

# Building Technologies Program

U.S. DEPARTMENT OF  
**ENERGY** | Energy Efficiency &  
Renewable Energy

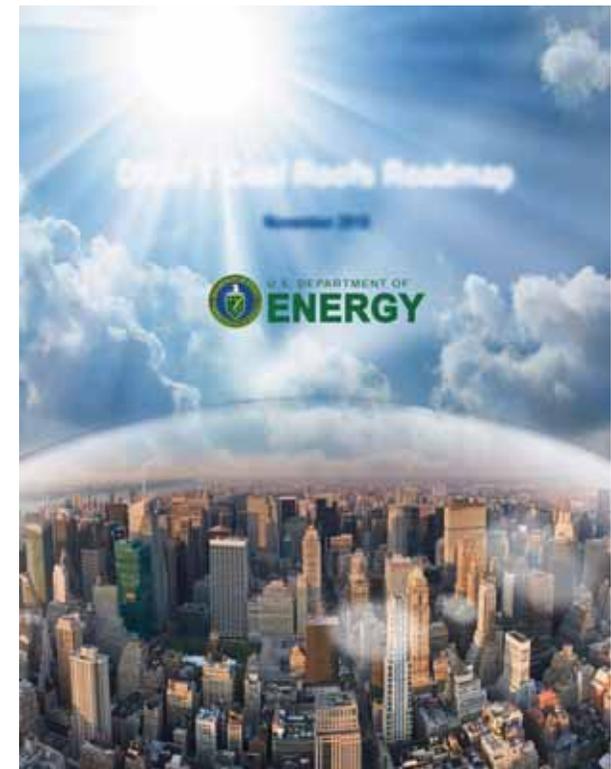


Cool Roof – US Activity

Marc LaFrance  
US DOE

12 September 2011

- Outline of proposed work on cool roofs
- Includes
  - Buildings level
  - Urban Level
  - Global Level
  - International Activities
- Comprehensive Draft Roadmap (older version Fall 2010) was subjected to stakeholder review



[www.eereblogs.energy.gov/buildingenvelope](http://www.eereblogs.energy.gov/buildingenvelope)

- New update expected this Fall, response to comments, and more near term deployment activities to be added

- Key Accomplishments:
  - Cool Roof Selection Guide
  - Cool Roof Calculator
  - DOE Cool Roof Policy
- Key Upcoming Work
  - Aged Rating Protocol
  - Advanced Materials



81°C



34°C

A low-sloped roof (pitch less than or equal to 2:12) must be designed and installed with a minimum 3-year aged solar reflectance of 0.55 and a minimum 3-year aged thermal emittance of 0.75 in accordance with the Cool Roof Rating Council program, or with a minimum 3-year aged solar reflectance index (SRI) of 64 in accordance with ASTM Standard E1980-01. Steep-sloped roofs (pitch exceeding 2:12) must have a 3-year aged SRI of 29 or higher.

Requires R30 insulation

**Is required unless determined to be uneconomical by life cycle cost analysis**

# Cool Roof Selection Guide

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DE-AC05-00OR22725

## Guidelines for Selecting Cool Roofs

July 2010

<http://www1.eere.energy.gov/femp/pdfs/coolroofguide.pdf>



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U.S. Department of Energy  
**Energy Efficiency  
and Renewable Energy**

Bringing you a prosperous future where energy  
is clean, abundant, reliable, and affordable

# Roof Savings Calculator

- Collaboration by ORNL and LBNL with funding from DOE and CEC and supported by EPA
- Provides cool roof assessments and advanced roof options
- Runs full simulations
- See [RoofCalc.com](http://RoofCalc.com)

