Cool Roofs in California

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U.S. EPA State Clean Energy-Environment Technical Forum

Urban Heat Islands (UHI), Clean Energy, and Air Quality

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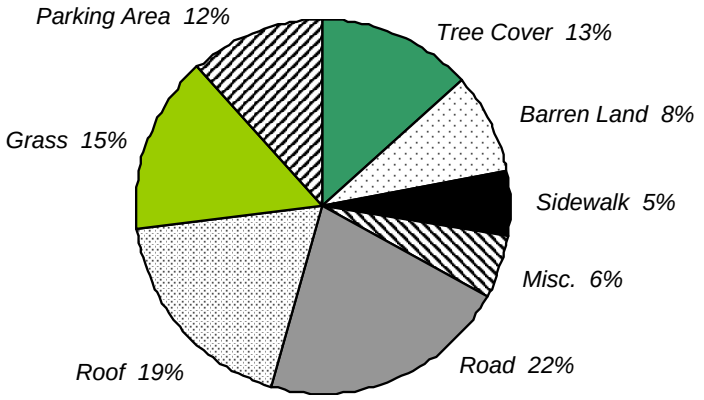
The surface of Sacramento, CA

~ 1 km^2

…is about 20% roofs



Area by Land-Cover Category Above the Canopy

Cool roof basics

- "Cool" roofs stay cool in the sun
  - high solar reflectance
  - high thermal emittance
- "Direct" benefits
  - Save building cooling energy
  - Reduce peak power demand
  - May last longer
- "Indirect" benefits (when used widely)
  - Cooler outside air
  - Less smog
  - Additional energy savings from cooler air
- Penalties
  - Increased heating energy use
  - More local pollution from winter heating

cool roofs

flat white roof

pitched white roof

pitched colored roof

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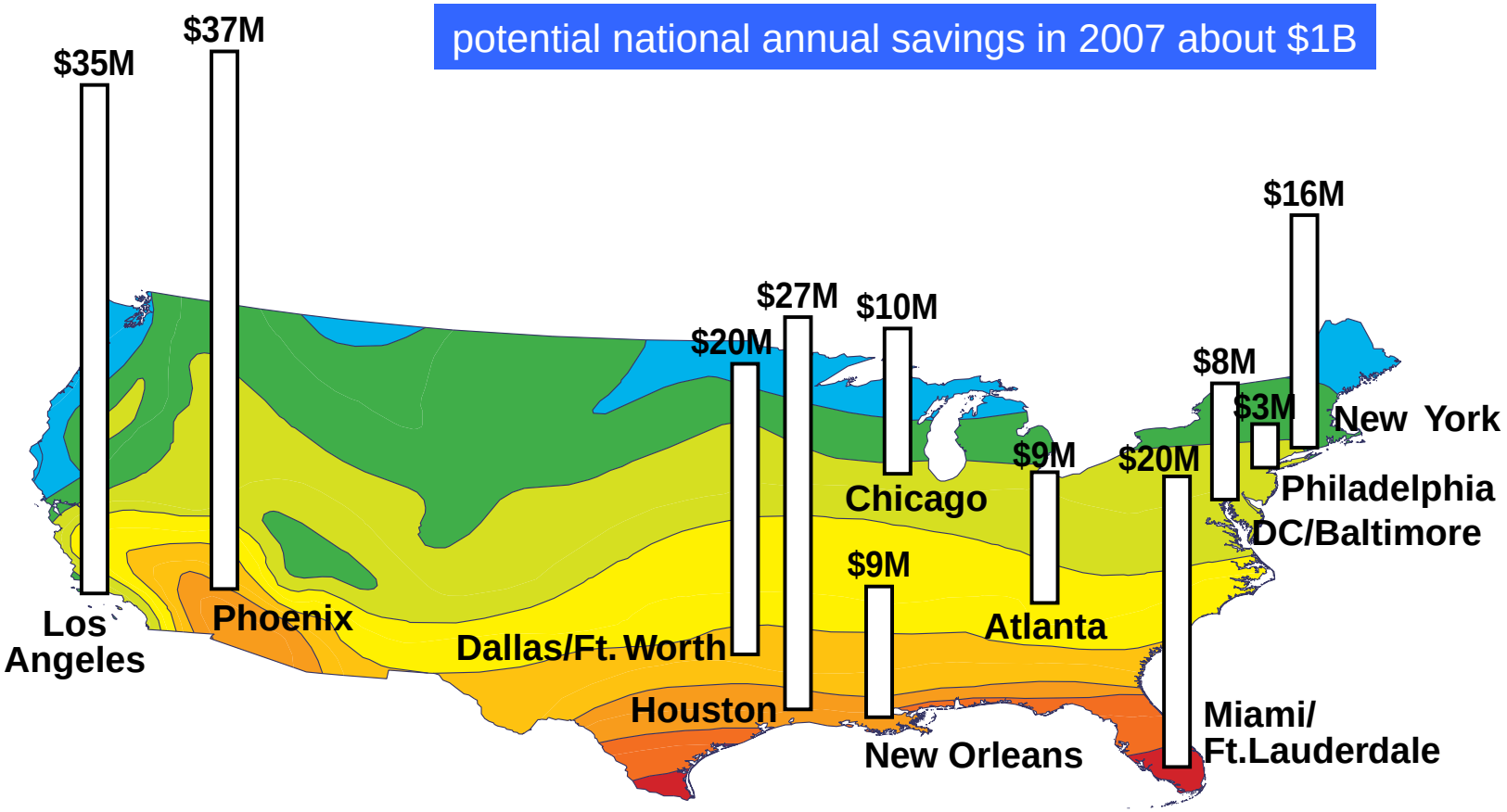
Berkeley Lab's cool roof program

