BE COOL

THE COOL ROOF MOVEMENT IS SWEEPING THE NATION

PHOTO COURTESY OF GAF-ELK, WAYNE, N.J.

Whether you are an architect; a homeowner or building manager; or roofing manufacturer, contractor or specifier, the term "cool roof" is a phrase you probably have heard cropping up in recent years. More often, green building is becoming a mainstream design consideration, and cool roofs are a great overall energy-saving measure for the building envelope. Not just a trend, cool roofing currently is the fastest growing sector of the roofing industry. More people are choosing cool roofs because of their environmental benefits, including sizeable energy savings, urban-heat-island mitigation, decreased smog formation and extended roof life.

In the last decade, cool roofs have evolved from standard white coatings to encompass all sorts of product types and colors. From modified bitumen to single-ply, field-applied coatings to tile and shingle to metal, all roofing product types now come in "cool" varieties. Considering the variety of cool roofing options available and increasing energy costs, installing a cool roof virtually is a no-brainer.

Cool Roof Basics

What exactly is a cool roof? Cool roofs are highly reflective and easily can reradiate absorbed heat. As a result, they keep the roof surface cooler instead of transferring absorbed heat to the building below. The surface temperature of a typical dark roof can reach more than 70 F (39 C) above ambient temperature, whereas a cool roof will tend to stay much cooler—closer to 20 F (11 C) above the outside temperature.

A roof's coolness is determined by measuring two radiative properties: solar reflectance, the fraction of solar energy that is reflected by the roof, and thermal emittance, the relative ability of the roof surface to radiate absorbed heat. Both properties are measured as a fraction or percent, and the higher the value for both properties, the cooler the roof. A cool roof only refers to the properties of the surface material of a roof; insulation, while also important in reducing heat transfer to the building, is not included in the definition of a cool roof. A combination of a cool roof and insulation, however, can be an excellent way to increase a building's efficiency. There is no universal consensus regarding what minimum solar reflectance and thermal emittance make a roof cool. Minimum requirements are set by organizations that maintain building codes and voluntary green-building programs and can vary considerably.

As mentioned, there is no particular type of roof that is cool. What matters is how cool the surface temperature of the roof stays when it is exposed to the sun. Contrary to popular belief, cool roofs do not come in only white. Thus, using a cool roof on your building does not mean you must sacrifice desired aesthetics. In an effort to provide energy efficiency and aesthetic satisfaction, the latest cool-roof technology focuses on "cool color" products. Though dark-colored, these roofing products still are considered cool because they are highly reflective in the near-infrared (non-visible) portion of the solar spectrum. This allows the material to be more reflective and keep the roof surface cooler, as well as provides for more options when choosing a cool roof for a building.

In general, cool roofs perform similarly and have similar benefits, regardless of product type. These benefits include:

- cooler internal building temperature
- increased occupant comfort
- decreased need for air-conditioning equipment
- lower monthly cooling energy bills
- increased roof life expectancy
- numerous positive environmental impacts (See "Environmental Benefits of Cool Roofs," page 61.)

Cool roofs increase occupant comfort because light is reflected and heat is emitted from the roof surface. As a result, less heat is transferred to the building below, keeping the building cooler and at a more constant temperature. Because less heat enters the building through a cool roof, occupants find less need to use air-conditioning equipment. This decreased need for internal cooling results in less energy expended to cool the building each month, which in turn, means less out-of-pocket payment for building owners and occupants.

In addition to these invaluable benefits, research has shown that cool roofs may last longer than their non-cool counterparts. Extreme daily cycles of heating

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and cooling tend to wear out materials as they expand and contract with the temperature, but use of a cool-roof surface layer on a roof system tends to slow down the rate of degradation. This is because a cool roof keeps the roof at a more constant temperature throughout the day, and the reduced thermal stress prolongs roof life.

Many advances in technology can help us design and build more energy-efficient, environmentally healthy and beautiful buildings. Cool roofing is one design option that should be widely considered. Cool roofs easily can be incorporated into building designs to achieve cost-effective energy savings while still fitting within a designer's aesthetic image. The images displayed throughout this supplement provide striking examples of how energy efficiency and design can work together seamlessly to form better buildings while considering the environment.

