



## **Weatherization – making conservation attainable for everyone**

Weatherization is something everyone can do to help save energy, save money and increase the comfort of his or her home. It can be as simple or extensive as you desire. The nice part about weatherization is that whatever you do will have a beneficial impact, even the smallest do-it-yourself (DIY) effort. This makes energy conservation attainable for everyone regardless of skill or means.

**Want to do it yourself?** Check out this website for excellent directions and additional tips: <http://www.doityourself.com/stry/h2conserve>

Let's dive in! This article contains information from a variety of sources and is categorized into sections for your convenience. The sections are listed below and set up as links so you can jump right to the section of most interest. Click on the heading in a section and it brings you back here. Say goodbye to your scrolling woes.

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### **Windows**

Windows can be like the weather; when it comes to doing something about them to save energy, everyone is talking about it but no one is doing anything. The reason for this is simple – traditional energy audit recommendations have invariably gone to the windows and advised replacement. From a homeowner's perspective, this can often be unattainable as window replacement is VERY expensive.

Windows indeed do represent one of the largest sources of energy leakage in a home. They are constantly exposed to the effects of the climate and often develop leaks around their framing, weatherstripping and panes. The earliest attempts at storm windows are just as leaky as the windows they protect in most cases.

Homeowners can still take measures to improve efficiency, comfort and energy consumption without the expense of a complete replacement. Here are some things that can be done on a DIY basis and at a reasonable cost. It's better to take some measures and enjoy the resulting benefits than to throw up your hands and do nothing over a cost issue.



- Caulk and seal around the window frames and around storms. Note: Be sure to allow for condensation to collect and drain out along the bottom of the storms. There are usually weep holes (openings in the bottom frame) for this purpose. This prevents water damage to the wooden portions of the window.)
- Make sure glazing is sound around the glass.
- Replace broken and cracked panes.
- Replace weatherstripping wherever possible on the tops and bottoms of the windows.
- If you don't have storms, consider putting plastic over the outside or inside of the windows.
- Use close-fitting or insulated shades inside the house. In the summer, draw them on the sunny side of the house and adjust them as the sun moves. In the winter, open them on the sunny part of the house and follow the sun to benefit from solar gain.



**Recommendation:** Don't be alarmed or frustrated by the high cost of window replacement. Do it if you can but take the steps noted above in any case to achieve a nice measure of conservation.

## Doors

Doors are one of the easier fixes when it comes to weatherization. First, they are fewer in number than windows unless you live in some really abstract work of modern architecture. Second, there are a number of easy options, many "homespun," for weatherizing these portals.

Doors fail us in energy conservation through leaks that develop around their frames, through weatherstripping that has seen better days and through radiating or transferring heat and cold into the home.

Rarely should you need to replace a door unless there is specific structural damage to it or around it. If you do not have a storm door, look into having one installed. For most convenience, get one that offers both screen and glass components. Fix the weatherstripping. This can be applied to the edges or around the door. There are a multitude of choices and most are applied using a self-stick feature and a sharp knife. Use door sweeps to block gaps at the bottom that cannot be addressed with weatherstripping.

Do not forget your garage door either. There are a number of solutions to seal around the edges that keep weather, dust, vermin and other unpleasant things out. A good NJ source for these products is a company named PortaSeal. They sell their products through outlets like Home Depot. Why choose a local manufacturer? Two reasons – it helps our



economy and the retailer causes less energy to be used to get the product to their stores when they buy from local sources.

Sliding glass doors are another issue altogether. Heavy drapes that block drafts and sun (see the last bullet in the windows section) work very well.

Want a homespun option for your doors? Place rolled up towels or blankets at the feet of doors to stop drafts.

**Recommendation:** Seal the doors as tightly as possible with the measures noted above. If you have the means, install storm doors where they don't exist and consider insulated doors for especially vulnerable situations.

## Insulation

The first thing you need to understand about insulation is R-value. This is the key measure and a larger number is better. The more R the merrier (say that three times fast). How much insulation do you need? That depends primarily on your local climate. The DOE has created a Zip Code-based tool to help you determine the recommended levels for your location at <http://www.ornl.gov/~roofs/Zip/ZipHome.html>

Now that you know what you should have, it's time to see what you do have. Where do you start? The attic is often the easiest place to begin your insulation sleuthing. Pop open the access and look at your attic space. First of all, what type of insulation do you have? Batt (rolls of insulation backed by paper) or blown-in (loose insulation sprayed into the space). Measure how much you have with a ruler. If it is less than 7" of batt or 6" of loose, you will likely benefit from more insulation. The good news? The attic is the easiest place to add insulation and provides excellent results. Nice of us to start here, huh?



