products provide cost effective alternatives to wood, saving diminishing timber resources by reusing manufacturing waste or recycled materials or by just getting more product from the same source.

Modern synthetic products, plywood, building wraps, peel-and-stick membranes, and sealants can be effective layers of a controlled building envelope. Yet historic and existing buildings are made from solid wood components that require significant expansion and contraction, airflow, and basic breathability. Applying a synthetic material over a wood product can create a situation where components cannot "fail together," thus trapping moisture and concealing underlying water damage, rot, infestation or mold. When a building envelope cannot be layered with the components working together, and water and air are not properly mitigated, synthetic products can trap moisture and mask problems that lie beneath.

Moisture, sun, and air are the demise of most wooden building components. Wood, being an organic material, is subject to degradation when alternating wet and dry conditions are present. A general rule of thumb is to keep all wood materials 18" from grade to prevent rot and decay from mold and fungus. Although when it is not possible, alternative synthetic products may be used, such on stair kicks, low mud boards or ground-contact conditions. Otherwise, in-kind wood-to-wood should be used, considering the quality of the wood grain, rot resistance, and back priming.

Conclusion

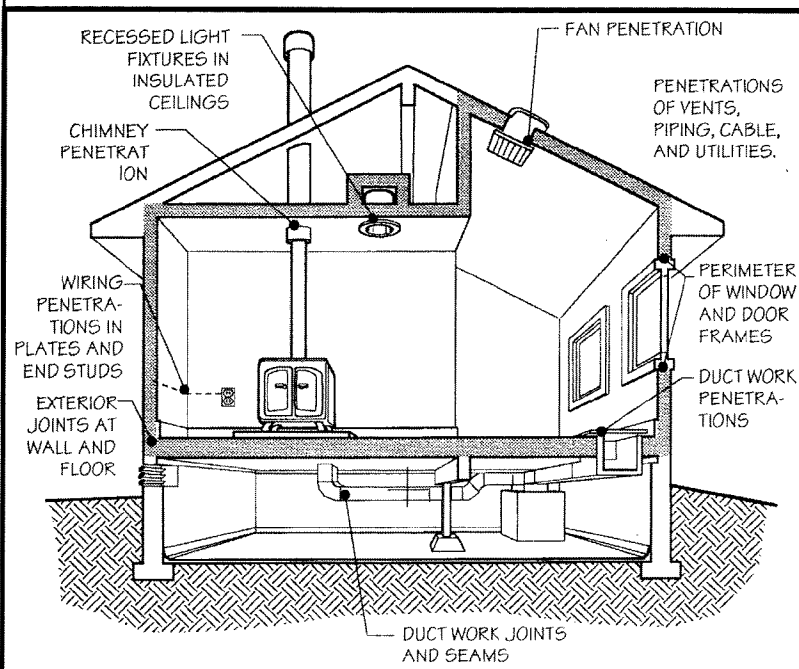
Historic buildings are each unique. They wear, react to their environment, and are manipulated. Historic building last for a variety reasons: they were well crafted, well maintained, or just plain lucky. Best practices, quality materials, and reversible techniques should honor well-built structures. Design intent, original fabric, and character acquired over time should be recognized through careful analysis and responsible retrofits, where the goal should be to do no harm first, then develop solutions for modern needs.

Robert Cagnetta is the principal of Heritage Restoration, Inc. in Providence, RI, specializing in the care and retrofits of existing and historic buildings. Rob is the current President of the Preservation Trades Network, and sits on various committees and boards that enhance our built environment and provide educational opportunities to professionals, homeowners and our rising, future traditional craftspeople. Rob can be reached at rob@heritagerestoration.net.

