

Heat Mitigation with Cool Surfaces for the Sustainable Built Environment

Presentation to UNEP Cool Coalition
Passive Cooling Working Group
June 19, 2025



CRRC is a US-based nonprofit organization

Our mission is to bring objective, scientific information related to cool surfaces to critical discussions and informed decisions about the impacts of heat islands, extreme heat, and energy use in the built environment.





Ratings of the radiative properties of roofing and exterior wall products



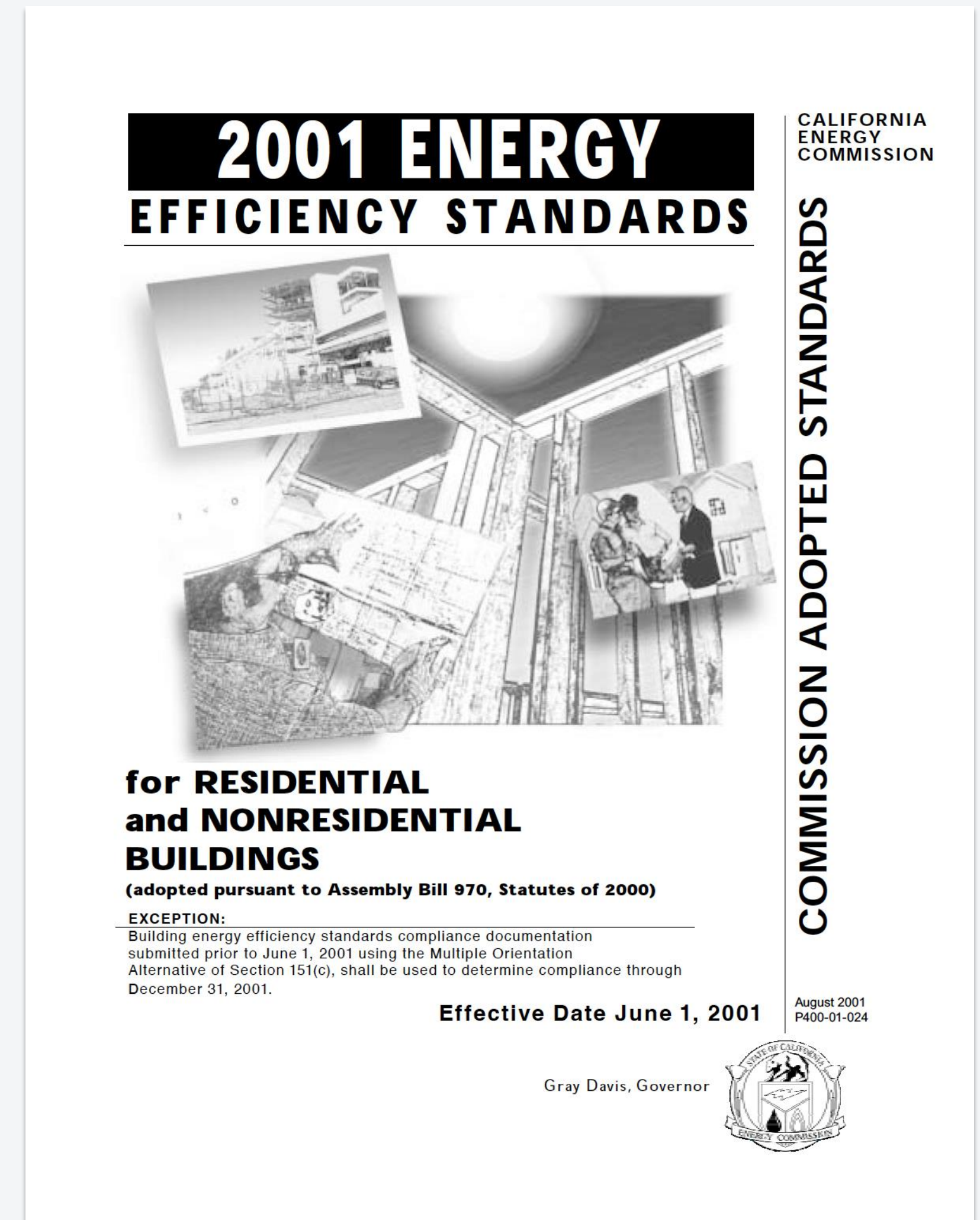
Research to support scientific rigor of rating programs



Education to raise awareness of the impacts of cool surfaces

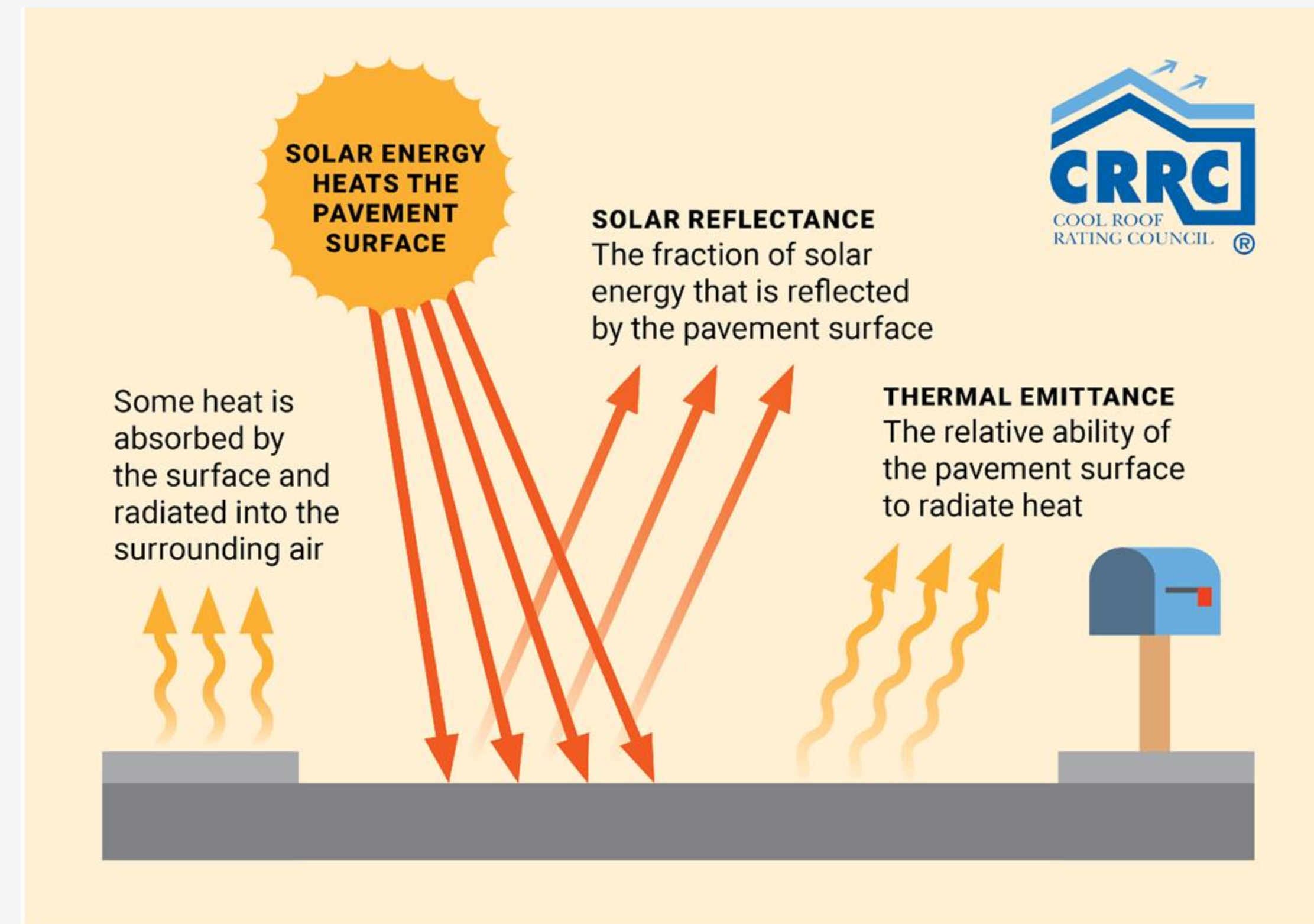
CRRC History

- Established in 1998
- Collaboration between industry, government, utilities, national labs, and nonprofit organizations
- Third-party ratings for California's cool roof code provisions in Title 24, Parts 6 & 11
- Scope expansion
 - Walls in 2019
 - Pavements in 2024