## Roof Savings Calculator (RSC)

Beta Release v0.7

Oak Ridge National Laboratory  
Lawrence Berkeley National Laboratory

### Introduction

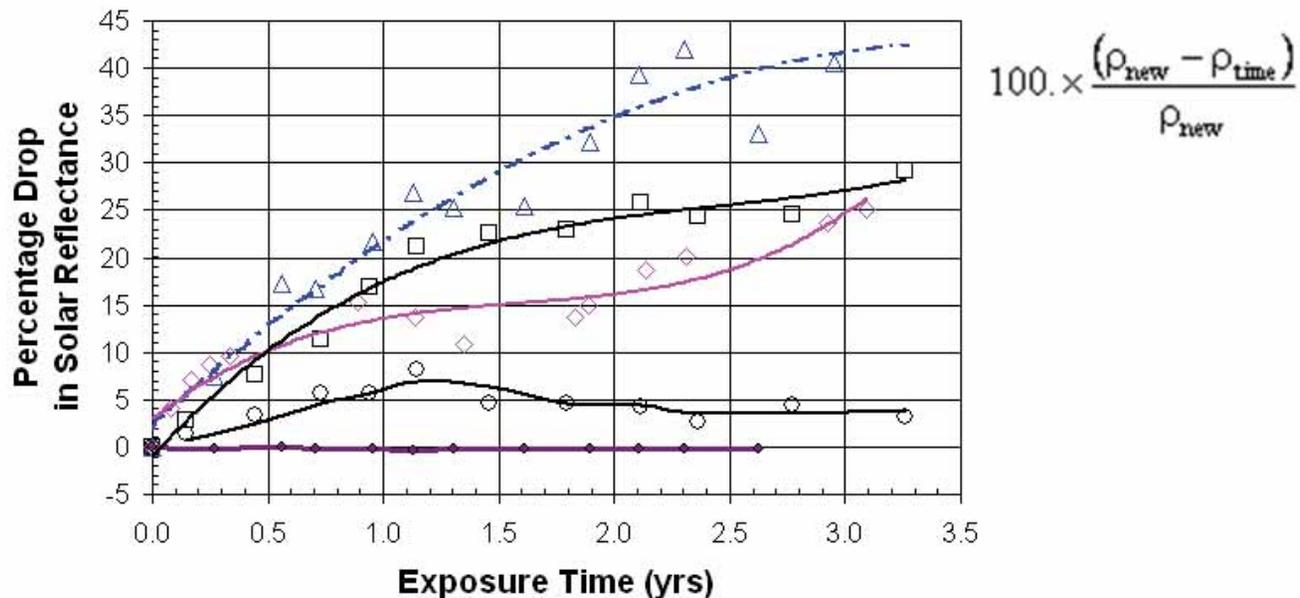
The Roof Savings Calculator was developed as an industry-consensus roof savings calculator for commercial and residential buildings using whole-building energy simulations. It is built upon the DOE-2.1E engine for fast energy simulation and integrates AtticSim for advanced modeling of modern attic and cool roofing technologies. An annual simulation of hour-by-hour performance is calculated for the building properties provided based on weather data for the selected location. Annual energy savings reported are based upon heating and cooling loads and thus this calculator is only relevant to buildings with a heating and/or cooling unit.

### Roof Savings Calculator

To begin, please select from the following options:



# Accelerated 3-year aged ratings



3½ year aged reflectance

- 0.623 ○ SR64E83 White Painted PVDF
- 0.486 □ SR69E06 Unpainted Galvalume
- 0.623 ◇ SR83E88 White Ceramic Coating
- 0.489 △ SR86E90 Thermoplastic membrane - White
- 0.104 ◆ SR09E89 Asphalt Shingle

**A major effort is to develop accelerated “aged” rating protocol to get results in six months rather than three years**

- Develop preliminary accelerated soiling protocol
- Study samples and refine protocol
- Validate and peer review protocol
- Release final accelerated aging protocol for cool roofs
- Major workshop, LBNL July 2011
- Next steps, ASTM and ISO standards (recruiting at least 5 countries)

# Not All Cool Roofs are White

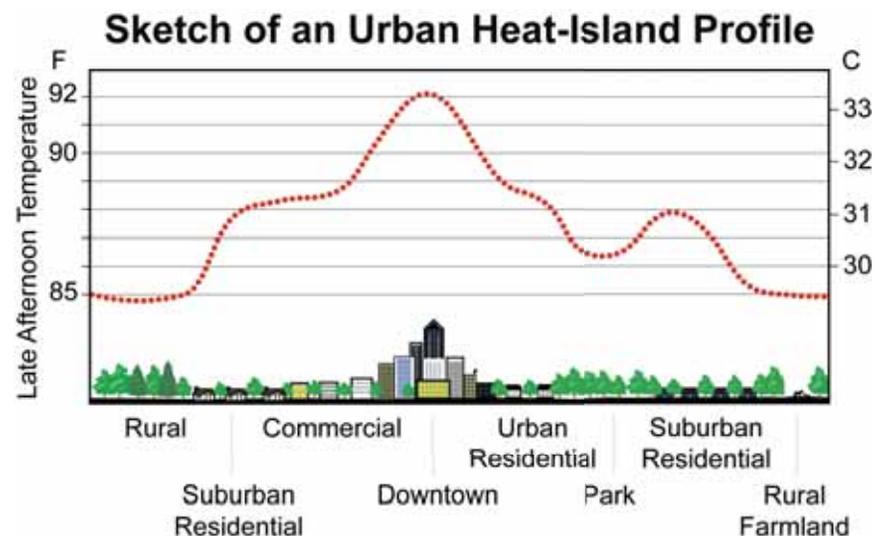


FY10 SBIR, FY11-FY13 CRADAs (~\$4M)

