



FILLING THE VOID

Insulation is certainly a key contributor to sustainable building. But with so many types to choose from, it's hard to pick the greenest one. Here's a look at the options. By Fernando Pages Ruiz

Insulation represents an inherently green building material because it is designed to save a energy.

Still, while any insulation is better than none, the many choices present a broad range of benefits, with certain products inherently more ecological than others.

Here is a sampling of the major types of insulation, their properties, and their sustainability beyond simply saving energy.

FIBERGLASS

Ubiquitous and economical, fiberglass represents the largest share of the market, comprising more than 50% of the insulation installed in the U.S. in 2007, according to the North American Insulation Manufacturers Association (NAIMA). It's available in loose form for blown-in installation and in

blankets, rolls, and batts for compression installation. Depending on density, both blown and stuffed fiberglass products provide R-13 to R-15 in a 2x4 wall cavity. Medium-density designed for 2x6 constructions now provides R-21. In a 9½-inch (2x10) cavity, high-density fiberglass can deliver a whopping R-38.

All fiberglass insulation manufacturers use 25% to 40% recycled glass in their products, according to Paul Bertram, director of environment and sustainability for NAIMA. The balance is sand, an abundant natural resource, with chemical binders added to create loft and a cohesive mat in the case of batt-style insulation.

One ecological issue with fiberglass is that glass and sand have to bake at extremely high temperatures to produce

fibers. On the flip side, a typical pound of fiberglass insulation “saves 12 times as much energy in its first year in place as the energy used to produce it,” says Bertram.

Most of the serious health concerns and allegations made about fiberglass insulation have been retracted or disproved in recent years. The National Academy of Sciences (NAS) reported in 2000 that epidemiological studies of glass-fiber manufacturing workers indicate “glass fibers do not appear to increase the risk of respiratory system cancer.” NAS now supports the exposure limit of 1.0 f/cc that has been the industry recommendation since the early 1990s. And as of 2001, the International Agency for Research on Cancer (IARC), on which the California standards for Proposition 65 were based, no longer classifies fiberglass as a human carcinogen.

OWENS CORNING. The manufacturer says its entire line of fiberglass insulation products has been certified by Scientific Certification Systems to contain an average of 35% recycled content, 5% of which comes from post-consumer sources. ProPink fiberglass insulation carries Greenguard certification, including its highest level with Greenguard Children & Schools product emission standards. 800.438.7465. www.owenscorning.com. Circle xxx.

► **DEMILEC.** Sealection Agribalance open-cell, semi-rigid, polyurethane spray-foam insulation contains more than 10% renewable agriculture-based products, says the firm. The material expands to fill the cavity, sealing cracks, gaps, and voids. It provides an R-value of XXXXX. 877.336.4532. www.demilecusa.com. Circle 000.



◀ **CERTAINTEED.** Designed for attic areas, InsulSafe SP blown-in fiberglass insulation is manufactured with no formaldehyde and is Greenguard certified. The product offers up to 20% better coverage versus competitors, the company says, with one bag covering up to 67 square feet. R-value is XXXXX per inch. 800.233.8990. www.certainteed.com. Circle xxx.

▼ **ADVANCED FIBER TECHNOLOGY.** AFT cellulose insulation is made from 85% post-consumer recycled newspaper and cardboard. The pulp is ground into a fine, fluffy powder, then treated with primarily boric acid and borax to render it fire resistant. The higher density of this cellulose insulation makes for a tight seal second only to foam products in blocking air infiltration and sound deadening, says the company. The R-values of this blow-in insulation vary with thickness from an R-13 in a 2x4 wall to R-42 in a 12-inch-deep attic installation. 419.562.1337. www.advancedfiber.com. Circle xxx.



▲ **THERMAFIBER.** Thermafiber mineral wool insulation is made with up to 90% post-industrial recycled content. It exceeds the California purchase specifications for TVOC and general emissions with formaldehyde concentrations of 12 ppb, exceeding the California standard of 20 ppb maximum for formaldehyde concentration. Thermafiber can provide high sound-transmission coefficients that improve the indoor environmental quality of a home. In addition, the product offers fire resistance of more than 2,000 degrees for more than five hours, the maker says. 888.834.2371. www.thermafiber.com. Circle xxx.