CRRC's Pavement Program Goals

- Provide science-backed education on the effectiveness of cool pavements in combating extreme heat
- Create a free public directory of pavement material ratings to support municipalities and other end-users in creating cool pavement requirements or incentive programs



Exploration of Pavement Ratings

- CRRC formed a Pavement Steering Committee comprising:
 - “Cool pavement” material manufacturers
 - Pavement material trade associations
 - End-users
 - Other interested organizations
- Objective is to create a program plan for pavement materials including testing & aging protocols, labeling requirements and a financial model

Pavement Ratings

- Radiative Properties
 - Solar Reflectance
 - Thermal Emittance
- Thermal Comfort – How changes to reflected solar radiation may affect pedestrian experience
- Aged rating protocol



Cool Surface Impacts & Evaluation

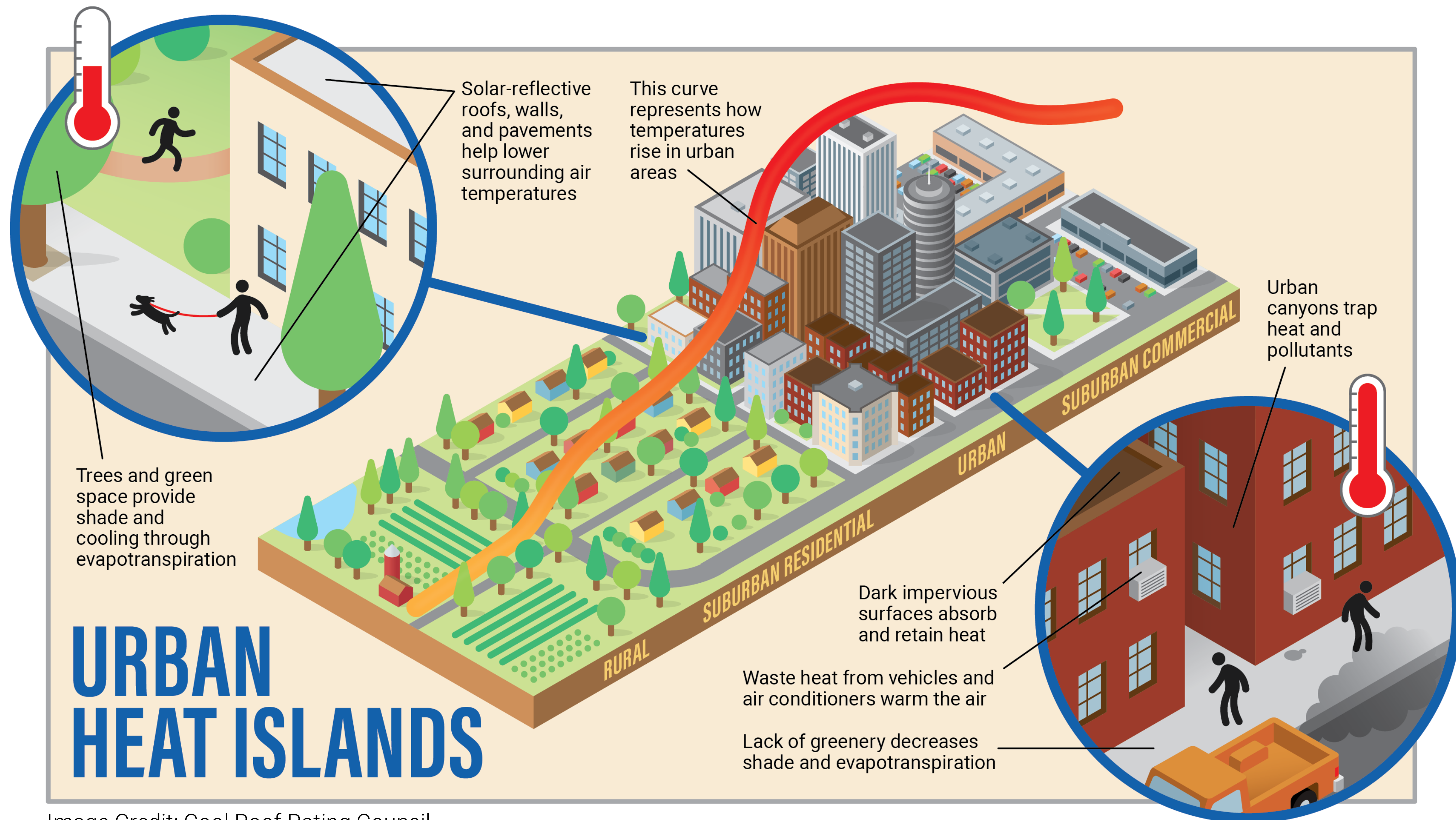


Image Credit: Cool Roof Rating Council

Cool surface impacts at multiple scales

Individual	Building	Community	Global
• Comfort • Health • Safety • Learning • Productivity	• Energy • Utility bills • Equipment & envelope durability	• Temperature • Air quality • Peak demand • Grid stability	• GHGs • Atmospheric cooling

Impacts are more significant in buildings with little to no insulation or mechanical cooling

Two properties describe “coolness”

Solar Reflectance (SR) (albedo)

Thermal Emittance (TE)

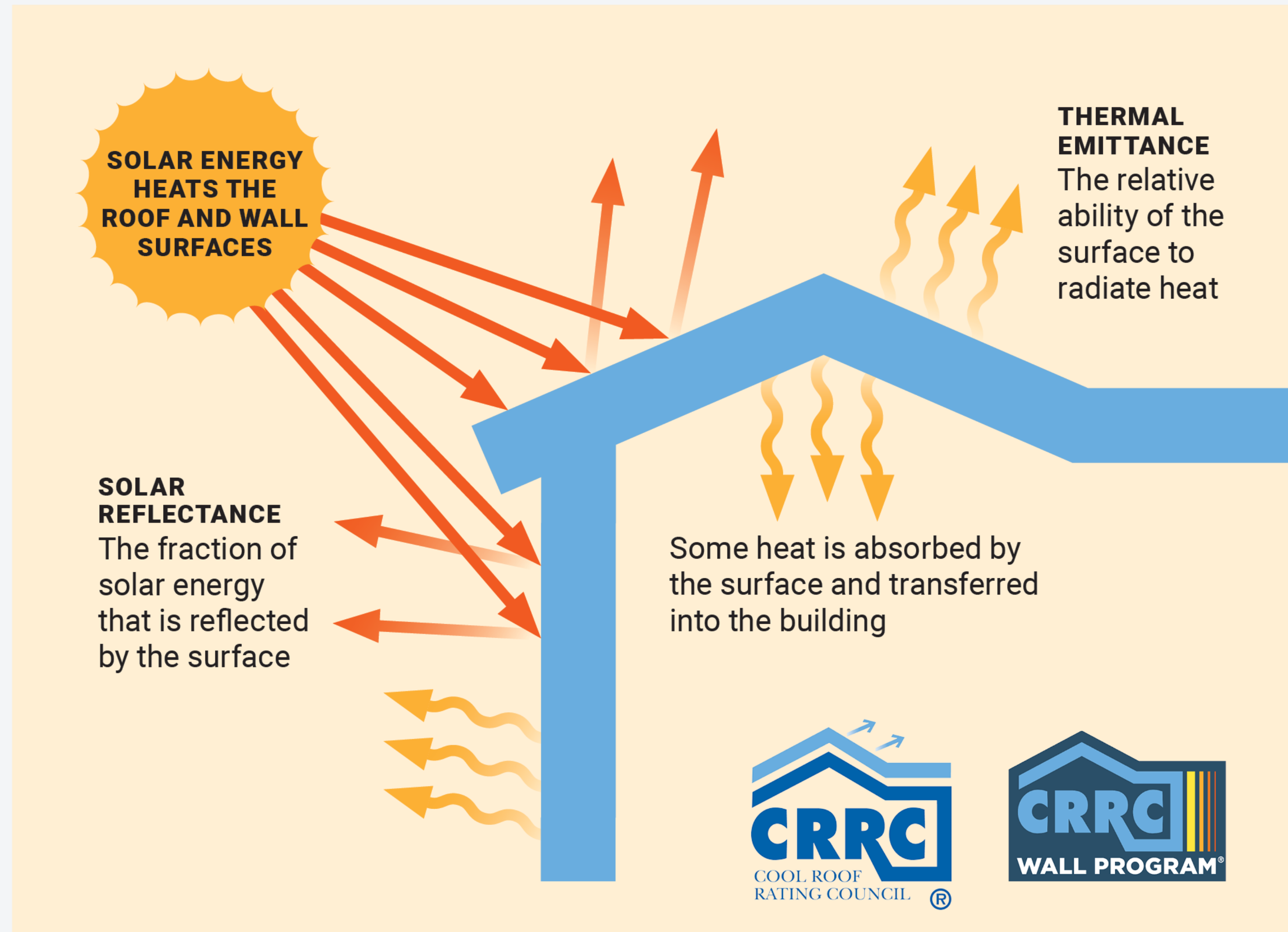


Image Credit: Cool Roof Rating Council

Solar Reflectance Index (SRI)

