



# CHANGE FOR THE BETTER WITH ENERGY STAR

Homes that earn the ENERGY STAR® prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency. [www.energystar.gov](http://www.energystar.gov)

## INCREASE INSULATION

### Building Envelope Improvements

Proper insulation is a key element for a more comfortable and energy efficient home. It is important to have a continuous boundary of insulation between the conditioned, indoor spaces and the unconditioned, outdoor spaces. This boundary is referred to as the “building envelope” and consists of walls, floors, and ceiling or roof. Low insulation levels and gaps or voids in the insulation materials can provide paths through which heat and air can easily flow into or out of the residence. Care must be taken to shape the insulation material around piping and electrical work without compressing it.

Building codes typically require a minimum insulation level for each component of the building envelope. These levels vary from state to state depending on climate conditions. When building a new home it is both easy and cost effective to increase these insulation levels beyond the minimum code requirements of most climates (see Figure 1 below for recommended levels). For an older home, it is easiest to increase insulation levels in the attic.

Insulation materials available include batt-type, loose fill, rigid foam panels, and spray-type. Insulation materials are rated according to their ability to resist heat flow. This thermal resistance rating is commonly known as an “R-value”. The higher the R-value of a material, the better its ability to resist heat flow. The reciprocal of the R-value is the U-value, which characterizes the rate of heat loss.

If moist air gets inside the building envelope and condenses on cold surfaces, it can cause damage to the insulation and building structure. In cold climates it is recommended to keep the insulation and envelope cavities dry by applying a vapor retarder or low permeability paint to the warm side of the envelope.

**FIGURE 1: Cost Effective Insulation R-Values<sup>a</sup>**

If you live in a climate that is...	And your heating system <sup>b</sup> is a...	Insulate to these levels in the...			
		Ceiling	wood frame walls	floor	basement/crawl space walls <sup>d</sup>
<b>Warm</b> with cooling and minimal heating requirements (i.e., FL & HI; coastal CA; southeast TX; southern LA, AR, MS, AL & GA).	Gas/oil or heat pump	R-22 to R-38	R-11 to R-15	R-11 to R-13	R-11 to R-19
	electric resistance	R-38 to R-49	R-11 to R-22	R-13 to R-25	R-11 to R-19
<b>Mixed</b> with moderate heating and cooling requirements (i.e., VA, WV, KY, MO, NE, OK, OR, WA & ID; southern IN, KS, NM & AZ; northern LA, AR, MS, AL & GA; inland CA & western NV).	Gas/oil or heat pump	R-38	R-11 to R-22	R-13 to R-25	R-11 to R-19
	electric resistance	R-49	R-11 to R-28	R-25	R-11 to R-19
<b>Cold</b> (i.e., PA, NY, New England, northern Midwest, Great Lakes area, mountainous area (e.g., CO, WY, UT, etc.)).	Gas/oil	R-38 to R-49	R-11 to R-22	R-25	R-11 to R-19
	heat pump or electric resistance	R-49	R-11 to R-28	R-25	R-11 to R-19

a. Adapted from the U.S. Department of Energy 1997 Insulation Fact Sheet.

b. Insulation is also effective at reducing cooling bills. These levels assume that you have electric air-conditioning.

c. R-Values are for insulation only (not whole wall) and may be achieved through a combination of cavity (batt, loose fill or spray) and rigid board materials.

d. Do not insulate crawl space walls if crawl space is wet or ventilated with outdoor air.

## BENEFITS

Increased insulation can provide many benefits including:

**Improved comfort.** Increased insulation reduces conductive heat losses and gains resulting in warmer interior surfaces in the winter and cooler interior surfaces in the summer. Approximately 40 percent of our physical comfort in homes is due to radiant heat exchange between our bodies and the surrounding interior surfaces. Increased insulation reduces this radiant heat exchange and minimizes temperature differences between rooms, thus maintaining a more consistent level of comfort throughout a house.

**Improved indoor air quality.** When a house has been air sealed and insulation has been increased and properly installed, there are fewer gaps and voids through which unconditioned air can leak into a house. This helps avoid dirt, dust, and other impurities that can negatively affect indoor air quality. A tight building envelope is a critical component to ensure good indoor air quality.

**Increased construction quality.** Building codes establish the legal minimum construction standards. Figure 2 shows that to increase insulation levels requires an insulation material with a higher R-value or increase the thickness of the building envelope component. In either case, the result is better quality construction. This is particularly true in cases where special care is taken during installation to insure no gaps or voids are left in the insulation.

**Reduced obsolescence.** Based on recent trends for improved efficiency, building envelopes with increased insulation levels are expected to become industry practice. Since it is more difficult and costly to increase insulation after a house is built, it is best to increase insulation levels during the original construction.

**Lower energy bills.** More than 40 percent of the energy consumed in a typical household goes to heating and cooling. Increased insulation reduces this energy consumption which lowers energy bills.

**FIGURE 2: R-Values for Various  
Insulation Materials**

<b>Insulation Material</b>	<b>R-value per inch of Thickness</b>
Batt-type	3.1 to 3.5
Loose fill	2.9 to 3.7
Board stock	3.5 to 6.2
Spray-type	3.5 to 6.0

ENERGY STAR® promotes the use of high-efficiency technologies and equipment to help homeowners improve the energy-efficiency of their homes. ENERGY STAR is sponsored by the U.S. Environmental Protection Agency and the U.S. Department of Energy.