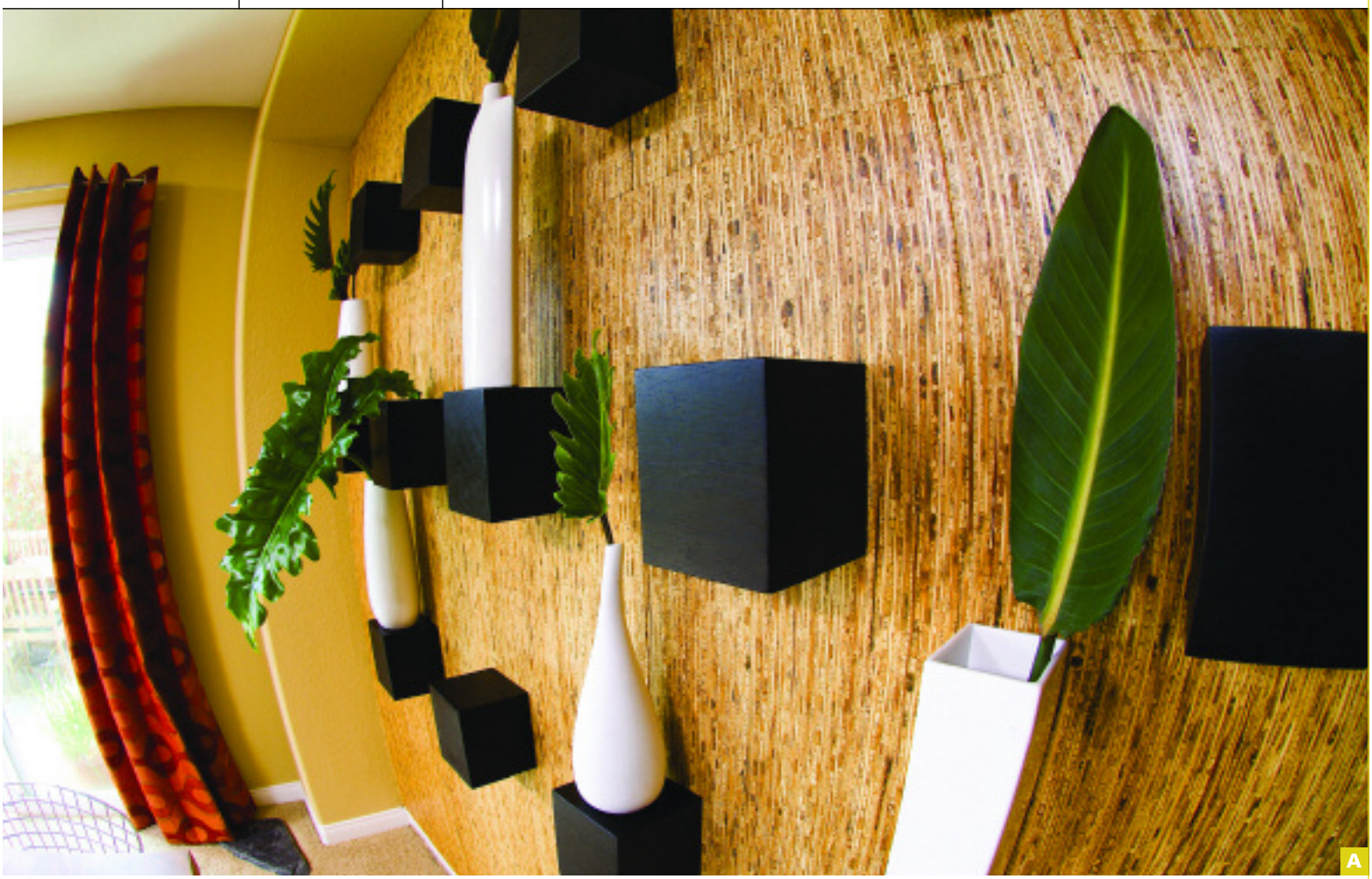
BY JEFF STEPHENS

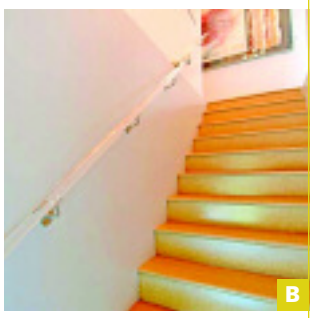


A

GROWING DEMAND

Green-building practices are transforming the built environment. New materials with recycled content or low-VOC levels are helping to incrementally reduce environmental impacts. But in this era of climate change, larger and more sustained change is needed. Product manufacturers must look beyond petroleum-based feedstocks to rapidly renewable or bio-based materials. Building products manufactured from rapidly renewable materials, such as bamboo, cork, wheat straw, hemp and others, have tremendous potential to meet the industry's demand for greener products—though it's important to understand the full picture.

