



ENERGY RETROFITS

for Historic Homes
in Hot-Humid Climates



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This pamphlet contains the findings of recent research on retrofit of older homes in San Antonio. The intent is to provide practical information and help homeowners prioritize cost-effective improvements that will lower energy use. The recommendations also consider the cultural heritage integrity of the historic homes.

This research was made possible by a grant from the Office of the Vice President for Research at the University of Texas at San Antonio and by generous support from the City of San Antonio Office of Sustainability and from Eco-Synergy Advisors.

Recommended work is based on researchers' professional knowledge and case study analysis of four San Antonio homes, considering: a. actual energy consumption; b. real-time electrical-use monitoring and recording; c. walk-through observations plus interviews; d. blower door and duct-leakage tests (CPS Energy Saver Program, Eco-Synergy Advisors); and e. IES-VE energy modeling software.



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Primary Retrofits

for Increased Comfort and Energy Savings

Attic Insulation

Attic Insulation is effective at saving energy.¹ Attics are generally accessible and the work does not require disruption to historic materials. Add unfaced (without vapor barrier) batt insulation 9.5" deep, or 10" of blown cellulose. Where depth is limited due to use of attic floor space, consider combination with rigid board insulation to achieve a value of R-30.

Radiant Barrier

A radiant barrier is ideal for hot climates because of the effectiveness at reducing solar heat gain.² The radiant barrier is a thin, reflective and flexible material easily applied with staples to the underside of the roof. Proper installation is critical for effectiveness, so follow the manufacturer's instructions.



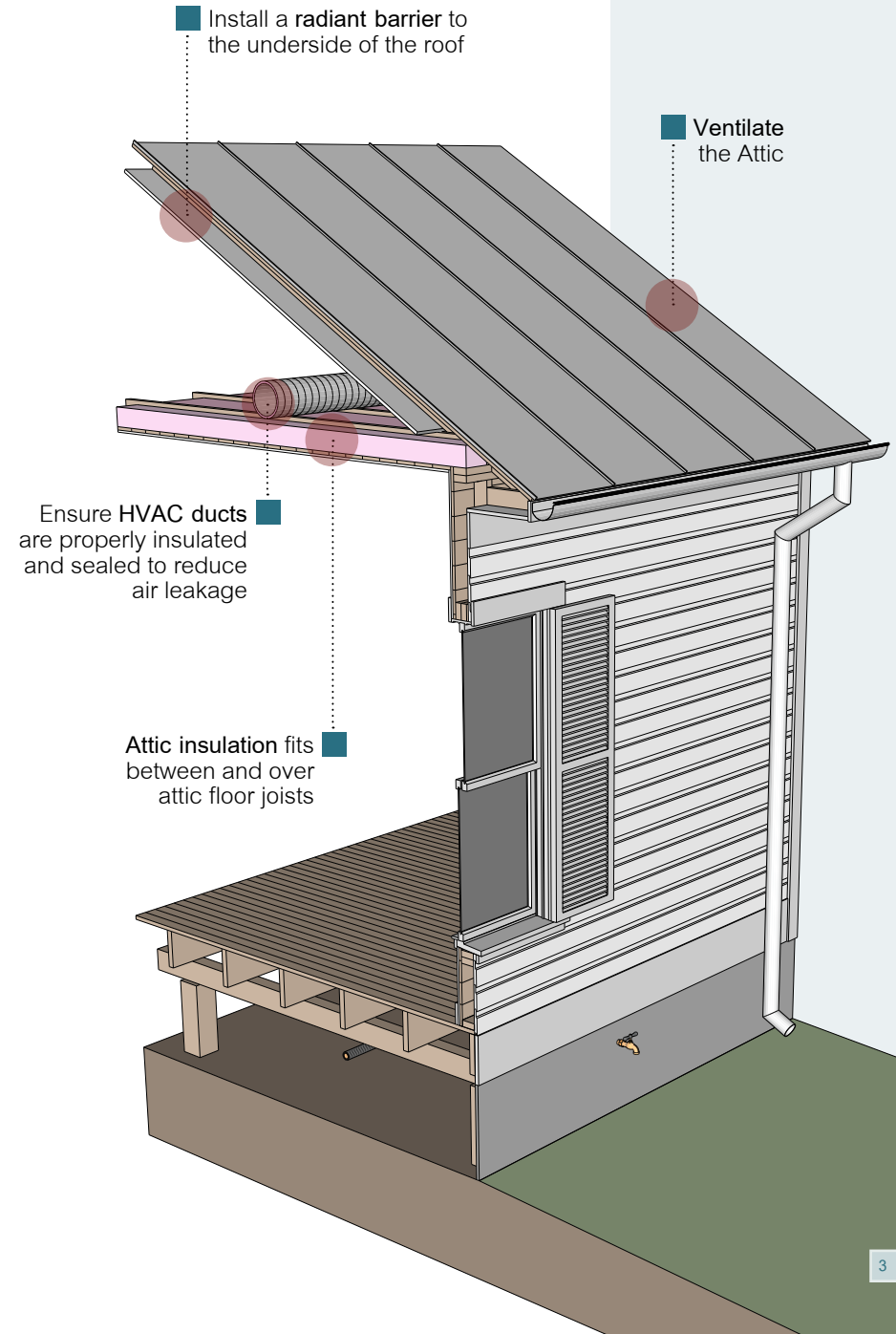
Radiant barrier installation is a simple, effective treatment for homes in hot climates.

