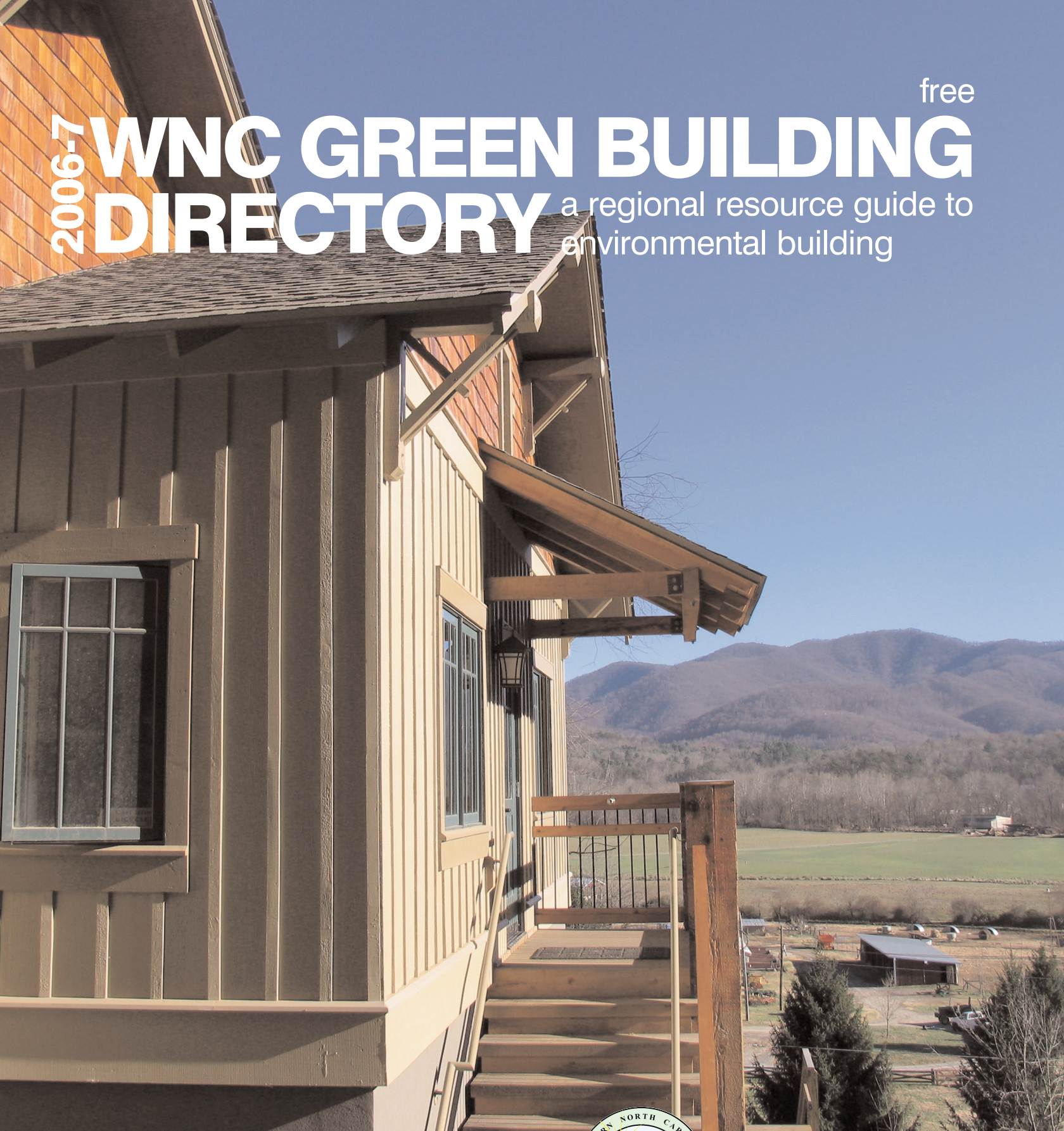


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# WNC GREEN BUILDING DIRECTORY

a regional resource guide to  
environmental building



what's inside:  
expert advice on green design  
how to curb your energy consumption at home  
detailed listings of local green builders and businesses



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*Steve Frellick*



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## Green Building Council Members

*On the cover: Constructed with the help of student work crews, the admissions building at Warren Wilson College uses half the energy of a typical building its size. (photo by Rebecca Bowe) See story, p. 12*

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## Using this directory

Whether you're a homeowner, builder, green-technology geek or tree-hugger, this guide explains "green," or environmentally conscious, building and offers guidelines and resources. In addition to information on local and regional green businesses and suppliers, the directory features the expertise of green-building professionals in a variety of articles and case studies. The publication is divided into four sections:

### Introduction

An overview of green building and an introduction to the Western North Carolina Green Building Council.

### Articles

Members of the local green-building community impart their wisdom on technical aspects of green building, in addition to how-to guidelines and an overview of local initiatives toward sustainable design. With the case studies presented here, you'll also get a chance to see inside the homes and offices of green building enthusiasts.

### Listings

A comprehensive directory of green architects, builders, service providers and suppliers to help you with your green project.

### Resources

A list of publications and Web sites to help you learn the lingo of green building.

### Why build green?

Think about environmental issues that face us today. Climate change, deforestation, ever-growing landfills, health problems associated with poor air quality and other environmental contamination — all of these are related to mass consumption of energy and natural resources. According to the U.S. Green Building Council, buildings in the United States account for 65 percent of electricity consumption and 36 percent of primary energy use. And operating a typical American house produces 26,000 pounds of greenhouse gases each year, according to the council. Green construction seeks to use less, waste less and minimize its environmental impact, which results in energy- and resource-efficient, durable, healthy buildings.

To get an idea of the difference green design can make, consider the green office buildings constructed for the Natural Resources Defense Council (NRDC) in New York, Washington and Santa Monica, Calif. With a total savings of 350,000 kilowatt-hours of electricity a year, according to the organization's Web site, these buildings remain on the cutting edge of environmental design. NRDC estimates that if every commercial building in the country were made to meet their green standards, the

amount of energy saved would power New York, Los Angeles and eight other major U.S. cities and eliminate the need for 300 power plants nationwide. At a time when energy costs are going through the roof, more and more businesses, organizations and individuals are recognizing the potential in low-impact design.

### What does a green building look like?

LEED (Leadership in Energy and Environmental Design) is the flagship program launched by the U.S. Green Building Council to rate the environmental performance of buildings in the commercial sector. In the past five years, more than 20,000 design professionals have trained to become LEED accredited, and corporations, schools and municipalities across the country have adopted LEED as a standard. For LEED certification, a building must reduce impacts in five categories: site planning, energy consumption, water use, indoor environmental quality and building materials. According to the council, a building is green when:

- It uses 30 percent to 60 percent less energy than a conventional building of its size.
- It uses renewable, recycled and least-toxic building materials.
- It is located to minimize its environmental impact.
- It's highly efficient with low operational costs and uses renewable energy.
- It's resource-efficient, conserves water and produces little construction waste.
- It is durable, low-maintenance and high quality.
- It provides a healthy indoor environment.
- It features sustainable landscaping and protects the ecosystem.

In North Carolina, a statewide initiative called the HealthyBuilt Homes (HBH) program exists to support small and medium-sized homebuilders with technical assistance, design reviews, and workshops on green building. Since the program's inception in 2004, 21 homes have been certified and 65 more registered to be built, all of them adhering to strict guidelines for energy efficiency, healthy indoor air quality, and resource conservation. Healthy Built Homes was brought to this area through a partnership with the WNC Green Building Council— just one example of many efforts the council has made to ensure that healthy and sustainable building practices flourish here in Western North Carolina. The area is fortunate to have many knowledgeable, talented and environmentally minded professionals working on green-building projects, and this directory offers a chance to get to know them.

— Rebecca Bowe



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## Introducing the WNC Green Building Council

The idea for the Western North Carolina Green Building Council (WNCGBC) was sparked six years ago at a casual gathering of five building professionals who shared a common desire to educate others on the health and environmental impacts of design and construction. Since then, it has developed into a 501C3 non-profit organization whose mission is to promote environmentally sustainable and health conscious building practices through community education.

Today, the WNCGBC has grown to over 100 members and launched dozens of educational events, tours, publications and workshops to make the local built environment more sustainable. The council was responsible for implementing the NC HealthyBuilt Homes program, a statewide building performance rating system that assists homebuilders in establishing truly green, high-performance, and low impact homes throughout the region.

WNC Green Building Council members conduct LEED (Leadership in Energy and Environmental Design) consultations for local green building projects, lead tours of local homes and commercial buildings that demonstrate energy-saving technology, and work in partnership with the Million Solar Roofs Initiative and the National Energy Education Development Project. The Green Building Hotline, operated out of the council's office, assists over 300 architects, builders, and homeowners per year in finding sustainable building materials, technologies, and professionals to work with. Read about their latest accomplishments and find out about upcoming workshops in The Greener Side, the WNCGBC's newsletter, available online.

**Help Support the Work of the WNC Green Building Council and Create a More Sustainable WNC!**

**Become a member and start making a difference today. Visit [www.wncgbc.org](http://www.wncgbc.org) to find out how.**



WNC Green Building Council  
PO Box 17026  
Asheville, NC 28816  
WNCGBC Hotline: (828) 232-5080  
[info@wncgbc.org](mailto:info@wncgbc.org)  
[www.wncgbc.org](http://www.wncgbc.org)



# green guidelines

technical expertise and cutting-edge green designs



**NC HealthyBuilt  
Homes Program**

## Don't be brainwashed by 'green washing'

by Rob Moody

Green building has become a buzzword around Asheville. Consumer demand stems from homeowners interested in lower energy bills, healthy indoor air quality and durability. These are benefits that true green builders offer. The National Home Builder's Association is introducing its own green-building standards and organizes an annual green-building expo. The U.S. Green Building Council is gaining strength and membership, as indicated by the 12,000 attendees at their Green Build Expo in Atlanta last November. The state of North Carolina recently started its own green-building certification program called NC Healthy Built Homes.

With all of this interest on the local and national levels, there is huge marketing potential available for builders and suppliers. As with any other hot topic, many people involved will benefit from the buzz. Some will benefit because they are sincerely green. Others will capitalize by putting forth a green façade. Some may purport green methods and ideals, but in reality they could lack the qualities that make a product or builder truly green. This is known as "green washing." How can consumers and builders guard against green washing? With education.

For products, several certifications can be trusted. The Forest Stewardship Council (FSC) is an international nonprofit whose goal is to promote responsible management of the world's forests. Their mission is to ensure that forestry practices are environmentally conscious, locally and socially ethical, and economically viable. Governed by a general assembly, board of directors and executive director, the FSC has the most stringent and recognized policies and standards. Buying FSC-stamped wood is a great way to reinforce that the product has been thoroughly monitored and certified as environmentally responsible.

The Greenguard Environmental Institute (GEI) is an independent, third-party testing program that measures emissions from a variety of products, from adhesives to carpet and insulation. GEI tests products to ensure that chemical and particulate emissions meet acceptable levels for good indoor air quality. Like the FSC, Greenguard has a governing advisory board that consists of experts in the field. The Greenguard Web site has a product guide to inform consumers of certified products. Greenguard certification allows the consumer to breathe easy.

Most consumers would not hire a contractor who does not have a license to build a home. For the same reasons, if someone wants a green home built, he or

she should insist that it be certified "green." Unless a builder has a history of green building, certification is the only way to ensure that a home is built to green standards. In North Carolina, that means the NC HealthyBuilt Home certification. Clarification is necessary here. Green building is different from energy efficiency. Green building takes a holistic approach that incorporates energy efficiency, indoor air quality, resource use, native landscaping, water conservation and other components. Energy efficiency just refers to a building's energy demand. The certification most recognizable for energy efficiency is the Energy Star program created by the Environmental Protection Agency and the Department of Energy. If a builder says the company builds Energy Star homes, there is proof of this claim. The homeowner should receive an Energy Star sticker that verifies the home is certified. This will be accompanied by a 5 percent Progress Energy discount on the electricity bill.

Is an Energy Star builder equivalent to a green builder? No. Energy Star does not cover some important aspects of green building, such as indoor air quality. Anyone affected by allergies, asthma or chemical sensitivity can attest to the importance of indoor air quality. If a builder suggests he or she is a green builder but only does Energy Star, this can mislead customers into thinking that the builder covers all green facets of building. Customers should ask builders about the specifics of their building practices. Consumers should ask their builder to build them a NC HealthyBuilt Home.

*Rob Moody is vice president of the Western North Carolina Green Building Council. He is president and owner of The EcoBuilders Inc., an Asheville area green builder. The EcoBuilders focuses on Asheville in fill custom and spec homes that are certified NC Healthy Built. He can be reached at 337-0623 or [ecomooody@theecobuilders.com](mailto:ecomooody@theecobuilders.com).*

### For more information, visit these Web sites:

- Western North Carolina Green Building Council, [www.wncgbc.org](http://www.wncgbc.org)
- Healthy Built Homes of Greater Asheville, [www.wncgbc.org/healthybuilt](http://www.wncgbc.org/healthybuilt)
- Forest Stewardship Council, [www.fsc.org](http://www.fsc.org)
- Greenguard Environmental Institute, [www.greenguard.org](http://www.greenguard.org)
- Energy Star, [www.energystar.gov](http://www.energystar.gov)



# Ravensford project will provide green schools for the Cherokee

by Maggie Carnevale

The Eastern Band of Cherokee Indians (EBCI) is developing a pre-K through 12 education campus in Cherokee. True to their culture of connectivity and respect for their natural surroundings, the EBCI is committed to building a campus dedicated to preserving the natural environment that sustains it.


The Ravensford school project may be the largest green building project in the region. Including elementary, middle and high schools, the project involves architects and consultants from around North Carolina. The EBCI and Padgett & Freeman Architects of Asheville aim to achieve the United States Green Building Council's Leadership in Energy and Environmental Design (LEED) Program's silver rating for the building. LEED's Green Building Rating System is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

A 144-acre tract of land obtained through a land exchange with the National Park Service is the location for the new education campus. The site abuts the Blue Ridge Parkway, the Great Smoky Mountains National Park and the Oconaluftee and Raven

Fork rivers. The arrangement of the site is determined by a 100- and 500-year flood plain where athletic fields, playgrounds and parking will be placed. Educational buildings will be located outside the flood plain and at least 100 feet from the edge of the wetlands. Structures are being designed to follow the contours of the hillside.

The project site is one of the most significant Cherokee sites in existence in terms of archaeology. TRC of Chapel Hill will explore the site and recover data before construction. Evidence of human occupation at the site dates to approximately 8,000 B.C. The Cherokee people controlled the Ravensford site until 1798, when European-Americans settled and farmed the valley. In 1918, the site and surrounding land was bought by a lumber company. A train system was established, and the town of Ravensford was built. In 1934, the property was acquired by the National Park Service to establish the Great Smoky Mountains National Park. In a land exchange in 2003, the Eastern Band of Cherokee Indians regained the site for a school campus.

All students will be housed on one campus to encourage community and sharing of both traditional culture and resources. A central spine links the three schools and forms the community space. A guiding principle for the school's design is that buildings be flexible to meet current and future educational programs, teaching techniques, technological requirements and enrollment. Nonbearing interior partitions will encourage the reassignment of space as needed without having to alter expensive structural elements. Exposed structure and HVAC

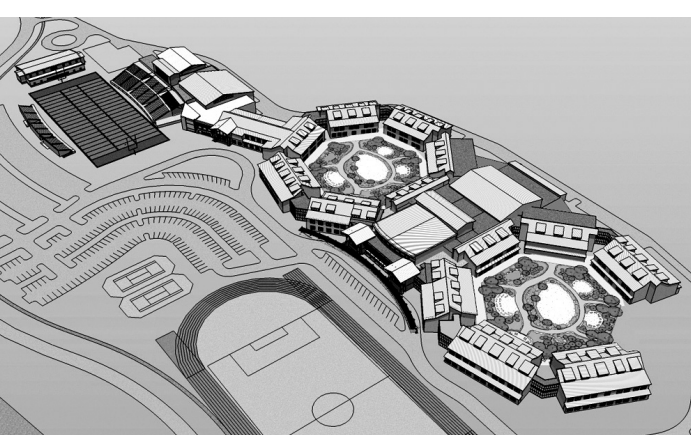


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An illustration of the campus layout, facing north (created by Padgett & Freeman Architects).

ductwork is proposed to allow the building itself to be a teaching tool.

A greenway connecting the school with downtown Cherokee will promote safe pedestrian transportation to and from the campus. Preferred parking spaces for hybrid vehicles and carpoolers will be located closest to the entrances. A percentage of the required parking lots will allow water to seep into the ground instead of entering the storm water system. Rain gardens and earth berms between parking areas will help with storm water retention and filtration. In addition, the school bus provider is researching the potential of converting the bus fleet from diesel fuel to biodiesel.

Landscaping will include indigenous plants that will shade parking lots and walkways. Culturally significant plants and crops

will be incorporated to enhance science, Cherokee art and history curriculums. Based on needed water capacity, the courts will use high-efficiency irrigation technology from rainwater captured on the roof. Outdoor classrooms, a biology pavilion, a greenhouse, nature trails, wetland platforms and stream-ecology trails are planned to encourage discovery of natural systems and enhance science programs.

Strategies to reduce water use will be realized. In addition to indigenous, drought-tolerant plants that require little or no irrigation, efficient fixtures and waterless urinals will be specified to reduce the amount of potable water demand. For educational purposes, rainwater will be used for sewage conveyance in some public areas. The dry stream feature in the courtyard is designed to allow flow during rain and to be a dry bed in drought.

The design of the new facility will help minimize long-term operational and environmental costs through energy-efficient design principles. A proposed geothermal heating and cooling system would use the constant temperature of the earth to reduce loads on individual air-handling units within the building. Structural insulated panels are being considered for exterior wall assemblies and the roof.

State-of-the-art daylighting systems will reduce the heat loads associated with artificial lighting and could help improve student performance. Research by the Heshong-Mahone Group for Pacific Gas & Electric indicated that a classroom well lit with daylight can improve student performance 7 to 18 percent.

*continues on page 10*

## Mother Earth's spring dress

*And this time of year  
our Mother Earth has worked all winter long  
in making her dress,  
beautiful dress,  
but it's green.*

*'Bout the early spring she adds some flowers to it.  
And whenever she gets ready  
she drops her skirt down the mountainside,  
you can see it across the mountain  
downhill,*

*all her skirt is full  
with all the flowers  
dogwood flowers, azaleas,  
and all kinds of flowers.*

*That's our Mother's skirt  
that she had worked on all winter long.  
So rejoice in it  
and try to keep it clean  
this is our Mother Earth that we walk on.*

*by the late Edna Chekelelee, in "Living Stories of the  
Cherokee," edited by Barbara Duncan (University of North  
Carolina Press, 1998)*

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Dormers at each upper level classroom allow for daylighting, and tubes from the roof will transport sunlight to lower-level classrooms. Shading devices on the exterior of the building will protect vision glass from direct heat gain and glare, and light shelves on the interior will reflect sunlight onto brightly painted ceilings, dispersing it deeply into the classroom.

At least 50 percent of construction and land-clearing waste will be recycled or salvaged from the site. All brush and small trees have been mulched and kept on site to use in the final landscaping plan. Larger trees will be milled at a nearby sawmill, and lumber will be used in the new buildings or donated to the Cherokee High School woodworking program. Material selection will give preference to materials that are rapidly renewable, nontoxic and low-emitting, and products made with recycled content. Sustainably-harvested wood will be utilized when possible.

The Ravensford school project will be a resource for community-wide environmental education and a model for schools nationwide. The project reflects the Eastern Band of Cherokee Indians' interest in environmental sustainability and Western North Carolina's commitment to green building.

Maggie Carnevale may be reached [atmcarnevale@padgettandfreeman.com](mailto:atmcarnevale@padgettandfreeman.com) or at Padgett & Freeman Architects at 254-1963.

## Consultants for the project include:

Padgett & Freeman Architects, PA

### LEED consultant

Western North Carolina Green Building Council

### Electrical engineer

Vreeland Engineers

### Structural engineer

Newcastle Design Group, PLLC

### Mechanical-plumbing engineer

Engineering Services Group, P.C.

### Civil engineer

Civil Design Concepts

### Commissioning firm

Engineering Economics Inc

### Daylighting analysis

Brown & Jones Architects

### Energy modeling

Consider Design, PA

### Landscape architect

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# Eco-agent real estate professionals can provide solutions

by Mary Love

In spring of 2005, representatives from the Asheville Board of Realtors, various nonprofit organizations and local colleges gathered to discuss sustainability and the impact of housing on the environment. Within a few months, this task force created a continuing education course that was approved by the NC Board of Realtors and established a course that is being examined for state and national certification for Realtors.

The Asheville Board of Realtors and its partners developed the eco-agent course for two reasons. First, as we enter the 21st century, it is clear that many of humankind's actions are out of balance with the natural world. The continuation of the relatively high quality of life we enjoy and arguably humankind's survival depend on changing how we relate to our environment. For many people, the decisions they make about buying a home or property will be among the most important decisions they make for the environment, for good or bad. The real estate agent serves not only as the broker for the transaction but also as a resource to parties in the transaction. We believe agents should provide access to information a client needs about environmental issues.

The Asheville Board of Realtors also recognizes that specialized knowledge is one way agents can distinguish themselves from their colleagues. Not all real estate agents or clients may be concerned about environmental issues. However, an agent has a duty to be informed about issues that can become material fact. And clients want to know that an agent is looking out for their best interests. An agent who is informed about environmental issues can help build trust between the client and the real estate profession. Eco-agents can help with issues about mold, radon and poor indoor air quality. They offer clients resources and can provide solutions to challenges.

To be certified as an eco-agent, the agent must complete 36 hours of training. The program is divided into core and elective courses. Core courses will be provided by the Asheville Board of Realtors. A continuing education course, "Environmental Issues: Resources/Healthy Choices," is four hours. A two-day seminar is also required.

The elective portion of the program is being developed. Decisions about the suitability of a course will be made by the Asheville Board of Realtors. The WNC Green Building Council is creating a curriculum to provide elective courses to agents and the public.

The first 16-hour, core-curriculum seminar was held last fall. There are four certified eco-agents: Mary Love of The Gleason Team, Debra Marshall of Century 21, Ginny Lentz with Beverly-Hanks and Mary Ellen Brown with Keller-Williams. Check [www.abr-nc.com](http://www.abr-nc.com) for updates about the course and eco-agents.

*Mary Love is a real estate consultant who focuses on eco-development and HealthyBuilt Homes. She is a member of the WNC Green Building Council. She can be reached at 279-6723 or [marylove@charter.net](mailto:marylove@charter.net).*

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# Living the low-impact dream at Warren Wilson College

by Rebecca Bowe

John Brock, a chemistry professor at Warren Wilson College, offers a startling bit of information to the tour group that has just crowded into his lab: “You may not realize this, but if I took a blood sample from each of you right now, it would contain traces of many synthetic compounds such as DDT,” a pesticide. Brock, who once worked at Centers for Disease Control in Atlanta, has made a career of trying to protect people from environmental pollutants through education and scientific study.

The effect of his brief lecture is to illustrate the direct link between environmental issues and human health. The point hits home with the tour participants, a group of realtors hoping to attain certification as eco-agents with expertise in green building. Led by representatives of Warren Wilson’s Environmental Leadership Center, they’ve assembled for a “green walkabout” to learn about the college’s innovative green construction designs, the solar-powered golf carts used as maintenance vehicles and other sustainability initiatives. Stan Cross of the center notes that launching green projects on campus does more than enhance the college’s image: ultimately, the initiatives limit the amount of harmful substances in the environment. “As an administration, we recognize that we, too, contribute negatively to problems such as carbon dioxide emissions that lead to climate change. So our goal is to constantly try and reduce how much a part of the problem we are,” says Cross.

They’ve taken the goal seriously. Highlighted during the walkabout are the new admissions building and the 36-bed EcoDorm, completed in summer 2003. Green architecture is only part of the lifestyle at Warren Wilson. A plethora of environmental programs keeps student work crews busy turning compost, driving biodiesel-powered tractors and pickups for landscaping, researching and restoring native vegetation, and tending livestock on the organic farm. The college promotes itself as a green campus and states in its environmental policy that it will “strive within the limits of practical considerations to conserve energy and resources, reduce waste, purchase environmentally-friendly products and minimize our adverse impact on the surrounding environment.”

## The admissions building

The new admissions building will undergo application for LEED-Gold certification. The Leadership in Energy and Environmental Design (LEED) rating system, developed by the U.S. Green Building Council, is a national standard for constructing high-performance, sustainable buildings. The admissions building uses half the energy a typical structure its size would consume, according to the college’s Web site. Heating and air conditioning are supplied with a geothermal system, which harnesses heat from underground rather than from burning fossil fuels. Wood in the siding came from the 750 acres of college-owned forestland. In an aim to leave the forest intact, workers harvested — using draft horses — only the yellow pine that was victim to the blight from the pine bark beetle.



Warren Wilson will go for LEED-Gold certification for their admissions building. (photo by Rebecca Bowe).

Inside, the doors are a mix of salvaged antiques, some custom-fitted for their frames. Desks consist of recycled filing cabinets and wheat-board desktops that were selected because wheat, unlike wood, is considered a “rapidly renewable” resource. The lights are all compact fluorescents (CFLs), which last 7 to 13 times as long as incandescent lights and use less energy.