THE GREEN-BUILDING INDUSTRY SEEKS RAPIDLY RENEWABLE MATERIALS



/ A / Kirei is an engineered panel product made from sorghum stalks that has been used for wall coverings, cabinetry, flooring and other architectural and interior-design uses since 1995.

PHOTOS COURTESY OF KIREI USA

/ B / Carbon sequestered during the raw-materials stage of wheat board's life cycle far outweighs the carbon released during manufacture and transportation of the product combined.

PHOTO COURTESY OF ENVIRON BIOCOMPOSITES

WHAT ARE RAPIDLY RENEWABLE MATERIALS?

Rapidly renewable materials have a regeneration rate of 10 years or less. Bamboo and cork are the two most widely known rapidly renewable materials, though building materials made from agricultural-waste byproducts, including wheat straw and sugarcane bagasse, or fiber crops, like kenaf and hemp, are becoming more common.

As sunlight is generally the primary energy input, these products may be less energy-intensive to produce. However, energy used in processing and transportation from areas in which some of these products are grown, such as China and the Mediterranean, also must be considered.

Rapidly renewable materials are recognized within the Washington, D.C.-based U.S. Green Building Council's LEED rating system in the Materials and Resources Credit. Within the LEED framework, use of rapidly renewable materials is intended to " … reduce the use and depletion of finite raw materials and long-cycle renewable material." It is, however, important to acknowledge that because many products made from rapidly renewable materials are relatively new, their long-term performance characteristics may be less known.

LIFE-CYCLE EFFECTS AND THE MOVE TO BIO-BASED

There is a widely held assumption that rapidly renewable materials are beneficial and should be preferentially used in green buildings. USGBC's Materials and Resources Technical Advisory Group, or MR-TAG, contracted with Burlington, Vt.-based BuildingGreen, publishers of green-building information, and North Bermick, Maine-based Sylvatica, an environmental- and social-impact consulting firm, to determine whether there is environmental justification for a credit that rewards the use of rapidly renewable materials instead of longer-rotation bio-based materials, such as wood. The study found that rapidly renewable bio-based materials may not be any greener than long-rotation bio-based material. An information sheet titled "Dealing with Wood and Biobased Materials in the LEED Rating System" summarizes the research effort and is available on USGBC's Web site at www.usgbc.org/ShowFile.aspx?DocumentID=1423.

The study notes products derived from corn, soybeans, cotton and certain other products often carry significant environmental burdens across their life cycles from fertilizers, pesticides, energy use in farming and processing, and soil runoff. According to Michelle Moore, USGBC's senior vice president for Policy and Public Affairs, any changes to the rapidly renewable credit will be influenced by how USGBC incorporates life-cycle analysis into LEED. A proposed LCA approach is expected to be released for public comment sometime in summer 2008.

RAPIDLY RENEWABLE PRODUCTS

The range of rapidly renewable products is limited only by one's imagination and the cost effectiveness of commercial production. Some rapidly renewable materials may capture multiple points in LEED; products made from agricultural waste may be produced within 500 miles (805 km) of a project and contain no added urea formaldehyde, which would earn credits MRc6, MRc5.1 and MRc5.2, and Indoor Environmental Quality credit 4.4, respectively. The following are some rapidly renewable materials you may be considering for your next green-building project.

CORK

Cork is considered a rapidly renewable material because bark from the cork oak tree can be harvested every nine years. Because of its cellular structure, cork works well for flooring; it provides acoustic and thermal insulation and is a resilient building material that is less affected by impact and friction.

Grown principally in the Mediterranean, a cork oak tree must be at least 25 years old before the bark is harvested for the first time. Cork must

continue to develop until the third harvest to achieve wine-stopper quality. Cork building materials typically are made from wine-stopper scraps. On average, each cork oak tree is harvested 15 to 18 times in its lifetime with the largest trees yielding up to 1 ton (0.9 metric ton) of cork per harvest.

According to the Gland, Switzerland-based World Wildlife Fund International, cork production provides a vital source of income for thousands of people and supports one of the world's highest levels of biodiversity among forest habitats with plant diversity reaching as high as 135 species per square meter. In an ironic twist, the increased market share for alternative wine stoppers could reduce the value of cork oak, leading the areas in which cork is grown to be converted or abandoned. It also may contribute to the end of the cork ecosystem.

WWF International and the Bonn, Germany-based Forest Stewardship Council have established programs to promote and encourage responsible cork use to save this natural resource. For more information, visit www.panda.org and www.fsc.org.

/ C / Because of its cellular structure, cork works well for flooring because it provides acoustic and thermal insulation, and is a resilient building material that is less affected by impact and friction.
PHOTO COURTESY OF CERES + TOLI INTERNATIONAL

AGRICULTURAL BYPRODUCTS

Waste byproducts of several agricultural commodities, such as wheat, sugarcane and sorghum, have great potential for rapidly renewable building products.

