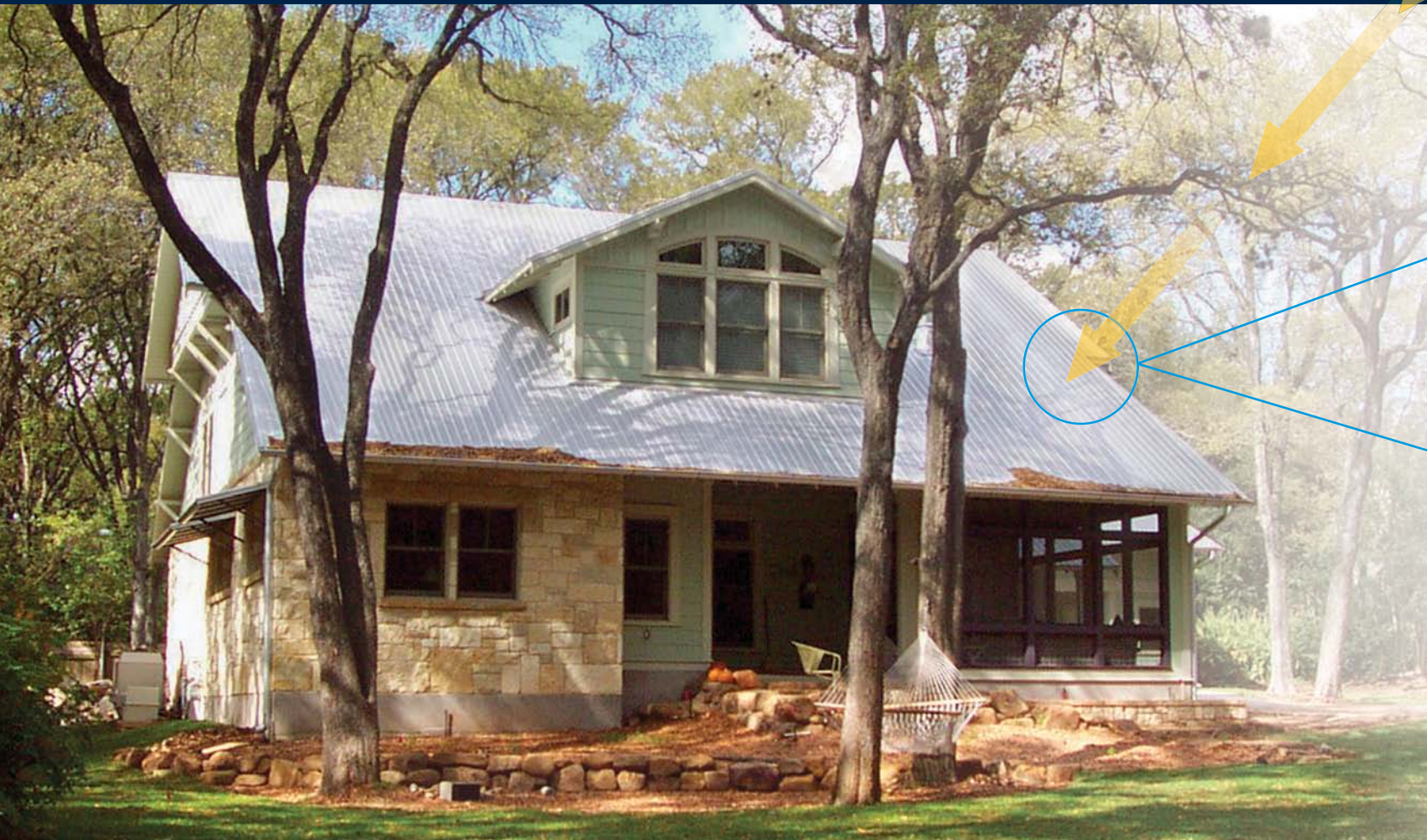


Save Energy With a Cool Roof



Reflective roofing improves comfort and reduces cooling costs in the Deep South and anywhere the sun shines

BY LINDA REEDER

High-reflectance roofing, often called “cool roofing,” started appearing on homes more than 10 years ago, and its use has climbed steadily ever since. The reasons are simple: Cool roofing can reduce cooling costs up to 15%, it can lower oppressive summertime temperatures in cities, and because it doesn’t get as hot, it often lasts longer than traditional roofing does.

