

The Writing's on the Wall

Recent Cool Wall Research and Measures

February 22, 2018

Hosted by:

U.S. EPA Heat Island Reduction Program



Building Energy and Greenhouse Gas Benefits

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Building energy and greenhouse gas benefits of cool walls

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The Writing's on the Wall: Recent Cool Wall Research and Measures

U.S. EPA Webinar • 22 February 2018



Source: Lea Suzuki, San Francisco Chronicle, 10 February 2013

A “cool” wall reflects sunlight to reduce cooling load, save energy, and lower emissions

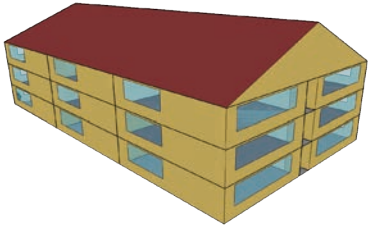
Wall solar reflectance

- Conventional $\approx 25\%$
- Cool color $\approx 40\%$
- Off or dull white $\approx 60\%$
- Bright white $\approx 80\%$

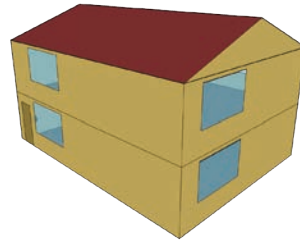


We used EnergyPlus to model cool-wall heating, ventilation, and air conditioning (HVAC) energy savings

