

Environment

City in Sierra Leone covers buildings in mirrors to fight extreme heat

People in Freetown, Sierra Leone, are increasingly exposed to extreme heat due to climate change and the urban heat island effect, but covering homes in a reflective film significantly cut indoor temperatures

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By James Dinneen



▲ Reflective film installed on the roofs of two buildings in Freetown, Sierra Leone
MEER

Tens of thousands of people in Freetown, Sierra Leone, live in informal settlements dense with metal and concrete buildings that trap heat and make heatwaves more dangerous. An experiment has shown that covering such buildings with a cheap

mirrored film can substantially reduce the temperature inside.

Since becoming the chief heat officer of Freetown in Sierra Leone, [Eugenia Kargbo](#) has experimented with all kinds of ways to protect the city from heat. When a group of researchers approached her with a plan to cover the city's buildings in mirrors to cool them off, she thought it was worth a try. "I said, 'why not?'"

The proposal came from a US non-profit called MEER, an acronym for Mirrors for Earth's Energy Rebalancing. Founder [Ye Tao](#) was in search of a place to test the cooling effects of a reflective film the organisation had developed out of recycled PET plastic and aluminium. In theory, a building covered in the film would absorb less of the sun's radiation and be cooler than one roofed with metal or tar.

Tao had heard about Kargbo's efforts to mitigate heat in Freetown, which have included planting hundreds of thousands of trees across the city and installing shading structures made of reflective plastic in a crowded marketplace. So, he asked her about testing the film.

Temperatures in Freetown regularly spike above 40°C (104°F) during the dry season from December to April, and remain hot even at night. The hottest days are [projected to become more frequent](#) with climate change.

The heat is also exacerbated by the [urban heat island effect](#) – a phenomenon in which urban areas get hotter than nearby rural areas due to less vegetation, less air flow and more heat-absorbing material on buildings and roads. Kargbo was interested in anything that might provide cooling effects indoors. The city's buildings are hot and getting hotter.

"The heat data shows everywhere in Freetown is getting hotter, but there are also communities that stay hotter throughout the day," says Kargbo.

This was particularly true of the numerous informal settlements built along the coast and the deforested hills around the city. Most buildings in the impoverished settlements are made from uninsulated concrete walls and corrugated zinc roofing that absorb and trap heat.

Kargbo says the heat and humidity, along with high levels of air pollution in the settlements, make for a "toxic combination" for residents' health and well-being.

In consultation with residents, Kargbo and other city officials along with Tao and his colleagues decided to test their reflective film in a settlement called Kroo Bay. The settlement is one of Freetown's largest with more than 10,000 people living in roughly 1 square kilometre.

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Jalahan Sesay, a recent graduate from the University of Sierra Leone who surveyed residents as part of the MEER project, says most people in Kroo Bay sleep outside during the hottest time of year, because staying indoors is intolerable. Most buildings lack a ceiling to separate the living space from the roof. "It's like having a radiator on top of people's heads," says Tao.

Working with local carpenters, Tao and his team installed mirrored film on the roofs of two residences. To compare its effectiveness against other cooling strategies, they also painted the roof of one residence white and added a new metal roof to another. All four buildings were similarly constructed and had around 180 square metres of roof area.

During the day, the interior temperature of the building with the new zinc roof was on average 1 to 2°C cooler than before, and the building with white paint was around 3°C cooler. Inside the two buildings covered in film, it was 6°C cooler, says Tao. The temperature of the roof on the two mirrored buildings was 15°C cooler than without the film, on average.

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- ▲ A heat map (left) shows the temperatures of the four roofs (pictured right), with darker areas signifying lower temperatures. While the new metal roof (bottom left) appears coolest, temperature measurements revealed the two roofs covered in reflective film (right) were actually cooler.

MEER

Sedie Sowa, another MEER intern who surveyed residents in Kroo Bay, says families who live in the mirrored buildings are pleased with it. “They say they sleep comfortably,” he says.

[David Sailor](#) at Arizona State University says assessing the amount of cooling depends a lot on measurement conditions – cooling effects from reflecting sunlight will be greatest during days with the most solar radiation, for instance. But he says a 6°C reduction is substantial. “There’s a lot of potential there not just to improve comfort, but to save lives.”

Tests are ongoing, but Kargbo says she is encouraged by the results, and aims to roof many more buildings in Freetown with reflective film. If an entire neighbourhood or more were to be covered, Tao says the cooling effects could accumulate as air flows across roofs, lowering air temperature across whole areas and not just within individual buildings.