



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

Energy Star® Roofing Systems

Using White Reflective Roofs to Conserve Energy
Improve the Environment and Save Money

By Peter D'Antonio
Sarnafil Roofing and Waterproofing Systems



Building Dynamics - The Roof

→ *The Roof functions as one of the most important features in a building:*

→ Basic Function: → Provide Weatherproofing

→ New Impact: → Energy Conservation
_____ → Improve Air Quality



Building Dynamics - The Roof

- Roof System Performance has a direct effect
- Indoor Air Quality
when it doesn't work!
 - **Development of mold**



Roof Design

- Roofs keep building free of moisture.
- Design effective vapor barrier.
- Design for rapid drying in case of leaks.



Selecting a Roof System

Important performance criteria:

- 25 year track record
- ability to withstand ponding water
- local contractor base
- ability to be repaired easily over lifetime
- low maintenance costs



Roof System Design

- Design features of a properly designed roof assembly
 - Membrane thickness
 - minimum 60 mil
 - optimum 72 mil
 - Insulation thickness
 - minimum R-30
 - optimum R-38
 - Slope
 - minimum 1/4"/foot



Roof Design

Thermal Performance of Roofing

- Roof Insulation
- Radiant Barriers
- Cool Roofs



Roof Insulation

- Energy use is reduced.
- Natural ventilation can be used for a greater number of hours.
- Smaller HVAC equipment can be purchased.
- Spaces are more comfortable.



Roof Insulation

- **Insulation entirely above deck:**
Install R-20 insulation above the structural deck.
- **Attic and other construction:**
Install a minimum of R-38 insulation



Roof Insulation Recommendations

- Design roof to avoid ice dams in cold climates.
- Consider recycled insulation materials for attic.





Urban Heat Islands



- Development replaces natural vegetation with pavement, buildings, and other structures
- These surfaces absorb the sun's heat causing surface temperatures and overall ambient temperatures to rise
- Heat islands reduce livability by increasing temperatures, air pollution, and the incidence of heat related illness and death



The Smog Connection

- Urban heat islands are not only hotter but are also smoggier.
- Smog is created by photochemical reactions of pollutants in the air and intensify at higher temperatures.
- In Los Angeles, for every degree increase above 70F smog increases by **3%**.



Urban Heat Island Pilot Project

- EPA Objective:
- Investigate the use of HIR strategies for the reduction of cooling-energy use and for the reduction of the ambient air temperature and improving air quality