ENVIRONMENTAL BENEFITS OF COOL ROOFS

Cool roofs carry many environmental benefits, including sizeable energy savings, urban-heat-island mitigation, decreased smog formation, and recycled and/or recyclable content. Some benefits are universal to all cool-roofing products and some vary by product type and manufacturer/brand.

Energy Savings and Global-warming Mitigation

It is no secret that as we make our way in the new millennium, we find ourselves entangled in a major energy crisis. Our growing energy consumption has resulted in a drastic increase in air pollution and a depletion of natural resources and is viewed by many as the primary cause of global warming. In an effort to address these concerns and rising energy prices, many people are introducing environmentally friendly practices into their building design. Yet many architects and roof specifiers are unaware that one simple and cost-effective way to reduce energy use is by using cool-roofing products. Especially in hot climates, using a cool roof substantially can reduce the amount of space conditioning needed during summer months. This equates to significant overall energy savings, sometimes as much as 50 percent, according to Energy Star, a program of the U.S. Department of Energy, Washington, D.C., and U.S. Environmental Protection Agency, Washington.

By using less energy during the hottest parts of the day (and year), cool roofs reduce energy demand when it tends to be at its highest. During these peak periods, energy also tends to come from the most polluting sources; therefore, reducing energy use by installing a cool roof reduces the amount of carbon-dioxide emissions and other air pollution caused by electric generation. Reducing CO_2 emissions helps mitigate global warming.

State and city codes are beginning to recognize how important cool roofs are to overall building-envelope energy savings. Cool-roof requirements have been adopted by Chicago and the state of California. They also are being considered in other areas.

Urban Heat Island and Smog Reduction

Another way cool roofs can positively impact our environment is by decreasing the urban-heat-island effect. An urban-heat island refers to a metropolitan area that is significantly warmer than surrounding areas. The urban-heat-island effect is caused by the presence of many dark surfaces, such as roofs and roads, that absorb heat from the sun and a lack of shading vegetation. It is for this reason that one may notice within just a few miles outside of city limits, the air usually is cooler and more comfortable during hot days, especially in the evening.

Smog forms more quickly at higher temperatures, which is why these urban-heat islands tend to develop much more smog than the surrounding countryside. Cool roofs reduce ambient temperatures, mitigating the problem. Green roofs also can improve temperature conditions in an urban-heat island. (For more information, see "Cool Roofs vs. Green Roofs," page 70.)

Recycled and/or Recyclable Materials

Many individual cool-roof products have integrated additional environmental benefits into their formulations. For instance, many metal products and synthetic shakes are at least partially manufactured from recycled content. Some products also are designed to be fully recycled at the end of their useful life. Recycling materials means fewer new resources are necessary, which often reduces energy consumption and puts less pressure on overflowing landfills.

COOL ROOFING ACROSS CLIMATE ZONES

Is a cool roof beneficial where I live? This question can be a tricky one to answer because climate zones vary so greatly across the U.S. and all over the world. A simple answer is that cool roofs are most beneficial in climates with hot summer months, which necessitate frequent use of air-conditioning equipment.

For example, in Tucson, Ariz., white roofs are commonplace for good reason. In summer, the average daytime temperature is 99 F (37 C), and the average nighttime temperature is about 70 F (21/21 C). In winter months, Tucson's temperature fluctuates between 66 and 33 F (19 and 0.5 C) from day to night, respectively. In a climate with such stifling temperatures, use of cooling equipment is a frequent craving if not a downright necessity. Tucson citizens and their wallets stand to benefit immensely from cool roofs. However, climates with less extreme heat temperature peaks can benefit from cool roofs, as well. Virtually any building in any climate can benefit, but the range of energy savings will vary from location to location, depending on whether a building frequently uses cooling equipment.

There is a pervasive assumption that cool roofs increase energy consumption in the winter heating season; however, the actual negative impact is minimal. This is because there are less hours of daylight in winter, and the sun is lower to the horizon and much less intense, resulting in less direct radiation striking the roof surface. Also, there often is snow covering the roof and more overcast days during the winter. In some cases there is a slight increase in heating costs for buildings in cooler regions, but the energy savings from decreased cooling equipment use in summer tends to more than compensate for any increased heating expenses. Cool roofs usually provide significant net annual energy savings.

