

Solar-Reflective “Cool” Walls: Benefits, Technologies, and Implementation

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Abstract

Solar-reflective “cool” roofs are established in California as an effective building energy efficiency measure, but cover only part of the opaque envelope. To advance the science, technology, and infrastructure needed for solar-reflective cool walls, we

- simulated energy savings, emission reductions, and urban cooling;
- worked with industry to assess and innovate technologies; and
- collaborated with government agencies, utilities, and industry to develop application guidelines, code language, incentives, and product ratings.

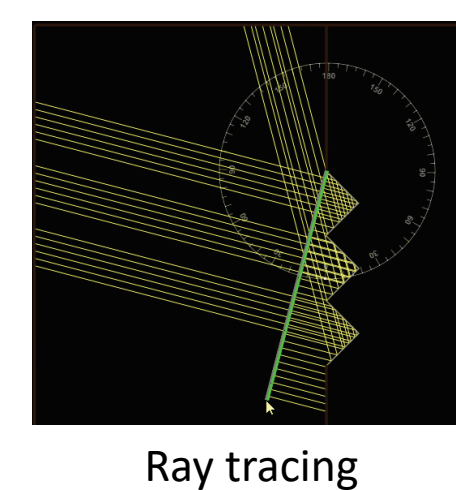
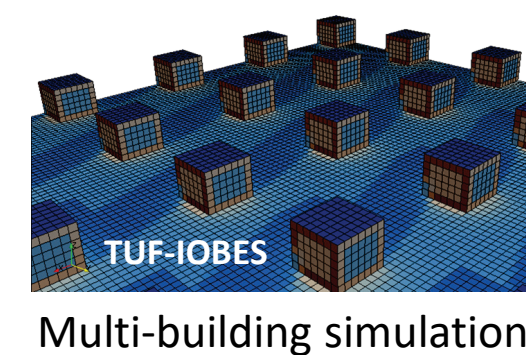
Key Findings and Outcomes:

- Cool walls reduce annual energy use and emissions throughout California.
- Cool walls can mitigate the summer urban heat island in Los Angeles.
- Many available wall products are cool and stay reflective over time.
- Fluorescence, photocatalysis, and retroreflection can each boost the performance of cool wall products.
- New or enhanced cool wall provisions to be considered for California Title 24, ASHRAE 90.1, ASHRAE 189.1, LEED, and ENERGY STAR.
- Cool Roof Rating Council (CRRC) is evaluating expansion to wall products.

Methods

Benefit Analysis

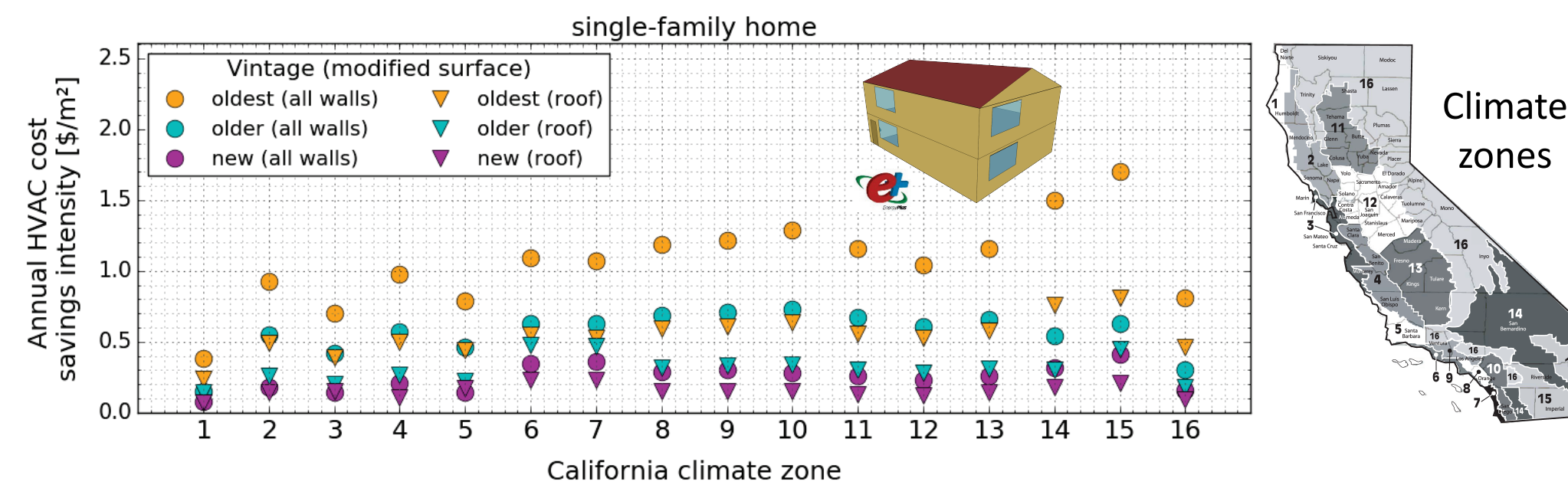
- Simulated with EnergyPlus annual building energy savings for isolated residential and commercial buildings across California and U.S.
- Modeled building-building and building-pedestrian interactions with TUF-IOBES (UCSD tool).
- Simulated outdoor air temperature changes w/Weather Research & Forecasting (WRF) model.