Immediately noticeable is the abundance of windows that allow natural light to stream in. This design feature employs passive-solar heating, reduces electricity consumption and caters to the comfort of the building’s inhabitants. While introducing the admissions building, Philip Gibson of the Environmental Leadership Center stresses the importance of incorporating “creature comfort” into architectural design, with consideration for circadian rhythms. “The body needs to feel the rhythm of the sun and know what time of day it is. Everyone in this building can see out as they’re working, and they’re likely to feel more productive because of it,” Gibson says. The windows display the landscape of farmland and hillsides that stretch hundreds of acres.

Outside the admissions building a rain garden is placed to absorb storm water runoff. Designed to catch the first inch to inch-and-a-half of rain that scours parking lots before moving downhill, the system uses gravel barriers to naturally filter out harmful particulate matter before the water is released. Eventually, wetland plants with the capability to absorb toxins from the runoff will be transplanted there to give it an aesthetic appeal while keeping nearby creeks safe from contamination.

## The EcoDorm

Plans for the EcoDorm started years ago. In 1998, when college officials decided to increase student housing, students wanted at least one new building to be “green.” Students, faculty and representatives from green-building firm Samsel Architects oversaw the eco-dorm design. Four goals — energy efficiency, water conservation, healthy indoor-air quality and use of local and recyclable materials — were design criteria. The building



features photovoltaic panels, composting toilets, low-energy lights, high-efficiency boilers and other green elements.

The walls and ceiling of the EcoDorm are made of structural insulated panels (SIPS), which consist of expanded polystyrene between two layers of oriented strand board. SIPS create a nearly-seamless building envelope, or exterior shell, that reduces air infiltration. For the interior wood framing, beetle-blighted yellow pine, the most locally available option, was chosen. The wood posed logistical issues with its tendency to warp, but students wanted the most environmentally-conscious choice.

Photovoltaic cells make up the awnings of several south-facing windows in the EcoDorm, and solar panels behind the building preheat water, which is piped inside for further heating by high-efficiency boilers. An underground cistern collects rainwater before it is pumped into the dorm, pressurized and used to flush toilets. The gardens surrounding the EcoDorm will be a "99 percent edible landscape," according to landscape crew coordinator Tom La Muraglia. Using permaculture, a sustainable-agriculture method, students plan to grow herbs, kiwis, figs, apples, pears, persimmons, greens and other natural treats outside their dorm.



*Awnings above south facing windows of the EcoDorm are equipped with solar panels. Outside, permaculture techniques are used to create an "edible landscape" (photo by Rebecca Bowe).*

Of course, racking up all these green points doesn't come without a price. Larry Modlin, the college's vice president of business affairs, said the tab for the building totaled \$180 a square foot, compared with \$120 a square foot for other new construction in the same time frame. It may have had something to do with the EcoDorm's two composting toilets, which cost a total of \$50,000. But in an article about the EcoDorm released by the college, the issue of expense is addressed: "The financial picture changes when using full-cost accounting, which recognizes costs as resources that are used or committed, regardless of when the

money is spent, from the moment something is produced to the moment it biodegrades. Perhaps the main question an institution (or individual) should ask when considering green building is, what is valuable to us?"

*Rebecca Bowe is coordinator of the 2006-2007 Green Building Directory for the Mountain Xpress. Her writing has appeared in E: The Environmental Magazine, Terrain Magazine, and the Mountain Xpress. Contact her at [greenbuilding@mountainx.com](mailto:greenbuilding@mountainx.com).*



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## Bark siding is the ultimate green-building material

by Chris McCurry as told to Nan Chase

When my husband, Marty, and I first harvested bark from poplar trees 12 years ago, we felt like pioneers. With help from old-timers in the mountains, we learned to use the same tools harvesters used more than a century earlier, before bark siding disappeared from the scene: bark spuds, peaveys, axes and hatchets, all hand-powered.

After a chestnut blight 100 years ago wiped out the trees used for bark siding, Marty and I have rediscovered the outstanding characteristics of bark, this time from abundant poplar trees in Southern forests. It took a lot of research, sweat and dedication, but bark is back. You may not have heard of bark siding, or shingles, but we find that for mountain vernacular, this is the most durable and attractive building material for exterior cladding. Ultimately, bark is the most economical of any such product, with the least environmental impact.

We have a green-building company, Highland Craftsmen, in Blowing Rock. For us, it's important to manufacture the shingles and other rustic forest products we supply in ways that don't use chemicals, so no chemicals can leach into soil or ground water. Besides poplar bark, which comes from trees already cut for use in the furniture and plywood industries, our product lines include large support posts, porch and stairway railings and sheets and panels of various barks for interior and exterior use. These come from clearing understory growth that prevents the natural regeneration of indigenous, large timber species. Poplar bark would have been discarded as debris at the logging site or mulched at sawmills. By using low-impact methods of bark reclamation, we can save tons of a valuable building material from that fate every year.

We especially love bark siding because it connects buildings to the earth in a beautiful, natural way. It feels rich and deeply textural, with a color that minimizes the visual impact of a building on the land. As a forest product, poplar bark brings unique design integrity to mountain structures. Bark siding can last 75 to 100 years without any painting or sealant. The siding traditionally was used on churches and inns, and now it's on resort homes and even commercial buildings. Without paint or stain, there's no chemical runoff ever.

Because we kiln-dry the bark once it is removed from trees, it is heat-sterilized against fungal spores and insect larvae, without pesticides or other potentially harmful chemicals. When you buy bark siding, be sure to check that it's kiln-dried, not only for your safety but to ensure that it doesn't warp or shrink on installation.

Bark siding is not difficult to install, but careful preparation yields the best results.



## Here are some installation suggestions:

### Specs

Depending on the grade — standard or premium — bark-siding shingles will be 3/4-inch to 1-1/2-inches thick. Individual bark shingles are 18 inches or 26 inches long, and the random widths range from 4 inches to 4 feet. Shingles may be cut lengthwise for different looks, and the amount of lap changes the look.

### Wall prep

Wood sheathing, at a minimum of a 5/8-inch, is necessary as a substrate, and house wrap is applied. We prefer an adhesive-backed, ice dam membrane to seal the edges of the trim to the house wrap. After shingles are applied, trim away any exposed excess. So the bark doesn't extend beyond window and door trim, these should be extra deep, at least 1-5/8 inches deep for standard-grade bark or 2-1/2 inches for premium or back-banded to that same depth. Paint or stain all trim before installing bark siding to avoid unsightly drips.

### Applying bark

Begin with a 3/4-inch rot-resistant wood kicker strip to give the first row the proper tilt. Apply a roofing membrane equal to the height of bark shingles over the strip, and begin installing the shingles. Make sure the shingles don't have contact with the ground. Elevate the bark siding at least 1-1/2 inches above any roofing or decking, and use flashing. After chalking off the next course, apply a roofing membrane to the next lap line and proceed. We recommend a 2-inch lap for shingles, but adjust this to coordinate visually to the row lines of trim or other siding materials.

### Nailing

Bark is attached with coated framing nails. If you use hand-driven nails, nongalvanized sinkers are best. With nail guns, use full-head chisel point, spiral shank bright gun nails. Standard-grade bark siding requires at least a 2-1/2-inch nail; premium grade needs at least a 3-inch nail. Nail heads will eventually rust and blend into the field, and because poplar bark is not highly acidic there's no nail decomposition. For the best pattern, each shingle should be



Applying bark house shingles (photo by Todd Bush).

nailed an inch from the bottom, no more than an inch from lateral edges and at a spacing not more than three inches across the field. For vertical exposures more than 14 inches, a second row of nails should be applied halfway up the exposure. Ensure the nail placement is on the bark's ridges and that nails are not countersunk, to prevent lateral separation and curl. If mechanicals

are roughed in before bark installation, be sure nails do not penetrate the sheathing and puncture components.

### Corner treatments:

Both inside corners and outside corners require careful application of individual bark shingles to ensure an attractive, weather-tight finish. That can take two forms. Inside and outside corners alike can be finished with milled corner trim. Just choose a style that complements the building's main "look," and butt the bark to it. Remember to paint or stain the trim before application. For a truly rustic, old-fashioned look, though, consider wrapping corners using bark only. For an inside corner, that means going tightly into the corner from one side then nailing a shingle a random width on the adjacent side and using a slightly larger piece of shingle as a wedge for this open space. The result is a tight fit. On the next course, approach from the opposite side, and repeat the process. On an outside corner, "wrap" the building's edge by picking a shingle slightly wider than the distance to the corner. Hold the shingle in place, and mark an oblique line from the sheathing line on top to the outside of the shingle it laps over on the bottom. Nail this shingle in place, and work the other side to the corner. Again, pick a shingle wider than needed to complete the corner, and repeat the process.

Highland Craftsmen offers on-site instruction for all aspects of bark-shingle installation as well as design service for builders and architects.

*Chris McCurry is vice president and co-founder of Highland Craftsmen. She can be reached at (828) 295-0796 or [chris@highlandcraftsmen.com](mailto:chris@highlandcraftsmen.com). Nan Chase, a freelance writer based in Boone, N.C., writes for regional and national publications and for companies that use green-building practices.*



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# Indoor-air quality is important for buildings

by Cindy Meehan-Patton

The air we breathe is a blessing to humanity. Living and working in clean indoor air is important for the body's restoration. We were not given a plethora of manipulated and compound chemicals when the universe was created; this has been mankind's doing. Therefore, it is our job as stewards of the earth to restore damage.

This is hard for humans to do. Our lives have become overwhelmed by complexity and the deception that we need the complexity. To add to the complexity, building with clean indoor air as the end result can mean different things to different people. It does not necessarily mean we should build a home out of straw if it means the home will be bombarded by humid air that results in mold and mildew. It does not necessarily mean that one should always keep windows closed to completely control indoor air through mechanical means. The balanced strategy between these two extremes seems to vary with each person's needs.

Mold is the most common indoor-air pollutant that is making many people sick. Strategies must be built into the design plan to prevent mold in any building. According to the Mayo Clinic, the number of asthma-related diseases from mold has increased by 300 percent in the past five years.

Experience tells me that if we live or work in an environment burdened by mold, then illness enters the body because mold suppresses the immune system. The universal opposites of dark and light, positive and negative, good and evil begin to shift in our lives when illness creeps in, resulting in imbalances in all facets of our lives. This interferes with our intention to live an abundant life.

How can we make our homes and other buildings healthier? First, we must understand that our climate in Western North Carolina is a mixed-humid (bordering on extreme) climate zone, according to the Environmental Protection Agency and the Energy and Environment Building Association. For more than 200 days a year, our outdoor humidity level is 75 percent to 100 percent. High humidity traveling through open windows, leaky walls, floors and roofs quickly can result in toxic mold indoors.

The first step to clean indoor air, therefore, is to keep the home dry inside and out. The best way to create a healthy home requires design strategies with a "built tight and ventilated right" result. The other step is to use nontoxic materials inside the home. Hundreds of nontoxic materials are available today compared with 1991, when I started my business.

For indoor-air quality, the main system in the home is the HVACD (heating, ventilation, air-conditioning and dehumidifying) system because it is the lungs and heart of the home regardless of the age of the house. Let's look at the heating and cooling component. With current resource depletions, we

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will all require the most energy-efficient system possible. Passive-solar designs for heating are best because they use the sun. However, pillaging trees from our forest to harness the sun is not ideal. We have an abundance of trees, some of them unique deciduous tree forms. This can present a challenge in creating a passive-solar structure.

Radiant floor heating can be healthy and comfortable but expensive to install. Its efficiency depends on the tightness of the home's envelope, or exterior shell, and the type of flooring used to transmit the warmth. A high SEER electric heat pump is a common healthy option for a tightly constructed home but has the major drawback of dependency on the electrical companies that pollute and are not as reliable as we once thought they were. And the monthly bill can be expensive, depending on the home's energy efficiency.

Reliance on oil, natural gas and propane is not only shaky in terms of these ever-decreasing resources but in terms of their toxicity. Propane and natural gas have an added chemical to detect leakage. The putrid smell produced is actually a pesticide. Combustible fuels inside the home are a dangerous and toxic choice to heat and cool. Several good "on demand" furnaces can be installed outside the home and are ideal because they are efficient and do not allow open pilot lights in the home. Last but not least for heating is perhaps the most practical option: wood, masonry or pellet stoves. The industry is creating more resource-efficient, cleaner-burning models all the time.

Cooling strategy options are numerous as well. If radiant floor heating is used, then Energy Star-rated portable cooling units can be effective in keeping the humidity down and creating comfort inside the home. These can be effective in a tighter built home as well. Some units can be placed above doors and between rooms inside the home, which can be particularly efficient in a passive-solar situation because they target the areas challenged with the most heat gain.

Let's look at ventilation and dehumidification. Reliance on natural ventilation (open windows) in a mixed to extreme climate such as WNC can be detrimental to your health and the health of your home and must be done in a monitored and balanced way. The use of strategically-placed dampers on mechanical and heat-pump systems along with zoned thermostats can help. There are many mechanical ventilation systems on the market now, including ERVs (Energy Recovery Units) and HRVs (Heat Recovery Units). Both types exhaust stale air and bring controlled amounts of fresh and filtered air in. But they don't have the dehumidification capacity required in a mixed humid-extreme climate.

The best system for our area brings a controlled amount of fresh air in, filters it and acts as a whole-house dehumidifier but leaves out the exhaust part of the equation. This seems to work well because it results in a positive pressure in your home at all times. According to Building Science Corporation, even the tightest home has weep holes, so when a house has a constant positive

*continues on page 18*

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## These Web sites can provide more information

- [www.eeba.com](http://www.eeba.com), [www.buildingscience.com](http://www.buildingscience.com)
- [www.BuildingGreen.com](http://www.BuildingGreen.com).

The periodical *Environmental Building News* also is a resource, in addition to the following books:

- *Builders Guide to Mixed Humid Climates* (Joseph Lstiburek)
- *Moisture Control Handbook* (Joseph Lstiburek and John Carmody)
- *The Solar House* (Dan Chiras)
- *The Sick House Survival Guide* (Angela Hobbs)

*continued from page 17*

pressure in it, the stale (or negative) air will find its way out. From my experience, this is true. This system addresses ventilation and dehumidification.

If your building is older and leaky then mechanical ventilation is not needed as much as cooling and dehumidification. Whole-house or basement-size dehumidifiers are the most efficient sources.

*Cindy Meehan-Patton is a founder of the WNCGBC. She is president of her residential-design practice, which has a healthy-buildings consultation division and a green materials store called Shelter Ecology Inc. She can be reached at 225-2829, or consult her Web site at [www.shelterecology.com](http://www.shelterecology.com).*

# Engineered wall systems are an option for your home

*by Marcus Renner*

Most homes today are built using a method called Western platform framing, also called two-by-four, or stick, framing. This type of framing saves time and money but is not the only efficient way to build. In the past 50 years, other wall systems with considerable advantages to our current form of building have been developed and tested. These systems are accepted by building-code officials in most areas of the country.

Stick framing can be done in a more energy-efficient way. Engineers have created a system known as Optimal Value Engineering, or OVE. This idea restructures how a stick-framed wall is built. Studs are configured so insulation can be added in places that usually aren't insulated well, including exterior corners, intersections of interior and exterior walls, the area where the roof meets the house, around envelope penetrations and behind shower stalls. Ridged insulation also can be used as the exterior sheathing to provide a continuous layer of insulation. OVE also addresses wood use by minimizing the amount used in a home by not overbuilding and placing support wisely. If constructed using the OVE approach, a stick-framed home can achieve substantial energy savings.

Structural insulated panels, or SIPS, are the most popular form of construction after stick framing. The panels are made of foam

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insulation sandwiched between a “skin” of oriented strand board, or OSB. The foam and wood create a strong wall section that provides a continuous layer of insulation. Few, if any, structural members divide the insulation. The layer of OSB on the two sides also provides a continuous nailing surface for drywall and siding.

The most popular and least expensive foam insulation used between the wood is extruded polystyrene, or EPS, also known as bead board or Styrofoam. When we look at all types of insulation, we use the R-value measurement. The “R” of a material is its resistance to heat transfer. The higher the R-value, the better a material will insulate a home from heat or cold. EPS foam, which is glued to the oriented strand board, has an R-value of about 3.5 an inch. Individual panels can be factory-cut to the specifications of the plans or cut on site. An average home can be erected within a few days.

Polyurethane foam SIPS have insulating foam injected into a mold, which adheres the OSB to the foam. The foam hardens and has an R-value of about 7 an inch. Although this diminishes slightly over time, polyurethane panels are better insulators. The panels are stronger, so there is no need for structural wood in the panel as in EPS structural insulated panels. This creates an unbroken layer of insulation around the envelope of the home.

Insulated concrete form, or ICF, construction uses foam blocks to create a form to pour concrete into. Unlike conventional concrete work, the form stays in place and provides a layer of insulation on either side of the wall. This configuration creates a layer of thermal mass that becomes energy storage because it is insulated on both sides. ICF homes can be 50 percent more energy efficient during the life of the home and much quieter than a common stick-framed house. Concrete walls also make the home stronger and better able to survive severe storms and earthquakes.

About 50 manufacturers make ICF form systems. Most use EPS foam to create the form walls and plastic to separate the foam and create space for the concrete. The blocks are reinforced with rebar and filled with concrete. Some ICFs are made with recycled materials such as mineralized wood chips and recycled EPS foam and cement.

Another engineered wall system that is becoming more popular is a pre-cast concrete wall. On highways you may see wall sections up to 12 feet long that are made at a factory and trucked to the site. The sections then are placed with a crane and bolted together to create the exterior wall of the home. Pre-cast concrete is mostly used for earth-bermed basements and lower floors although it can be stacked three stories high.

The concrete wall is usually 2 inches to 3 inches thick, and the interior of the wall has rigid insulation with an R-value of 12.5. Pre-cast walls typically don’t need a concrete footer as most below-grade walls do. All that’s needed is a gravel trench that allows water to drain away. A slab floor is poured, and drywall can easily be attached to ribs on the interior. The exterior comes finished to look like stucco and can be painted. The wall system can be installed in less than a day and provides an insulated concrete wall with a small amount of concrete.



*This ICF wall shows reinforcing steel inside before the concrete pour (photo by Marcus Renner).*

Autoclaved, aerated concrete, or AAC, uses cement to create a lightweight material filled with tiny air bubbles. The material comes pre-cut in blocks or panels. For residential construction, blocks 8 inches to 12 inches thick are used for walls. AAC provides structure and insulation. Any type of interior and exterior finish can be used, but plaster and stucco are the most popular and easiest.

AAC construction is fast and easy. Common carpentry tools can be used, and the process is quickly learned. The material is easy to sculpt, and architectural details can be adhered anywhere with the glue-like mortar. AAC walls are soundproof because the air bubbles act as thermal and sound insulation. AAC performs best in climates that require more cooling than heating, so your location may affect the walls’ performance.

Each of these engineered wall systems has advantages and disadvantages and should be understood by the builder before deciding whether or not to use them. Keep in mind that a house is a system made up of many other systems. A holistic approach should be taken to understand how the systems interact. Engineered wall systems provide a tighter building. We have to allow the home to breathe through a well-designed passive or mechanical ventilation scheme to avoid moisture buildup on the interior.

Today’s engineered wall systems are usually designed to provide more insulation, a tighter building envelope and a stronger wall than a stick-framed building. These products and methods can save money and the environment.

Some helpful Web sites are: [www.icfweb.com](http://www.icfweb.com), [www.sips.org](http://www.sips.org) and [www.new-technologies.org/ECT/Civil/autoclaved.htm](http://www.new-technologies.org/ECT/Civil/autoclaved.htm).

*Marcus Renner works with Appropriate Building Solutions Inc., a sustainable-construction company in Western North Carolina. He teaches sustainable building classes at Appalachian State University. He can be reached at [marcus@abuildingsolution.com](mailto:marcus@abuildingsolution.com).*

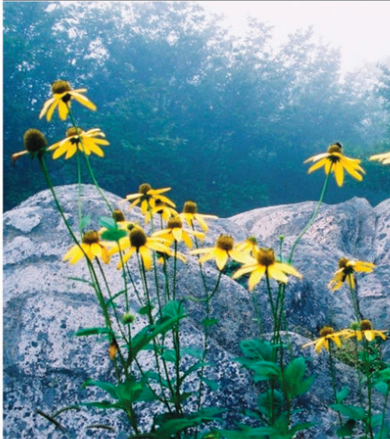
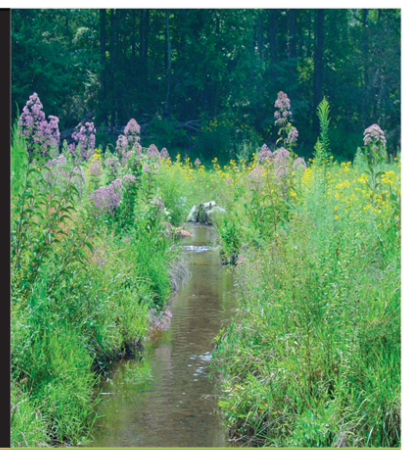
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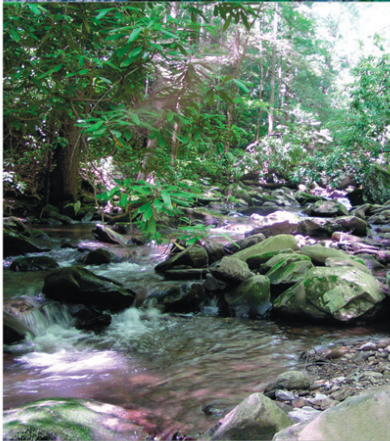
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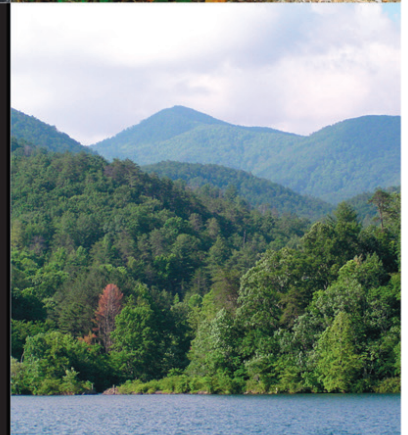
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# Green building without building over the green

by Kevin Caldwell

The southern Appalachian region is one of the most biologically rich eco-regions in the Northern Hemisphere. The land draws people nationwide, and the record number of homes popping up means this biodiversity is being scraped into oblivion. Much of the damage is avoidable, and conservation development, or the practice of developing while preserving the natural history and wild space on a given piece of land, is helping reduce many otherwise large impacts.

Western North Carolina's blossoming green-building industry reduces environmental impacts with "green" construction materials and methods and energy-efficient home designs. Owners of green homes base their plans on ecology to ensure the home is on the greenest site. This is done before construction by land planning and taking inventories of botany, wildlife and physical features. Conservation aims to protect rare species and their habitats, unfragmented forests, wildlife habitats, richness of native species, streams and wetlands, and it aims to ensure natural-resource sustainability and ecological patterns across the landscape.

***Today, NC loses 172 square miles  
(110,000 acres annually /  
300 acres daily)  
to permanent developments, and  
development is increasing.***

Ranging from Pennsylvania to Alabama, this region defines the southern stretch of one of Earth's oldest mountain chains. These ancient mountains eroded over geological time, and we now see them between about 900 feet and 6,680 feet high. We live within one of two temperate rain forests on Earth, formed some 55 million years ago. Before industrial clear-cutting in the early 1900s, most of eastern North America received more than 80 inches of rainfall a year, and many areas still receive about that much.

The southern Appalachians contain more than half of all flowering plant and fern species known in North America on only 2 percent of its land surface. North Carolina houses more than 7,500 wildlife and plant species, 1,200 of which are state rare-list species. Hundreds of common to rare endemic species (those limited to a region) are home here, alongside remnant tropical plants. Similarly, rare natural communities, including swamp forests, alluvial forests, bogs, rocky summits, and variations of common forest types, hide



*Remnant old growth forest in Western North Carolina  
(photo by Kevin Caldwell).*

out in the hills here. Habitat loss, degradation and fragmentation of natural areas for natural-resource extraction and development are the greatest threats to biodiversity worldwide. Most losses are permanent and ongoing, resulting in a homogenization of nature across vast areas.

Though forested on appearance, today's landscape pales against conditions that existed before industrialization. Gone are the woodland buffalo, coves of ginseng and goldenseal, elk, passenger pigeons, chestnuts, Carolina parakeets, lake sturgeons, cougars, bottomland canebrakes, gray wolves, and valley mosaics of beaver ponds, swamp forests, bogs and pools long since drained for farming. Since 1492, more than 600 plant and animal species have become extinct in North America from direct killing and habitat loss. While these species were driven off, original forests yielded an average of 75,000 to 100,000 board feet of timber an acre and occasional 25,000-board-foot trees. Today's volume averages some 5,000 board-feet an acre, which is a loss of 90 percent to 95 percent of the original volume that nature produced over thousands of years. "Board feet" is a volume of lumber measurement equal to 1 inch by 12 inches by 12 inches, or 144 square inches.