HVAC Ducts

When supply air leaks into the attic or crawl space it can make the HVAC system work 25% harder. HVAC air distribution ducts must be properly insulated and sealed to reduce air leakage.

Ventilation

Ventilate unoccupied attics to reduce the likelihood of moisture problems which may decrease the life of the roof. Gable-end vents are typical on historic homes and should be kept operational. Ridge vents can sometimes be integrated with a new roof.



Secondary Retrofits

for Increased Comfort and Energy Savings

Air Infiltration

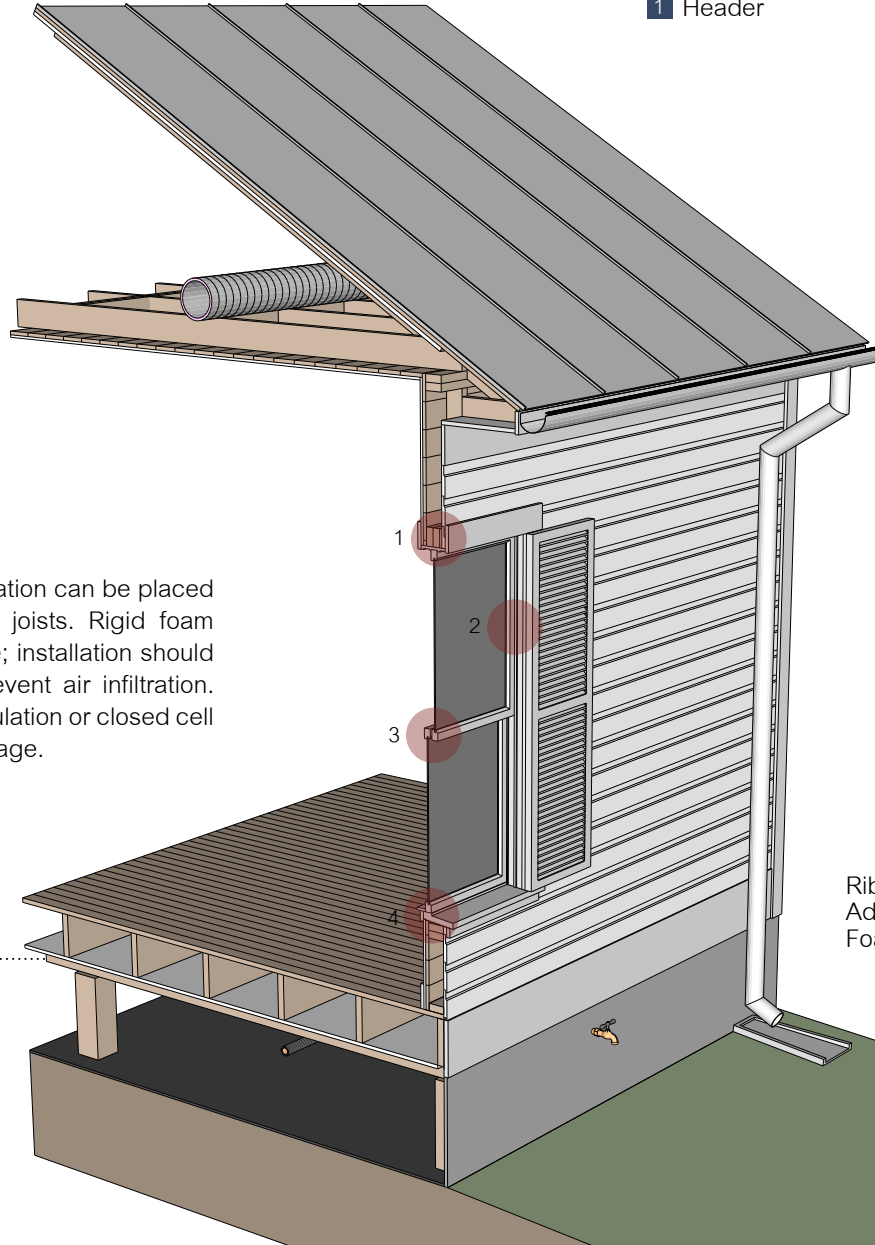
Major gains in reducing air infiltration can be made by weather-stripping historic windows and doors.³ Windows should remain functional, including the upper and lower sash (called “double hung”), because they are ideal for managing the interior climate on favorable weather days.

