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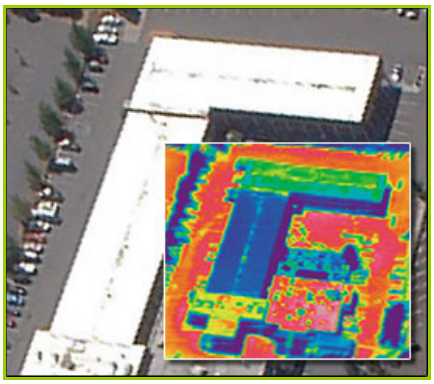
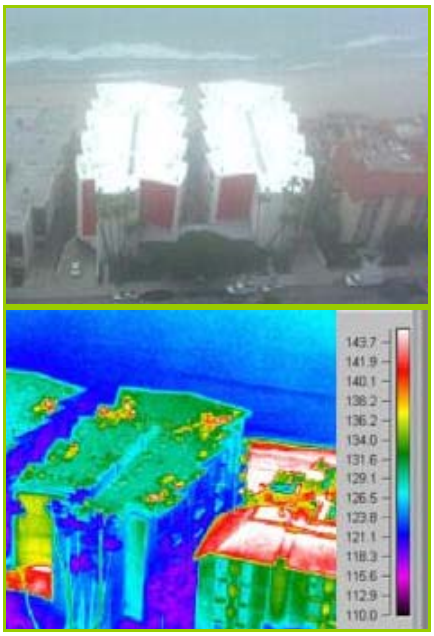
March 2009

Cool Roofs

Prepared For:
The Los Angeles Community College District



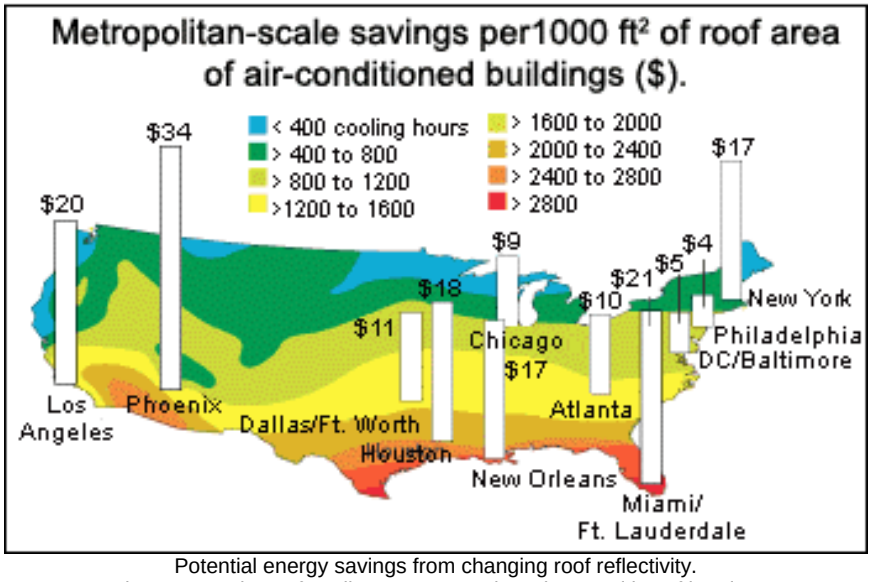


DESCRIPTION OF TECHNOLOGY

A cool roof is a term for a roof that has been treated with a coating to reduce the amount of absorbed solar radiation. In general, these coatings are white or light-colored, but new coatings are being developed in various colors that produce equal results.

In cold climates, dark roofs have a beneficial passive heating effect in the winter. Cool roof coatings increase the heating costs compared to a dark-colored roof, making them impractical for climates with cold, cloudy winters and mild summers.

Cool roofs are best used in hot climates to maximize the energy savings in summer and minimize the energy penalty in winter. Climates with mild winters, such as Los Angeles, should always use cool roof technologies. This fact has been incorporated by California's Title 24 Energy Code, which requires cool roofs in all new buildings in the state.



Potential energy savings from changing roof reflectivity.
Note: Net savings are savings of cooling energy use less the penalties of heating energy use.

Over 90% of roofs in the United States, and most roofs in the world, are dark-colored. These roofs can reach surface temperatures of 180°F or higher on a hot summer day. This places an increased load on the building's cooling equipment, decreases comfort levels of building occupants, and contributes to overall power grid demand during these critical peak hours.