ENERGY EFFICIENCY AND HISTORIC HOMES ARE NOT ENEMIES

Joy Sears, Restoration Specialist, Oregon SHPO

Yes, Virginia, historic homes can be energy efficient! You do not have to decide between energy efficiency or historic homes. You can make your old house more energy efficient by following the general direction of this article. Everything in it can be done by the average homeowner and is something that I have done to my own old house, or am considering in the future. Most of the improvements are relatively inexpensive, but they also rely on the people in your house to work the best. None of these weatherization measures requires you to take a second mortgage, and most can be done on a weekend in the right weather. These energy efficiency measures will also meet the *Secretary of the Interior's Standards*, which are the basis for most design review in many local municipalities.



Older buildings were built to last and to be used. The U.S. Energy Information Administration found that buildings constructed in the early 20th century are more energy efficient than those built from the Great Depression to the end of century.¹ Built when heating and cooling were more difficult to accomplish, many older homes had non-mechanical energy-saving features, such as south-facing facades for solar gain, deep eaves and awnings for shading, and cross-ventilating hallways and operable windows. Over time, whether in wisdom or ignorance, we have remuddled these houses by blocking in openings for much smaller windows, closing off lightwells to increase living space, plugging or removing built-in ventilation ducts, and securing windows shut. All these measures reduce the energy efficiency that is built into many historic buildings.

Critical areas for air leakage control. Photo courtesy of: U.S. Department of Energy, <http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter/graphic/643>

Passive measures relying on changing the behavior of each occupant:

- Reduce the amount of electric lighting needed by taking advantage of daylighting as much as possible.
- Use operable shutters, adjustable awnings, and window treatments such as closable drapes or heavy curtains to keep heat out in the summer and keep heat in the winter.
- Install a programmable thermostat to control the temperature according to use.
- Put on a sweater or another layer of clothing when you are cold as your mother used to tell you.
- Service and clean mechanical equipment every six months or yearly
- Change or check air filters for mechanical equipment every month.

Beyond the passive measures, the amount of air infiltration from small cracks and holes on the exterior of your old house can be the equivalent to leaving a window open all winter (see illustration above). The whole house needs to be examined on a yearly basis to make sure no new holes or cracks have developed. The best way to check for possible

¹ U.S. Energy Information Administration, *Emissions of Greenhouse Gases Report*.

areas of air infiltration is to light an incense stick and watch the smoke while moving it around any opening in a wall. A couple tubes of caulk used around windows and doors where they met the siding can do wonders. Larger gaps or cracks may require spray foam. Generally, spray foam should be used sparingly to minimize the risk of trapping moisture. Installing weather-stripping, either permanent spring bronze or temporary foam, to windows and doors will reduce air infiltration. Just make sure that they shut when done and realize that it might take some trial and error to get it right. The same goes for installing foam gaskets in electrical outlets and switches on exterior walls. All these items are available in most hardware and discount stores and are relatively inexpensive. Just these measures can reduce your energy usage significantly.

Think of your body as a house. If you are cold, you would put a hat on your head. Insulate your attic first, but that does not mean to fill the whole space. It still needs to ventilate properly. Just adding three and a half inches of insulation in your attic can save more money than replacing windows and with a much quicker payback in your investment. The next step is to insulate your foundation and/or basement. Crawl spaces must have a layer of heavy mil-plastic sheeting spread across the space, lapped up the walls a few inches and secured in place with sand or rocks. This moisture barrier will help keep the space dry. Then consider adding insulation between your floor joists secured with wire anchors or string in basements and crawl spaces if reasonably accessible and if it doesn't interfere with electrical and plumbing already in place.

Weatherization measures meant to protect value:

- Sealing cracks and adding insulation are the most efficient ways to weatherize your home.
- Adding weather stripping to all exterior doors and windows
- Installing foam insulation gaskets under covers on all outlets and switches on exterior walls.
- Sealing the basement by insulating all access doors and sealing all cracks in the foundation walls, inside and out.
- Adding insulation to accessible attic space and floors above unheated crawlspaces and basements. Insulation vapor barriers should always face the heated space.
- Sealing and insulating all attic doors or hatches.
- Adding exterior storm windows to single-pane windows. Make sure they are properly sealed, caulked, and have open weep holes at the sill for moisture to escape.
- Adding appropriate storm and screen doors.
- Insulating all hot-water pipes and furnace ductwork. Check all pipes and ductwork for leaks.
- Closing fireplace dampers when not in use or considering adding an inflated chimney balloon plug or insulation if warranted.
- Planting trees or adding awnings or arbors on south and west elevations.