Life-cycle analysis of wheat board by the National Institute of Standards and Technology, Gaithersburg, Md., demonstrated new wheat-board products actually have a positive impact on the environment. Carbon sequestered during the raw-materials stage of wheat board's life cycle far outweighs the carbon released during manufacture and transportation of the product combined. Wheat board rated the best for overall environmental impact across 230 products evaluated by NIST.

Worldwide, more than 1 billion tons (907 million metric tons) of sugarcane was grown in 2005 with the U.S. producing 25 million tons (23 million metric tons). Bagasse, the crushed cane fibers resulting from milling, can be used for agri-fiber board. In the late 1990s, Seminole, Fla.-based Acadia Board Co. tried and failed to produce commercially viable bagasse board under the tradename Duracane. A study conducted in 2003 by Louisiana State University AgCenter, Baton Rouge, demonstrated an

reSOURCES

BEES, Building for Environmental and Economic Sustainability, National Institute of Standards and Technology, Washington, D.C., www.bfrl.nist.gov/oae/software/bees/bees_USDA.html

CORK

- **American Cork Products Co.**, Houston, www.amcork.com
- **Amorim Flooring North America**, Hanover, Md., www.wicanders.com
- **Cork Direct**, Lithonia, Ga., www.corkdirect.com
- **Expanko Inc.**, Coatesville, Pa., www.expanko.com
- **Globus Cork**, Bronx, N.Y., www.corkfloor.com
- **Jelinek Cork Group**, Oakville, Ontario, Canada, www.jelinek.com
- **Portuguese Cork Association**, Santa Maria de Lamas, Portugal, www.realcork.org
- **Solida Cork**, Mississauga, Ontario, www.solidacork.com

■ AGRICULTURAL BYPRODUCTS

- **Agriboard Industries**, Wichita, Kan., www.agriboard.com
- **Environ Biocomposites**, Mankato, Minn., www.environbiocomposites.com (To read about wheat board's positive rating as a building material by the National Institute of Standards and Technology, Washington, D.C., visit www.environbiocomposites.com/nistLetter.pdf.)
- **Kirei USA**, San Diego, www.kireiusa.com

■ KENAF AND HEMP

- **BioKenaf**, www.cres.gr/biokenaf
- **Hemp Lime Construction Products Association**, Aldershot, England, www.hemplime.org.uk
- **Kenaf Eco Fibers Italy**, Guastalla, www.kenaf-fiber.com
- **Kenaf Green Industries**, www.kenafibers.com
- **Suffolk Housing Society**, Bury St Edmunds, England, www.suffolkhousing.org

efficient way of transforming bagasse into high-quality industrial panel products but concluded that successful commercialization depended on cost-effective manufacturing.

Kirei is an engineered panel product made from sorghum stalks, an edible grass grown around the world. After harvesting the grain for food, the stalks are compressed, washed and woven into sheets. These sheets are then stacked and heat-pressed with a formaldehyde-free adhesive to create blocks, which are cut to the desired size. Kirei has been used for wall coverings, cabinetry, flooring and other architectural and interior-design uses since 1995.

KENAF AND HEMP

Kenaf is a warm-season annual fiber crop harvested for its stalks. It has adapted to most of the southern U.S. and parts of southwest California. Although known for its use in paper products, kenaf fiber also is used for engineered wood, insulation and clothing-grade cloth. Through its Biokenaf Project, the European Union is conducting extensive studies, including life-cycle impacts, of kenaf as a non-food crop.

Industrial hemp also is proving to be a practical, inexpensive, fire-resistant construction material. It is made by heating and compressing plant fibers to create strong construction paneling. Research conducted by Washington State University, Pullman, demonstrated the superior strength, flexibility and economy of hemp composite building materials compared to wood fiber.

The Suffolk Housing Society, Bury St Edmunds, England, undertook a unique project in early 2000, exploring the building potential of hemp. Four identical houses were built in Haverhill, Suffolk. Two houses used hemp mixed with hydraulic lime, a variety of slaked lime that makes mortar, as the principal material. The others were constructed of brick and block. Watford, England-based Building Research Establishment, a building consultancy, prepared a detailed evaluation of the hemp homes, examining structure and durability, thermal and acoustical performance, permeability, waste minimization and construction costs. The hemp homes were found to be as durable as those of traditional construction. The study concluded that while the hemp homes have less impact on the environment because the material is less energy intensive to produce and creates less waste, the homes cost about 10 percent more to build than brick-and-block houses. A full copy of the report can be found on BRE's Web site at www.bre.co.uk/pdf/hemphomes.pdf.

MOVING FORWARD

Rapidly renewable and bio-based materials hold the opportunity to grow the next generation of building products. To ensure the best possible products move into mainstream production and use, building-product specifiers must understand these raw materials and their embodied energy, as well as how quickly the resources can be renewed. The BEES program established by NIST will help determine the best rapidly renewable products for the next generation of green-building projects.

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