Whether it's for environmental, political, or health reasons, many homeowners today are turning over a new leaf and building green. Besides producing their household's electricity from renewable energy sources like the sun and wind, many are incorporating natural, recycled, or reclaimed building products into their home's design and construction.

TOP 10

Eco-Friendly Building Products

Rachel Connor & Laurie Stone, with Dan Chiras

By choosing green building products, you can help conserve our dwindling supply of nonrenewable resources, divert and reuse materials once destined for landfills, and minimize the impacts on our remaining forests. Using green materials and energy-efficient products also can decrease the amount of energy required to heat and cool your home—reducing your utility bills—and can help make your home a healthier place for you and your family.

"A decade ago, green building was stymied by the lack of product; there was only a handful of green building materials on the market," says author and green building expert Dan Chiras. "Today, the number is approaching two thousand and expanding rapidly."

Although building green can be costlier upfront, it pays off in the long run, saving homeowners money by reduced replacement costs, greater energy efficiency, and higher performance and durability.

If you're interested in building green, where do you begin? And how can you spare your pocketbook, while supporting good planetary practices? To help guide your decision-making, *Home Power*'s green building editors asked Dan to choose his top ten green building products. Dan is the author of numerous books on ecological building, including *The Natural House, The New Ecological Home,* and *The Natural Plaster Book.* Here is his list, with our narratives.

Straw bale with a southern flair: Michael Pierce and Elise Lang's Farmington, Georgia, home.

Courtesy Shawn Schreiner

Courtesy Enviroshake

ENERGY-EFFICIENT WINDOWS

Windows provide light, permit views, and connect us to the outside world. However, during cold weather, a typical home can lose more than 25 percent of its conductive heat through its windows. Windows also can admit an overabundance of solar radiation, causing uncomfortable temperature swings within the house. Ideally, a window should provide ventilation and thermal insulation, and mitigate unwanted solar heat gain.

Single-paned window units have an insulative value of approximately R-1; double-paned windows have an R-value of 2. And "superwindows," or high performance windows, which incorporate special plastic films, low-emissivity (low-E) coatings, and gas-filled space (argon or krypton gas) between the panes, can have R-values above R-4. The higher the R-value, the more energy efficient your window, and the more comfortable your home will be.

Thin plastic films, like Southwall Technologies' Heat Mirror, are factory stretched between a window's double panes to create additional insulating spaces. These films also may be coated with low-E coatings to increase the window's R-value. Low-E coatings allow visible light to pass through, but block longer wavelength infrared radiation (heat). By specifying the number and placement of these low-E coatings, you can optimize window energy efficiency and maximize your home's thermal comfort. Argon or krypton gas, instead of air, can be used between the panes of glass to minimize conduction inside the window, further increasing its insulative value.

When you're replacing windows in your home, remember that installing standard windows in a highly insulated wall can compromise the building envelope's overall insulation value. Purchase the highest performance windows you can afford, and be sure that window installers carefully seal and reinsulate the rough window openings to minimize air leakage. Poor installation can negate the energy gains of a superefficient window.

Replacing windows can be expensive, but there are cost-effective alternatives, including using window films, shades, shutters, and insulation panels. A proper edge seal, and radiant and vapor barriers all increase the performance of these products.

ENVIRONMENTALLY FRIENDLY INSULATION

The most common form of insulation in homes today is fiberglass, fabricated primarily from silica sand, which is spun into glass fibers and held together with an acrylic or phenol-formaldehyde binder. Studies have shown that fiberglass insulation may pose a health risk to applicators who may inhale the fibers. Workers and residents may also be exposed to formaldehyde used as a binding agent. Formaldehyde is released from insulation during and after installation.

In studies performed in the 1990s by the medical research arm of the U.S. Department of Labor, three different kinds of glass fibers were found to be toxic to cells and to damage DNA. In a 1994 article in the *American Journal of Industrial Medicine*, John R. Goldsmith, MD, summed up the current research by stating that fiberglass has "been shown by industry-sponsored studies in Europe and the United States to be associated with possibly increasing the risk of mortality from lung cancer and chronic pulmonary disease."