Gaps in wood framing around windows and doors must be addressed in the same weather-stripping retrofit project. Use caulk systems (with backer rods as needed) and paint. Exterior and interior molding (a.k.a. trim) can be carefully disassembled to access the work areas and then reinstalled back in the same location. Spot application of spray foam insulation can be helpful, but avoid excessive use of this product because it expands into hidden locations and is not reversible.

Floor Insulation

Under the floor “crawlspace” insulation can be placed between or underneath the floor joists. Rigid foam board insulation is the best choice; installation should be tight with taped seams to prevent air infiltration. Small, spot applications of batt insulation or closed cell spray foam will assure good coverage.

Rigid foam board insulation



Compression Tube

1 Header

Install weather-stripping around doors and windows⁴

Metal Spring

2 Jamb

Compression Tube

3 Meeting Rail

Ribbed Adhesive Foam

4 Sill

Still Good

but Less Effective Options

Windows

Historic windows visible from the street should be maintained; the performance gain to be had from replacing half the windows is negligible compared to weatherstripping the historic windows. The energy efficiency of new windows and doors in southern climate zones comes primarily from the better (lower) rate of air infiltration offered by factory-assembled components. Thus, a well-manufactured new window should have a lower rate of air infiltration than a recently weather-stripped historic window, though individual results will vary.



Long-term homeowners should be aware that gaskets and seals on the replacement windows have an approximate life span of 20 years, at the end of which the entire window must be replaced to maintain the better rate of air infiltration. In contrast, the wood windows in a typical home from the early 1900's can remain functional indefinitely if properly maintained.

Gaps in wood framing around windows and doors must be addressed when replacements are installed. Use caulk systems (with backer rods as needed) and paint. Exterior and interior molding (a.k.a. trim) can be carefully disassembled to access the work areas and then reinstalled back in the same location. Spot application of spray foam insulation can be helpful, but avoid excessive use of this product because it expands into hidden locations and is not reversible.