1. Quantify cool roof energy, power savings
   - building energy simulations
   - building energy measurements
2. Bring cool roofing materials to market
   - white roofs: initial solar reflectance ~ 0.70
   - cool colored roofs: initial solar reflectance ~ 0.40
3. Promote use of cool roofs
   - ASHRAE, California building energy standards
   - Utility rebates

Potential cool roof annual energy savings in 11 U.S. metropolitan areas

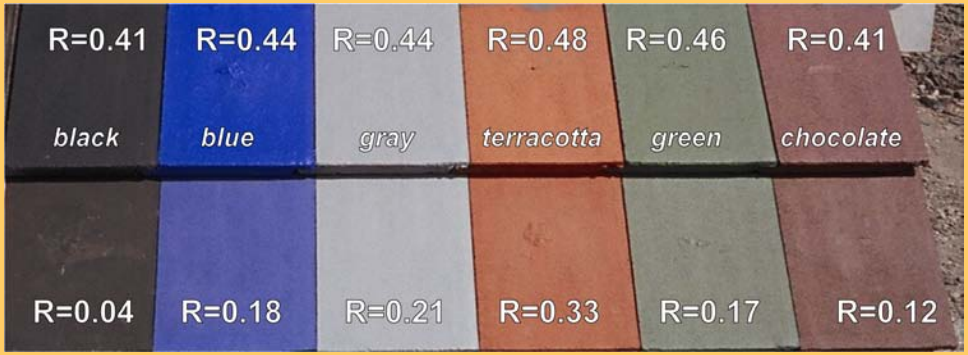


1997 $; solar reflectance increased by 0.3 (nonresidential), 0.2 (residential)

Developing cool colored roofs

cool concrete tile
R ≥0.40

standard concrete tile
(same color)