Develop next generation products:

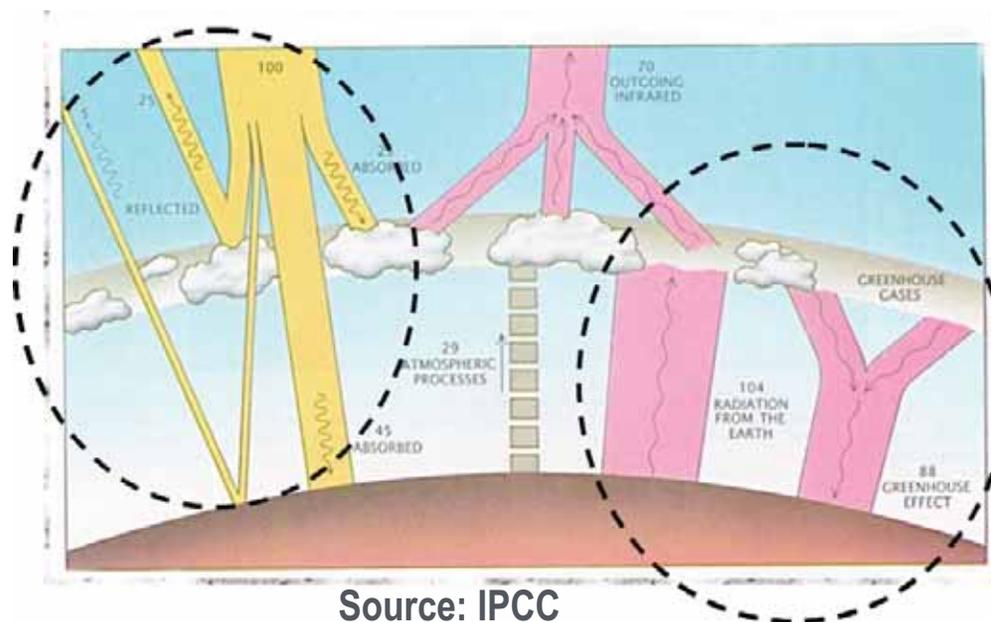
- Affordable cool asphalt shingles
- Evaluate de-soiling and anti-soiling additives/functionalities, self-cleaning materials
- Develop higher performing and more durable field applied coatings
- Develop thermochromic intelligent roof coating
- Explore cool pavements

- Key Accomplishments:
  - Major Literature Review
  - Scoping study for validation work
  - Tentative plan for San Jose demonstration
  - Potential to reduce peak electricity by 10 – 15 percent
- FY12 Plans (not confirmed)
  - New congress, funding not yet determined, low House Mark
  - Not core energy efficiency so lower Building Technologies priority



- Review of over 240 research papers, articles, and presentations
- Key Findings:
  - The scale of UHI phenomena is large and increasing. The cost incurred is considerable.
  - Countermeasures (including white and vegetative roofs) are an effective way to reduce urban temperature and its effects.
  - The few macro scale assessments suggest countermeasures would improve urban environments and lead to both direct and indirect CO2 savings.
  - The current research on UHI stems from only a few research organizations – the research base needs to be broadened and deepened.
  - Awareness of the issue of UHI phenomena is low. DOE needs to increase awareness in addition to supporting countermeasures.