Although ASHRAE 90.1 only recommends cool roofs in climate zones 1, 2 and 3 (the southern U.S. states), cool roofs can be beneficial in other places, too. Take Chicago, for example, which is in none of the above-mentioned zones. Chicago winters are cold and windy, but summers are hot and humid and many city dwellers use cooling equipment. Recognizing the benefit of cool roofs, Chicago enacted a cool-roof ordinance as part of its building energy code in 2003.

Another valuable tool for determining the benefits of using a cool roof in a particular area is an energy-savings calculator. The U.S. Department of Energy, Washington, D.C., and U.S. Environmental Protection Agency, Washington, have created energy-savings calculators for this purpose.

In general, it is a good idea to consult with your contractor or roof consultant about your specific climate region and the viability of cool roofing in your area.

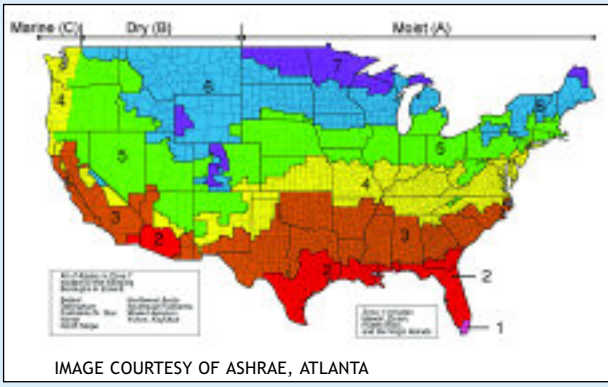

IMAGE COURTESY OF ASHRAE, ATLANTA

There is a pervasive assumption that cool roofs increase energy consumption in the winter heating season; however, the actual negative impact is minimal.

COOL ROOF RATING PROGRAMS

As more cool-roof products become available and codes and programs specify cool roofs, it becomes more difficult to discern what products qualify as cool and which are most appropriate for a specific project. Roof rating programs provide a source of radiative performance data for roofing products and a means for exploring and comparing different roofing options.

There currently are two nationally recognized cool-roof rating programs in the U.S.: the Oakland, Calif.-based Cool Roof Rating Council's Product Rating Program and the Washington, D.C.-based U.S. Environmental Protection Agency's Energy Star Reflective Roof Program. Both are useful tools for choosing the right cool roof for a project.

Cool Roof Rating Council

CRRC is a nonprofit membership organization whose mission is to provide accurate and credible third-party information about the radiative properties of roofing materials. CRRC is the only rating system providing independently verified roof-performance data.

CRRC's Product Rating Program measures and reports the initial and aged solar reflectance and thermal emittance of roof products. Any product can be rated with CRRC as long as it is tested in accordance with the CRRC's Product Rating Program. Companies can choose to become licensed with CRRC and test their products using one of CRRC's accredited independent testing laboratories. CRRC-rated products are listed in the online CRRC Rated Products Directory, and licensed companies may use the CRRC Product Label on their CRRC-rated product or product packaging.

The CRRC Rated Products Directory is available free to the public, in a searchable, sortable format. The directory lists the seller, brand and model name, product type, slope application, CRRC product identification number, and initial and three-year-aged solar-reflectance and thermal-emittance values. Architects, roofing specifiers and others can use the directory to find a variety of roofing options to meet their specifications. CRRC operates a Random Testing Program to verify that products sold reflect their lab-tested values.

CRRC does not set a definition for cool, nor does it set minimum solar reflectance and thermal-emittance requirements. Code bodies and programs set their own requirements and may reference the CRRC's rating system as a reliable source of roofing product data. For example, the Sacramento-based California Energy Commission's Building Energy Code, Title 24, relies on CRRC as the sole supervisory rating entity for its cool-roof prescriptive requirement.

Energy Star

EPA and DOE's Energy Star Reflective Roof Program is complementary to CRRC's Product Rating Program. The Energy Star certification mark is widely recognized by homeowners and architects as an indication of energy-efficient products.