Old buildings must breathe just like people. Bathrooms, kitchens, and laundry areas need to be ventilated to the exterior. If mechanical ventilation is unavailable, opening a window and running a fan is beneficial to the health of your house and your family. Moisture and mold problems can occur from vents that empty into attics or crawlspaces. We live differently then we did before World War II. Today, a family of four doing normal activities—showering, cooking, using a dishwasher, etc.—can produce ten to 16 pounds of moisture a day in a single family home. If ventilation has been increased but moisture is still a problem, dehumidifiers should be considered.

Storm Windows: Interior versus Exterior

While interior storm windows may perform better than exterior storm windows, they also have some potential drawbacks. One is that they tend to be more prone to water condensation between them and the window sash. This condensation can cause the windowsill, frame, and sash to deteriorate if not monitored carefully. Interior storm windows also hinder opening the window for ventilation because the panels must be removed in order to open the window, thus negating a building's passive heating and cooling system. Finally, interior storm windows do not provide any protection for the window sash from the elements. As a result, the greater monetary savings that might result from an interior storm window's greater energy efficiency may be offset by the cost of more frequent and extensive maintenance of the window sash. Property owners should take all of these factors into account when considering using interior storm windows.

In some situations, though, interior storm windows may be the most appropriate choice. For example, historic buildings that pre-date the advent of storm windows and are intended to appear exactly as they did when built may benefit from unobtrusive interior storm windows. Such buildings usually have sophisticated climate control systems for heat and humidity, and their condition is monitored more closely than those of an average

property owner's home. Metal casement windows or other swing-out windows for which exterior storm windows are not available may also require interior storm windows, but in most cases, they will prevent the window from being opened from the inside. Interior storm windows may be the only reasonable choice for curved windows, such as fanlights above doors or other windows. Of course, interior storm windows consisting of plastic sheeting affixed with double sided tape as a temporary measure when the winter winds are howling are a time tested and honored tradition of building restoration projects.

People often groan when I start talking about storm windows in general. Few people want to go through the routine of carrying storms or screens up the ladder to install on the house every six months. When clear-aluminum triple-track storm windows came on the market after World War II, people no longer had to remove their wood-framed storm windows on a yearly basis. Yes, these aluminum storms get a bad rap, but they are not permanent and can always be removed. They also protect the primary windows from the elements. Their biggest drawback is that the fixed upper panel prevents ventilation through the operable upper sash of the window; but in many cases, the upper sash doesn't move either by design or because it has been fixed in place. Even my little c. 1936 house has the upper sashes nailed, screwed, or painted in place, which makes them less efficient.

Insulate exterior walls or not? One day my visiting father from the Midwest was working on my house and decided to relocate an outlet on an exterior wall. He turned around with a somber expression and told me my house didn't have any insulation in my walls. I fell over laughing to his bewilderment. I told him, of course, I knew my house didn't have insulation, and it wasn't necessary in our climate (in Oregon). This issue is an ongoing discussion with preservationists and insulation/weatherization contractors. One of the issues preservationists want to avoid is "woodpeckered" houses, where siding has been drilled for blown in insulation leaving behind highly visible plugs or patches after installation. Insulation is also an expensive process and often not a cost-effective measure for homes with original lathe and plaster walls and historic siding on the exterior.