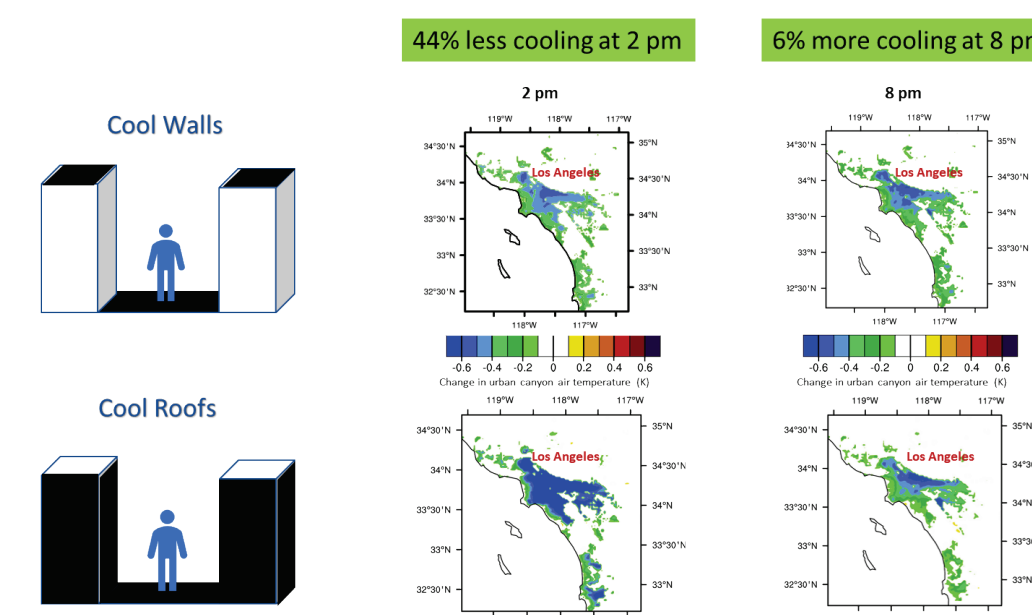
Technology Assessment and Innovation

- Tracked reflectance losses of wall products exposed in Berkeley, Fresno, and Los Angeles.
- Measured performance of self-cleaning and soil-resistant wall products.
- Synthesized near-infrared fluorescent pigments to make paints w/high Effective Solar Reflectance (ESR).
- Designed retroreflective wall materials that can reflect sunlight skyward.