Formaldehyde is classified by the International Agency for Research on Cancer as a "probable human carcinogen." In some individuals, formaldehyde exposure can cause eye, nose, and throat irritation, headache, nausea, and a variety of asthma-like symptoms. Many fiberglass insulation manufacturers have replaced the formaldehyde binders with more benign acrylic binders.

Due to its recycled content, and superior energy and acoustic performance, cellulose insulation is an environmentally preferable product that is cost-competitive

Courtesy Rivertown Media & Communications

Scrap paper gets new life as Nu-Wool cellulose insulation.

with fiberglass. Paper waste composes 75 to 95 percent of cellulose insulation. Unlike some fiberglass insulation, cellulose insulation does not contain formaldehyde-based binders that can off-gas. Up to 25 percent of the product is composed of ammonium sulfate or borate—nontoxic chemical additives that provide insect- and fire-resistant qualities. The borate additive is more desirable—ammonia sulfate can cause significant odor problems if it is not applied precisely to specifications. Although wet blown insulation is much healthier than its fiberglass counterpart, chemically sensitive individuals may want to order loose-fill cellulose made without recycled newsprint.

Other eco-friendly insulation alternatives also are available, such as insulation made from recycled cotton, perlite (volcanic rock), and mineral wool (from recycled steel slag or rocks).

Courtesy www.phoenixorganics.com

LOW- AND ZERO-VOC FINISHES

Paints and finishes may be one of the leading causes of indoor air pollution, releasing low levels of toxic substances into the air for months after application. The source of these toxic substances is a variety of volatile organic compounds (VOCs) that, until recently, were used to improve the performance and durability of coatings. New environmental regulations and consumer demand have spurred the development of low- and zero-VOC paints and finishes. These products are durable, affordable, and pose less harm to human health and the environment.

Low- and zero-VOC paints, stains, and finishes use water instead of petroleum-based solvents as a carrier. The carrier keeps the paint in a liquid state for easy application. As the paint dries, the carrier evaporates, leaving a film of coating. Paints with petroleum-based solvents contain substantial amounts of VOCs, which can off-gas into the surrounding area as the paint dries. Levels of VOCs in waterborne paints are significantly lower than solvent-borne coatings. The actual amount of VOCs can vary from product to product, but is listed on the paint can. Low-VOC paints will still emit an odor until dry. If you are particularly sensitive, buy paint that contains fewer than 25 grams of VOCs per liter.

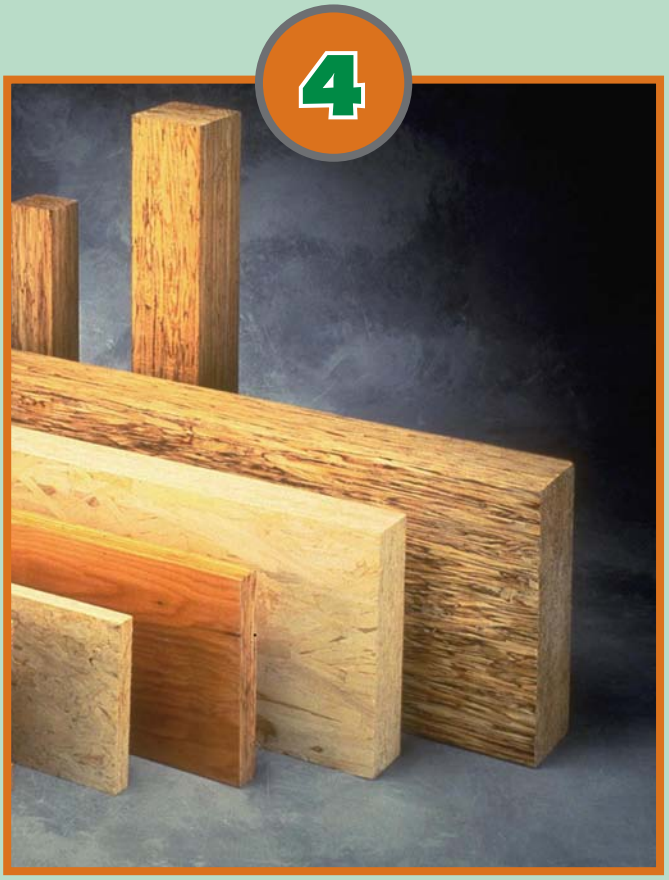
A U.S. Environmental Protection Agency (EPA) standard allows any paint with 0.5 grams of VOCs per liter or less to be labeled "zero-VOC." Although zero-VOC paints pose fewer risks to your health and to the environment than paints containing high levels of VOCs, even many zero-VOC paint formulas still contain toxic ingredients, including acetone, ammonia, formaldehyde, and biocides. And these chemicals can have serious adverse effects on indoor air quality. Adding a color tint can raise the VOC level from zero to 10 grams per liter.

