

Weatherize Your Home— Caulk and Weather Strip

Warmed or air-conditioned air mixes with outside air through gaps in your home's thermal envelope—exterior walls, windows, doors, the roof, and floors. Such air leaks can waste large amounts of energy.

Most experts agree that caulking and weather stripping any gaps will pay for itself within one year in energy savings. Caulking and weather stripping will also alleviate drafts and help your home feel warmer when it's cold outside. However, these two weatherization techniques can't replace the need for proper insulation throughout your home.

Assessing air quality

Because caulk and weatherstripping limit indoor-outdoor air circulation, you should assess your indoor air quality before you

apply them. Some homes contain dust, mold, carbon dioxide, and other indoor air contaminants. Sealing air leaks in these homes, without proper ventilation, can also seal in their indoor air pollutants. Therefore, any plan to tighten the thermal envelope of a home should be accompanied by a look at your home's ventilation needs.

This fact sheet does not cover indoor air quality assessment and ventilation. See "Resources" at the end of this fact sheet for whom to contact for more information.

Detecting air leaks

You may already know where some air leakage occurs in your home, such as an under-the-door draft that makes you want to put on socks. But you'll probably need to search to find the less obvious gaps.



Ron Coppock Photography, Inc., NREL/PX03384

Look at areas where different materials meet, like between brick and wood siding, between foundation and walls, and between the chimney and siding. Also inspect around the following for any cracks and gaps that could cause air leaks:

- Door and window frames
- Mail chutes
- Electrical and gas service entrances
- Cable TV and phone lines

Using caulk to seal air leaks throughout your home can help reduce energy costs.



This document was produced for the U.S. Department of Energy (DOE) by the National Renewable Energy Laboratory (NREL), a DOE national laboratory. The document was produced by the Information and Outreach Program at NREL for the DOE Office of Energy Efficiency and Renewable Energy. The Energy Efficiency and Renewable Energy Clearinghouse (EREC) is operated by NCI Information Systems, Inc., for NREL / DOE. The statements contained herein are based on information known to EREC and NREL at the time of printing. No recommendation or endorsement of any product or service is implied if mentioned by EREC.



You can use caulking compound to seal leaks in a variety of places throughout your home...

- Outdoor water faucets
- Where dryer vents pass through walls
- Bricks, siding, stucco, and foundation
- Air conditioners
- Vents and fans.

Depressurize your home to help detect leaks. On a cool, very windy day, turn off the furnace. Shut all windows and doors. Turn on all fans that blow air outside, such as bathroom fans or stove vents. Then light an incense stick and pass it around the edges of common leak sites. Wherever the smoke is sucked out of or blown into the room, there's a draft. Or just turn on all your exhaust fans (don't need to turn off the furnace) and try one of these methods:

- At night, shine a flashlight over all potential gaps while a partner observes the house from outside. Large cracks will show up as rays of light. Not a good way to detect small cracks.
- Shut a door or window on a piece of paper. If you can pull it out without tearing, you're losing energy.

For a more thorough and accurate measurement of air leakage, you can hire a technician to conduct a blower door test in your home. Blower doors are variable-speed fans with a frame and shroud that allows them to fit inside a variety of door frames. Pressure gauges determine airflow through the fan, as well as fan-induced pressure. The leakier a house, the more airflow required to induce a pressure difference. When used as a diagnostic tool, a blower door can also reveal the location of many leaks.

Caulking

Selection

You can use a caulking compound to seal leaks in a variety of places throughout your home, including around windows and door frames. In addition to plugging air leaks, caulking can also prevent water damage inside and outside of the home when applied around faucets, ceiling fixtures, water pipes, drains, bathtubs and other plumbing fixtures.