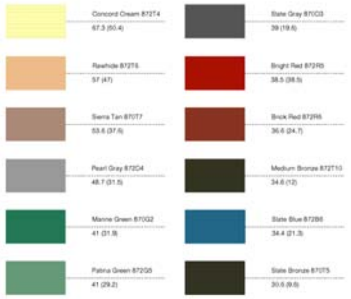


Courtesy
American
Rooftile
Coatings

solar reflectance gain =	+0.37	+0.26	+0.23	+0.15	+0.29	+0.29

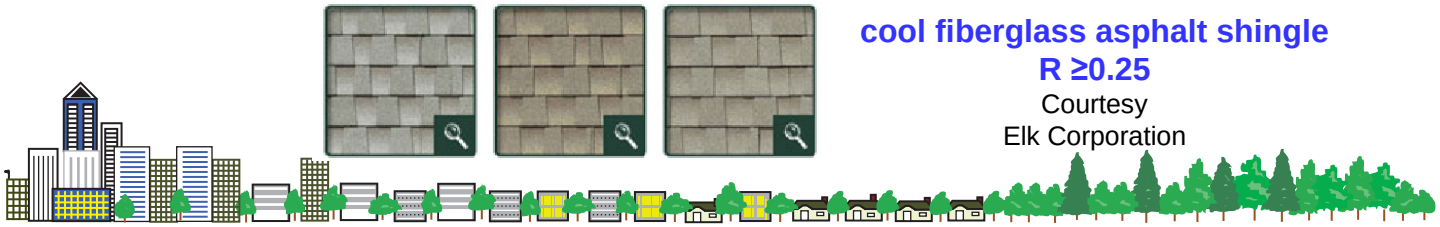
cool clay tile
R ≥0.40

Courtesy
MCA Clay Tile



cool metal
R ≥0.30

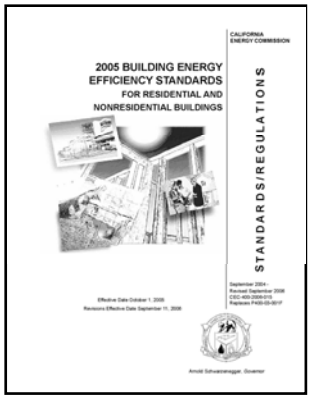
Courtesy
BASF Industrial
Coatings



cool fiberglass asphalt shingle
R ≥0.25
Courtesy
Elk Corporation

Promoting cool roofs

- Building energy standards
  - Performance credits in ASHRAE 90.1 + 90.2 (2001)
  - Prescriptive requirements in California Title 24 (2005)
- Utility rebates
  - California offered 15¢/ft^2 during its 2001 energy crisis
  - Two CA utilities (PGE, SCE) now offer 10-20¢/ft^2 in some climate zones

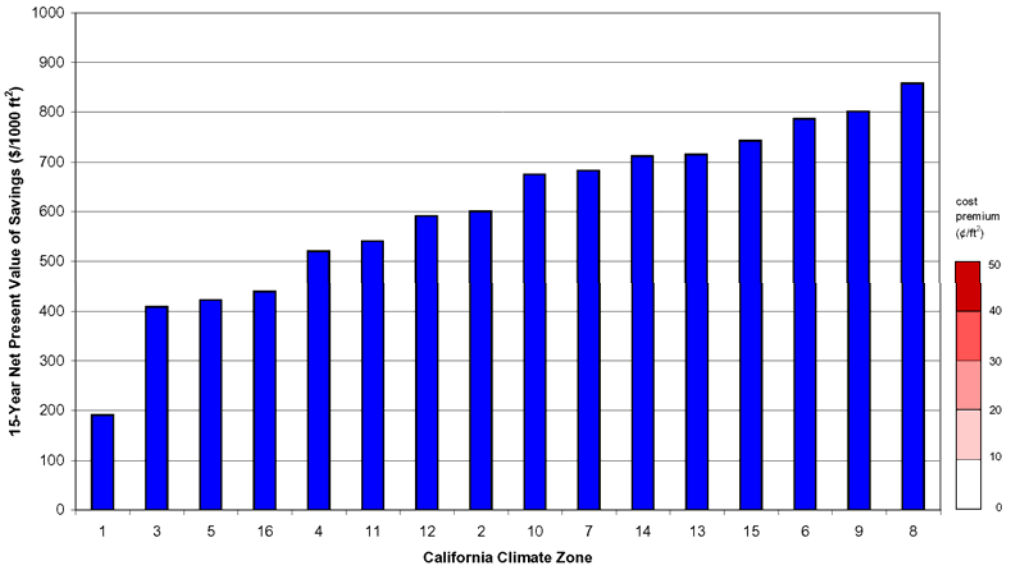


PGE & SCE rebate program (2007)

