**Natural Insulation Products**
*Home Energy* magazine, September/October 2003

# Natural Insulation Products

*Soft on the environment—and sometimes even soft to the touch —natural insulation products are filling a growing market niche.*

**by Mary James and Edward Wyatt**

MARY JAMES

Matt Zambarano, of Applied Foam in Jericho, Vermont, had been working in the insulation industry for six years when he first heard about soy-based polyurethane foam insulation from a prospective client. In the early days of his career, Zambarano had lined many a wall with fiberglass but as he became more familiar with the air sealing properties of spray-on foam insulations, his allegiances shifted. A product that simultaneously slows heat transfer and blocks air movement makes sense given Vermont's long, cold winters, according to Zambarano. Tired of subbing out foam jobs to other subcontractors, Zambarano took the financial plunge in May of 2002 and bought the application equipment for himself. When a customer with an 80-year-old house that needed major renovation work approached him and asked him about soy-based polyurethane foams, Zambarano started researching the product.

In many ways, foam insulation products are similar to one another: They expand to fill all spaces within structural cavities; they are not affected by moisture; they do not settle as loose-fill products do; they are mold and mildew resistant; and they provide no food or nesting places for rodents or insects. Finally, the R-values of foam products with similar densities are basically equivalent. But Zambarano found one critical difference between soy-based and other foams.

"It's the price point," explains Zambarano. "Soy-based foams are 2 or 2 ½ times more expensive than fiberglass insulation [in Vermont], as opposed to other foam products that are 4 or more times as expensive." Insulating a four-bedroom colonial in Vermont with fiberglass runs about $3,000, according to Zamberano. "Applying a traditional foam product would cost $11,000-$12,000, but with a soy-based foam the total price is about $6,000." This cost savings can be attributed primarily to the lower cost of soy oil, which is about one-third to one-quarter that of isocyanates. This key ingredient in more than one of the soy foam products sold today is SoyOyl, made by Urethane Soy Systems of Princeton, Illinois. In addition to price, soy-based foams do not use a chlorofluorocarbon (CFC)-based or a hydrochlorofluorocarbon (HCFC)-based blowing agent, as some insulating foams do.

In the first four months of this year, Zambarano has sprayed out roughly 10,000 lbs of soy-based foam onto 40,000 board ft of walls. The industry has a rule-of-thumb estimate that approximately 15 bushels, or 450 lb, of soybeans are needed to supply the oil for the amount of soy-based foam that would insulate an average 2,500 $ft^2$ home. Soy-based foams come in 0.5lb/$ft^3$ densities and tend to be quite soft when applied. Once applied, the foam's semirigid structure allows the insulation to expand and contract with the structure, hopefully preventing the formation of cracks that could break the foam's air seal.

With R-values of 3.5–3.7 per inch, the foam can fill a 2 ft x 6 ft cavity to a total value of R-19. The walls of the 80-year-old house whose owner first introduced Zambarano to soy-based foam were only 4 inches thick. That homeowner ended up with only R-13 in his walls and still has nothing but praise for how comfortable his house was throughout Vermont's unusually extended winter this past year.

## *From Beans to Jeans*

At the other end of the country, John Shurtz, of Green Builders of Marin, in Novato, California, recently completed his fifth remodeling job in which recycled denim was stuffed into the walls (see photo). The product he uses, Ultra-Touch, is primarily postindustrial denim scrap with a small amount of straight postindustrial cotton, plus approximately 15% microscopic plastic olefins as fiber, and it is treated with chemicals (borate) to give it a strong rating for fire-

resistance. Manufactured as batts, UltraTouch is made with a three-dimensional lattice-type structure for greater insulating value and noise reduction qualities. The batts are made in 16 1/2-inch and 24 1/2-inch widths for a snug cavity fit. The product is often billed as "itch-free" insulation.

Shurtz first heard about UltraTouch two years ago at a green showcase put on by Pacific Gas and Electric Company. Shortly after, he was remodeling a home for a client who is chemically sensitive, and he suggested using the denim insulation. The suggestion was enthusiastically accepted. His crew found the installation process remarkably similar to installing fiberglass batts, and the denim insulation was more pleasant to work with. Although the recycled denim costs about 30% more than fiberglass, Shurtz has since installed UltraTouch in the homes of several clients who favor the product because it recycles what would otherwise be landfilled.

Soy-based foams and recycled denim—these are just two of a growing number of insulation products that are getting promoted as natural or environmentally friendly alternatives. Air-Krete's cementitious foam, and cellulose that is derived principally from postconsumer paper are also marketed as green products. In Europe the range of natural insulation products extends to wool, flax fibers that are bound together with potato starch, and a form of cellulose that combines recycled newspaper and recycled jute sacking.

## Why Go Natural?

So what sets apart a natural insulation product from a conventional one? Natural insulation materials are made from renewable plant or animal sources. The use of these sources tends to reduce the amount of energy needed to extract and create the final product, compared to an insulation made from nonrenewable sources. Because natural insulations are crafted from nontoxic materials, installing them doesn't expose the contractor to toxicity-related health problems. Finally, they claim to have a lower embodied energy than their conventional counterparts.