Cool Wall Benefits Are Similar to Those of Cool Roofs

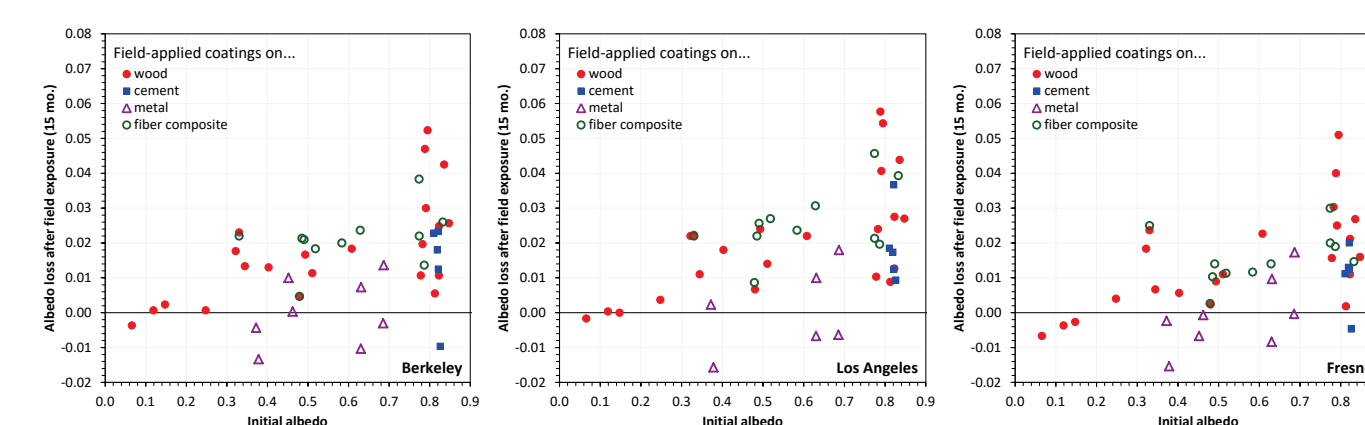
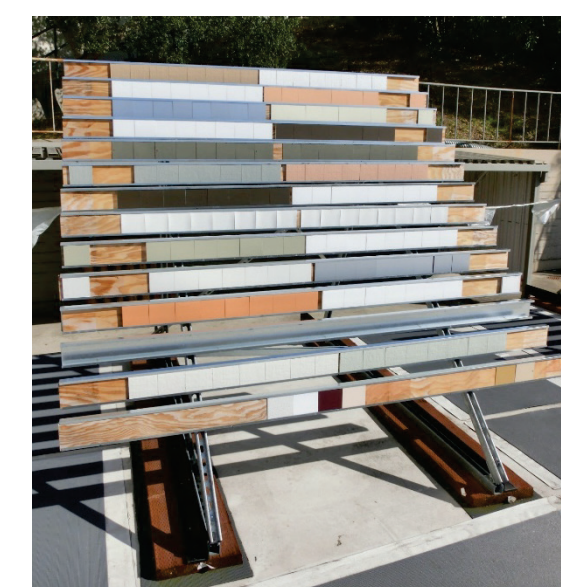


- (1) Walls receive less sunlight than roofs, but energy savings intensities are comparable because walls have only about half as much insulation.

