Living Tiny: Spray Polyurethane Foam Helps the NextGen Net-Zero/ Healthy Home Achieve Zero Energy Usage

We live in an era where sustainable and renewable energy resources are at hand. By taking advantage of these technologies, knowledgeable homeowners and homebuilders are reducing their energy consumption to a powerful degree while combating climate change by keeping a carbon footprint and emissions at bay. While some may have the means to reside in a luxurious home featuring a tapestry of such energy-efficient technologies, others prefer to live Green in smaller homes. The latter has, as of late, become a popular living option that is powered by two residential trends: Smaller home construction and off-grid living. One of the most prominent examples exemplifying both these trends – the 2016 NextGen Net-Zero/Healthy Home – was displayed at the International Builders Show (IBS) earlier this year.

Totaling 500 sq. ft. in size, this round-shaped "Tiny Home" resembles a large pod and was constructed as a demonstration home around the concept of living comfortably within a smaller space. Shelter Dynamics, the general contractor of the project, went for a specific design that showcased energy-efficient products contributing to the improvement of indoor air quality and whole-house water quality. A hybrid insulation system, which included the application of closed-cell spray polyurethane foam (SPF), coupled with photovoltaic panels was the crucial combination that provided the net-zero brand to the home.

Prior to the IBS demonstration, the home was assembled in a remote open lot in the nearby Mojave Desert, and was then transported to the IBS show in Las Vegas, Nevada. The application of SPF was integral in sealing the home's envelope and tightening up the entire system during the transportation phase. The SPF application, which was completed by USI (formerly United Subcontractors, Inc.) also warranted great praise from the SPF and construction industry. Case in point: The Spray Polyurethane Foam Alliance (SPFA) subsequently recognized USI for their work on the "Tiny Home" project with the Contractor Industry Award first-place prize for Residential Wall Applications.

"It was a fantastic project to be a part of," says Jim Tipperreiter, Vice President of Sales and Marketing of USI. "It's not every day that you are called for a 360º application. The award itself is a representation of the quality standards that we value and demand from all of our installers and branches."

Before the SPF application took place, Shelter Dynamics constructed the structure's frame, consisting of continuous wooden structural support beams that curved from the floor and up over the wall to form the roof. Additionally, curved polyiso boards had been installed to the exterior lateral framing and another layer of framing had been put over the polyiso. The home was supported by a 12' x 26' trailer, which allowed USI's two-man crew to apply foam to the floor of the home. The USI crew was brought in by spray foam manufacturer Covestro, who supplied all the materials for the insulation system.

"Tiny house living offers a way for people to get back to the basics," says Tipperreiter. "I think Covestro and USI understand this is a market niche because of its growing popularity. So far, we've seen many educated homeowners that want to use this innovative approach to improve their way of living. Spray foam is certainly the best insulation material to use in order to accomplish the net-zero rating because it provides an air sealant, as well as the best possible insulation value for the home."

One of the first instructions given by the USI crew after they arrived at the jobsite was to have all cars in the lot's vicinity moved to avoid any overspray damage. Then, using three-mil plastic sheeting, the crew masked off the beams, windows, and doors of the home for overspray damage protection. They constructed scaffolding and utilized ladders to facilitate access to the roof of the home. For fall protection, the two crewmembers outfitted themselves with safety harnesses and tied off their lanyards to carefully placed anchors around the structure. The USI crew wore PPE consisting of fresh-air respirators attached to an Allegro A-750 pump, Tyvek suits, and nitrile rubber gloves for the duration of the SPF application.

"USI adheres to their own playbook of standard safety procedures on all spray foam jobs," says Tipperreiter. "Special care is taken to ensure that when spraying outside of any structure that there are anchor points on which to fasten fall protection equipment and ensure that the crew has everything needed to perform their job in a safe, efficient, and timely manner."

By way of a Graco Reactor E-30 proportioner and a Graco Fusion AP gun, the crew installed directly to the polyiso in between the wooden framing five inches of Bayseal, a 2 lb. closed-cell spray polyurethane foam formulated by Covestro. The total spray area consisted of 7,500 board feet, providing an insulating value of R-40 to the home.

"SPF was the perfect insulation to meet the precision install of this home's irregular shape," says Tipperreiter. "Combining polyiso board with closed-cell SPF insulation was a cost-effective solution that maximized R-value and minimized air leakage. It is safe to say that the living space will be a very comfortable and energy-efficient place to be in. The insulation system in this home is critical to achieve the net-zero energy usage goal and control the energy input and output."

Susbsequently, the USI crew topped the foam with 25 mils of Covestro's tan-colored Bayblock HT, a waterproofing acrylic roof coating, which became the outermost material of the envelope. Tipperreiter affirmed that the coating is highly resistant to UV degradation, and that the light tan color specifically meets EnergyStar reflectance criteria, creating a continuous, seamless coating around the entire home.

The crew completed the SPF and coating application in one day. Then, Shelter Dynamics installed several layers of plywood on top of the SPF system; installed the photovoltaic panels; finished putting the rest of the home together; and the Tiny Home was transported to the IBS Show for its regal premiere. According to Tipperreiter, the exhibition of the home was a home run for Shelter Dynamics as many potential homeowners ascertained the substantial energy savings that the net-zero Tiny Home can provide.

"Since the IBS show, Shelter Dynamics has had over 200 orders for homes of this nature," says Tipperreiter. "We are happy to know that we played a critical part in their success."

Shelter Dynamics will continue to develop Tiny Homes into a production model that can be built for volume sales. Each home is designed to be portable, enabling ease of movement to locations ranging from designated residential sites to rural wilderness areas. Every home will maintain the net-zero designation, made possible, in part, by spray polyurethane foam.

For more information visit www.usiinc.com and www.covestro.com.