Today, North Carolina loses 172 square miles (110,000 acres annually, 300 acres daily) to permanent developments, which are increasing. Nearly 84 percent of the region is privately owned, which means most land eventually will be developed. More than 50 percent of the Significant Natural Areas designated by the North Carolina Natural Heritage Program (NCNHP) are unprotected. Daily, we lose untold numbers of wildlife and plant species

*continues on page 22*

find out who's reducing, recycling and reusing

# resource conservation

and their habitats to development without even a baseline record of what's being lost. Salting the wounds are hoards of invasive-exotic plants easily establishing themselves on freshly excavated soils, where they rapidly reproduce, spread adjacent native ecosystems and begin evicting the natives. Still, this region is a center of biodiversity in North America. We can reduce impacts through biological inventories and thoughtful planning before building.

The following guidelines help minimize unnecessary impacts during and after development. They're best suited on intact, undeveloped lands rather than on urban and other developed areas although most are applicable on any raw land.

- Invite a land-trust official to look at the land first if you think the tract deserves protection. Do not survey lots (especially inholdings) or plan roads and home sites before assessing the land because this negates the property's conservation value.
- Explore the land intensely before you build. Over time, this allows ideas to mature that will improve conservation and construction.
- Never build on the areas you love the most. Save them and visit frequently.
- Maintain the largest amount of undeveloped, protected acreage as possible, and protect large core areas when possible.
- Maintain natural-area connectivity with vegetated areas on adjacent lands. For example, leave the undeveloped area of your land against undeveloped areas on adjacent parcels. Talk with your neighbors about creating larger protected zones across properties.
- Protect streams and wetlands with 100-foot-minimum no-touch vegetated zones, and avoid stream crossings.
- Avoid prominent and visible ridgeline home sites.
- Inventory, identify and protect rare natural communities, rare species and their habitats to the extent possible. This process will also reveal other management needs.
- Create clustered home sites in the smallest possible area, if the



*Pinkshell Azalea — found globally only in western North Carolina and getting bulldozed daily near Highlands/Cashiers region (photo by Kevin Caldwell).*

terrain allows, while maintaining privacy.

- Concentrate home sites and driveways near road entries to avoid daily auto and human activity through the heart of the land.
- Minimize soil impacts by building roads and drives along contours when possible while avoiding switchbacks. Use native erosion-control mixes, and re-vegetate disturbed areas with natives when possible.
- Road-building is best done in the growing season (mid-March to early October), so erosion-control seed mixes can establish quickly.
- Clearing trees and shrubs is best done between leaf-off (i.e. fall, when the leaves fall off) and leaf-on (i.e. spring) to avoid direct disruption of migratory bird-nesting and exposure of trees to air-borne pathogens on damaged bark and branches. Winter tree damage is far less harmful than growing-season damage, when vegetation is actively pumping nutrients.
- Consider potential off-site damage to adjacent properties from erosion, exposure and other things. Your actions might directly affect your neighbors, so talk about what you're doing.



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- Stockpile the native topsoil from construction zones. Even a small amount helps.
- Move native plants from road and home excavation sites. Many herbs and shrubs can be rescued and banked for future plantings or moved to their habitats on site. Around the home, plant the dominant plants from the impacted natural community before planting regionally native plants not native to your site. Lastly, divide and plant from the native plant stock within their non-impacted areas to help mitigate for your impact.

Appalachian biodiversity and beauty awe natives and newcomers, yet we destroy the very resource we love. The inventory and planning processes increase, not decrease, our conservation and construction options. By not knowing what's on our property, conservation is random and unplanned, like building a home without a blueprint. When we incorporate the natural heritage of the land into our plans, we add responsibility for the land to our self-given right to do what we want.

*Kevin Caldwell is a biologist with Equinox Environmental in Asheville. He is former owner of Appalachian Ecological Consultants and has worked with the Sweet Water Trust of New England, the Kentucky Natural Heritage Program, Merck Forest and Farmland Center in Vermont and Gaia Herbs in Brevard. He can be reached by e-mailing Kevin@equinoxenvironmental.com.*

## The Mountain Forest Stewardship Co-op

Hug a low-impact logger—you may not go back to trees

by Alyx Perry

In Western North Carolina, the latest forest-conservation trend has an unusual face: loggers. Recently people who practice low-impact logging with horses and oxen came together to define a new industry. After years of practicing some of the oldest traditions in forestry and offering some of the most precise timber harvesting services anywhere — but rarely making a good living at it — the loggers formed the Mountain Forest Stewardship Cooperative.

One of the co-op's main goals is to make low-impact logging economically feasible for loggers, landowners and foresters. By processing wood into final products instead of selling logs, the co-op increases its profits. The extra profit margin makes sustainable forestry an easier choice for forestry professionals and landowners. Another goal is to provide more accessible services for landowners. The co-op wants to increase the availability of specialized services for sustainable forest management and restoration.

*continues on page 24*



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A third goal is to provide local sustainable-wood-product choices and offer a local wood-products market that restores our forests and economies instead of degrading them.

Across the South, this new forest-products industry is forming. The industry is based on sound forest management, local ownership and preserving the South's forest-based heritage. It is a movement of family landowners, loggers, forestry professionals, environmentalists, sawmill operators and others who believe the best opportunity we have to conserve our forest landscapes, save our wildlife and revive our rural economies is a sustainable, forest-based economy.

**The sustainable-forest-products industry is based on three principles:**

- Forest management must focus on restoration and maintenance of ecological integrity. Healthy forests are better for wildlife, recreation and our economy.
- Keep it local to keep it profitable. Corporate ownership of the South's forest-products industry has brought declines in local economic returns even as harvest levels have increased. Business and land ownership, value-added processing and sales should all be local whenever possible to maximize economic returns to local people and communities.

- Focus on community-based strategies. Strategies that are built by local communities to address local needs are more sustainable ecologically, economically and socially.

**Here's why sustainable forestry works:**

- Landowners can produce regular income from timber and other products while maintaining a functioning forest. Most of the South's timber harvest comes from private lands, so pleasing landowners is crucial, and they are demanding better forestry. If landowners are under economic pressure to sell or develop their forestland, periodic income from harvests and public forestry programs can relieve the pressure.
- Local ownership and processing maximizes economic benefits to rural communities. Maximizing local processing in locally-owned businesses means more jobs with better pay. In addition, profits stay local rather than being spent outside the community or exported to stockholders.
- Sustainable forestry preserves our heritage while sustaining our economy. Rural communities can rely on sustainable, land-based economic development and local entrepreneurship rather than industrial or business recruiting.

The Mountain Forest Stewardship Co-op is committed to cultivating a strong forest-based economy in Western North Carolina that restores our forests, provides good jobs and keeps



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the profits of our land and labor in local communities. Currently, all of the co-op's wood is harvested from local family forests using logging with horses and oxen, and all wood products are processed by local mills. Co-op members provide millwork, including flooring, trim and paneling, and will consider any product request. Co-op members do both timber harvesting and processing, so they can fill unusual custom orders.



The co-op is not certified by the Forest Stewardship Council (FSC), but members plan to be. Certification is similar to organic certification in farming and ensures excellent forest management, fair wages for workers and low-waste processing. Look for the FSC label when you shop for wood products to know your purchase supports forest restoration, not forest destruction.

For information about the co-op's products, call 277-9008. Only a small inventory is kept and most sales are by pre-order, so the best time to call is when you're still planning your project. This year, the co-op plans to start selling some products through local retailers. For more information about sustainable forestry and community-based efforts in the South, go to [www.SouthernSustainableForests.org](http://www.SouthernSustainableForests.org).

*Alyx Perry is with the Southern Forests Network. Perry can be reached at [alix@southernsustainableforests.org](mailto:alix@southernsustainableforests.org).*

# “Earthship” residence is really down to earth

by Stan Jones and Pattie Frost Jones

The Earthship, the home of Stan and Pattie Frost Jones, is a sustainable home designed to be self-contained, located 5 miles south of Marshall just off the French Broad River. Used automobile tires filled with rammed earth are stacked like bricks to form the foundation and load-bearing walls of the Earthship. The front of the house is sloped, featuring insulated glass panels, and the north side is earth-bermed. A greenhouse with a variety of plants lines the front interior. Natural daylight ensures that the spaces are lit well. Several nonload-bearing walls are constructed of mortar and aluminum cans.



*The Earthship's sloped glass design allows for optimal collection of winter sunlight, and keeps the interior relatively cool in the summer months when the sun is higher in the sky.*

The site selection has several advantages. The site has full solar exposure all day, and no ridges or woods shade the front of the house. In addition, the land is a meadow, so no sizable trees were removed. The house is situated to create drainage away from the structure.

Besides the site, the systems in the house contribute to its energy efficiency:

## Heating and cooling system.

The design of the Earthship is key to heating and cooling the house. A wall of glass on the south side of the house is sloped to optimally capture the winter sun. Heat from the sun's rays heats the space. The mass of rammed-earth tires and concrete stores the heat. When the temperature inside the space drops below the temperature of the mass, the mass begins to release heat into the living space. Sloped glass also helps the Earthship interior remain relatively cool. The summer sun is high in the southern sky, which means the sun's rays only reach the front of the house that time of year. Additional shading is needed in the summer months. An important component of Earthship design is the cross-ventilation from southern windows and skylights in each room. Air passing through the southern windows picks up heat and remove it through open skylights.

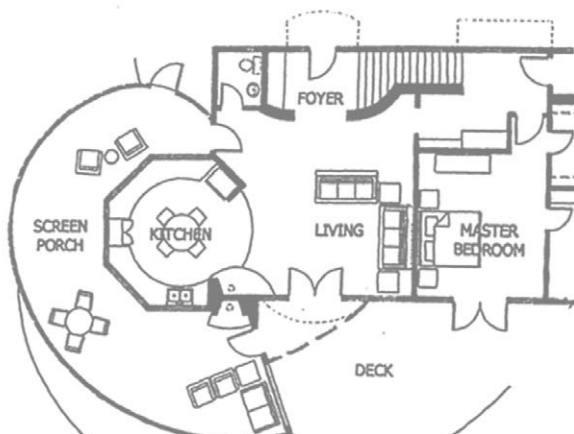
## Electrical System.

Electricity is provided by a photovoltaic array of eight 150-watt panels. Batteries inside the house store enough power to make it through cloudy days. An inverter converts DC power to AC

*continues on page 26*

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An outside view of the Earthship. Located in a meadow, it utilizes full sunlight, and no sizable trees were removed to construct it.

power to make electricity to run household appliances. Lighting for the house is both DC and AC. Compact fluorescent bulbs are used throughout.

### Water System.

The roof of the Earthship is designed to catch rainwater. The slightly sloped roof drains rainwater into cisterns located on both ends of the house. From the cisterns, the water is pumped (using a DC pump) into a pressure tank. This is the water supply for washing clothes and dishes, showers, watering plants and other needs. A solar water heater is planned. Now, hot water is furnished by a tankless, on-demand propane gas water heater. The water heater will be a backup during consecutive cloudy days.

The house has other energy-efficient features:

### Greenhouse.

The entire length of the Earthship is a planter bed. A variety of plants can be grown for food, beauty and shade.

### Recycled materials.

Wood trim around windows and doors was made mostly from salvaged redwood. Earthship doors were hand built using reclaimed wood from pallets. More than 1,200 SUV tires were saved from the landfill to construct the load-bearing and thermal mass walls. Bottles and cans were used in the construction of the nonload-bearing walls. Plumbing fixtures were purchased at the Habitat for Humanity store.

### Finishes.

The main finish material inside the Earthship is adobe plaster made on site with earth from the excavation. This and the stone surfaces are sealed with nontoxic sealers. Concrete countertops and slabs are finished with nontoxic concrete stains. All interior wood doors, ceilings, trim and cabinets are finished with tung oil.

*Stan Jones has worked in construction as a designer and construction administrator for 25 years. During this time he has received training in solar greenhouse design and construction. He has just started a design/build business and also works as a general contractor.*

*Pattie works toward the protection of the natural environment. She has a Bachelor of Science (Ecology and Field Biology) and a Master of Public Administration (Focus on Natural Resource Policy). While living in the Pacific Northwest United States, she worked as a field organizer and public outreach coordinator for several environmental organizations.*

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# Choosing a floor that's healthier for you and the environment

by Michelle Garrison

A floor completely changes the style and feel of an interior space. Floors can be colorful and vivid, sleek and modern or full of rustic character. Some of the most popular and unique flooring is made with natural materials that are either recycled, rapidly renewable or sustainably harvested. Whatever your style, you can find an appropriate sustainable flooring option.

Choosing sustainable materials can help prevent waste, reduce pollution, preserve forests and ecosystems, and reduce toxic chemicals in your home. Synthetic carpets can produce about five billion pounds of landfill waste in just a year. Carpets also are some of the worst environmental offenders in the home because they contain petrochemicals and VOCs (volatile organic compounds) that contaminate indoor air. For you, your home and the environment, it is worth a little extra expense to purchase a healthier flooring material.

You should consider these points before choosing flooring: Will it be a high-traffic area? Is there a lot of moisture? What is your subfloor material? Do you have pets? What type of look do you want? If you are not familiar with a specific flooring material, consult a professional before buying.

*Choosing sustainable materials can help prevent waste, reduce pollution, preserve forests and ecosystems, and reduce toxic chemicals in your home.*

## Here are some flooring materials to consider:

### Bamboo.

This rapidly-renewable material is gaining popularity because it has a natural, modern look with a subtle grain and smoothness that resembles a light wood. It generally comes in two colors, a lighter, natural color and an amber color (achieved by pressure-steaming, which darkens through carbonization). The only drawback is that recent demand for bamboo flooring has flooded the market with manufacturers who are producing poor-quality products that may split, gape or crack. Be sure to buy quality bamboo flooring with low-VOC adhesives; it is well worth the cost and is still more affordable than most hardwoods.

### Linoleum.

This is not the resilient flooring made from polyvinyl chloride. "Linoleum" comes from the Latin linum, or flax, and oleum, which means oil. Linoleum is a natural flooring made by oxidizing linseed oil to form a thick mixture that is cooled and mixed with pine rosin and wood flour to form sheets on jute backing. Linoleum is durable, rapidly renewable and biodegradable. It comes in many colors you can mix and match to create a life-size checkerboard, if you wish.



*The bark of the cork oak trees is harvested every 9-11 years, leaving the tree to live its full life expectancy.*

### Cork.

This product is rapidly renewable and post-industrial. The bark of the cork oak tree is harvested every nine to 11 years, which allows the tree to live its full life expectancy. After harvesting, the cork is drilled for bottle stoppers, and the scraps are used for flooring. How is that for sustainable? The cork harvest is a 1,000-year-old tradition in Portugal that is struggling because the wine industry is beginning to use plastic instead of cork. This is

*continues on page 28*

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FSC Certified Red Birch Floor (photo by Richard Haffkins).

a great cause to support, and the flooring is beautiful, antimicrobial, acoustically insulative and easy on the back and joints.

### Carpet.

If you're still crazy about carpet, there are some alternative options. Wool carpet is renewable, durable, biodegradable and nontoxic. It's also soft, easy to clean, has insulating properties, and is nonallergenic, odor-resistant and fire-resistant. A couple of manufacturers also make carpet from recycled bottles, and it's much less polluting than typical synthetic carpets.

### Sustainably-harvested wood.

Sustainably harvested wood can be a touchy subject. Steps have been made to reduce our dependence on forests, but we will always have a need for wood, whether for building materials or the air we breathe. So, as consumers, it's important we support sustainable forestry. We should buy wood that is certified as sustainably harvested by the Forest Stewardship Council (FSC) and support our local sustainably-harvested forestry operations. This is an important step toward regulations that will ensure our forests will remain for future generations. For more information about FSC, visit [www.fscus.org](http://www.fscus.org).

### Recycled wood.

Not much beats the quality and durability of recycled wood, restored from old buildings and bridges and milled into flooring. The character of recycled wood tells an amazing story through its knots and incredible longevity. It is quite an experience living with part of an old tree in your home. Restoring wood can be labor-intensive, which sometimes makes it more costly, but the feel of literally walking on history is worth it.

### Here are other tips to help you decide:

Choose pre-finished flooring. Look for a UV- (ultraviolet) cured aluminum oxide or acrylic finish with a warranty of more than 25 years. The finish will outperform any job-site-applied finish and eliminate toxic dusts that often result from sanding. The installation process is easier and cheaper because you don't have to pay for a sanding and finishing job.

Recycle old carpet. CARE (Carpet America Recovery Effort) is a nonprofit organization that recycles carpets into decking composite lumber, roofing shingles, railroad ties and other materials. Visit them at [www.carpetrecovery.org](http://www.carpetrecovery.org).

Use water-based adhesives with no VOCs or a low amount of VOCs. Our installers like to avoid glues at all costs. Glues can be tricky to use, and there are specific kinds for certain flooring materials, so ask a professional before tackling the job.

Use recycled or cork padding. Recycled fiber padding is highly insulative and made of post-industrial waste fibers, and cork is rapidly renewable.

Purchase half-inch- or 5/8-inch-thick flooring instead of the industry standard of three-quarter-inch-thick. It is less wasteful, lasts just as long and is lighter and easier to work with. The sanding process is easier because it is run through the mill more slowly and varies less in its thickness.

*Michelle Garrison is owner/partner of Conscious Flooring, an internet flooring company based here in Asheville. She has a B.A. Degree in Sustainable Design. For more information, you can reach her at (828) 712-5069.*

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# A case study of a prize-winning, green Asheville house

by Stephen Beili and Rob Moody

Within a week of moving back to Asheville after living elsewhere for 34 years, Stephen Beili saw a lot on the street where his family lived when he was born. The next task was to design a home for himself that incorporated his interest in environmentally-conscious glamour ("ecoglam"). While on Pack Square one day, he met Rob Moody of The EcoBuilders, sitting in his biodiesel truck, and they began to talk about working on the project together.

With Moody's input on pricing and the potential green aspects of local construction, Beili designed a small, three-story home in the historic district of Montford, full of colorful, open spaces.

Construction began in spring 2005 and was completed in October. The house was entered into the Asheville Home Builders Association Parade of Homes, in which it won a gold award in its price range and a special features award for environmental consciousness and eclectic design.

### Information about the home includes:

- Small footprint, 1,400-square-foot home
- Gold rating in the NC HealthyBuilt Homes program of

- greater Asheville
- An infill development project with a sidewalk that connects the home to the business district, which encourages fewer and shorter automobile trips
- Location in a National Historic District, adding to the rich heritage of the neighborhood
- Invasive trees were removed before construction
- Native, drought-resistant species were planted after construction
- The site was selected and the house was designed to:
- Fulfill the desire to walk out the front door and to town
- Give the opportunity to see a backyard forest from the main rooms and the balcony
- Sheet mulching was used to control weeds and erosion
- Low-flow aerators were used where possible
- Previous materials (mulch) were used for ground cover
- Bath and shower have a visual connection to nature
- Nontoxic, open-cell foam insulation used throughout the building envelope to seal all potential air infiltration, which exceeds the energy code requirement by 10 percent
- Energy-star certified
- Pressure test (blower door) used to ensure a well-sealed home
- Efficient framing techniques that decreased lumber usage by up to 20 percent without compromising structural integrity
- Insulated, low-emissivity windows and doors minimize heat loss and gain
- Upper-level operable awnings allow rising hot air to escape

*continues on page 30*

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Main Floor Plan    Top View    *Mike Rice*

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continued from page 29

in summer and passively cool the home

- High-efficiency radiant heat system
- Tankless water heater
- Energy-star refrigerator and dishwasher
- Most interior lights are low-voltage or compact fluorescent
- Natural lighting illuminates colorful walls
- Light wells and windows on all sides of the house maximize natural lighting possibilities
- Site waste was minimized. Everything possible was recycled or reused
- Durable finishes used on the exterior siding. Pre-finished cedar shake panels with a 25-year warranty
- No carpeting
- Before occupation, the home was cleaned by a service that uses all natural and biodegradable cleaning solutions
- A composting portable toilet was used on site during construction

*Rob Moody is vice president of the Western North Carolina Green Building Council. He is also president and owner of The EcoBuilders Inc., an Asheville-area green builder that focuses on Asheville infill custom and spec homes that are certified NC HealthyBuilt. Rob can be reached at 337-0623 or [ecomooody@theecobuilders.com](mailto:ecomooody@theecobuilders.com)*

*Stephen Beili named his residential design firm Studio Dionisi Incorporated to encourage a focus on the pleasure of design: light, color; building green, water, views, etc. Dionisi is Italian for Dionysus, the Greek god of pleasure.*

# Waste reduction on the residential job site

by Terry Albrecht

Many of us have heard the statistic — the building industry produces 136 million tons a year of construction and demolition (C&D) waste. In North Carolina, the waste accounts for 29 percent of the entire solid-waste stream. Waste-reduction strategies in the building industry can make a huge difference. That’s easier said than done on the residential job site. Recycling options are limited for smaller builders in Western North Carolina. It takes a commitment from builders and contractors to reduce the waste stream. It also takes a commitment from solid-waste service providers to help with C&D recycling solutions.

Waste reduction begins with reducing waste at the source through good design and planning. Use functional designs with dimensions in 2-foot increments and those that accommodate standard-size materials. Think through the “take-off—estimation of raw material needs—when ordering.

Next, seek out all avenues for material reuse. Use building suppliers that accept returns. Make every effort to keep your on-site materials clean, covered and well-organized. This helps you get maximum credit for any material returns. If you have the luxury of storage space, save materials for other projects. Trade unused wood material with subcontractors who need scaffolding, formwork, ramps, mixing bases and other equipment. Encourage



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subcontractors to take your unwanted leftover supplies. Consider other community outlets for leftover or salvaged building supplies, such as the Habitat Home Store.

Third, consider your recycling options. Most commercial waste haulers will work with builders to pick up consolidated loads of clean wood, metal or corrugated cardboard (sometimes with mixed paper). The builder's challenge then becomes worker-subcontractors' instruction, collection segregation, scheduling pickups, space requirements, and hauling and container costs. The biggest problem is having sufficient materials (such as corrugated cardboard during cabinet and appliance delivery) to justify a scheduled pickup or special-container pickup especially when the smallest open roll-off dumpsters are typically 10 cubic yards. Sharing a recycling (cardboard) dumpster in track developments for multiple, adjacent building sites is sometimes practical. If you haul your own waste, your recycling options are more feasible from logistics and cost standpoints.

Although recycling may not bring in revenue for the material, it can at least reduce or eliminate landfill "tipping" fees. Collecting segregated loads of clean wood can cut tipping fees in half. Some local processors of cardboard and scrap metals will accept these materials. Some builders have success giving away materials, such as clean wood for kindling. One local builder placed a free ad in the IWANNA paper to promote a giveaway.

If your waste is being hauled to the Buncombe County landfill, tipping fee penalties may be assessed if your C&D loads have more than 5 percent of corrugated cardboard, clean wood, masonry products or metal. Your commercial waste-hauler may pay tipping fee penalties without your knowledge because the hauler wants to keep you as a customer. When other trash, such as bagged garbage, food waste or household waste, is mixed in your C&D load, the whole load must be landfilled in the municipal solid waste (MSW) area of the landfill rather than the C&D area of the landfill. In Buncombe County, the MSW tipping fee is \$36 a ton compared with \$28 a ton for C&D waste.

A more viable recycling option for our regional construction industry is a material recovery facility for construction and demolition waste streams. Material Reclamation Inc. operates C&D recycling facilities in Raleigh and High Point. Last year, the company processed 91,000 tons of mixed C&D materials and reclaimed about 60 percent. A regional C&D material recovery facility could be a convenient and cost-competitive recycling solution for the construction industry and commercial waste-haulers in our area. Ideally, C&D recovery operations work in public-private partnership with county landfills. Buncombe County proposed such a partnership in 2003 without success. Maybe momentum in the construction industry will encourage a fresh look at the opportunities.

*Terry Albrecht, P.E. is the program director of the Waste Reduction Partners (WRP) program at the Land-of-Sky Regional Council. WRP is a governmental nonprofit program that provides waste reduction and energy management technical assistance for WNC businesses, industries and institutions. Mr. Albrecht can be reached at (828) 251-6622, or [terry.Albrecht@ncmail.net](mailto:terry.Albrecht@ncmail.net).*

#### Here are some waste haulers with recycling outlets:


- Consolidated Waste Services, 645-0660
- Griffin Waste Services, 281-4549
- Waste Management, 253-5364
- Wyatt Waste Container, 250-0996
- GDS, 253-3929

#### Here are some recycling processors:

- Curbside Management (cardboard and containers), 252-2532
- Asheville Waste Paper Co. (cardboard and containers), 252-6963
- Biltmore Iron and Metal, 253-9317
- Blue Ridge Metal Recycling Inc., 254-2840
- Western Carolina Recycling (scrap metal), 252-1689

#### Here are other contacts:

- Pallets: Riverside Stump Dump Inc., 251-5777; WNC Pallet, 667-5426
- Salvage and building supply reuse: Habitat Home Store, 254-6706
- County Solid Waste Management: Buncombe County, 645-5311; Henderson County, 697-4505
- N.C. Division of Pollution Prevention and Environmental Assistance, (919) 715-6500, [www.p2pays.org](http://www.p2pays.org)
- Local material exchange site, <http://groups.yahoo.com/group/Asheville-Freecycle/>



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# A builder's perspective on the straw bale home

by Bobby McHugh

Though skeptics abound, the modern straw bale home is the flagship of the green-building movement. A well-done straw bale will use resources wisely, inspire and comfort, and perform efficiently throughout its life cycle. Before we were married, my wife and I thought about how great it would be to build with straw. Lured by the natural curves, the recycled nature of straw and the erroneous claims of constructing a house for less than \$50 a square foot, we looked into it. How expensive could it be? It's straw! With some hands-on experience and serious design and planning, we learned the first lesson of straw bale building: the straw is just the walls. Eventually we built and moved into our home, learning many lessons along the way, especially about what green building meant to us.