Unlike CRRC, Energy Star does set minimum requirements for solar reflectance that a product must meet to qualify for an Energy Star rating. The requirements for solar reflectance are as follows: Low-slope roofs must have an initial solar reflectance greater than or equal to 0.65, and after three years, the solar reflectance must be greater than or equal to 0.50. Steep-slope roofs must have an initial solar reflectance greater than or equal to 0.25, and after three years, the solar reflectance must be greater than or equal to 0.15. As of Jan. 1, Energy Star now also requires measurement and reporting of thermal emittance but does not set a minimum requirement for qualification.

Energy Star allows a manufacturer to provide its reflectance and emittance data testing in accordance with Energy Star's guidelines. For aged ratings, Energy Star allows manufacturers to collect data from installed roofs that have been in place for more than three years. Energy Star also will accept CRRC data as long as it meets Energy Star's minimum solar-reflectance requirement.

EPA created an online Roofing Comparison Calculator that estimates the net energy and cost savings for installing an Energy Star-rated roof product. This tool can help determine if a cool roof is a good strategy for a particular building by calculating how much energy and money a product with a specific solar reflectance will save. The calculator requests information about building details, heating-and-cooling systems, existing and proposed roofs, and location. Once this information is submitted, the calculator lists a short summary of cost and energy savings.

GREEN-BUILDING RATING PROGRAMS

Several organizations have developed voluntary guidelines and certification programs aimed at reducing the environmental impact of buildings. Many of these green-building rating programs, such as LEED and Green Globes, recognize and give credit for the integration of a cool roof in the building design.

More building owners and architects are using these systems, and several jurisdictions have adopted these green-building programs as mandatory requirements for municipal buildings, including Atlanta, the state of California, New York City and Seattle. These programs allow architects to set and reach specific energy, health and environmental goals to improve the quality of buildings and the well-being of their occupants.

USGBC's LEED Program

The LEED program is the Washington, D.C.-based U.S. Green Building Council''s voluntary certification program for green buildings. LEED has several rating systems that address different building types, including for new construction and major renovations (LEED-NC) and existing buildings (LEED-EB).

LEED-NC Version 2.2 awards a point for a cool roof under Sustainable Sites Credit 7.2, Heat Island Effect: Roof. LEED-NC credits roofs with Solar Reflectance Index values greater than or equal to 78 for low-slope roofs and greater than or equal to 29 for steep-slope roofs. LEED-NC references CRRC as a source of product ratings though it does not require the product to be CRRC-rated.

LEED-EB Version 2.0 awards a point for a cool roof under Sustainable Sites Credit 6.2, Heat Island Reduction: Roof. To receive a LEED-EB point, the roofing material must be Energy Star compliant and must be rated with a minimum thermal emittance of 0.90.

LEED for Neighborhood Development currently is in its pilot phase and scheduled to be launched in 2009. LEED-ND awards a point for a cool roof under Green Construction and Technology Credit 10, Heat Island Reduction. A roofing material that covers a minimum of 75 percent of the roof surface of all buildings within the project and maintains an SRI value greater than or equal to 78 for low-slope roofs and 29 or greater for steep-slope roofs will receive a LEED point.

Green Globes

Initially developed in Canada, the Portland, Ore.-based Green Building Initiative sponsors the Green Globes system in the U.S. Green Globes V.1 Rating System is an online, questionnaire-based green-building rating system, which allots up to 115 points for different measures in several categories. Under the Site category, up to 10 points can be earned for using high-albedo, or cool, roof surfacing. To earn this credit, Green Globes requires an SRI value greater than or equal to 78 for low-slope roofs and 29 for steep-slope roofs. The number of points is awarded based on the percent of the roof covered with cool-roof material.

PHOTO COURTESY OF HYDRO-STOP INC., CHARLESTON, S.C.

BUILDING CODES

Building energy-efficiency codes set minimum standards for energy efficiency in new construction. Two primary organizations, the Washington, D.C.-based International Code Council and Atlanta-based American Society of Heating Refrigerating and Air-Conditioning Engineers Inc. have developed National Model Energy Codes. ICC references ASHRAE's standards, which are described in more detail below. These documents are not mandatory or enforceable until a jurisdiction adopts them as part of regulation or law. In the U.S., most states and jurisdictions have adopted these organizations' codes while others, like California, have developed their own.

