

# Cool Roofs for Hot Projects

## Modified Bitumen and BUR – An Energy Efficient Alternative

**By Jessica Clark, Cool Roof Rating Council (CRRC)**

Today there are cool roof options for almost every type of low and steep sloped roof surface and the multitude of health and energy efficiency benefits make specifying a cool roof additionally appealing. Modified bitumen and Built-Up Roofing (BUR) products may be known more for their durability, thermal performance and fire and wind resistance than their energy performance ability. However, an increasing number of manufacturers are creating *cool* modified bitumen and BUR products that can more effectively reflect the sun's heat away from a building.

Cool roof options can lower the roof surface temperature by 70°F, compared to a standard black asphalt roof.<sup>1</sup> This can have an immense impact on the temperature fluctuations of a roofing system, leading to lower maintenance costs, longer roof life and a decrease in cooling loads. As cool roof requirements become increasingly common in building codes and voluntary green programs, it is important to understand their benefits and how they work, as well as are aware of resources that make it easy to specify cool roof systems.

### Cool Roof Benefits

Cool roofs are ideal for Florida's hot and humid climate, as they are most effective in areas where temperatures and air conditioning use are high. By reducing heat gain through the roof surface, cool roofs decrease air conditioning use that leads to 10-30% in energy savings at the hottest part of the day, when energy demand is at its peak.<sup>2</sup> According to the Lawrence Berkeley National Laboratory's Heat Island Group, if cool roofs were implemented nationwide, we would save \$1 billion in cooling costs, with \$20 million in the Miami/Ft. Lauderdale area alone. This also helps relieve the need for additional power plants.

Additionally, cooling cost savings will be greater in urban areas, where temperatures can be 2°- 8°F higher than the surrounding area – a phenomenon called the Urban Heat Island Effect.<sup>2</sup> Cool roofs help diminish the Urban Heat Island Effect, by lowering ambient air temperatures during hot weather, which leads to a reduction in smog and improves building occupant comfort. To top off the list of benefits gained from cool roofing, reflective roofs have the potential to act as a significant global warming mitigation strategy as reflected energy passes through the atmosphere much more effectively than re-radiated energy.

### Fundamentals of Radiative Properties

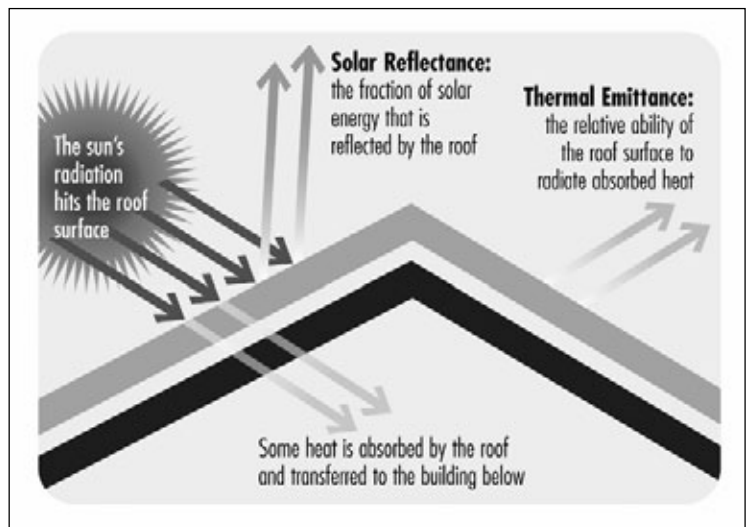
Understanding the radiative properties of roofs is crucial to recognizing how a roof will function under

the presence of the sun's heat. The energy performance of roofing materials is measured by its solar reflectance and thermal emittance properties. Solar reflectance is the fraction of solar energy that is reflected away from the roof. Thermal emittance is a fraction representing the relative ability of the surface to re-emit absorbed heat. Both measurements are measured on a scale from zero to one, with higher numbers representing a *cooler* roof.

Aged solar reflectance and thermal emittance values are sometimes referenced by codes or programs. A study by the Oak Ridge National Laboratory and DLR Consultants showed that the loss of effectiveness of solar reflectance for most roof surfaces levels out at about three years.<sup>3</sup> Aged values are thus based on a three-year exposure measurement. Roof materials are placed at *test farm* sites and weathered for three years, at three locations representative of standard climates in the U.S. (hot and humid, cold and temperate, hot and dry). The values recorded at these locations are then averaged to determine the aged solar reflectance and thermal emittance of a product.

The Solar Reflectance Index (SRI) is an alternative measurement to solar reflectance and thermal emittance, and is calculated using the two values. It is defined by the Lawrence Berkeley National Laboratory as the roof's ability to reject solar heat, as shown by a small temperature rise. SRI is defined so that a standard black is zero and a standard white is 100, therefore particularly hot materials can result in slightly negative values, and particularly cool materials can exceed 100. SRI is a measurement that is referenced by an increasing number of code bodies and voluntary green building programs, including LEED NC Version 3 and ASHRAE 0.1-2007.

