Beat the Heat: How Solar-Reflective Walls Combat Heat Islands and Improve Energy Efficiency

Audrey McGarrell and Ronnen Levinson, Ph.D

Cool Roof Rating Council
July 21, 2022
Cities are typically hotter than surrounding suburban and rural areas.

Image Source: Ronnen Levinson, Lawrence Berkeley National Laboratory
Smaller heat islands also exist within cities

- These are areas with more dark surfaces and lack of vegetation ¹

- Often where people of color and low-income residents live ², ³

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1. U. S. Environmental Protection Agency https://docs.google.com/presentation/d/18p9DIorNQdlyZ3rt-JEXEIoFFChJl/edit#slide=id.ge280a0fcf6_0_12
Climate change is making cities hotter

7.2ºF hotter by 2100

1. Zhao et al. 2021 https://doi.org/10.1038/s41558-020-00958-8
Heat is the leading weather-related killer

“In an average year in the U.S., heat kills more people than any other type of extreme weather,” says Kristina Dahl, a senior climate scientist at the Union of Concerned Scientists.

Quoted in Scientific American, July 22, 2021 article


Image Source: World Health Organization
Heat also impacts energy use and air quality

- Increases cooling demand
  - More air conditioning use
  - Heat exhaust from A/C use

- Increases peak demand
  - Blackouts
  - Grid failure

- Decreases air quality
  - Ozone production
  - Slows air flow
  - Peaker plant emissions
Solar-Reflective Walls as a Tool to Combat Heat

Ronen Levinson, Ph.D

Lawrence Berkeley National Laboratory
Solar-Reflective Walls can help address heat impacts and provide benefits beyond energy efficiency.

Image Source: Cool Roof Rating Council
Learn more: https://doi.org/10.20357/B7SP4H
Solar-reflective walls highly reflect sunlight

West-facing walls in Portland, OR, measured around 7 pm PT on 2022-07-19 when the outside air temperature was about 85 °F
Solar-reflective walls reduce building solar heat gain.
Conventional and “cool” pigments can have cooling impacts

<table>
<thead>
<tr>
<th>SR</th>
<th>0.0 – 0.1</th>
<th>0.1 – 0.2</th>
<th>0.2 – 0.3</th>
<th>0.3 – 0.4</th>
<th>0.4 – 0.5</th>
<th>0.5 – 0.6</th>
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<th>0.7 – 0.8</th>
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**Spectrally selective**

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**Levinson et al. (2019).** [https://doi.org/10.20357/B7SP4H](https://doi.org/10.20357/B7SP4H)

lower-tier cool walls (0.40 ≤ SR < 0.60)  higher-tier cool walls (SR ≥ 0.60)
Product weathering is crucial for understanding radiative performance over time

Image credit: Lawrence Berkeley National Laboratory

Solar-Reflective Walls in Codes, Programs, and Standards

Ronen Levinson, Ph.D

Lawrence Berkeley National Laboratory
A growing number of codes, programs, and standards require or promote the use of solar-reflective walls.
LEED v4.1 Heat Island Mitigation with Cool Walls Pilot Credit

- Published by USGBC in April 2021 and extended through April 2023

- Surface at least 75% of building’s gross exterior wall area with “cool-wall material”

LEED definition of “cool-wall material”:
Initial SR of at least 0.60
Initial TE of at least 0.75

Learn more: https://www.usgbc.org/credits/SSpc154-v4.1?return=/credits/New%20Construction/v4.1
LEED projects need credible data

- At least 5 projects are currently pursuing this credit
- Users have expressed a need for assistance finding compliant products
Important Role of Third-Party Ratings

- Inform consumers about product’s ability to reduce heat gain
- Helps consumers ID higher performing/compliant products
- Gives assurance of unbiased & verified data
- Provides validity to marketing claims
- Supports programs & policies
CRRC Third-Party Ratings for Wall Products

Audrey McGarrell

Cool Roof Rating Council
CRRC is a 501(c)(3) nonprofit

- Evaluates and labels the radiative performance of roofing and exterior wall products
- Provides a public service through ratings, research, and education
- Supports development of policies and programs by providing data. *CRRC does not advocate for specific requirements*
Established in 1998 through stakeholder collaboration

And many, many players in the roofing industry
Private and Public Sector Participation

Class A Industry
Manufacturers
Distributors
Suppliers
Trade Associations

Class B General Interest
Roofing Contractors
Not-for-Profits
Consultants
Government Agencies
Energy Companies
Educational Institutions
Test Labs & Test Farms
First radiative property rating program for exterior wall products in the world

- Launched in January 2022
- Developed and maintained in collaboration with industry, government, national laboratories, and others
Robust Technical Requirements

- CRRC-2 Wall Product Rating Program Manual
- Contains participation requirements, technical criteria, and test methods
- Updated periodically by Board of Directors at the recommendation of Wall Rating Program Committee
Product Testing and Weathering

https://coolroofs.org/programs/product-testing-and-weathering
Rating options to fit your needs
## CRRC Rated Wall Product Directory

https://coolroofs.org/directory/wall

<table>
<thead>
<tr>
<th>CRRC PROD ID.</th>
<th>MANUFACTURER</th>
<th>BRAND AND MODEL</th>
<th>PRODUCT TYPE</th>
<th>COLOR</th>
<th>SOLAR REFLECTANCE INITIAL</th>
<th>THERMAL EMITTANCE INITIAL</th>
<th>SOLAR REFLECTANCE 3 YEAR</th>
<th>THERMAL EMITTANCE 3 YEAR</th>
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<tbody>
<tr>
<td>W559-2633</td>
<td>Ankunding PLC</td>
<td>Ability Citrus</td>
<td>Vinyl Siding</td>
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<td>W158-8244</td>
<td>Dibbert Inc</td>
<td>Adaptation Buttercup</td>
<td>Polypropylene siding</td>
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<td>W240-8722</td>
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<td>Trust Spring</td>
<td>Retro-Reflective Material</td>
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Search, Filter, and Sort Features