The Energy Star® Roofing Program





Energy Star Roofing Program

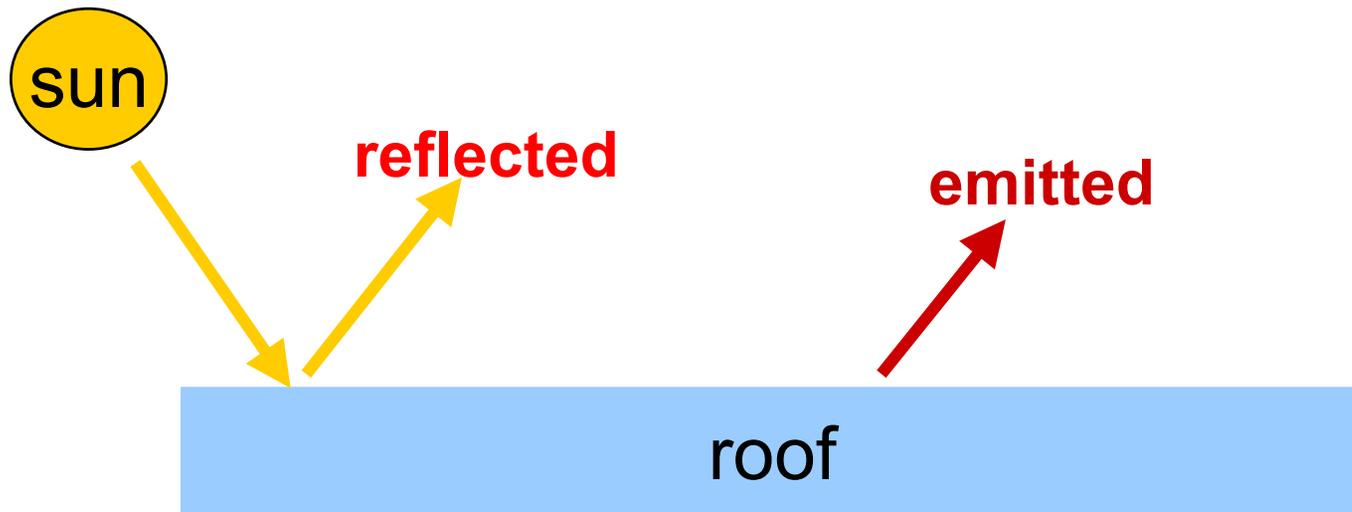
Key Terms

Solar Reflectivity

Amount of incoming solar energy a material reflects, also called “albedo” (usually in %)

Emissivity

Amount of energy a material emits due to its own heat and temperature (usually in %)



EnergyStar® Roof Products Program Product Specifications

LOW-SLOPE ROOFS: Surfaces with a slope of 2:15 inches or less*

Characteristic	Performance
Energy efficiency	
Initial solar reflectance	Greater than or equal to 0.65
Maintenance of solar reflectance	Greater than or equal to 0.50 three years after installation under normal conditions
Reliability	
Manufacturers warranty for defects in materials and manufacturing.	Each company's warranty for reflective roof products must be equal in all material respects to the warranty offered by the same company for comparable non-reflective roof products. A company that sells only reflective roof products must offer a warranty for comparable non-reflective roof products.

STEEP-SLOPE ROOFS: Surfaces with a slope greater than 2:12 inches*

Energy efficiency	
Initial solar reflectance	Greater than or equal to 0.25
Maintenance of solar reflectance	Greater than or equal to 0.15 three years after installation under normal conditions
Reliability	
Manufacturers warranty for defects in materials and manufacturing.	Each company's warranty for reflective roof products must be equal in all material respects to the warranty offered by the same company for comparable non-reflective roof products. A company that sells only reflective roof products must offer a warranty for comparable non-reflective roof products.

* For roof products that can be applied to either low-slope or steep-slope roofs, manufacturers should refer to the low-slope roof tables for Energy Star® specifications.



