POSITION PAPER ON ROOF REFLECTIVITY

The use of reflective, or "cool," roofs has become a much-debated topic throughout the United States in the last several years, due to their presumed role in providing energy savings, reducing peak energy demand and mitigating the Urban Heat Island Effect. Many of these attributes are associated with the color of the roof's surface. The EPDM Roofing Association (ERA) believes that any evaluation of long-term energy savings, peak load reduction or mitigation of Urban Heat Island Effect must include the entire roof system. In addition, there has been a notable absence of any cost-benefit analysis in public policy discussions about reflective roofs, especially in the areas of reflective roof maintenance and displacement of certain products from the market. ERA believes that additional data on these topics are crucial for intelligent decision-making by the building design and construction communities or by public policy officials who may use reflective roofs as a regulatory tool.

Reflective or "Cool" Roofs

At this time, there is no single, agreed-upon definition of a reflective, or cool, roof. While all attempts at a definition address solar reflectance (or albedo), emittance is not always included. The most frequently referenced definition is that used in the Environmental Protection Agency's Energy Star Roofs Program; other definitions have originated in regulatory requirements considered in the City of Chicago and promulgated in the state of California.

ERA believes a uniform definition of a reflective or cool roof is a necessary first step in having an informed discussion on the subject. Further, ERA believes the overall roof system design; including thermal performance of the roof system should be the focus of the discussion. When assessing roof performance, R-values of the roof should always be included. Unfortunately, many buildings do not meet the energy standards of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). ERA believes strongly that energy performance including minimum insulation levels as defined in ASHRAE requirements should be a first consideration.

Validation of Energy-Savings Claims

There are widely varying energy savings claims resulting from the use of a cool roof. EPA's Energy Star Web site claims energy savings up to 50 percent, while certain manufacturers of cool roofing products have claimed savings of "up to 70 percent." It is not clear if these claims are summer cooling savings only or net savings that take into account energy penalties in buildings where there are significant heating loads. Compounding the problem is the availability of two government-agency sponsored "Cool Roof Calculators" -- by EPA and the Department of Energy --that produce different energy savings estimates with identical data input. This dilemma not only affects decision-makers such as architects and building owners, but also affects the manufacturers of all roofing products.

There is a loss of reflectivity values and energy savings due to degradation in the reflectance of roofs over time, attributable to aging and dirt accumulation. In addition, the costs of installing and maintaining cool roofs and restoring the reflectivity of the roof, need to be factored into considerations of the economic value of reflectivity. This is true especially where there is high reliance on the reflectivity to achieve reduced energy consumption, i.e., where high reflectance is used in lieu of added insulation values.

The confusion in the market about energy savings credited to reflective roofing systems has the potential for the misuse of reflective roofs, and consequently of eroding consumer confidence with appropriately installed reflective roofs. ERA understands that all computer models and other simulations of energy performance have limitations and may not truly reflect the performance of occupied buildings. Therefore, a clear description of assumptions that are used by government calculators to arrive at estimated energy savings associated with the use of reflective roofing systems is critical. In the residential market, where the Federal Trade Commission strictly regulates advertising claims of energy savings to consumers, the complexity of estimating the effective energy savings is even greater.

ERA believes that energy savings claims related to the use of reflective roofs, especially by government agencies, should be substantiated and integrated into a single, validated, transparent roof energy calculator. All underlying assumptions and mathematical models should be clearly stated. All limitations due to seasonal variation and geography should be described. This calculator should be capable of determining energy use over time as the components degrade from their initial values.

Regulatory and Other Government Initiatives

A number of government bodies, most notably the state of California and the City of Chicago, have taken action to require the use of reflective roofs as a means of saving energy. These initiatives result in a narrowing of choice for the consumer, which often eliminates roof systems that have been proven to perform over time. Alternate government choices that result in energy savings, such as non-reflective roofs with increased insulation, or non-reflective roofs with increased surface shading provided by the use of ballast, have not been adequately explored.

ERA believes communities and policymakers need to understand the entire energy balance of buildings and to use cool roofs as just one tool in determining energy performance. ERA believes that climate makes a substantial difference in the value of reflective roofs and the effect of reflectivity must be carefully considered before any requirements are in place. Additional information about the accumulated effect of energy savings, costs and environmental benefits is needed.

Reduction in Peak Energy Demand

The role of reflective roofs in reducing peak energy demand in the short term has been demonstrated in California. However, any long-term, consistent benefit depends on the manner in which reflective roofs are maintained. Dirt accumulation and aging can impact this benefit, as can the effects of other effluents. Care must also be taken when attempting to extend the California experience to other parts of the country. For example, it would appear that a cool roof would deliver the same reduction in peak energy demand in Florida, a state with a climate that contributes to peak loads resulting from cooling. However, Florida is equally concerned about peak loads during the heating season, because of the widespread use of inefficient heating systems. The cost/ benefits need to be weighed in each community and can be very dependant on the costs of electricity and or other energy sources.

ERA believes maintenance, i.e. cleaning, of reflective roof surfaces is a necessary component of peak load demand reduction. In addition, the relationship between the continued decrease in peak loads and the reduction in the reflectivity of cool roof surfaces must be explored.

The Urban Heat Island Effect

The Urban Heat Island Effect is described as a condition in which urban areas have higher air and surface temperatures than the surrounding rural regions. There is ample evidence to support the underlying assumption about this phenomenon, and it is generally agreed that it may contribute to air quality problems. However, ERA believes

that much more information is needed about Urban Heat Islands before changes in building codes are warranted, and other mandates are imposed. For example, information is needed on the extent to which there is a problem in areas where heating degree days exceed cooling days, and information is also needed about whether restrictions on the use of certain building materials are warranted.

Measuring Effectiveness of Mitigation Strategies

The spotlight is clearly on the use of reflective roofs as a major contributor to reducing the Urban Heat Island Effect. However, the lack of empirical air temperature data for those areas where reflective roofs have been installed has prompted EPA to use energy savings as a surrogate measure of the effectiveness of reflective roofs in reducing the Heat Island Effect.

ERA believes the use of energy savings as a measure of Urban Heat Island Effect mitigation necessitates the acceptance of all strategies that result in energy savings, and not just the use of reflective roofs. These include building envelope insulation, energy efficient HVAC equipment and energy-efficient lighting, among others.

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