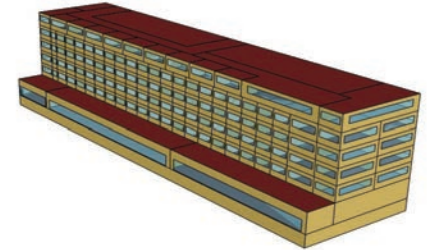
Apartment building



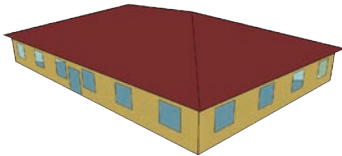
Single-family home



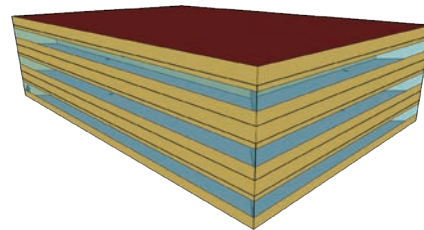
Large hotel



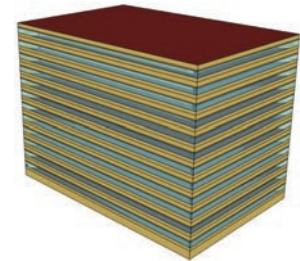
Small office



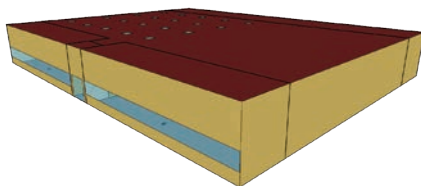
Medium office



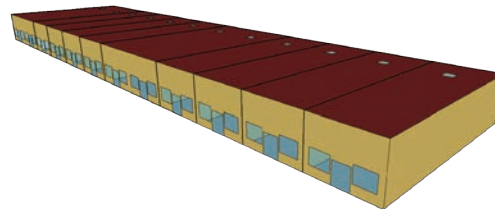
Large office



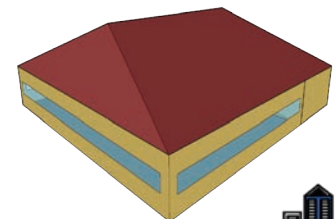
Stand-alone store



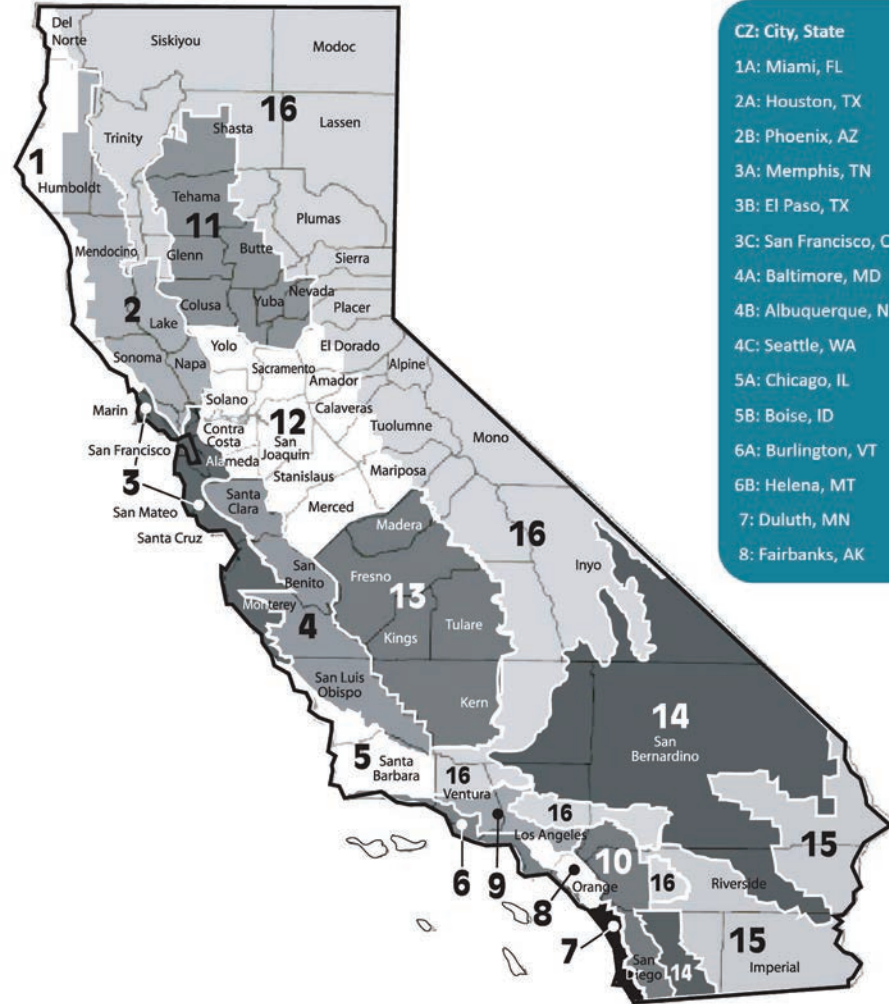
Strip mall



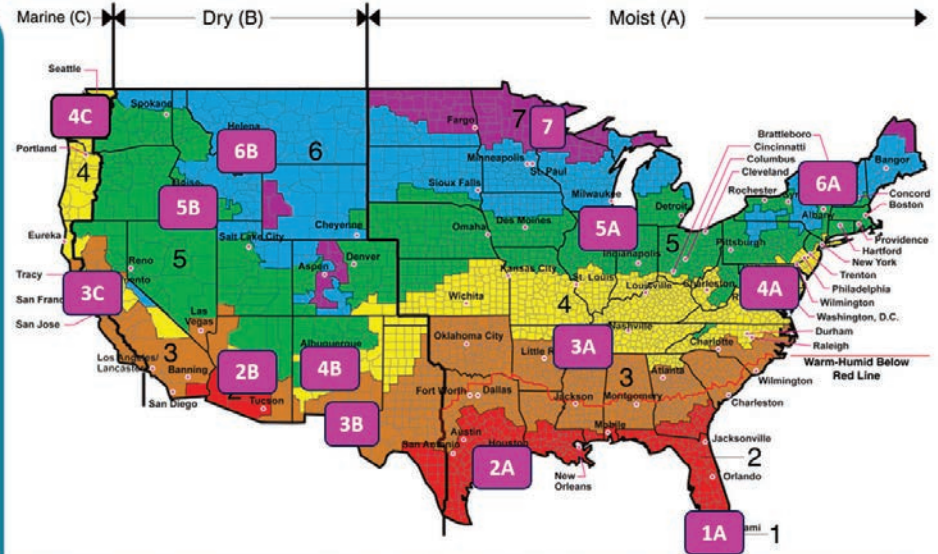
**Restaurants
(sit-down and fast-food)**



We evaluated annual energy, cost, and emission savings in each California and U.S. climate zone (> 100K simulations!)



- CZ: City, State
- 1A: Miami, FL
 - 2A: Houston, TX
 - 2B: Phoenix, AZ
 - 3A: Memphis, TN
 - 3B: El Paso, TX
 - 3C: San Francisco, CA
 - 4A: Baltimore, MD
 - 4B: Albuquerque, NM
 - 4C: Seattle, WA
 - 5A: Chicago, IL
 - 5B: Boise, ID
 - 6A: Burlington, VT
 - 6B: Helena, MT
 - 7: Duluth, MN
 - 8: Fairbanks, AK