Just because it reflects sun and heat, though, doesn’t mean that it will stand out in typical urban or suburban neighborhoods. In fact, cool roofing can look a lot like traditional roofing and is available in more colors and styles than ever before, often at little or no extra cost compared to traditional roofing products.

What makes a cool roof cool?

The U.S. Department of Energy (DOE) looks at several factors when deciding whether a product meets its definition of cool roofing.

COOL ROOFING WORKS IN TWO WAYS

When solar energy strikes a cool roof, at least 25% of that energy is reflected away. Solar energy also can radiate from the roofing itself. The most effective cool roofing works both ways.

Angled battens keep it cool. Architect Peter Pfeiffer started using an elevated roof system for his clients' homes more than 10 years ago. He specifies unpainted Galvalume roofing because of its natural reflectivity. The roofing is installed on a series of short 1x4 furring strips called battens. The battens are angled so that heated air can exit the ridge.

Solar reflectance: the amount of solar energy reflected by the roof

The sun's radiation hits the roof surface.

Thermal emittance: the ability of the roof surface to radiate absorbed heat

Some heat is absorbed by the roof and is transferred to the building below.

1. High reflectance: At least 25% of solar energy must be reflected off the surface. Standard asphalt shingles have a reflectance around 10%.

2. Long-lasting reflectance: Dirt and weathering can decrease solar reflectance over time. Cool roofs should still be reflecting at least 15% of the sun's energy after three years.

3. High thermal emissivity: This describes a material's tendency to release heat rather than store it. The higher a material's emissivity value, the more heat it releases. In hot, sunny climates, a highly emissive roof is desirable; in cold climates, low-emissivity roofing may help to reduce winter heating loads.

Another way to affect cooling loads and attic temperatures is by venting the underside of the roofing material. This technique usually involves placing metal or tile roofing on a series of furring strips, or battens. The battens provide an airspace between the roofing material and the sheathing, which then allows any heated air to exit the ridge. Architect Peter Pfeiffer in Austin, Texas, rou-



COOL METAL

Naturally reflective and highly emissive, metal is ideally suited to homes in hot climates. Cool-metal roofing, which is commonly made from steel and aluminum, is available in a dizzying range of styles and colors.

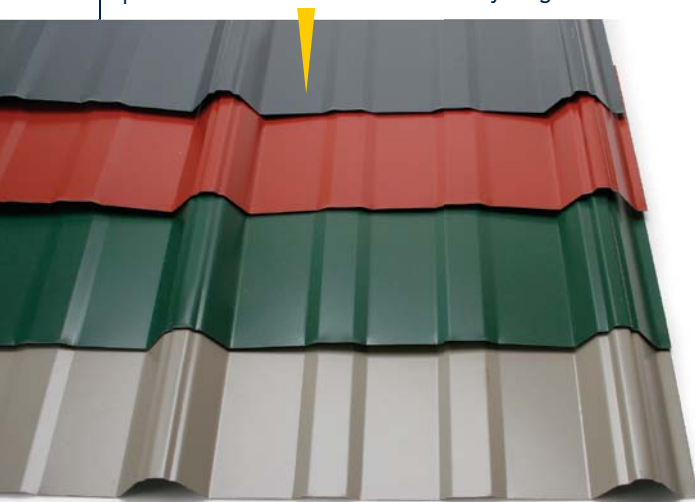


Standing-seam roofing can last indefinitely. It is more expensive than exposed-fastener panels, but its surface is free from gasketed nails or screws, where leaks eventually develop. Finishes range from plain zinc and Galvalume to custom colors of every shade.

Stone-coated metal-shingle panels are available in many styles and colors. Some styles are placed flat on the roof deck, while others are installed on elevating battens. They're a popular replacement for shake roofs in California and other areas at high risk of wildfire. Most metal-shingle panels also have excellent resistance to hail and high winds.

Steel exposed-fastener panels

have been sheltering conch-style houses in South Florida for generations. These Energy Star-approved panels from Fabral are available in colors and in plain metallic finishes like zinc and Galvalume. Made from a combination of zinc and aluminum, Galvalume ages better than plain zinc and maintains its reflectivity longer.



tinly specifies the use of Galvalume metal roofing placed on battens to reduce temperatures in attics.

