

## Guide to Cool Roofs

Cool roofs can save energy as well as beautify your home.

The immediate and long-term benefits of roofs that stay cool in the sun have made cool roofing the fastest growing sector of the building industry. Studies exploring the energy efficiency, cost-effectiveness, and sustainability of cool roofs show that in warm or hot climates, substituting a cool roof for a conventional roof can:

- Reduce the annual air-conditioning energy use of a single-story building by up to 15%.
- Cool interior spaces in buildings that do not have air conditioning, making occupants more comfortable.
- Reduce carbon emissions by lowering the need for fossil fuel-generated electricity to run air conditioners.
- Potentially slow climate change by cooling the atmosphere.

If you are installing a new roof or remodeling an existing building, there are a range of cool roof options to fit your needs and save money.

### How Cool Roofs Work

Traditional dark-colored roofing materials absorb sunlight, making them warm in the sun and increasing the need for air conditioning. White or special “cool color” roofs absorb less sunlight, stay cooler in the sun and transmit less heat into the building. This reduces the need for air conditioning by lowering interior building temperatures.



Cool roofs help lower indoor air temperatures by reflecting sunlight and decreasing heat absorption.

The “coolness” of a roof is determined by two properties and their combined effects on surface temperature:

- Solar reflectance — the fraction of sunlight that is reflected.
- Thermal emittance — the efficiency with which a surface cools itself by emitting thermal radiation.

Both properties are measured on a scale of 0 to 1 — the higher the values, the cooler the roof.

### The Emergence of Cool Roofs

Cool roofing is not a new concept. In the mid-1980s, researchers at DOE national laboratories in Tennessee and California were measuring the energy-saving benefits of “solar radiation control coatings” on test roofs. Although energy savings were confirmed in these early studies, they were not yet sufficient to lead roofing designers and installers to switch from traditional dark-colored roofing systems.

#### Did you know?

- Solar reflective roofs, solar reflective pavements, and vegetation could lower urban air temperatures, saving additional energy and improving air quality.
- Cool roofing also reduces peak demand for electricity, helping to lower costs and avoid power outages.
- Cool roof products dominate the commercial roofing marketplace in warm and hot climates.

## Cool Roofs Today Save Energy and Money

Today both white and “cool color” products are available for low-slope and steep-slope roofs. “Cool” choices now exist for most traditional roofing materials. Cool roofing should be considered whenever construction, an energy retrofit, or a roof replacement is being planned. It is rarely economical to replace a mechanically sound roof just to increase its solar reflectance. Check [roofcalc.com](http://roofcalc.com) to see if a cool roof would be cost-effective for you.

- Cool products are generally economical on low-slope roofs for commercial or industrial buildings.
- Cool options are available for most traditional roofing materials.
- White roofs are coolest, but cool colors are a popular alternative for roofs that can be seen by neighbors.
- ENERGY STAR® lists about 3,000 compliant cool-roofing materials.
- Federal tax credits are available for some cool materials, including asphalt shingles and metal products.
- Many state agencies and utility programs offer incentives for installing cool roofs.
- Cool roof credits are offered in sustainable building programs such as the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED).
- For low-slope roofs (pitch  $\leq$  2:12), cool thermoplastic membranes, elastomeric coatings, and metal products are available.
- For steep roofs, cool asphalt shingle, clay tile, concrete tile, and metal products are available.

Cool asphalt shingles currently sell for up to \$0.50 per square foot more than conventional asphalt shingles. Cool versions of some other roofing materials may require a reflective surface coating that adds about \$1 per square foot to the installed cost.

- Installing a white roof on a commercial building yields annual energy savings worth up to \$0.20 per square foot and installing a cool color roof on a home yields annual energy savings worth up to \$0.05 per square foot. Savings vary, and are greatest in hot and warm climates. Use the calculator at [roofcalc.com](http://roofcalc.com) to estimate your savings.
- A cool roof may increase the need for heating energy in winter by reflecting sunlight that would otherwise warm the building. Even in mixed climates, however, winter penalties can be smaller than summer savings.

### How to Select and Buy Cool Roofing Materials

The energy and cost savings that can be achieved by using cool roofing technologies depend on many factors, such as climate and building characteristics.

Three aspects of cool roofing technologies also affect their cost-effectiveness:

- The aged solar reflectance and thermal emittance of the roof (since many roofs become less reflective over time, energy savings should be based on long-term values of solar reflectance and thermal emittance).
- The incremental initial cost of the cool roof (if any).

- The incremental cost of keeping a cool roof clean and reflective (if any).

### Further Resources

Cool Roof Rating Council Products Directory

[www.coolroofs.org](http://www.coolroofs.org)

DOE Building Energy Software Tools Directory

[www.eere.energy.gov/buildings/tools\\_directory](http://www.eere.energy.gov/buildings/tools_directory)

Energy 101: Cool Roofs

[www.eere.energy.gov/multimedia/video\\_cool\\_roofs.html](http://www.eere.energy.gov/multimedia/video_cool_roofs.html)

ENERGY STAR Cool Roofing Materials

[www.energystar.gov/index.cfm?c=roof\\_prods.pr\\_roof\\_products](http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products)

Cool Roofs Calculator

[www.roofcalc.com](http://www.roofcalc.com)

### Financial Incentives

Tax credits, incentives, and rebates may be available in your area. Please visit [www.energysavers.gov/taxcredits](http://www.energysavers.gov/taxcredits) for more information.

U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

EERE Information Center  
1-877-EERE-INFO (1-877-337-3463)  
[www.energysavers.gov](http://www.energysavers.gov)

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.

DOE/EE-0384 • February 2011