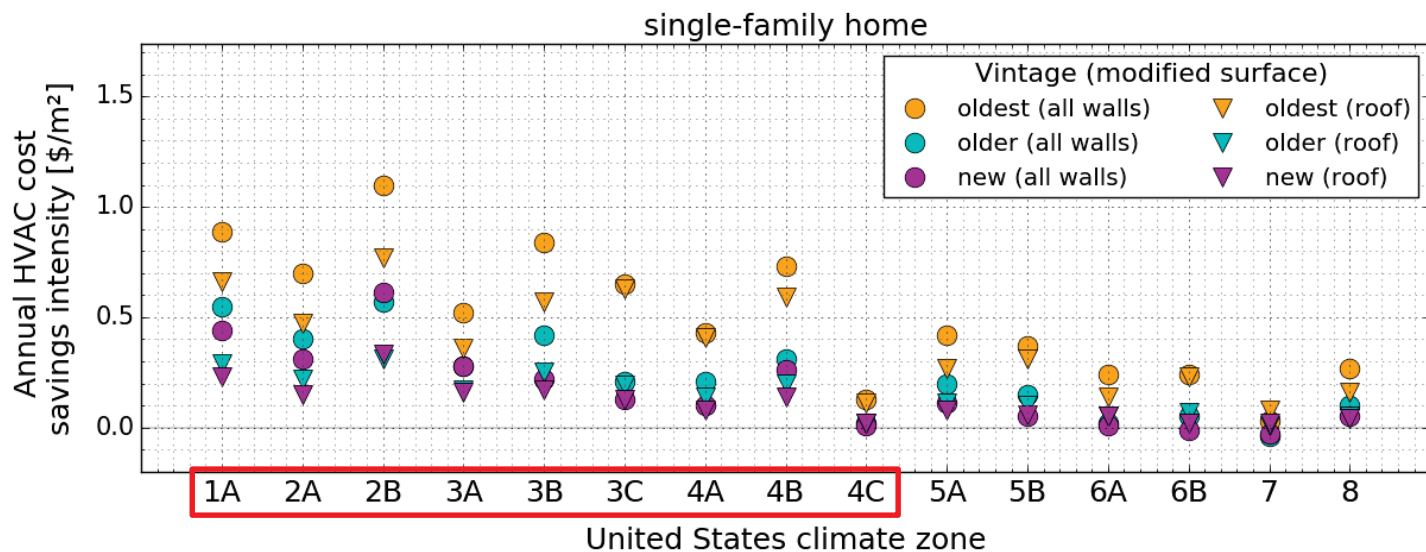
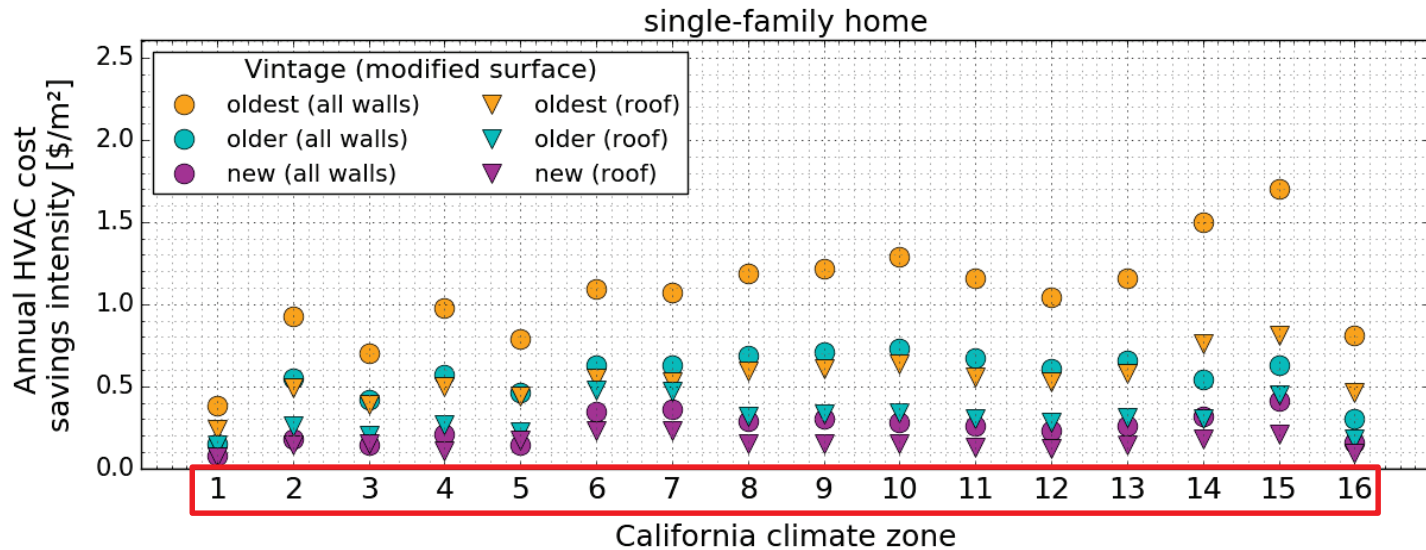


All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dillingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

