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# White Roofs Catch On as Energy Cost Cutters

By FELICITY BARRINGER  
Published: July 29, 2009

SAN FRANCISCO — Returning to their ranch-style house in Sacramento after a long summer workday, Jon and Kim Waldrep were routinely met by a wall of heat.

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J. Emilio Flores for The New York Times

A Wal-Mart store in Chino, Calif., has both a cool roof and solar panels to cut its energy use.

“We’d come home in the summer, and the house would be 115 degrees, stifling,” said Mr. Waldrep, a regional manager for a national company.

He or his wife would race to the thermostat and turn on the air-conditioning as their four small children, just picked up from day care, awaited relief.

All that changed last month. “Now we come home on days when it’s over 100 degrees outside, and the house is at 80 degrees,” Mr. Waldrep said.

Their solution was a new roof: a shiny plasticized white covering that experts say is not only an energy saver but also a way to help cool the planet.

Relying on the centuries-old principle that white objects absorb less heat than dark ones, homeowners like the Waldreps are in the vanguard of a

## By Degrees

### *A Cool Shield*

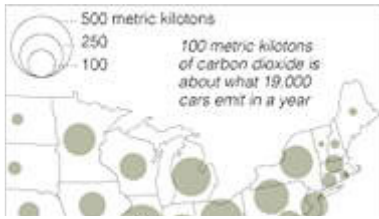
This is one in a series of articles about stopgap measures that could limit global warming.

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Jim Wilson/The New York Times

A white roof has helped cool Jon Waldrep's Sacramento home.

movement embracing “cool roofs” as one of the most affordable weapons against [climate change](#).

Studies show that white roofs reduce air-conditioning costs by 20 percent or more in hot, sunny weather. Lower energy consumption also means fewer of the carbon dioxide emissions that contribute to global warming.

What is more, a white roof can cost as little as 15 percent more than its dark counterpart, depending on the materials used, while slashing electricity bills.

Energy Secretary [Steven Chu](#), a Nobel laureate in physics, has proselytized for cool roofs at home and abroad. “Make it white,” [he advised a television audience](#) on Comedy Central’s “Daily Show” last week.

The scientist Mr. Chu calls his hero, Art Rosenfeld, a member of the [California Energy Commission](#) who has been campaigning for cool roofs since the 1980s, argues that turning all of the world’s roofs “light” over the next 20 years could save the equivalent of 24 billion metric tons in carbon dioxide emissions.

“That is what the whole world emitted last year,” Mr. Rosenfeld said. “So, in a sense, it’s like turning off the world for a year.”

This month the Waldreps’ three-bedroom house is consuming 10 percent less electricity than it did a year ago. (The savings would be greater if the family ran its central air during the workday.)

From Dubai to New Delhi to Osaka, Japan, reflective roofs have been embraced by local officials seeking to rein in energy costs. In the United States, they have been standard equipment for a decade at

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new Wal-Mart stores. More than 75 percent of the chain's 4,268 outlets in the United States have them.

[California](#), [Florida](#) and Georgia have adopted building codes that encourage white-roof installations for commercial buildings.

Drawing on federal stimulus dollars earmarked for energy-efficiency projects, state energy offices and local utilities often offer financing for cool roofs. The roofs can qualify for tax credits if the roofing materials pass muster with the [Environmental Protection Agency's Energy Star program](#).

Still, the ardor of the cool-roof advocates has prompted a bit of a backlash.

Some roofing specialists and architects argue that supporters fail to account for climate differences or the complexities of roof construction. In cooler climates, they say, reflective roofs can mean higher heating bills.

Scientists acknowledge that the extra heating costs may outweigh the air-conditioning savings in cities like Detroit or Minneapolis.

But for most types of construction, they say, light roofs yield significant net benefits as far north as New York or Chicago. Although those cities have cold winters, they are heat islands in the summer, with hundreds of thousands of square feet of roof surface absorbing energy.

The physics behind cool roofs is simple. Solar energy delivers both light and heat, and the heat from sunlight is readily absorbed by dark colors. (An asphalt roof in New York can rise to 180 degrees on a hot summer day.) Lighter colors, however, reflect back a sizable fraction of the radiation, helping to keep a building — and, more broadly, the city and Earth — cooler. They also re-emit some of the heat they absorb.

Unlike high-technology solutions to reducing energy use, like [light-emitting diodes](#) in lamp fixtures, white roofs have a long and humble history. Houses in hot climates have been whitewashed for centuries.

Before the advent of central air-conditioning in the mid-20th-century, white- and cream-colored houses with reflective tin roofs were the norm in South Florida, for example. Then central air-conditioning arrived, along with dark roofs whose basic ingredients

were often asphalt, tar and bitumen, or asphalt-based shingles. These materials absorb as much as 90 percent of the sun's heat energy — often useful in New England, but less so in Texas. By contrast, a white roof can absorb as little as 10 percent or 15 percent.

“Relative newcomers to the West and South brought a lot of habits and products from the Northeast,” said Joe Reilly, the president of [American Rooftile Coatings](#), a supplier. “What you see happening now is common sense.”

Around the country, roof makers are racing to develop products in the hope of profiting as the movement spreads from the flat roofs of the country's malls to the sloped roofs of its suburbs.

Years of detailed work by scientists at the [Lawrence Berkeley Laboratory](#) have provided the roof makers with a rainbow of colors — the equivalent of a table of the elements — showing the amount of light that each hue reflects and the amount of heat it re-emits.

White is not always a buyer's first choice of color. So suppliers like American Rooftile Coatings have used federal color charts to create “cool” but traditional colors, like cream, sienna and gray, that yield savings, though less than dazzling white roofs do.

In an [experiment](#), the [National Laboratory in Oak Ridge, Tenn.](#), had two kinds of terra-cotta-colored cement tiles from American Rooftile installed on four new homes at the [Fort Irwin Army](#) base in California. One kind was covered with a special paint and reflected 45 percent of the sun's rays — nearly twice as much as the other kind. The two homes with roofs of highly reflective paint used 35 percent less electricity last summer than the two with less reflective paint.

Still, William Miller of the Oak Ridge laboratory, who organized the experiment, says he distrusts the margin of difference; he wants to figure out whether some of it resulted from different family habits.

Hashem Akbari, Dr. Rosenfeld's colleague at the Lawrence Berkeley laboratory, says he is unsure how long it will take cool roofs to truly catch on. But he points out that most roofs, whether tile or asphalt-shingle, have a life span of 20 to 25 years.

If the roughly 5 percent of all roofs that are replaced each year were given cool colors, he said, the country's transformation would be complete in two decades.

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A version of this article appeared in print on July 30, 2009, on page A1 of the New York edition.

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