



# Paint the Town White - Reflective Roads and Roofs Cool Climate

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White Roofs in Santorini –  
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Researchers at Lawrence Berkeley National Laboratory have confirmed an idea that's been tossed around for years – that making roofs and roads more reflective could help keep the planet cool despite rising levels of greenhouse gasses.

Using a detailed climate model from NASA Goddard Space Flight Center, the researchers found that making roofs and roads in the world's large cities more reflective – increasing the “urban albedo” -- by just 10 percent could balance the heating effect of 57 billion metric tons of carbon dioxide emissions. That's two years of worldwide CO<sub>2</sub> emissions at the 2006 rate.

Cooler roofs and roads are not a long-term solution to the problem of human-caused climate change, but they could help slow the pace of global warming.

“These offsets help delay warming that would otherwise take place if actual CO<sub>2</sub> emissions are not reduced,” says Surabi Menon, the lead author of [a recent paper](#) entitled “Radiative Forcing and Temperature Response to Changes in Urban Albedos and Associated CO<sub>2</sub> Offsets” in the journal [Environmental Research Letters](#), vol 5 no 1, 2010.

## What the Urban Albedo Researchers Did

The Berkeley Lab researchers started with an existing model of the land surface characteristics of the entire globe, called the Catchment Land Surface Model, developed at NASA Goddard Space Flight Center. The model includes detailed information about surface slope, coverage by vegetation or roads and buildings, moisture content, and the amount of solar energy being absorbed or reflected.



They then increased the reflectivity in urban areas by assuming that roofs could be treated to reflect 25 percent more of the solar energy that falls on them, and paved areas 15 percent more. These modest changes increased the overall solar energy reflected by cities by 10 percent. That increased the amount of sunlight reflected back into space from the surface of the U.S. by 1 percent, and from the entire land surface of the Earth by 0.3 percent.

The researchers next calculated how much greenhouse gas in the form of atmospheric carbon dioxide would have to be removed to produce an equal amount of cooling. That turned out to be 57 billion metric tons of CO<sub>2</sub> - a massive carbon footprint. Since keeping a metric ton of carbon dioxide out of the atmosphere is valued at around \$25, making city rooftops and pavements more reflective would be worth about \$1.4 trillion.

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Fifty-seven billion metric tons is the amount of CO<sub>2</sub> pumped into the atmosphere by all human activities over the course of two years, or the equivalent of taking most of the world's cars off the roads for twenty years.

Although those cooler roofs and roads represent a lot of greenhouse gas emissions, it's far from a solution to the challenges of human caused global warming and climate change. The researchers found that worldwide land surface temperatures would drop on average by just .01 degree Celsius as a result.

The study's co-author Hashem Akbari says that many other changes are needed to do more than delay the warming climate models predict by a few years. "Two years worth of emissions is huge, but compared to what we need to do, it's just a dent in the problem," he says. "We've been dumping CO<sub>2</sub> into the atmosphere for the last 200 years as if there's no future."

## Implementing the Cool Roof Findings

Since becoming the U.S. Secretary of Energy, Nobel Prize winning physicist Stephen Chu has directed that all new or replacement roofs on Department of Energy buildings throughout the U.S. will be highly reflective "cool roofs" as long as this will be cost effective over the roof's lifetime. Chu has also written to the heads of all other federal agencies asking them to do the same with their buildings.

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Chu emphasizes the importance of this simple, low-tech step towards combating global warming and climate change. “Cool roofs are one of the quickest and lowest cost ways we can reduce our global carbon emissions and begin the hard work of slowing climate change,” he says. “By demonstrating the benefits of cool roofs on our facilities, the federal government can lead the nation toward more sustainable building practices, while reducing the federal carbon footprint and saving money for taxpayers.”

Not a bad payoff for the equivalent of a coat of white paint.

Cool Roof Resources: U.S. Department of Energy ["Cool Roof Resources for Federal Agencies"](http://www.eere.energy.gov) Eere.energy.gov