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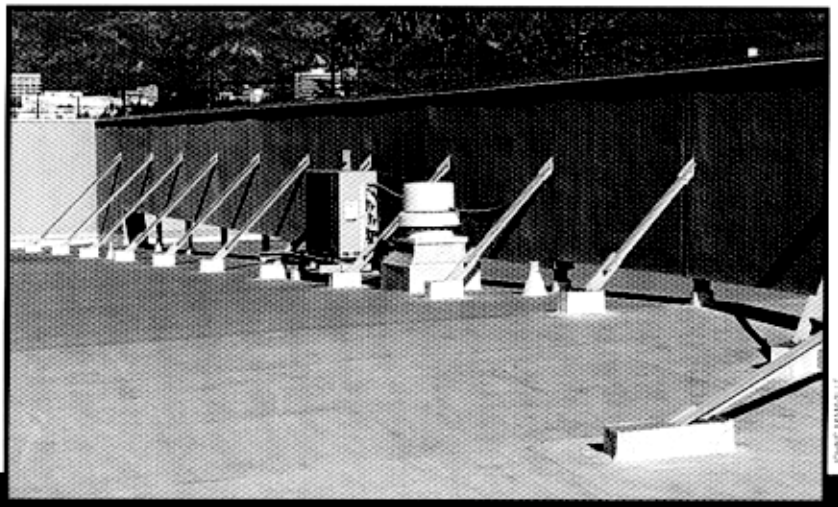
Does your facility contribute to the $40 billion spent on cooling annually? thanks to reflective roof products, it doesn't have to

Sitting on Sa

— by Barbara L. Vergetis Lundin, editor

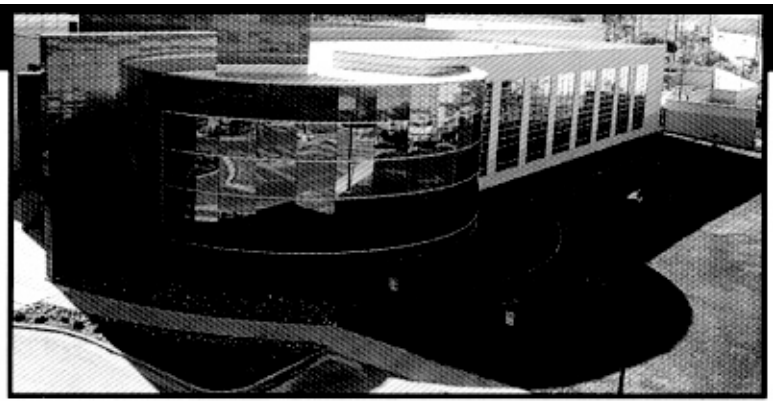
APPROXIMATELY $40 BILLION IS SPENT ANNUALLY IN THE United States to air condition buildings, according to the U.S. Environmental Protection Agency (EPA). This represents one-sixth of all electricity generated in the United States each year. But there is a way for facility professionals to cut those costs. By using reflective roof products, specifically designed to reflect solar radiation, roof surface temperatures can be lowered by up to 100 F, according to EPA experts.

Roofing products should meet two criteria: They should be reflective — a measure of how much light energy is reflected away from the roofing material rather than absorbed — and they should have high emissivity — a measure of how fast absorbed energy is emitted back into the atmosphere.



JOHNS MANVILLE

Clini-Lab in Pasadena, Calif., was a good candidate for reflective roofing because the old roof had many penetrations and pitch pockets.



JOHNS MANVILLE

DIRECTV chose reflective roof products for a remodeling project at their Culver City, Calif., location.

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RESEARCH SAYS The Florida Solar Energy Center has found that light colors are an effective means of reducing the peak demand for cool energy in buildings.

One surprising finding of the Florida Solar Energy Center's research is the role air distribution systems play in cooling energy usage. In Florida, the air distribution system is typically installed in the plenum space between the roof deck and the dropped ceiling over the finished interior space. In that space, air ducts distributing cooled air of 55 F can be exposed to temperatures of 120 F under a dark-colored roof deck. If the roof is covered with a white reflective material, such as a single-ply membrane, that plenum air space temperature drops to 90 F — reducing the cooled air temperature differential by almost half.

The EPA echoes these findings with the results of its studies: A reflective roof can reduce the amount of energy needed for cooling by up to 50 percent and reduce peak cooling demand by 10 to 15 percent, enabling facility professionals to purchase smaller, less expensive HVAC systems.

One caveat: "Savings should be calculated on a case-by-case basis because of varying levels of roof insulation, the solar reflectance and infrared emittance of the roof product, and the climate of the building," suggests Brian Gish, manager, chemical engineering, Carlisle SynTec Incorporated,.

REDUCING HEAT BUILD UP Reflective roof products reduce the heat build-up caused by dark-colored roof products. "As the roof system absorbs the sun's energy, it acts as a large heat sink," says Bob Nelson, director of engineering services, Duro-Last Roofing, Inc. "Depending on the color — black being the worst — the temperature rise within the roofing system can be double the ambient air temperature." So, on a 90 degree F day, the roofing system can reach temperatures exceeding 150 F.