A study sponsored by the DOE's Building Technology Program and conducted by Oak Ridge National Laboratory confirmed what Pfeiffer and other architects have learned in the field. The 2006 study showed that elevating stone-coated metal-shingle panels on a series of battens reduced the amount of heat penetrating the ceiling by 70% and reduced cooling loads by 30% compared to a conventional asphalt-shingle roof.

Where does it make sense to have a cool roof?

While it's obvious that the greatest energy savings from a cool roof will occur in the country's warmest climates (zones 1 through 3 as referenced in the International Energy Conservation Code), cool roofs can be beneficial in all but the northernmost parts of the United States, according to the Environmental Protection Agency (EPA).

COOL TILE

Tile roofing was first brought to the Americas in the mid-1600s by Dutch settlers in New York. Its use gradually declined in the East because of cheaper alternatives, but its ability to keep buildings cool and to resist wildfire has sustained its popularity in California and the Southwest.

Tiles can look like

slate and wood shakes. Roofs made with clay or concrete tiles have much greater resistance to wildfire and can mean insurance discounts for homeowners replacing a wood roof. Even these dark-colored tiles meant to mimic slate have an Energy Star label. Some profiles have ribs on the back for extra strength without excess weight.

This is because the amount of useful energy reflected in the winter, when days are short and the sun is less intense, is typically less than the unwanted energy absorbed during the long, hot days of summer. And because most homes in cooler climates are heated with gas or oil and are cooled with more costly electricity, there's usually a net savings.

If your climate has three months of cooling (80°F or hotter with clear skies), you should probably consider a cool roof. Cool roofs are also a good idea when you have a duct system in an unconditioned attic or have a home with a roof area that's 25% or more of the total exterior surface.

Homes that are uncomfortably hot in the summer or that have roofs that wear out prematurely from sun damage are also prime candidates for a cool roof.

To be sure that your home and climate are right for a cool roof, check out the online calculators at www.ornl.gov/sci/roofs+walls/steepslopecalc/index.htm and www.roofcalc.com, which can determine the costs and expected savings associated with replacing a conventional roof with a cool roof.

Other factors affect performance

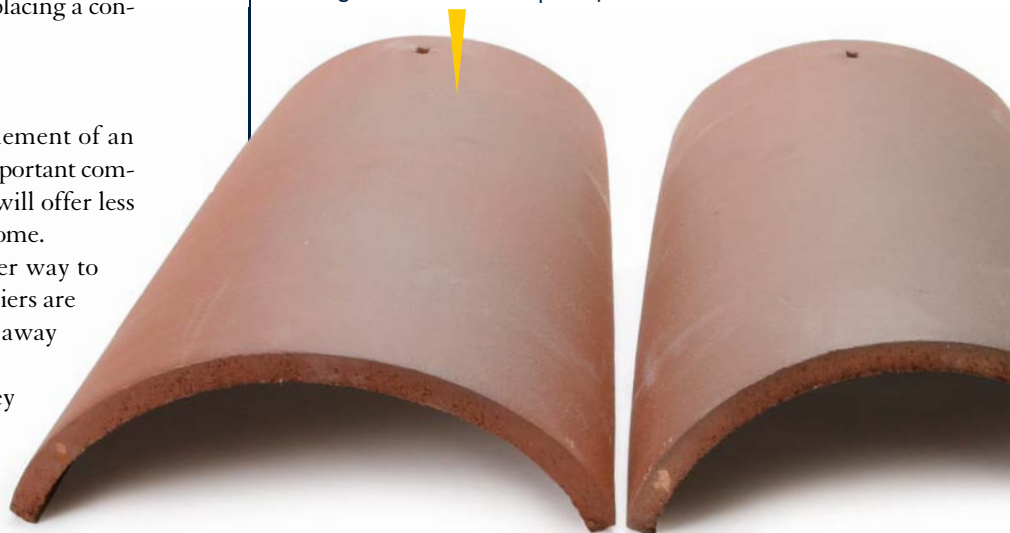
While important, a cool-roof covering is only one element of an energy-efficient roof assembly. Insulation is another important component. In fact, a cool roof over a well-insulated attic will offer less energy savings than a cool roof on a poorly insulated home.

In underinsulated roofs, radiant barriers are another way to reduce summer heat gain in hot climates. Radiant barriers are reflective films or coatings that direct infrared energy away from a house.