A c. 1936 window that needs to be repaired and not replaced.
Photo courtesy of the author

Adding insulation to historic wall cavities needs to be done with caution. Improperly installed insulation can prevent moisture from escaping and lead to paint failure from condensation, termite infestation, and structural damage. During the energy crisis in the late 1970s and in the 1980s, many insulation products pumped into houses to save energy ultimately failed or caused bigger problems. Some were toxic with a formaldehyde base or other chemicals which we now realize are unsafe. In some cases, insulation installed in the past has settled or turned to dust, thereby negating any insulation value. Most new insulating products—"green" or not—have not been around long enough to determine their long-term effects on historic homes. A large number of the foam insulations are meant to be permanent and are not removable from any building components, historic or otherwise.

Conclusion

Recent renewed interest in energy efficiency and environmental sustainability has given rise to the misconception by many that old houses are inherently inefficient, when, in fact, the opposite is true. Local preservation commissions can help property owners get the most out of their old house by providing simple, easy to follow advice such as is given above, and by referring them to additional sources of information.

In addition to the work of the State Historic Preservation Offices and local preservation advocates, the National Trust for Historic Preservation is taking the lead in promoting the links between sustainability and historic preservation. Historic preservation can and needs to be an important component of any revitalization effort to promote sustainable development in any community. The conservation and improvement of our existing built resources,

including re-use of historic and older buildings, greening the existing building stock, and reinvestment in established and historic communities, is crucial to combating climate change. We can all do our part for energy conservation by starting at home.

Additional Resources

Lord, Noelle, "Embracing Energy Efficiency," *Old-House Journal*, September/October 2007, pp.40-45.

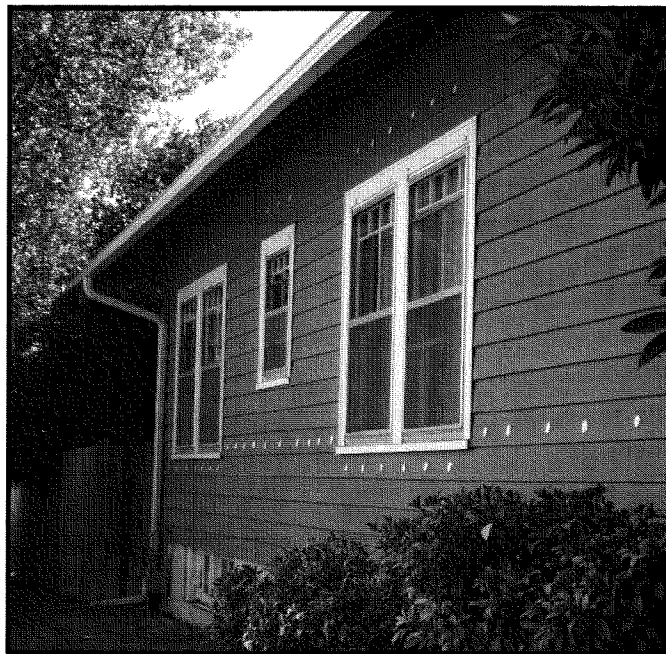
National Institute of Building Design, Whole Building Design Guide

<http://www.wbdg.org/index.php>"Sustainable Historic Preservation."

National Park Service, Technical Preservation Services. "Weatherizing and Improving the Energy Efficiency of Historic Buildings." <http://www.nps.gov/history/hps/tps/weather/index.html>.

National Trust for Historic Preservation, Weatherization Guide for Older & Historic Buildings, www.PreservationNation.org/weatherization.

Sedovic, Walter and Jill H. Gotthelf, "What Replacement Windows Can't Replace: The Real Cost of Removing Historic Windows." *APT Bulletin: Journal of Preservation Technology*, 34:4, 2005.



"Woodpeckered" house due to blown-in insulation.
Photo courtesy of the author.

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WANTED!

YOUR DESIGN GUIDELINES

The Owens Library at UGA's College of Environment and Design, Partnered with the National Alliance of Preservation Commissions now has 278 design guidelines on its shelves from across the nation and beyond! This is a great resource for preservationists and shows the growing importance of historic design guidelines.

HELP US HELP YOU!