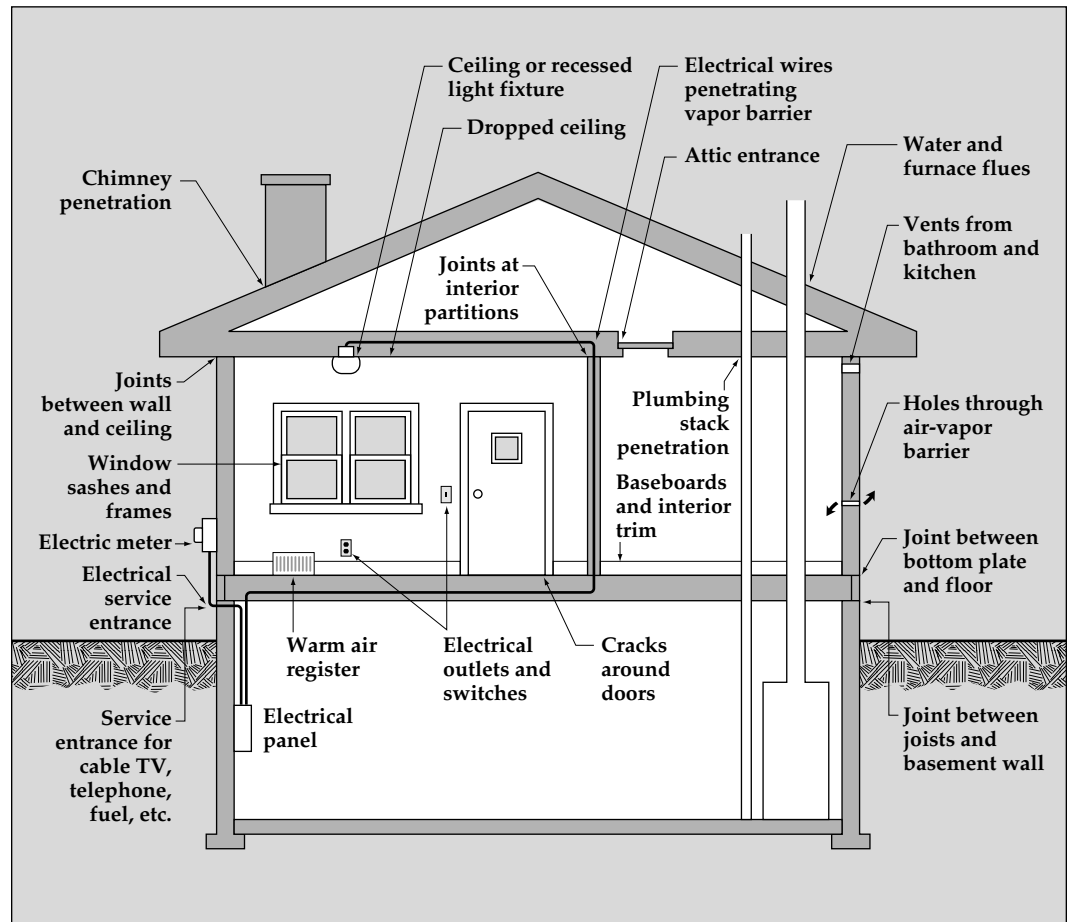


Fig. 1. Places where air leakage can occur in your home.

Although not a high-tech operation, caulking can be tricky.