Let's add insulation to the attic. Batt is the easiest for a DIY project. Blown-in requires specialized pneumatic equipment that can be rented but takes more skill (and clean up). A key to getting the most out of insulation is to install it with minimum compression. Compressing insulation removes the air voids which provide the insulation value. Trying to stuff a 6" fiberglass batt into a space only 4" deep seriously reduces the insulation value. Ask your insulation provider for tips and techniques on proper insulation. I like to lay my insulation at 90 degrees to the existing insulation to help cover any gaps or drafts in the existing insulation.

One more suggestion. Tread carefully in the attic. If your attic has rafters without flooring, you don't want to step through the ceiling.

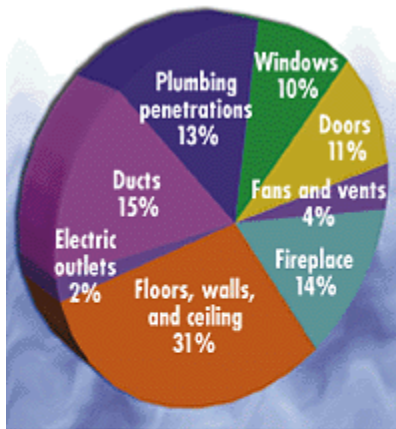


Now, on to the basement or crawl space (slab-on-grade homeowners can skip this step). The underbelly of your home is another excellent place to insulate especially, if it is unconditioned. It has the disadvantage of being more difficult to insulate due to the variety of pipes and wires that are present. About the only option in a basement is batt insulation or rigid foam. If you go with the batts, resist the temptation to stuff the insulation into place (see the preceding note on compression). Rigid foam can make life easier, but plan for allowing access to critical pipes and wires.

The hardest area of your home to insulate is the walls. Once the house is built, it takes a lot of effort to go back and insulate walls. The most common approach is to drill holes into the outside of the house about 18” on center and blowing in insulation. Expanding foam insulation can be applied in the same manner. This doesn’t work if you have a brick home or an exterior of aluminum or vinyl siding.

**Recommendation:** Unless you are building new or renovating an old home by stripping it to the bare studs, stick with insulating the attic and basement. The DOE offers additional information at <http://www1.eere.energy.gov/consumer/tips/insulation.html>.

### Drafts (air leaks)



#### **How Does the Air Escape?**

Air infiltrates in and out of your home through every hole, nook, and cranny. About one third of this air infiltrates through openings in your ceilings, walls, and floors.

It seems there is no satisfying conditioned indoor air. On cold days, your warm air wants out and on warm days your cool air wants out. The wandering air masses take advantage of gaps in the exterior of your home to make their escape. If this weren’t bad enough, they often encourage their outside brethren to take their place inside! To add insult to injury, this air swap is something we can often feel as air movement or drafts.

The only way to keep your conditioned air where it belongs is to block their avenues of escape and seal as many leaks as possible. Prime offenders are windows and doors. Over time, weather stripping around these openings deteriorates and begins to leak. Homes will also develop gaps around door and window frames. The light switches and electric outlets in exterior walls can leak an amazing amount of air. Finally, any plumbing, duct work or electrical wiring penetrations in exterior walls can provide ready avenues for your willful conditioned air to escape.

Sealing leaks is actually pretty easy, affordable and makes a great DIY project. The following tips from the DOE spell out areas of focus.

- Caulk and weatherstrip doors and windows that leak air.



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- Caulk and seal air leaks where plumbing, ducting, or electrical wiring penetrates through exterior walls, floors, ceilings, and soffits over cabinets.
- Install rubber gaskets behind outlet and switch plates on exterior walls.
- Look for dirty spots in your insulation, which often indicate holes where air leaks into and out of your house. You can seal the holes by stapling sheets of plastic over the holes and caulking the edges of the plastic.
- Install storm windows over single-pane windows or replace them with double-pane windows. *As an alternative, use plastic sheeting over exterior windows or the shrink-wrap type inside during the winter. You can also look into insulated shades that fit tightly inside the frame. None of these are as good as storms or window replacement but they are significantly more affordable.*
- When the fireplace is not in use, keep the flue damper tightly closed. A chimney is designed specifically for smoke to escape, so until you close it, warm air escapes—24 hours a day!
- For new construction, reduce exterior wall leaks by either installing house wrap, taping the joints of exterior sheathing, or comprehensively caulking and sealing the exterior walls.

