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Back to Basics

From Cleaning to Collaboration in the Workplace

SUSTAINABILITY FEATURE:

Going Solar
Why PPAs are a Low-risk Choice

PAGE 50



Whether building owners and managers believe in global warming or not, the sustainability movement continues to grow and will ultimately encompass every commercial, industrial and retail structure. It is happening with increasing velocity. Smart property owners and managers should be preparing now for the inevitable rules and regulations designed to conserve energy and reduce carbon emissions and global warming.

While some U.S. states such as California are already adopting regulations for more stringent green building operations, others are watching these states closely to see what happens. Energy conservation and environmental protection are principles that have

been adopted by the Obama administration. As the world advances the green revolution, it is doubtful that the U.S. will stay on the sideline while other nations such as China (now the world's leading manufacturer of solar panels) fight global warming.

Moving ahead

While the U.S. still has a long way to go to be truly sustainable, the country is not lagging behind by much. Going green is a national movement that is taken seriously by many property owners and developers—and the rest will have to jump on board the green bandwagon, either by law, by consumer demand or to be considered a good corporate citizen. There are also significant economic benefits for building owners and managers to go green.

For instance, approximately US\$40 billion is spent annually in the United States just to cool buildings—accounting for one-sixth of all energy consumed annually. Other ma-

Beat the Heat with a Cool Roof

MICHAEL MAGALLANES



For consumers of energy in commercial and industrial buildings include manufacturing processes, waste disposal/recycling, water, transportation and operations. Being truly sustainable is a complex and challenging mission.

Tax incentives available

Through its Tax Incentive Assistance Project, the U.S. federal government is offering a tax deduction of up to US\$1.80 per square foot to owners or tenants (or designers, in the case of government-owned buildings) of new or existing commercial buildings that are constructed or reconstructed to save at least 50 percent of the heating, cooling, ventilation, water heating and interior lighting energy cost of a building that meets American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2001.

Only buildings covered by the scope of ASHRAE Standard 90.1-2001 are eligible. Partial deductions of US\$0.60 per square foot can be taken for improvements to one of three building systems that reduce total heating, cooling, ventilation, water heating and interior lighting energy use by a certain percentage—the building envelope (10 percent), lighting (20 percent), or heating and cooling system (20 percent). These deductions are available for buildings or systems placed in service from Jan. 1, 2006, through Dec. 31, 2013.

A basic alternative

While there are many different products and procedures available in an ever-expanding green marketplace, there are some basic yet effective steps that can be taken. At the top of the list is the cool roof, which can be implemented rather easily and at a very reasonable cost. Black and dark-colored roofing materials can dramatically increase a building's cooling load, while cool roofs reflect the sun's radiant energy before it penetrates into the interior of the building, thus reducing the load.

Energy-efficient cool roofing systems can significantly reduce roof temperature during the summer, thereby reducing the building's energy requirements for air-conditioning. This helps cut energy costs by keeping attics and ducts cooler, improving occupant comfort, cutting maintenance costs, increasing the lifecycle of the roof and reducing urban heat islands along with associated smog. In fact,

reflective materials can help keep a building's surrounding neighborhood cooler.

What is a cool roof?

Cool roofs are roofs consisting of materials that effectively reflect the sun's energy from the roof surface. Cool materials for low-slope roofs are mainly bright white in color, although non-white colors are starting to become available for roof applications. These roofs must also have high emissivity—allowing them to emit infrared energy.

Bare metals and metallic coatings tend to have low reflectivity and are not considered cool materials.

Solar reflectance and thermal emittance are the two measures used to determine the coolness of a roof. Solar Reflectance Index (SRI) of a roofing product is a method for determining the radiative properties of roofing materials. SRI is defined by ASTM Standard E1980-01; the U.S. Environmental Protection Agency (EPA) summarizes SRI



as “the relative steady-state surface temperature with respect to the standard white (SRI=100) and standard black (SRI=0) under the standard solar and ambient conditions.”

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White reflective coatings contain transparent polymeric materials—such as acrylic—and a white pigment—such as titanium dioxide (rutile)—to make them opaque and reflective. These coatings typically reflect 70 to 80 per-

cent of the sun’s energy. Despite the white appearance, these pigments absorb the 5 percent or so of the sun’s energy that falls in the ultraviolet spectrum. Thus, the pigments help protect the polymer material and the substrate underneath from ultraviolet damage. As long as the coating is white or light-colored, the roof will have high reflectance and emittance levels.

Factors to consider

If you as a building owner or manager decide to consider a cool roof, the following are factors to remember:

- When selecting a roof material, look for high solar reflectance, endurance of high reflectance over time and high emittance. High emittance lowers the roof temperature by increasing the release of heat by thermal radiation. For a high-reflective roof, avoid untreated metal roofs and aluminum coatings. If installing a metal roof, make sure it is painted a light color (not a clear coating) and is rated by the Cool Roof Rating Council.
- Avoid non-solar-reflective asphalt shingles or coatings, if your budget allows.