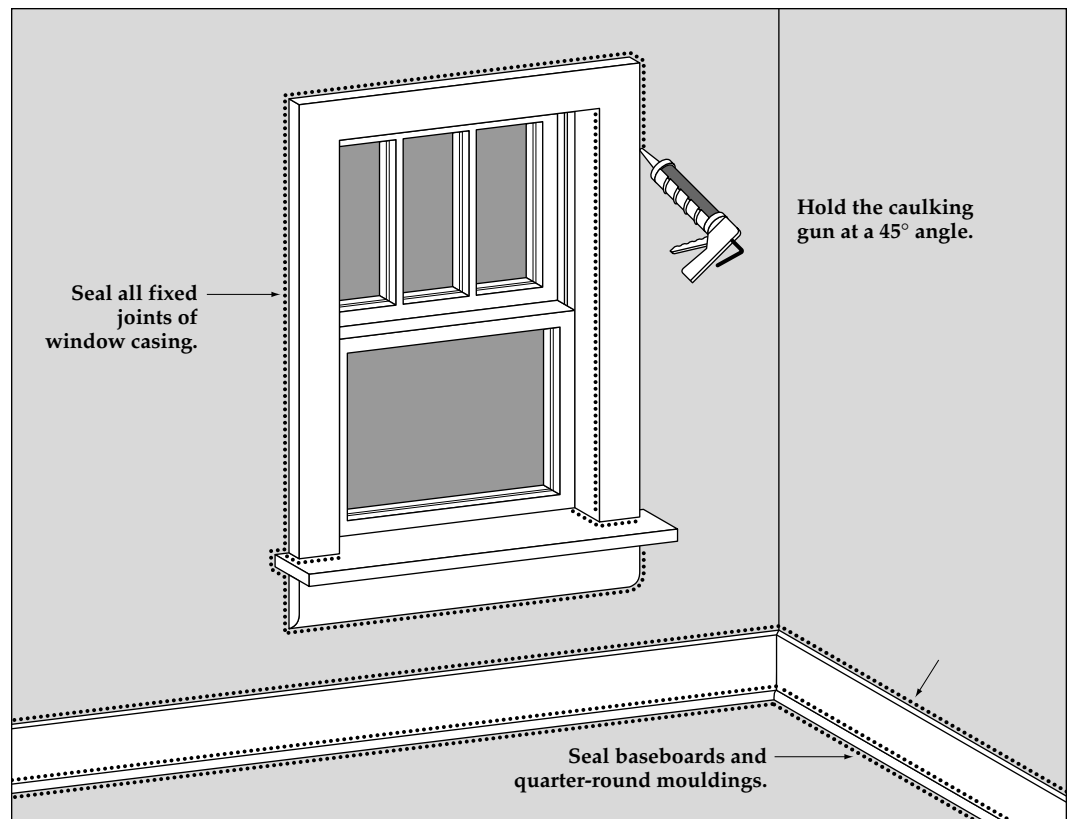


Fig. 2. Apply caulk to seal fixed joints in your home.

Caulk forms a flexible seal for cracks, gaps, or joints less than 1 quarter-inch wide. Most caulking compounds come in disposable cartridges that fit in half-barrel caulking guns (if possible, purchase one with an automatic release). Some pressurized cartridges do not require caulking guns. When deciding how much caulking to purchase, consider that you'll probably need a half-cartridge per window or door and four cartridges for the foundation sill.

Caulking compounds can also be found in aerosol cans, squeeze tubes, and ropes for small jobs or special applications. Water-based caulk can be cleaned with water, while solvent-based compounds require a solvent for cleanup. Caulking compounds also vary in strength, properties, and prices. See Table 1 on page 4 for a description and comparison of the common caulking compounds.

Application

Although not a high-tech operation, caulking can be tricky. Read and follow the instructions on the compound cartridge. And save yourself some trouble by remembering a few important tips:

- Clean all areas to be caulked for good adhesion. Remove any old caulk and paint, using a putty knife or a large screwdriver. Make sure the area is dry so you won't seal in moisture.
- Hold the gun at a consistent angle. Forty-five degrees is best for getting deep into the crack. You know you've got the right angle when the caulk is immediately forced into the crack as it comes out of the tube.
- Caulk in one straight continuous stream, if possible. Avoid stops and starts.
- Send caulk to the bottom of an opening to avoid bubbles.
- Make sure the caulk sticks to both sides of a crack or seam.
- Release the trigger before pulling the gun away to avoid applying too much caulking compound. A caulking gun with an automatic release makes this so much easier.
- If caulk oozes out of a crack, use a putty knife to push it back in.
- Don't skimp. If the caulk shrinks, reapply it to form a smooth bead that will seal the crack completely.