Roof Slope	Rebate Tier	Initial Solar Reflectance	Initial Thermal Emittance	Rebate [$/ft^2]
Low	N/A	≥ 0.70	≥ 0.75	$0.20
Steep	Tier 1	0.25 0.39	≥ 0.75	$0.10
	Tier 2	≥ 0.40	≥ 0.75	$0.20

Making the case for cool roofs in California's Title 24 building energy code

- NPV of life-cycle cost savings exceeds cost premium



- Products available
- Low-sloped (many)
  - white coatings
  - white single-ply membranes
  - white metal
- Pitched (growing)
  - clay, concrete tiles
  - metal
  - fiberglass asphalt shingles
- Cool Roof Rating Council
  - http://coolroofs.org

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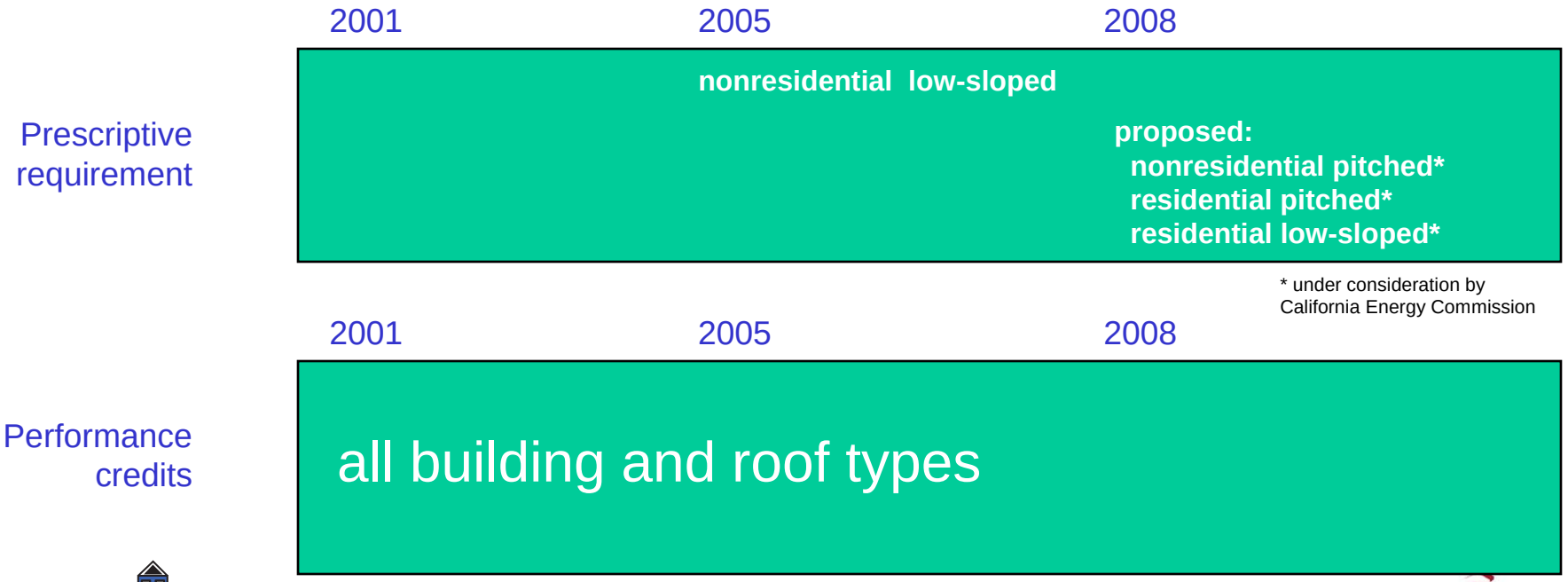
Cool roofs in Title 24: a timeline

Compliance options

1. prescriptive: each building element meets standard (“checklist”)
2. performance: energy use of proposed building does not exceed energy use of “prescriptive” building



Further information

- Berkeley Lab's Cool Colors Project
  - http://CoolColors.LBL.gov
- Berkeley Lab's Heat Island Group
  - http://HeatIsland.LBL.gov
- Cool Roof Rating Council
  - http://CoolRoofs.org
- EPA Roofing Comparison Calculator
  - http://roofcalc.cadmusdev.com

Appendix (for discussion only)