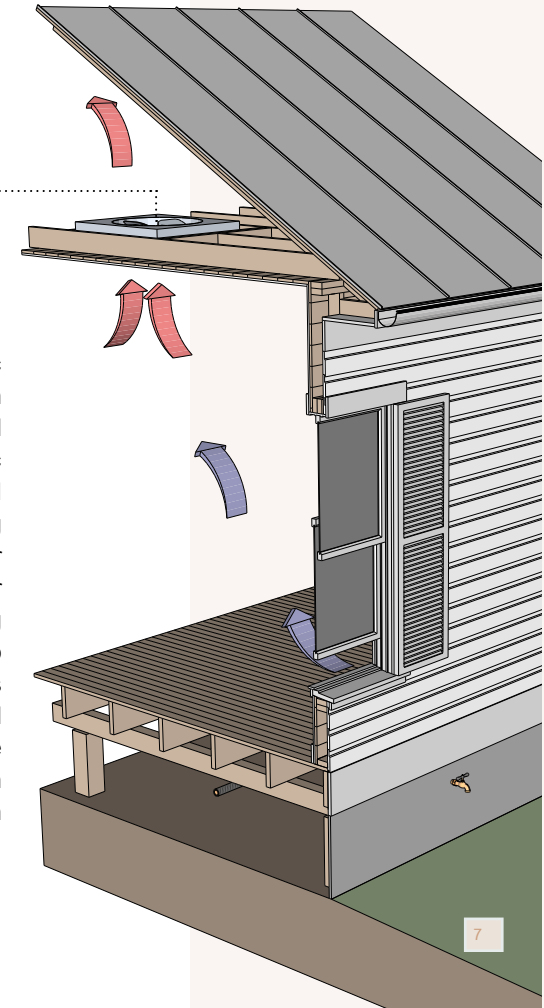
Old wood may have lead paint. Test for lead, and if retrofit work will disturb lead paint, then follow all safety precautions and regulations for dealing with this hazardous material.

Reduce air infiltration by sealing gaps and cracks. Once the air infiltration at windows, doors and crawlspace is improved to the extent possible (see recommendations elsewhere), work can be done on the walls. Caulk systems, in conjunction with good painting work, are a common way to seal and eliminate unwanted air infiltration. Improvement work should focus on areas between the foundation and the sill, wall penetrations (such as electrical outlets and water spigots), and areas with damaged material such as cracked siding.

Infiltration

Whole-House Fan

A whole-house fan located in the attic pulls cooler outdoor air through open windows and evacuates the hot and stale indoor air through existing attic vents. This technique works very well in the "shoulder" seasons of spring and fall to quickly cool with outdoor air. According to the EPA, "indoor air pollutants have been ranked among the top five environmental risks to public health."⁵ Outdoor airflow helps reduce indoor air pollutants and is generally more healthful for the occupants. Note: proper installation is essential to prevent air infiltration when the fan is not in use.



Ongoing Comfort & Savings

Programmable Thermostat

Install a programmable thermostat. Also, participate in utility company programs to help monitor usage and reduce energy consumption.

HVAC

When it's time to replace, purchase SEER 15 or higher.

Ceiling Fan

Use a ceiling fan to promote air movement within rooms that are in use. The moving air generates an effect called evaporative cooling on the skin.

Lighting

Replace incandescent light bulbs with more energy efficient, compact fluorescent light (CFL) bulbs.