Wheat straw, the most common local variety, is the stalk of the wheat grain plant. The straw exceeds half the weight of a harvest of grain and is typically burned or baled to use in erosion control. Straw is a waste product. If you consider building the walls of a house with a waste product, you may think you can build the whole thing using recycled products. In fact, most straw bale builders find all sorts of alternatives to store-bought products: mosaic granite floors from the waste pile, windows from demolished fast-food restaurants, and wood milled from the house site are but a few examples.

Your home is outside all the time. It needs a good hat, a good pair of shoes and a warm coat. This is especially true of the straw bale home that will brave the elements of the Appalachian Mountains. Straw homes have an enemy in moisture and need to stay dry inside and out. Deep overhangs keep unwanted sunlight out and are the first defense against falling rain, keeping the bales nearest the foundation away from splashing water. The foundation can be made of any material though a radiant-heated

*The straw bale house is a departure from the material-hungry mansions of our time.*

slab is the favorite locally. Positive drainage, in which the landscape slopes away from the house, and a diligent drainage plan will help keep the wall sills dry. A passive-solar design suits straw walls. Heating with the sun in the winter keeps the bales dry, and taking advantage of cool breezes in the summer does the same. Stucco coats vary a lot in local straw bale homes. For strength, most contain a little Portland cement, which is partly-hydrated lime. The more lime the better because lime's alkalinity retards the growth of mold. Seeing a bale rotting with black mold after it was left outside in the rain would make you think it would happen instantly to a mildly-wet straw wall, but our mostly lime and sand-covered walls have never shown a sprig of mold.

Keeping with the green-building creeds regarding material use and the fact that building with straw is labor-intensive, straw

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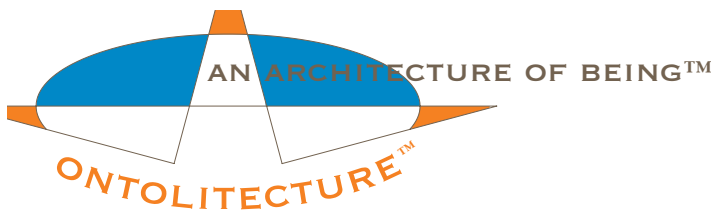


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*Withstanding the elements of the Appalachian Mountains is no problem for this straw bale home (photo by Bobby McHugh).*

bale homes are not typically big. The mentality is that you design a house for what you need. There is a humility in the straw bale home that points to all the trees, all the steel, all the stone and sweat that produced it. The straw bale house is a departure from the material-hungry mansions of our time. There is no way to make a 6,000-square-foot home “green,” not even with straw walls. The straw bale home asks: what do we need? If every homebuilder, designer and developer would ask that question, we might have enough resources for the next generation to build.

Your home can warm your heart and feed your soul. To ensure that, build a sacred space. It doesn't have to be a temple or altar. In our house, it's the sleeping porch. Napping on an outdoor bed full of blankets and pillows in the sun with a book over my eyes is my idea of heaven. Have a space in your house that you can go to just to feed yourself. This goes for non-straw-walled houses, too. Each of the lessons I learned building with straw taught me about the most important points of green building, and I believe building with straw will teach others as well.

*Bobby McHugh lives in Black Mountain. His business, Old School Design~Build, LLC, creates efficient homes with alternative materials and unique artistic touches. Contact him at Rebaloo@peoplepc.com.*



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# Use rainwater management as a 'best management practice'

by Shawn Hatley

A national campaign promotes rainwater management as a best management practice, or environmental protection practice, to achieve large-scale water conservation and water quality protection goals. Water is our most limited natural resource, so it makes sense to integrate rainwater management into your residential or business project.

Rainwater systems are a strategy to manage the water supply and stormwater at homes and businesses. Increasing water demands and costs, mandatory restrictions and water-quality concerns spur homeowners, businesses and design teams to use rainwater systems. Challenges to a water supply include low-producing wells, high irrigation demands, expensive municipal water and lack of water. Rainwater is a supplement to a water supply—whether the source is a well, spring or city—and can help meet more than 65 percent of daily non-potable demands.

With real-estate values going up, the cost of stormwater damage to your investment can decrease value tremendously and increase your liability. Rainwater harvesting can reduce stormwater runoff. Rainwater cisterns store downspout drainage and rooftop runoff during heavy rains. That reduces flooding of sewers and susceptible areas and protects water quality in streams, lakes and rivers.

Rainwater cisterns also help with fire protection. Neighborhoods and businesses use cisterns with fire hydrants to supplement water supplies in remote mountain regions. Some insurance companies recognize the practice with reduced premiums.

It's important to understand the four components in all rainwater systems: filtration, storage, a pump system and treatment.

Filtration is the first step to make sure the highest quality of water enters your storage tank. Filter water before storing it. Water storage is the most important part of a rainwater system. In selecting a rainwater cistern, consider whether water will be stored above or below ground, how much storage you need and whether you want the above-ground tank to be wooden, steel or plastic. Remember to use black or dark green tanks that are opaque to light for above-ground storage. Other tanks can allow algae to grow in the water and cause water-quality problems.

Pump systems deliver rainwater for various applications. The systems can be sized to pressurize small garden hoses or supply school buildings with rainwater to flush toilets and irrigate ball fields. Water treatment purifies rainwater to meet quality requirements. For example, irrigation systems require sediment screening to prevent clogging of spray heads. Projects that require more protection use high-efficiency carbon filters and ultraviolet disinfection for nonchemical water purification.

To calculate the cistern size, know your project water demands on a monthly basis, and then estimate the collection potential. That's the amount of rainwater a catchment area such as a rooftop can collect based on local rainfall averages. For example, one inch of rain on one square foot of collection area equals .623 gallons of rainwater. One inch of rain on 1,000 square feet of collection area yields 600 gallons of collectible rainwater. Once you calculate the collection potential and know project water demands, calculating the cistern size is simple. Like an accounting balance sheet, simply "bank" rainfall, and subtract water demand. This method creates a monthly forecast of water supply compared with water demands. For months with low rainfall, integrate a backup water supply.

There are myths about rainwater systems. One is that the systems are expensive. Rainwater systems are available on the retail level for less than \$900 and include filtration, storage, pump system and water treatment capability. A general rule for



Wayne County Cooperative Extension irrigates Master Gardener flower beds with rainwater. Who says rainwater systems do not have pressure?



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estimating costs is \$1 per gallon of storage. The cost of city water is cheap, but that certainly will change.

States and cities around the country offer incentive programs for rainwater cisterns. Incentives include exemptions from state taxes on rainwater equipment, rebates and cost-sharing arrangements. A program in Mecklenburg County pays homeowners up to \$3,000 to install rainwater cisterns. Another incentive is green-building programs. The North Carolina Healthy Built Homes Program gives credits for rainwater management. Rainwater management also gets credits from the U.S. Green Building Council and the National Association of Homebuilders' (NAHB) Green Home Building Guidelines.

North Carolina is a leading state for rainwater-management developments and projects. The North Carolina state legislature building harvests rainwater and condensate from heating, ventilation and air-conditioning systems in three 18,000-gallon cisterns for landscape irrigation. The North Carolina Arboretum collects rainwater for the bonsai exhibit and to protect downstream water quality. Guilford County Schools use rainwater to flush toilets and irrigate athletic fields, and the North Carolina Museum of Natural Sciences' Prairie Ridge Eco-



*Prairie Ridge Eco-Station in Raleigh uses rainwater to flush classroom toilets. This enriches student curriculum and promotes water conservation.*

station stores rain in a 1,400-gallon cistern to flush toilets in the outdoor classroom.

There are several ways to integrate rainwater management into your project. One way is simply to ask. A common response from engineering and architecture firms about why rainwater management is not integrated into projects is that clients did not ask. Once educated about the concept and its ability to protect water quality and conserve water, clients ask for it. Companies also are becoming more educated about rainwater management as it relates to drainage, stormwater permit requirements, Green Building Program credits and water-supply challenges. As long as your cistern holds water, rainwater management will go a long way toward protecting water quality and conserving valuable drinking-water resources.

*Shawn Hatley is the southeastern regional rep for the American Rainwater Catchment Systems Association, or ARCSA ([www.arcsa-usa.org](http://www.arcsa-usa.org)), the president of BRAE ([www.braewater.com](http://www.braewater.com)), and he practices as a LEED accredited professional. Contact Hatley at [sahatley@braewater.com](mailto:sahatley@braewater.com) or (800) 772-1958.*

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### Renovate your house the green way

by Matt Siegel

We all know that natural resources are not unlimited. We also know that everything we consume takes energy to extract, process and transport. This is sometimes referred to as a product's embodied energy. This is especially relevant when it comes to building materials. Many building materials are being shipped 4,000 miles or more to the final-end user. So when looking at green building, one route to go is simply to reuse the materials that are already here. For me, green renovation of an existing home is the best way to achieve this. My current home is the third house my wife and I have renovated, and we're getting greener each time as we learn about different products and discover new opportunities.

First, here's a little background on the house. It was built in 1920, and the same family had lived here since it was built. It is about 1,100 square feet with a full, unfinished basement. The house had vinyl siding put on over the original wood. It is heated with radiators supplied by a steam boiler.

One of our goals was to try different products to see how much we could do affordably. Since I get hundreds of calls a year about green building products, I thought it would be nice to actually have hands-on experience with as many as possible.

We were fortunate enough to have a month to work on the house before we moved in.

Our first step was to blow cellulose insulation into the walls, which we had done at our previous house. Many people do this from the outside by removing siding. When done from the inside, holes have to be made about every 16 inches, so I encourage this to be done from the outside if possible to decrease the mess and repair work necessary. We, however, had planned on doing it from the inside.

We bought 25 bags of cellulose insulation at \$7 each. (Lowe's will give you the blower machine if you buy more than 20 bags.) As I drilled the first three-inch hole in our wall, I was pleased to find that apparently when the siding was put on they had blown fiberglass insulation in all the walls. It's worth checking in older homes by making a half-inch hole somewhere inconspicuous and easily repairable. We blew all 25 bags up in the attic. It is one of the cheapest ways to save energy with an almost guaranteed payback in the first year.

The next step was to work on the simple issues that can make a big difference in the long run. We installed a programmable thermostat, which cost \$30, so our

heat would automatically be set back at night. Then we bought enough compact fluorescent lightbulbs, or CFLs, for all our light fixtures, in bulk packs at about \$2 each. I tried different brands and light colors to see how they performed. The CFLs with a color of 3,000-k (or Kelvin, a temperature scale used to measure the color of fluorescent lights) provide a much whiter light than the 2,700-k bulbs. CFLs also are available in a natural-daylight color. I saw no difference in quality between the \$2 bulbs and the \$4 bulbs although it may be reflected in the longevity of the bulbs. Either way, CFLs are easy energy-savers that pay themselves back in less than a year. There is only one energy-saving technique that pays itself back in about a week or less. We installed a solar clothes dryer, also known as a clothesline, for \$4, including clothespins. While not preferred by everyone, this is one of our most successful energy-saving technologies.

Our total, average electric bill each month is about \$30 for 300 kilowatt-hours for two adults and a child with everything except heat provided by electricity. We offset our environmental impact by paying \$12 a month for three blocks of NC Green Power that goes toward putting renewable energy on the grid.

Replacing doors and windows is not always the most economical way to save energy. However, in a house with 18 single-pane windows that are very leaky, it certainly can make a difference in air leakage and noise reduction. I also believe, as is true with many green upgrades, that the money spent will be regained in the selling price of the home. The replacement windows we chose after my research were the Lincoln Windows double-hung replacement kits. The ones we ordered from a local building supplier are solid wood, aluminum clad on the outside and pre-primed with low-emissivity glass (which blocks heat). The windows take 30 minutes to put in once your old windows are out and cost \$170 to \$200 each, depending on size and style. I highly recommend them. For the stationary windows, I had thermo-pane windows made with low-e glass at Wholesale Glass in Asheville.

We installed a storm door on the front door for \$220. For the existing fireplace, we had a Loc-Top damper installed to almost completely prevent heat loss through the chimney. I also caulked, foamed and weather-stripped anywhere there was additional air leakage, at a cost of \$20.

For the interior, aesthetic renovations we wanted to do, we tried to be creative with materials and reduce the amount of new materials we bought. We removed a chimney to open up the kitchen to the dining room, but instead of taking it completely down, we stopped at countertop level. We used the bricks we took out to line our garden beds. Then we found someone who was selling pieces of a bowling alley that had been



torn out. At only \$10 a linear foot, I now have 2-inch-thick, solid maple countertops decorated with bowling-lane arrows and dots. We also got several light fixtures and other building supplies at the Habitat for Humanity store. It feels great to reuse and support a good cause.

Our experimentation with interior finishes was a lot of fun, and we certainly learned a lot from it. This was to be the third time we refinshed our floors, one of my least favorite renovations. The other times we used conventional polyurethane, and the last time we hired out the job. Since I can no longer stand the smell of the stuff and didn't want to make someone else suffer, I looked for an alternative. After hearing about the poor durability of water-based urethanes, I decided to use a linseed oil-based floor finish from Bioshield at \$66 a gallon. While the manufacturer told me it must be brush-applied, a two-day job, I didn't feel sick once, and there was no residual odor after the 72-hour curing time. So far, it has held up as well as conventional polyurethane and has a unique look.

For most of the house, we used Glidden's Lifemaster zero-VOC (Volatile Organic Compounds) paint, mainly because it was the least expensive, at \$18 a gallon, less than some conventional paints. It performed very well, and the only limitation, as with all low-VOC paint, is that you can only tint it to light colors. The real fun came in our bedrooms, where we used all-natural, milk protein-based paint at \$26 a gallon and clay paint at \$40 a gallon, also from Bioshield. The milk casein paint came as a powder and was mixed in batches. It was somewhat difficult to get on evenly, but it's great if you're interested in doing a pattern or texture (it

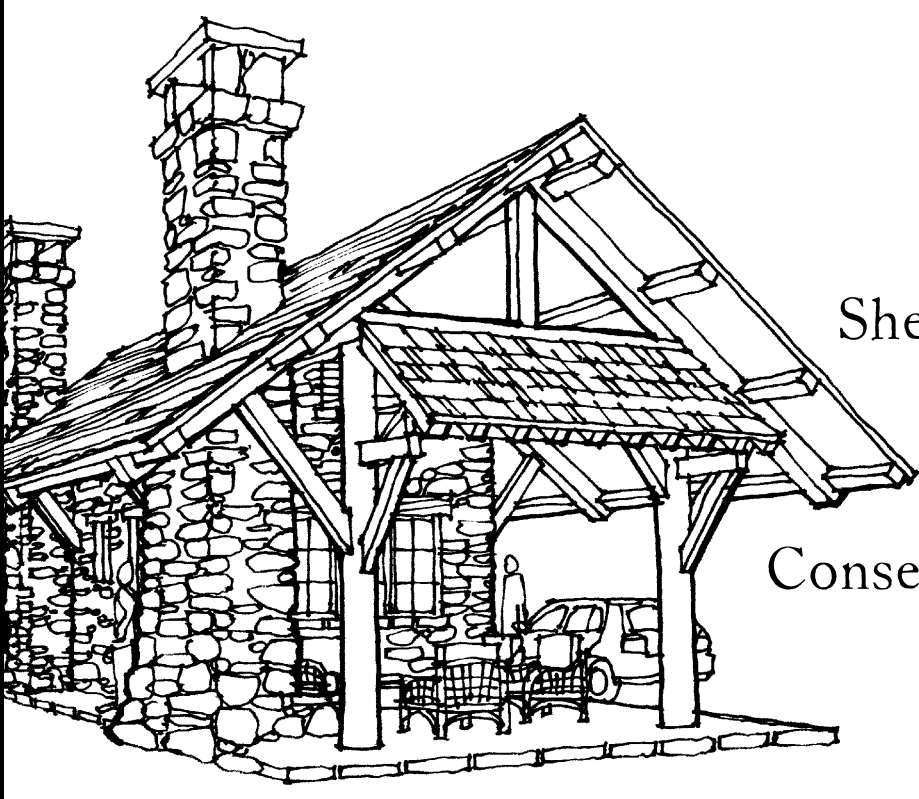
helped to mix in about a cup of latex paint). The paint smells like milk. The clay paint was fantastic, with a pudding consistency that adds texture. It smells like mud until it dries.

One of the main reasons we bought the house was for the opportunity to install solar collectors. That's possible because of a south-facing portion of roof and the accessible underneath of the floor where radiant floor heat could be installed. When we do that, we will choose a 95 percent-plus-efficient boiler that will also heat our water for domestic use.

We plan to build a fence around some of our yard for our dog and do not want to use pressure-treated lumber. After some research, we found a source for locust 4-by-4 posts and local hemlock to use as the vertical fencing. We also plan to make rain barrels to capture water for our vegetable garden.

Our choices make a difference in home renovation. When you use zero-VOC paint, you are making a choice not to use high-VOC paint. Consumers have the opportunity each time they buy something to make a statement to retailers, manufacturers, builders and others about their priorities. Green-built homes and materials will become more available if each of us decides to build or renovate in a green way. You can make your home a place you're proud of that reflects your values and even educates people who enter it. I encourage you to experiment with different products and compare prices and options for your situation.

*Matt Siegel is director of the WNC Green Building Council. He can be reached at 232-5080 or [info@wncgbc.org](mailto:info@wncgbc.org).*



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# The modular housing industry goes green

by Tanya M. Williams

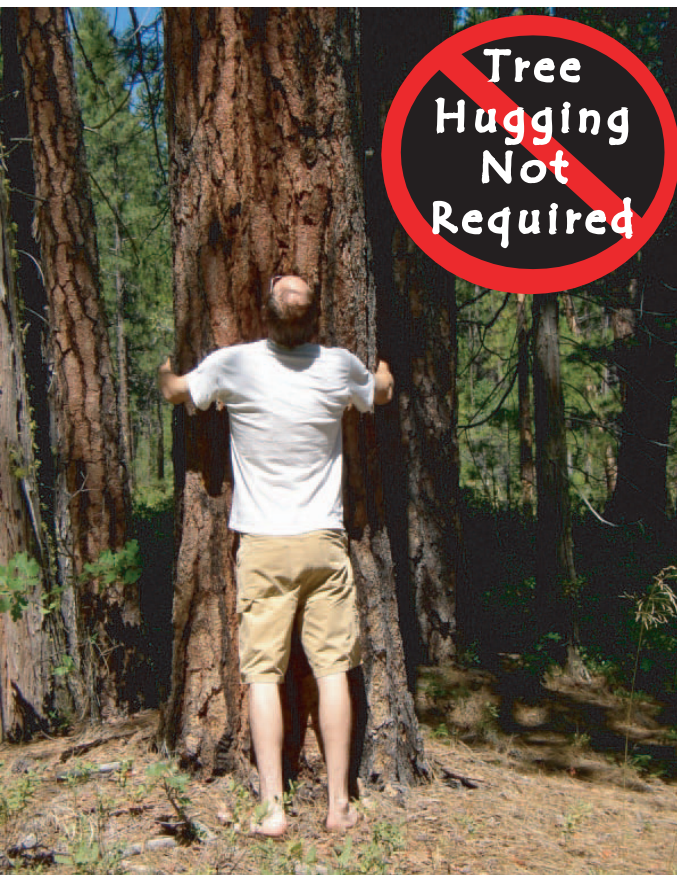
For decades, modular housing has carried a stigma that's been hard to shake. Poorly-installed vinyl siding, unimaginative design, over-standardized plans and boring elevations are somewhat to blame as well as an association with mobile homes. While not built to the residential building code's standards, mobile homes have cast modular homes in a bad light due to thinner walls, substandard windows and other aspects — anything but green. But factory-built homes have come a long way. And the modular concept, desirable in furniture, carpeting and other décor, has become a viable and affordable option for green building.

The potential for modular as an environmentally friendly building practice stems in part from the nature of factory- and systems-built construction. Rather than constructed a stick at a time on site (where building materials are purchased as needed and may be subject to weather conditions), modular homes are constructed in a climate-controlled factory, and materials are purchased in bulk. That saves the manufacturer, the builder and the homeowner money and time. The materials stay dry, which reduces the opportunity for mold growth and indoor-air quality problems. And wastes are minimized because scrap lumber can be used for sills, ledges and other miscellaneous needs.

Doug Williams, director of customer care at R-Anell Homes, a modular manufacturer based in Denver, N.C., says the company's total waste-disposal costs average \$178 a house. That's roughly equivalent to the hauling and dump charge for a ton of waste. The typical residential project produces three to four times that amount.

In terms of indoor-air quality, modular homes are arguably healthier because the home is framed, insulated, sheetrocked and wrapped indoors. Many manufacturers are moving to formaldehyde-free insulation for the safety of their employees and the benefit of future homeowners. Lumber and other building materials are stored in warehouses and often, due to production volume, used within days of their arrival. Therefore, moisture and humidity have little opportunity to adversely affect the structure. In addition, the homes are generally primed, if not painted, before delivery, which gives any VOCs time to dissipate before the dwelling is occupied. VOCs are organic chemical compounds such as formaldehyde that evaporate from solvents, industrial wastes and other materials.

Another area where modular can be greened is through the comfort systems and building envelope, or exterior shell, of the home. Several modular manufacturers are Energy Star-certified builders and provide features that include 2-by-6 construction, low-e (low-emissivity) windows, increased insulation, house wrap, radiant barrier sheathing, air sealing and other upgrades to improve the home's performance. Some Energy Star-certified manufacturers will perform a duct blaster test on factory-



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*A modular certified HealthyBuilt Home in the Montford neighborhood (photo by Rebecca Bowe).*

installed HVAC (heating, ventilation and air-conditioning) systems to ensure the equipment has been installed properly and ducts have been sufficiently sealed and insulated. Periodic blower door tests are also done at the factory to ensure that the process is producing a properly sealed structure.

For eco-conscious builders, the beauty of working with modular is the flexibility and efficiency of the method. Modular homes can be built to order, ranging from a home that arrives nearly move-in ready to one that is virtually a shell, ready for the builder to provide all the interior and exterior finishes. Builders often can negotiate upgrades to allow for raised heels on trusses, engineered roof-framing or use of formaldehyde-free materials. Or builders can opt out of factory features in areas where the manufacturer cannot provide a suitable solution. For example, a builder might choose to do all the flooring and exterior siding on site to allow for the installation of CRI- (Carpet and Rug Institute) certified carpets, bamboo or engineered wood flooring and fiber cement (HardiPlank) siding and trim.

Modular builders are responsible for site preparation and foundation work, so additional measures can be taken before the home arrives to ensure the overall sustainability of the project. For builders striving for NC HealthyBuilt Home (HBH) certification, this includes opportunities such as increasing slab insulation, using solvent-free foundation sealants, increasing fly-ash content in concrete, improving foundation drainage, providing ventilation for radon and other steps that are often just considered good building practices. The HealthyBuilt Home program also credits builders for site opportunities such as protecting pre-existing trees, situating the home for passive-solar heat, employing redundant or improved erosion-control programs, and mulching or milling trees that are removed from the site.

The potential for modular as a viable green-building method has caught the attention of some of the country’s most respected

architects and innovative builders. Sarah Susanka, interior designer of “Not So Big House” fame, collaborated with HEED House, LLC of Charlotte to design a modular-format Not So Big Showhouse. West Coast architect Michelle Kaufman has designed two modern, green, modular floor plans — the Glidehouse and Sunset Breezhouse, in conjunction with Sunset Magazine. The modernist architecture magazine Dwell also has produced a line of prefabricated, modular-inspired floor plans and elevations, or “Dwell homes.”

Asheville-based modular builder Innova Homes has teamed with Professional Building Systems of North Carolina to build the first modular house certified as an NC HealthyBuilt Home. A longtime Energy Star-certified builder, Innova Homes pursued HBH certification to see what level of planning, documentation and design modifications would be required to take its homes from Energy Star- to HealthyBuilt Home-certified. The project, a spec home for a client in Columbia, S.C., achieved a silver HBH certification for features such as fiber cement siding, increased insulation, low-e double-glazed windows, a 13 SEER heat pump with three zones of control and independent programmable thermostats, CRI-certified carpets, compact fluorescent lights, low-flow showerheads and a high-efficiency water heater.

Another benefit of modular is its relative affordability compared with stick-built construction. The ability of manufacturers to buy supplies in bulk and have a full-time work force reduces overall costs and quickens the building process. When an order is placed,

*continues on page 40*

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the home is generally ready to be delivered within four weeks. At this point, the modules are set and, depending on the level of finishing work to be done on site, the home can be move-in ready in as soon as a month, though most projects are finished in two to four months. Stick-built homes often take eight months to a year to finish. The efficiency translates into cost savings, making modular, even green modular, a more affordable option for homeowners. Many local builders of affordable homes have embraced the idea that affordable housing should also be affordable to operate and have incorporated Energy Star into their programs. Energy Star is a prerequisite for the HealthyBuilt Home program. Much of HBH certification is tied to Energy Star certification, so it's possible to incorporate HBH into affordable housing projects and to bring green building to a broader clientele.