In the South, they can reduce the amount of money spent on electricity for cooling by 7% to 10%, according to a study by the Florida Solar Energy Center. Radiant barriers perform best when they face an exterior-side airspace so that heat can be removed



Clay and concrete tiles have a natural airspace. When made in traditional barrel- and S-shaped forms, these tiles have an airspace on the underside that allows heated air to escape by convection. One drawback is weight; tiles for new construction can weigh more than 900 lb. per square. Lightweight tiles for reroof applications weigh closer to 600 lb. per square.



COOL ASPHALT

The best part about cool-roof asphalt shingles is that they're indistinguishable from regular asphalt shingles. This quality makes them appealing to homeowners concerned about their house fitting into the neighborhood. Asphalt shingles are also the least expensive cool-roofing option.



White three-tab shingles like these Supreme AR shingles from Owens Corning sell for about \$75 a square at home centers. Because they reflect much of the heat and UV radiation they're exposed to, white shingles often last longer than similar dark-colored shingles. Unfortunately, any skid marks (caused by careless installers) or discoloration from dirt and pollution will be more pronounced over the bright white background.



These cool-roof architectural shingles look like traditional architectural shingles. Owens Corning's Duration Premium Cool Shingles are available in four colors. They also have a 130-mph wind warranty and a 10-year algae-resistance warranty. Similar products are available from virtually all other shingle manufacturers.

by convection. If there is no airspace, a radiant barrier will not reflect infrared radiation.

It is important to note that radiant barriers can cause attic-moisture problems because many of the products have low permeability and prevent water vapor from escaping. A perforated radiant barrier will help moisture to escape in hot climates, but in cold climates, the condensation can freeze, blocking the perforations and creating an unwanted cold-side vapor barrier.

In cooler climates, money is usually better spent on additional thermal insulation. Some estimates put the cost of a radiant barrier at the same price as 2 in. of thermal insulation, so in climates where reducing thermal conduction is more important than reducing heat transfer into a house, more insulation is a better investment.

Equipment efficiency and the location of ductwork, especially when the ducts are in an unconditioned attic, also affect energy savings.

What are the trade-offs?

Cool roofs in hot, humid climates may be more prone to mold or algae growth because they do not reach the same high temperatures as traditional roofs. In addition, because cool roofing is often light in color, black streaks caused by algae discoloration may be more pronounced than streaks on darker-colored roofing. To combat discoloration, many roofing manufacturers include copper or zinc additives in their cool-roofing products to prevent mold and algae growth.

In terms of durability, cool roofing should last as long as traditional products. In fact, cool roofing must have the same warranty as a company's less reflective roofing materials to earn an Energy Star label.

Cool roofs cost little extra

Depending on the material, cool roofs are little or no more expensive than traditional roofs. For example, CertainTeed estimates that on an average home, the company's Landmark Solaris cool-roof shingles would cost from \$1000 to \$2000 more than Landmark Premium shingles, a comparable product without "cool" properties.

For MCA Superior Clay Roof Tile, there is no difference in cost between standard clay tiles and the 11 colors that have earned the Energy Star label.

Some gas and electric companies offer rebates for cool roofs, so it's a good idea to check with your local utilities or to visit the Cool Roof Rating Council website (www.coolroofs.org), which lists rebate programs. The Database of State Incentives for Renewables and Efficiency (www.dsireusa.org) is another good place to check. It lists many energy-efficiency programs and rebates by state. □

Linda Reeder is an architect in New Haven, Conn., and is the author of *Guide to Green Building Rating Systems* (Wiley, 2010). Photos by Dan Thornton, except where noted.

HOW DO YOU FIND COOL-ROOFING PRODUCTS?

Energy Star and the Cool Roof Rating Council (CRRC) both maintain lists of approved cool roofing. The Energy Star website (www.energystar.gov) has a list of more than 5000 low- and steep-slope roofing products that have earned the

Energy Star label. Categories include initial solar reflectance, reflectance after three years, initial emissivity, and suitability for low- or steep-slope roofs. You can also select products by roofing type, color, and warranty.

The CRRC maintains a product directory on its website, but not all products listed are considered cool. However, the search tool allows you to limit your options to high-reflectance and high-emissivity products, as well as roofing type and color.