Cellulose manufacturers, for example, emphasize that their products contain a high percentage of recycled content and rank low in terms of embodied energy. According to GreenFiber, their cellulose product consists of 85% recycled content with a minimum of 80% recovered, postconsumer paper fiber. The remaining content consists of fire-retardant chemicals, such as boric acid, and stabilizing additives. Since newsprint is available locally all over the United States, this manufacturer stresses that their product's primary raw material does not need to be transported long distances, which cuts down on energy requirements for manufacturing GreenFiber. Additionally, manufacturing cellulose insulation not only pares down landfilled newsprint waste, but also reduces the energy needed to haul the old newspapers to a landfill. According to the Cellulose Insulation Manufacturers Association's *Resource Conservation Research Home Insulation Fact Sheet*, insulating a typical 1,500 ft$^2$ ranch-style home with cellulose insulation recycles as much newsprint as an individual will consume in 40 years.

For most of these products, hard data on their embodied energy either are not available or have not been verified by a certifying organization. Manufacturer's data regarding performance are available and can usually be found on the Web. For soy-based polyurethane foams, the stated characteristics compare well with those of other types of foam insulation products (see Table 1). Foam insulations generally are characterized as one of three fundamental types: molded expanded polystyrene (MEPS), extruded expanded polystyrene (XEPS), or polyurethanes, which include polyisocyanurates and soy-based foam. MEPS, which is also known as beadboard, is a closed-cell foam that, when made into insulation, often comes in blocks or rigid board form. It can absorb moisture; a vapor retarder must be installed alongside it. XEPS is also a closed-cell material, but it is more fluid than MEPS and is usually blown into cavities. It can also be formed into sheets, but this is less common. XEPS is typically about 50% denser than MEPS and does not absorb moisture. Although long-term experiential data are not available for soy-based foams, anecdotal evidence points to comfort and energy-saving results that are similar to those obtained with other foam insulation products.

As for recycled cotton, the main advantage is the one the installer reaps—no exposure to fiberglass. In terms of its thermal and sound protection properties, it is said to perform as well as other batt-type insulation, such as fiberglass. For the consumer, the main attraction over fiberglass lies in its being made from what would otherwise be a waste product. However, manufacturers of fiberglass are increasingly incorporating recycled content into their products. Thirty-four of Johns Manville's residential fiberglass insulation products made in North America, for example, have been certified by Scientific Certification Systems as containing on average 25% recycled glass, with 20% of that being postconsumer remelted bottle glass. Johns Manville has also recently started selling a fiberglass insulation that uses a new acrylic-based binder, instead of the

**Table 1. Comparing Insulations**

| Property | Soy-Based Foam | Polyurethane Spray-on Foam (Icynene) | Molded Expanded Polystyrene (MEPS) | Extruded Expanded Polystyrene (XEPS) | Fiberglass Batt | Cotton (UltraTouch) |
|---|---|---|---|---|---|---|
| Thermal resistance (R-value)/in | 3.6 | 3.6 | 3.8 – 4.4 | 5.0 | 3.2 | 3.4 |
| Density, core (lb/ft$^3$) | 0.5 | 0.5 | 1.0 | 1.5 | 1.2 – 1.6 | 1.2 |

Source: manufacturers' data

traditional formaldehyde-based binder, to eliminate off-gassing of formaldehyde.

Altogether natural insulation products clearly are a niche market so far. In February 2002, the United Soybean Board published a study that estimated that soy-based products have the potential to capture at least 25% of the annual North American polyurethane market (which includes urethane foams, binders, coatings, adhesives, and sealants)—or about 800 million lb out of a total market of 3 billion lb. However, these data might be optimistic, as they come from the same organization that helped fund the development of soy-based foam insulation. Still, many natural insulation products appear to have good real-world performance so far, and their use can potentially increase by an order of magnitude or more—as long as contractors can get access to them. Availability might be limited in certain areas of the country, as some of these products are not made on the same scale as mainstream insulation products are. As monitored performance data are not yet readily available for these products, *Home Energy* would be very interested in finding out whether performance studies are or will be undertaken in homes using natural insulation products.

MATT ZAMBARANO

It's not tofu, but this relatively new spray-foam product is made from soy oil.

*Mary James is the publisher of* ***Home Energy*** *and Edward Wyatt is an engineering consultant and an assistant technical editor of* ***Home Energy****.*

## For more information:

**United Soybean Board**
16640 Chesterfield Grove Rd.
Ste. 130
Chesterfield, MO 63005
Tel: (800)989-USB1 [8721]
Web site: www.unitedsoybean.org

**Bonded Logic, Incorporated**
**UltraTouch denim insulation**
411 East Ray Rd.
Chandler, AZ 85225
Tel: (480)812-9114
Fax: (480)812-9633
Web site: www.bondedlogic.com

**Urethane Soy Systems Company, Incorporated**
535 Elm Place
Princeton, Il 61356
Tel: (888)514-9096
Fax: (815)879-5300
Web site: www.soyoyl.com

**U.S. GreenFiber, LLC**
809 W Hill St., Ste. A
Charlotte, NC 28208
Tel: (704)379-0653
Fax: (704)379-0685
Web site: www.cocooninsulation.com