Open Windows

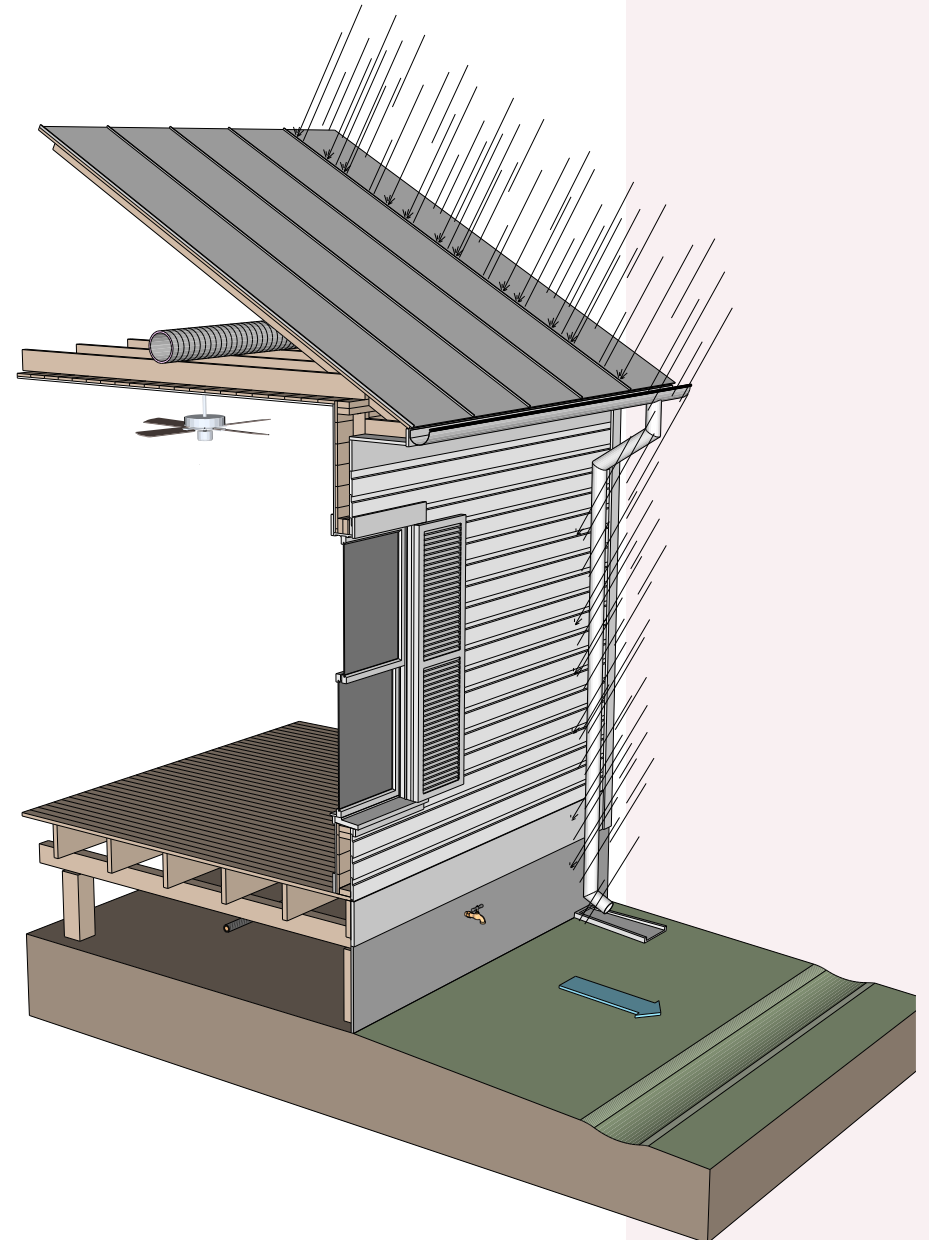
Turn off the air conditioning and open windows when conditions are favorable. If a hung window lacks screens, purchase and use expandable screen inserts.

Shading Devices

Shading devices reduce solar heat gain in interior spaces, increasing summer comfort and easing the work of the HVAC system.⁶ Maintain or reconstruct missing historic shading devices that belong on your house, if any. Interior shades are effective, too, though less so.

Energy Star Appliances

When the useful service life is ended, replace with "Energy Star" rated appliances.