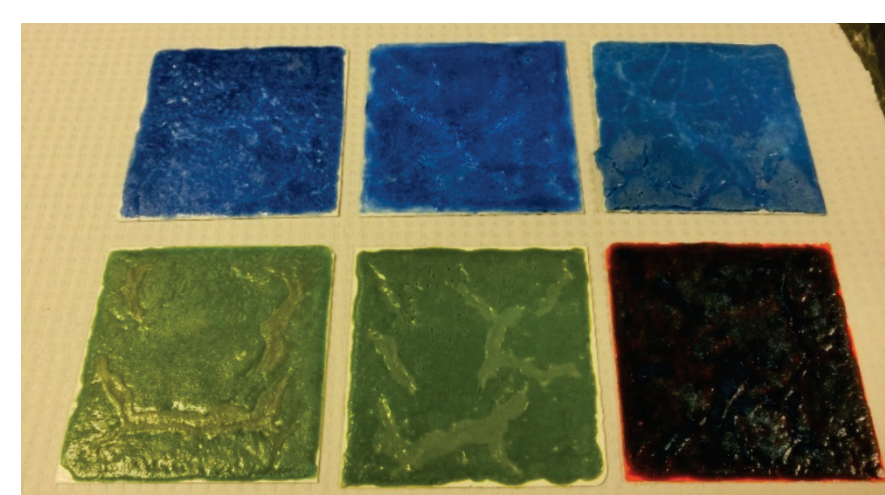


- (2) In July, reflective walls in Los Angeles Country yield near as much daily average air cooling as reflective roofs (86%).

We Assessed and Enhanced Cool Wall Performance



- (1) Wall reflectance fell by up to 0.06 after 15 months of California exposure—a modest decline.



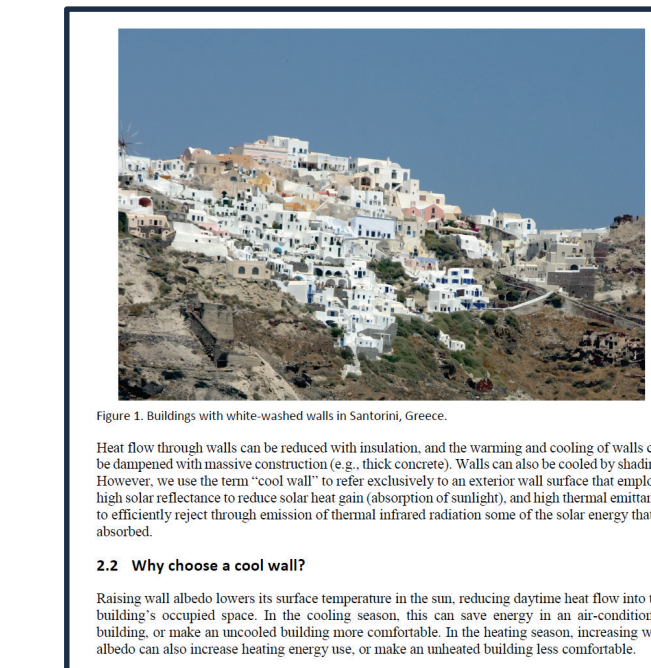
- (2) Fluorescent blue pigment raised ESRs of blue, green, and blue-black coatings by up to 0.15.



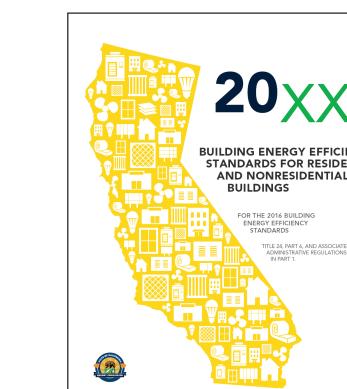
- (3) White architectural fabric with photocatalyst (bottom) stayed cleaner in Fresno than control without (top).

We Are Building the Infrastructure Needed for Cool Walls

- (1) Application guidelines



- (3) Building standards, green building programs, rebates, and product ratings—in development



- (2) Industry participation



Next Steps

- Product rating system (under consideration at Cool Roof Rating Council)
- 2022 California Title 24 Codes and Standards Enhancement initiative
- Revised and expanded provisions in ASHRAE 90.1 and 189.1
- LEED Sustainable Sites (Heat Island Reduction) pilot credit
- ENERGY STAR label
- Utility rebates

More Information

Partners:

- 3M
- Behr
- Dexerials
- Metal Construction Assoc.
- Mitsubishi Plastics Composites America
- PPG
- Saint-Gobain
- Sherwin Williams
- TexCote
- Valspar

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