Tanya M. Williams is a freelance writer and the office manager for Innova Homes, LLC. Contact her at [tanyawilliams@bellsouth.net](mailto:tanyawilliams@bellsouth.net).

# How to green your home with sustainable renovations

by Duncan McPherson

Thousands of people remodel their homes every year. Green renovations are more energy efficient, conserve resources and are healthier for occupants. These renovations make homes more affordable to maintain and operate.

Here are simple things you can do to renovate green:

## Landscape and yard

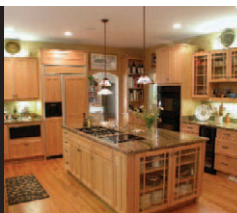
- Minimize the amount of lawn area. This reduces the amount of mowing, fertilizing and watering required. Replace grass with native trees, shrubs and wildflowers, and mulch heavily with leaves or wood chips.
- Start a compost pile. Compost food scraps, lawn clippings, leaves and wood ashes to reduce the amount of waste for the landfill and create free soil amendments. See [www.compostguide.com](http://www.compostguide.com) for more information.
- Use only organic fertilizers, insecticides and fungicides. This keeps harsh chemicals from creeks and streams and protects wildlife and aquatic habitat.
- Plant vegetation that improves natural habitats for birds and insects, using, for example, berry and butterfly bushes and fruit trees.

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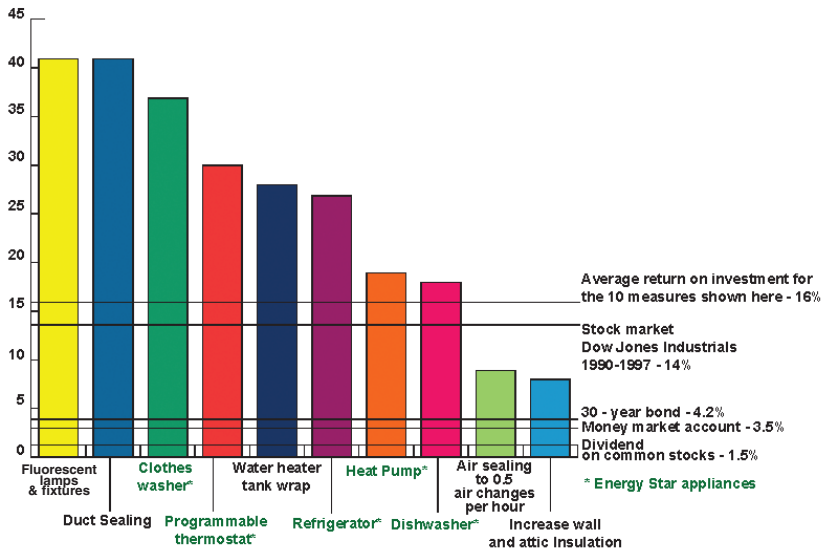


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Annual return on investment (%) after-tax



Application of these 10 energy efficiency measures in a typical home yields nearly \$600 in annual bill savings, and an impressive 16% overall return on investment.

- Install a bat house. This can greatly reduce the number of mosquitoes in your yard and increases the diversity of wildlife in your neighborhood. As with humans, bats can be particular with their homes, so do some research on how to install one. Go to [www.batconservation.org](http://www.batconservation.org).

- Plant bushes and trees to provide shade in the summer. Planting deciduous trees on the west side of your house can reduce summer afternoon heat through windows.

### The envelope

- Get a comprehensive energy audit of your house. Blower door tests, duct blaster tests and thermographic cameras help identify where to focus your efforts and money.
- Install weather-stripping at doors and windows to reduce drafts.
- Seal all large cracks or holes in the exterior of the house with an expanding foam. This reduces drafts and increases the overall efficiency of your building envelope, or exterior shell.
- Replace old windows with high-efficiency low-e (low emissivity) windows. Go to [www.efficientwindows.org](http://www.efficientwindows.org)
- Add or replace insulation especially in attics and basements.
- For more information go to: [www.energystar.gov](http://www.energystar.gov)

### Equipment and appliances

- Install a programmable thermostat, which can pay for itself in a year.
  - Replace incandescent bulbs with high-quality, compact fluorescent bulbs.
  - Seal and insulate your duct work especially if it's in a crawl space or attic that isn't air-conditioned.
  - Replace or clean furnace filters monthly.
  - Replace an inefficient washing machine to save water and energy. Front-loading machines use less water and energy and require less energy for drying than standard top-loading machines.
  - Replace an old hot-water heater with a high-efficiency or tankless heater.
  - Replace your furnace, air conditioning, heat pump and boiler with high-efficiency equipment. Look for a SEER rating (an efficiency rating) of 13 or higher, an HSPF (an efficiency measurement) of 7.5 or higher or efficiency ratings of 90 percent.
  - Purchase Green Power renewable energy through your electric company. Go to [www.ncgreenpower.org](http://www.ncgreenpower.org).
  - Buy Energy Star appliances and electronics to reduce your electricity consumption.
  - For more information, go to [www.aceee.org](http://www.aceee.org).
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- Buy Energy Star appliances and electronics to reduce your electricity consumption.
- For more information, go to [www.aceee.org](http://www.aceee.org).

## Water

- Use rain barrels to collect rainwater from your roof.
- Repair leaking or dripping faucets.
- Replace old toilets with efficient toilets. Dual-flush toilets are available from several manufacturers.
- Use low-flow aerators at your faucets and showerheads, and save thousands of gallons a year.
- Replace an old dishwasher with a new high-efficiency model.
- Prioritize your outdoor watering during droughts — trees and shrubs first, then flowers and last, your lawn.

For more information, go to [www.h2ouse.org](http://www.h2ouse.org).

## Indoor

- Bath exhaust fans should vent to the outside, not into an attic, basement, or crawl space. This reduces humidity and risk of mold growth.
- Remove mold in your basement or elsewhere with a diluted solution of bleach.
- Use only latex-based, low-VOC (volatile organic compound) paints and finishes. Most major brands offer low-VOC products.
- Seal the crawl space or partial basement. Cover and seal any exposed dirt or walls below grade with thick plastic to reduce the amount of humidity and risk of mold growth.
- Test for radon.
- Test for lead paint.
- Set up a recycling area in your house.
- Dispose of hazardous waste appropriately. Contact your local sanitation department for information.

*Duncan McPherson is a LEED-accredited professional with Samsel Architects in Asheville. He is a founding member of the Western North Carolina Green Building Council and may be reached at Duncan@samselarchitects.com.*

# Greening it up for \$26 or less

by Rebecca Bowe

Creating a more energy-efficient and sustainable living space may seem daunting at first. That's particularly true if constructing that dream home—complete with a photovoltaic array, geothermal heat, and least-toxic materials—is still a bit of a stretch financially. But before taking out a loan to retrofit your space according to those green ideals, it's important to realize that sustainable living can start with a few small, inexpensive steps. "There are many things a homeowner can do to save money and natural resources, all for little or no money," says Cory Lowe, outreach coordinator at Rocky Mountain Institute (RMI), a Colorado-based nonprofit.

The following advice from RMI and the American Council for an Energy Efficient Economy (ACEEE) addresses cutting carbon dioxide emissions, consuming less water and electricity, and saving — rather than spending — the kind of green that doesn't grow on trees.

## Things you can do for free.

The following tips, from a checklist on the RMI Web site ([www.rmi.org](http://www.rmi.org)), include the average amount of carbon dioxide conserved in a year for each measure taken. RMI estimates total savings of \$400 a year with these free measures:

- Adjust your home's water heater to 120 degrees from the usual 145 degrees. (163 pounds of carbon dioxide)
- Increase the air-conditioning thermostat by three degrees in the summer. (470 pounds of carbon dioxide)
- Lower the heating thermostat in winter by two degrees. (353 pounds of carbon dioxide)
- Turn off lights when you leave a room. (376 pounds of carbon dioxide)
- Wash clothes in cold water. (500 pounds of carbon dioxide)
- Hang your laundry outside to dry instead of using a dryer. (1,386 pounds of carbon dioxide)
- Turn off home-office equipment when not in use. (137 pounds of carbon dioxide)

## Steps that will pay for themselves in less than a year.

- Install a water-saving 2 1/2-gallon-a-minute showerhead (\$15).
- Install water-efficient faucet heads for kitchen and bathroom sinks (\$2 each).
- Install a programmable thermostat (\$26).
- In the attic and basement, plug the air leaks a cat could crawl through. Replace and re-putty broken window panes (about \$20).
- Clean or change the air filter on your warm-air heating system during winter and on air-conditioning units in the summer (\$2).
- Install an R-7 or R-11 water heater wrap (\$12).
- Insulate the first three feet of hot and inlet cold water pipes (\$6).



- Install a compact fluorescent lightbulb in the fixture you use the most (\$15).

The American Council for an Energy Efficient Economy ([www.aceee.org](http://www.aceee.org)) offers energy-saving advice that ranges from the simplistic to the complete overhaul. Little things that go a long way include cleaning the coils under the refrigerator once a year, closing the heating vents in unused rooms, and closing drapes during sunny summer days and after sunset in the winter. The council suggests reviewing utility bills to assess annual household energy consumption or calling a local utility company or state energy office to schedule a home energy audit. Once a target amount has been set for annual energy savings, more long-term projects can be launched, such as revamping heating and cooling systems or trading in old appliances for more energy-efficient models.

Whether the goal is to put money aside for green renovation or just to cut costs in the age of rising fuel prices, these checklists can help you conserve. Putting in the effort today means saving more than just cash — it's a contribution to preserving the environment that will be shared by future generations.

*Rebecca Bowe is the Mountain Xpress coordinator for the Green Building Directory. Contact her at [greenbuilding@mountainx.com](mailto:greenbuilding@mountainx.com).*

## The NC HealthyBuilt Homes Program is in your neighborhood

*by Matt Siegel, Dona Stankus and Colleen Starkes*

A HealthyBuilt home is a comfortable, healthy, affordable home that reduces use of energy and water and protects the environment. Building materials and processes are selected to reduce pollution and waste of natural resources during the manufacturing and construction phases and for the life of the home. Because of the quality, amenities and energy savings, the homes have a higher value and are easier to sell.

The NC HealthyBuilt Homes Program (HBH), a statewide green-building program, is a collaboration of the North Carolina Solar Center in Raleigh, the state energy office, North Carolina Department of Administration, NC HealthyBuilt Homes community partners and local professional building organizations. The program supports small and medium-size homebuilders with technical and marketing assistance, design reviews, workshops, presentations and field-consultation services that teach green-building practices.

NC HealthyBuilt Homes and builders in the program must meet requirements to participate. How you meet the requirements is up to you. There are guidelines for building in an environmentally-

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friendly way. You may be surprised at how many “green” choices you already make. The fees to enter the program are small given the many marketing and consulting people you will work with.

Since its inception in March 2004, the NC HBH program has grown. The program has added more than a dozen builders since March 2005 and includes builders in Wake County, along the coast and in the Charlotte area. Forty builders have used the program, 21 homes have been certified, and 65 more homes are registered to be built in the coming year. NC HBH builder members now represent the following counties: Brunswick, Buncombe, Burke, Carteret, Catawba, Chatham, Dare, Durham, Forsyth, Gaston, Madison, Mecklenburg, New Hanover, Pender, Union, Wake and Watauga.

The program has its first community partner, NC HealthyBuilt Homes of Greater Asheville. The local program—a partnership between the statewide program, the Western NC Green Building Council and the Asheville Home Builders Association—is growing as home buyers and builders realize the value of green building. As of December 2005, 19 NC HealthyBuilt Homes had been built and certified in Western North Carolina with about 60 more expected this year. The first NC HBH of Greater Asheville orientation drew 30 builders, developers, real estate agents and architects.

This year, at least two small developments are expected, starting with between eight and 30 homes each that will be part of the NC HBH of Greater Asheville program. These houses will be available to home buyers. In the next year, program officials hope to work with several local governments to provide incentives to builders who use the NC HBH of Greater Asheville program.

### These are some of the benefits to homeowners from the NC HBH program:

- Homes are constructed for healthy environments. NC HealthyBuilt homes are built with the environment and your family’s health in mind. During construction, builders practice sustainable-site measures and resource-conservation strategies.
- Homes have lower operating costs. Because NC HealthyBuilt homes are more energy efficient, you save on utility bills. And with the higher quality of a HealthyBuilt home, you can count on less maintenance in the future.
- The program includes guidelines for high performance. NC HealthyBuilt Homes are built to meet performance guidelines and have third-party verification to ensure durability and efficiency.
- Enjoy more comfort. Advanced techniques used to seal the home’s “envelope,” or exterior shell, mean a safer and more

comfortable living space. You will enjoy a quieter home with improved indoor air quality, fewer drafts and reduced moisture.

- The homes have lasting value. The retention of trees, water, materials and energy adds natural value to your home. The quality is monitored through a third party, which makes the homes more valuable and easier to sell.

### Here are some builder profiles from across the state:

#### Western North Carolina:

The Faherty residence is a new 2100 sq ft active/passive certified Gold Level HealthyBuilt Home. It was built to accommodate both living and office space using a lot of engineered products—precast concrete foundation, engineered I joists, finger joint studs, and a Truss roof system. All of these reduce the amount of material needed to do the structural work. The exterior is low-maintenance, durable stucco with 50-year

architectural shingles for roofing. The heating system is radiant floor energized by a solar thermal system and a 95 percent efficient boiler. Icynene insulation, energy efficient windows, advanced framing and a bermed first floor serve to improve energy efficiency. A heat recovery ventilation system and a built-in dehumidifier support indoor air quality, as does the use of low-VOC finish products, non-carpeted flooring, automated ventilation for the bathrooms, a kitchen vent system and a radon vent. Sustainably-harvested wood and recycled products were used for trim and cabinets.

#### Coastal counties:

NC HBH membership is booming along the coast with the addition of The Preserve. At this Wilmington community, the developer, TSL Construction of New Hanover County, requires homebuilders to become a member of the HBH program and construct HealthyBuilt homes. Three homes are under construction there. Some homes in The Preserve will feature solar hot water heating systems; a south roof area designed for future solar collectors; tree preservation plans; high-efficiency toilets, showerheads, water heaters and exterior lighting; and Energy Star appliances. Other new HBH members on the coast include Steve Postich Builders of Brunswick County, Phil Andrews Construction, Custom Cuts Construction of New Hanover County, Knowles Construction of Durham and Carteret counties and Bo Taylor Homes Inc. of Dare County.

#### Mecklenburg County:

In the Charlotte Area, two homes registered with the NC HBH program involve renovations. Banister Homes Inc. plans to gut a home and rebuild it to be a HealthyBuilt home. Pippin Home Designs Inc. has offered to evaluate the HBH checklist as applied to renovation projects and give feedback. Other new members in the Charlotte area include Harrington Construction Inc.; Oakley





Custom Homes Inc., which has a home registered with construction to start soon; and Environmental Building Solutions of Union County.

#### **Wake County:**

Builder Chad Ray, owner of Olde Heritage Builders, is in the NC HBH program. His first effort, a home in Zebulon, received an HBH certificate in November 2005 and won a gold award in the Wake County Parade of Homes. Other new NC HBH members in Wake include Cherokee Investment Partners, Energy Conservers & Consultants Co. Inc. and Palladium Homes, Inc.

For more information about program fees and other details, go to [www.healthybuilthomes.org](http://www.healthybuilthomes.org) or [www.wncgbc.org/healthybuilt](http://www.wncgbc.org/healthybuilt).

*Matt Siegel, director of the WNC Green Building Council, can be reached at 232-5080 or [info@wncgbc.org](mailto:info@wncgbc.org). Dona Stankus is director of the statewide HealthyBuilt Homes program at the N.C. Solar Center and is certified with the American Institute of Architects. Stankus can be reached at [Dona\\_Stankus@ncsu.edu](mailto:Dona_Stankus@ncsu.edu). Colleen Starkes also works at the N.C. Solar Center.*

## **Why Pay Thrice?**

Owners of inefficient homes must pay for building, higher utility bills, and the cost of a degraded environment. The key to savings lies in building design.

*by Ken Huck*

Over the last four decades, building energy researchers in the United States and abroad have documented that the vast majority of single-family homes waste substantial amounts of energy and money because their thermal insulation systems are poorly designed and constructed.

This dilemma, which includes even new houses that are built to meet today's codes such as the International Energy Conservation Code (IECC), arises from the failure of building code writers and home designers to recognize that each home is a unique integrated energy system requiring its own thermal design and analysis.

Politically influential associations of large homebuilders have also had a role in retarding the improvement of insulation standards. These special-interest groups have persistently and aggressively lobbied against money-saving building code advancements, which would require increases in the thermal

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performance of new buildings. It is clear that insulation requirements for exterior walls have languished at R-13 far longer than they would have if the interests of homeowners paying the energy bills had been ably represented.

The super-insulated Darmstadt "Passivhaus" (Passive House) and more than 4,000 homes based on its energy design principles are models of what can be achieved when energy use is integrated into building design early: using off-the-shelf components and good thermal design, these affordable, passively heated houses use only 8 percent of the energy for heating that is required to heat conventionally designed, code compliant homes.

### Ways to ensure that your home is energy efficient before you build:

1. Enlist the support of a building energy designer to help evaluate, select, and specify the most effective energy-efficiency measures (EEM) to ensure that the least expensive and most energy efficient home is constructed.
2. Specify airtight construction and require a blower door test to verify it.
3. Install an efficient, continuously variable speed, energy recovery ventilator (ERV) with demand sensors.
4. Insulate, insulate, insulate! (R-35 walls and R-50 attic in western North Carolina)

*If all of the human family is to share the quality of life now enjoyed by highly industrialized, information age societies, such as ours, we must dedicate ourselves to doing more with less.*

5. Place the majority of window area on the south face of the home where winter sun is accessible. Be sure to size south overhangs correctly to avoid summer overheating.
6. Insulate the walls of your foundation or basement and vapor seal the floors.
7. Choose the best PVC-free windows that you can find.
8. Select a knowledgeable builder who is aligned with your energy design goals and who is committed to creating a home for you that serves both your economic interests and the environment.
9. Plan for a future solar electric retrofit by maximizing southern roof faces and keeping them free of penetrations, shadows and obstructions such as gables or chimneys.
- 10 Consider using a heat pump, preferably a more efficient ground loop type, as a heat source.

We must dedicate ourselves to doing more with less if all of the human family is to share the quality of life we now enjoy. By working with one of the many dedicated members of the WNCGBC to guide your home's energy design and construction, you will guarantee yourself a home that is comfortable, affordable, and ecologically sustainable. Both you and the environment will benefit!

To learn more about PassivHaus visit:  
[http://www.passiv.de/07\\_eng/haupt\\_e.html](http://www.passiv.de/07_eng/haupt_e.html)

*Ken Huck is the principal energy designer at Susten® Building Energy Solutions. Susten® is an energy design engineering consultancy and a constructor of energy-optimized green buildings.*

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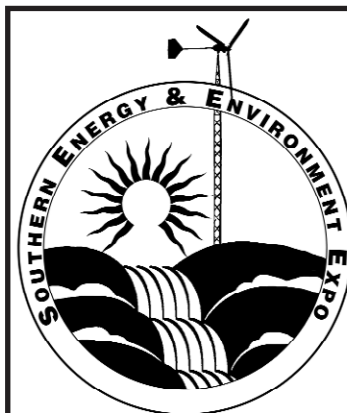
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# New Energy Star home guidelines are released

by Maggie Leslie

Last September, the Environmental Protection Agency released new guidelines for Energy Star-qualified homes. The guidelines establish standards that respond to significant changes in residential energy codes and standard building practices.

The old Energy Star guidelines qualified homes that are 30 percent more efficient than the 1993 Model Energy Code. With significant changes to the state energy codes in the past 12 years, many Energy Star-qualified homes do not meet even local standards. The old guidelines required only that the home receive a Home Energy Rating System (HERS) score of 86 out of 100 or that it meet the prescriptive requirements of the Builder's Option Package. These approaches aim to require good insulation and windows and tight construction and ductwork but fail to mandate minimums of R-value, air leakage or quality construction. So a home with very efficient windows but leaky ductwork and poorly installed insulation still could attain the Energy Star label.

The new Energy Star guidelines attempt to remedy these loopholes. By Jan. 1, 2007, all Energy Star-qualified homes will be at least 15 percent more efficient than the state energy code. And there will be more oversight by the HERS rater. Each home will be required to have a thermal bypass inspection to make sure the home is properly air-sealed and insulated. All insulation must be installed according to manufacturers' recommendations to comply with the guidelines, or it will not receive an Energy Star label. The software program also has developed a protocol for downgrading the R-value (resistance to heat flow, which describes the capacity of insulation materials) of the insulation depending on the quality of the installation. The new requirements establish minimums for duct and envelope leakage, a big source of inefficiency.

Energy Star will require that all cooling equipment be sized according to the Air Conditioning Contractors of America's Manual J, which assesses the size of a heating or cooling system a house needs. The HERS rater will require that a copy of the cooling-load calculation be submitted for each home to be certified. This is of particular benefit in our region of Western North Carolina, where oversized cooling equipment can lead to excess moisture, humidity, mold growth and high utility bills.

Starting in January 2006, 13 SEER (Seasonal Energy Efficiency Ratio, which describes the efficiency of heat pumps and air conditioners) became the minimum efficiency of cooling equipment manufactured. While this is not due to EPA-imposed minimums, it will make it more difficult to achieve the Energy Star label. This is because the program scoring works by allocating points for each aspect of the home that exceeds the energy code. Previously, with a 10 SEER code minimum, installing more efficient HVAC (heating, ventilation and air-conditioning) systems was an easy way to attain points. Now, only systems above a 13 SEER will receive points.

Another change to the program is the scoring system. The new



HERS index will reflect energy usage instead of efficiency. So a score of 0 reflects a "zero energy home," and a score of 100 is a home built to the 2006 International Energy Code. An Energy Star home will still fall in a similar scoring range, about 85, approximately 15 points and 15 percent above code.

The new Energy Star guidelines still do not require, or offer points for, indoor-air quality measures or efficient lighting. But the EPA is developing an indoor-air quality package and offers an advanced lighting package for additional certification. The packages are great ways for builders to upsell their clients while building in durability, performance, comfort and low utilities in their homes. The basic Energy Star guidelines will, however, require that each home have at least one Energy Star-qualified product category, such as windows, HVAC, lights or appliances. That recognizes that energy use from lighting and appliances is a significant piece of the energy-use pie.

So what do all these changes mean for residential homebuilders and homebuyers? The next 12 months will be a "grandfather" period for the Energy Star program. HERS raters will begin to implement the new program standards, and by January 2007 all homes must comply. All certified homes must comply with the new guidelines unless they were enrolled in a utility- or state-based efficiency program by Dec. 31, 2005, or are permitted by July 1. However, local HERS raters may begin to implement the program immediately. Homebuilders need to contact their HERS rater to discuss how the new standards affect their construction practices and ability to attain the Energy Star label. By purchasing an Energy Star-qualified home, homebuyers can be more confident that the Energy Star label stands for quality and efficiency. For more information visit [www.EnergyStar.gov](http://www.EnergyStar.gov).

*Maggie Leslie is treasurer of the Western North Carolina Green Building Council and is a consultant for builders interested in high performance and green building with an Asheville-based HERS Rater, Home Energy Partners. She can be contacted at [Mleslie@HomeEnergyPartners.com](mailto:Mleslie@HomeEnergyPartners.com) or 350-1155, ext. 305.*

# Energy efficiency tax credits

by Maggie Leslie

## Federal tax credits for new homes

Homebuilders receive a tax credit of \$2,000 for homes that reduce energy use for heating and cooling only—not hot water—by 50 percent compared to the national model code, as per the 2004 IECC (International Energy Conservation Code) Supplement. This assumes the use of a 13-SEER (seasonal energy efficiency ratio) air conditioner.

Producers of manufactured homes can also choose to qualify for a tax credit of \$1,000 for homes that save 30 percent. This \$1,000 credit for reaching 30 percent savings is not available for site-built homes, which must reach the 50 percent savings tier to qualify for the \$2,000 credit.

## Federal tax credits for existing homes

This section provides tax credits for homeowners, including HUD (U.S. Department of Housing and Urban Development) manufactured homes and condos, for installations completed in 2006 and 2007. Homeowner-builders who are not able to use the builder tax credit should be able to qualify for these credits, unless the IRS disqualifies new construction. These provisions offer cost-based incentives of 10 percent of the amount expended by the taxpayer for “Qualified Energy Efficiency Improvements” and up to \$300 for “Qualified Energy Property” up to a maximum credit limit of \$500.