Table 1. Common Caulking Compounds

| Caulking Compound | Recommended Uses | Cleanup | Shrinkage | Adhesion | Cost | Comments |
|--|--|---|----------------------------|--------------------|-------------------|---|
| <i>Silicone: household</i> | Seals joints between bath and kitchen fixtures and tile. Forms adhesive for tiles and metal fixtures. Seals metal joints as in plumbing and gutters. | Dry cloth if immediate; mineral spirits or naphtha. | Little or none. | Good to excellent. | High. | Flexible: cured silicone allows stretch of joints up to three times normal width or compression to one-half the width. |
| <i>Silicone: construction</i> | Seals most dissimilar building materials such as wood and stone, metal flashing, and brick. | Dry cloth if immediate; mineral spirits or naphtha. | Little or none. | Good to excellent. | High. | Permits joints to stretch or compress. Silicones will stick to painted surfaces, but paint will not adhere to most cured silicones. |
| <i>Polyurethane, expandable spray foam</i> | Expands when curing; good for larger cracks indoors or outdoors. Use in nonfriction areas, as rubber becomes dry and powdery over time. | Solvent such as lacquer thinner, if immediate. | None; expands quite a bit. | Good to excellent. | Moderate to high. | Spray-foam quickly expands to fit larger, irregular-shaped gaps. Flexible. Can be applied at variable temperatures. Must be painted for exterior use to protect from ultraviolet radiation. Some manufacturing processes produce greenhouse gases. |
| <i>Water-based foam sealant</i> | Around window and door frames in new construction; smaller cracks. | Water. | None; expands only 25%. | Good to excellent. | High. | Takes 24 hours to cure. Cures to soft consistency. Water-based foam production does not produce greenhouse gases. Will not over-expand to bend windows (new construction). Must be exposed to air to dry. Not useful for larger gaps, as curing becomes difficult. |
| <i>Butyl rubber</i> | Seals most dissimilar materials (glass, metal, plastic, wood, and concrete.) Seals around windows and flashing, bonds loose shingles. | Mineral spirits or naphtha. | From 5% to 30%. | Good. | Moderate to high. | Durable 10 or more years; resilient, not brittle; can be painted after one week curing; variable shrinkage; may require two applications; does not adhere well to painted surfaces. Toxic, follow label precautions. |
| <i>Latex</i> | Seals joints around tub and shower. Fills cracks in tile, plaster, glass, and plastic; fills nail holes. | Water. | From 5% to 10%. | Good to excellent. | Moderate. | Easy to use. Seams can be trimmed or smoothed with moist finger or tool. Water resistant when dry. Can be sanded and painted. Less elastic than above materials. Varied durability, 2 to 10 years; will not adhere to metal; little flexibility once cured; needs to be painted when used on exteriors. |
| <i>Oil or resin-based</i> | Seals exterior seams and joints on building materials. | Mineral spirits or naphtha. | From 10% to 20%. | Good. | Low. | Readily available. Least expensive of the four types. Rope and tube form available. Oils dry out and cause material to harden and fall out. Low durability, 1-4 years; poor adhesion to porous surfaces like masonry; should be painted; can be toxic (check label). Limited temperature range. |

Weather Stripping

Selection

Weatherstripping can seal leaks around movable joints, such as windows or doors. You need to choose a type of weatherstripping that will withstand the friction, weather, temperature changes, and wear and tear associated with its location. For example, when applied to a door bottom or threshold, weatherstripping could drag on carpet or erode as a result of foot traffic. Weatherstripping in a window sash must accommodate the sliding of panes—up and down, sideways or out. The weatherstripping you choose should seal well when the door or window is closed while allowing it to open freely.

Choose a product for each specific location. Felt and open-cell foams tend to be inexpensive, susceptible to weather, visible, and inefficient at blocking airflow. However, the ease of applying these materials may make them valuable in low-traffic areas. Vinyl, slightly more expensive, holds up well and resists moisture. Metals (bronze, copper, stainless steel, and aluminum) last for years and are affordable. They can also provide a nice touch to older homes where vinyl might seem out

of place. You can use more than one type of weatherstripping to seal an irregularly shaped space. Take durability into account when comparing costs. Table 2 on page 6 describes and compares commonly used weatherstripping.

To determine how much weatherstripping you will need, add the perimeters of all windows and doors to be weatherstripped. Then add 5 to 10 percent to accommodate any waste. Also take into consideration that weatherstripping comes in varying depths and widths.

Application

Weather-stripping supplies and techniques range from simple to the technical. Consult the instructions on the weatherstripping package. Here are a few basic guidelines:

- Weatherstripping should be applied to clean, dry surfaces in temperatures above 20° F (-7° C).
- Measure the area to be weather stripped twice before you cut anything.
- Apply weatherstripping snugly against both surfaces. The material should compress when the window or door is shut.

The weatherstripping you choose should seal well when the door or window is closed while allowing it to open freely.