Search keywords

Solar Reflectance
Filter by minimum initial or 3 year aged values
Initial
min: 0 max: 1.00
0.00
3 Year Aged
min: 0 max: 1.00
0.00

Thermal Emittance
Filter by minimum initial or 3 year aged values
Initial
min: 0 max: 1.00
0.00
3 Year Aged
min: 0 max: 1.00
0.00

Colors
- Red
- Yellow
- Blue
- Bright White
- Tan
- Black
- Metallic
- Orange
- Green
- Purple
- Off-White
- Grey
- Brown
- Variegated (multi)

Product Type
- One-Coat Stucco
- Three-Coat Stucco
- Metal
- Vinyl Siding
- Insulated Vinyl Siding
- Polypropylene siding
- Paint / Architectural Coating
- Retro-Reflective Material
- Architectural Fabric
- Metal Composite Material
- Polymer Film
- Fiber Cement Siding
- Painted Wood Composite
- Masonry

Manufacturer:
- All

Product Market:
- All

Sort by Date Added
- Date Added
- CRRC Product ID
- Manufacturer
- Brand and Model
- Product Type
- Solar Reflectance Initial Value
- Solar Reflectance 3 Year Value
- Thermal Emittance Initial Value
- Thermal Emittance 3 Year Value

Ascending
Descending
### Share Dynamic Search Results

#### CRRC Rated Wall Products

<table>
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<tr>
<th>Product Type</th>
<th>MANUFACTURER</th>
<th>BRAND AND MODEL</th>
<th>PRODUCT TYPE</th>
<th>COLOR</th>
<th>SOLAR REFLECTANCE</th>
<th>THERMAL EMITTANCE</th>
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<td>INITIAL</td>
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<td>0.01</td>
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**To**

Subject

https://coolroofs.org/directory/wall?keywords=bright+white
CRRC Product Labels and Logos

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<tr>
<td>Thermal Emittance</td>
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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 Educational Resources

https://coolroofs.org/resources

What is a Solar-Reflective Wall?

Looking for Codes, Programs or Standards?

CRRC Wall Rating Program

Reducing Urban Heat with Cool Roofs and Solar-Reflective Walls

What is the Urban Heat Island Effect?

Urban heat islands (UHI) are areas where surface air temperatures are higher than surrounding areas. This could be an entire city or areas within a city. A UHI forms in an area with:

- Dark, impermeable surfaces (e.g., roofs, walls, industrial areas, and roads)
- Relative lack of vegetation and tree canopy
- Buildings that block or close air movement and trap solar and infrared radiation
- Vehicles and air conditioning units that release waste heat

Why Reference CRRC Wall Rating Program?

- CRRC participation open to both standard and "cool" products
- Codes and programs set "cool" definitions, performance requirements
- Allows for flexibility and control of program requirements
- Programs can scale and lower minimum requirements as needed
- Federal agency clients can compare a wide variety of products
- Codes and programs already have reflective wall requirements
- CRRC quality assurance protocols ensure product rating integrity

Contact the CRRC: coolroofs.org/walls

Jeff Stecken, Executive Director
jeff@coolroofs.org

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Rating your Wall Products

Become a Wall Program Licensee
https://coolroofs.org/programs/wall-rating-program/become-a-wall-licensee

Work with an AITL for product testing

Submit your Product Rating Applications!
https://coolroofs.org/programs/wall-rating-program/rate-a-wall-product
Other ways to get involved

Email audrey@coolroofs.org to:
➔ Join the Wall Rating Program Committee Email List
➔ Learn more about the Wall Program

Cool Roof Rating Council
@Official_CRRC

Stay up to date with the CRRC
Sign up for CRRC news & announcements

https://tinyurl.com/CRRCNews
Questions?

Feel free to unmute or put questions in the chat!
### Wall Program Licensee Fee Structure


<table>
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<tr>
<th>Application Submittal Month</th>
<th>Licensee Sales</th>
<th>Accredited Manuf. Test Lab (AMTL)</th>
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<td>&gt;$100M</td>
<td>$10-35M</td>
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<tr>
<td>January</td>
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<tr>
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<td>$6,533</td>
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<td>December</td>
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# Wall Program Product Rating Fees


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<td>Color Family Additional Element</td>
<td>$75</td>
<td>$25</td>
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</tbody>
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Wall Program Accredited Independent Testing Laboratories


R&D Services, Inc.
Michael Joyce
209 Tennessee Blvd.
Watertown, TN 37184
Tel: (931) 372-8871
Email Michael Joyce

PRI Construction Materials Technologies, LLC
Brent Barbeau
6412 Badger Drive
Tampa, FL 33610-2004
Tel: (813) 621-5777
Email Brent Barbeau