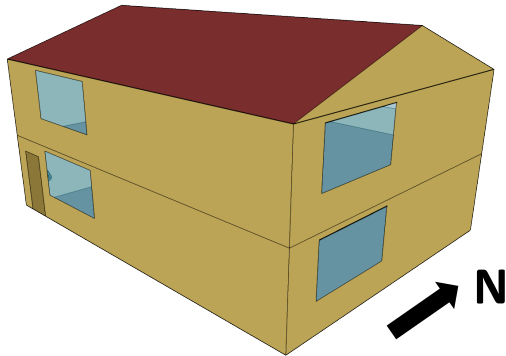


Cool walls save energy, carbon dioxide in homes, offices, and stores in all California climates + U.S. climates 1 - 4

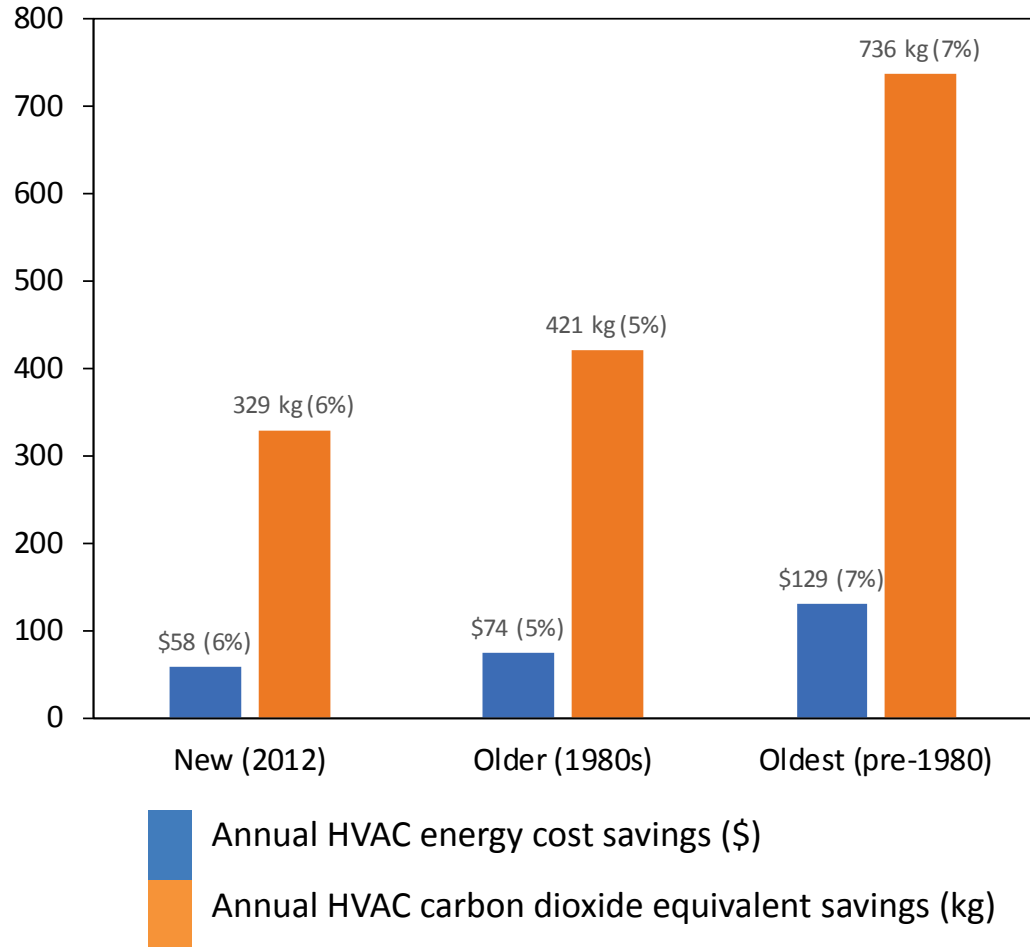


Example: Single-family home in Houston, TX

Single-family home



Floor area: 220 m² (2,400 ft²)
Net wall area: 180 m² (1,900 ft²)
Wall albedo: 0.25 → 0.60
Building orientation: averaged

