

## Determining a roof system's energy efficiency and cost

by Mark S. Graham

**L**ess than 30 years ago, using thermal insulation in roof assemblies was the exception rather than the rule. Today, however, many building owners want comparatively large amounts of thermal insulation in their roof systems to reduce buildings' heating and cooling costs.



When making purchasing decisions about thermally efficient roof systems, building owners frequently ask roofing professionals several questions, including: "How much insulation is needed?" and "How much will the insulation save me in reduced energy costs?"

Finding the answers to these questions and concisely and accurately presenting them to building owners always has been difficult. However, several recent developments have simplified the process.

### ASHRAE 90.1-1989

In 1992, President Bush signed into law the National Energy Policy Act (EPAAct). Although it addresses many aspects of energy usage and conservation, EPAAct includes specific requirements intended to improve buildings' thermal efficiencies.

Specifically, EPAAct requires individual states to establish their own energy codes and mandates minimum state code compliance with nationally recognized energy-efficiency standards. Currently, the American Society of Heating, Refrigerating & Air Conditioning Engineers (ASHRAE) 90.1-1989, "Energy Efficient Design for New Buildings Except Low-Rise Residential Buildings," is the recognized

baseline requirement for energy-efficient construction of commercial buildings (i.e., generally all buildings except low-rise, residential, manufactured housing and those that are federally owned).

ASHRAE 90.1-1989 provides minimum requirements for building components' energy efficiencies. For roof systems, ASHRAE 90.1-1989 establishes a minimum acceptable thermal efficiency of an overall roof assembly by a calculation based on local climatic conditions and building usage. Tables are provided within the standard from which calculation variables can be derived.

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In many cases, the minimum amount of thermal insulation required by ASHRAE 90.1-1989 is considerably more than roofing professionals are accustomed to providing. For example, for a low-rise, commercial building in Salt Lake City, Utah, that is heated only, the minimum overall thermal resistance (R-value) for the roof assembly is 16.06. If the building is heated and air-conditioned, the R-value is 19.11.

In many states, ASHRAE 90.1-1989 has been adopted as the basis for the energy code. Therefore, where applicable, ASHRAE 90.1-1989 should be considered the *minimum* thermal insulation requirement for commercial buildings' roof systems.

### Heating, cooling costs

Using an analytical method, the heat transfer rate (thermal transmittance [U-factor]) through a building component, such as a roof assembly, can be determined. Once the U-factor for a building component is known, the approximate heating and/or cooling energy costs for maintaining comfortable temperatures inside a

building can be calculated. Such calculation methods are presented in the *ASHRAE Fundamentals Handbook*, and simplified, empirical calculation methods are provided in *The NRCA Energy Manual*.

Although time-consuming and sometimes confusing, these methods have been available to roofing professionals who want to provide approximations for energy-cost savings as a result of adding additional thermal insulation to their roof assemblies.

To simplify the energy calculations' processes, the National Roofing Foundation recently released *RoofWise: The Digital Energy Workbench*. The CD-ROM software program provides an interactive, graphical method of constructing roof systems to evaluate their thermal efficiencies and estimates annual energy costs for typical conditions.

Using the default calculation values from *RoofWise* for the Salt Lake City example, annual energy costs attributable to a minimally insulated roof system will be about \$9,095. However, if the building owner upgrades to a thermally efficient roof system in compliance with ASHRAE 90.1-1989, the annual energy costs attributable to the roof system only would be about \$1,326, which is \$7,769 in annual energy cost savings.

### Competitive advantage

Building owners need accurate roofing-related energy-efficiency analysis information to assist them when making informed roof system purchasing decisions. Providing this type of information is one way roofing professionals can differentiate themselves from competitors. **PR**

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*Editor's note: ASHRAE 90.1-1989 and the ASHRAE Fundamentals Handbook are available from ASHRAE at (404) 636-8400. The NRCA Energy Manual and RoofWise: The Digital Energy Workbench are available from NRCA's Marketing Services Department at (847) 299-9070.*

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