If your current design guidelines are not included in the collection, please send a copy to:

NAPC • P.O. Box 1605 • Athens, GA 30603

INCENTIVE PROGRAMS FOR WEATHERIZATION

Helpful

Weatherization Links

Compiled by Caitlyn Oshida, NAPC support staff

National Trust for Historic Preservation. *Weatherization Guide for Older and Historic Buildings.*, 2009. Web. 5 Oct 2010.

<http://www.preservationnation.org/issues/weatherization>.

The National Trust for Historic Preservation focuses on how to make historic buildings more energy efficient while still maintaining their unique character. This page provides links and information to the Trust's guide on roofing, windows, insulation, and mechanical systems, which provide tips for maintenance and energy saving ideas, as well as other helpful weatherization information. The site also gives information on incentives, audits, and other useful resources on making older buildings more energy efficient.

United States Department of Energy. *Historic Preservation.*, 2010. Web. 5 Oct 2010.

http://www1.eere.energy.gov/wip/historic_preservation.html.

The U.S. Department of Energy (DOE) is working with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers to develop a programmatic agreement that will address the historic preservation requirement for DOE State Energy, Weatherization and Energy Efficiency Community Block Grant Programs. This agreement is striving to create "a manageable framework for streamlining DOE's compliance with the requirements of the National Historic Preservation Act" while protecting historic sites. The site provides links to the prototype of the agreement as well as other useful federal government historic preservation legislation.

Compiled by Caitlyn Oshida, NAPC Support Staff

There are numerous weatherization strategies for historic buildings that will maintain character and materials while reducing on utility bills. Some property owners, however, may not be aware of incentive programs that are available to help. Below is a sampling of weatherization incentive programs at the federal level and in various states—preservation commissions and commission staff are encouraged to research these and other programs, including those from local non-profits or utility companies.

Federal¹

Weatherization Assistance Program

The Weatherization Assistance Program was created in 1976 in response to the energy embargo of 1973, and today, each state now administers over \$5 billion in stimulus funds for this program. More than 5.8 million homes have already benefitted from this program, and an additional one million homes are expected to receive weatherization assistance through the recent economic stimulus funding.

There are approximately 38 million households eligible for weatherization services, and about 15 million of these are good candidates. Any household at or below 200% poverty, per the modified statute, is considered low income and eligible for this program. Priority is given to the elderly, people with disabilities, and families with children. For more information and instruction on how to apply in your state go to the U.S. Department of Energy's website: <http://www1.eere.energy.gov/wip/wap.html>.

Homeowner's Tax Credit for Energy Efficiency

The recent economic stimulus package reinstituted and expanded tax credits for energy-efficient home improvements. This program provides a tax credit for 30% of the cost of eligible energy-efficient activities, up to a cap of \$1,500. Only improvements on the primary residence qualify. Geothermal heat pumps, solar water heaters, solar panels, and small wind energy systems are not subject to the cap. The incentives are in effect until 2016. Storm windows and doors are eligible as long as there is a qualifying manufacturer certification statement which certifies that the product or component qualifies for the tax credit.

Energy Efficiency and Conservation Block Grants

The Energy Efficiency and Conservation Block Grants provide assistance to local government to implement energy efficiency and conservation strategies. It has received \$3.2 billion in economic stimulus funding. Over 2,300 state, local, and tribal governments are eligible for direct formula grants from the Department of Energy. Competitive grants are also available through this program. Jurisdictions ineligible for these grants may still apply for these competitive funds. To find contact information for your state's energy office and to learn more about the offered programs, go to the National Association of State Energy Officials website: <http://www.naseo.org/>.

State Tax Credits for Historic Preservation

Thirty states currently offer credits against state tax liability for the rehabilitation of qualifying historic buildings, and 25 states offer tax credits for the rehabilitation of owner-occupied residences. Each state administers its tax credit program differently. To find

¹ Compiled by the National Trust for Historic Preservation: <http://www.preservationnation.org/issues/weatherization/incentives.html>

contact information for the program in your state, go to the following National Trust for Historic Preservation website: <http://www.preservationnation.org/resources/public-policy/center-for-state-local-policy/additional-resources/MPP-State-Tax-Credits-2007.pdf>.