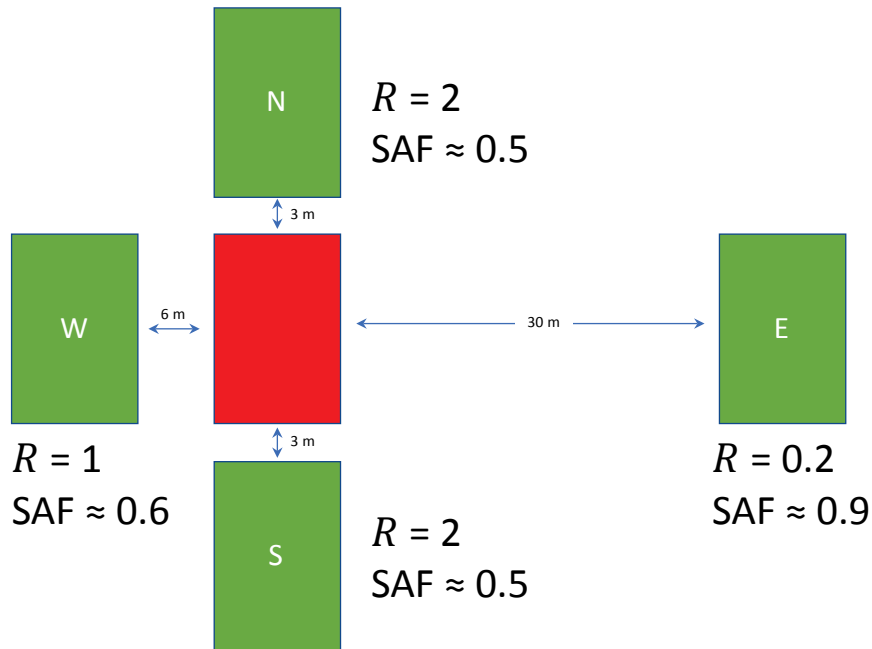


Savings in pre-1980 homes over 2 times that in new h



Can scale savings by Solar Availability Factor (SAF) to adjust for shading & reflection by neighboring buildings

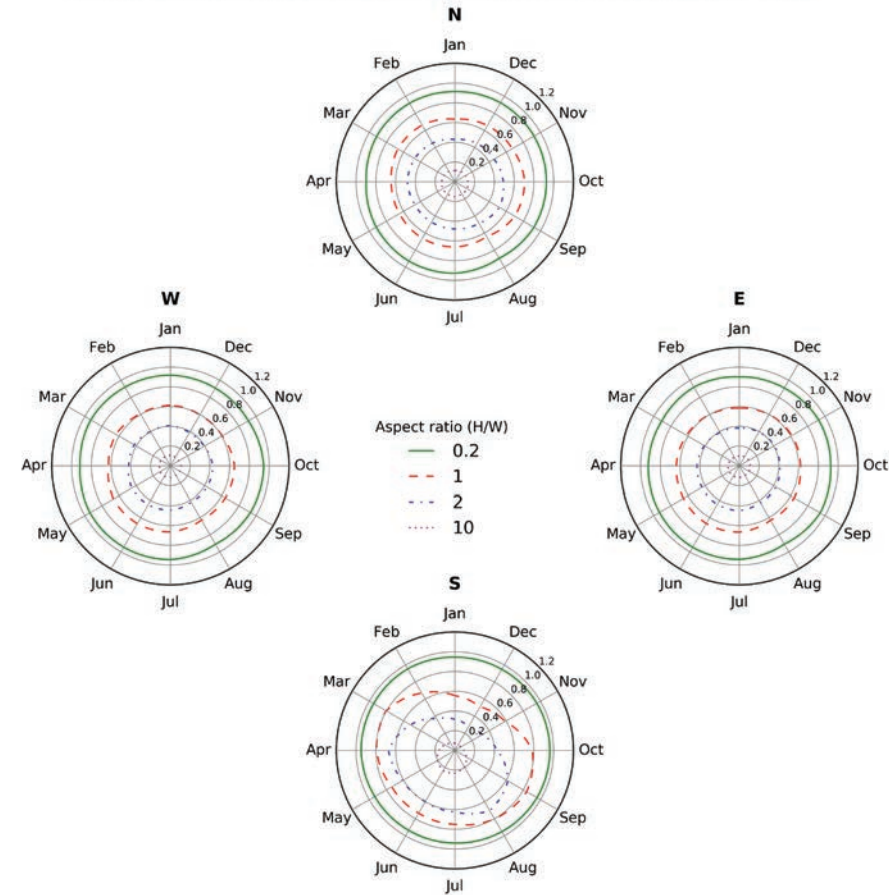
Single-family homes (each 6 m tall)



