BY RUSSELL HAMLET

Designing sunscreens

Central heating and cooling systems combined with decades of cheap energy have allowed architects and builders to ignore millennia of acquired knowledge about working with the environment to make houses more comfortable. Concerns about rising energy costs and global warming, however, have refocused home design and construction on passive heating and cooling techniques. One trend in this effort to build better houses is passive survivability: the idea that houses should be designed so that the building envelope can maintain a habitable environment without the use of mechanical systems.

The passive-survivability movement might incorporate new materials and technology, but it's harnessing old wisdom to squeeze comfort and savings out of the sun. One of these strategies, passive-solar design, uses windows and shading devices to control the sun's impact on a house.

Good sun, bad sun

In much of North America, there are distinct heating and cooling seasons. Orienting the long side of a house toward the south allows you to take maximum advantage of solar-heat gain in winter months. As summer approaches and the temperature climbs, cooling the house becomes a concern,

TWO WAYS TO SIZE A SUNSCREEN

To shade a window effectively, the overhang or sunscreen must block the sun entirely on the summer solstice. There are two approaches to finding the right depth:

1. Use the shade-line factor

One method of sizing a sunscreen is the simple equation **depth = height ÷ shade-line factor.** Height is measured from the windowsill to the bottom surface of the overhang, as shown in the diagram. The shade-line factor accounts for the position of the sun and is determined by the geographic latitude of the house and the orientation of the window. Find the house's latitude on the chart, and then choose the shade-line factor for the orientation of the window. This house is at 40°N, and the second-story window faces due south; so 5 ft. ÷ 2.6 = 1-ft.-11-in.-deep overhang. (For shade-line factors at other latitudes, see www.susdesign.com.)

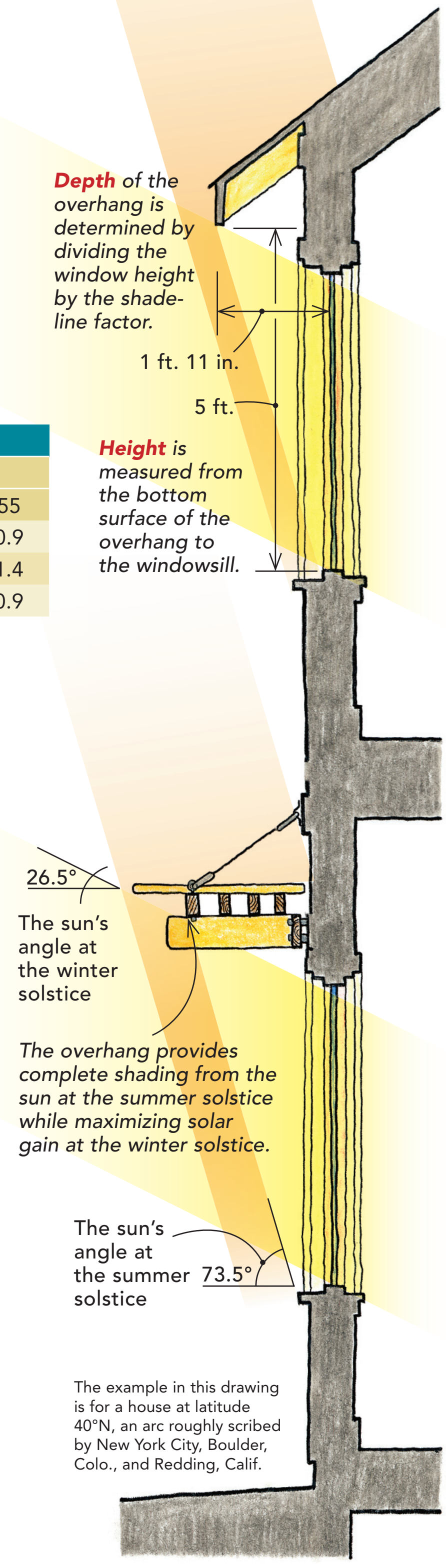
SHADE-LINE FACTORS

Window faces	Latitude in degrees						
	25	30	35	40	45	50	55
Southeast	1.9	1.6	1.4	1.3	1.1	1.0	0.9
South	10.1	5.4	3.6	2.6	2.0	1.7	1.4
Southwest	1.9	1.6	1.4	1.3	1.1	1.0	0.9

