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**Department of
Energy**
Assistant Secretary
Energy Efficiency
and Renewable
Energy



Insulation: Where and How Much?

[Figure 1](#) shows which building spaces should be insulated. Discuss the house plans with your builder, and make sure each of these spaces is properly insulated to the R-values recommended here. Remember to buy the insulation based on this R-value, and to check the product label to determine the insulation's proper thickness, especially if you plan to install it in a confined space, such as in wall cavities and cathedral ceilings.

[Figure 2](#) shows the Department of Energy's climate zones, along with a short summary of our insulation recommendations for new houses. These recommendations are based on comparing your future energy savings to the current cost of installing insulation. A range is shown for many locations for these reasons:

- Energy costs vary greatly over each zone.
- Installed insulation costs vary greatly over each zone.
- Heating and cooling equipment efficiency varies from house to house.
- Our best estimate of future energy costs may not be exactly correct.

So, how should you decide how much insulation to install?

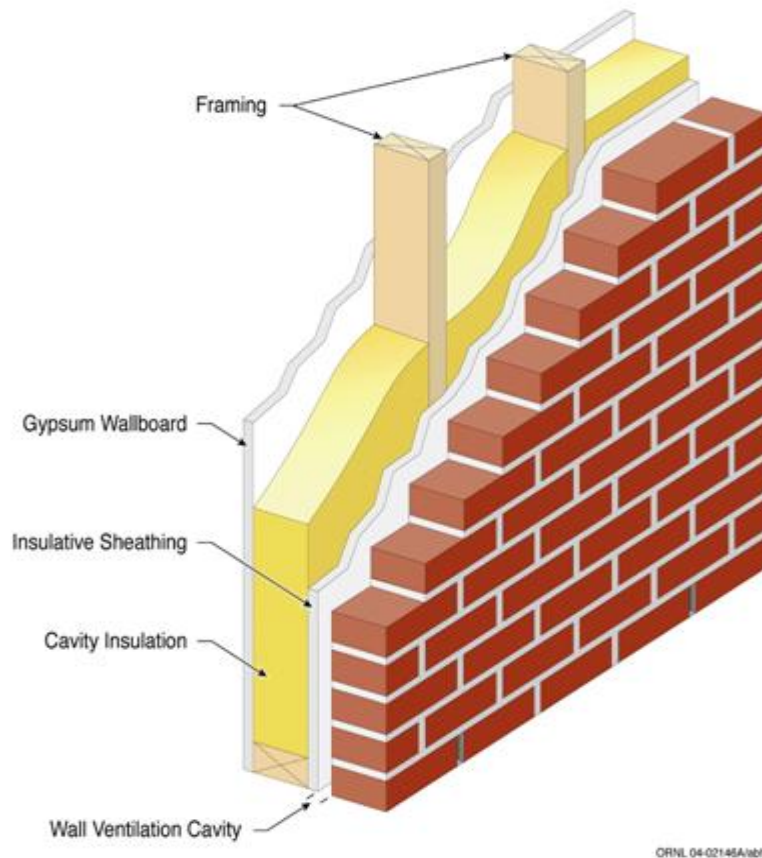
The future energy savings, of course, depends upon how much energy costs in the future. Our best estimate is that fuel costs will rise at approximately the same rate as general inflation. If you think that fuel costs will increase more than that, you should install the greater amount of insulation shown. Looking at the map, if you think the energy costs in your area are greater than energy costs for other locations in same climate zone, you should install the greater amount of insulation.

We can also give you better guidance for your specific location and recommendations for other insulation locations in your home. The [ZIP-Code](#) calculator will actually let you enter your own insulation prices, energy costs, and heating and cooling system efficiencies. However, some personal computer security systems won't allow Java programs to run properly. The [recommended R-values](#) table can be helpful in those cases,

because it will provide recommendations based on insulation and energy costs for your local area.

Both insulative sheathing and cavity insulation are specified for walls because it is important to use them together as a system. Any combination of sheathing and cavity insulation shown in [Figure 2](#) will give you a similar life-cycle savings.

The band joists, or outside edges of the floor frames, should be insulated while the house is under construction. For most of the country, you should try to install R-30 in this location. If you live in [Climate Zone 1](#), R-19 is adequate. More detailed drawings and insulation techniques for the band joist are shown in the [Wall Insulation Technology Fact Sheet](#).



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Foundation insulation options for new construction are broader than for existing homes. The builder may, for example, choose to insulate the exterior of a basement or crawlspace wall. You should discuss termite inspection and control options with your builder when choosing your foundation insulation method. Special sill plate (the joint between the top of the foundation and the bottom of the house frame) mineral fiber sealing products are designed to reduce air leaks if installed during the initial house construction. All flammable insulations or insulation facings must be covered or otherwise protected to meet fire codes. More information is given in the [Basement Insulation Technology Fact Sheet](#).

If water lines and the ducts of your heating or air-conditioning system run through unheated or uncooled spaces, such as attic or crawlspaces, then the water lines and the ducts should be insulated. Make sure your contractor checks the ductwork for [air leaks](#) before installing the duct insulation. The contractor should then wrap the ducts with duct wrap insulation of R-6 with a vapor retarder facing on the outer side. All joints where sections of insulation meet should have overlapped facings and be tightly sealed with

fiber glass tape; but avoid compressing the insulation, thus reducing its thickness and R-value.

Return air ducts are more likely to be located inside the heated portion of the house where they don't need to be insulated, but they should still be sealed off from air passageways that connect to unheated areas. Drywall- to-ductwork connections should be inspected because they are often poor (or nonexistent) and lead to unwanted air flows through wall cavities.