- Calculated metric that combines SR and TE of a roof surface into one value
- [ASTM Standard E1980](#) describes calculation of SRI
- Values between 0 and 100, but can exceed 100 for very cool surfaces
- Applies to roofs
 - Not for walls
 - May not be appropriate for pavements

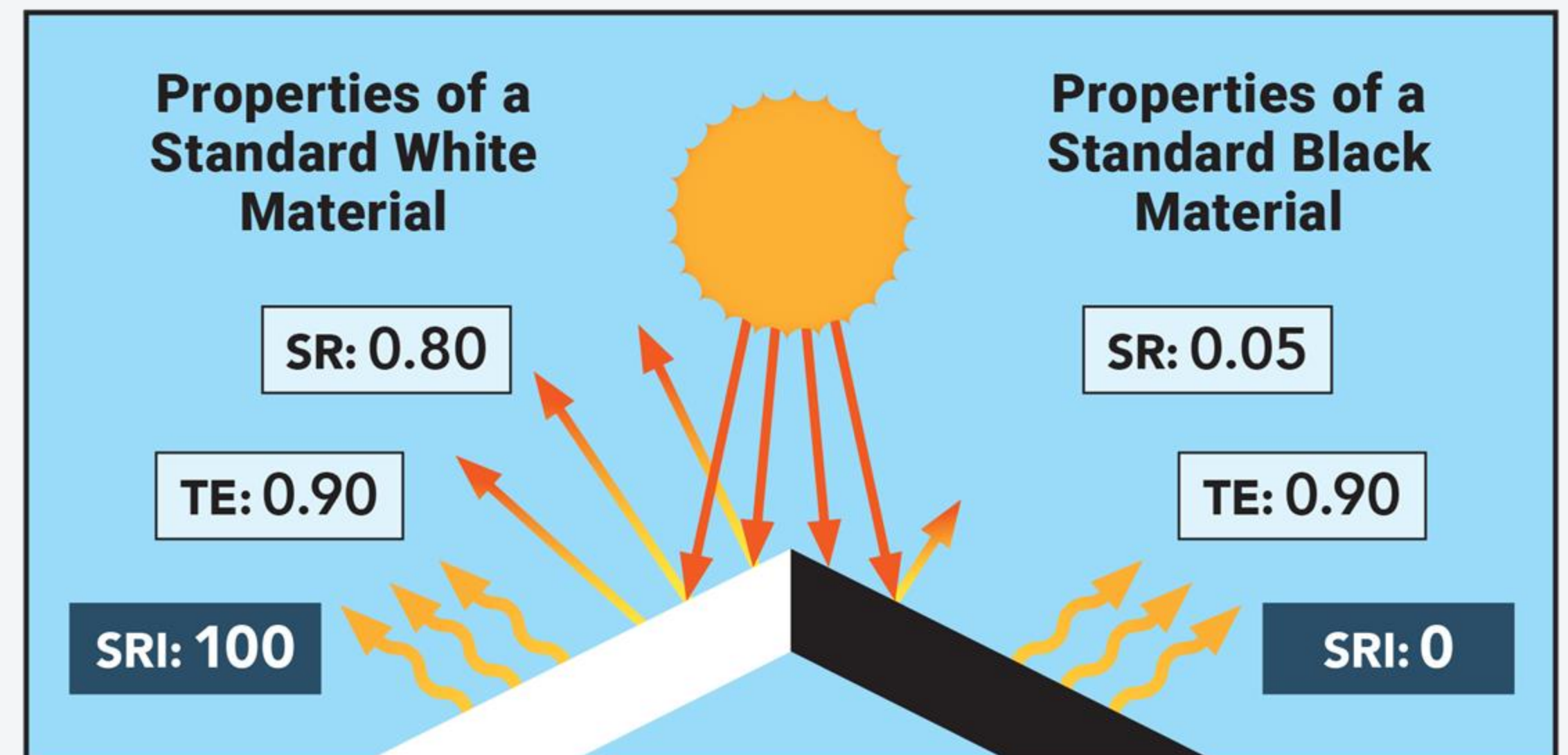


Image Credit: Cool Roof Rating Council

Commonly available cool products



“Cool-colors” reflect near infrared radiation



Image Source:: American Rooftile Coatings

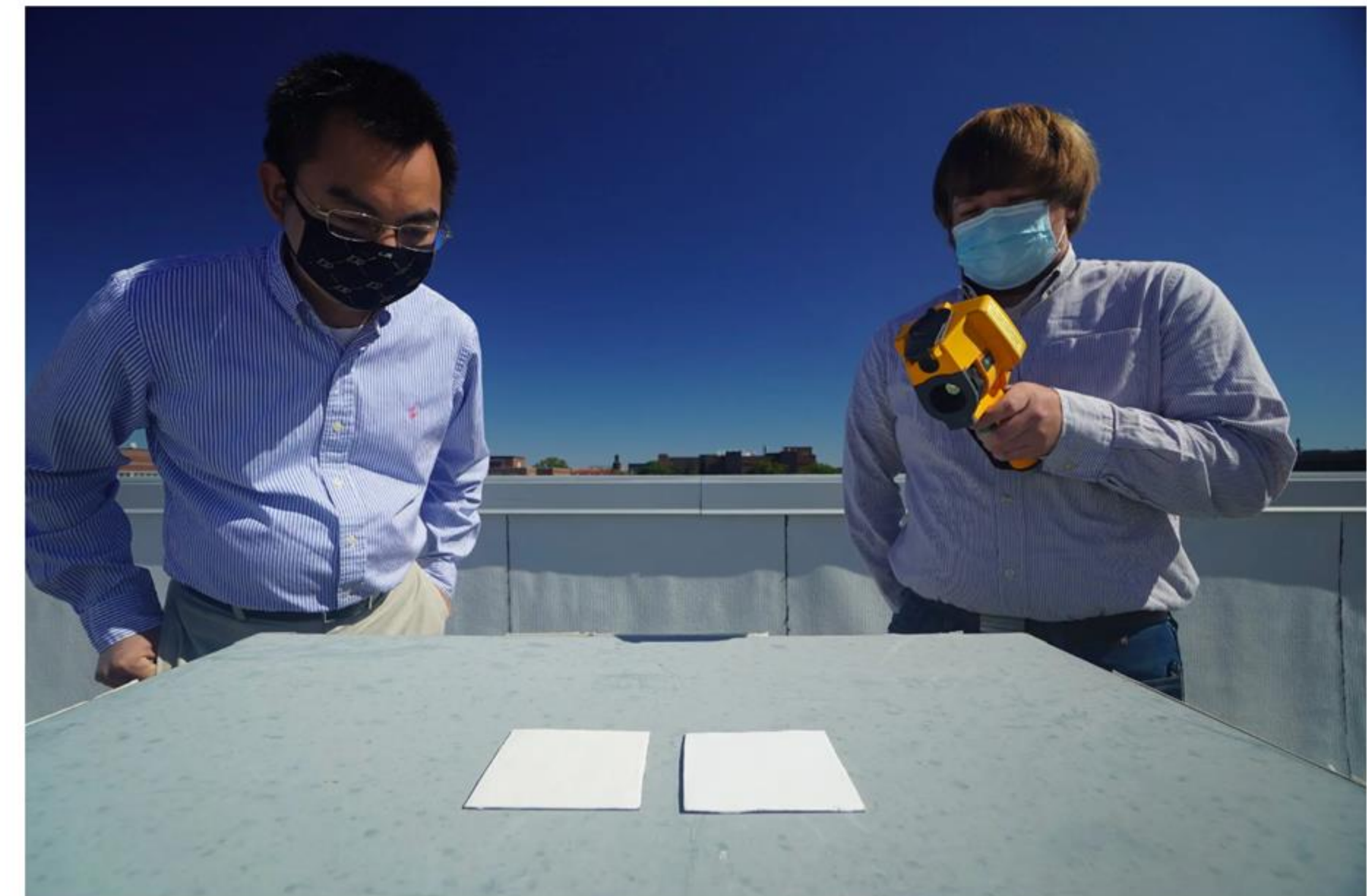
Passive Daytime Radiative Cooling (PDRC)