Perhaps the biggest objection to fiberglass batts in green building circles comes from the binders used to glue the glass fibers into a cohesive mat. These binders usually contain formaldehyde, a chemical known to cause sensitivity in certain people and classified as a human carcinogen by the IARC, and as a probable human carcinogen by the EPA.

Most manufacturers insist that the low levels of formaldehyde used in manufacturing fiberglass batts makes any health concern exaggerated when compared to many other building products and naturally occurring off-gassing from raw materials, such as wood. In fact, some fiberglass batt insulation with added formaldehyde has gained GreenGuard certification.

But if you are concerned, loose fill or “blown” fiberglass insulation requires no binder, which means no formaldehyde. For those using batts, Johns Mansville offers the only fiberglass batt product line with no added formaldehyde. “We don’t consider the formaldehyde binders in insulation to be a big contributor to indoor air pollution, but since we can use alternatives without formaldehyde, why not do our little part to improve the environment?” explains Erick Olson, a senior technical product specialist for Johns Manville.

Any stuffed insulation requires excellent on-site quality control to perform at its rated R-value. A few missed cuts, gaps, or cracks left between batts and the R-value plummets. Blown and foamed insulation usually provide a more foolproof system to prevent air infiltration, but an excellent sealing job using a well-aimed caulk gun and a few cans of foam sealant coupled with a craftsman-like batt installation can yield low-cost insulation results comparable to the blown systems.

NON-FIBERGLASS BATTS

Non-fiberglass batts can be made of cotton, sheep’s wool, or mineral (rock or slag) wool. All of the alternative batt insulation products are made almost entirely from recycled or renewable materials. They offer similar thermal performance as fiberglass but at a slight cost premium. They come unfaced and need the addition of a separate vapor retarder in the extreme-cold climate zones.

To make them fire resistant and prevent

mold and insect infestation, most alternative batt (and cellulose) insulation fibers are coated with ammonium sulfate or borate. Although one manufacturer advertises its product as so safe a child could eat it, both sulfates and borate are used as pesticides and have toxic properties. At a minimum, a respirator should be worn when installing any kind of insulation.

CELLULOSE

Although the broad category of cellulose insulation includes a variety of products such as granulated cork, hemp fibers, straw, and grains, the most common and readily available cellulose insulation is made almost entirely from recycled newspapers, cardboard, waste paper, and wood pulp. Cellulose insulation is perhaps the best example of a significant recycled product in widespread use. Most is approximately 90% post-consumer recycled waste paper, with fire-retardant chemicals and, in some products, acrylic binders added.

“Mineral fiber materials take at least 25 to 30 times more energy to make than cellulose of equivalent R-value,” says Daniel Lea, executive director of the Cellulose Insulation Manufacturers Association, citing cellulose’s low-intensity manufacturing process and high recycled content.

Nowadays, blown cellulose is applied dry or merely damp, eliminating the extended drying times required for older, “wet” applications. Because of its relative high density and fire suppressants, this recycled newsprint product increases the fire resistance of building assemblies by 22% to 55%, per the Canadian National Research Council. It also provides a better air seal than fiberglass because of its higher density and slight dampness when applied, which tends to push the material into framing member penetrations.

As with cotton and wool, cellulose is an organic and flammable product that requires added biocides and flame retardants, usually borate and ammonium sulfate. Most cellulose installations are done by contractors using special equipment, but loose fill is also available that anyone can simply pour out of a bag. As with all other insulation products, installers should wear proper respirators as recommended by the manufacturer, especially since some people have sensitivity to newsprint ink.



▲ **AIR-KRETE.** The company’s magnesium silicate, cement-based insulation is foamed or pumped into closed cavities. This insulation is purportedly hypoallergenic and popular with chemically sensitive people, the company claims. Since it is not temperature sensitive, it can be installed indoors under any weather conditions and tolerates contact with high-heat sources, such as exhaust pipes, without concerns for combustion. The product is fully recyclable and can be used for soil enrichment. Air-Krete has an R-value of about 3.9 per inch. 315.834.6609. www.airkrete.com. Circle xxx.