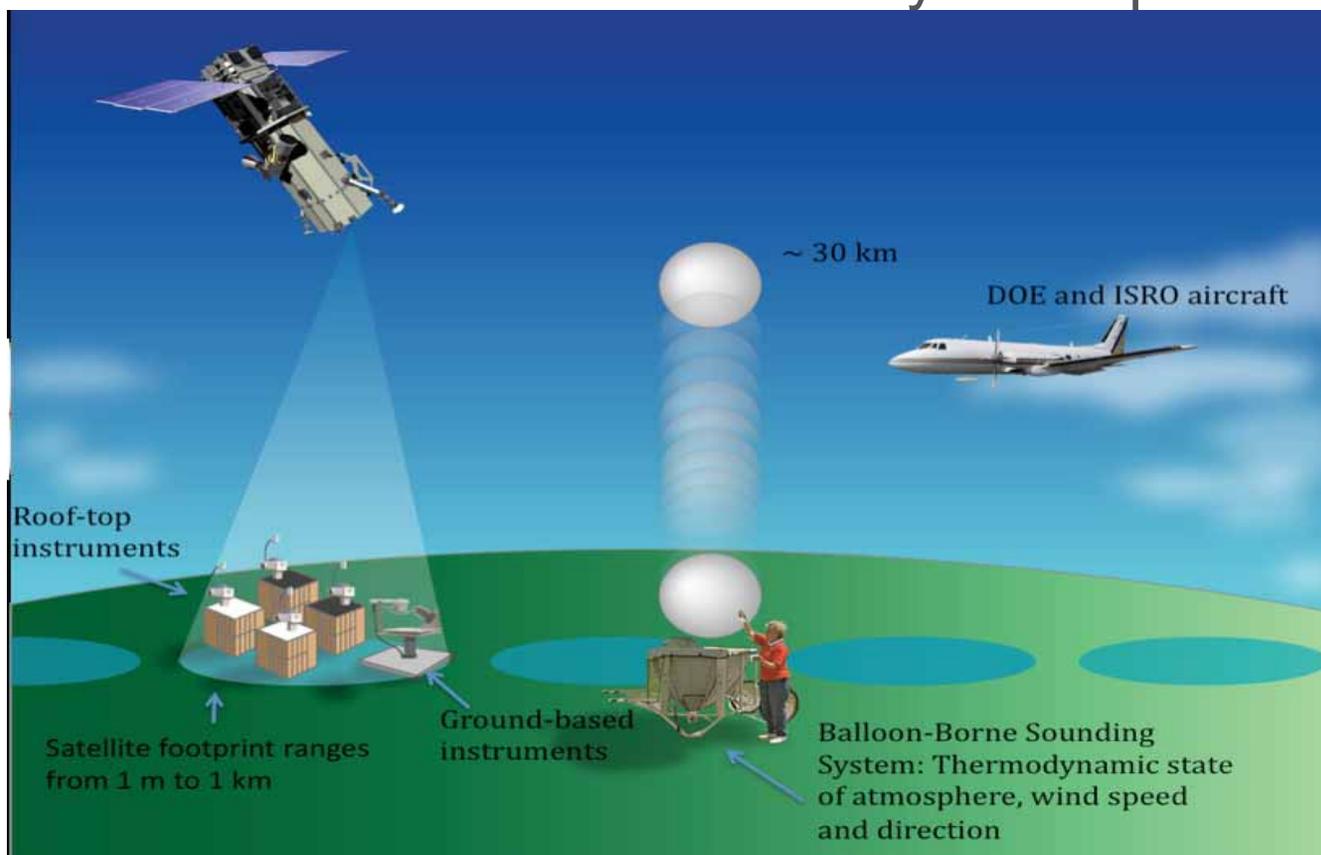
- Key Accomplishments:
  - Peer Review Panel
- Key Upcoming Work
  - Validation of Global cooling models
  - India Project



Potential Carbon Mitigation: CO<sub>2</sub> offset for cool roofs  
and cool pavements = 44 GT CO<sub>2</sub>  
(key researchers: Rosenfeld, Akbari, Menon)

# Global Cooling Tasks

- Validate and Verify Models
- India Project: Collaborating on an Office of Science study to measure radiation impact before and after roof surface albedo is increased in clean and dirty atmospheres



- Active projects
  - GSEP Cool Roof Working Group Formed
  - Bi-lateral Agreement with China on cool roofs, Clean Energy Research Center, Study on impacts with PV and Green Roofs
  - APEC Energy Smart Communities Initiative, SB2 APEC Building Material Test Center (Thailand), SB3 Cool Roof Demonstrations
  - Building Envelope Workshop in Brazil with ABNT, November 2011
  - Cool roof demos in India
  - Global Cooling Validation project in India
  - Recruiting international partners for ISO test standards

