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

Cool Roof Rating Council
15 June 2016

Source: Lea Suzuki, San Francisco Chronicle,
10 February 2013
The core research team includes LBNL, USC, and UCSD
We have ten industry partners

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Project objectives

1. **Evaluate** direct and indirect energy and environmental benefits of solar reflective walls

2. **Assess** and **advance** available and emerging cool wall technologies

3. **Develop** the infrastructure needed to promote their appropriate use
Evaluating the energy and environmental benefits of cool walls
We will quantify cool wall energy savings through EnergyPlus building simulations.

What are the annual changes in cooling, heating, and lighting energy uses?

California has 16 building climate zones.
EnergyPlus simulations show that per unit surface area, E & W cool walls save nearly as much energy as cool roofs.

Conditioning = heating + cooling
How does wall albedo affect the solar heat gain, daylighting, and energy uses of neighboring buildings?

We will use a model developed by research team at University of California, San Diego.

Temperature of Urban Facets Indoor-Outdoor Building Energy Simulator (TUF-IOBES)
How do cool walls affect the urban environment?

- Will model the effects on outdoor air temperature and outdoor mean radiant temperature
- Will assess the ability of photocatalytic walls to remove urban air pollution ($\text{NO}_x$ & ozone)
Learning more about what cool wall products are available today
We are evaluating cool wall products through natural exposure trials and laboratory measurements

- Exposure sites established in the San Francisco Bay Area, Los Angeles, and the Central Valley
- Specimens will be exposed for two years and measured quarterly
- Developed performance metrics, measurement protocols for walls

Solar reflectometer

Spectrophotometer w/integrating sphere
We will characterize the initial and aged radiative properties of many wall materials.
California exposure program began in April 2016 on 69 cool wall products

Exposure site at LBNL, Berkeley CA
Expanded project to also include 53 wall products at 3 U.S. sites for 5 years

- Phoenix
- Cleveland
- Miami

53 wall products
There are a variety of wall products included in the CA and US natural exposure programs.
Wall products are exposed in special racks that avoid cross-contamination

Atlas rack (Miami, Phoenix, Cleveland)

LBNL rack (Berkeley, Fresno, Los Angeles)
Developing better cool wall products
The project will investigate (at least) three innovative cool wall technologies

3. Retroreflective walls that can cool buildings and the city while minimizing glare
We developed an apparatus to measure effective solar reflectance (ESR)

- Rotates samples in the sun to measure the ESR of fluorescent products
- Could also measure SR of retroreflectors

IR thermometer
How will this research be applied?
Research results will inform development of resources to increase adoption of cool walls.
Some building codes already include solar reflective walls

- **ASHRAE 189.1 (since 2011)**
  - east & west walls with SRI ≥ 29 can be an exception to requirement for shading on walls
- **ASHRAE 90.1 (2016, forthcoming)**
  - new measure required only in climate zone 0 (hot & tropical), which does not represent any areas in the U.S.

We will work to improve and expand these measures based on research results.
We will also be investigating options to incentivize the use of cool wall products.

- A compliance performance credit for CA’s Building Energy Efficiency Standards
- An energy efficiency rebate with utilities
- An ENERGYSTAR label for cool wall products
To increase the adoption of cool walls, we are investigating the feasibility of a cool wall rating system

- Model a rating system on other existing & successful programs, like CRRC & NFRC
- Will use data from US and California exposure program
- Exposure data will inform how to establish “aged” requirements
Project deliverable schedule

- **June 2015**: Metrics and Methods Report
- **June 2016**: Energy and Emission Savings Report
- **June 2017**: Cool Walls Co-Benefits Report
- **June 2017**: Project Review Workshop
- **April 2018**: Natural Exposure & Performance Report
- **April 2018**: Innovative/Development Report
- **April 2018**: Guidelines/Infrastructure Report
- **April 2018**: PROJECT CONCLUDES
Thank you!