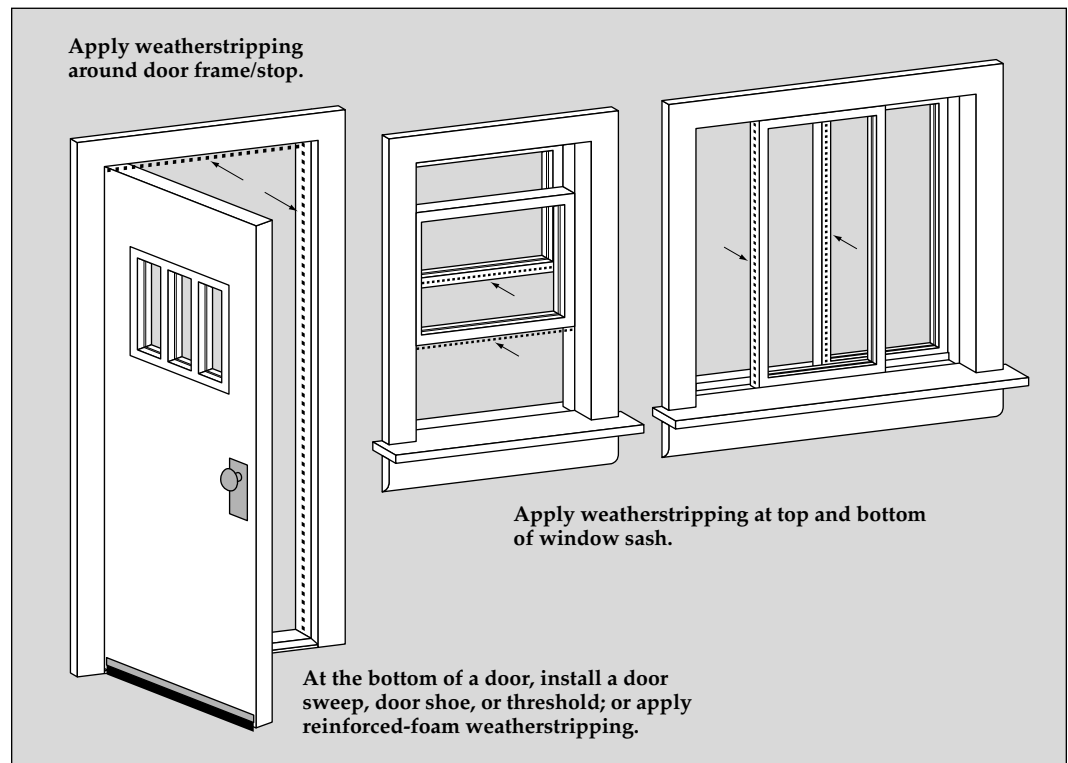


Fig. 3. Apply weatherstripping around the movable joints of your doors and windows.

