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## **Understanding Cool Metal Roofing**

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'Cool roofing' has become the latest buzz phrase for environmentalists and those involved in the construction industry. While everyone believes they have a basic understanding of what cool roofing is, most people really aren't clear as to what constitutes a cool roof. It's about more than just having a white roof, as many may think.

Before one can gain a handle on what is meant by a 'cool roof', an explanation of why the issue has become so important is necessary. Over the last several years, events such as the rolling blackouts in California have drawn attention to energy consumption demands. Satellite pictures have shown the air temperature over metropolitan areas during the summer can be as much as 10 degrees higher than in suburban areas.

Many studies have been conducted by various organizations to explain this occurrence. According to the Lawrence Berkeley National Laboratory, "Urban areas tend to have higher temperatures than their rural surroundings as a result of gradual surface modifications that include replacing the natural vegetation with buildings and roads. The term 'Urban Heat Island' describes this phenomenon."

In 1997 the Environmental Protection Agency started the Heat Island Reduction Initiative (HIRI). This is a multi-agency collaborative effort to help city planners and officials reduce the problem. Part of this initiative involves educating those officials on the causes and measures to combat the Urban Heat Island effect.

As stated, one cause of the Urban Heat Island effect is the lack of trees and other shade providing plants in cities. The vegetation is replaced by heat-absorbing materials such as asphalt and concrete. This leads to a whole host of other problems which compound the effect.

Heightened temperatures cause an increase in smog, which is formed by a chemical reaction between VOCs, NOx compounds and heat. The reaction

turns ground level ozone into smog. The added pollution irritates the lungs of all who breathe it, especially children, the elderly and allergy sufferers.

Demands on air conditioning are also increased with the higher temperatures. Increased demand means an increase in prices for consumers. More fossil fuels are burned to create more energy to meet added demand. Once again, components in the pollutants from the power plants help create smog. The heat gets trapped making the city even warmer, thereby increasing the need for air conditioning and the vicious cycle continues.

It should be noted that while the heat is trapped over the city, it is not caused by overall global warming. However, according to the EPA, it can contribute to a global climate change. With the resultant pollutants from higher energy demands, greenhouse gases are increased as well. It is, therefore, imperative that measures be taken to reduce the effects of Urban Heat Islands--and cool roofs can help.

### **What Are 'Cool Roofs'?**

Most conventional roofing materials absorb some amount of solar radiation, which causes the surface to heat up. That heat can be transferred to the interior of the building. The added heat also accelerates the deterioration of those roofing materials. Cool roofing material reduces these problems.

A cool roofing material is defined by its emissivity and reflectance, also known as albedo. The higher the emissivity and reflectance, the cooler the roof. These characteristics can be measured as either a percentage or a value range between 0 and 1.

Varying governing bodies have different requirements, but for **California's new Cool Savings Program**, roofs must have a reflectivity of at least 65% and emissivity of at least 80% upon installation. Research for the State of California states these numbers may reduce the temperature of roofing in the summer by as much as 60 degrees.

Another cool roofing guideline in California involves its **2005 version of California Energy Commission Title 24**. The roof is part of a whole energy budget for the building. The prescriptive approach criteria mandates 0.70 reflectance and 0.75 emittance values. A performance-based approach allows for lower values, but then other adjustments must be made to compensate for the different value in the energy budget. Any roof that is not

labeled by the Cool Roof Rating Council (see related article) will automatically be given a reflectance rating of 0.1.

In Texas, the **Oncor Electric Delivery Co.** has its own values for cool roofing and has developed an incentive program for contractors and customers who use retrofit roofing products that save a minimum of 20kW during peak electric demand. The roofs must be Energy Star certified and have an initial reflectance of at least 0.65 and a 0.55 reflectance after three years. The roof must have a minimum slope of 2:12 and a minimum of a 10-year life span. The program is open to large customers with a demand load of over 100kW.

**Energy Star** requires low-slope roofing must have a minimum initial reflectance of 0.65 and greater than 0.50 after three years of service in normal conditions. For steep-slope roofs, the initial reflectance must be at least 0.25, and greater than 0.15 after three years. Energy Star certification does not have a minimum emissivity rating.

**The City of Chicago**, which has been deeply interested in the topic of cool roofing, has set its standard at a 0.25 reflectance rating for both new and weathered steep-sloped roofing. It also has no minimum emissivity requirement. These standards govern low to moderate sloped roofing that is installed prior to the end of 2008. After that time, all roofs must meet Energy Star labeling qualifications.

As with the many different cool roof requirements, there are many products that may be considered as cool roof materials. These include light-colored elastomeric and other types of membranes and coatings, BUR, cement tile, and painted metal roofing.

For metal roofing, the type of paint finish is a major factor in determining whether or not it is a cool roof. Painted metal tends to have a higher emissivity than bare metal, according to the Cool Metal Roofing Coalition, regardless of the type of metal used. Therefore, many coatings manufacturers have been actively working on developing more highly-reflective paint finishes for metal panels. These are known as IR (infrared radiation) reflective coatings.

The reflective paints are made from inorganic pigments. They differ from organic pigments in that they exhibit a greater durability against color change and the elements. For extremely demanding applications, special

Complex Inorganic Color Pigments are used. These pigments have a higher reflectivity than standard finishes. This allows manufacturers to provide colors other than white which meet reflectivity standards. A larger selection of colors will enable designers and building owners to take advantage of cool metal roof products, yet still achieve the architectural effect desired.

Other pigments are currently being researched for even greater reflectivity.