$R = \text{building height } H / \text{separation } W$



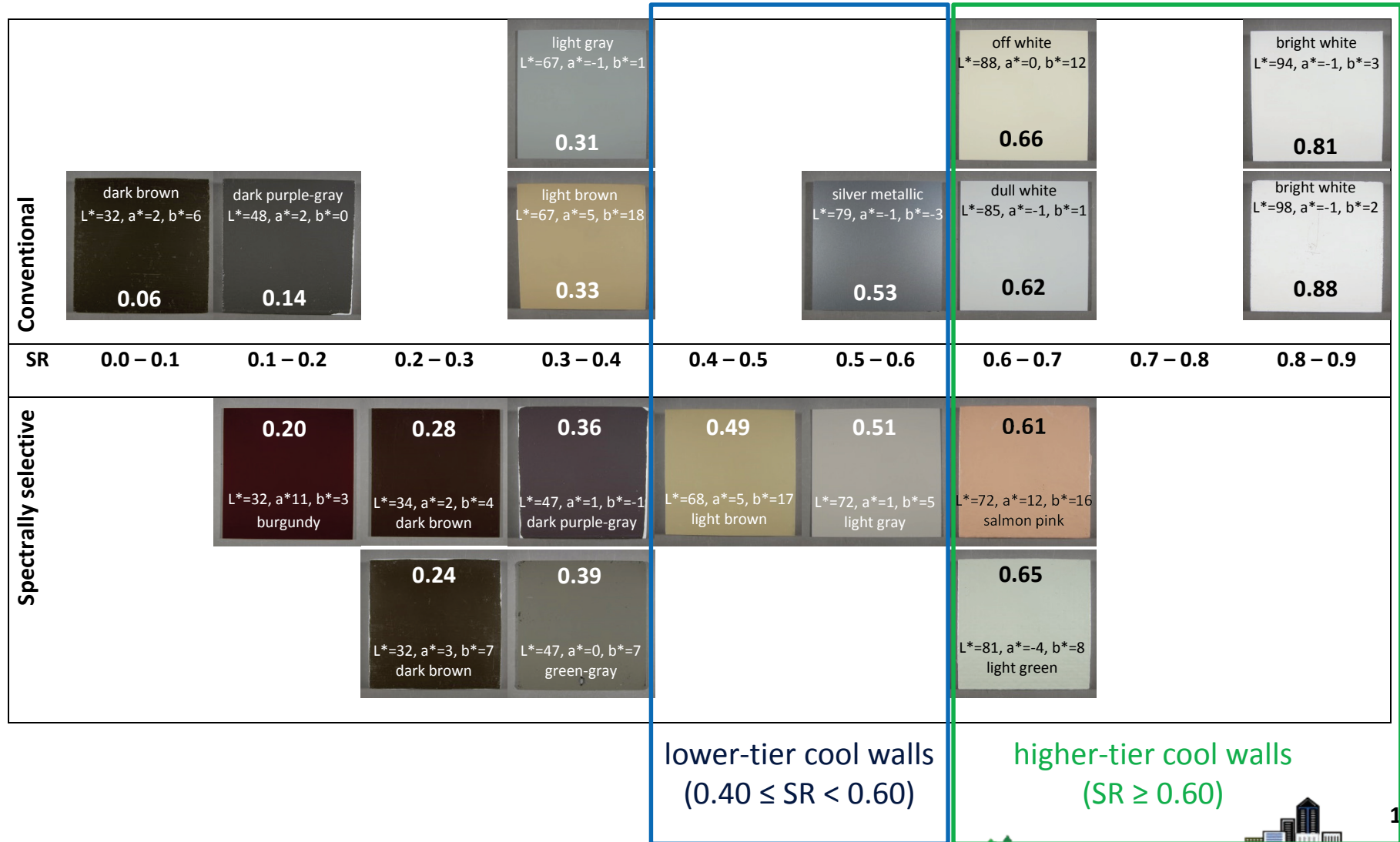
Solar availability factors in climate FR (Fresno, CA)