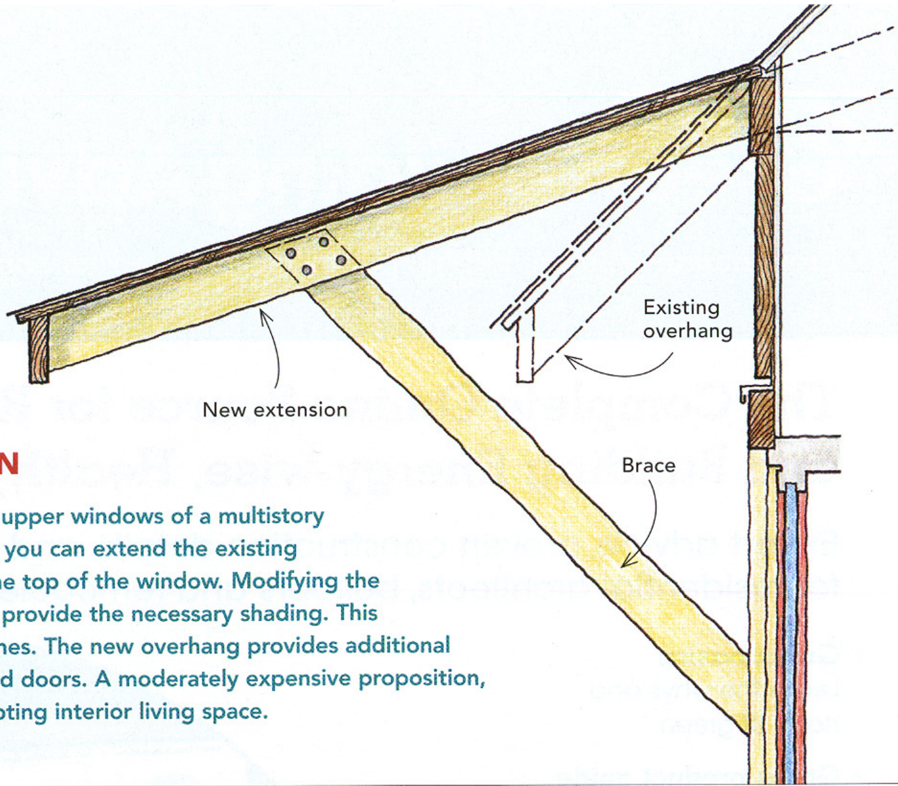
2. Calculate the sun's angle

An alternative way to calculate sunscreen or overhang depth is to draw a section of the house through the window to scale, showing the sun's angle on the summer and winter solstice. Once you know your latitude, calculating the sun's angle is simple: Winter-solstice sun angle = 90° – (Latitude + 23.5°); summer-solstice sun angle = 90° – (Latitude – 23.5°). (In North America, 23.5° accounts for the tilt of the earth's axis.) At latitude 40°N, the sun's angle above the horizon is 73.5° on the summer solstice and 26.5° on the winter solstice, as shown on the first-floor window (right).

Using the windowsill as the horizontal axis, mark the summer-solstice sun angle on the drawing. To provide complete shading on the summer solstice, extend the overhang or sunscreen so that the bottom edge intersects the line of the sun angle. If you want to maximize winter solar gain, draw the angle of the winter-solstice sun from the top of the window, and set the height of the sunscreen at the intersection of the two sun angles. On a sunny site, you might want to extend the sunscreen to provide shading after the summer solstice in July and August, when the sun is lower in the sky, but temperatures are hot.



The example in this drawing is for a house at latitude 40°N, an arc roughly scribed by New York City, Boulder, Colo., and Redding, Calif.



MODIFY THE OVERHANG TO ACT AS A SUNSCREEN

To shade the windows on a ranch-style house or the upper windows of a multistory house, modify the existing overhang. In some cases, you can extend the existing pitch further, but don't drop the rafter tails below the top of the window. Modifying the overhang with an extension at a shallower pitch can provide the necessary shading. This approach looks best on houses with varied roof pitches. The new overhang provides additional protection from the weather for siding, windows, and doors. A moderately expensive proposition, the work usually can be accomplished without disrupting interior living space.

so you want to limit solar gain. Although windows are sold with low-e coatings to let you maximize or minimize solar-heat gain (see pp. 74-81), no single window works as effectively as a properly sized overhang or sunscreen to optimize performance throughout the year. Not only are these shading strategies an easy way to control solar gain, but they're also relatively inexpensive and can be retrofitted to a house.

