

## Is White the New Green?

*Three California energy experts make a convincing — and sincere — case that painting roofs white in the hot parts of the planet could offset the greenhouse gas woes caused by the world's cars*

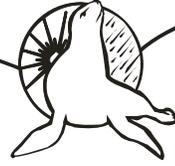
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By: Sam Kornell



It has long been known that white-roofed buildings, like this one in Andalusia in Spain, stay cooler in hot weather. Three energy experts make the case that painting white the roofs and pavement in the hot parts of the planet could offset the greenhouse gJosep Altarriba

**I**n early January, Hashem Akbari sent federal officials a rather improbable sounding proposal. An Iranian-born nuclear engineer who, for the last three decades, has worked as a scientist at the Lawrence Berkeley National Laboratory, Akbari would like to see \$3 billion of the economic stimulus package directed toward painting white or a light color



as many of the nation's roofs, and as much of its pavement, as possible — all with the goal of directing more solar radiation into space.

Akbari, along with Surabi Menon, another LBNL scientist, and Arthur Rosenfeld, a former LBNL scientist and now a California Energy Commission board member, claim that painting urban surfaces in warm parts of the world white or a light color could offset the carbon emissions of all 600 million of the world's cars for 18 to 20 years — at a savings equivalent to at least \$1 trillion worth of CO2 reductions.

This is not a hoax: Akbari, Menon and Rosenfeld are three of the country's leading experts in their field, and their study published in the journal *Climatic Change* is backed by years of carefully calculated data.

It has long been known that white-roofed buildings stay cooler in hot weather. Blinding confirmation of this can be found in the streets of Andalusia in Spain, or the Greek Islands.

It turns out that they cool the air outside of their walls, too. On a typical summer day, Los Angeles is 5 degrees warmer than surrounding areas, and studies have consistently shown that by far the largest factor in this discrepancy is the absorption of solar heat by dark roofs and pavement — a phenomenon known as the "urban heat island" effect..

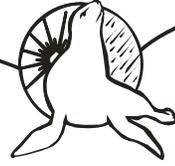
In 1985, Akbari and his colleagues began attempting to quantify how much "cool" roofs and pavement might improve urban air quality (hotter weather equals dirtier air), while cutting down on the need for air-conditioning. Then, five years ago, it occurred to them that cooling urban areas might also mitigate climate change.

As the greenhouse effect intensifies, one of the most dangerous consequences is a decrease in the earth's albedo — the degree to which it reflects solar radiation. Antarctic ice, for example, acts like a giant mirror, reflecting the heat of the sun back into space; as the ice melts, the earth absorbs more heat, leading to more global warming — a self-perpetuating process scientists call a feedback loop.

The idea of "geo-engineering" the world to make it bounce more of the sun's heat back into space has been around for years, but until Akbari and his colleagues decided to look into it, no one had attempted to quantify how much atmospheric cooling might be achieved by, as it were, painting the town white.

In 2004, they began running the numbers, and when they finished they were incredulous.

"When we did the calculations, initially we couldn't believe the results," Akbari said. "So



we re-checked the numbers in different ways." Again, he said, the results were unambiguous: Every 100 square feet of roof area turned from a dark color to white is equivalent to offsetting the emission of one ton of heat-trapping, atmospheric CO<sub>2</sub>.

To get an idea of what this means, consider that in a single year, the average American is responsible for about 20 tons of CO<sub>2</sub> emissions. Per capita, Americans have the largest carbon footprint of any nationality in the world, and all of the activities that make this so — driving our cars, using our electrical appliances, buying consumer products — adds up to the equivalent, atmospherically speaking, of 2,000 square feet of white roof.

In all, Akbari, Menon and Rosenfeld estimate that permanently retrofitting roofs and pavement in tropical and temperate regions of the world would offset 44 gigatons of CO<sub>2</sub> emissions. It takes about a year and a half for the entire world to cook up 44 gigatons of CO<sub>2</sub>.

The scale of such mitigation, in proportion to its cost, is unrivaled among technology-based climate solutions. "This is not trivial a number," said Stephen Schneider, the co-director of Stanford's Center for Environmental Science and Policy, and the editor of *Climatic Change*.

Schneider emphasized that the plan would offset, not eliminate, the necessity of reducing carbon emissions, but he said that as singular greenhouse mitigation strategies come, the LBNL study is elegant, simple and profoundly cheap.

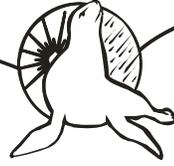
It's also well timed. Akbari pointed out that by his and his colleagues' calculations, the plan could save Americans \$2 billion annually in unspent air conditioning, even after taking into account the increased need for heating in winter. Moreover, he argued, it dovetails with the president's economic and environmental goals.

The Obama administration has made it clear that it wants a substantial portion of the stimulus package to go toward creating a greener economy, but that desire has to be balanced against the imperative to immediately circulate cash and create jobs. Painting or resurfacing roofs or pavement, Akbari said, would nicely fulfill both objectives. The technology exists and is readily available, and since a substantial portion of the country's home and commercial real-estate owners are going to need to re-roof at some point in the near future anyway, it's about as shovel-ready as any proposal currently on the table.

Akbari has thus far not heard back from the government, but he's holding out hope that his funding proposal will be folded into the energy-efficiency provision of the stimulus package.

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"I don't see why it shouldn't be," he said. "It will be lucrative for the government and for business owners, and it will create jobs and offset carbon emissions."

However, he noted that the attraction of urban cooling is unlikely to fade anytime in the foreseeable future — indeed, with 70 percent of the world's population projected to live in cities by 2040, it should only increase. He makes a convincing case.