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The radiative properties of modified bitumen and BUR products are determined by the topmost layer of the roofing system. Thus, the reflectivity of the granules, capsheet or surface material of the product determines the energy performance of the roofing system. Cool modified bitumen and BUR products often have specially engineered granules designed to reflect more solar energy away from the building than conventional granules. Another cool option is to choose modified bitumen and BUR products with a white or light colored capsheet.

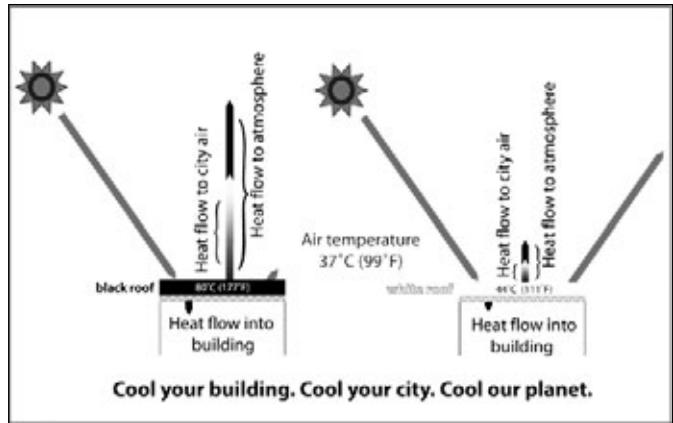
## Codes and Standards

As more and more building codes and voluntary programs such as LEED recognize the ability for cool roofs to mitigate climate change and increase energy efficiency, it has become increasingly important for roof specifiers, contractors and architects to understand the radiative properties of roofs. The 2007 Florida Building Energy Code Chapter 13 Section 13-604.A.3 Performance-Based Residential Credit specifies a cool roof as a material having a solar reflectance of 0.70 and thermal emittance of 0.75. LEED NC Version 3 SS Credit 7.2 has an SRI of 78 for low-sloped roofs (d"2:12) and 29 for steep-sloped roofs (>2:12). Cool modified bitumen roofs applied to existing homes with a solar reflectance of 0.65 (0.50 aged) for low-slope and 0.25 (0.15 aged) for steep-slope also qualify for the Federal Tax Credit for Consumer Energy Efficiency.

## Using the Rated Product Directory

The CRRC is an excellent resource for finding the radiative properties of all types of roof products. A non-profit education organization, it maintains a free online directory of the radiative properties of over 2,000 roofing products. Their website also includes an extensive resource section where you can find information on national codes, voluntary programs and rebate programs.

To search the list of CRRC rated products, begin at the main page at [www.coolroofs.org](http://www.coolroofs.org) and click on the Rated Products Directory tab. The directory allows you to search for roofing products using several parameters. Users can refine their search by choosing product type, market, manufacturer, brand, model, color, solar reflectance, thermal emittance, slope or any combination thereof. When searching for products that meet a code or program requirement, minimum solar reflectance and thermal emittance are particularly useful parameters. Just type in the minimum values, and your search results will include all products rated with the CRRC that meet the minimum code requirements. Many people also find the product ID search helpful when they want to learn more about a CRRC-labeled product they find in the store. All products listed in the Rated Product Directory are linked with manufacturer contact information to assist in your search for the ideal product. Although CRRC rates many products, this does not mean that they are



deemed *cool* by any specific code body or green program. The CRRC does not require products to meet a minimum standard in order to be included in the Rated Products Directory.

You may notice that several modified bitumen and BUR roofing products in the Rated Product Directory are listed with multiple product models under a single CRRC product ID number. The CRRC accepts compound ratings for products that share the same surface formulation (and therefore maintain the same reflectance and emittance values), but have differing backing or design features. For example, a company may sell a modified bitumen product with a specific capsheet that can be applied several different ways, such as torch-applied or self-adhesive, and thus is sold as multiple variants. The energy performance of the product is not altered by its underlying elements.

Cool roofs provide an exceptional option for your next project, saving energy and extending the roof's life while mitigating the Urban Heat Island Effect and climate change. Please use the CRRC's Rated Product Directory as a resource to identify and specify the ideal roofing product for your project.

## Resources

1. Lawrence Berkeley National Laboratory's Heat Island Group, [HTTP\heatisland.lbl.gov\coolroofs\](http://heatisland.lbl.gov/coolroofs/)
2. [energystar.gov](http://energystar.gov)
3. Roodvoets, D., Desjarlais and W. Miller, (April 2004). Long Term Reflective Performance of Roof Membranes. RCI Annual Conference

## The Cool Roof Rating Council

Founded in 1998, the Cool Roof Rating Council's mission is to implement and communicate fair, accurate, and credible radiative energy-performance rating systems for roof surfaces; to support research into energy related radiative properties of roofing surfaces, including durability of those properties; to provide education and objective support to parties interested in understanding and comparing various roofing options.

The CRRC ([www.coolroofs.org](http://www.coolroofs.org)) is comprised of a diverse membership of industry leaders. For further information, email [info@coolroofs.org](mailto:info@coolroofs.org) or call 866-465-2523.