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**5** Determining the R-Value You Need

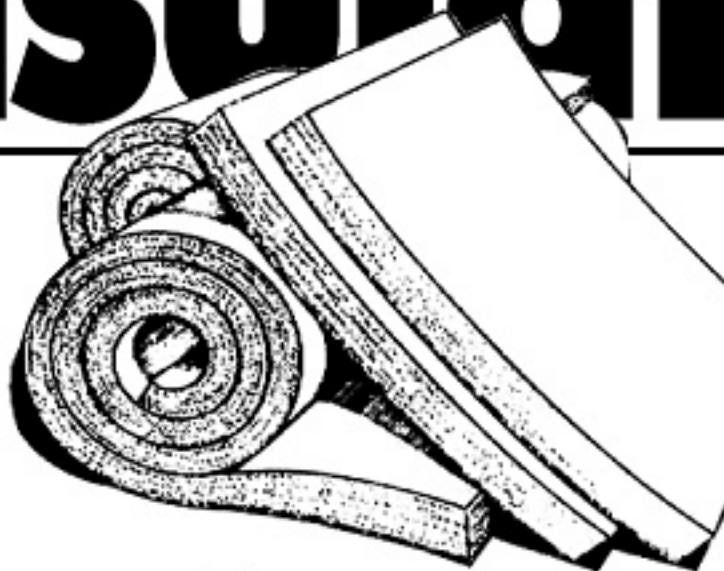
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Department of Energy  
Assistant Secretary  
Energy Efficiency and Renewable Energy

**Fact Sheet**

# Insulation



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## INTRODUCTION

**E**lectricity bills, oil bills, gas bills – all homeowners pay for one or more of these utilities, and wish they paid less. Often many of us do not really know how to control or reduce our utility bills. We resign ourselves to high bills because we think that is the price we have to pay for a comfortable home. We encourage our children to turn off the lights and appliances, but may not recognize the benefits of insulating the attic.

### Why Should You Insulate?

Heating and cooling ("space conditioning") account for 50 to 70% of the energy used in the average American home. About 20% goes for heating water. On the other hand, lighting and appliances and everything else account for only 10 to 30% of the energy used in most residences. It makes good sense to turn lights and appliances off when they are not needed, and you'll save even more on your energy costs if you reduce the amount of energy needed for heating and cooling.

Unless your home was constructed with special attention to energy efficiency, adding insulation will probably reduce your utility bills. Much of the existing housing stock in the United States is not insulated to the best level. Older homes are likely to use more energy than newer homes, leading to very high heating and air-conditioning bills. Even if you own a new home, adding insulation may save enough money in reduced utility bills to pay for itself within a few years, continue to save you money for as long as you own the home, and increase the resale value of your house.

### The Crucial Role of Thermal Insulation

Inadequate insulation and air leakage are leading causes of energy waste in most homes. Insulation saves money and our nation's limited energy resources. It can also make your house more comfortable by helping to maintain a uniform temperature throughout the house. Walls, ceilings, and floors will be warmer in the winter and cooler in the summer. Insulation can also act as a sound absorber or barrier, keeping noise levels down.

It is possible to add insulation to almost any house. You may be able to do the job yourself if the structural framing is accessible – for instance, in unfinished attics or under the floor over an unheated space. Or, you may prefer to hire an insulation contractor. In either case, it is important to choose and install the insulation correctly.

The amount of energy you conserve will depend on several factors: your local climate; the size, shape, and construction of your house; the living habits of your family; the type and efficiency of the heating and cooling systems; and the fuel you use. Once the energy savings have paid for the installation cost, energy conserved is money saved – and the annual savings will increase if utility rates go up.

### Insulation Priorities

It is most important to:

- *Insulate your attic* to the recommended level, including the attic door, or hatch cover.
- Provide the recommended level of insulation *under floors above unheated spaces, around walls in a heated basement or unventilated crawl space, and on the edges of slabs-on-grade.*
- Use the recommended levels of insulation for *exterior walls* for new house construction. When remodeling or re-siding your house, consider using the levels recommended for new construction in your existing walls.

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## HOW DOES INSULATION WORK FOR YOU?

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**H**eat flows naturally from a warmer to a cooler space. In the winter, this heat flow moves directly from all heated living spaces to adjacent unheated attics, garages, and basements, or to the outdoors; or indirectly through interior ceilings, walls, and floors – wherever there is a difference in temperature. During the cooling season, heat flows from outdoors to the house interior. To maintain comfort, the heat lost in winter must be replaced by your heating system and the heat gained in summer must be removed by your air conditioner. Insulating ceilings, walls, and floors decreases this heat flow by providing an effective resistance to the flow of heat.

Insulation is rated in terms of thermal resistance, called R-value, which indicates the resistance to heat flow. *The higher the R-value, the greater the insulating effectiveness.* The R-value of thermal insulation depends on the type of material, its thickness, and density. In calculating the R-value of a multi-layered installation, the R-values of the individual layers are added. Installing

more insulation in your home increases R-value and the resistance to heat flow.

*The effectiveness of an insulated wall or ceiling also depends on how and where the insulation is installed.* For example, insulation which is compressed will not give you its full rated R-value. Also, the overall R-value of a wall or ceiling will be somewhat different from the R-value of the insulation itself because some heat flows around the insulation through the studs and joists. That is, the overall R-value of a wall with insulation between wood studs is less than the R-value of the insulation itself because the wood provides a thermal short-circuit around the insulation. The short-circuiting through metal framing is much greater than that through wood-framed walls; sometimes the metal wall's overall R-value can be as low as half the insulation's R-value. With careful design, this short-circuiting can be reduced. More information about whole-wall R-values can be found on the Web page referenced on page 18.

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## DOES YOUR HOME NEED MORE INSULATION?

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**T**o begin to answer this question, you must first find out how much insulation you already have and then determine how much more would be cost-effective. Many older homes have less insulation than homes built today. A qualified home energy auditor will include an insulation check as a routine part of an energy audit. For information about home energy audits, call your local utility company. State energy offices are another valuable resource for information. An energy audit of your house will identify the amount of insulation you have and need, and will likely recommend other improvements as well.

If you don't have someone else inspect your home, you'll need to look

