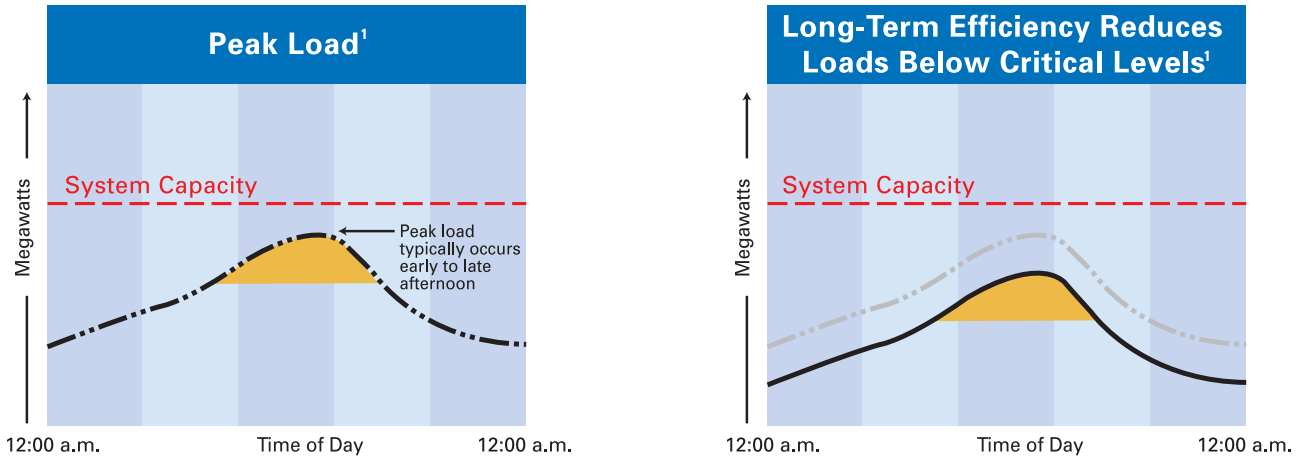
Understanding Cool Roofs

Many factors affect the indoor temperature of a building and ultimately our comfort as building occupants. Environmental factors such as sunshine, clouds, humidity and wind speed all impact the building envelope causing a temperature change. The first line of defense for a building is the material selection and placement in the building envelope.

Highly infrared emissive and solar reflective roofing surfaces can help save money in air-conditioning costs because less heat is transferred into the building. Increased insulation can also mitigate this heat transfer. This translates into less cooling to keep people comfortable. This is especially true on hot afternoons in peak energy periods, such as 3 p.m. in the middle of July on a 90°F day. Lower peak usage helps to reduce the chance of rolling power outages, which means businesses stay up and running.



1 Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory, a DOE national laboratory, DOE/GO-102002-1613, September, 2001.

The Role of Reflectivity and Emissivity in Cool Roofs

In order to help better understand the concept of cool roofs, we need to understand reflectivity and emissivity.

Reflectivity

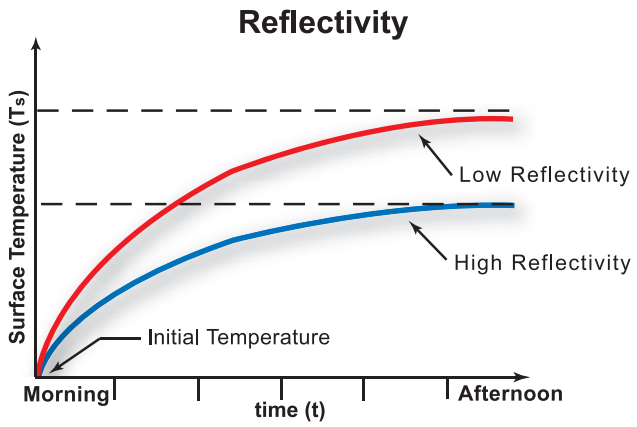
Solar reflectivity (or reflectance) is the fraction of the solar energy that is reflected by the surface (i.e., roofing membrane) back to the sky. White membranes have the highest solar reflectivity, while black have the lowest.

Emissivity

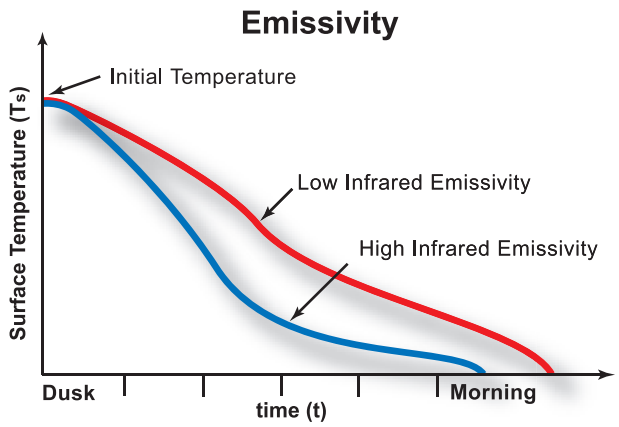
Infrared emissivity (or emittance) is a measure of the ability of a surface to shed some of its heat (in the form of infrared radiation) away from the surface (i.e., roofing membrane). High infrared emissivity helps keep surfaces cool. Metallic surfaces have a low infrared emissivity.

Conceptually, Figure 1 below demonstrates how the sun's solar radiation affects a product's reflective and emissive properties.

Figure 1. Illustrating Reflectivity and Emissivity



Conceptually, the above graph presents two products – one with high reflectivity, one with low reflectivity. During peak afternoon hours, the product with the higher reflectivity delivers a cooler roof top surface.



Conceptually, the above graph is presented to show that at dusk, when the sun's solar radiation diminishes, the higher emissive product dissipates stored heat at a faster rate than the lower emissive product.

Energy efficient material selection will impact indoor environmental comfort, which results in lower energy consumption and reduced demand during peak periods.

Figure 2 compares properties from three types of roofing products:

- White (cool) roof
- Aluminum-coated roof
- Dark roof

Highly reflective and highly emissive products, such as the white membrane, combined with the proper amount of roof insulation, offers a system that significantly reduces heat gain into the building.

Figure 2. Cool Roof Theory

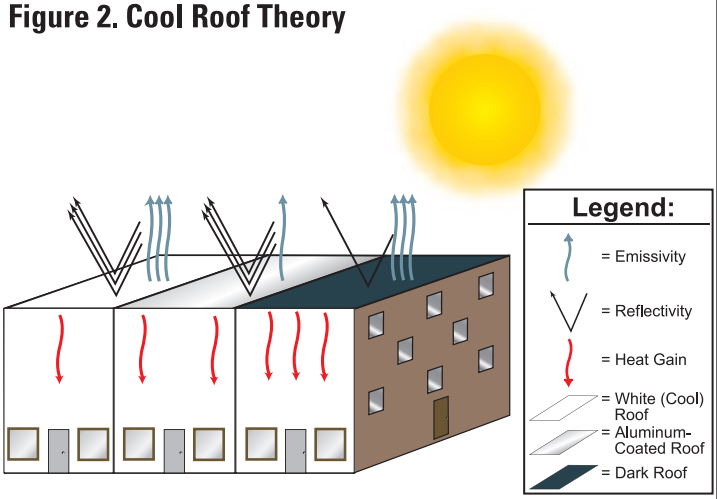


Figure 2 above is presented in a simplified form to illustrate the theory of cool roofs. There are many complex and related variables that must be considered when selecting the correct roofing product for the application.

Johns Manville

Roofing Systems Group
717 17th Street
Denver, CO 80202
1-800-654-3103
www.jm.com