Natural paints and finishes are formulated with plant-based, instead of petroleum-based, ingredients like plant oils, dyes, and resins. They also may incorporate milk casein, natural latex, and beeswax; and minerals such as clay, chalk, and earthen pigments. Water-based natural paints give off almost no odor. Plant-oil-based natural paints usually have a fresh fragrance of citrus or essential oils. According to the Green Affordable Housing Coalition, a group of San Francisco Bay Area green building design professionals, allergies and sensitivities to these paints are uncommon.

ENGINEERED LUMBER

Because of knots, pitch pockets, and other inconsistencies, only part of a log may be suitable for processing into high-grade dimensional lumber. In contrast, engineered wood products can make use of 60 to 70 percent of the raw material, and their production is not dependent upon a diminishing supply of old-growth timber. Engineered wood products can be made using second-growth resources and nontraditional wood species that aren't endangered. Even though they're made from smaller trees, they are often stronger and straighter than traditional lumber products.

Glue-laminated beams (glue-lams) are engineered for strength by bonding smaller pieces of wood together to create a larger beam that is stronger than any similarly sized piece of solid lumber. This combined strength enables a builder to achieve spans not normally possible with standard dimensional lumber. Trus Joist's TJI joists are a high-tech combination of an OSB material and flanges made from a laminated veneer lumber or sawn lumber. TJI Joists are resource-efficient—consuming up to two-thirds less wood than traditional sawn lumber—and manufactured to resist bowing, shrinking, and twisting caused by changes in temperature and moisture conditions. Using these joists can reduce the amount of wood required in a residential flooring or roofing system by at least 50 percent.



Courtesy Trus Joist-Weyerhaeuser

STRAW BALES, ADOBE, STRAW-CLAY, AND NATURAL PLASTERS

According to Dan, an essential criterion for what makes a building material "green" is its embodied energy—the amount of energy required to extract or harvest the raw materials that are used to manufacture the products, process the materials to create finished merchandise, and transport both the raw and finished materials during the various stages of the production-consumption cycle. From an ecological standpoint, the lower a material's embodied energy, the better. Building with local, natural materials, such as earth and straw, dramatically reduces the total embodied energy of a new home or remodeling project, and also makes a healthy, beautiful home. For more information on the embodied energy of building materials, and building with earth and straw, see "From the Ground Up: Natural House Building Primer" in *HP99*.

Courtesy Shawn Schreiner

Satomi Lander of Kingston, New Mexico, demonstrates the artful technique of applying earthen plaster to this straw bale home.

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Courtesy © 1996 Forest Stewardship Council A.C.

The FSC logo identifies products that contain wood from well-managed forests in accordance with the rules of the Forest Stewardship Council.