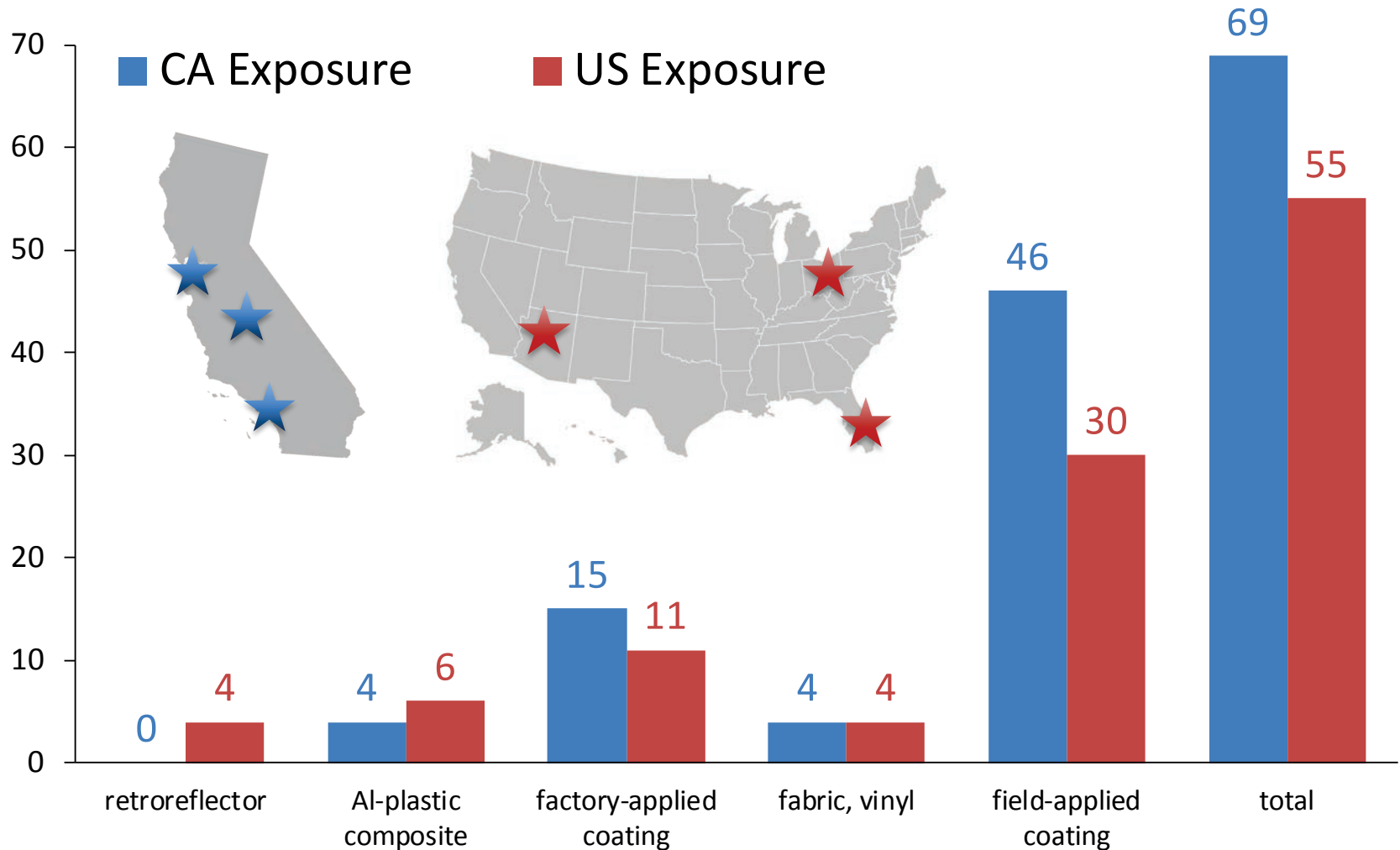
ground albedo = 0.20, central wall albedo = 0.25, neighboring wall albedo = 0.25