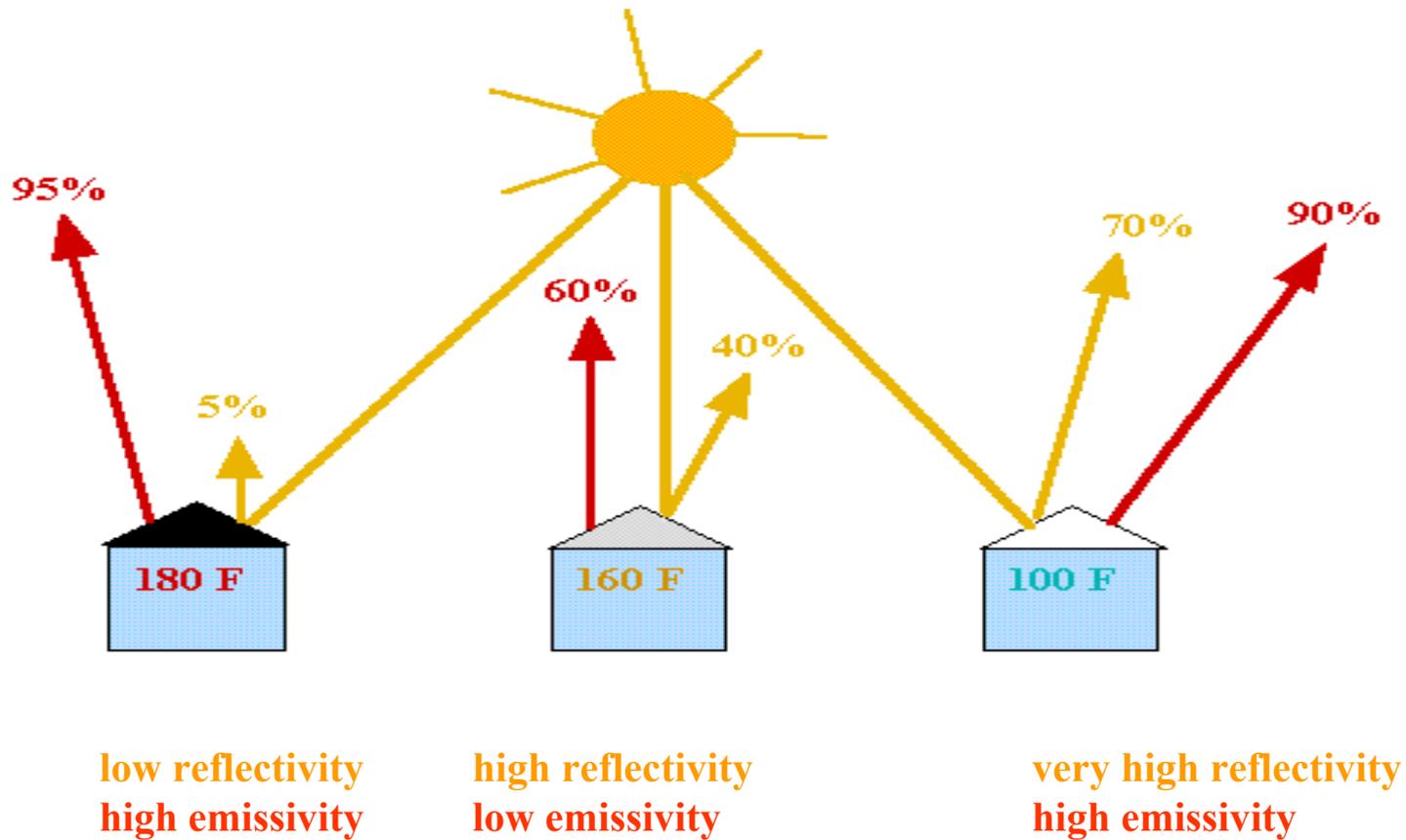
Roofing Material Comparison

- White reflective membrane 83%
- White granular surface 26%
- Smooth surface BUR 6%
- EPDM black 6%

- Source: Cool Roofing Material Database/LBNL
- <http://eetd.lbl.gov/CoolRoof/membrane.htm>



Effect of Reflectivity & Emissivity on Temperature





Cool Roofs

- Can save demand and energy charges.
- Are highly cost effective.
- Can increase the life of the roof membrane.
- Reduce 'heat island' effects.





Cool Roofs

- Cool roof material must be kept clean.
- Make sure material is compatible with underlying substrate.
- Liquid-applied coatings should comply with ASTM standards for durability.





Smith Middle School Energy Efficient Design Features

- Energy Star Rated Roof System
- Roof Monitors for Natural Daylighting with light detection system
- Roof Storm Water Retention System
- Roof Mounted Solar Water Panels
- Photo Voltaic Panels for lighting



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Smith Middle School Chapel Hill, N.C.





Storm Water Retention System





Daylight Roof Monitor





Solar Water Heating Panel





Energy Star Roofing Program

Who will benefit with the highest savings?

Buildings with the following characteristics

1. high air conditioning costs
2. a large roof surface
3. lower levels of insulation
4. location in a hot, sunny climate



Energy Star Roofing Program

Will it cost my facility more money?

The good news: an Energy Star Roof product could significantly reduce annual cooling costs by as much as 40% according to the EPA. Savings will depend on location and climate, insulation levels, the products Solar Reflectance Value, and maintenance.



Energy Star Roofing Products

- *White reflective roof systems with added insulation provide significant, cooling cost reductions*
- *Energy savings are passive - not occupant driven*



Energy Star Roofing Products

Benefits of High Performance Roof Systems

Longer life cycle

Lower maintenance costs

Lower life cycle costs

Reduce cooling costs

Extend real time roof life

Increased environmental benefits

Maintain better learning environment