FOREST STEWARDSHIP COUNCIL (FSC) CERTIFIED LUMBER

In many forests around the world, logging practices continue to destroy habitat, pollute water, and displace indigenous peoples. While many environmentalists strive to minimize the use of wood in construction, avoiding wood use altogether is difficult. Fortunately, the FSC, a nonprofit organization that encourages the responsible management of the world's forests, has developed a set of principles and criteria for forest management that address legal issues, indigenous rights, labor rights, and environmental impacts surrounding forest management. FSC-certified lumber is available around the world. For a list of FSC-certified product manufacturers visit their Web site (see Access).

PLASTIC LUMBER

According to the Food and Agriculture Organization of the United Nations, the world lost 39.7 million acres of forest each year during the 1990s. Today, alternatives to lumber abound, especially for outdoor projects. Many companies now manufacture plastic lumber made from 100 percent recycled materials. Trex decking and railing products are made primarily from recycled plastic grocery bags, reclaimed industrial plastic wrap, and waste wood from woodworking manufacturers. The combination of reclaimed wood and plastic capitalizes on the best qualities of each material. Plastic shields the wood from moisture and insect damage, preventing rot and splintering, and wood protects the plastic from ultraviolet damage and lends a solid, natural feel to the material. Once installed, these products are nearly maintenance free, providing years of durable performance. Many consumers are choosing plastic lumber as a safer substitute for pressure-treated (also known as CCA-treated) wood, which has been impregnated with toxic preservatives.

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Courtesy Trex Company Inc.

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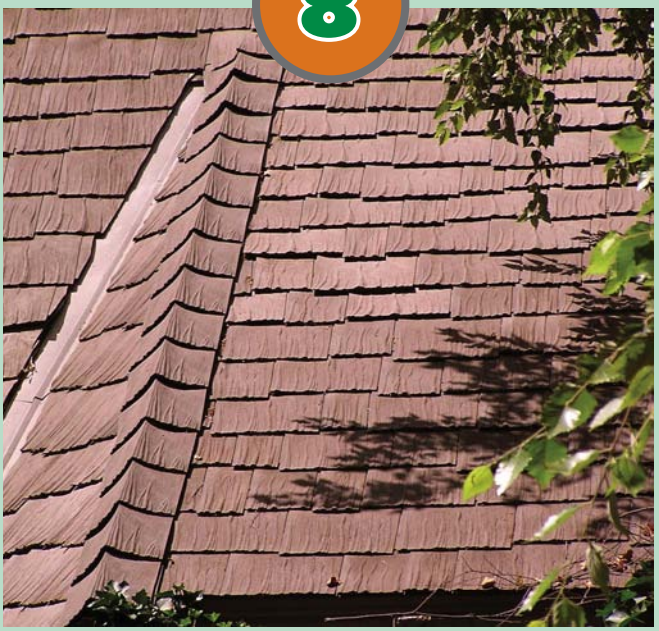

Courtesy Raker Creative LLC/Re-New Wood Inc.

Eco-shake roofing shingles are made from post-industrial recycled PVC and 100 percent reclaimed wood fibers.

ENVIRONMENTALLY FRIENDLY ROOFING MATERIALS

Most homeowners know from experience that asphalt roofs need to be replaced every ten to twenty years. These "disposable roofs" produce a vast amount of waste—more than 11 million tons each year, according to shinglerecycling.org. However, new roofing products are paving the way for recycled rooftops across the country.

Teel's Panelshakes are made from post-consumer plastic milk jugs and waste wood fibers. Enviroshakes incorporate a mixture of post-industrial recycled plastic, recycled rubber elastomers from tires, and cellulose fiber materials. Re-new Wood's Eco-shake combines two recycled materials: reinforced vinyl and cellulose fiber. The Eco-shake shingle dramatically reduces the amount of materials that would otherwise find its way into landfills, and helps preserve forests by using only waste wood products. The shingles come with 50-year warranties. And because this product resists fire and hail, many insurance companies offer substantial discounts—up to 28 percent—for homes on which they've been installed, says David Adamson, founder of EcoBuild, a green-building consulting firm in Boulder, Colorado.