- Emerging technologies
- Highly reflective & emissive
- Lowers to sub-ambient temps



Photo by: ABC15

SkyCool Systems cool roofing film on Arizona mobile homes



Dr. Ruan, left, and Joseph Peoples of Purdue University used an infrared camera to compare the cooling performance of white paint samples on a roof. Jared Pike/Purdue University

Key Considerations

- Important to use appropriate materials on substrates
 - Roof coatings
 - Thicker
 - Waterproofing
 - Wall coatings (architectural paints)
 - Thinner
 - Aesthetics



Applying white coating to a roof in China. Photo: United Coatings



Product Rating Evaluation

- Product testing produces radiative performance data that serve as “ratings”
- Ratings are based on initial and 3-year aged SR and TE
- Third-party verifies data for accuracy
- Certified data are published online and on product labels



Image Credit: Cool Roof Rating Council



D&S Solar Spectrum Reflectometer

Photo Credit: Cool Roof Rating Council



410-Solar Reflectometer

Photo courtesy of Surface Optics Corporation



D&S Emissometer

Photo Credit: Cool Roof Rating Council



Pyranometer

Attribution: USGov, Public domain, via Wikimedia Commons



Spectrometer (Spectrophotometer)

Attribution: Viv Rolfe, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons

Product Testing

- Surface radiative properties measured by accredited independent testing laboratories
- Testing requirements located in ANSI/CRRC S100 and CRRC Product Rating Program Manuals



ANSI/CRRC S100 (2025)
Standard Test Methods for Determining
Radiative Properties of Materials

© 2025 Cool Roof Rating Council, Inc. All Rights Reserved.

Cool Roof Rating Council
2435 N Lombard Street
Portland, OR 97217

Phone (866) 465-2523



ANSI Approved December 5, 2024



WALL PRODUCT RATING PROGRAM MANUAL
CRRC-2

© 2025 Cool Roof Rating Council, Inc. All Rights Reserved.

2435 N. Lombard Street
Portland, OR 97217
www.coolroofs.org
Phone (866) 465-2523

CRRC Wall Rating Program Manual



ROOF PRODUCT RATING PROGRAM MANUAL
CRRC-1

© 2025 Cool Roof Rating Council, Inc. All Rights Reserved.