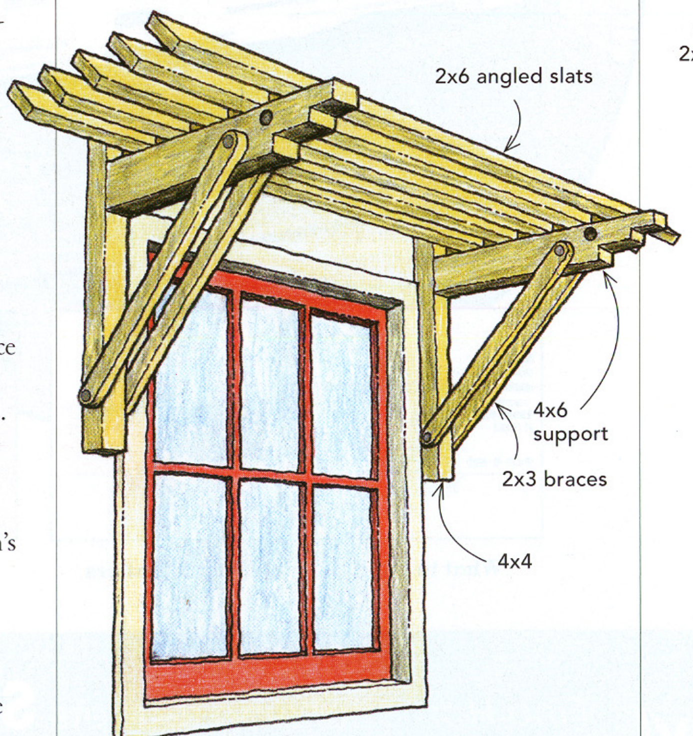
Shading saves money

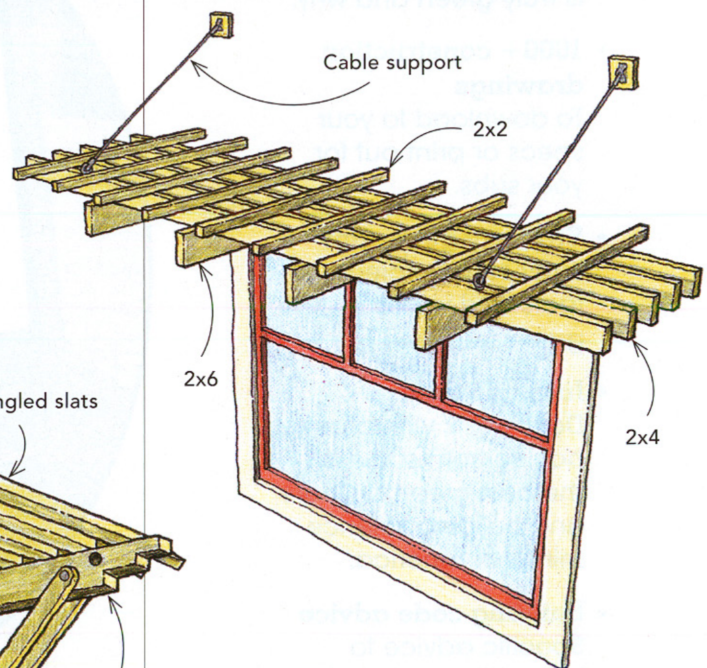
Properly designed sunscreens save money in two ways: They lower energy consumption by reducing heating demand in winter and cooling demand in summer; and because they reduce peak loads, the HVAC system can be smaller, which costs less.

A sunscreen can be an overhang or a separate shading device added above a window or a glass door. Because the sun's path across the sky changes seasonally, from a low path near the horizon in winter to a high path directly overhead in summer, sunscreens provide summer shading on the south side of a house. Solar gain on

WOOD-SLAT SUNSCREEN

- **Good style for houses with substantial massing.**
- **Angle and spacing of slats control reflected light.**
- **Relatively inexpensive; easy retrofit.**





WOOD-TRELLIS SUNSCREEN

- **Good style for traditional Arts and Crafts, Craftsman, and cottage-style homes.**
- **Can echo a nearby pergola and also incorporate vines.**
- **Supports can be from above or below.**
- **Relatively inexpensive; easy retrofit.**

the east and west facades takes place too low in the sky to control with sunscreens. Deciduous plantings are a good option on those sides; be sure the foliage is low enough to the ground to work properly. Also, orient the shorter sides of the house east and west to limit solar gain.