A cool roof is not mandatory to comply with TITLE 24, but if a cool roof is not used, the designer must compensate with other comparable energy-saving measures.

ASHRAE 90.1 and 90.2

ASHRAE maintains standards to define acceptable building performance levels. ASHRAE Standard 90.1-2004, "Energy Standard for Buildings Except Low-Rise Residential Buildings," section 5.3.1.1, allows reduced roof insulation (U-factor) if a cool roof is used. ASHRAE 90.1-2004 defines a cool roof as having a minimum solar reflectance of 0.70 and minimum thermal emittance of 0.75. This allowance is permitted in climate zones 1, 2 and 3 only (the southern U.S. states).

ASHRAE 90.2-2007, "Energy Efficient Design of Low-Rise Residential Buildings," section 5.5, also allows for reduced roof insulation with a cool roof, citing a minimum solar reflectance at 0.65 and a minimum thermal emittance of 0.75 or a Solar Reflectance Index value of 75 or greater. Section 5.5 also states values for solar reflectance and thermal emittance should be determined by a laboratory accredited by a nationally recognized organization; the Oakland, Calif.-based Cool Roof Rating Council's Product Rating Program is cited as an example. The reduced insulation allowance is

permitted in climate zones 1, 2 and 3 only. Currently ASHRAE standards 90.1 and 90.2 are under revision. The revised standards will take effect in 2010. The CRRC Product Rating Program maintains its reference in the draft version.

California Title 24

As of October 2005, the Sacramento-based California Energy Commission's Building Energy Standard, Title 24, includes a cool-roof prescriptive requirement for low-slope roofs, those less than 2:12 (9 degrees), and nonresidential roofs for new construction and major reroofing. A cool roof is not mandatory to comply with Title 24, but if a cool roof is not used, the designer must compensate with other comparable energy-saving measures.

Title 24 requires that cool roofs be tested and labeled by CRRC. Title 24 defines a cool roof as, "Any roofing product with an initial thermal emittance greater than or equal to 0.75 when tested in accordance with CRRC-1 [and] a minimum initial solar reflectance of 0.70 when tested in accordance with CRRC-1." However, Title 24 makes limited exceptions for clay and concrete tiles and products with low thermal emittance and comparatively high solar reflectance.

At press time, CEC was conducting a rulemaking for the 2008 update to Title 24. CEC's draft language proposes adding cool-roof prescriptive requirements to steep-slope and residential applications that will vary by climate zone. Once finalized, the updated version should take effect in spring 2009.

EXAMINING THE COOL ROOF RATING COUNCIL

The Oakland, Calif.-based Cool Roof Rating Council is incorporated as a nonprofit, educational organization to implement a fair and credible radiative-property rating system and support research and education relating to cool roofs. Interested parties, such as building code bodies, energy-service providers, architects and specifiers, property owners and community planners may choose to use the CRRC Rated Products Directory to find roofing products.

CRRC is able to provide accurate, credible information through its use of third-party accredited independent testing laboratories, or AITLs, and its standardized testing procedures. Another crucial component to ensuring product ratings are upheld in the marketplace is through CRRC's Random Testing Program. CRRC Rated Product Directory users can reference listed product ratings with confidence because they are subject to random testing from the marketplace to ensure the integrity of the product rating.

In addition to verifying that rated products meet their initial test measurements, CRRC also verifies the consistency of its AITLs on an annual basis. Every year, several samples of different product types are circulated to each AITL for testing. This process verifies that the laboratories yield consistent measurements on the same sample, ensuring the ratings are reliable regardless of which lab performed the initial tests.

ANSI Consensus Process

CRRC currently is in the process of pursuing accreditation to become a Washington-based American National Standards Institute Accredited Standards Developer. Once this application is

complete, CRRC will submit the *Product Rating Program Manual*, also known as *CRRC-1*, as an American National Standard. In accordance with ANSI's Essential Requirements, CRRC is committed to an open, fair and public review process.