Dry Houses Save Energy

Moisture and Building Materials

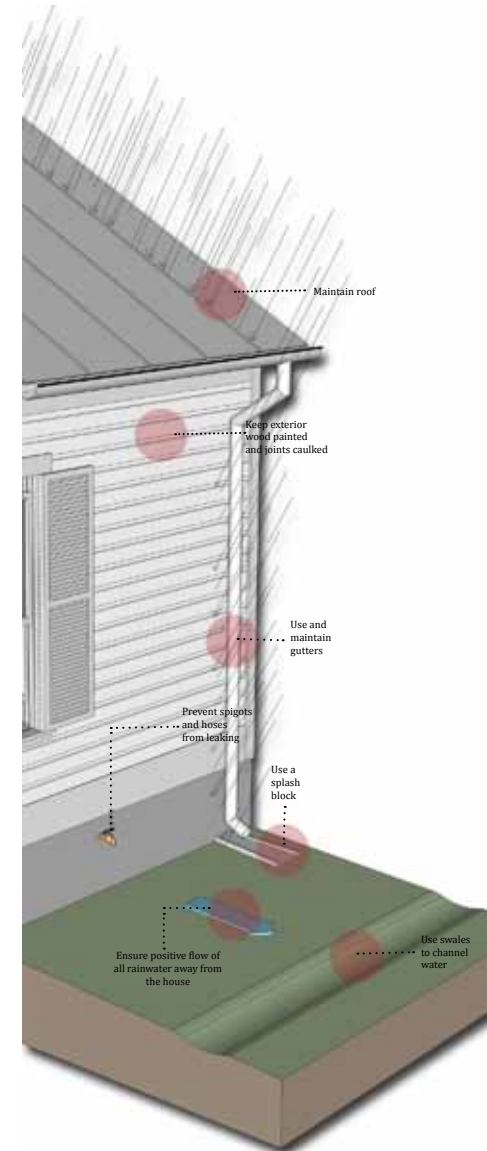
Foundations and the crawlspace under a historic, wood-frame house need to be kept dry. Wet materials have no insulation value. In fact, wet building materials can increase energy transfer, the reverse effect of insulation.^{7,8} Additionally, water is a cause of wood decay and wood can absorb moisture from the air. Place a waterproof membrane in the crawlspace (6-mil polyethylene sheets placed directly on the ground) to block moisture evaporating up from the ground.⁹ Keep the house dry by controlling and directing rainwater away from the house. Use and maintain gutters, downspouts, splash-blocks, and swales. Wet buildings lose energy and decay faster. Dry buildings last longer, meaning fewer costly repairs over time. If cisterns are used, be careful that they do not promote wetness of building materials.

Roof Maintenance

Roof leaks often occur at vertical penetration when the flashing cement or caulk dries out and cracks. The areas prone to leaks are at vents, chimneys, skylights and end walls.¹⁰ Maintain the roof to keep building materials and attic dry.

Exterior Siding and Trim

Keep the exterior wood painted and the construction joints properly caulked to keep wind-driven rain from entering walls. Wet materials have poor thermal performance, and wood can rot. Walls need to shed water away from the house.¹¹ A tight building envelope lowers air infiltration, as well, saving more energy.



Dry Houses Save Energy

Outdoor Spigots (Hose Bibs)

Water from spigots and hoses are potential sources for water damage. Leaky connections or valves can lead to moisture on building materials and water ponding near the foundation.¹²

Water Ponding

Water collecting near the foundation of the home may be a sign of improper grading.¹² The grade should be sloped away from the house. A surface diversion swale may be necessary to channel water away where it can be absorbed into the ground away from the house.

Trees and Shrubs

Trees block sunlight, reducing solar energy gain. Maintain trees for their beauty and the shade that promotes comfortable conditions. Tall shrubs and smaller trees on the west side of a home can filter the late afternoon sun. Prune all plant material to keep growth from touching walls and roofs. The airspace allows building materials to dry after rain, reduces pathways for insects to enter the house, and prevents abrasion damage.

Historic Porches and Decks

Utilize historic porches and decks. Live outside when the conditions are favorable. Find the prevailing breeze in the shade. Most historic homes have these spaces designed in as a standard feature.



Maintain trees for their beauty and shade.



Utilize historic porches and decks.

Not Recommended

Wall Insulation

The addition of wall insulation is not advised for historic homes in a warm, humid climate, and should be one of the last considerations for an energy retrofit. The energy savings are small compared to the expense, and the potential gain is not worth the risks. Insulating walls is an intensive process that may result in damage to historic material. Other risks include moisture inside the walls, promoting rot and decay, which may occur if the new insulation inhibits evaporation or holds moisture. Moist insulation, or any wet building material, will actually increase the energy transfer through the wall.¹³ If wall insulation is deemed essential, then blown-in cellulose insulation is generally the most cost-effective choice.