RECYCLED TILE

Environmentally friendly materials for flooring, countertops, and bathroom surfaces include sustainably harvested wood and grass, and resilient products composed of natural, nontoxic, and recycled materials. Dan's favorite—tile made with recycled materials—reuses a common waste material and turns it into a durable, maintenance-free building material. Many recycled tiles are made from 100 percent recycled glass. These tiles take less than one-half of the energy to produce than ceramic tile, and use less than one-fourth of the energy required to produce a cast-glass tile.

Bedrock Industries' Blazestone tiles, available in a variety of hues and shapes, are created from post-consumer and post-industrial recycled glass. They offer several colors (cloud white, pond, cedar, turtle, and java) made with only 100 percent post-consumer recycled glass. Aurora Glass produces a range of luminous recycled glass tiles, from 1-inch accent tiles to 6-inch field tiles, made from recycled window and other glass products that would otherwise wind up in a landfill. Sandhill Industries fabricates their richly colored tiles from 100 percent post-industrial plate glass. And Terra Green Ceramics offers three series of recycled glass tile, all manufactured with at least 58 percent recycled glass content, the majority of which comes from airplane windshields. These recycled tiles, which are well suited for bathroom and shower wall applications, may be used as an accent in combination with a field of less expensive tile.

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Courtesy Jerry Stone/Terra Green Ceramics Inc.

LOW- AND NO-FORMALDEHYDE PRESSED WOOD PRODUCTS

Particleboard is widely used in cabinets and furniture. Unfortunately, conventional particleboard uses formaldehyde as a preservative and in its binder. Low doses of formaldehyde, which can off-gas from particleboard products, cause watery eyes or burning sensations in the eyes, nose, and throat. Larger doses can cause nausea, breathing difficulties, headache, and fatigue. High doses can cause asthma attacks. Both the EPA and the National Institute for Occupational Safety and Health classify formaldehyde as a "probable human carcinogen." Today some types of particleboard are now manufactured with resin binders that do not contain formaldehyde. If formaldehyde-free particleboard or plywood products are not available in your area, the next best choice is to seal the particleboard to prevent formaldehyde off-gassing.

Oriented strand board (OSB) is a construction panel made with layers of wood "strands" that are aligned, formed into panels, and pressed with an exterior-grade adhesive resin. Exterior-grade OSB contains phenol formaldehyde, which is less harmful than the urea formaldehyde used in interior-grade plywood. According to the EPA, pressed woods that contain phenol formaldehyde resin generally emit lower levels of formaldehyde than those containing urea formaldehyde resin.

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Free of formaldehyde binders, AdvanTech oriented strand board (OSB) carries a 50-year limited warranty.

Green Guidelines

Decided to go green? Consider these criteria when you're choosing a particular product:

- Manufactured by socially and environmentally responsible companies
- Produced sustainably—harvested, extracted, processed, and transported efficiently and with minimal impact to the environment
- Low embodied energy
- Locally produced
- Made from recycled materials
- Made from natural or renewable materials
- Durable
- Recyclable
- Nontoxic
- Nonpolluting

—Adapted from *The New Ecological Home: A Complete Guide to Green Building Options* by Daniel Chiras

Access

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Dan Chiras, Sustainable Systems Design, 9124 Armadillo Trail, Evergreen, CO 80439 • 303-674-9688 • danchiras@msn.com • www.danchiras.com

Aglaia Natural Paints, Environmental Building Supplies, 819 SE Taylor St., Portland, OR 97214 • 800-322-6843 or 503-222-3881 • Fax: 503-222-3756 • ebs@ecohaus.com • www.aglaiapaint.com • Natural, plant-based paints & finishes

American Formulating & Manufacturing (AFM) • 800-239-0321 or 619-239-0321 • info@afmsafecoat.com • www.afmsafecoat.com • Low- & zero-VOC paints & finishes

Aurora Glass, 2345 W. Broadway, Eugene, OR 97402 • 888-291-9311 or 541-681-3260 • Fax: 541-681-8755 • auroraglass@auroraglass.org • www.auroraglass.org • Recycled glass tile