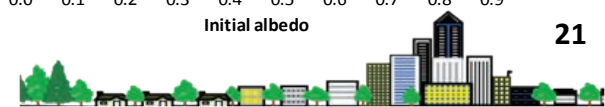
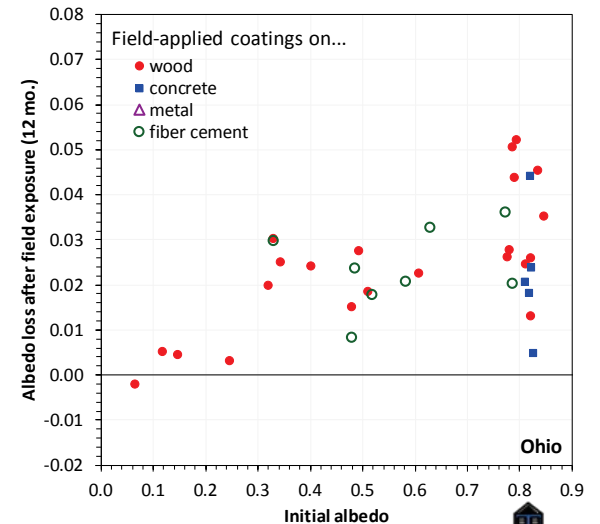
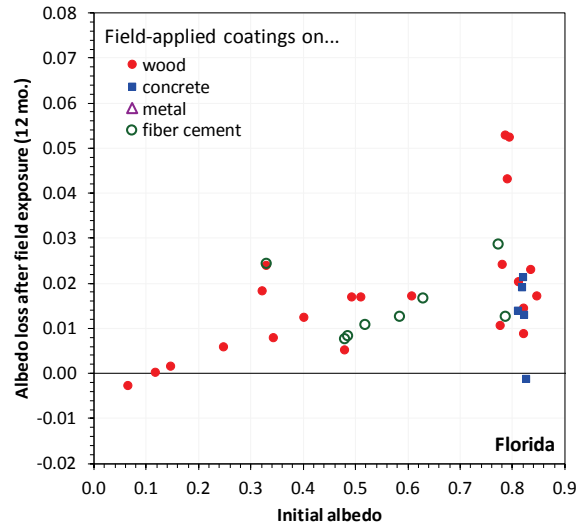
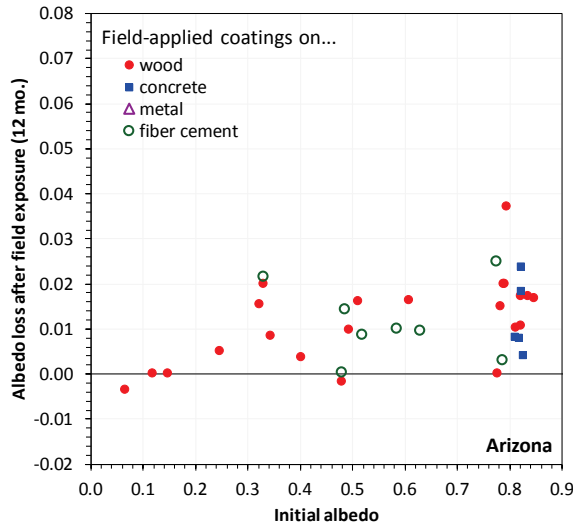
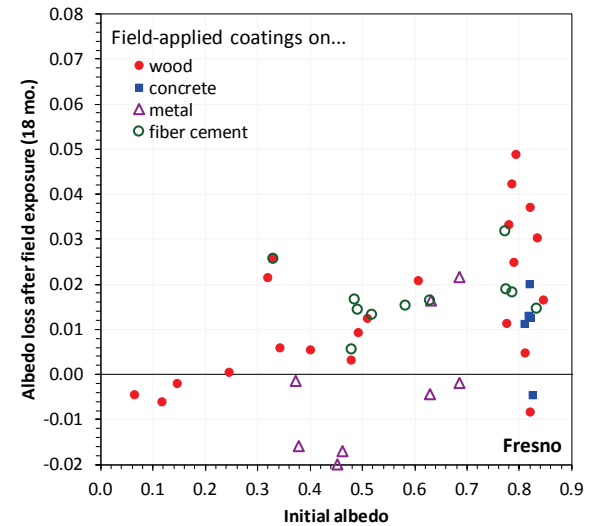
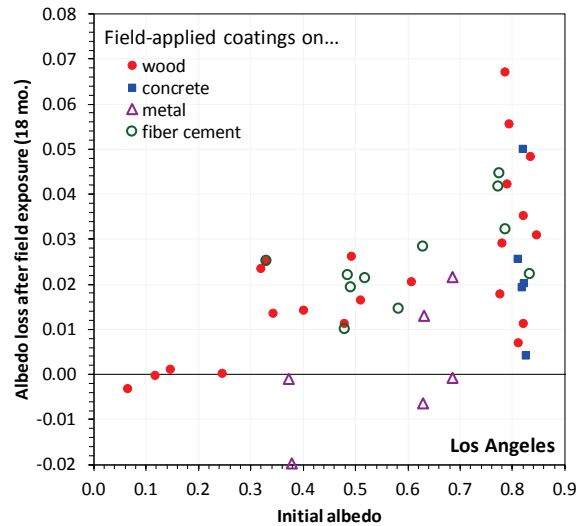
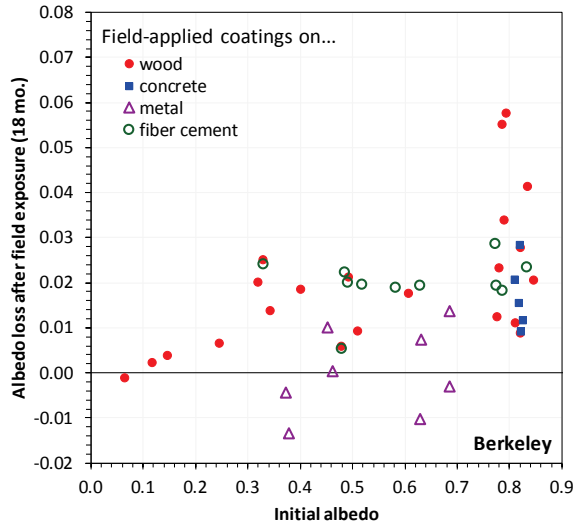
Cool wall products with high solar reflectance (SR) are sold today



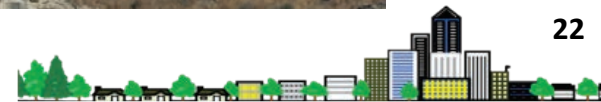
Wall products are undergoing 2 year exposure in California, 5 year exposure at U.S. sites



Solar reflectance losses modest (≤ 0.05) after 15 months in California, 12 months in U.S.



Thank you!





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