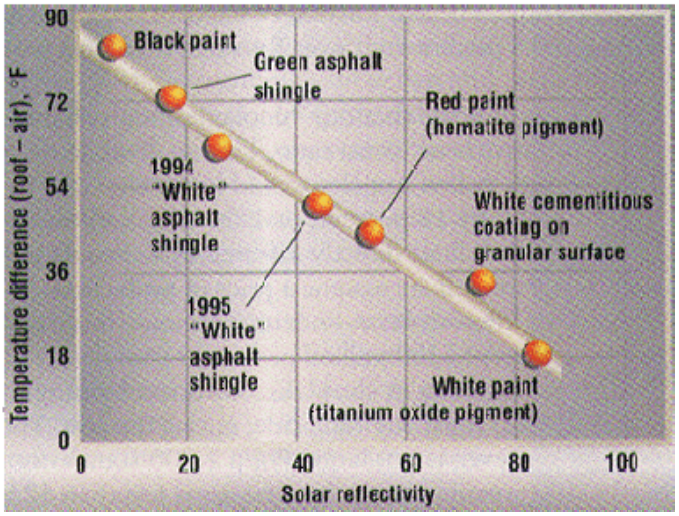
In addition to these negative effects, high roof surface temperatures cause roofing materials to deteriorate more quickly and can increase maintenance costs.

BuildLACCD

Butyl rubber elastomeric coating

Cool roof coating being applied

Silicone elastomeric coating being applied



Roof temperature as a function of reflectivity

There are many roofing options that can improve the thermal performance of a roof, although not all qualify to be called a “cool roof”. Various definitions of a “cool roof” have been developed to set minimum performance standards.

The California Energy Code (Title 24) defines a “cool roof” as a roof that has a minimum thermal reflectance of 70% and a minimum thermal emittance of 75%. In the State of California, all new non-residential and high-rise residential buildings must have a cool roof that meets these requirements to comply with the energy code via the prescriptive compliance approach. The cool roof must be certified by the Cool Roof Rating Council, an independent third-party agency.

The U.S. Green Building Council has defined a “cool roof” as a roof that has a Solar Reflective Index (SRI) above 78 for low-sloped roofs and above 29 for steep-sloped roofs. The SRI is a combination of thermal emittance and reflectance factors. A building with a cool roof that meets these requirements earns a LEED credit (SS credit 7.2) for reducing the heat island effect of the building.

EnergyStar also certifies reflective roof products and maintains a list of manufacturers and products on their website. The EnergyStar requirements for low-slope roofs are an initial reflectance of 65% and a reflectance of 50% after three years under normal conditions. For steep-slope roofs, these values change to 25% and 15% to achieve the EnergyStar label.

All new buildings on the nine LACCD campuses must meet the requirements of California’s Title 24 Standard and LEED NC v2.2 Sustainable Sites credit 7.2 – Heat Island Effect, Roof. They may use EnergyStar certified manufacturers as long as the products comply with Title 24 and LEED.

Energy Analysis

A case study was done for a typical building in Los Angeles, California. Using the energy modeling program EnergyPro, the effect of adding a cool roof to this structure was studied. The cool roof selected was a Duro-Last roof that had an 88% initial reflectance and an 87% initial emittance as specified by the manufacturer.

Adding a cool roof with the properties listed had a net positive effect on the thermal performance of this case study. The following table shows a simple payback analysis.

Roof Type	Roof Area (sq.ft.)	First Cost	Annual Energy Use			Annual Energy Savings	Simple Payback Period
			kWh	Therms	Cost		
Standard	187,000	$1.31 million	337,860	13,096	$103,129	-	-
Cool Roof	187,000	$1.68 million	243,529	19,238	$79,538	$23,591	15.9 years

The annual electricity usage is reduced due to the cool roof, but the amount of natural gas used for heating increases. Since energy use for cooling is much greater than that for heating in Southern California, the net effect of the cool roof is an overall energy use reduction. The energy cost was based on the Southern California Edison TOU-8 rate schedule for electricity and the Southern California Gas Company GN-10 schedule for natural gas.

Additional Resources

The following websites contain additional information on cool roofs.

Government websites
- www.energy.ca.gov/title24/coolroofs/index.html
- www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products
- www.epa.gov/heatisland/strategies/coolroofs.html
- www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm

Industry websites
- www.coolroofs.org
- www.consumerenergycenter.org/coolroof
- www.reflectivecoatings.org