Success is in the details

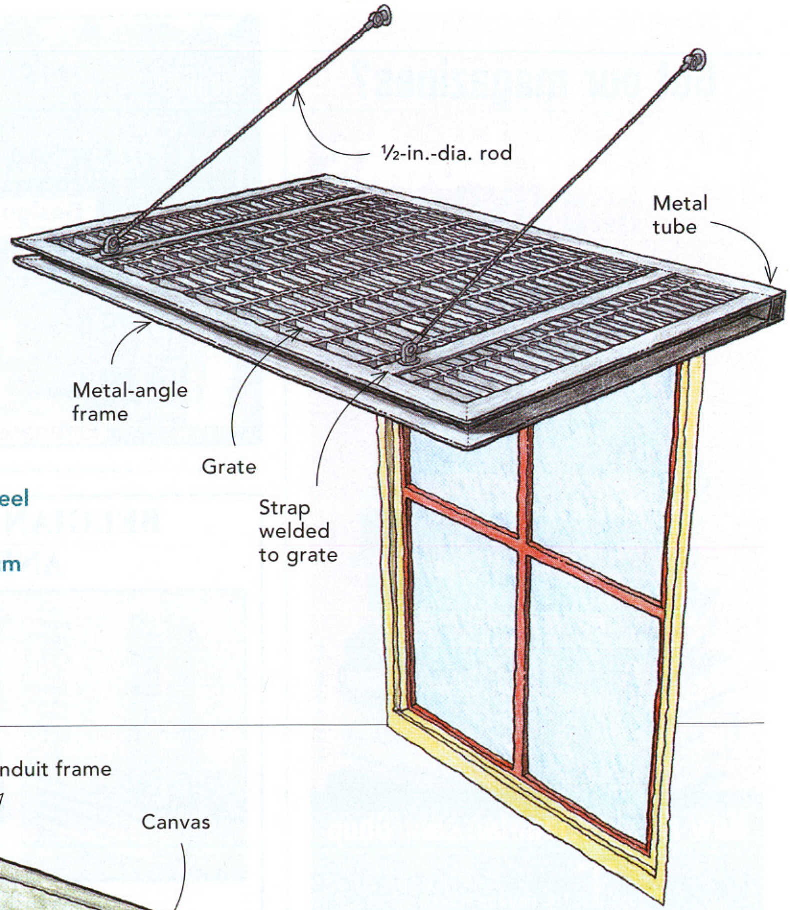
Sunscreen design involves two components. The first is getting the size right. The most important element is the depth of the sunscreen: It has to block summer sun but still allow winter sun to pass through the window (drawing p. 102). The sunscreen should also be wider than the window. As a rule of thumb for windows up to 6 ft. wide and about 4 ft. tall, I extend the sunscreen 1 ft. to 2 ft. beyond each edge of the window. For wider and taller windows and glass doors, the sunscreen should extend 2 ft. to 3 ft. beyond each side of the glass. These guidelines work well when the window orientation is within 15° of true south.

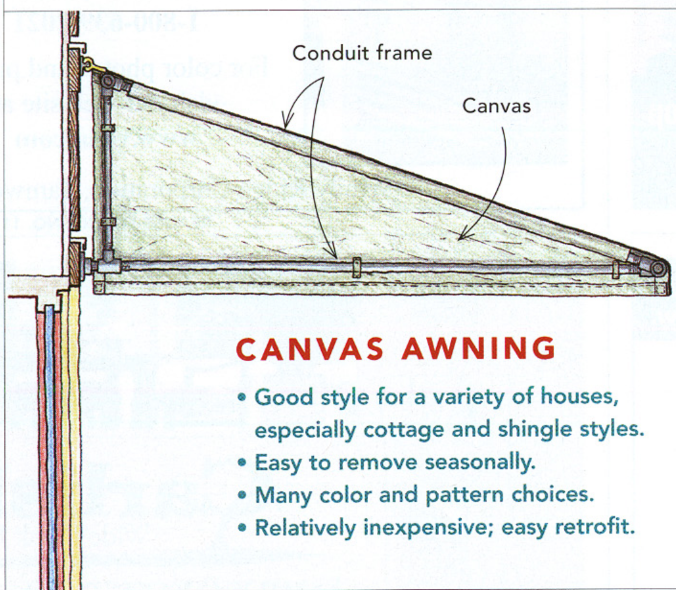
Once you've determined the size of the sunscreen, you can tackle the second component: aesthetics. You have a lot of leeway as long as you take cues from the house. Look for inspiration in exposed rafter tails, siding treatments, and trim details and sizes. Color and accent details can highlight or downplay the prominence of the sunscreen. The drawings on these pages are a gallery of design ideas that work on different-style houses.

LEED–accredited architect Russell Hamlet (www.studiohamlet.com) lives on Bainbridge Island, Wash. Drawings by the author.

METAL-GRATE SUNSCREEN

- Good style for modern and urban homes and industrial settings.
- Requires a fabricator; steel should be galvanized or powder-coated; aluminum should be anodized.
- Relatively expensive; easy retrofit.





CANVAS AWNING

- Good style for a variety of houses, especially cottage and shingle styles.
- Easy to remove seasonally.
- Many color and pattern choices.
- Relatively inexpensive; easy retrofit.

PHOTOVOLTAIC SUNSCREEN

- Good style for modern homes.
- Reduces grid-supplied electricity use.
- Expensive; more difficult retrofit.