**Recommendation:** Do only what you can reach safely for exterior sealing. There's no need to injure yourself with a tumble from a ladder. Get help for the inaccessible areas. Caulk and seal as recommended above. Use caulks and sealants specifically designed for the purpose. Silicon-based products tend to have a much longer life, meaning you won't need to redo the job as often.

### Ductwork

Centrally distributed hot and cool air need ductwork with a minimum of leaks to be the most energy efficient and deliver maximum comfort. The reason this is important is that conditioned air will leak out on the supply side. The energy (and money) used to heat or cool the air is now wasted. Return air duct leaks can draw in unconditioned air that increases the load on your heating and cooling system, causing it to use more energy (and money) than needed to do its job. Anywhere the ductwork is cut or branches is a potential source of leakage. As handy as duct tape (or duck tape for those preferring the most popular pronunciation) is for many household chores, it is actually awful for sealing ducts. Funny the way things turn out.

Ductwork needs heavy-duty mastic sealing solutions. Specialized duct sealing tape is available for this purpose. It is recognizable by its thicker adhesive layer and is usually backed with a reflective foil. Mastic can also be applied by caulk gun or trowel. Your local hardware store can give you recommendations.

Duct sealing is not the easiest project. Depending upon your home's construction, the ductwork may be under the house, buried in walls or tucked away in the attic. To seal seams, you need to get all the way around the duct, which is often difficult.



Ideally, your ductwork will be completely insulated. Unfortunately, that is rarely the case and represents a major expense in a retrofit situation. And insulating ductwork doesn't eliminate the need to seal the joints. You need to do both.

**Recommendation:** Address those areas that you can. For instance, seal between room registers / diffusers and the ductwork. In attics, seal around where round flexible ductwork enters the rigid ductwork. Where the old duct tape is peeling off, remove what you can and reapply with duct sealing tape or mastic. Do the same in basements and crawl spaces.

With respect to insulating ductwork, again, do what you can. Partial insulation is not all that beneficial and if you have to jam the insulation into place to get around obstructions you are actually wasting your effort, as compressed insulation is much less effective.



- A. Leaky duct connection
- B. Return leaks
- C. Furniture blocking register
- D. Leaks at furnace and filter slot and duct tape failure
- E. Fallen duct insulation
- F. Supply leaks
- G. Kinks in ductwork restricting airflow

Source: EPA, also posted on California Energy Commission web page:  
<http://www.consumerenergycenter.org/home/tightenup/ducts.html>



## Ventilation

Proper ventilation is essential for health, comfort and efficient heating and cooling equipment operation. Poorly sealed homes don't count towards ventilation so don't get your hopes up. Think of cholesterol. There is good cholesterol and bad. Controlled ventilation is like good cholesterol while drafts and leaks are like bad.

You can actually seal your house too tight and create serious health problems. Carbon monoxide is a real issue. Overall indoor air quality is another. Finally, your heating system needs air to support its operation. If starved for air, it loses efficiency rapidly. It might also steal air from inside the home further increasing the risk of CO buildup.

A home needs to "breathe" and replenish the air inside on a periodic basis. In the heating, cooling and ventilation industry, this is known as air turns or air changes. This needs to be controlled using the heating and cooling system in order to contribute to comfort and energy efficiency.

According to a 2002 paper written for the April edition of the ASHRAE Journal by Joseph Lstiburek, Ph.D., P.Eng., the desired controlled ventilation is quantified as:

*"7.5 cfm/person + 0.01 cfm/ft<sup>2</sup> of conditioned floor area*

*Occupancy is defined as the number of bedrooms + 1*

*This value comes from proposed ASHRAE Standard 62.2P, *Ventilation for Acceptable Indoor Air Quality in Low-Rise Residential Buildings*. The merits of this controlled ventilation rate are not discussed here. For a common single family detached house (three bedrooms, 2,000 ft<sup>2</sup> [186 m<sup>2</sup>]), this works out to 50 cfm (24 L/s) of outdoor air. Restated, based on typical house volumes (ceiling heights ranging between 8 ft and 10 ft [2.4 m and 3 m]), this is between 0.15 and 0.2 air changes per hour."*

**Recommendation:** Consult with your HVAC contractor for advice in this area. If you are having problems with stuffiness, stale air, mold or other unwelcome indoor air quality effects, controlled ventilation may provide the answer you need.

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