



## Insulation Options

*A few facts to help you choose wisely among the foams and fibers.*

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In residential and light commercial work, the major contenders for the contractor's insulation dollar are fiberglass, polystyrene, and polyisocyanurate. How should you choose among these options?

Unlike solar glazing, insulation doesn't provide views of the sky. It just slows down the flow of heat. Since insulation offers few amenities other than warm toes, the economics should be pretty straightforward. Still, choosing the best insulation strategy remains tougher than, say, choosing among soap detergents, for a couple of reasons. One, it's hard to discern fact from fancy in the blend of research, hype, and gossip that makes up insulation lore. And two, heat flow, in addition to being invisible, often trips up our common sense—unless we are fortunate enough also to be physicists.

| Material                    | Cost<br>(¢/ft <sup>2</sup> -R) |
|-----------------------------|--------------------------------|
| Fiberglass                  | 1.5 to 1.7                     |
| Expanded polystyrene        | 3.9 to 4.5                     |
| Foil-faced polyisocyanurate | 5.4 to 6.0                     |
| Extruded polystyrene        | 5.6 to 8.4                     |

A spot check on insulation prices in the Boston metropolitan area yielded the costs shown above. Fiberglass prices were quite stable, whereas the rigid insulations varied considerably. In some cases, the same brand of rigid insulation varied by as much as 30 percent in the same town.

The crudest comparison of insulations is the cost of the material per square foot R-value. By this measure, fiberglass is still the winner hands-down (see chart). This is a good starting point, but final decisions should rely on an estimate of *total system cost*. This should account for additional framing and strapping, special trim and nailing problems, and lost living space caused by thickened walls. Estimates I've seen comparing wall systems this way vary across the map literally and figuratively. But there are some trends. In the superinsulated range—R-30 to R-40—most find fiberglass walls with double studs or trusses the cheapest way to go. In smaller and more complex superinsulated homes—those with dormers, jogs, and cutaways—rigid insulations offer some labor- and

space-saving advantages. In the not-quite-superinsulated range—R-20 to R-30—it's a toss-up.

### Fiberglass

Fiberglass batts and blankets owe their low cost to the fact that they are more than 99 percent air by volume. The high-density fiberglass insulations used in roofing are not such a bargain. Fiberglass works great as long as it does its job of holding the air still in the building cavity. Air flowing through it, by it, or around it cuts its insulating power by more than we would like to think. Lab tests indicate that 2-percent voids in a wall cut R-values by 13-21 percent. Ill-fitting batts in a ceiling with 5-percent gaps lengthwise and widthwise had R-values reduced by 57 percent. So next time you put a 15-inch batt in a 16-inch stud space, fill that gap.

Other tests show that attic air flowing at 1 meter/second over attic fiberglass reduced R-values by 40 percent. This is a higher airspeed than occurs in most attics, but the test has some practical implications: venting an attic from eave to ridge is better than venting across the ceiling surface; and a good exterior air barrier in your walls is probably a good idea.

Some designers worry about fibrous insulations losing value due to moisture. For a given moisture content per unit volume, fiberglass does no worse than other common insulation materials. Because of its fibrous nature, it may pick up moisture more readily, but it gets rid of it more quickly too. In 12,000-degree-day climates, a small air leak in the ceiling can lead to ice cubes in the attic fiberglass. In milder climates, many get by with no ceiling vapor barrier at all, as long as attic ventilation is good.

### Foil-faced polyisocyanurate

Common brand names are Thermax<sup>®</sup> and Hi-R<sup>®</sup>. Other companies, including Owens-Corning, are getting into the act. These materials owe their popularity to having the highest R-value per inch of any commonly available material. Plus, if the foil-facing is kept clean and faced into a ¾-inch air space, another R-2.7 is added. Tests indicate that to get this benefit, you