The Real Value of R-Value

Your choice, give your clients a high R-value or low utility bills

With energy costs taking such a huge bite out of the monthly budget, it's little surprise that energy efficiency is the top consideration among homeowners and home improvers, according to a recent survey by the NAHB (National Association of Home Builders) Research Center and Icynene Inc. The typical U.S. family spends close to $1,500 each year on energy bills, almost half of which covers heating and cooling costs (*Source: Energy Star*).

There are few better ways than the right insulation to enhance the energy-efficiency, comfort and even health of the homes you design or build. The right insulation can pay for itself in monthly energy cost savings, can eliminate hot or cold spots in a home, can help control moisture problems, and can improve indoor air quality. There are dozens of products on the market, none of which can be taken for a test-drive or return once installed.

So how do you ensure you're offering the best insulation to your clients? This question helps explain the enduring popularity of R-Value as a standard for comparing the energy efficiency of insulation. R-Value helps us "compare by numbers" in that the higher the number, the better the insulation is at reducing energy loss. By this measure, you might assume that R-40 insulation should be far more effective than R-20 insulation - right? The truth is, there are some good reasons to think beyond R-Value when shopping for insulation.

A leaky story

To start, what is R-Value? R-Value was created to measure the thermal resistance to heat flow (conductive flow) offered by traditional insulation in a controlled laboratory setting. What it doesn't consider is that, in a real home, heat (and money) also flows in or out through radiation (energy in waves) and convection (air leakage).

You might also think that increasing insulation R-Value provides a proportionate increase in its ability to control energy loss. In reality, R-8 insulation already controls 90 percent of potential energy loss through a material *(Source: Fourier's Law of Thermodynamics).* Upgrading from R-8 insulation to R-32 insulation, for example, would reduce conductive heat flow by only another seven percent assuming no air can move through the insulation (see Figure 1).

The real problem is heat loss through convection (or air leakage). Building scientists have recognized that air leakage has a greater impact on energy consumption than does R-value. In fact, air leakage

contributes to as much as 40 percent of the total energy lost from a home (Source: *U.S. Department of Energy*). Air leakage creates an environment that's uncontrollable by building occupants who often describe the environment as too hot or too cold, too drafty or too noisy; and even more detrimental is the potential occurrence of moisture-related problems like mold growth. Even the best conventional insulation on the market won't control air leakage - regardless of R-Value.

Figure 1: Increasing R-Value may not deliver the savings your clients expect

Level of insulation R-Value	**Amount conductive heat flow reduced**	**Estimated cost per sq. ft. (insulation)** (based on total of 4,000 sq. ft.)	**Extra cost per square foot vs. R-8 insulation**	**Total extra cost vs. R-8 insulation** (based on total of 4,000 sq. ft.)	**Improvement in Efficiency vs. R-8 insulation**	**Additional savings/year vs. R-8 insulation** (based on yearly heating/cooling costs of $750)	**Years required for extra cost to pay for itself**
R- 8	90%	$0.60	-	-	-	-	-
R-12	93%	$0.90	+ $0.30	+ $1,200	+ 3 %	*$22.50*	*53 years*
R-16	95%	$1.20	+ $0.60	+ $2,400	+ 5 %	*$37.50*	*64 years*
R-20	96%	$1.40	+ $0.80	+ $3,200	+ 6 %	*$45*	*71 years*
R-32	97%	$2.00	+ $1.40	+ $5,600	+ 7 %	*$52.50*	*107 years*

Airtight solution to superior building envelope performance

Since R-value doesn't measure an insulation material's ability to control air leakage, design and trade professionals must look at other material properties to determine which products are suitable for healthy, energy-efficient design and construction. Two important considerations include the vapor permeance and air permeance of an insulation material. The first, vapor permeance, measures the rate at which the insulation diffuses moisture. Ideally, insulation should allow low rates of moisture diffusion to occur in order to prevent moisture entrapment. Air permeance, on the other hand, indicates the air leakage rate of an insulation material. A material that doesn't fill the entire cavity results in air pockets, which permit air movement within the cavity. And when moisture-laden air travels through the building envelope, problems can occur. Additionally, if this moisture-laden air is traveling from the exterior to the interior of the building, air conditioning equipment must work overtime to remove the moisture. Not only does this result in excessive energy consumption, but this can also pose a threat to the integrity of the building envelope and the quality of the indoor environment.

Consider the following when evaluating the effectiveness of insulation …that take performance beyond R-Value

- ☐ *How well does the insulation control air leakage that can account for up to 40% of a home's energy loss? (spray foam insulation such as Icynene® is particularly effective at creating a continuous air barrier)*
- ☐ *How quickly will the insulation pay for itself? (Are the monthly energy savings greater than the monthly cost of financing the insulation purchase?)*
- ☐ *How well does the insulation reduce air leakage in hard-to-insulate areas such as rim joists, cathedral ceilings, crawlspaces, garages, etc?*
- ☐ *Can the insulation help reduce heating and cooling loads (and costs) while removing the need for larger/costlier mechanical equipment?*
- ☐ *Will the insulation help keep out allergens, dust and other pollutants?*
- ☐ *Will the insulation shift with the home over time as it settles? Will it leave spaces, gaps?*
- ☐ *What happens if the insulation gets wet? Will it keep its insulating properties? Can it grow mold? (Open-celled foam like Icynene® will remain unaffected by wetting and drying so that it continues to operate at peak performance levels. Water will simply drain right through the material without spreading so that it, as well as surrounding building materials, can quickly dry.)*
- ☐ *Does the insulation contribute to poor indoor air quality?*
- ☐ *Can the insulation help control sound (around plumbing, between rooms, from outside)?*
- ☐ *Does the insulation require a number of finishing materials (plastic wrap, gaskets, tape) to eliminate gaps or cracks?*

For additional information about insulation R-Value and more effective ways to reduce energy consumption, visit www.icynene.com.