## “Qualified Energy Efficiency Improvements” are specifically defined as:

- Any insulation material or system specifically designed to reduce heat loss or gain
- Exterior windows (including skylights)
- Any metal roof having pigmented coatings specifically designed to reduce heat gain, which meet Energy Star program requirements.
- Exterior doors

## “Qualified Energy Property” is defined as:

- Electric heat pump water heater with EF (efficiency factor) of 2.0 or greater
- Electric air-source heat pumps with HSPF (heating seasonal performance factor) of 9.0 or greater
- Geothermal heat pumps
- Closed loop products with EER (energy efficiency rating) of 16.2 and COP (coefficient of performance) of 3.3 or greater
- Open loop products with EER of 14.1 and COP of 3.3 or greater
- DX (direct expansion) products with EER of 15 and COP of 3.5 or greater
- Central air conditioner that receives the highest efficiency tier established by the Consortium of Energy Efficiency as of Jan. 1, 2006
- Natural gas, propane or oil water heater with EF of 0.80 or greater
- Natural gas, propane or oil furnace, or hot water boiler with AFUE (annual fuel utilization efficiency) of 95 percent or greater
- Advanced main air circulating fan used in natural gas, propane or oil furnace that uses no more than 2 percent of the total annual energy use of the furnace.

## Credit limitations on qualified energy property are as follows:

- \$50 for any advanced main air circulating fan
- \$150 for any qualified natural gas, propane, or oil furnace or hot water boiler
- \$300 for any item of qualified energy property.

For information on federal and state tax credits for renewable energy sources, see the article entitled “Solar Tax Credits” in the directory’s Solar Energy Systems section.

## Resources:

[www.southface.org](http://www.southface.org)  
<http://www.fsec.ucf.edu/EPAAct-05.htm>

Maggie Leslie is treasurer of the Western North Carolina Green Building Council and is a consultant for builders interested in high performance and green building with an Asheville-based HERS Rater, Home Energy Partners. She can be contacted at [Mleslie@HomeEnergyPartners.com](mailto:Mleslie@HomeEnergyPartners.com) or 350-1155, ext. 305.



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## A solar primer

by Beach Barrett

If you are interested in solar energy, the first thing to remember is the number 33. That's because the North Carolina Solar Center in Raleigh can be reached at 800-33NCSUN. Established in the 1980s, the center is an invaluable resource that offers information on qualified solar installers, suppliers who provide consultation on solar projects, and solar house design. Their Web site is [www.ncsc.ncsu.edu](http://www.ncsc.ncsu.edu).

There are two types of solar products. Solar heating collectors convert solar energy into usable heat. They usually heat water for domestic hot water and space heating. Solar-electric panels are made of a semiconductor material that converts solar light into electricity. As a rule, solar heating systems will give you the most return for your money.

The most common type of solar heat collector is a flat-plate collector, mounted vertically. These are made with aluminum frames, glass fronts and insulated backs and contain black-coated copper fins. The most common sizes are 4 feet by 8 feet and 4 feet by 10 feet. Another type of collector is the vacuum tube collector, which comes in varied sizes and is usually set at the same pitch as flat plates. Vacuum collector systems usually collect less energy than flat-plate systems in bright sun (due to differences in square footage) but perform better in overcast and very cold conditions.

Concentrating collectors use a reflective surface to aim solar rays onto a solar absorber. In addition, an "invisible solar system" goes behind a metal roof and can also incorporate photovoltaics, or converting the sun's energy to electricity. Collectors can be mounted on the ground or roof.

Passive solar, a form of solar heating with no moving parts, is a set of design criteria applied to a home. Usually, 70 percent to 80 percent of the glazing in the home is on the south side. The southern glazing is about one-twelfth the square footage of the building's square footage. The sun through the south windows must land on a solar mass, usually a 4-inch concrete slab, and the home is well insulated. A passively heated home will save enough energy in 50 years or less to pay for the entire cost of construction. With a passive-solar home, remember that all "low-e" (low emissivity) windows are not the same. Low-e glazing made for southern climates is designed to keep the sun out, while glazing for northern climates is designed to let the sun through and keep the heat in.

Before you build, it's a good idea to get a solar survey of your site. Several devices can map the path of the sun at your location, and most solar contractors perform this service. As a rule, solar-heating systems



*Solar electric panels mounted on a rooftop (photo by Rebecca Bowe).*

can tolerate some tree shading and can face up to 40 degrees from south with little impairment. Solar-electric systems are more exacting and can't tolerate any shade.

Solar energy is usually collected when it is least needed, so it must be stored for later use. Generally, you will need a gallon to 1.5 gallons of storage capacity for every square foot of flat-plate collector and even more for vacuum collectors. For example, a system using four 4-by-10 collectors will require a 160- to 240-gallon storage tank.

A 4-by-10 solar collector usually provides enough domestic hot water for two people. Solar hot-water space-heating systems can incorporate up to 10 or more collectors, but payback diminishes if a solar-heating system is sized too large. This is because more collectors lie idle as the weather warms up.

The cooler a collector is, the more energy it can harvest from the sun. Therefore, a system that requires low water temperatures to operate, such as domestic hot-water heating or radiant floor heat, are a perfect match for solar energy. Heating systems that use radiators or hot-water baseboard require high (160 degrees and more) water temperatures and should be avoided. For the best performance, make sure that all solar piping from the collector to the storage tank is insulated with 1-inch wall-thickness insulation.

*continues on page 50*

Solar collectors are designed to withstand the extremes they go through, and the industry has refined and improved the materials used to make them. The average lifespan is 20 to 30 years, and the only maintenance required is periodic cleaning. The other part of the system that is vulnerable is exposed piping above the roof or ground. The piping should be well-insulated and covered with a weatherproof covering such as aluminum flashing.

Solar systems cost about \$2,000 for each collector installed. Vacuum tube systems cost a bit more. A square foot of collector will generate about 2 cents of equivalent propane energy in a full sun day. Most solar domestic hot-water systems pay for themselves in four to seven years. Solar-heating systems take longer because the collectors lie idle in the summer.

Solar-electric collectors are called photovoltaic panels, and panels are grouped together in photovoltaic arrays. The panels and arrays come in a variety of sizes that can be mounted on roofs, ground racks or poles.

As with solar-thermal systems, solar-electric systems store power for later use. In stand alone or independent systems, electricity is stored in large batteries. After several days of cloudy weather, the battery may become depleted, and a backup source of energy such as a propane generator is used. These components drive up the cost of a stand-alone system. In a grid-tie system, the utility is used for storage and backup. When the panels make excess energy, it is sold to the utility grid, and when

the panels stop making power, the utility returns the power. Grid-tie systems cost about 30 percent less than stand-alone systems, but they usually don't work during a power outage.

Solar electricity is expensive, and there is no real payback yet. A typical home in the United States uses about 20 kilowatt hours a day. A stand-alone photovoltaic home is designed to consume one-tenth of that amount. A good stand-alone system costs between \$20,000 and \$24,000. In a photovoltaic home, electricity is treated as a refined energy used for the functions that only electricity can do, including lighting and pumping water. All other chores, including heating and refrigeration, are consigned to a cruder form of energy such as propane, oil or thermal solar. Solar-electric panels are expected to perform well for 20 years. Storage batteries can last from eight to 16 years.

There are tax credits for solar use. The combined state and federal solar-tax credits as of 2006 in North Carolina are 55 percent of the cost of the system. The maximum credit allowed on a residential solar system is \$5,500, and if the system augments a heating system, the credit can extend to the heating system as well. There's also a tax credit for including passive-solar features in a new home. The credit can be rolled over for several years until it is absorbed. The tax credits also apply to solar-electric systems, and they can be expanded on commercial projects.

*Beach Barrett has been in North Carolina since 1979. He started a radiant floor heat and solar-energy business, Thermacraft Energy Services, in 1988.*

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# Promoting the use of solar-electric technologies

by Matt Siegel

The Million Solar Roofs Initiative, or MSRI, was established in 1997 as a national initiative for global climate change. The program supports state and local communities in promoting the widespread use of solar-electric technologies. These technologies generate electricity called photovoltaics, or PVs, and solar thermal for heating hot water and homes. The result will be reduced fuel costs and an improved environment.



*Energy from the sun shining in North Carolina in one day is sufficient to provide all of the energy for the entire state for a full year.*

Energy from the sun shining in North Carolina in one day can provide all the energy needed for the entire state for a year. North Carolina sends about \$6 billion each year to other states and countries for our electricity. North Carolina citizens could be spending that money here in our state on housing, heating fuel, health care and education if we reduced the need to import our energy. Sixty percent of the electricity North Carolina uses is generated from coal, which causes greenhouse gases, air pollution and health problems. The movement toward renewable energy, on the other hand, is creating tens of thousands of jobs in the manufacturing and installation of hot-water solar collectors, PV panels and other forms of renewable energy. The sun is a clean, nonpolluting source of energy that is not subject to price increases and shortages caused by natural or human disruptions.

North Carolina has one of the best solar-income tax credits in the country (35 percent), and federal solar-income tax credits of 30 percent are available starting in 2006. The tax credits reduce the amount of income tax due. Both hot-water collectors (for water or space heating) and PV panels (to generate electricity) qualify for tax credits for residences. Higher tax credits are available for businesses and industries. The average cost for an installed hot-

water solar collector to heat domestic water is about \$4,500. Reduce this by about half with the money saved from tax credits, and add the balance to a new or existing mortgage, and the monthly savings can often exceed additional monthly payments.

According to research at the University of Wisconsin's Solar Energy Laboratory, a typical household's electric water heater annually produces about as much carbon dioxide as the typical family's car. Using solar to replace the electric water heater would provide an environmental benefit equivalent to doubling the fuel mileage of the family car.

Many other states and countries are forging ahead with solar initiatives that will increase the installation of solar collectors. The Million Solar Roof Initiative in Western North Carolina helps educate the public about solar energy and its benefits. Using solar energy is just one opportunity now to be a part of the solution.

As part of the MSRI program, the Western North Carolina Green Building Council has a goal to identify 50 solar installations in the next year. If you have a solar-energy installation at your home, please register it at [www.NCREregistry.org](http://www.NCREregistry.org). For more information about green building or how to become a member or volunteer with our council, visit our Web site at [www.wncgbc.org](http://www.wncgbc.org).

*Matt Siegel is director of the WNC Green Building Council. He can be reached at 232-5080 or [info@wncgbc.org](mailto:info@wncgbc.org).*

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# A close-up of a passive solar house

by Joe Baum

For years, my wife Lenore and I dreamed of leading a more simple life in the country in a sustainable house. Our opportunity came when I retired from an engineering career. For Lenore, this was the chance to build her dream kitchen, where she could continue to teach vegetarian cooking in an optimal natural setting with a terraced, organic garden.

Inspired by a Japanese-style folk house, the Baum residence and cooking school in Weaverville was completed in October 2005. Chris Larson, an Asheville architect, designed the passive solar house. To make the project more affordable, we worked with the builder, Douglas Clark of Greenbrier Builders, every day for 14 months.

Nestled on a south-facing hillside, the home has an open floor plan that capitalizes on the views, daytime solar exposure and easy flow for students in the cooking school. The main living space is on the first floor, with 2,100 square feet. The north side is earth-bermed with insulated concrete form, or ICF, construction. The loft level, with 600 square feet, has space for yoga and meditation, along with my office and storage.

Some of the most rewarding features of the house include living on grade, which gives a sense of grounding and connection with the earth; the cedar-lined master bath with a sunken, Japanese soaking tub; an outside shower set in an Asian garden, protected by a curving, dry-stack, stone retaining wall; and the kitchen, with a 270-degree mountain view, a large pantry and extensive social and work space around a curving island. The many windows and skylights provide transparency and invite the outside in.

In addition to the passive design with large, low-emissivity windows (which block heat), extended overhangs and sizable thermal mass, the house features radiant hot-water heating for all of the domestic hot water and much of the space heating. Solar energy collection is enabled by six hillside-mounted, 4-by-10 hot water panels through a drain-back system. Two solar storage tanks have a capacity of 240 gallons. The domestic tank is 30 gallons and is coupled to the backup, high-efficiency propane boiler, which has its own outside air intake and exhaust pipes. It is so liberating and satisfying to see and hear the system harvesting heat from the sun. Four zones distribute radiant heat to the insulated slab floor and the walls in the loft. A woodstove and gas fireplace are heat sources.

A tight building envelope was ensured by special attention and foaming of joints during framing and with Icynene insulation for non-ICF exterior walls and ceilings. We didn't have plumbing positioned in the outside walls. The structure has received an Energy Star rating.

Ventilation for this airtight home is a focus. A combination of casement and awning windows are positioned to take advantage of the natural site airflow in low to moderate humidity. Ceiling



*The living areas have large southern windows and extensive thermal mass in the tile floors and stone wall for winter solar gain. The teaching kitchen and the remaining first floor have sustainable natural cork flooring. The large range hood employs automatically activated make-up air ducting.*

fans and rotating table fans provide efficient cooling where needed. To keep the heat outside, a covered, screened patio off the kitchen is used for summertime cooking and comfortable dining. Active make-up air for the cooking-stove exhaust is automatically engaged through a linked blower-damper system. Using an outside shower keeps unwanted moisture out of the house. In high humidity, a two-stage compressor is used with a variable-speed blower and thermostats to manage humidity and cool as necessary. To provide make-up air throughout the year, outside air is drawn into the blower through an automatic damper activated electronically on a user-preset schedule. During the winter, passive make-up air is provided at the woodstove, and active circulation of heat flows from the second floor to the first floor.

Other design features include low-maintenance long-life cement siding; lichen-colored metal roofing; heat-reflective, ceramic InsulCote exterior paint, similar to the color of tree bark; sustainable and cushioned cork flooring; a contemporary "root cellar;" solar path lighting and Energy-Star-rated appliances. Native landscaping eliminates the need for watering, chemical additives and mowing grass. An organic vegetable and herb garden with composting is planned for the spring, and wiring conduits were installed to add a solar-electric system in the future. During construction, we lived on the site in an RV, using solar-oven cooking and solar electric panels.

For years, we read green-building books and attended solar conferences and home tours to develop an idea of what we wanted. Though some people view hiring an architect as an extra expense, we were really glad we did. Chris Larson translated our vision into an amazing, artistic reality which continuously feeds our souls. We feel blessed to have realized our dream and believe it was worth the mental and physical effort we put into it. If you come to a cooking class here, you'll experience it for yourself.

*Joe Baum is retired from an engineering and management career at General Motors and is now consulting. Lenore has more than 30 years of experience in natural-foods cooking and instruction and is author of Lenore's Natural Cuisine and Sublime Soups. They can be reached at 645-1412 or lenorebaum@lenoresnatural.com.*



# Solar-heated water with radiant floor heat

## Using solar evacuated tube technology

by Ole Sorensen

Imagine your solar hot-water system heating your kitchen, laundry and bath water as well as heating your home. You'd have the comfort of rolling out of bed to the touch of a warm floor on cold winter mornings, and basking in the heat of yesterday's sunshine as you shower. You'd also have peace of mind knowing that while your radiant floor heating system provides you with health and comfort, it is also a contribution to a healthier planet.

Hydronic radiant floor heat is a wonderful way to heat your home because it is energy efficient, quiet, very comfortable, invisible in the living space, and safe for allergy sensitive people, as it keeps out the drafts that bring in dust. Radiant floor systems allow even heating throughout, not just in localized spots as with forced air. The room heats from the floor up, warming the feet and body first. The components such as tanks, pumps, boilers and controls are long-lasting and the tubing products have warranties of 25 years or more.

Radiant floor heating systems are available using air, electric or water. The focus here is on hydronic (water) radiant floor systems, which are the most efficient and have been used extensively in Europe for decades. Today, 50 percent of new heating installations are radiant floor heat. Here's how it works: Heated water from a boiler is pumped through pex (a type of strong non-toxic plastic) tubing laid in a pattern underneath the floor. The tubing can also be embedded in a concrete foundation slab, a lightweight concrete slab on top of a subfloor, or over a previously poured slab. A wide variety of floor coverings can be used such as tile, wood, concrete or laminates.

A hydronic radiant floor heating system can be powered by fossil fuels, but it is highly efficient because it is considered a low-temperature heating system. A typical solar-heated water system starts with a solar collector that absorbs the sun's radiation and converts it into energy that is used to heat water. The stored heated water is then applied to supplement the heating of household water and the water used in the radiant floor system.

Recent developments in solar technology provide even greater energy efficiency. The basic flat plate collector is the more commonly used type of solar collector, but a new technology called solar evacuated tubes with heat pipes offers an improved performance of 200-400 percent. The basic flat plate collector is a flat box containing absorber plates—that's where the sun's radiation is absorbed—with water filled pipes running through them. This type of collector tends to lose heat through the glass. The solar evacuated tubes, on the other hand, also use an absorber plate, but instead of water running through there is a special vacuum-sealed tube. The vacuum eliminates heat loss. The solar evacuated tubes are arranged in a row that is connected to a copper bar (manifold) by a heat pipe. The pipe heats the water running through the manifold, and the water is circulated to the storage tank.



*An array of solar evacuated tube collectors, showing how they connect to the manifold at the top.*

Solar evacuated tubes are available in arrays of 30 or more and perform well in both direct and indirect sunlight, making them useful in areas with cold, cloudy winters while achieving both higher temperatures and higher efficiencies than flat-plate collectors.

The tubes can be adjusted to face the optimum orientation for maximum solar radiation absorption. Because each solar tube is an independent collector with its own heat transfer mechanism, each one can be individually oriented to optimize the heat gain. And because the tubes are lightweight and never hot to the touch, installations and maintenance are simple. The direct flow concept permits installation horizontally, vertically or at any required angle, allowing for architectural and aesthetic freedom. So if you can't put it on your roof you can put it on an outside wall.

When considering renewable energy, heating your home with solar heated water and hydronic radiant floor heat is the one of the most financially feasible options. With system lifetimes well above 30 years and payback times as short as 7 years for domestic hot water systems, and 12 years for home heating systems, solar energy is a healthy solution that will bear fruit for many years to come. The combined North Carolina and Federal Tax Credits for renewable energy installations as of 2006 will amount to as much as 55 percent of the project cost. We strongly suggest researching the specific rules that apply to various tax credits ([www.ncsc.ncsu.edu](http://www.ncsc.ncsu.edu) is a good place to start).

When you decide to reduce the use of fossil fuels by installing a solar hot water (SHW) system to heat your domestic hot water, consider your contribution a worthy one. There are more than 300,000 SHW system units (not including swimming pools) installed across the United States, and installations are continuing to increase. In fact, a June 2004 report describes the installation of a Thermomax SHW system consisting of 360

*continues on page 54*

evacuated tube heat-pipe solar collectors at the top of the hot water circulation loop in the Social Security Administration's Mid-Atlantic Center in Philadelphia. And between 1996 and 2004, the consumer base of the Hawaiian Electric Company installed more than 25,000 SHW systems. In doing so, they effectively reduced utilities demands by a total of 12.7 megawatts: enough to power approximately 18,000 typical US homes.

According to the US Department of Energy, heating domestic water today accounts for up to 14 percent of the average household's energy use and nearly 4 percent of the total US energy consumption (1.7 quadrillion kilowatt hours from 2004), which on average created 1.18 trillion tons of carbon dioxide. Considering our need for independence from fossil fuels and the staggering amount of pollution they produce, an investment in solar certainly brings with it the heartfelt comfort of knowing we are giving ourselves and our children a healthier future, and bringing a much-needed balance back to our ecosystem.

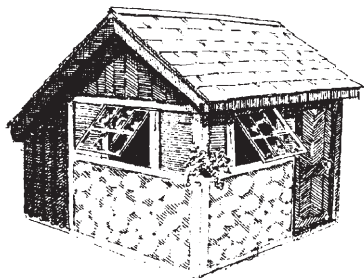
*Ole Sorensen is the owner of Solar Dynamics in Asheville, NC. You may contact him by calling (828) 665-8507, or e-mailing ole@solardynamics.org.*

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## State and federal tax credits offer more incentives for renewable energy

*by Leslie Segal*

Incentives for renewable energy have increased with new state and federal tax credits and a new regulation approved by the North Carolina Utilities Commission. Solar energy won a victory in last year's federal energy bill. The provision may one day be considered a sign of the most significant renewable-energy policy shift in more than three decades. The federal commercial tax-credit incentive increased from 10 percent to 30 percent. And there was no residential incentive before the new 30 percent credit.

"If consumers have been waiting for a tax credit for solar, now is the time to do it," says Rhone Resch, executive director of the Solar Energy Industries Association.

### These credits are available as of Jan. 1, 2006:

#### State commercial credits:

There's a 35 percent North Carolina credit of up to \$250,000 for commercial photovoltaics (generating electricity from sunlight), wind, hydroelectric, solar hot water and space-heating applications. Credit is taken in five equal installments, and credit may not exceed 50 percent of a taxpayer's liability for the year.

#### Federal commercial credits:

The federal credit of 30 percent has no cap on the amount of credit for commercial PV, solar hot water and space-heating applications. Excess credit may be carried forward two years.

#### State residential credits

There's a 35 percent North Carolina credit of up to \$10,500 for photovoltaics, wind and hydroelectric systems. A credit of up to \$3,500 is available for active space-heating systems. For solar water-heating systems, there's a credit of up to \$1,400. For each of these credits, excess credit may be carried forward five years, and credit can't exceed 50 percent of a taxpayer's liability for the year.

#### Federal residential credits:

You may take both a 30 percent credit up to \$2,000 for photovoltaics and a 30 percent credit up to a separate \$2,000 for a solar water-heating system. Excess credit may be carried forward to the next tax year.

What we call the best investment under the sun refers to the North Carolina and federal tax credits for a residential solar-thermal heating system. Solar-thermal heating provides heat for water, space heating and swimming pools. Solar collectors change energy from the sun into heat energy, which is transferred to a storage system or interior space. Solar thermal is the oldest and most widely used renewable energy technology worldwide. It is also the most affordable such technology, enhanced by the increased credits.



Home-heating costs in Western North Carolina were expected to skyrocket this winter. If supplementing a propane heating system, a solar-thermal system will save an average of \$1,945 in offset propane costs annually. If used to supplement an electric heating system, solar thermal will save an average of \$1,700 in annual electricity costs. If used to supplement natural gas heating, solar will offset \$900 a year of the cost of natural gas.

The average cost of a four-collector solar-heating system with installation is \$10,000. A state tax credit of up to \$3,500 is available, and a federal credit of up to \$2,000 is available. An initial \$10,000 out-of-pocket expense is reduced to \$4,500 when credits are taken over five years. The system payback equates to a 36 percent return on investment in the first two years if supplementing a propane heating system, a 34 percent return as a supplement to electric heat and a 26 percent return as a supplement to natural gas heat. The system payback occurs in as soon as three years. The return-on-investment and payback calculations do not take into account an increase in fuel costs. If fuel prices were \$2.62 a gallon for propane, 10 cents a kilowatt-hour and \$1.56 a therm for natural gas, the return on investment after the fifth year, when all credits had been taken, would be 19 percent, 17 percent and 9 percent respectively.

Another important development for renewable energy took effect Jan. 1. The North Carolina Utilities Commission issued the net-metering regulation long awaited by the North Carolina Sustainable Energy Association and North Carolina Solar Center. About 40 states have net-metering laws. Net metering allows residential and commercial consumers with grid-tied renewable-energy systems to run their meter backward when they produce more electricity than they consume. Net metering provides a potentially valuable option for photovoltaics systems. North Carolina customers of Dominion, Duke and Progress power companies may participate in the program. Electric co-ops and municipal utilities may participate on acceptance.

Solar-energy advocates hope the net-metering program eventually will include systems that incorporate batteries, state electric co-ops and municipal utilities. Advocates also hope that net-metering regulations eventually may be used with the NC GreenPower Program. Energy rates depend on time of day and season. Net-metering guidelines include time-of-use rates, which means off-peak generation cannot offset peak usage. Similarly, excess summer production cannot be carried over to winter. The net-metering program is based on offsetting usage from the utility. The offset credit is the same retail rate per kWh at which a consumer purchases electricity from the utility. In North Carolina, that averages 10 cents a kWh. Homeowners and businesses with small renewable-energy systems (up to 20 kilowatts for residential and up to 100 kilowatts for commercial) now have the choice of supplying energy for the NC GreenPower program or taking advantage of the net-metering rules.

“While NC GreenPower may provide a better deal for customer generators with small solar-electric systems, net metering provides a potentially valuable option for larger photovoltaic systems and small wind generators,” says Steve Kalland, director of the NC Solar Center.



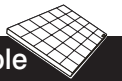
*Residential 2.7 kW grid-tied PV system located in Durham. This project is part of the North Carolina Green Power Program, designed and installed by Sundance Power Systems in 2005 (photo by Dave Hollister).*

NC GreenPower is a nonprofit renewable-energy organization funded through rate-payer donations. It's the first statewide green-energy program in the nation supported by all the state's utilities. About 7,000 utility customers purchase blocks of 100 kWh for \$4 to support the program. NC GreenPower aims to supplement the state's power supply with more green energy. The NC GreenPower production credit incentive is 18 cents per kWh of excess power generated. In addition to the credit from NC GreenPower, the utility pays an “avoided cost” rate at the wholesale rate for each excess kWh produced. The wholesale rate is based on what it costs the utility to generate a kWh of electricity, which averages 3 cents a kWh.

Rising energy prices and decreased supplies are real. Many of us have been thinking about renewable energy for years. Now is the time to pursue it.

*Leslie Segal is marketing director at Sundance Power Systems Inc., which provides renewable-energy and hydronic heating systems with design and installation services. Contact Sundance at 689-2080 or [info@sundancepower.com](mailto:info@sundancepower.com), or visit [www.sundancepower.com](http://www.sundancepower.com).*

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Legerton Architecture specializes in the design of individual residences (new homes, renovations, and additions) and small commercial projects. Sustainable and energy efficient design is integrated into all of our projects.