By applying reflective roof coatings, facility professionals can save 20 to 70 percent of the cooling energy used in the building — a savings of .20 to .70 cents per square foot, a study by Lawrence Berkeley National Laboratory's Building Energy Analysis Program shows.

Further, reflective roof coatings slow down the aging process of the underlying roof materials, says Benjamin Heilbrunn, president, Ace Coating Co., Inc.

Reflective coatings also reduce the amount of heat absorbed by the roof, thereby reducing energy consumption and thermal shock — damage caused by large, rapid fluctuations in temperature.

Facilities are good candidates for reflective roofs if they have fairly low insulation levels; high cooling costs; a large roof surface compared to the overall size of the building; and reside in a hot, sunny location.

Other good candidates are large, one-story, air-con-


STEVENS ROOFING

Light colors are an effective means of reducing the peak demand for cool energy in buildings.

ditioned buildings like supermarkets or department stores located in areas that encounter more cooling degree days than heating degree days, says Kevin Foley, national accounts manager, Sarnafil Inc.

"The potential energy savings for this building type is enormous, because the roof represents a majority of the heat gain," says Foley. "This type of building is characterized by constant air-conditioning use. The perpetual opening of doors when customers are entering or exiting exacerbates the need for more air conditioning."

Any building with low-slope roofing can also benefit. "Dead flat roofs will pond water, leaving areas of dirt on the surface that detract from its reflectivity," says Duro-Last's Nelson. "By providing slope — ¼-inch per foot minimum — most water will drain from the roof, keeping the membrane's reflective properties longer."

Roofs with little or no insulating value can see dramatic results. "A new highly reflective roofing membrane in combination with added insulation can reduce energy consumption, thereby reducing energy costs," says Nelson. "A building with a traditional built-up roof system with little insulating value can be effectively overlaid with a highly reflective single-ply roofing system, incorporating additional insulation and cutting cooling energy costs at least in half."

At facilities where budget is an issue, reflective roof products can be an asset. "Reflective roof products may prolong the need for roof replacement, enabling facilities with limited budgets to obtain a longer service life out of their existing roof systems while potentially lowering energy bills," says Chris Salazar, vice president of marketing and sales, Karnak Corporation.

URBAN HEAT ISLANDS Because of the increased use of dark, heat-absorbing building and construction materials — including dark roofing and cladding materials, parking lots and roads — and the corresponding reduction in the amount of natural tree cover that provides shade, higher temperatures result in urban areas. Cities can be 2 to 8 degrees warmer than the surrounding countryside. This is known as urban heat island effect. During the 1996 summer Olympics, for example, Atlanta was considerably hotter — up to 12 F on average — than the surrounding Georgia countryside. Additionally, hotter summer urban areas correlate to higher levels of ozone pollution. As cities and urban areas continue to grow, so have urban heat islands.

"Most U.S. cities experience relatively hot summer weather, regardless of location," says Michael L. Rew, manager, Technical and Guarantee Services, Johns Manville Roofing Systems Group. "The number of days that may be positively affected by reflective roof products can vary

depending on location, but almost all locations can benefit from reflective roofing products in urban environments."

One way to reduce the urban heat island effect is to use more white- and light-colored roofing materials, and plant more shade trees. In fact, a national program coordinated by American Forests and supported by the U.S. Department of Energy has been developed to do just that. Cool Communities has been designed to encourage facility professionals and building product manufacturers to plant more shade trees and to use more light-colored or "cool" construction materials.

Due to increased demand for reflective roof products, prices have come down

"Buildings that reflect the sun's energy do not absorb or emit as much heat as those buildings with black roofs. As a result, not only does the individual building owner save energy costs and put less demand on the power grid, but the building does not contribute to the urban heat island effect prevalent in many U.S. cities today," contends Tom Gallivan, marketing manager, Stevens Roofing Systems.

In addition to utility demand, there is a correlation between temperature and air quality, according to Gallivan. In Los Angeles, for example, for every degree the temperature raises above 70 F, the incidence of smog increases 3 percent. As temperatures decrease, so does pollution, as cool air holds less contaminants than hot air. Lawrence Berkeley National Laboratory researchers estimate that if all the buildings in greater Los Angeles had cool roof systems, the total energy and smog savings would be about half a billion dollars per year.

"The use of reflective roofing products in urban areas can reduce ambient summer temperatures by as much as 4 to 8 F," says Rew. "This not only reduces energy requirements for air-conditioning equipment but can significantly reduce the production of smog, positively impacting air quality."

The demand for reflective roof products has grown significantly over the past decade. "This has allowed manufacturers the opportunity to maximize production schedules," says Duro-Last's Nelson. "Coupled with strong competition, this has brought prices down to nearly match those of more traditional non-reflective roof products."

More importantly, when you conduct a true life-cycle

STEVENS ROOFING

Roof selection should keep in mind life cycle-costs, taking into account energy and environmental savings.

cost analysis factoring in energy consumption costs, roof installation labor and maintenance costs, white- or light-colored energy-efficient products become less expensive in the long run, says Stevens' Gallivan.

