Remember Thermal Mass?

By Steve Bliss

"You can't have too much mass." "Light-mass houses are best." "Mass should be in direct sunlight." "Spread it throughout the building." "Mass should be light-colored." "Color it dark." "Mass is good in high, arid climates." "Mass is good in Florida." "Mass can replace insulation." "Mass has no insulation value."

These are some of the claims I have heard over the years, and tried to evaluate.

Thermal mass isn't easy to understand, and its effects are difficult to measure and predict. No wonder builders resist adding thermal mass to their buildings, except where high-mass materials are standard. For the most part, it's just as well.

The tools for understanding mass may lie in the beer cooler, King Tut's tomb, and the refrigerator.

Mass in the mind

Because the dynamics of mass are pretty complex, I find it helpful to think about simple analogies. My favorites are the beer cooler, King Tut's tomb, and the refrigerator. The beer cooler has a low-R shell (½-inch Styrofoam) with a high-mass interior (cold beer) that keeps the contents cool for several hours. Once it warms up, though, the mass does you no good—unless you drink it.

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In Tut's tomb, on the other hand, the mass is on the exterior. Because there's so much of it, it will stifle almost all thermal swings on the interior, keeping it close to the annual average temperature. The uncrowded pyramids, I'm told, are cool and comfortable. But those with big crowds (causing high internal gains) are hot, smelly, and stuffy.

The refrigerator combines a fairly high-R shell with a low- or high-mass interior, depending on the contents. Question: Does a full refrigerator/freezer use less energy than an empty one, as is sometimes claimed? Answer: The empty one will cycle more, because air cannot store much heat (or coolth). But no one I spoke with could tell whether this saves energy. Like the cooler, the full one will stay cold longer in a power outage.

In a house, as in a refrigerator, mass really does only one thing. It delays the flow of heat. This can save fuel in two ways. It can store heat or "coolth" that you've bought cheaply (solar or off-peak electricity, for example) for use when it's more expensive. In climates where daily temperatures swing above and below the comfort zone, mass can save energy by applying the day's heat against the night's "coolth." Mass also improves comfort, particularly in solar homes, by reducing temperature swings.

Mass for passive solar

There's no argument that in passive solar houses you need to add thermal mass when the glazing area exceeds 6 or 7 percent of the floor area. There's less agreement, though, on where and how to place the mass.

The more mass the better. Many early passive houses were undermassed, says solar pioneer Doug Balcomb. "You can't have too much mass in a direct-gain house," Balcomb said in a recent *Solar Age* interview (10/85). In a well-insulated shell, he says, the more mass there is, the more stable temperatures will be—and this, he emphasizes, increases comfort.

Beyond some point, though, adding mass won't help performance. Once you