2435 N. Lombard Street
Portland, OR 97217
www.coolroofs.org
Phone (866) 465-2523

CRRC-1 Roof Product Rating Program Manual

January 23, 2025 Version

Product Weathering

Natural weathering is crucial
for understanding radiative
performance over time

Three years undisturbed

Three U.S. climates

- Hot/Arid
- Cool/Temperate
- Hot/Humid

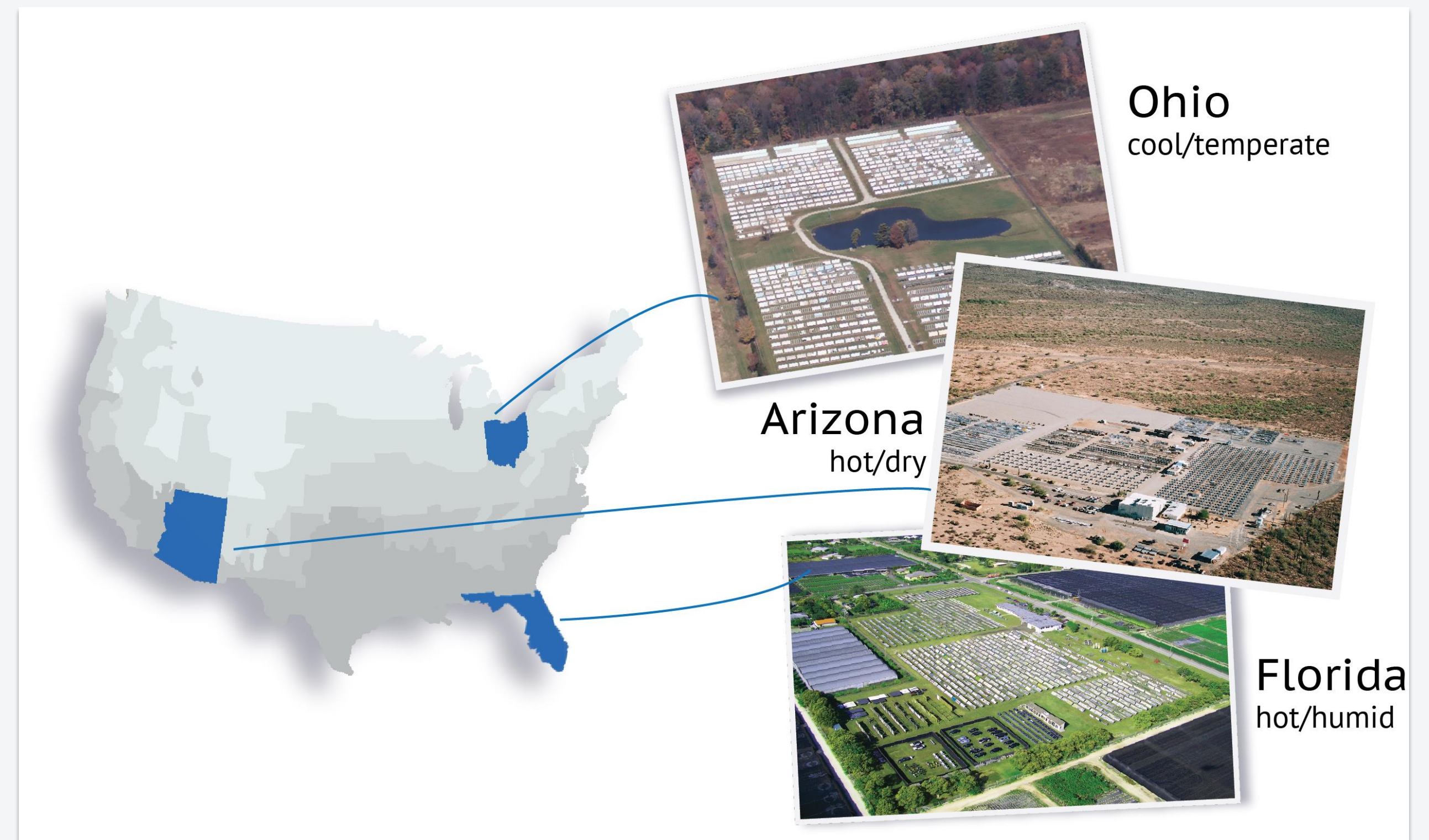
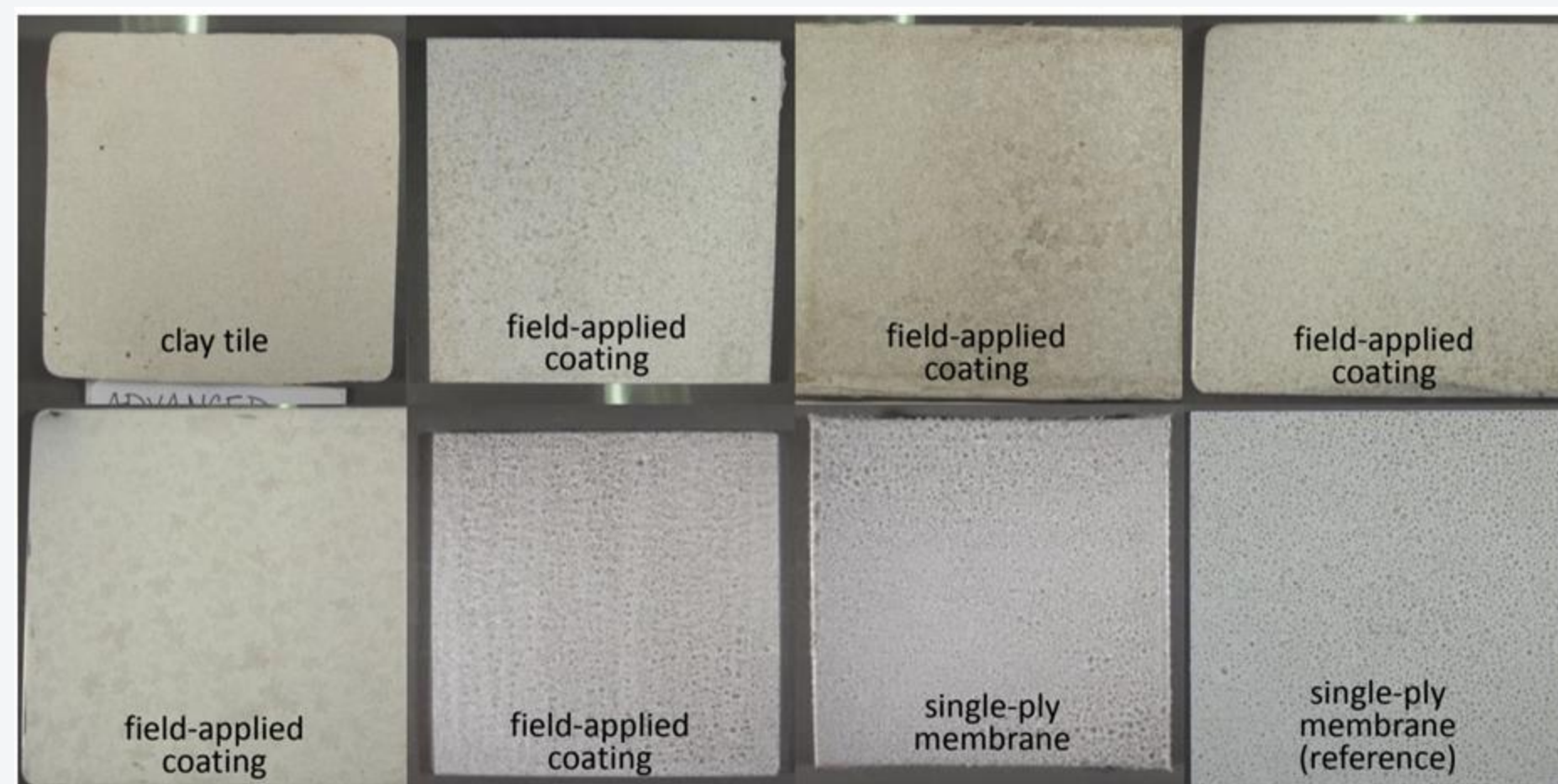
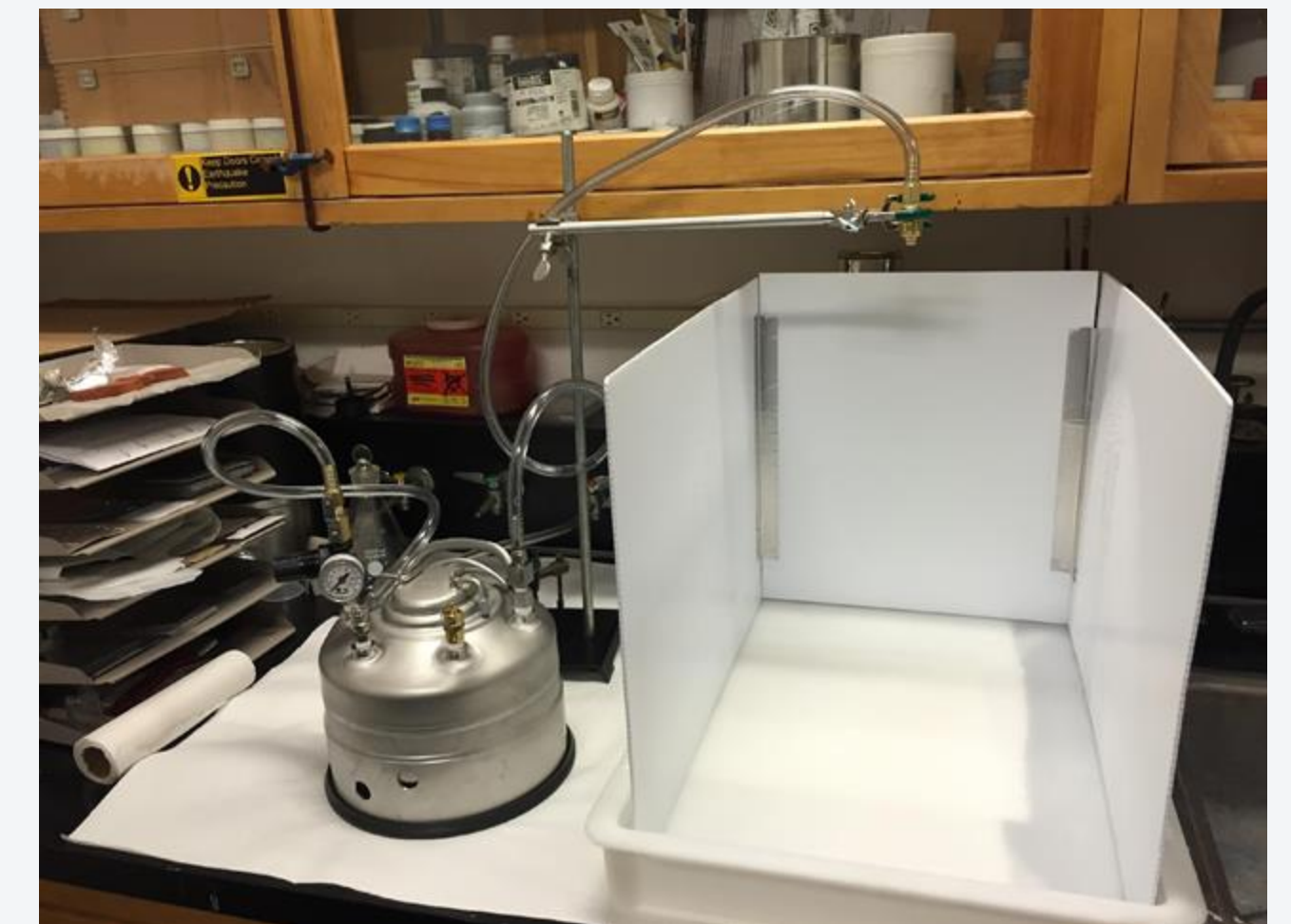