Bedrock Industries, 1401 W. Garfield St., Seattle, WA 98119 • 877-283-7625 or 206-283-7625 • Fax: 206-283-0497 • info@bedrockindustries.com • www.bedrockindustries.com • Recycled glass tile

BioShield Paints, 1330 Rufina Cir., Santa Fe, NM 87505 • 800-621-2591 or 505-438-3448 • Fax: 505-438-0199 • info@bioshieldpaint.com • www.bioshieldpaint.com • Natural, plant-based paints & finishes

Enviroshake, PO Box 1462, Chatham, Ontario, Canada N7M 5W8 • 866-423-3302 or 519-380-9265 • Fax: 519-380-0689 • info@enviroshake.com • www.enviroshake.com • Enviroshake recycled-content roofing shingles

Forest Stewardship Council, 1155 30th St. NW Ste. 300, Washington, DC 20007 • 202-342-0413 • Fax: 202-342-6589 • info@fscus.org • www.fscus.org • Database of FSC-certified product manufacturers

Huber Engineered Woods, 1 Resource Sq., 10925 David Taylor Dr. Ste. 300, Charlotte, NC 28262 • 800-933-9220 • www.huberwood.com • Formaldehyde-free oriented strand board (OSB)

Re-New Wood Inc., PO Box 1093, Wagoner, OK 74467 • 800-420-7576 or 918-485-5803 • customerservice@ecoshake.com • www.ecoshake.com • Eco-shake recycled-content roofing shakes

Sandhill Industries, 6898 S. Supply Way Ste. 100, Boise, ID 83716 • 208-345-6508 • 208-345-4424 • sales@sandhillind.com • www.sandhillind.com • Recycled glass tile

Southwall Technologies Inc. • 800-365-8794 or 650-962-9111 • Fax: 650-967-8713 • archsales@southwall.com • www.southwall.com/products/heatmirror.html • Heat Mirror window film

Teel Global Resource Technologies, 426 Hitchcock St., Baraboo, WI 53919 • 800-322-8335 • Fax: 608-355-3088 • www.teel-grt.com • Panelshakes recycled-content roofing shingles

Terra Green Ceramics Inc., 1650 Progress Dr., Richmond, IN 47374 • 765-935-4760 • Fax: 765-935-3971 • custsrv@terragreenceramics.com • www.terragreenceramics.com • Recycled glass tile

Trex Company Inc. • 800-289-8739 • question@trex.com • www.trex.com • Plastic lumber

Trus Joist-Weyerhaeuser, 200 E. Mallard Dr., Boise, ID 83706 • 800-338-0515 or 208-364-1200 • Fax: 208-364-1300 • www.trusjoist.com • Engineered wood products

The New Ecological Home: A Complete Guide to Green Building Options, Daniel Chiras, 2004, Paperback, 336 pages, ISBN 1-931498-16-4, US$35 from Chelsea Green, PO Box 428, White River Junction, VT 05011 • 800-639-4099 or 802-295-6300 • Fax: 802-295-6444 • info@chelseagreen.com • www.chelseagreen.com

GreenSpec Directory, 4th ed., Dwight Holmes, Larry Strain, Alex Wilson, & Sandra Leibowitz, 2004, Paperback, 448 pages, ISBN 1-929884-12-5, US$89 from BuildingGreen Inc., 122 Birge St. Ste. 30, Brattleboro, VT 05301 • 800-861-0954 or 802-257-7300 • Fax: 802-257-7304 • info@buildinggreen.com • www.buildinggreen.com • Online version also available

Green Building Materials: A Guide to Product Selection and Specification, Ross Spiegel & Dru Meadows, 1999, Hardcover, 336 pages, ISBN 0-47129-13-31, US$75 from John Wiley and Sons, 10475 Crosspoint Blvd., Indianapolis, IN 46256 • 877-762-2974 • Fax: 800-597-3299 • www.wiley.com