think the benefits would be small, since the radiant barrier does such a good job of blocking attic heat gain. Similarly, the cooling benefits of a two-sided barrier or multiple barriers would be small, since the first barrier stops 97 percent of the radiation.

Radiant barriers can also reduce cooling loads through walls. But because convection plays a larger role here, radiant barriers play a smaller role. Also, the cooling load on a wall is smaller to begin with, so there is less to save compared with a roof. As in the roof, the foil must face an airspace and is best located under the sheathing. Unlike in a roof, venting between the radiant barrier and the sheathing will help here by cutting convective heat transfer. Sun-drenched west and south walls will reap the greatest benefit.

Heating

Every now and then we see someone peddling radiant insulation for cold climates. Does that make sense? Well, yes and no.

Radiant barriers block heat gain downward better than heat loss upward, because heat is lost upward largely by convection. Still, on a cold winter night, a radiant barrier provides some insulation by blocking the ceiling insulation from "seeing" the cold underside of the roof. In the daytime, however, a radiant barrier blocks desirable heat gains from sun-heated roofs. On balance, a radiant barrier provides a net winter savings, but you would do better to add another R-11 batt. According to ASHRAE data, a radiant barrier at a 45° slope with the heat flow upward is worth about R-2.5. *Conclusion*: Don't install roof radiant barriers just to save on heating costs. But they do provide a modest winter benefit.

How about walls? A wall radiant barrier facing a 3/4-inch space rates about an R-3. If it's serving another function, such as a vapor barrier and wire chase, or it's needed for cooling, then it's probably a good deal. Otherwise forget it.

Multiple barriers, which do little extra in stopping heat flow downward, can work in stopping heat flow horizontally or upward (since you need to suppress convection). There are products on the market that expand to form two or more foil-lined cells. I've used them but don't know how well they work. I'm told that you can add the R-values of the multiple cells as you would with a multi-glazed window. If you plan to use one of these products, look for test data that cover the specific use you have in mind. Also remember that it will take a tight fit to stop heat loss. Otherwise warm air will convect around the edges of your multi-layer high-R barrier.

The savings

According to Fairey, a radiant barrier will cut cooling costs by 10 to 15 percent when added to a house with R-19 ceiling insulation. Adding an R-11 batt to the R-19 batt would only save about 5 percent.

In areas like Florida, annual savings in cooling would run as high as 500 kilowatt-hours, worth about $50 per year, compared with an installed cost of about $300. That's not a bad investment. In fact, FSEC's calculations show that radiant barriers are a better investment than more ceiling insulation at least as far north as Baltimore. In the only northern city they modeled—Chicago—the extra insulation outperformed the radiant barrier on an annual basis, due to the much better winter performance of the insulation. In general, wherever the cooling load is large enough to justify installing central air conditioning, a radiant barrier is worth considering.

For those of you who do cooling calculations, a good rule of thumb is that a radiant barrier effectively wipes out the sol-air effect (see "Notebook," 6/85). That means you can base your cooling calculations on the ambient air temperature alone.

For more information on radiant barriers, write the Florida Solar Energy Center, 300 State Road 401, Cape Canaveral, Fla. 32920. Design Notes 6 and 7 describe the theories and application techniques. Fact sheet 23 lists radiant barrier products and manufacturers. The publications are free.