▼ **ICYNENE.** Icynene water-blown foam insulation expands to 100 times its volume to fill cracks and crevices and minimize air leakage. It carries an R-value of 3.6 per inch.

The product also is available in a pour-fill variation that expands upward to 60 times its original volume; it will not expand outward and damage the wall. The pour-fill version has an R-value of 4 per inch. 800.758.7325. www.icynene.com. Circle xxx.



◀ **JOHNS MANVILLE.** Formaldehyde-free MR faced fiberglass batts use a water-based acrylic binder that meets California’s Section 01350 standards. The facing serves as an integral vapor retarder, chemically protected against potential fungi growth. The company claims to obtain its sand from sources close to the manufacturing plant to reduce transportation impacts, and claims the highest post-consumer recycled content in the industry at 20%. 800.654.3103. www.jm.com. Circle xxx.

▶ **SECOND NATURE.** Sheep’s wool is an insulation product commonly used in Europe and available in the United States through the Internet. A natural insulator, wool has a slightly higher R-value per inch than fiberglass and does not lose its insulating property when wet. It has inherent properties that resist both flame and many insects, but remains susceptible to moths, so it is treated with boron. Thermafleecce comes in 2-inch-thick batts cut to friction fit within 16- and 24-inch stud spacing. They carry an R value of 3.8 per inch and can be layered to achieve the desired total R value. www.secondnatureuk.com. Circle xxx.



► **BIOBASED INSULATION.**

Unlike some traditional spray-foam insulation products that are petroleum-based and use HCFCs as blowing agents, BioBased 1701 is a soy-based, 100% water-blown, closed-cell polyurethane insulation. It has earned the GreenGuard air quality certification.

BioBased 1701 has an R-value of 19 at 3½ inches. 800.803.5189. www.biobased.net. Circle xxx.



FOAM

Although R-values remain close to equivalent across all insulation products, expanding foam has an added benefit because of the excellent air seal it provides. Foams are two-part products that are mixed through a blowing mechanism and sprayed into the framing cavity. The two chemicals react and expand. As the foam expands, it fuses tightly around all pipes, ducts, and wires, creating an airtight seal that yields much higher thermal performance than R-value alone would suggest.

The adhesive quality of foam offers another benefit rarely associated with insulation: High-density foam insulation provides improved structural integrity that helps make a building a little stronger.

Nowadays, most foams use HCFCs as blowing agents, which are less destructive to the ozone layer than the old, and now banned, CFCs, but still considered environmentally detrimental.

Foams that do not use ozone-depleting blowing agents include Icynene, which uses carbon dioxide and water; Air Krete, a foam produced from magnesium oxide (derived from sea water) and compressed air; and BioBased, which uses compressed air.

As a builder of low-cost houses, I look for the least expensive option to achieve the best results possible. For this reason, I often use high-density fiberglass batts coupled with an excellent sealing job. But when my company set out to build a LEED for Homes–certified demonstration house, we chose BioBased insulation as a high-performance alternative.

Depending on market niche, the variety of insulation products available lets a builder distinguish his house as a comfortable, energy-efficient, and environmentally safe place to call home.

Fernando Pages Ruiz builds environmentally friendly, low-cost housing in the Midwest and mountain states, and wrote “Building an Affordable House: Trade Secrets of High Quality, Low Cost Construction” and “Affordable Remodel.”

◀ **BONDED LOGIC.** Ultra Touch cotton insulation friction-fit batt insulation can be used for 16- and 24-inch spacing. The product is made with 85% post-industrial recycled content. The line includes an R-30 batt that fits into 2x6 walls or joist cavities. Cotton insulation offers acoustic properties 36% higher than fiberglass, says the company, only slightly less than mineral wool. 480.812.9114. www.bondedlogic.com. Circle xxx.



RESOURCES

Cellulose Insulation Manufacturers Association: www.cellulose.org

North American Insulation Manufacturers Association: www.naima.org

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