Image credit: Atlas Weathering Services

Laboratory Aging for Roof Rapid Ratings

- Based on ASTM D7897
- Roof Program only



Cool Surface Case Studies

Chennai Cool Roof Project Gains Global Recognition

By UrbanNews June 16, 2025

0

Share

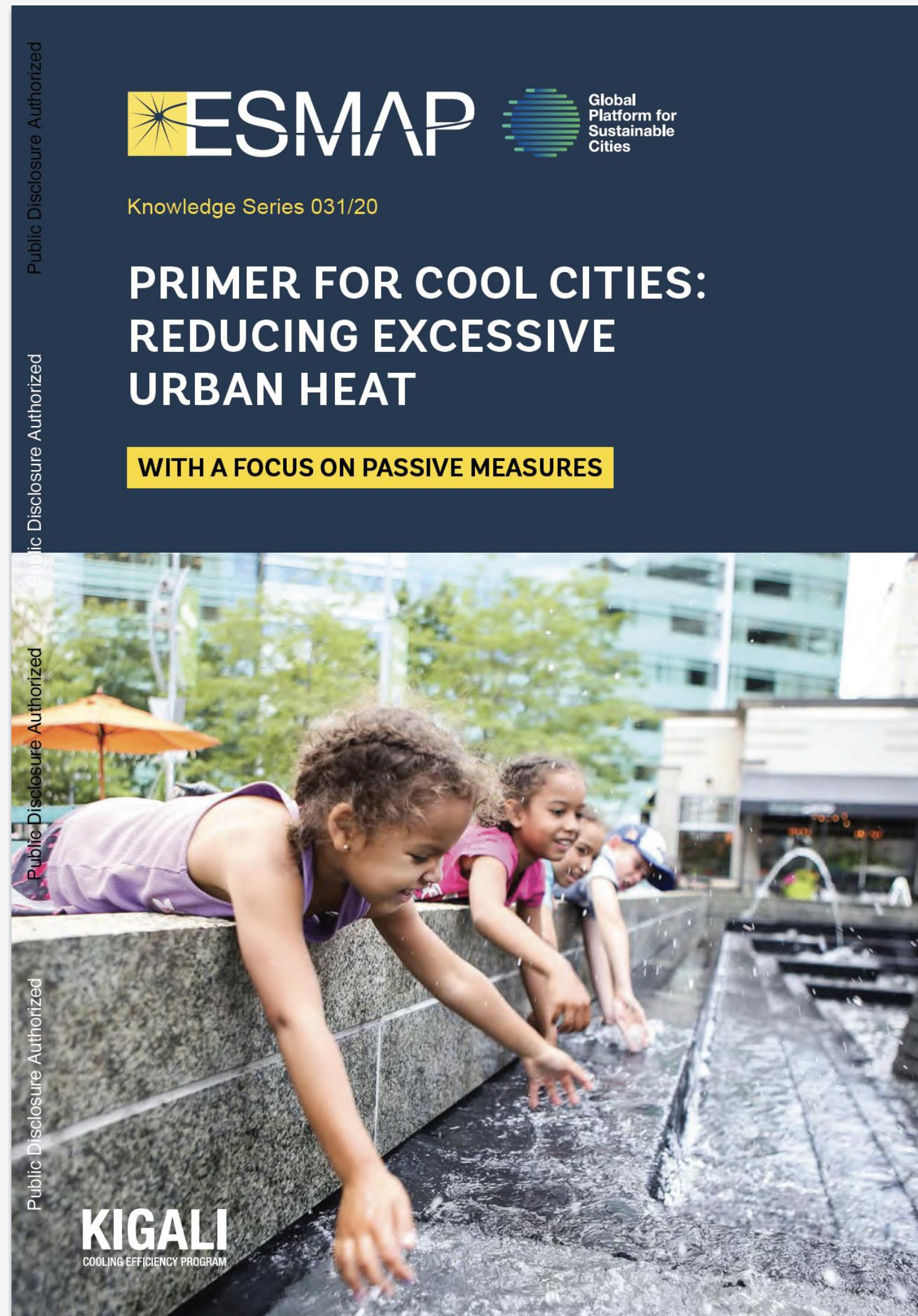


NM Pro News Magazine, 16 June 2025

<https://urbanacres.in/chennai-cool-roof-project-gains-global-recognition/>

“The ‘Cool Roof’ initiative implemented in Chennai’s Perumbakkam has drawn international attention, with the United Nations Environment Programme (UNEP) citing it as a replicable climate innovation for rapidly urbanising regions. Recognised as a scalable urban heat mitigation model, the project is now being considered for similar rollouts in India’s capital, Delhi, and other heat-prone cities.

“This intervention, developed in partnership between the Tamil Nadu government, the UNEP-led Cool Coalition, and the Rocky Mountain Institute, is part of a larger urban heat resilience framework. A pilot was launched at the Lighthouse Project in Perumbakkam, where cool roof technology using high solar reflective paint was applied to two residential blocks. The result was a tangible temperature drop of 5 to 8 degrees Celsius within homes during peak summer months—transforming thermal comfort in affordable housing sectors.” – NM Pro News



Access [Here](#)



[Email CRRC for copy](#)



Case Study: Los Angeles, USA

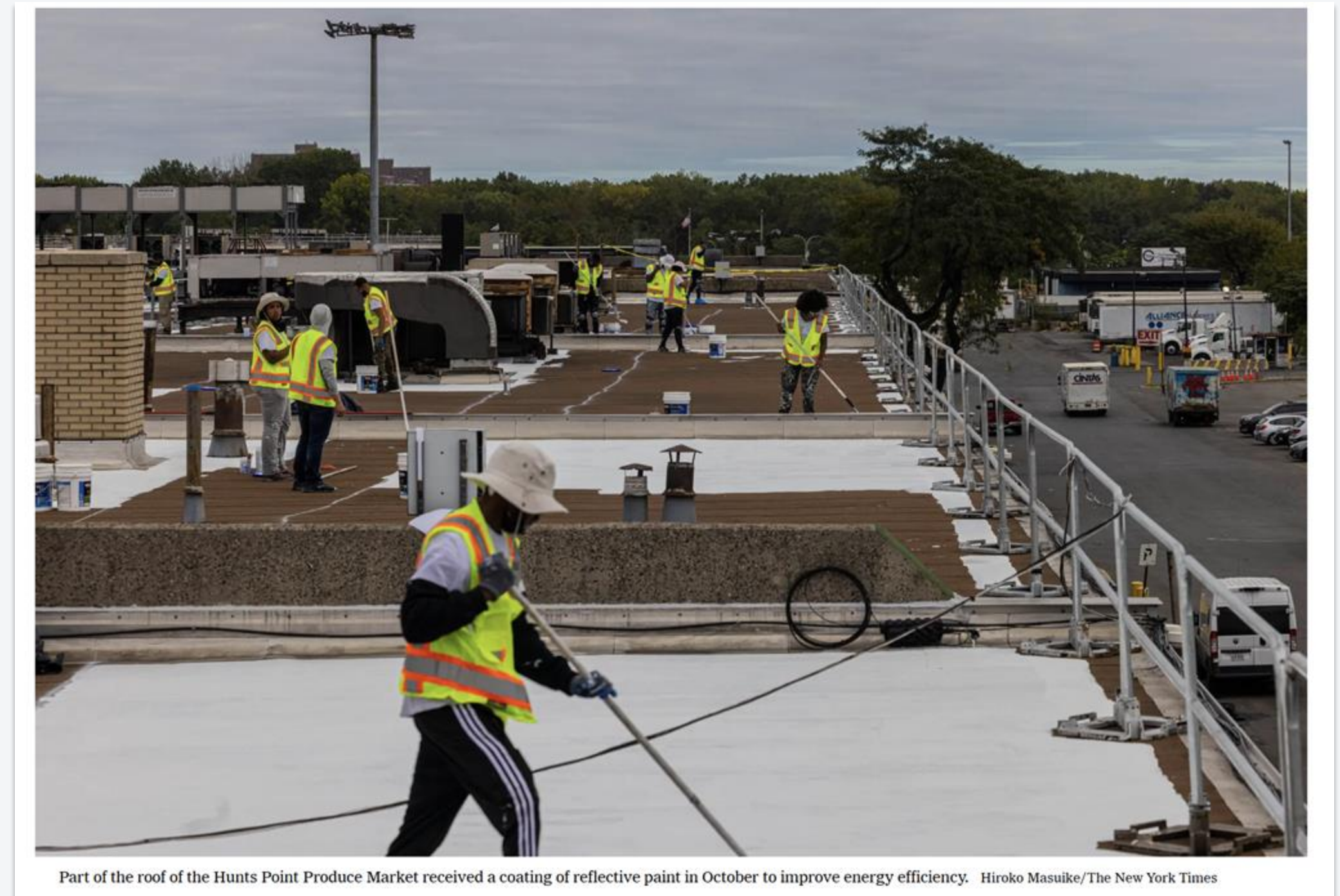
- 3 single-family homes
 - Each roof is 1,500 square feet
 - Reflective shingles installed to replace old asphalt roofs (winter/spring 2023)
 - Shingles coated with innovative NOx-abating granules
- LADWP Community Emissions Reduction grant program



Image Credit: GRID Alternatives

Case Study: New York City, USA

- Hunts Point Produce Market
- Country's largest wholesale produce market
- 30,000 square feet coated (October 2021)
- Hunts Point, Bronx, New York City
 - Top 20% of heat-vulnerable neighborhoods in NYC
- NYC CoolRoofs and HOPE Program
- Leveraged federal grant



Part of the roof of the Hunts Point Produce Market received a coating of reflective paint in October to improve energy efficiency. Hiroko Masuike/The New York Times