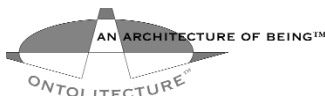
## MATHEWS ARCHITECTURE, P.A.

### Mathews Architecture, P.A.

Richard Mathews  
34 Wall Street, Suite 307  
Asheville, NC 28801  
(828) 253-4300

www.mathewsarchitecture.com

We promote environmentally responsible, quality building practices, and help our clients make wise choices in utilizing the best available sustainable resources, non-toxic materials, and energy-efficient systems.



## Ontolitecture

Adam Wisler  
30 Ben Lippen School Road  
Asheville, NC 28806  
(828) 252-1974  
www.ontolitecture.com

Ontolitecture, an Architecture of Being, are creating Sustainable Living Solutions where each owner's dreams are. Adam Wisler, Architect, and team provide complete services for solar, residential, and commercial design.

## Padgett and Freeman Architects, PA

30 Choctaw Street  
Asheville, NC 28801  
(828) 254-1963  
FAX: (828) 253-3307  
www.padgettandfreeman.com



## Platt Architecture, PA

Laura Botch  
33 West Main Street  
Brevard, NC 28712  
(828) 884-2393  
www.plattarchitecture.com  
See: www.plattarchitecture.com,  
www.newmountainarchitecture.com,  
www.hgtv.com/hgtv/dream\_home

## Daryl S. Rantis Architects, P.A.

247 Country Club Road  
Asheville, NC 28804  
(828) 257-2998  
Practicing ecologically responsible building and planning services since 1990. Specializing in beautifully resolved environments with a focus on sustainable New urban village design and bio-regionally appropriate architecture.

## SAMSEL ARCHITECTS

### Samsel Architects, PA

Jim Samsel  
60 Biltmore Avenue  
Asheville, NC 28801  
(828) 253-1124  
FAX: (828) 254-7316  
jim@samselarchitects.com  
www.samselarchitects.com

Using integration of the natural and built environment as a key design principle since 1985, Samsel Architects incorporates energy efficiency and environmental design into all projects. 3 LEED Accredited Professionals, NC HealthyBuilt Homes Program, Energy Star, and LEED certification. Servicing residences, offices, art galleries, inns.



Sorin Architecture, PLLC  
Mitchel Sorin, AIA

## Sorin Architecture

Mitchel Sorin  
25 Rankin Avenue, Suite #302  
(828) 253-5935

Sorin Architecture provides environmental planning and green building design solutions for residential and commercial clients- creating collaborative designs that meet client needs, shape our communities, and sustain the human spirit.

## Think Green Building

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244 Barnet Mountain Drive  
Marshall, NC 28753  
(828) 230-9857  
www.thinkgreenbuilding.com  
See full listing under Builder



## Sun Plans Inc

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www.sunplans.com  
Author of "The Sun-Inspired House"— house designs warmed and brightened by the sun. Pre-designed passive solar house plans and internet-based custom home design.

## builders



APPROPRIATE  
BUILDING  
SOLUTIONS, INC.



## Appropriate Building Solutions, Inc.

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Appropriate building solutions, Inc provides sustainable solutions at every stage of a construction project, from planning and design through construction and maintenance. We are committed to building well-constructed, sustainable and beautiful homes.

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(828) 301-6683

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(828) 252-9357  
Jasenechal@aol.com  
www.baldmtnhomes.com

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28 Sourwood Lane  
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(828) 684-8665

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guytonandcady@bellsouth.net



## Cornerstone Builders

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170 Old Fort Road  
Fairview, NC 28730  
(828) 628-0669

[www.buildcornerstone.com](http://www.buildcornerstone.com)

Cornerstone Builders is a small, family owned outlet, specializing in custom, Healthy Built Homes®. We pride ourselves in delivering a high-end product with impeccable craftsmanship, tailored to each individual client.

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Rob Howard  
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Granite Falls, NC 28630  
(828) 217-0506  
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## Dave Bogin Construction Co. LLC

David A. Bogin  
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(828) 231-9991  
bogiecrackers@aol.com  
Custom residential builder specializing in the use of low/no toxic building products.



## Demos Builders, Inc

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Asheville, NC 28801  
(828) 777-2395

[www.demosbuilders.com](http://www.demosbuilders.com)

Demos Builders, Inc. specializes in building eco-friendly custom homes that reduce our

footprint on the land without compromising craftsmanship, aesthetic appeal, customer satisfaction, and affordability. Licensed and fully insured.



## Earthtone Builders

Greg McGuffey  
Asheville, NC  
(828) 628-6436  
[earthtone@surfglobal.net](mailto:earthtone@surfglobal.net)

We offer custom built, energy efficient homes that reflect a passion for the environment. Committed to the highest quality construction and client service, we are building better and building green.



## The Ecobuilders, Inc

Rob Moody  
(828) 337-0623  
[ecomood@theecobuilders.com](mailto:ecomood@theecobuilders.com)  
[www.theecobuilders.com](http://www.theecobuilders.com)

Locally owned and operated, The Ecobuilders, Inc is the green builder behind North Carolina's first certified Healthy Built Home. Environmentally conscious site preparation, energy efficiency, indoor air quality, native species landscaping, and aesthetic, functional design.

## Forward Construction Inc

Jim & Sue Forward  
24 Smokey Road  
Asheville, NC 28803  
(828) 298-9532  
[sef28803@aol.com](mailto:sef28803@aol.com)

Forward Construction Inc was founded in 1972 and has been building energy efficient environmentally conscious homes of unsurpassed quality for discriminating clients in the Asheville area for more than 20 years.

## Green Built Environments

Victoria A. Schomer  
90 Webb Cove Road  
Asheville NC 28804  
(828) 251-4747  
[www.greenbuilt-e.com](http://www.greenbuilt-e.com)  
See full listing under Interior Design.



## Green Home Construction & Real Estate, Inc

Cody Reid and Nikki Gunter  
Asheville, NC  
(828) 712-2824

[www.ncgreenhome.com](http://www.ncgreenhome.com)

We offer full spectrum green building and real estate services including site planning, high-efficiency home design, ICF construction, and green remodeling. Licensed and insured general contractor and real estate broker.



## Green Mountain Builders

Steve Abranyi  
25 Country Squire Lane  
Highlands, NC 28741  
(828) 787-2297

[www.greenmountainbuilders.com](http://www.greenmountainbuilders.com)

Green Mountain Builders is proud to offer excellent customer service along with exceptionally crafted custom homes and remodels in the beautiful Highlands/Cashiers area.



## Home Source Builders

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1070 Tunnel Road Bld. 1 Suite 20  
(828) 298-0201

[www.homesourcebuilders.com](http://www.homesourcebuilders.com)

Insured/ licensed residential brokerage and construction firm. We believe in blending modern conveniences with the preservation of our natural beauty. Buy, sell, or build— we can help make that happen.



## INNOVA HOMES LLC

## Innova Homes, LLC

David Bennert  
428 Haywood Road, Suite C  
Asheville, NC 28806  
(828) 252-9998

[www.innovahomes.net](http://www.innovahomes.net)

Innova Homes builds cost-effective, energy-efficient homes in Asheville and WNC. A committed Energy Star builder, we're also recognized in the NC Healthy Built Homes program, bringing green certification to the modular home market.



**Ken Gaylord Architects**  
**/ Black Hawk Construction**

109 South Main Street  
Hendersonville, NC 28792  
(828) 692-4550  
kengaylord.com  
See full listing under Architect

## Larry Manning

### Larry Manning

140 Southern Cross Road  
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(828) 713-3294

I am a licensed general contractor, with 30 years of experience in carpentry and contracting. Passive solar, earth berm, AAC block, wood frame, natural building, cob and straw bale, conventional and innovative construction.

### Living Tradition Timber Frames

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Asheville, NC 28801  
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Jgoukas@yahoo.com  
www.lt-timberframe.com



### Mountain Realty Builders LLC

Jim Hunter  
825-C Merrimon Ave #314  
Asheville, NC 28804  
(828) 301-0806  
www.mtnrealtybldrs.com

Building single family homes and townhouses using mainstream green building techniques (airtight, insulate, ventilate right) for both stick built and insulating concrete forms construction. Healthy Built Homes(r)/ Energy Star Partner.

## old school design - Build, LLC

### Old School Design/ Build

Bobby McHugh  
320 Sassafras Lane  
Black Mountain, NC 28711  
(828) 712-8451  
rebaloo@peoplepc.com

Old School refers to a mindset focused on traditional ideas and principles. Smart design in a modest-sized home affords clients the beautiful craftsmanship and nice finishes that are the signature of an Old School home.



### Rare Earth Builders, Inc

Mark Bondurant  
5183 Beaverdam Road  
Canton, NC 28716-6748  
(828) 628-0009  
www.RareEarthBuilders.com

Since 1999, Rare Earth has been building high performance, custom homes of exceptional beauty striving always to minimize negative environmental impacts. Our goal remains first-rate service and great value.

### SAGE Builders

Doug Keefer  
299 Morgan Branch Road  
Leicester, NC 28748  
(828) 713-7208

doug-nelle@mindspring.com  
SAGE Builders (Sustainable, Appropriate, Green, and Energy efficient) specializes in solar designs and custom woodworking. A master woodworker for 15 years, the owner offers hand-crafted homes with fine woodworking details.



### SouthEast Ecological Design

Kevin Ward  
1043 Old Fort Road  
Fairview, NC 28730  
(828) 628-6448  
www.ecologicaldesign.net

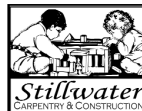
An ecological general contracting company and green design/build firm organized to approach land use, and building holistically and sensibly. We offer sustainable new construction, additions, remodels, consultation and landscaping services.



### Steve Williams, Builder

Steve Williams  
7 Mountain Chateau Lane  
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A hands-on custom builder, we strive to achieve an environmentally friendly blending of home and homesite. Our small volume allows us to work closely and meet each customer's specific needs.



### Stillwater Carpentry & Construction

Chad Vanne  
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(828) 674-6833  
FAX:(828) 697-3395  
stillwatercc@hotmail.com

Stillwater provides an alternative to traditionally built homes in Henderson and surrounding counties by focusing on high performance and sustainable building practices. Client centered and versatile, we are a full service company.



### Think Green Building

Clarke Snell  
244 Bernet Mountain Drive  
Marshall, NC 28753  
(828) 230-9857  
www.thinkgreenbuilding.com

We believe that good buildings unite specific people with a specific spot on the planet to the benefit of both. Through designing, building, consulting, trouble-shooting, teaching, and writing, we help create good buildings.



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Victoria C. Hipps  
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Black Mountain, NC 28711  
(828) 400-9785  
victoriaworthinc@bellsouth.net

Let our commitment to excellence-in-building create a healthy home for you and those you love. Current projects: Blackberry Knoll Townhouses in Black Mountain and Duplex Apartments in West Asheville.

### Verdi Building Systems

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Ladson, SC 29456  
(843) 863-9830  
FAX:(843) 863-9832  
amy@theverdicompany.com  
www.theverdicompany.com



**Conscious Flooring**

Michelle Garrison  
392 Sulphur Springs Road  
Asheville, NC 28806  
(888) 835-6677  
(888)-8-FLOORS  
www.consciousflooring.com  
See full listing under Flooring & Floor Coverings

**Hi Tech Construction Products**

Tim Tucker  
700 Ray Avenue  
Hendersonville NC 28792  
(828) 329-5339  
hitechconst@yahoo.com

**The Parking Place**

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Graham, NC 27253  
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We are a distributor of recycled rubber parking curbs, speed bumps, and speed humps.

concrete/masonry



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(828) 253-9383  
www.metromont.com  
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Weaverville, NC 28787  
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(828) 768-4438  
Jderskine@hotmail.com  
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(828) 775-0095  
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developers



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David Bennet  
428 Haywood Road, Suite C  
Asheville, NC 28806  
(828) 252-9998  
www.innovahomes.net  
See full listing under Builder

**Real Concepts of North Carolina, LLC**

PO Box 746  
Horse Shoe, NC 28742  
(828) 891-8605  
FAX:(828) 891-2922  
Real Concepts specializes in green-built developments focusing in the Asheville and Brevard areas. We build cottage-style and treehouse-style homes as well as multi-unit town homes and condominiums.

**Town of Black Mountain Building and Zoning**

Dan Cordell  
106 Montreat Rd  
Black Mountain, NC  
(828) 669-6437  
www.townofblackmountain.org

certified ECO realtors



**Beverly-Hanks & Associates REALTORS**

Ginny Lentz, ECO, CRS, GRI REALTOR  
61 Weaver Blvd, Suite H  
Weaverville, NC 28787  
(828) 645-1914  
ginnylentz@beverly-hanks.com  
Ginny Lentz, ECO-realtor, is passionate about

conscious sustainable development, with maximum preservation of the land...AND energy-efficient design for newer homes and condos. Call for tax-advantaged strategies where everyone wins! 16 years experience.



**Beverly-Hanks & Associates- Broker Associate**

Pete Pollay  
300 Executive Park  
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www.buyinwnc.com  
As an environmental consultant, Peter Pollay brings together the knowledge of Real Estate and the science of green building to better serve you with environmentally friendly real estate transactions.



**Century 21 Mountain Lifestyles**

Debra J Marshall  
2123 Hendersonville Road  
Arden, NC 28704  
(828) 684-2640  
www.C21MountainLifestyles.com  
Debra has more than 10 years experience in Real Estate. Certified in many areas including environmental consultant, residential specialist, and buyer representation, she is sensitive to environmental issues affecting real estate transactions.



**Country Classic Real Estate**

Lori Tapp  
378 Haywood Road  
Asheville, NC 28806  
(828) 350-5858  
www.countryclassicasheville.com

We are a small, local business interested in sustainable conscious growth for our beautiful mountain communities. We live green so we know green. Let us support your green building development.

**Eco-Realtor, Broker, Consultant Keller Williams Professionals**

Mary Ellen Brown  
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Asheville, NC 28801  
(828) 771-2345  
maryellenbrown.com



## Keller Williams Professionals/ Scott Carter Sells Team

Michael Figura  
86 Asheland Ave  
Asheville, NC 28801  
(828) 337-8190  
[www.scottcarterseells.com](http://www.scottcarterseells.com)

Assisting commercial and residential builders and developers with site acquisition, marketing green buildings and developments through education, and helping industry professionals and consumers profit from green development.

## Keller Williams Professionals/ The Gleason Team

Mary Love  
828-279-6723  
[marylove@charter.net](mailto:marylove@charter.net)



## Keller Williams Professionals

Penny Williams  
86 Asheland Avenue  
Asheville NC 28801  
(828) 768-7366  
[www.FindAshevilleHomes.com](http://www.FindAshevilleHomes.com)  
Penny is an Eco-certified real estate consultant. She has the knowledge and resources to find you the most efficient and healthiest home within your budget.

## realtors



## Karen C Gleason

Karen C. Gleason  
86 Asheland Avenue  
Asheville NC 28801  
(828) 255-HOME  
[karengleason.com](http://karengleason.com)  
Offering specialized real estate services for green buyers, sellers, investors, and developers including exclusive marketing of eco communities, selling services for Healthy Built Homes, buyer education, and development consulting.

## Green Home Construction & Real Estate, Inc.

Cody Reid and Nikki Gunter  
Asheville, NC  
(828) 712-2824  
[www.ncgreenhome.com](http://www.ncgreenhome.com)  
See full listing under Builder

## Keller Williams Professionals

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(828) 335-1110



David Mosrie/Ray O'Quinn  
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6 East Chestnut Street, Asheville, NC 28801  
(828) 216-6500

[davidmosrie@bellsouth.net](mailto:davidmosrie@bellsouth.net)  
[rayoquinn@charter.net](mailto:rayoquinn@charter.net)  
Offering personal and professional representation for sustainable, energy-efficient, and affordable housing and development. Combined, over a dozen years experience in real estate, green building and holistic health experience.

## electrical



## Automation Systems PLLC

Thomas Baldwin, PE  
5 New Bern Drive  
Fletcher, NC 28732  
(828) 606-3155  
[tbald@bellsouth.net](mailto:tbald@bellsouth.net)  
See full listing under Engineer

## engineers



## Automation Systems PLLC

Thomas Baldwin, PE  
5 New Bern Drive  
Fletcher, NC 28732  
(828) 606-3155  
[tbald@bellsouth.net](mailto:tbald@bellsouth.net)  
Offering sustainable engineering for energy management systems, lighting, power distribution. Integration of appropriate technology with energy conservation. Planning, design, construction, management, commissioning, troubleshooting, renovations, and forensics.

## environmental consultants

## EQUINOX ENVIRONMENTAL PLANNING & DESIGN SERVICES

## Equinox Environmental Consultation & Design, Inc

David Tuch  
37 Haywood Street  
Asheville, NC 28801  
(828) 253-6856  
[david@equinoxenviromental.com](mailto:david@equinoxenviromental.com)  
[www.equinoxenviromental.com](http://www.equinoxenviromental.com)  
Home to extraordinary environmental & cultural

treasures, our mountain region also faces tremendous pressures on its land, water, and air. Equinox Environmental provides award-winning planning and design services that facilitate conservation and sustainable development of our regions landscapes to ensure continued ecological and economic vitality.

## Feng Shui: Creating Harmonious Space

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See full listing under Interior Design



## Home Energy Partners

Maggie Leslie  
200 Patton Avenue  
Asheville, NC 28801  
(828) 350-1155  
[www.homenergypartners.com](http://www.homenergypartners.com)  
Professional services include: consultation, building performance certification, the Icynene Insulation system, the Healthy Crawlspace System, Fresh-air Ventilation Design/Sales, HVAC load-calculations/design, existing home evaluations/ retrofits, & marketing for building performance.

## Home Energy Solutions

Rob Howard  
PO Box 3352  
Hickory, NC 28603  
(828) 217-0506  
[www.homeenergysol.com](http://www.homeenergysol.com)

## Susten® Building Energy Solutions

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82 Buffalo Street  
Asheville, NC 28806  
(828) 350-7529  
(828) 273-5334  
[kenhuck@vcn.bc.ca](mailto:kenhuck@vcn.bc.ca)  
[www.susten.com](http://www.susten.com)  
Susten®'s energy efficiency experts save your money by teaming with you to design and construct a comfortable, healthful, ecologically sustainable and cost effective super insulated building tailored to your specific situation.

## excavating/site work



## Asheville Trade Alliance

Jon Berbaum  
729 Haywood Road  
(828) 398-0033

## Elemental Landscapes

Todd Dearing  
125 Sayles Town Pl.  
Fairview NC 28730  
(828) 230-3452

## finishes



The **ARCH**  
Architectural Accents and Gallery

### The ARCH

Catherine Silver  
1020 Merrimon Ave, Suite 103  
Asheville, NC 28804  
(828) 253-5455  
FAX: (919) 640-8580  
cmsilver@thearchnc.com  
www.thearchnc.com

The ARCH store and gallery offers creative handmade tile collections, unique hardware, beautiful wood shelves, and gallery art. Southeast stocking dealer of American Clay Earth Plaster™, NAHB 2004 Green Builder Award.

### Green Built Environments

Victoria A. Schomer  
90 Webb Cove Road  
Asheville NC 28804  
(828) 251-4747  
www.greenbuilt-e.com  
See full listing under Interior Design.

### Green Mountain Builders

Steve Abranyi  
25 Country Squire Lane  
Highlands, NC 28741  
(828) 787-2297  
www.greenmountainbuilders.com  
See full listing under Builder



### Leicester Valley Clay

### Leicester Valley Clay

Doc Welty  
854 South Turkey Creek  
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Hand crafted custom tile and terra cotta in the arts and craft style. Decorative tile accents. Fireplace mantles. Exterior wall sculptures. Garden Planters.

### Shelter Ecology

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43 Pine Ridge Drive  
Asheville, NC 28804  
225-2829  
FAX:828-252-0692  
sheltereco@charter.net  
www.shelterecology.com  
See full listing under Indoor Air Quality

## flooring



### Advanced Thermal Solutions, Inc.

(828) 749-1774  
(828) 692-5392  
www.gotsun.com  
See full listing under Alternative Energy.



### Conscious Flooring

Michelle Garrison  
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www.consciousflooring.com  
Environmentally Friendly FSC certified: recycled woods, bamboo, cork, natural linoleum, decking, and more. All of our products are carefully chosen through many years of experience to satisfy high standards of quality, beauty, and sustainability.

### Custom Floors by Ashburn

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Custom Floors by Ashburn has been in business since 1976. Marvin specializes in installing, sanding, refinishing hardwood floors using water borne finishes. Past client Governors Mansion in VA.

### Oaks Unlimited

Joe Pryor  
3530 Jonatahan Creek Road  
Waynesville, NC 28785  
(828) 926-1621  
FAX:(828) 926-3383  
www.oaksunlimited.com

## furnishings



### Joe Ransmeier Woodworking

Joseph Ransmeier  
140-E Roberts Street  
Asheville NC 28801  
(828) 285-9105  
riverdistrictartists.com/joeransmeier  
See full listing under Woodworker



### Revolution Design Custom Fabrication, LLC

Joe Archibald  
2000 Riverside Drive, Box #4  
Asheville, NC 28804  
(828) 253-3373

### www.revolutiondesignworks.com

Specializing in the design, fabrication, and installation of custom contemporary cabinets, furniture, and interiors using environmentally friendly materials and procedures.

## HVAC heating & cooling



### Advanced Thermal Solutions, Inc.

(828) 749-1774  
(828) 692-5392  
www.gotsun.com  
See full listing under alternative/renewable energy

### Air Craftsman Heating and Cooling, Inc

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Asheville, NC 28815  
(828) 299-1809  
FAX:(828) 299-1676  
aircraftsman@bellsouth.net  
amstd-dealer.com/aircraft4165

### Home Energy Partners

Maggie Leslie  
200 Patton Avenue  
Asheville, NC 28801  
(828) 350-1155  
www.homenergypartners.com  
See full listing under Environmental Consultant

## THERMACRAFT

### Thermacraft Energy Services

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Horeseshoe NC 28742  
(828) 231-5030  
(828) 891-5707  
thermacraft.net

Wirso factory trained installers. Over 250,000 feet of radiant floor and ice melt tubing installed to date. Residential and commercial projects up to 15,000 sq. ft. State-of-the-art boilers and controls. Many solar energy options available as well as ground source heat pumps. Professional installations, satisfaction guaranteed.

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See full listing under Alternative/Renewable Energy

### GLC Services, Inc

Guy Cox  
92 N. Main Street  
Canton, NC 28716  
(828) 648-8400

FAX:(828) 646-9673

glcservices@charter.net

glcservices.net

We are an HVAC/heating and Cooling contractor- mainly residential- specialists in geothermal, solar, hydronics, in-floor radiant, and high-velocity mini-duct systems- custom-designed for the energy and ecologically responsible consumers.

## indoor air quality



### GLC Services, Inc

Guy Cox

92 N. Main Street  
Canton, NC 28716

(828) 648-8400

FAX:(828) 646-9673

glcservices@charter.net

glcservices.net

See full listing under HVAC/heating & cooling

### Green Built Environments

Victoria A. Schomer

90 Webb Cove Road  
Asheville NC 28804

(828) 251-4747

www.greenbuilt-e.com

See full listing under Interior Design

### Home Energy Partners

Maggie Leslie

200 Patton Avenue  
Asheville, NC 28801

(828) 350-1155

www.homenergypartners.com

See full Listing Under Environmental Consultant

### Shelter Ecology

Cindy Meehan-Patton

43 Pine Ridge Drive  
Asheville, NC 28804

225-2829

FAX:828-252-0692

sheltereco@charter.net

www.shelterecology.com

Cindy Meehan-Patton offers interior and architectural design services for tight, high performing, healthy homes and offices along with the appropriate green materials beginning with a consultation on defining your green building needs.



## insulation

### Home Energy Partners

Maggie Leslie

200 Patton Avenue  
Asheville, NC 28801

(828) 350-1155

www.homenergypartners.com

See full listing under Environmental Consultant

## interior design



### The ARCH

Catherine Silver

1020 Merrimon Ave, Suite 103  
Asheville, NC 28804

(828) 253-5455

FAX:(919) 640-8580

cmsilver@thearchnc.com

www.thearchnc.com

See full listing under Finishes

### Green Built Environments

Victoria A. Schomer

90 Webb Cove Road  
Asheville NC 28804

(828) 251-4747

www.greenbuilt-e.com

Victoria Schomer, ASID, LEED AP Green Homes and beautiful healthy interiors! Green Built Environments works with architects, builders and homeowners recommending green principles and materials for new building, remodeling, and interior design projects.



### Life Forms Aquarium Services

Asheville, NC

(828) 329-5271

www.lifeformsaquariums.com

Life Forms Aquarium Services designs, installs, and provides maintenance for exotic, ecofriendly, aquarium habitats. We combine art and nature to create living masterpieces that inspire, educate, and soothe the soul.

### Revolution Design

#### Custom Fabrication, LLC

Joe Archibald

2000 Riverside Drive, Box #4  
Asheville, NC 28804

(828) 253-3373

www.revolutiondesignworks.com

See full listing under Furnishings

### TK Designs

Traci Kearns

(828) 242-5888

### Shelter Ecology

Cindy Meehan-Patton

43 Pine Ridge Drive  
Asheville, NC 28804

(828) 225-2829

FAX:828-252-0692

sheltereco@charter.net

www.shelterecology.com

See full listing under Indoor Air Quality.