Ongoing Technical Development

CRRC continues to update its Product Rating Program to address new technical concerns. CRRC currently is looking at the effect of high-profile roofing, such as tile and shaped metal products, on solar reflectance and will work on developing a specific methodology to rate high-profile products in the coming months

This year, CRRC also implemented a requirement that field-applied coatings must be applied within 10 percent of the manufacturer's recommended thickness for initial testing. CRRC now verifies the coating thickness using the thickness measurement technique in ASTM D1669-07,

→ SRI CALCULATOR

Certain energy standards and voluntary programs, including ASHRAE 90.1; Washington, D.C.-based U.S. Green Building Council's LEED; and Portland, Ore.-based Green Building Initiative's Green Globes, require minimum Solar Reflectance Index values. The concept of SRI was developed by Dr. Hashem Akbari of Lawrence Berkeley National Laboratory, Berkeley, Calif., and is an estimate of the roof surface temperature at standard conditions. It is calculated in accordance with ASTM E1980 using solar reflectance, thermal emittance and wind-speed values and compares the material to a reference white and reference black material. In the past year, USGBC also developed an SRI calculator for LEED. Visit www.usgbc.org/DisplayPage.aspx?CMSPageID=1447 and click on the NC2.2 SS link and open the file for credit 7.2.

PHOTOS COURTESY OF EAGLE ROOFING PRODUCTS, RIALTO, CALIF.

"Standard Practice for Preparation of Test Panels for Accelerated and Outdoor Weathering of Bituminous Coatings." CRRC also is currently collaborating with the Reflective Roof Coatings Institute, Kansas City, Mo., and Roof Coatings Manufacturers Association, Washington, to study the effects of coating substrate and film thickness on solar reflectance over time. CRRC strives to adequately address the concerns and requests of all stakeholders.

Color Family Program for Metal Products

In an effort to make CRRC's Product Rating Program more viable for metal roofing, which includes thousands of available colors, CRRC worked with the Cool Metal Roofing Coalition, Pittsburgh, to develop its Color Family Program. This program defines 17 color families. Each family occupies a color space defined by a given range of colorimetry measurements; each color family is also given a minimum default solar reflectance and thermal emittance value.

For each binder/resin technology, the manufacturer only has to conduct initial and aged testing on one representative element per color family group. Only initial measurements are required for each additional representative color family product rated per manufacturer. Through the Color Family Program, factory-applied coating and metal-panel manufacturers have the option of rating similar products together as a group, though they must accept the default solar reflectance and thermal emittance as a minimum value.

Aged Ratings

In 2003, CRRC instituted its aged-rating component, and the first products were placed on test farms for weathering exposure. In December 2006, the first aged products were removed from the test farms, and the first aged results were added to the CRRC Rated Product Directory. Now directory users have the added benefit of looking at a product's performance after three years.

To obtain CRRC aged ratings, product samples used for initial testing are sent to test farm locations in three different climate zones for three years. The weathering locations are a dry, intensely hot climate, like Arizona; a cooler, rainy climate where there is pollution and soot, like Ohio; and a hot, humid climate where algae growth is prevalent, like Florida. Together these varied locations approximate the U.S.'s climate variations to allow for an accurate picture of the different ways a roofing product might react to the elements after prolonged exposure. Upon removal, they are retested unwashed, and the aged ratings are determined as an average from all three sites.

USEFUL LINKS

- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS INC., Atlanta, www.ashrae.org/technology/page/548
- CALIFORNIA ENERGY CODE TITLE 24 UPDATES, www.energy.ca.gov/title24/2005standards/index.html
- COOL ROOF RATING COUNCIL, Oakland, Calif., www.coolroofs.org
- ENERGY STAR REFLECTIVE ROOF PROGRAM, www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products
- GREEN GLOBES FROM THE GREEN BUILDING INITIATIVE, Portland, Ore., www.greenglobes.com
- LEED FROM THE U.S. GREEN BUILDING COUNCIL , Washington, D.C., http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222
- LEED'S SRI CALCULATOR (Click on the NC2.2 SS link and open the file for credit 7.2.), www.usgbc.org/DisplayPage.aspx?CMSPageID=1447
- ROOF CONSULTANTS INSTITUTE, Raleigh, N.C., www.rci-online.org
- U.S. DEPARTMENT OF ENERGY COOL ROOF CALCULATOR, www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm
- U.S. ENVIRONMENTAL PROTECTION AGENCY COOL ROOF CALCULATOR, roofcalc.cadmusdev.com/RoofCalcBuildingInput.aspx

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PHOTO COURTESY OF HYDRO-STOP INC.

