



Cover Story: A key player SPF and the net-zero energy movement

Energy-efficient spray polyurethane foam is becoming a major force in the net-zero energy building movement.

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Spray polyurethane foam (SPF) is a commonly used building product with useful applications in roof system installations and insulating building envelopes. Ideal for use in residential and commercial construction, using SPF across multiple construction segments has increased steadily over time according to the American Chemistry

Council's Center for the Polyurethanes Industry. SPF's high performance and energy-efficiency characteristics have contributed to its widespread adoption and use.

In roofing projects, SPF acts as a water barrier, air barrier and thermal insulator. Because of SPF's superb energy-efficiency capabilities, it has become a major force in the net-zero energy building movement that is picking up momentum across the U.S. The movement describes a push toward buildings with net-zero energy consumption. The energy consumed by a net-zero energy structure is roughly equivalent to the amount of renewable energy generated on the same site.

Overview

SPF is a lightweight material ideal for use in roofing projects when:

- The roof deck is an unusual configuration or shape, such as a domed roof
- A lightweight material is required
- A slope application is required to provide controlled drainage
- The roof substrate includes many penetrations, such as photovoltaic (PV) supports
- The roof is being applied to a structure located in a region with extreme weather cycles
- Maintaining the existing roof covering is desired

SPF's positive qualities range from versatility to a lengthy life span to durability. The physical properties of the material change minimally over time, leading to a life span of more than 50 years with regular care and maintenance. SPF roof systems first were used in the U.S. in the late 1960s, and several of those roofs still are in service. With proper maintenance (repair and recoating), these roof systems can last the life of a building.

SPF also strengthens a building envelope in many ways. SPF roofing solutions boast a compressive strength of 40 to more than 60 pounds per square inch (psi) as compared with other foam insulations with about 16 to 25 psi strengths. SPF's adhesion

strengthening capabilities are paramount, especially in places where severe weather such as hail, wind and heavy rain are an issue.

Often the toughest test for a roof system is its performance during extreme weather and storms. When selecting materials for installing durable and resilient roof systems, SPF stacks high among the competition when it comes to weather and storm resistance.

Closed-cell SPF can increase a structure's resistance to wind uplift when it is applied to a roof's interior side. In 2007, a University of Florida, Gainesville, study, "Field Tests of SPF Retrofit," concluded the application of closed-cell SPF under a roof deck provides up to three times the wind-uplift resistance for wood sheathing panels compared with a conventionally fastened roof system built before 2000. In 2000, after Hurricane Andrew, the Florida Building Code increased the nailing schedules for fastening plywood roof decks to reframing.

SPF is even more effective when it is used in low-slope roofing applications on built-up roofing and metal substrates. After Hurricane Katrina hit in 2005, the National Institute of Standards and Technology (NIST) examined low-slope roof systems in the region and found SPF roof systems performed well without SPF blow-off or damage to flashings.

A 2006 NIST report, "Performance of Physical Structures in Hurricane Katrina and Hurricane Rita: A Reconnaissance Report," discovered only one examined SPF roof system had incurred notable damage, and the damage was confined to 1 percent of the roof. Researchers noted SPF provided high performance in moisture prevention, kept the roofs intact and successfully provided protection from hail and debris.

Although other effective products exist for roofing and insulating projects, SPF is unique in the marketplace as a single-source solution with an ability to seal the roof and

envelope, acting as a continuous air, thermal and moisture barrier—an ability that otherwise requires application of multiple products from different contractors to achieve.

Issues to consider

Similar to many other building products, SPF has specific considerations that must be addressed before application. All substrates must be clean, dry and free of excessive debris before installation. Any liquid water present on a roof surface can result in blisters occurring between the foam and deck. Therefore, after a heavy rain or dew conditions, it is important the substrate be examined and ensured for dryness.

SPF also must not be applied in cold temperatures. If the temperature is below 50 F, it generally is not advisable to install most SPF systems. SPF also may generate fine airborne particles, which can inadvertently deposit themselves onto finished surfaces such as window glass and nearby vehicles. To minimize the dispersion of these particles, tents and screen systems may be needed during installation. Generally, SPF should not be applied to a roof when wind speeds exceed 15 mph.

The net-zero energy movement

Sustainable building practices that include roof systems and structure components are not part of a simple fad or passing trend. Many leading builders employ significant eco-conscious building practices to push sustainability forward. Major U.S. corporations have established "green" standards for the real estate they inhabit, and end users have come to expect and demand energy-saving homes and workspaces.

These stakeholders, along with states and municipalities, have begun to fuel the net-zero energy movement. With buildings traditionally consuming a major amount of fossil

fuel in the U.S., they are significant greenhouse gas contributors. Therefore, net-zero energy structures are viewed as an important step toward reducing carbon emissions, as well as the U.S.' overall dependence on fossil fuels.

In addition to national builders moving their new development sites toward net-zero energy goals, California has become a major force behind the movement. In July 2014, California initiated the revision process to the 2016 version of Title 24, California's building energy-efficiency codes, which are designed to push the state's residential and commercial buildings toward net-zero energy usage. Under Title 24, all new residential construction is to be net-zero by 2020, and all new commercial buildings are to achieve the same goal by 2030. Although aggressive, these goals are achievable with the right design implementation and accessibility to proper building materials.

The design of a net-zero energy building concept focuses on two main initiatives: a reduction in energy consumption via energy-efficient technologies and the generation of a structure's own renewable energy. PV systems are commonly employed to achieve the latter.

Long-term net-zero energy begins with the design and construction of a quality building enclosure. High-performance attics and wall systems are a focus in California's 2016 Title 24 building energy code. High-performance, unvented attics create a significant negative effect in the efforts to reduce peak cooling demand in structures. Because of SPF's unique attributes, the material is widely recognized by builders and the California Energy Commission staff as an optimal solution for high-performance unvented attics.

However, roof systems and walls also are paramount factors to achieve net-zero energy. As a roofing and insulation solution, SPF seals a building envelope and reduces unwanted air leakage, greatly enhancing a structure's overall energy efficiency. In a net-

zero energy building, the material assists greatly in the reduction of energy consumption, complementing other measures by reducing the energy load required for on-site power generation.

California, an environmental leader, often initiates eco-conscious mandates, with other states across the U.S. eventually following suit. Although already being pushed by builders and innovative products companies in the U.S., the net-zero energy movement is expected to gain tremendous steam when additional states and municipalities follow California's lead.

Taking center stage

Ideal for use in residential and commercial construction, as well as in retrofit projects, SPF is likely to continue to grow in popularity as a single-source product that serves as an air, thermal and moisture barrier to a structure. In roofing, it will continue to play an important role as a protective and insulating solution.

SPF's strong energy-efficiency performance has been demonstrated across many of the U.S.' model net-zero energy structures and new home communities, and it is likely it will continue to play an increased role in the growing net-zero energy movement.

With progressive builders, states, municipalities and various other stakeholder groups continuing to campaign for the elimination of negative effects during construction and all phases of a structure's life cycle, Earth-saving technologies and products such as SPF will be pushed to the center stage as key tools in the U.S.' aggressive efforts toward sustainability.

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