Image Credit: New York Times

Case Study: Cool Surface Art, USA



“Beat the Heat”

Photo Credit: Kristy Sandoval

<https://www.pacoimabeautiful.org/programs/beat-heat-mural>



“Blue Zeus”

Image Source: UCLA Luskin Center

<https://innovation.luskin.ucla.edu/2019/10/22/street-art-meets-climate-science-in-the-big-blue-face-of-zeus/>

Supporting Wide-Scale Deployment of Cool Surfaces

Challenges to Wide-Scale Deployment

**Awareness
&
Education
(Demand)**

**Product
Availability
(Markets)**

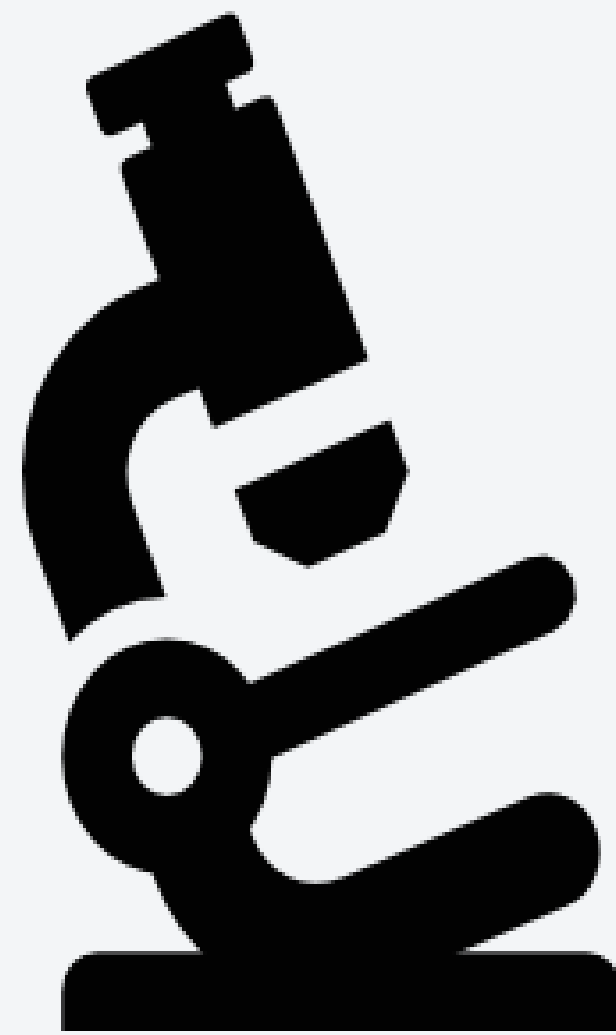
**Financial
Incentives
(Cost)**

**Potential
unintended
impacts
(Design)**

Ratings, Research and Education are Critical



Ratings of the radiative properties of roofing and exterior wall products



Research to support scientific rigor of rating programs



Education to raise awareness of the impacts of cool surfaces

Industry Support & Collaboration



Cool Roof Installations (Los Angeles)
Photo credit: GRID Alternatives



Cool Roof Installations (Miami)
Photo Credit: Mule-Hide Products



Cool Pavement Installation (Los Angeles)
Photo credit: Cool Roof Rating Council

Market Drivers are Necessary



Third-party ratings play an important role



- Inform consumers about product's ability to reduce solar heat gain
- Help consumers ID compliant products
- Give assurance of unbiased and verified data
- Provide validity to marketing claims
- Support programs and policies
 - Development
 - Compliance & enforcement

Available Radiative Property Data

- Two online product directories
- Free to access
- Updated in real time
- CRRC Labels



CRRC

Rated Roof Products

Walls Directory

Support

1

Search keywords

Q

3192 results

Product Type

Colors

Solar Reflectance

Thermal Emittance

SRI

Manufacturer:

Slope:

Product Market:

CRRC PROD ID.

MANUFACTURER

BRAND AND MODEL

PRODUCT TYPE

COLOR

SOLAR REFLECTANCE

THERMAL EMITTANCE

SRI

0287-0001

IRC Topper

IRC Topper Asphalt Shingle

Asphalt Shingle

Multicolor

0.30

0.29

0.88

0.87

31

29

...

0287-0010a

IRC Topper

IRC Topper Metal Shingle

Metal

Red

0.35

0.35

0.83

0.83

36

36

...

0103-4154

Iron Roofing

Iron Roofing Polymer 1 Tile

Tile

Tan

0.30

0.30*

0.92

0.92*

33

33

...

CRRC PRODUCT ID

0452-9025 (smooth)

TYPE

Coating

APPLICATION APPROVAL DATE

August 15, 2018

MANUFACTURER

Magic Coating Company Inc.

MANUFACTURER

Bright White

MANUFACTURER CONTACT

Sharon Randolph

619-555-3300

www.magiccoating.com

PRODUCT MARKET

All Markets

SLOPE

Low

Shell

Coa

Coa

CRRC

COOL ROOF RATING COUNCIL

Rated Product ID #: 0000-0000

	Initial	Aged
Solar Reflectance	0.00	0.00
Thermal Emittance	0.00	0.00

The ratings above are subject to CRRC rating program conditions, requirements, and limitations. Visit coolroofs.org for important information and disclaimers about CRRC rating conditions, requirements, and limitations.

CRRC

WALL PROGRAM

Wall Rated Product ID #: W000-0000

	Initial	Aged
Solar Reflectance	0.00	Pending
Thermal Emittance	0.00	Pending

The ratings above are subject to CRRC rating program conditions, requirements, and limitations. Visit coolroofs.org for important information and disclaimers about CRRC rating conditions, requirements, and limitations.

Informational Resources

Resources

Find answers to your questions about cool roofing and solar-reflective exterior wall products.



What is a Cool Roof?

LEARN MORE →



What is a Cool Exterior Wall?

LEARN MORE →



Looking for Codes, Programs or Standards?

LEARN MORE →



Looking for Financial Incentives?

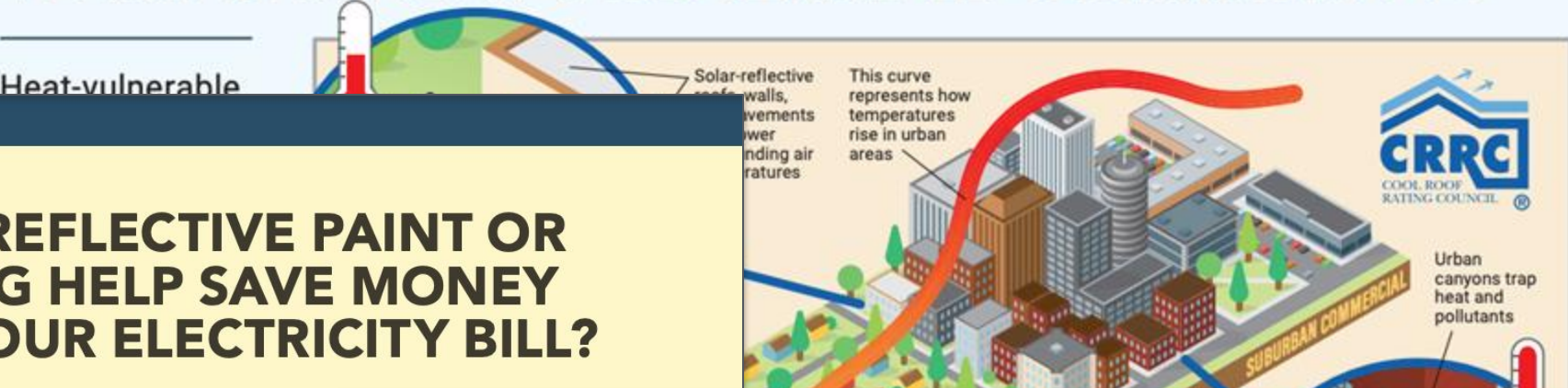
LEARN MORE →

HEAT EQUITY AND RESILIENCE

A MEDIA PRIMER ON HEAT-VULNERABLE COMMUNITIES AND “COOL” BUILDING SOLUTIONS

This document provides scientifically supported information to assist media and public relations professionals with reporting about heat-vulnerable communities and passive cooling solutions, such as solar-reflective “cool” roofs and exterior walls.