## Feng Shui: Creating Harmonious Space

Helen Emmet

Professional Consultation Services

(828) 669-2480

www.creatingharmoniousspace.com

Masterful guidance in the art and science of Feng Shui. HOMES-BUSINESS-GARDEN DESIGN- Educational Seminars. Graduate Metropolitan Institute of Design, advanced tuteledge in China and under master Lin Yun since 1994.

## land management



### Green Plan Inc

Gerald Green

150 Cumberland Ave  
Asheville, NC 28801

(828) 216-6819

www.greenplanwnc.com

Encouraging livable habitats through planning and development. Services include: feasibility analysis, site planning, master planning, pre-development coordination and management. Also providing comprehensive planning and ordinance updates for local governments.



### Pisgah Forest Institute

Heather Cosby

400 North Broad Street  
Brevard, NC 28712

(828) 884-8229

www.brevard.edu/pFi

The Pisgah Forest Institute presents a FREE workshop for educators titled "Sustainability-Teaching for Tomorrow" June 25-29, 2006. Meals and Lodging are provided. Full details are available at www.brevard.edu/pFi.

## landscaping



### A Bee's Fruit Trees

Matt Stivers

P.O.Box 513

Asheville, NC 28802

(828) 778-2199

griffinabee@yahoo.com

We provide a full planting service. Our goal is to balance real estate development with useful vegetation. Growing fruit trees offers food, beauty, and sustainable resources for generations. Celebrate life!



**Blue Ridge Atlantic Enterprises**   
Shawn Hatley  
307 North Main Street  
Oakboro, NC 28129  
(800) 772-1958  
sales@braewater.com  
www.braewater.com  
See full listing under Water Conservation

### Elemental Landscapes

Todd Dearing  
60 Balm Grove  
(828) 230-3452

### Evergreen Landscaping Services, Inc

Paul or Claudine Cremer  
PO Box 809  
Weaverville, NC 28787  
(828) 658-0294

### Gardenwerks, Inc

Joanne Bender  
(828) 775-5143  
PO Box 6896  
Asheville NC 28816  
www.mygardenwerks.com  
We use native plants, biological water features, and existing terrain to create landscapes that are environmentally sound and individually satisfying. Call to schedule a consultation for your home or business.

### Pfister Stoneworks

Peter Pfister  
118 West College Street  
Black Mountain NC 28711  
(828) 775-0095  
See full listing under Concrete/ Masonry

### SouthEast Ecological Design



Kevin Ward  
1043 Old Fort Road  
Fairview, NC 28730  
(828) 628-6448  
www.ecologicaldesign.net  
See full listing under Builder

## landscape architecture

### Equinox Environmental Consultation & Design, Inc



David Tuch  
37 Haywood Street  
Asheville, NC 28801  
(828) 253-6856  
david@equinoxenviromental.com  
www.equinoxenviromental.com  
See full listing under Environmental Consultant

### Feng Shui: Creating Harmonious Space

Helen Emmet  
Professional Consultation Services  
(828) 669-2480  
www.creatingharmoniousspace.com  
See full listing under Interior Design

### Mary Weber Landscape Architecture

Mary Weber  
131 Evelyn Place  
Asheville, NC 28801  
(828) 281-3153  
FAX:(828) 281-3153  
marymweber@bellsouth.net  
Mary Weber Landscape Architecture specializes in environmentally sustainable and creative landscape designs. Services include site planning, parks and trails planning, commercial and residential design, children's play spaces, and spiritual gardens.

## restoration



### Earth Care Cleaning

Kristopher Volpe  
101 Brevard Road  
(828) 775-3830  
Deep cleaning and sanitizing all types of carpets, rugs, hard floors, upholstery, mattresses, spot and odor removal, anti-allergy treatments, mold and mildew treatments, carpet and fabric protection. Using 100% non-toxic and biodegradable cleaning products.

### Green Mountain Builders



Steve Abranyi  
25 Country Squire Lane  
Highlands, NC 28741  
(828) 787-2297  
www.greenmountainbuilders.com  
See full listing under Builder

### JD Renovation

Joe Danison  
1314 Sweetwater Road  
Marshall, NC 28753  
(828) 649-1039  
FAX:(828) 649-1205  
www.jdrenovation.com

### Legerton Architecture, P.A.



Annabeth Schenck  
21 North Liberty Street  
Asheville, NC 28801  
(828) 251-9125  
annabeth@Legertonarchitecture.com  
See full listing under Architect

### SouthEast Ecological Design



Kevin Ward  
1043 Old Fort Road  
Fairview, NC 28730  
(828) 628-6448  
www.ecologicaldesign.net  
See full listing under Builder

## salvage

### Old Buildings Wanted

Jerry McCurry  
(828) 642-4732  
(828) 208-0295

### Preservation Hall

Darcy Willis  
55 North Main Street  
Weaverville, NC 28787  
(828) 645-1047  
info@preservation-hall.com  
www.preservation-hall.com

We have served WNC for over 16 years with quality vintage architectural elements for renovation & new construction. Includes doors, mantles, lighting, windows, and more. Visit or call.

## special construction



### Appropriate Building Solutions, Inc.



Myrick Rozier  
PO Box 2821  
(828) 350-0451  
www.abuildingsolution.com  
See full listing under Builder

### Earhtone Builders



Greg McGuffey  
456 Fairview Forest Drive  
Fairview, NC 28730  
(828) 628-6436  
www.earthtonebuilders.com  
See full listing under Builder

### Elemental Landscapes

Todd Dearing  
125 Sayles Town Pl.  
Fairview NC 28730  
(828) 230-3452

### Innova Homes, LLC



David Bennett  
428 Haywood Road, Suite C  
Asheville, NC 28806  
(828) 252-9998  
www.innovahomes.net  
See full listing under Builder

### SouthEast Ecological Design



Kevin Ward  
1043 Old Fort Road  
Fairview, NC 28730  
(828) 628-6448  
www.ecologicaldesign.net  
See full listing under Builder

## sustainable forestry



### Appalachian Voices Forest Restoration Program

Benji Burrell  
703 W King Street #105  
Boone, NC 28607  
(828) 262-1500  
avforestprogram@bellsouth.net  
www.Appvoices.org

### Mountain Forest Stewardship Co-op

Alyx Perry  
(828) 277-9008  
www.southernsustainableforests.org

## thermal & moisture protection



### Home Energy Partners

Maggie Leslie  
200 Patton Avenue  
Asheville, NC 28801  
(828) 350-1155  
www.homenergypartners.com  
See full listing under Environmental Consultant

## tree service



### A Bee's Fruit Trees

Matt Stivers  
P.O.Box 513  
Asheville, NC 28802  
(828) 778-2199  
griffinabee@yahoo.com  
See full listing under Landscaping

## water conservation



### Pisgah Forest Institute

Heather Cosby  
400 N. Broad Street  
Brevard, NC 28712  
(828) 884-8229  
www.brevard.edu/pFi  
See full listing under Land Management

### RAIN PRO, Inc

Mike Stroud  
203 Spencer Street  
High Point, NC 27265  
(336) 869-2250  
mstroud@northstate.net  
www.rainpro.biz

## BRAE Rainwater Technologies™

### Blue Ridge Atlantic Enterprises

Shawn Hatley  
307 North Main Street  
Oakboro, NC 28129  
(800) 772-1958  
sales@braewater.com  
www.braewater.com  
BRAE markets Complete Rainwater Harvesting Kits for residential, commercial, and government projects. Contact BRAE to learn how to conserve and protect water resources with rainwater harvesting solutions in your community.

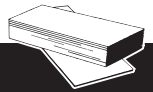
## windows & doors



### Window Planning Center, Inc

Bob Ballard  
4 Vaughn Circle  
Fletcher, NC 28732  
(828) 684-4873  
FAX: (828) 684-1981  
fletcher@windowplanningcenter.com  
www.windowplanningcenter.com  
Distributor of high-quality, energy-efficient windows and doors. Options include sound reduction, coastal-compliant (for high-wind locations), design assistance. Specializing in wrought iron entry doors and Hurd windows. Service after the sale.

## wood



### Conscious Flooring

Michelle Garrison  
392 Sulphur Springs Road  
Asheville, NC 28806  
(888) 835-6677 alt: (888)-8-FLOORS  
www.consciousflooring.com  
See full listing under Flooring & Floor Coverings



### Sunrise Sawmill, Inc

Don and Michelle Shuford  
68 West Chapel Road  
Asheville, NC 28803  
(828) 277-0120  
www.SunriseSawmill.com  
Common and custom cut lumber; sawdust, chips, and mulch; boards, beams, and timbers;

buyers of logs and timber; family owned and operated for over 25 years.

## woodworker



### Joe Ransmeier Woodworking

Joseph Ransmeier  
140-E Roberts Street  
Asheville NC 28801  
(828) 285-9105  
riverdistrictartists.com/joeransmeier  
I use Appalachian hardwoods, plywood & composites to build entertainment centers, home offices, kitchen and bath cabinets, bookshelves and furniture finished with water-borne, environmentally friendly clear finish or paint.

### Revolution Design Custom Fabrication, LLC

Joe Archibald  
2000 Riverside Drive, Box #4  
Asheville, NC 28804  
(828) 253-3373  
www.revolutiondesignworks.com  
See full listing under Furnishings

### Stillwater Carpentry & Construction

Chad Vanne  
PO Box 928  
Hendersonville, NC 28793  
(828) 674-6833  
FAX: (828) 697-3395  
stillwatercc@hotmail.com  
See full listing under Builder

### SAGE Builders

Doug Keefer  
299 Morgan Branch Road  
Leicester, NC 28748  
(828) 713-7208  
doug-nelle@mindspring.com  
See full listing under Builder

It's easy  
being  
green...



All of the companies and individuals in this guide lend their support in your decision to build with sensitivity to the environment. Whether you are looking to build a new home or renovate an existing one, these people make it easier to be green.

**MOUNTAIN**  
**Xpress**  
[www.mountainx.com](http://www.mountainx.com)



## Alternative/ Renewable Energy

**Renewable Energy Access** is a widely recognized source for renewable energy news and information on the internet.

([www.renewableenergyaccess.com/rea/home](http://www.renewableenergyaccess.com/rea/home))

**The Source for Renewable Energy** is a comprehensive online buyer's guide and business directory to more than 9000 renewable energy businesses and organizations worldwide. (<http://energy.sourceguides.com/index.shtml>)

**Solar Energy International (SEI)** offers hands-on workshops in solar, wind and water power and natural building technologies in eleven locations.

([www.solarenergy.org](http://www.solarenergy.org))

**Passive Solar Energy 1** - a PDF file with good Passive Solar information ([www.illinoisolar.org](http://www.illinoisolar.org))

## Hydro Power

**Montana Green Power** A good site for information about hydro power. ([www.montanagreenpower.com/renewables/hydropower/hydropowerlinks.html](http://www.montanagreenpower.com/renewables/hydropower/hydropowerlinks.html)-)

## Wind Power

**American Wind Energy Association** Since 1974 the American Wind Energy Association (AWEA) has advocated the development of wind energy as a reliable, environmentally superior energy alternative in the United States and around the world. ([www.awea.org/](http://www.awea.org/))

**U.S. Department of Energy, Energy Efficiency and Renewable Energy** is a good informational site about wind energy. ([www.eere.energy.gov/RE/wind.html](http://www.eere.energy.gov/RE/wind.html))

## Energy Efficient Appliances

**American Council for an Energy-Efficient Economy** Provides information about the long-term energy costs of appliances, tax incentives, and directories of manufacturers.

([www.aceee.org/consumerguide/mostenef.htm](http://www.aceee.org/consumerguide/mostenef.htm))

## Insulation

**North American Insulation Manufacturers Association (NAIMA)** is a trade association of North American manufacturers of fiber glass, rock wool and slag wool insulation products. This site provides a wealth of information on the uses and benefits of these products from thermal comfort to public health.

([www.naima.org](http://www.naima.org))

## Lighting

**Department of Energy: Energy Efficiency and Renewable Energy** An informational sight about different types of energy efficient lighting

([www.eere.energy.gov/EE/buildings\\_lighting.html](http://www.eere.energy.gov/EE/buildings_lighting.html))

## Windows

**Efficient Windows Collaboration** This is a database of efficiency initiatives including tax incentives, building code changes and legislative initiatives. It provides unbiased information on the benefits of energy-efficient windows, descriptions of how they work, and recommendations for their selection and use.

([www.efficientwindows.org](http://www.efficientwindows.org))

## Financial Incentives

**Database of State Incentives for Renewable Energy**

Information on US state and federal tax incentives for solar electric and other renewables, alternative-fuels vehicles, and energy conservation. ([www.dsireusa.org](http://www.dsireusa.org))

**Rocky Mountain Institute** shows businesses, communities, individuals, and governments how to create more wealth and employment, protect and enhance natural and human capital, increase profit and competitive advantage, and enjoy many other benefits-largely by doing what they do far more efficiently.

([www.rmi.org](http://www.rmi.org))

## Green Building Groups

**The U.S Green Building Council** is the nation's foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. ([www.usgbc.org](http://www.usgbc.org))

**The Cleveland Green Building Coalition** is a nonprofit organization created to inform civic, business and building industry leaders as well as the general public about the economic, health and aesthetic benefits of green building. ([www.clevelandgbc.org](http://www.clevelandgbc.org))

**The Green Affordable Housing Coalition** is a coalition of San Francisco Bay Area public-sector and private-sector professionals committed to incorporating green building practices into the design, construction, operation, and maintenance of affordable housing. ([frontierassoc.net/greenaffordablehousing/Index.shtml](http://frontierassoc.net/greenaffordablehousing/Index.shtml))

**City of Oakland's Green Building Resource Center** ([www.oaklandpw.com/greenbuilding/index.htm](http://www.oaklandpw.com/greenbuilding/index.htm))

**The Green Building Association of Central Pennsylvania** promotes environmentally responsible

design, planning, construction, and operation of the built environment through education, outreach and networking. ([www.gbacpa.org](http://www.gbacpa.org))

**The Northwest EcoBuilding Guild** is an association of builders, designers, homeowners, tradespeople, manufacturers, suppliers and others interested in ecologically sustainable building. ([www.ecobuilding.org](http://www.ecobuilding.org))

## Green Building Materials

**Better Bricks** -To help achieve sustainable, high performance buildings, BetterBricks is dedicated to raising awareness and demand for energy efficiency by sharing information and resources with the people who design, own and operate them. ([www.betterbricks.com](http://www.betterbricks.com))

**Green Sage** Sustainable building materials and furnishings ([www.greensage.com](http://www.greensage.com))

**GreenSpec** is BuildingGreen's product information service. It contains detailed listings for more than 1,800 environmentally preferable building products with descriptions, manufacturer information, and links to additional resources. ([www.greenspec.com](http://www.greenspec.com))

**The Green Building Resource Guide** is a database of over 600 green building materials and products selected specifically for their usefulness to the design and building professions, rather than merely their green material content. ([www.greenguide.com](http://www.greenguide.com))

**Green Building Concepts** supplies information exchange on a more resource and energy efficient lifestyle. (<http://greenconcepts.com>)

**Greener Building** is a site with personal expertise about products with the sustainable building community. It is a site dedicated to personal contributions about products and technologies as well as your personal wisdom about building in your area. ([www.greenerbuilding.org](http://www.greenerbuilding.org))

**Green Homes for Sale** is a marketplace for buying and selling green and healthy homes. ([www.greenhomesforsale.com](http://www.greenhomesforsale.com))

**Glossary of Green Building Terms** This glossary helps you to articulate sustainable and green building concepts commonly used in residential construction. ([www.greenbuildingcookbook.com/Glossary.html](http://www.greenbuildingcookbook.com/Glossary.html))

**Energy and Environmental Building Association (EEBA)** was formed to provide education and resources to transform the residential design, development and construction industries to profitably deliver energy efficiency and environmentally responsible buildings and communities. ([www.eeba.org](http://www.eeba.org))

**The Massachusetts Technology Collaborative** site holds definitions of terms relating to energy-efficient technologies and elements of green buildings. ([www.mtpc.org/cleanenergy/energy/glossaryefficiency.htm](http://www.mtpc.org/cleanenergy/energy/glossaryefficiency.htm))

**PATH: Public Private Partnership for Advancing Housing Technology** PATH is dedicated to accelerating the development and use of technologies that radically improve the quality, durability, energy efficiency, environmental performance, and affordability of America's housing. ([www.pathnet.org](http://www.pathnet.org))

## Government Resources

**Building Technology Center- Oak Ridge National Laboratory** The premier U.S. research facility devoted to the development of technologies that improve the energy efficiency and environmental compatibility of residential and commercial buildings. ([www.ornl.gov/sci/btc/](http://www.ornl.gov/sci/btc/))

**Energy Information Portal** A DOE website containing links to online documents about energy efficiency and renewable energy. ([www.eere.energy.gov](http://www.eere.energy.gov))

**ENERGY STAR** is a government-backed program helping businesses and individuals protect the environment through energy efficiency. ([www.energystar.gov](http://www.energystar.gov))

**The NC Solar Center and State Energy Office** sponsor this database of case studies, tested techniques, strategies, and technologies. ([www.ncgreenbuilding.org/site/ncg/index.cfm](http://www.ncgreenbuilding.org/site/ncg/index.cfm))

## Indoor Air Quality

**U.S. EPA** gives information about mold, air quality, asthma, and tips for how to handle mold in your home. ([www.epa.gov/mold/moldresources.html](http://www.epa.gov/mold/moldresources.html))

**U.S. EPA** provides this site as a guide about indoor air quality. ([www.epa.gov/iaq/pubs/insidest.html](http://www.epa.gov/iaq/pubs/insidest.html))

**Mold1.net** is a mold resource webpage giving more mold links. (<http://ga.mold1.net/>)

**Canada's Centre for Occupational Health and Safety** provides more mold (or mould) advice. ([www.ccohs.ca/oshanswers/biol\\_hazards/iaq\\_mold.html](http://www.ccohs.ca/oshanswers/biol_hazards/iaq_mold.html))

**The Occupational Health & Safety Office**, under the U.S. Department of Labor, gives information about health and safety as it relates to indoor air quality. ([www.osha.gov/SLTC/indoorairquality](http://www.osha.gov/SLTC/indoorairquality))

**California Indoor Air Quality (IAQ) Program** conducts and promotes the coordination of research, investigations, experiments, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, and control of indoor pollution. ([www.cal-iaq.org/](http://www.cal-iaq.org/))

**The American Indoor Air Quality Council** promotes awareness, education, and certification in the field of Indoor Air Quality. ([www.indoor-air-quality.org](http://www.indoor-air-quality.org))

# Smart Growth

**Smart Growth Network (SGN)** The U.S. EPA and several non-profit and government organizations formed this network in 1996 to seek out new ways to grow that boost the economy, protect the environment, and enhance community vitality. ([www.smartgrowth.org/default.asp](http://www.smartgrowth.org/default.asp))

**Smart Growth America** is a coalition of national, state and local organizations working to improve the ways we plan and build the towns, cities and metro areas we call home. ([www.smartgrowthamerica.com/](http://www.smartgrowthamerica.com/))

**The U.S. EPA** provides this smart growth site. ([www.epa.gov/smartgrowth/](http://www.epa.gov/smartgrowth/))

**The National Center for Smart Growth Research and Education** is a non-partisan center for research and leadership training on Smart Growth and related land use issues nationally and internationally. ([www.smartgrowth.umd.edu](http://www.smartgrowth.umd.edu))

**Natural Resources Defense Council (NRDC)** is working on smart-growth solutions that can help curtail sprawl and build more sustainable communities for the 21st century. ([www.nrdc.org/cities/smartGrowth/default.asp](http://www.nrdc.org/cities/smartGrowth/default.asp))

# Sustainable Site Planning

**The Smart Communities Network** offers great resources, tools, links to articles, publications, and community success stories on a variety of topics from Community Energy, to Green Development, to Sustainable Business. ([www.sustainable.doe.gov](http://www.sustainable.doe.gov))

# Publications

**Environmental Building News** is a monthly newsletter published since 1992 featuring comprehensive, practical information on a range of topics related to sustainable design in the built environment. ([www.buildinggreen.com/articles/index.cfm](http://www.buildinggreen.com/articles/index.cfm))

**“Good Energy at the Good Life Center”** An article about the Good Life Center created by Scott and Helen Nearing. ([www.goodlife.org/glc\\_news.html](http://www.goodlife.org/glc_news.html))

**Home Power Magazine** Comprehensive coverage of solar, wind, and microhydro electricity, home energy efficiency, solar hot water systems, space heating and cooling, green building materials and home design, efficient transportation, and more. ([www.homepower.com](http://www.homepower.com))

**Environmental Design and Construction Magazine** is a bi-monthly magazine that reports on the innovative products, strategies and technologies that are driving the green building industry's success. ([www.edcmag.com](http://www.edcmag.com))

**World Changing** An online source for news on sustainable efforts. (<http://worldchanging.com>)

# Local Resources

**North Carolina Sustainable Energy Association** This non-profit association works to create a sustainable energy future in North Carolina through the promotion of renewable energy technologies including solar, wind, micro-hydro, geothermal, biofuels and energy efficiency.  
PO Box 6465  
Raleigh, NC 27628-6465  
(919) 832-7601  
[www.ncsustainableenergy.org/index.html](http://www.ncsustainableenergy.org/index.html)

**North Carolina Solar Center** serves as a clearinghouse for solar and other renewable energy programs, information, research, technical assistance, and training for the citizens of North Carolina and beyond.  
Box 7401  
North Carolina State University  
Raleigh, NC 27695-7401  
(800) 33-NCSUN  
[www.ncsc.ncsu.edu](http://www.ncsc.ncsu.edu)

**The WNC Alliance** is a democratic grassroots organization that addresses the critical issues affecting the future of our region.  
29 North Market Street , Suite 610  
Asheville, NC 28801  
Phone (828) 258-8737  
Fax (828) 258-9141  
[www.main.nc.us/wnca](http://www.main.nc.us/wnca)

**WNC Regional Air Quality Agency** The Mission of the Western North Carolina Regional Air Quality Agency is to protect and monitor the area's air quality to safeguard the public health, safety, and to protect the environment.  
49 Mount Carmel Road  
Asheville NC  
(828) 255-5655  
Fax: (828) 255-5226  
[www.wncair.org](http://www.wncair.org)

**North Carolina Green Building Technology Database**  
Case studies of green building techniques, strategies and technologies.  
[www.ncgreenbuilding.org](http://www.ncgreenbuilding.org)



# Platinum

- Mathews Architecture, P.A.
- The Eco Builders, Inc.
- Samsel Architects, P.A.
- Southeast Ecological Design Inc
- Appropriate Building Solutions
- The Gleason Team
- Home Energy Partners

# Silver

- Griffin Architects
- Earthtone Builders
- Ken Gaylord Architect/Black Hawk Construction
- Green Mountain Builders LLC
- Soderquist Construction
- Stephens Smith Farrell Architecture
- Rare Earth Builders
- Stillwater Carpentry & Construction
- Country Classic Real Estate
- Forward Construction
- Air Craftsman Heating and Cooling
- Solar Dynamics
- Cemex
- Blue Ridge Atlantic Enterprises

# Business

- Cady/Guyton Construction
- Architerra
- Keller Williams Professionals Real Estate
- Heartwood Renovation and Building, Inc.
- Thompson-Rhodes Builders, Inc.
- Cunningham & Co. Mortgage Bankers
- Legerton Architecture, P.A.
- Conscious Flooring
- Highland Craftsmen Inc
- Building Solutions Coordinators LLC
- Cornerstone Builders
- Shelter Ecology
- RainPro
- Advantage Wall Systems
- Sunrise Sawmill
- Essential Systems Engineering, PA
- Real Concepts of North Carolina
- Jan Grierson Architects
- Revolution Design Custom Fabrication
- McNutt Service Group
- Demos Builders, Inc.

- Mountain Realty Builders
- Home Source
- Innova Homes, LLC
- Thornton Realty
- Hurt Architecture and Planning
- Sundance Power Systems, Inc.
- Victoria Worth Inc.
- Equinox Environmental
- Keller Williams Realty
- McDonough Architects
- Green Home Construction & Real Estate, Inc.
- Steve Williams Construction
- Sage Builders
- Progressive Architecture
- The Green Onion

And Many Thanks to All of WNCGBC's Individual Members!

# Join now!

## Membership benefits include:

- Quarterly newsletter
- Free admission to public forums and tours
- Networking opportunities
- Board voting privileges
- Discounts on promotional items
- Discounts on educational events
- Decal
- Additional benefits for Non-Industry, Silver, Gold and Platinum Members

## Membership categories:

Student	.....	\$.15
Individual	.....	\$.35
Non-Profit	.....	\$.50
Non-Industry	.....	\$.150
Silver	.....	\$.250
Gold	.....	\$.500
Platinum	.....	\$.1000

Start making a difference today!  
Contact the WNC Green Building Council to find out how.

PO Box 8427  
Asheville, NC 28814  
(828) 232-5080  
www.wncgbc.org

# Built on a balanced understanding

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