PHOTO COURTESY OF HYDRO-STOP INC.

Cool roofs are HIGHLY REFLECTIVE and easily can reradiate absorbed heat. As a result, they keep the roof surface cooler instead of transferring absorbed heat to the building below.

Most types of products tend to decrease in solar reflectance during the three-year period, especially products with a higher initial solar reflectance, because they accumulate dirt and soot on their surface. The aged thermal emittance measurements tend to remain about the same.

Education and Outreach

Part of CRRC's mission is to provide education about the benefits of cool roofing. CRRC is reaching more individuals by attending numerous roofing and green-building trade shows each year. The organization also educates individuals through publications. As a result, more roofing specifiers are aware of the benefits of cool roofs and how the CRRC Rated Product Directory can help find roofing products.

Consider becoming a CRRC member. CRRC members can help steer the actions of the CRRC by voting at annual membership meetings, joining one of several committees or running for a position on the board of directors. Joining CRRC also enables members to keep abreast of new developments in the fastest-growing sector of the roofing industry.

COOL ROOFS VS. GREEN ROOFS

People often confuse cool roofs and green roofs. While they are both "green," the two terms refer to distinct roofing types. A cool roof refers to a roofing surface intended to reflect a significant portion of the sun's heat away from a building. In contrast, a

KEY WORD GLOSSARY

(Definitions are from the Cool Roof Rating Council's Product Rating Program Manual, *or* CRRC-1.*)*

ACCREDITED INDEPENDENT TESTING LABORATORY (AITL) A testing laboratory that is CRRC accredited to test roofing products and is completely independent from any Licensed Seller or licensed Other Manufacturer.

COLOR FAMILY GROUP One or more production-line, factory-applied metal coatings or factory-coated metal roofing products that are rated by one CRRC licensed roofing company and have the same binder/resin technology and color properties and radiative properties that fall within the ranges established for the respective CRRC color family. All color family elements within a single Color Family Group are assigned the same CRRC product identification number.

THERMAL EMITTANCE The ratio of the radiant heat flux emitted by a sample to that emitted by a blackbody radiator at the same temperature, or, more simply, the relative ability of the roof surface to radiate absorbed heat.

LOW-SLOPE ROOF Surfaces with a slope of 2:12 inches (9 degrees) or less.

RADIATIVE PROPERTIES The solar reflectance and thermal emittance of a roofing product.

SOLAR REFLECTANCE INDEX (SRI) The relative steady-state surface temperature (T) of a surface with respect to the standard white (SRI=100) and standard black (SRI=0) under the standard solar and ambient conditions according to ASTM E-1980, "Standard Test Method for Color of Transparent Liquids."

SOLAR REFLECTANCE The ratio of the reflected flux to the incident flux; simply put, the fraction of solar energy that is reflected by the roof.

STEEP-SLOPE ROOF Roof surfaces with a slope of greater than 2:12 inches (9 degrees).

PHOTOS COURTESY OF GAF-ELK

green roof, also known as a living roof, ecoroof or vegetated roof, is partially or completely covered with a layer of soil and vegetation, planted over a waterproof substrate. Green roofs are not rated by cool-roof rating systems because the solar reflectance and thermal emittance measurements are not important properties for green roofs.

Like cool roofs, green roofs help keep the roof surface cool and prevent heat transfer to the building below. Benefits of green roofs can be similar to the benefits of cool roofs. These include increased occupant comfort, reduced need for air-conditioning and heating, and reduction of the urban-heat-island effect. Green roofs' vegetation protects roof membranes by shielding the membranes from UV radiation and extreme temperature fluctuations. In addition, green roofs reduce storm-water runoff while filtering pollutants out of the air and rainwater. They also provide a valuable space for building occupants to grow edibles and native species.

When considering green roofs in your design plans, it is important to remember that they generally have more structural demands to support the extra weight of the soil and vegetation and may require additional maintenance considerations, including irrigation. Before specifying a green roof, check with a roof consultant about the feasibility and practicality of using a green roof on your building.

COOL ROOF RATING COUNCIL

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