

Beyond White – Advances in *COOL COLORS*

White flat cool roofs grace the tops of buildings from New York to California – touted from the *New York Times* to *The Daily Show* for their **cool** benefits. However, if you prefer a colored roof, now you can have your color and still be cool!



How cool is that? California Governor Arnold Schwarzenegger checks the temperature of a cool-colored metal roofing product.

Like white roofs, new cool-colored roofs reflect sunlight to stay cool. Cool-colored roofs offer more than just architectural appeal and durability.

Save money & energy!

By using less air conditioning.

Reduce your carbon footprint!

Emit less carbon by saving energy.

Improve comfort!

Stay cooler in buildings that don't have air conditioning.

Keep communities healthy!

Reflective roofs can cool the outside air.
Cooler air means less smog.

Noontime sun shines about 100 watts of power per square foot, which is equivalent to one hot light bulb per square foot. Traditional dark roofs can absorb 90% of sunlight, heating the building. People respond by turning on their air conditioners. This consumes a great deal of energy, straining the electric grid and polluting the air. Hot roofs also warm the outside air.

The solution: cool roofs that reflect sunlight! White roofs reflect about 80% of sunlight and can stay 70°F cooler than black roofs.

U.S. homeowners often prefer colored roofs. For them, there are now **colored** roofs that are **cool**.

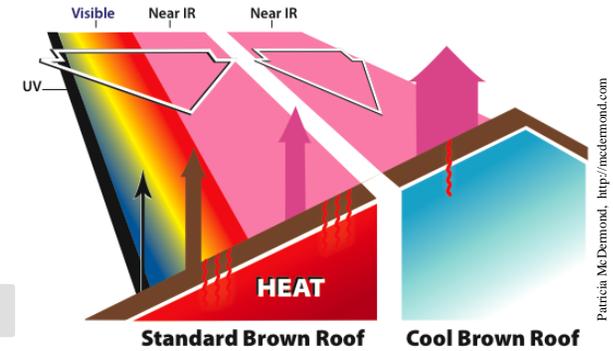


Go cool with a red clay tile roof—just one of many options!

The Science of Cool Colors

Sunshine includes ultraviolet (UV), visible and near-infrared light. Only visible light affects color. About half of the Sun's energy is *invisible* near-infrared light. Traditional dark roofs strongly absorb UV, visible and near-infrared sunlight. New

cool dark roofs look like traditional dark roofs but better reflect near-infrared sunlight.



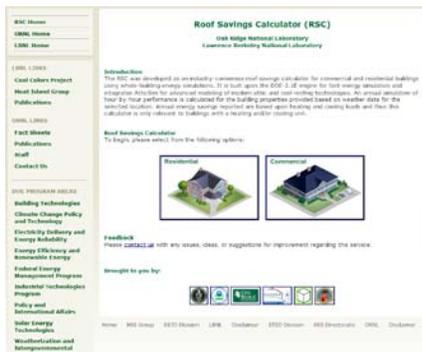
The **standard brown roof** (left) reflects 10% of near-infrared sunlight (narrow pink arrow). The **cool brown roof** (right) looks just like the standard brown roof but reflects about 40% of near-infrared sunlight (wide pink arrow). The building under the cool brown roof requires less air conditioning to maintain comfort.

Advances in cool-color research

Lawrence Berkeley National Laboratory (LBNL) and Oak Ridge National Laboratory (ORNL) worked with roofing manufacturers to create cool-colored asphalt shingle, clay tile, concrete tile and metal roofs, then bring them to market.

Energy Savings – Yes!

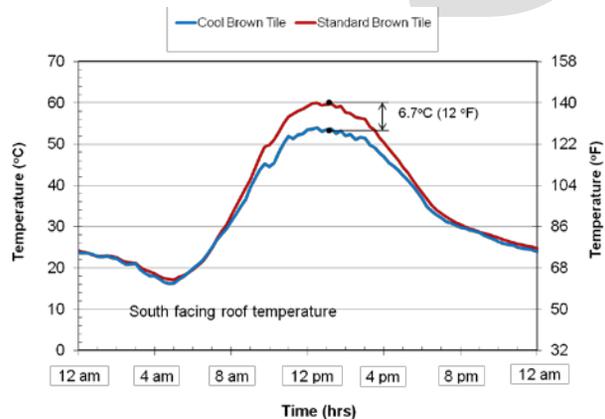
It's now easy to calculate the energy savings from cool roofs with the new Roof Savings Calculator.



Estimate your utility savings with the Roof Savings Calculator online at RoofCalc.com.

The researchers tested and validated this calculator using experiments on ORNL's Envelope Systems Research Apparatus – a carefully instrumented roof and attic.

To strengthen the case for cool-colored roofing products, the project team demonstrated energy savings on homes in California with cool-colored concrete roofing tiles. Homes with cool tiles required less air conditioning than homes with conventional tiles.



On a summer afternoon, the cool brown tile is 12°F cooler than a standard brown tile.

They also weathered cool-colored roofing materials at many sites in California to understand how soiling and exposure change reflectance. The results will help manufacturers design cool roofing products that stay clean and reflective.

Incentivizing Cool

Installing cool-colored roofs on 80% of California homes could save 50 GWh of electricity each year – enough to power nearly 4000 homes. The project team helped California utilities Pacific Gas & Electric and Southern California Edison create cool roof rebate programs. Homeowners can now cash in on cool-colored roofs with rebates.

What's in the Works

The project team partnered with industry to create new cool-colored roofing products. These prototype concrete tiles and asphalt shingles come in a wide variety of cool dark colors and are expected to qualify for utility rebates.

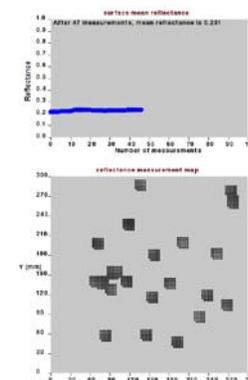
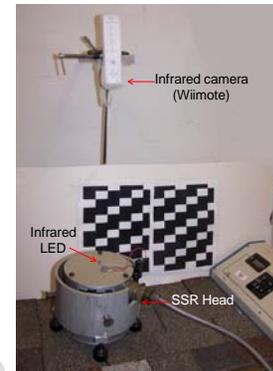


These prototype cool concrete tiles come in many colors, and reflect up to 48% of sunlight.



These prototype cool asphalt shingles come in many colors, and reflect up to 33% of sunlight.

To help industry manufacture and test products, the team developed easier and more accurate techniques for the measurement of reflectance.



This new scanning device helps verify the reflectance of cool-colored roofing products (asphalt shingle shown in photo).

Acknowledgments

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Resources

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Roof Savings Calculator

<http://RoofCalc.com>

Cool Colors Project

<http://CoolColors.LBL.gov>

Cool Communities Project at LBNL

<http://CoolCommunities.LBL.gov>

Heat Island Group at LBNL

<http://HeatIsland.LBL.gov>

Building Envelopes Program at ORNL

<http://ORNL.gov/sci/roofs+walls>



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