Table 2. Common Weatherstripping

| Weatherstripping | Best Uses | Cost | Advantages | Disadvantages |
|---|---|--------------------------------------|---|--|
| Tension seal: Self-stick plastic (vinyl) folded along length in a V-shape or a springy bronze strip (also copper, aluminum, and stainless steel) shaped to bridge a gap. The shape of the material creates a seal by pressing against the sides of a crack to block drafts. | Inside the track of a double-hung or sliding window, top and sides of door. | Moderate; varies with material used. | Durable. Invisible when in place. Very effective. Vinyl is fairly easy to install. Look of bronze works well for older homes. | Surfaces must be flat and smooth for vinyl. Can be difficult to install, as corners must be snug. Bronze must be nailed in place (every three inches or so) so as not to bend or wrinkle. Can increase resistance in opening/closing doors or windows. Self-adhesive vinyl available. Some manufacturers include extra strip for door striker plate. |
| Felt: Plain or reinforced with a flexible metal strip; sold in rolls. Must be stapled, glued, or tacked into place. Seals best if staples are parallel to length of the strip. | Around a door or window (reinforced felt); fitted into a door jamb so the door presses against it. | Low. | Easy to install, inexpensive. | Low durability; least effective preventing airflow. Do not use where exposed to moisture or where there is friction or abrasion. All-wool felt more durable and more expensive. Very visible. |
| Reinforced foam: Closed-cell foam attached to wood or metal strips. | Door or window stops; bottom or top of window sash; bottom of door. | Moderately low. | Closed-cell foam an effective sealer; scored well in wind tests. Rigid. | Can be difficult to install; must be sawed, nailed, and painted. Very visible. Manufacturing process produces greenhouse gas emissions. |
| Tape: Nonporous, closed-cell foam, open-cell foam, or EDPM (Ethylene Propylene Diene Monomer) rubber. | Top and bottom of window sash; door frames; attic hatches and non-operable windows. Good for blocking corners and irregular cracks. | Low. | Extremely easy to install. Works well when compressed. Inexpensive. Can be reinforced with staples. | Durability varies with material used, but not especially high for all; use where little wear is expected; visible. |
| Rolled or reinforced vinyl: Pliable or rigid strip gasket (attached to wood or metal strips.) | Door or window stops; top or bottom of window sash; bottom of a door (rigid strip only). | Low to moderate. | Easy installation. Low to moderate cost. Some types of rigid strip gaskets provide slot holes to adjust height, increasing durability. Comes in varying colors to help with visibility. | Visible. Self-adhesive on pliable vinyl may not adhere to metal. |
| Door sweep: Aluminum or stainless steel with brush of plastic, vinyl, sponge, or felt. | Bottom of interior side of in-swinging door; bottom of exterior side of exterior-swinging door. | Moderate to high. | Relatively easy to install; many types are adjustable for uneven threshold. Automatically retracting sweeps also available, which reduce drag on carpet and increase durability. | Visible. Can drag on carpet. Automatic sweeps are more expensive and can require a small pause once door is unlatched before retracting. |
| Magnetic: Works similarly to refrigerator gaskets. | Top and sides of doors, double-hung and sliding window channels. | High | Very effective air sealer. | |
| Tubular rubber and vinyl: Vinyl or sponge rubber tubes with a flange along length to staple or tack into place. Door or window presses against them to form a seal. | Around a door. | Moderate to high. | Effective air barrier. | Self-stick versions challenging to install. |
| Reinforced silicone: Tubular gasket attached to a metal strip that resembles reinforced tubular vinyl. | On a doorjamb or a window stop. | Moderate to high. | Seals well. | Installation can be tricky. Hacksaw required to cut metal; butting corners pose a challenge. |

(Continues on next page)

Table 2 continued

| Weatherstripping | Best Uses | Cost | Advantages | Disadvantages |
|--|---|-------------------|--|--|
| Door tread: Aluminum face attachment with vinyl C-shaped insert to protect under the door. | To seal space beneath door. | Moderate to high. | On the exterior, product sheds rain. Durable. Can be used with uneven opening. Some door shoes have replaceable vinyl inserts. | Fairly expensive; installation moderately difficult. Door bottom planning possibly required. |
| Bulb threshold: Vinyl and aluminum. | Door thresholds. | Moderate to high. | Combination threshold and weatherstrip; available in different heights. | Wears from foot traffic; relatively expensive. |
| "Frost-brake" threshold: Aluminum or other metal on exterior, wood on interior, with door-bottom seam and vinyl threshold replacement. | To seal beneath a door. | Moderate to high. | The use of different materials means less cold transfer. Effective. | Moderately difficult to install, involves threshold replacement. |
| Fin seal: Pile weatherstrip with plastic Mylar fin centered in pile. | For aluminum sliding windows and sliding glass doors. | Moderate to high. | Very durable. | Can be difficult to install. |
| Interlocking metal channels: Enables sash to engage one another when closed. | Around door perimeters. | High. | Exceptional weather seal. | Very difficult to install as alignment is critical. To be installed by a professional only. |

Resources

The following are sources of additional information on caulking, weather stripping, and other related topics. The list is not exhaustive, nor does the mention of any resource constitute a recommendation or endorsement.

Ask an Energy Expert

DOE Energy Efficiency and Renewable Energy Clearinghouse (EREC)
P.O. Box 3048
Merrifield, VA 22116
Phone: 1-800-DOE-EREC (1-800-363-3732)
TDD: 1-800-273-2957
Fax: (703) 893-0400
E-mail: doe.erec@nciinc.com
Online submittal form:
www.eren.doe.gov/menus/energyex.html
Consumer Energy Information Web site:
www.eren.doe.gov/consumerinfo/

Energy experts and information specialists at EREC provide free general and technical information to the public on many topics and technologies pertaining to energy efficiency and renewable energy, including air quality assessment, which is not covered in this fact sheet.