Vapor Retarders

Vapor retarders (or barriers) are not recommended for historic walls in a hot humid climate. However, if the house undergoes a renovation that bares the framing, then house wrap is typically applied to the exterior face of the wood frame to act as an air and liquid barrier, and insulation is installed between the studs. Historic siding material can be salvaged and re-installed over house wrap. This process is not a recommended retrofit because the effect on energy savings in warm, humid climate zones is overwhelmed by the installation costs.

Not Recommended

Storm Windows are not recommended unless they are an integral part of the historic house. Historic storm windows are quite rare on smaller, less expensive homes in warm, humid climate zones, but if they existed during the historic period, they would be useful to rebuild, repair, or maintain. Modern storm windows dramatically alter the appearance of historic windows, and should not be used on windows that are visible from the public streets in a historic district. Storm windows can reduce air infiltration and add insulation, but the energy savings in a warm, humid climate are too marginal for the installation cost. Furthermore, storm windows prevent the use of the window for ventilation during favorable weather.

Storm Windows

Investment



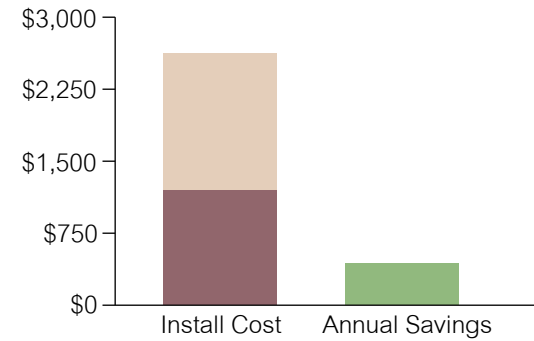
House Characteristics

U.S. Climate Zone: (2) Hot-humid
 Zoning: Designated historic district protected by local ordinance
 Type: One-story, detached, platform frame construction on piers.
 Date of Construction: ca. 1910
 Conditioned Floor Area: 1700 sq/ft

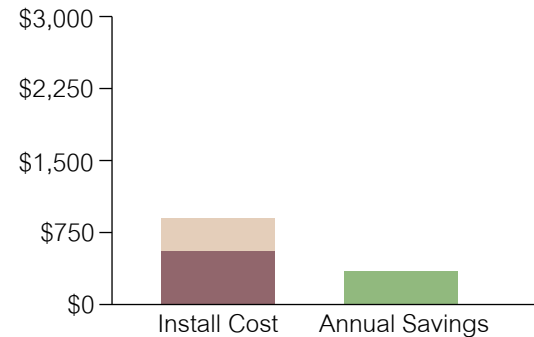
Some homeowners prefer the do-it-yourself (DIY) approach, so the material costs are shown separately where appropriate

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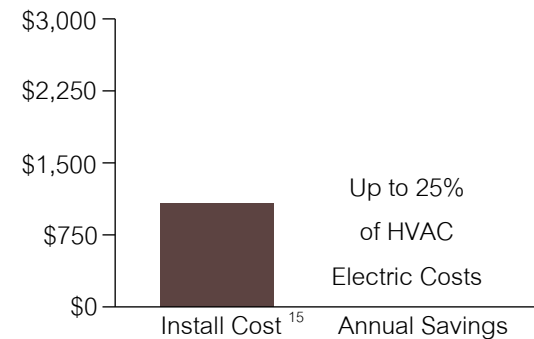
- Material Cost¹⁴
- Labor Cost¹⁴
- Material and Labor Cost¹⁴
- Annual Energy Cost Savings