- Evaluate your climate. Do heating or cooling loads dominate your energy usage? If cooling dominates, you may be a good candidate for a new energy efficient roof.

Four categories of cool roofs

There are four broad categories of roofing materials that can be used to upgrade a roof’s reflectivity to ENERGY STAR® levels: metal, tile, roofing membranes and reflective coating. Of the four, a reflective coating may be the most economically achievable for existing buildings because it doesn’t require any significant retrofitting of the structure, which can be costly and time consuming.

Exact energy and money savings for each type of cool roof will depend on a number of factors—such as the type and efficiency of insulation in the ceilings and exterior walls; the windows; the efficiency of the cooling system; and, most importantly, the climate of the building’s location. A reflective coating can lower interior temperature of a commercial or industrial building by 8 to 12 degrees Fahrenheit during the hottest four hours of a summer day—noon to

Cool roofs: Sustainable programs and codes

A key set of codes for cool roofs has been established by ASHRAE in its Standard 90.1-2001. Other codes and rating systems are offered by the following organizations:

Cool Roof Rating Council

The Cool Roof Rating Council (CRRC) administers a rating program in which companies can label roof surface products with radiative property values. The CRRC does not set a minimum definition for cool but simply lists the measured radiative property values on its directory. However, a cool roof product that provides 70 percent reflectivity and 75 percent emissivity is effective. Any roofing product can be tested as long as it is in compliance with the Product Rating Program Manual (CRRC-1). All radiative property testing is conducted by accredited testing laboratories. Solar reflectance can be measured in accordance with ASTM test methods

C1549, E1918, E903 and CRRC-1 Method #1: Test Method for Certain Variegated Products. Thermal emittance is measured in accordance with ASTM C1371. A product’s placement on the directory does not mean that the product is cool as defined by any particular code body or program.

LEED®

Leadership in Energy and Environmental Design (LEED) is the U.S. Green Building Council’s green building rating system—a voluntary certification program for sustainable buildings. LEED for new construction and major renovations (LEED-NC - Version 2.2) gives credit for a cool roof under Sustainable Site Credit 7.2: Heat Island Effect: Roof. LEED-NC credits roofs with a SRI value greater than or equal to 78 for low-slope roofs, and 29 for steep-slope roofs. LEED for Existing Buildings (LEED-EB - Version 2) gives credit for a cool roof under Sustainable Site Credit 6.2: Heat Island Reduction: Roof. LEED-EB

gives credit for a roof that is an ENERGY STAR®-compliant roofing material that has a minimum thermal emittance of 0.90.

LEED-NC references the CRRC as a source of product ratings, though it does not require the product to be CRRC-rated. It permits other sources as well, such as the U.S. Environmental Protection Agency’s ENERGY STAR reflective roof program.

ENERGY STAR

ENERGY STAR-qualified roof products reflect more of the sun’s rays. This can lower roof surface temperature decreasing the amount of heat transferred into a building. Roof products qualify for the ENERGY STAR label based on their solar reflectance, without compromising product quality and performance. ENERGY STAR-labeled roofs are more common on commercial buildings but can also be used on residential homes.



4 p.m. Not only does the lower interior temperature help reduce energy costs, but it also improves worker productivity by creating a working environment that is more comfortable at a lower cost.

Some specific benefits of cool roofs are:

- Saving on annual electricity bills by reducing summer air conditioning costs;
- Saving peak electricity demand costs if you have time-of-use metering;
- Reducing roof maintenance and replacement expenses by extending roof life;
- Increasing indoor comfort in summer by reduction of infrared conversion from visible light;
- Reducing the “heat island effect” in cities and suburbs;

- Reducing air pollution and smog formation; and
- Reducing roofing waste added to landfills.

A benefit to surrounding neighborhoods

A cool roof not only benefits the building on which it is installed, but also the surrounding neighborhood. In the summer, major urban areas become heat islands where temperatures can soar 4 to 8 degrees Fahrenheit above the temperature in the surrounding area. This rise in temperature corresponds to a rise in harmful ozone—and therefore smog levels in the urban air. For every degree above 70 degrees Fahrenheit, the incidence of smog increases 3 percent.

However, a city populated with buildings with reflective roofs will not experience this effect as strongly. A recent study by the Law-

rence Berkeley National Laboratory’s Heat Island Group found that if the buildings in Los Angeles were upgraded with reflective roofs, the city could save US\$35 million per year in energy costs.

At the end of the day, cool roofs may be the best investment for property owners and managers as they pursue improved energy efficiency and sustainability. A cool roof is relatively inexpensive to apply and easy to maintain. And yet, a cool roof can significantly reduce the heat island effect, keep building interiors cooler without air-conditioning, and protect the roof for a longer life. **FMJ**



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