State Incentives Examples²

Connecticut

Sales Tax Exemption: Home Weatherization Products

Connecticut offers an exemption from the state sales tax on the sale of home weatherization products. The product must be designed and marketed for residential use and not for commercial use. For more information go to the following website: <http://www.ct.gov/drs/cwp/view.asp?A=1514&Q=384952>.

Energy Conservation Loans

The Energy Conservation Loan Program (ECL) provides financing at below market rates to single- and multifamily residential property owners for the purchase and installation of energy-efficient improvements. This program is available for homeowners with a gross annual income at or below 150% of the State Median Income. The program is administered by the Connecticut Housing Investment Fund (CHIF) with funding from the Connecticut Department of Economic and Community Development (DECD). For more information, go to the following website: http://www.chif.org/owner_borrowers/index.shtml#energy%20.

Maine

Efficiency Maine Home Energy Savings Program

The Efficiency Maine Home Energy Savings Program was created to deploy \$9 million in federal stimulus money set aside to increase the energy efficiency, safety, and comfort of existing homes, and in doing so, to provide jobs, reduce dependence on foreign oil, and decrease greenhouse gas emissions. There are two tiers for energy efficiency upgrades for incentives: Tier 1 projects are eligible for a rebate of 30% of the total cost of the project, capped at \$1,500 per dwelling unit and must lead to an estimate heat or hot water energy reduction of 25% or more, and Tier 2 projects include those which will lead to heat or hot water energy reductions of 50% of the cost of the project, capped at \$3,000 per dwelling unit. For more information go to the following website: http://www.efficiencymaine.com/at-home/hesp_program.

Oregon

Energy Trust of Oregon

The Energy Trust of Oregon provides cash incentives for energy-efficient upgrades to single- and multifamily homes. Many upgrades are eligible for state and federal tax credits. This program will aid in finding qualified contractors and financing improvement to homes such as air sealing, duct insulation, duct sealing, insulation profession install, insulation self-install, and windows. Federal energy tax credit for projects is 30% of cost, up to \$1,500. For more information go to the following website: <http://energytrust.org/residential/incentives/Weatherization/>.

Thanks to Adrian Fine at the National Trust for Historic Preservation for his contributions to this article.

United States Department of Energy. Weatherization Assistance Program., 2010. Web. 5 Oct 2010. <http://www1.eere.energy.gov/wip/wap.html>.

The U.S. Department of Energy provides funding to states, U.S. territories, and Indian tribal governments funds through the Weatherization Assistance Program (WAP) that can be used by low-income families to improve the energy efficiency of their homes through the use of advanced, "green" technology. The site provides program guidance to help find documents for grant recipients, information about the Recovery Act, Residential Retrofit Guidelines, and links for individuals to find their state weatherization forms and services.

United States National Park Service. Weatherizing and Improving the Energy Efficiency of Historic Buildings., Web. 5 Oct 2010.

<http://www.nps.gov/history/hps/tps/weather/index.html>. The U.S. National Park Service defines weatherization as a means of "implementing cost-effective measures to make a building's envelope more energy efficient," and for historic buildings this means that these improvements have minimal impact on the historic design and materials of the building. This site suggests developing a unique weatherization plan for a building to help reduce energy consumption and suggests ways to modify user behavior, such as installing a timer or motion detector to turn lights off when rooms are not occupied. They also provide links to helpful hints such as conducting an energy audit, eliminating air infiltration, repairing and upgrading windows and doors, installing insulation, and more energy saving tips.

² For more examples of state programs, see the online Database of State Incentives for Renewables and Efficiency (DSIRE) at <http://www.dsireusa.org/>.