It's all about math. "Far too many roofing decisions are short-sighted, based on the lowest up-front cost," says Sarnafil's Foley. "But there are countless numbers of buildings whose conventional roofing systems have needed to be replaced within 10 years. On the other hand, there are proven, highly reflective roofing systems that might have required a 5 to 7 percent premium on day one, that have survived more than 30 years exposure to the elements."

Under a new paradigm in roofing, roof system selection will be made with more awareness to the roofs' entire life-cycle cost, taking into account energy and environmental savings and maintenance expenses, says Foley.

Reflective roof products come in a variety of forms from sheet goods to coated metal to roof coatings. Reflective roof products do not have to be white, but should be light colored. More important than reflectance of visible light is the reflectance of infrared or solar heat radiation, as it is a larger contributor to the heating of roofing materials than visible light. In addition to high reflectance, an energy-efficient roof material should have a high infrared emittance — a measure of the ability of a warm or hot material to release some of its heat in the form of infrared or heat radiation.

A new term has been developed recently — Solar Reflectance Index — which is a measure of the roof's ability to reject solar radiation as shown by a small tem-

Energy Star Roof Products

To encourage the use of energy-efficient reflective roof products, the EPA has developed the ENERGY STAR® Roof Products Program. Through this program, roof products that meet EPA specifications for solar reflectance and reliability will carry the ENERGY STAR label. EPA representatives expect that, at least initially, metal, single-ply membrane, and coating products will be most widely represented in this new roofing category.

The ENERGY STAR program works with manufacturers to label their products in such a way that it helps facility professionals determine ways to reduce energy consumption, according to Randy Rugg, marketing manager, United Coatings.

Under the ENERGY STAR Roof Products Program, products labeled as ENERGY STAR-compliant must have an initial solar reflectance value equal to or greater than 0.65 and must maintain a value equal to or greater than 0.50 under normal conditions for three years after installation. The manufacturer must also warrant against defects in materials or manufacturing based on the industry standard for comparable non-reflective roof products. Once self-certified, manufacturers can designate those specific products with the ENERGY STAR label. The program allows facility professionals to select products energy-efficient roof products more easily.

"Facility professionals should look for the ENERGY STAR label on roof products and product literature if they are interested in using materials that have proven minimum reflectivity standards," says Brian Gish, manager, chemical engineering, Carlisle SynTec Incorporated. "For maximum energy efficiency, facility professionals should inquire about the roof product's actual measured solar reflectance and it's solar reflectance index. Products are available in the industry that meet or exceed ENERGY STAR program requirements."

"The ENERGY STAR Roof Products Program provides building managers and facility professionals with tools and data that can help them make decisions based on factual data," says Chris Salazar, vice president of marketing and sales, Karnak Corporation. "They can justify the savings and the expense involved in obtaining the savings."

perature rise. It is an index that combines solar reflectance and infrared emittance. By definition, a standard black is valued at 0; a standard white is valued at 100. Roofing materials with the highest SRI are the coolest choices for roofing.

When specifying reflective roofing, products should have an initial reflectance equal to or greater than .65 and maintain a value equal to or greater than .5 after three years of performing under normal conditions. Many manufacturers are making this requirement easier to meet by developing products with even higher solar reflectance and infrared emittance ratings.

STANDARDS DEVELOPMENTS

The American Society of Testing and Materials (ASTM) has set standards for measuring the reflectivity of external building materials, such as white roofing. The ASTM's Cool Construction Materials Committee has developed a Solar Reflectance Index with values from 0 to 100, where 100 is defined as standard white and 0 is defined as standard black. The index measures a material's solar reflectance and thermal emissivity — the power to radiate heat from a surface.

ASTM has finalized standards to measure solar reflectance in the field and develop a comparative Solar Reflectance Index that can be used for all roofing systems. ASTM 1980 is the standard for calculating the solar reflectance index — both reflectivity and emissivity — and ASTM 1918 measures the reflectivity of larger flat or low-slope surfaces in the field, such as roofs.

Recent developments in roof coatings add to their attractiveness. An ASTM standard specification for "Liquid Applied Acrylic Coating Used in Roofing," ASTM D6083 is designed to benchmark acrylic roof coatings to assure facility. Fire retardants have been developed to help protect buildings and their contents. Higher tensile products are available to release dirt and keep roof reflectivity at higher levels for longer periods. High-performance, waterborne, acrylic coatings are replacing higher VOC solvent-borne coatings in many applications.

"Reflective roof coatings are fairly economical to apply and maintain," says United Coatings' Rugg. "In many instances, they don't require the old roof to be torn off and disposed of, they are sustainable, seamless, fully warranted and, within three or four years, facility professionals can save enough on energy bills to pay for the initial cost of labor and coating." ■

For more information on the EPA's ENERGY STAR Roof Products Program, call 888/STAR-YES. E-mail comments to bvl@tradepress.com.