# Building Codes – Ultimate Policy: Key Elements are Interrelated

## Code Development

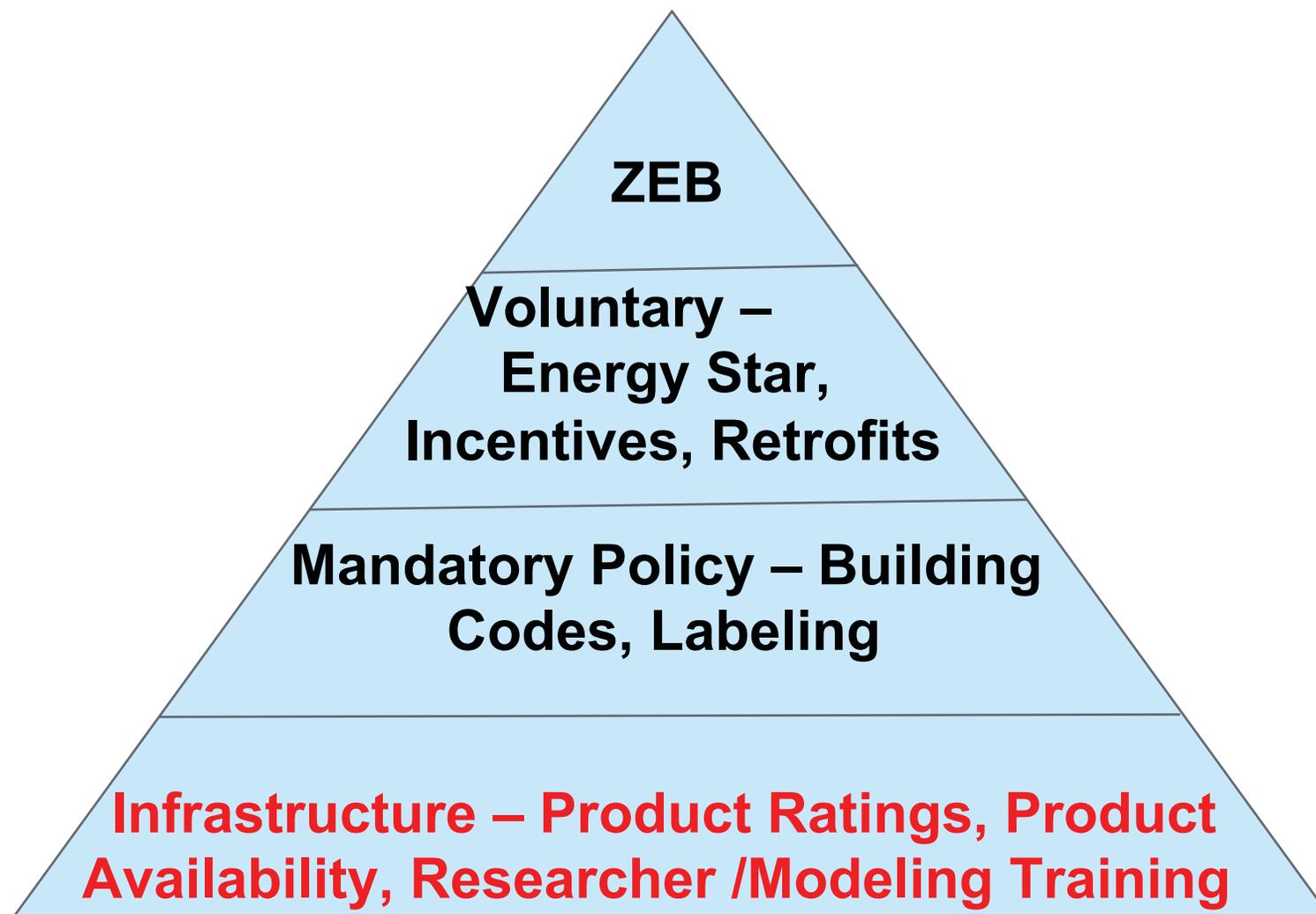
- Sends a strong message to economy
- Sets goals to strive for

## Infrastructure

- Needed to assess key building components
- Likely starting point, but hard to get interest w/o codes

## Enforcement

- Key issue to achieve results, but often not investigated deep enough
- Core problems include lack of product ratings, product availability, lack of knowledge



# Cool Roofs More Effective in Hot Developing Economies - Example

Key Driver	USA	India
Climate	Moderate	Very Hot
Insulation Levels	High	Low
Roof Configuration	Flat and Steep	Mostly Flat
Conventional Roof	Black on commercial, Asphalt on residential	Concrete Slab
Solar Reflectance Improvement Potential	Flat SR 10 to 60+ Steep SR 15 to 30+	All SR 20 to 60+
Labor Cost	High	Low
NET IMPACT	Mostly cost effective for new construction on commercial buildings	Can be cost effective for all existing and new buildings, and will provide comfort for non-conditioned buildings - avoid future conditioning.

## Contact Information

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