DOE Energy Efficiency and Renewable Energy Network (EREN)

Web site: www.eren.doe.gov/

A comprehensive online resource for DOE's energy efficiency and renewable energy information.

Organizations

Alliance to Save Energy

1200 18th Street NW, Suite 900
Washington, DC 20036
Phone: (202) 857-0666
Fax: (202) 331-9588
E-mail: info@ase.org
Web site: www.ase.org

A nonprofit coalition of prominent business, government, environmental, and consumer leaders who promote the efficient and clean use of energy worldwide

(Continued on page 8)

(Continued from page 7)

DOE Office of Building Technology, State and Community Programs (BTS)

Web site: www.eren.doe.gov/buildings/

In partnership with industry and government, develops, promotes, and integrates energy technologies and practices to make buildings more efficient and affordable.

Indoor Air Quality Information Clearinghouse (IAQINFO)

Environmental Protection Agency

P.O. Box 37133

Washington, DC 20013-7133

Phone: 1-800-438-4318, (703) 356-4020

Fax: (703) 356-5386

E-mail: iaqinfo@aol.com

Web site: www.epa.gov/iaq/

Helps provide information and answer questions about indoor air pollution.

Weatherization Assistance Program

BTS

Web site: www.eren.doe.gov/buildings/weatherization_assistance/

Works with local and state weatherization programs throughout the United States, reducing heating and cooling costs for low-income families and individuals.

Web Sites

Caulking and Weatherstripping

Energy Efficiency Resource Gateway

Louisiana Department of Natural Resources

Web site: www.leeric.lsu.edu/energy/caulking/

An online brochure on the how-to and what-to-use for caulking and weather stripping.

Home Tightening—Home Series

Iowa Energy Center

Web site: www.energy.iastate.edu/efficiency/residential/homeseries/tightening/

Shows how stopping air leaks in your home with caulk and weatherstripping is the most effective way to save energy in your home and increase a home's comfort.

Remodeling How-To's: The Ways of Weather Stripping

Remodeling Online

Web site: <http://remodeling.hw.net/frmArtFront/0,1071,282~341~342~1306~1,00.html>

Features article on "The Ways of Weather Stripping" best suited to older homes.

Residential Energy Efficiency Database (REED)

Web site: www.its-canada.com/reed/

An information source for individuals seeking understanding on techniques, technologies, and products related to residential energy efficiency.

Weatherization Guide

Urban Options

Web site: www.urbanoptions.org/pages/weatgrph.htm

Takes you step by step through all the basics of plugging air leaks and adding insulation in your home.

Energy Saving How To's

Do It Yourself.com

Web site: www.doityourself.com/energy/

Covers the basics of most weatherization topics.

Weatherizing Your Home

The Resource: Consumer Education

Nebraska Extension Publications

Web site: www.ianr.unl.edu/pubs/consumered/

Click on "Energy Conservation" to reference information on weatherizing your home, using both caulk and weatherstripping.

Further Reading

Air Sealing, BTS, November 1999. Available in PDF at www.eren.doe.gov/buildings/documents/ and in print from EREC (see "Ask an Energy Expert" above).

Consumer Guide to Home Energy Savings, American Council for and Energy-Efficient Economy (ACE³), Washington, D.C. Available from ACE³ at www.aceee.org or by calling (202) 429-0063.

Energy Savers: Tips on Saving Energy & Money at Home, DOE. Available online in HTML and PDF at www.eren.doe.gov/consumerinfo/energy_savers/, and in print from EREC (see "Ask an Energy Expert" on page 7). Spanish version also available.

Insulation Fact Sheet, DOE. Available online in HTML at www.ornl.gov/roofs+walls/insulation/ins_01.html and in print from EREC (see "Ask an Energy Expert" on page 7).

Residential Energy: Cost Savings and Comfort for Existing Buildings, J. Krigger, Saturn Resource Management, Helena, MT, 2000. Phone: 1-800-735-0577; Fax: (406) 442-1316; Web site: www.residential-energy.com.