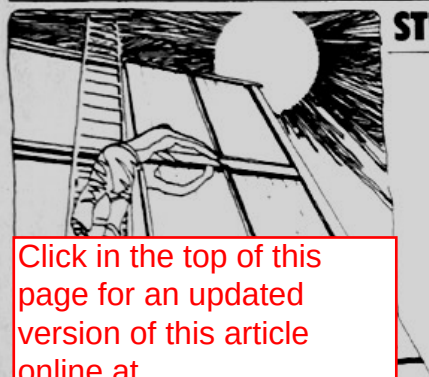

How Solar Is My House?

Gauging passive solar performance can be confusing unless you understand the measures used.

A lot of numbers get tossed around in evaluating, comparing, and marketing solar homes. Just as a bucket of water can be described as either 40 percent empty or 60 percent full, different numbers can rate the same house while giving very different impressions.

Solar Fraction

In passive solar homes, an often misleading, though widely used, index of solar performance is the solar fraction in any of its various forms. In a retrofit project, a percent solar calculation is relatively straightforward, since a reduction in fuel use, all other things being equal, can be attributed to solar. Of course, if conservation measures are taken first, as well they should be, the savings from conservation must be accounted for. When calculated from the new, lower heating load after tightening up the house, the percent solar savings will be higher than if it were derived from the original heating load. For most purposes, it is wiser to quantify the savings in Btu's, or their dollar equivalents, and forget about percentages altogether.

In new construction the numbers get more slippery still. A solar firm is often asked to design a home that is, say, 50 percent solar "like our neighbor's house." The designer must ask, "fifty percent of what?" One method of computing a solar fraction, now in disfavor, compares the gross solar gain through the south aperture to the gross heat loss of the house. This essentially compares the house to itself if the sun never shone or to itself if it were flipped around to face the north. It counts as solar gain all the heat that actually escapes out the south glazing from whence it came. In large aperture designs, this loss through the south glazing is substantial, often accounting for one quarter to one third of the building's gross heat loss. The resulting solar percentage might appear high but offers no clue about the thermal performance or the wisdom of the design. Calculated this way, a leaky house with oversized south glazing is likely to attain a high solar fraction and high fuel bills as well.

The Los Alamos National Laboratory developed another solar percentage figure for use in estimating solar and auxiliary contributions in passive solar designs. The Solar Savings Fraction (SSF) represents the ratio of the useful solar contribution to the net heating load of the building, that is, the load assuming the south aperture is thermally neutral with no losses and no gains. While the SSF constitutes a more conservative and realistic index of solar performance, it should only be used to compare one system to another in the *same* house or two different houses with the *same* net heating load.

For marketing purposes, one might want to compare the thermal performance of a solar versus a non-solar home of comparable size and insulation value. Still, it would be more accurate to say that the solar home will produce a 30 percent savings in fuel costs compared with the conventional home rather than to say that the house is 30 percent solar.

For most purposes the bottom line is auxiliary heat use. How much will it cost to keep warm?

Heat loss coefficient

The number frequently used to compare the thermal effectiveness of the building shell is the annual Btu heat loss normalized for the square footage of the building and the heating degree days. The heat loss coefficient of a standard, contemporary home typically ranges from 8 to 10 Btu/(°F-day ft²). This number is useful for design purposes, but tends to show large aperture passive buildings as poor performers because of the high losses through the glazing. To make sense of this number you must know what assumptions were made. Was nighttime insulation used? What were the air change rates and thermostat set points? Were the data measured, or calculated, or obtained by some combination?

Auxiliary heat use

For most purposes the bottom line in quantifying thermal performance is the auxiliary heat use. How much is it going to cost to keep warm? To make comparisons easy, the annual

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