Attic Insulation
 Payout: 9-12 yrs

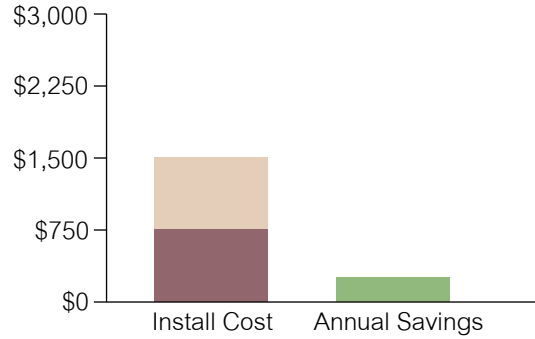


Radiant Barrier
 Payout: 3-6 yrs

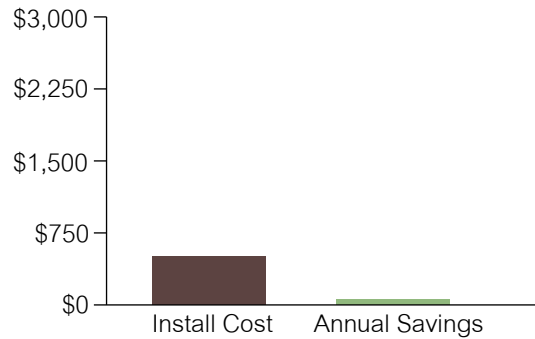


Sealing Ducts
 Payout: 3-10 yrs

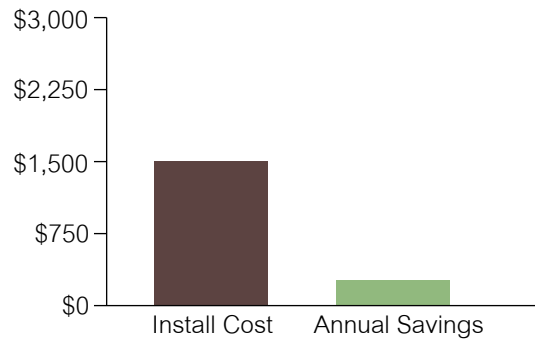
Floor Insulation
Payout: 6-8 yrs



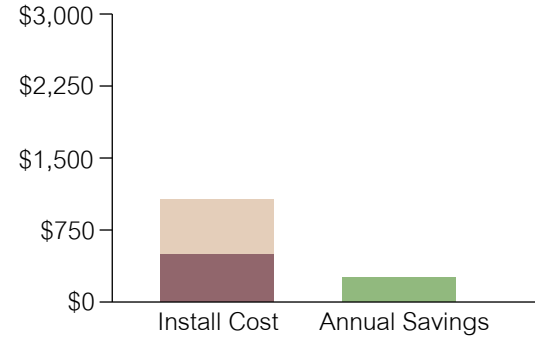
Infiltration at Doors
Payout: 3-6 yrs



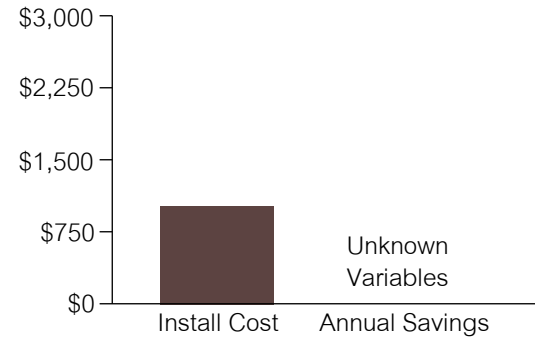
Infiltration at Windows
Payout: 3-8 yrs



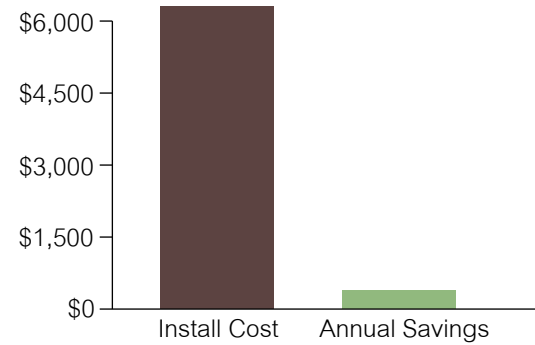
Air Infiltration
Payout: 9-12 yrs



Whole-House Fan
Payout: n/a yrs



Window Replacement
Payout: 15-20 yrs



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The mission of the Center for Cultural Sustainability is to explore the continuity of the cultural systems of human existence. Cultural sustainability includes consideration, understanding and respect for heritage – identities and values that bind people to places.

To learn more about the work we do, please visit our web page.

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