WHAT IS A HEAT-VULNERABLE COMMUNITY?

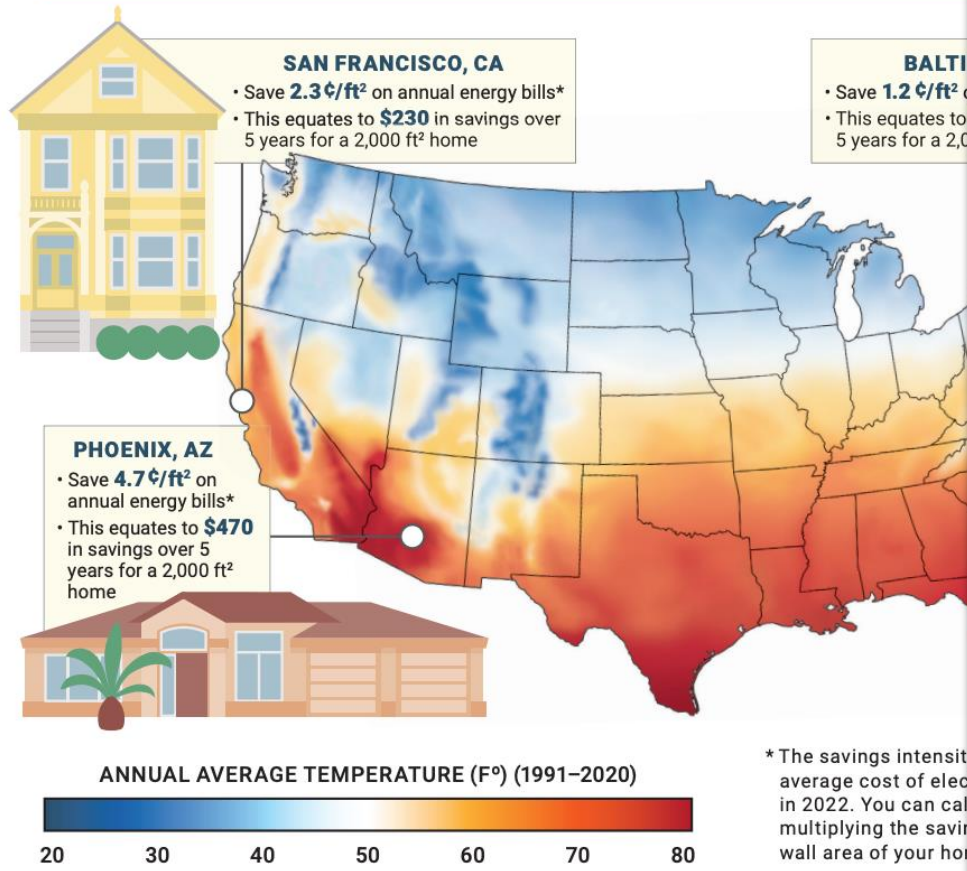


CAN REFLECTIVE PAINT OR SIDING HELP SAVE MONEY ON YOUR ELECTRICITY BILL?

AS SUMMER HEAT WAVES BECOME WORSE,

households across the U.S. are running their air conditioners more. Cool exterior walls, or walls that efficiently reflect sunlight (solar reflectance) and emit absorbed heat (thermal emittance), are one easy modification that can help lower energy bills, especially for older homes in warmer climates. Highly reflective walls can be light in

color, like the example below, or they can use darker colors that appear darker but efficiently reflect heat. The example savings for a family home with 2,000 ft² of exterior wall area (equating to 1,650 sq ft of roof area) is five (5) years. Many people live for a much longer lifespan much longer result in many more years of savings.



This information is based on a simulation study published by the California Energy Commission. Savings for individual buildings depend on many factors. The examples in this document are for family homes (built in 1989) with gas furnaces where the solar reflectance of all exterior walls is 0.25 to 0.60. To find simulated data for homes with different characteristics, do a search for “Cool Roofs” on coolroofs.org.

PUBLISHED JULY 2024

COOLING BEYOND THE BUILDING:

THE POTENTIAL FOR REFLECTIVE SURFACES TO COUNTER GLOBAL WARMING

It is well known that reflective surfaces help keep buildings cooler and reduce the costs and greenhouse gas (GHG) emissions from air conditioning, but is your cool roof also contributing to a cooler planet? A growing body of research highlights the ability of cool surfaces to reflect more sunlight, rather than absorb it, which means these surfaces return more of the sunlight back through the atmosphere and out into space, starting from the moment the surfaces are installed.

WHAT IS ATMOSPHERIC COOLING?

The Earth gets energy from the sun in the form of sunlight, also known as solar radiation. Increasing the fraction of solar energy that is reflected from the Earth’s surface cools the planet’s surface and the atmosphere. We can do so by replacing dark, more solar-absorptive surfaces with lighter, more solar-reflective surfaces, such as cool roofs.

In addition to potentially reducing new GHG emissions via energy efficiency, cool roofs could offset the warming effect of GHGs already in the atmosphere. Scientists have tried to quantify the global cooling effect in terms of offsetting GHG emissions since much of our climate policy and finance is based on GHG mitigation.



HOW MUCH ATMOSPHERIC COOLING IS POSSIBLE FROM COOL ROOFS?

It turns out, quite a lot. Efforts to quantify this effect concluded that the use of more solar-reflective surfaces in cities around the world could cancel the warming effect of 44–57 billion metric tons of emitted carbon dioxide—up to 55% more than the annual global emissions of carbon dioxide in 2022. At a building scale, that means that increasing the reflectivity of 1,000 ft² (93 m²) of roof area could offset the warming effect of 10 tons of CO₂ emissions [1,2].

If all dark roofs were replaced with more solar-reflective roofs, the planet would immediately reflect more sunlight to space, cooling the atmosphere in a manner that is equivalent to removing



GHGs from the air. The roof’s reflectance would need to continue to exceed that of the original dark surface to maintain the atmospheric cooling benefit over time.¹

1. How to properly calculate and value albedo modification is an ongoing discussion amongst the scientific and finance communities.

Akbari, Menon, and Rosenfeld [1] found that even a modest increase in the solar reflectance of a roof surface can have a positive impact on reducing GHG emissions by lowering the building’s cooling demand by reducing its solar heat gain, reducing peak demand, and increasing the community’s albedo (solar reflectance).

Complex atmospheric dynamics may prevent highly reflective roofs from realizing the full global cooling potential attributed to them, but the fundamentals remain unchanged—cool roofs absorb less of the sun’s energy, decreasing the amount of heat that gets trapped in the atmosphere, and help to cool the world and our homes.

REFERENCES

- [1] H. Akbari, S. Menon, A. Rosenfeld, Global cooling: Increasing world-wide urban albedos to offset CO2, Climatic Change 94 (2009) 275–286. <https://doi.org/10.1007/s10584-008-9515-9>.
- [2] S. Menon, H. Akbari, S. Mahanama, I. Sednev, R. Levinson, Radiative forcing and temperature response to changes in urban albedos and associated CO2 offsets, Environmental Research Letters 5 (2010). <https://doi.org/10.1088/1748-9326/5/1/014005>.

PUBLISHED JUNE 2024

LEARN MORE

-  **WHAT IS A COOL ROOF?**
-  **CRRC RATED ROOF PRODUCTS DIRECTORY**

For more information and resources about cool roofs, visit coolroofs.org.



coolroofs.org



Cool Surfaces Lesson Plan

- Free resource for middle school teachers
- Professional videos, teacher guide, and hands-on experiment
- Teach students about urban heat islands and tools to enhance heat resilience
- Opportunities for place-based learning
- Help empower children to be a part of climate adaptation and resilience in their communities



coolroofs.org/resources/cool-surfaces-lesson-plan

KEEP LEARNING WITH THE CRRRC!

Designing Buildings for Heat Resilience & Energy Efficiency

Free on-demand course
at aecdaily.com



**Approved
Continuing
Education**



CRRC as an International Resource

- Technical Assistance
- Lab Training
- Advice on organization structure and governance



CRRC Laboratory Training at Center for Advanced Research in Building Science and Energy, CEPT University, Ahmedabad, India in 2024

Questions?

Sarah Schneider
sarah@coolroofs.org



[Cool Roof Rating Council](#)



[@Official_CRRC](#)



[@official_crrc](#)