Radiant Barriers: Silver Bullet, Energy Conservation Strategy or Snake Oil

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Retrofit radiant barriers are one of those energy conservation strategies that generate a lot of confusion and controversy. I suspect the confusion stems from the fact that most people are not that familiar with the dynamics of radiant heat transfer. I also believe some radiant barrier suppliers and contractors use this lack of familiarity with radiant heat transfer and building science to their advantage and this is where the controversy arises.

Radiant barriers work. They reflect radiant or electromagnetic energy. They also have low emissivities which means they don't radiate or give off heat. Roof sheathing products that have integral radiant barriers on the attic side are an example of a cost effective radiant barrier product. They are cost effective because the installed first cost is so minimal and there is no additional labor to install them.

Three questions must be asked before putting retrofit radiant barriers in proper perspective. What are realistic energy savings for radiant barriers added to existing homes? Are the energy savings that some radiant suppliers and contractors promise inflated? The final question is, are they worth the cost? The answers to these questions are essential to properly evaluating radiant barriers.

Since no one building product can determine the performance of a home there are no silver bullets in residential energy conservation. If a radiant barrier salesman argues otherwise, he is a snake oil salesman. If radiant barriers are not a silver bullet, then it must be determined if they are a prudent energy conservation strategy or something less.

I would consider any energy conservation strategy to be respectable based on simple payback formulas. If a radiant barrier produces respectable savings at an economical first installed cost they would meet this standard. Radiant barriers would also have to be compared to other energy conservation strategies like duct sealing, shade screens, additional insulation and air barrier work when making a determination about their value.

Radiant barriers begin to slip into the realm of snake oil in the hands of unscrupulous manufacturers, suppliers and contractors who make bogus claims about their ability to reduce your cooling and heating loads and then sell them at exorbitant prices. The

higher the percent of energy savings promised and the higher the installation costs the more likely you are speaking to either an uninformed or dishonest salesman.

A couple of weeks ago I spoke to an HVAC contractor who has a customer who paid $3000 for a radiant barrier and according to the HVAC contractor's customer his electric bills did not go down at all. If indeed this anecdote is true, then I'm sure this homeowner would tell you he was duped.

To better understand the fallacies perpetuated by some radiant suppliers and contractors we need to go back to the energy basics. Most people know that an un-insulated 2x4 wall has very little heat resistance to heat transfer or R-value. During the summer heat is conducted through the exterior sheathing and then the heat is transferred across the un-insulated cavity through convection and radiation.

Install insulation in this 2x4 wall and the dynamics change. The cavity suddenly has resistance to heat flow or R-value. Why? The tiny air pockets that the insulation creates trap air and thus stop convection. The insulation also dramatically reduces the long wave radiant heat transfer by absorbing it and scattering it. The radiant heat transfer is particle to particle.

How do you get more R-value in that same 2x4 cavity? You can purchase an R-11, R-13, and R-15 fiberglass batt and install it in the same 2x4 cavity. The R-13 and R-15 batts are denser than the R-11 and a denser batt creates even more tiny air pockets that stop convection and dramatically reduce radiant heat transfer.

When a radiant barrier supplier or contractor states that "standard insulation will not stop radiant heat transfer," they are confusing the issues. In cellulose insulation in an attic the heat gain through the insulation is approximately 80% conduction and 20% radiant. If you've got a properly installed R-38 in an attic, the contribution of attic heat gain to the whole house is relatively small. Spending a significant amount of money to reduce this 20% radiant heat transfer is not worth the investment. Adding more cellulose insulation to reduce the conduction, which is greater than the radiant heat transfer, would also be a poor investment.

A great deal of radiant barrier marketing materials is geared to lead consumers to believe that conventional insulation alone is not enough. Let me provide a sample of some of the misleading and inflated claims of energy savings that consumers get bombarded with on the internet, in sales literature and by some sales people:

> "Regardless of how much insulation you have in your attic, adding radiant barrier will save on your heating and cooling expense, and keep you more comfortable. Energy savings vary from 17% to 25% …"
>
> "Install (*Manufacturer Name*) radiant barriers and cut your heating and cooling cost by 30% to 60%." (*Manufacturer's web site*)
>
> "First of all, (*Manufacturer Product Name*) don't 'cost' they pay. This is an investment that will offer you a minimum of a 25% reduction on energy costs and becomes more valuable as energy costs rise. Further, what is a more comfortable house worth."

These claims are bullshit. In his book, <u>On Bullshit</u>, Princeton University professor Harry Frankfurt stated that "bullshit is unavoidable whenever circumstances require someone to talk without knowing what he is talking about." P. 63 I've performed enough infrared scans to know that conventional insulation works fine when installed correctly. This begs the question, why are some radiant barrier sale people so adamant?

If these products were as good as the radiant suppliers and contractors said they were, you'd see a lot more radiant barriers installed in attics in the Phoenix marketplace. Customers would recommend the radiant barriers to their neighbors. Radiant barriers are not catching on and I suspect this is for good reason. They don't perform as advertised.

Think about it, if the heat flow through a well insulated attic only accounts 10 to 15 percent of your sensible cooling load, then how can a radiant barrier reduce annual cooling costs by a minimum of 25%? It is impossible.

If a home in Phoenix has a properly installed R-30 attic insulation or better, I don't believe that the homes annual cooling and heating costs will be reduced by more than 10% at best. According to the Florida Solar Energy Center "it's reasonable to expect that an attic radiant barrier can save 8-12 percent of your annual cooling costs in the Southeast." According to the SRP web site the effectiveness of Radiant Barriers at reducing cooling loads is somewhere between 2% and 10%. If I gave the radiant barrier companies the benefit of the doubt and said the savings for heating and cooling are 10% then the cost would be the determining factor of their value and this assumes their performance is not degraded over time.

Most radiant barriers performance will drop off dramatically once dust starts to accumulate on top of it. Anyone who has been up in is ventilated attic that has a white

blown fiberglass insulation has observed just how much dust can accumulate on top of the insulation. The radiant barriers performance is dramatically degraded as dust accumulates on top of it. The emissivity can drop from 0.03 to 0.80 in a short period of time making which makes the radiant barrier almost useless. Mutli-layer radiant barriers deal with the problem, but they are expensive and thus less competitive with other more practical energy conservation strategies.

The cost of the radiant barrier is critical in making the determination if the radiant barrier is a prudent energy conservation strategy or a poor value. Some radiant barriers are being sold for as much as $1.00 to $1.80 a square foot. This is two to four times what an additional R-30 would cost on top of existing insulation. Do the math and determine the simple payback *(purchase price ÷ annual energy cost savings = simple payback)* and a return on investment *(annual savings ÷ installed cost x 100)*. The more expensive a radiant barrier is the more likely it not will not pencil out.

It turns out that radiant barriers not only reflect electromagnetic energy, but also the values and level of knowledge of the suppliers and contractors promoting them. The performance claims and sales price will determine if they are indeed a prudent energy conservation strategy or something significantly less. In the end the issue is not with the material itself, but with the values and intent of the people who are selling these products.

My conclusion is that radiant barriers in existing homes can't compete with more proven energy conservation strategies. Advanced Insulation will not sell or install radiant barriers in homes because I'm not convinced they are a good value to our customers. In regard to envelope improvements, I'll take duct sealing, shade screens, insulation and air barrier work over radiant barriers on any hot sunny day.

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