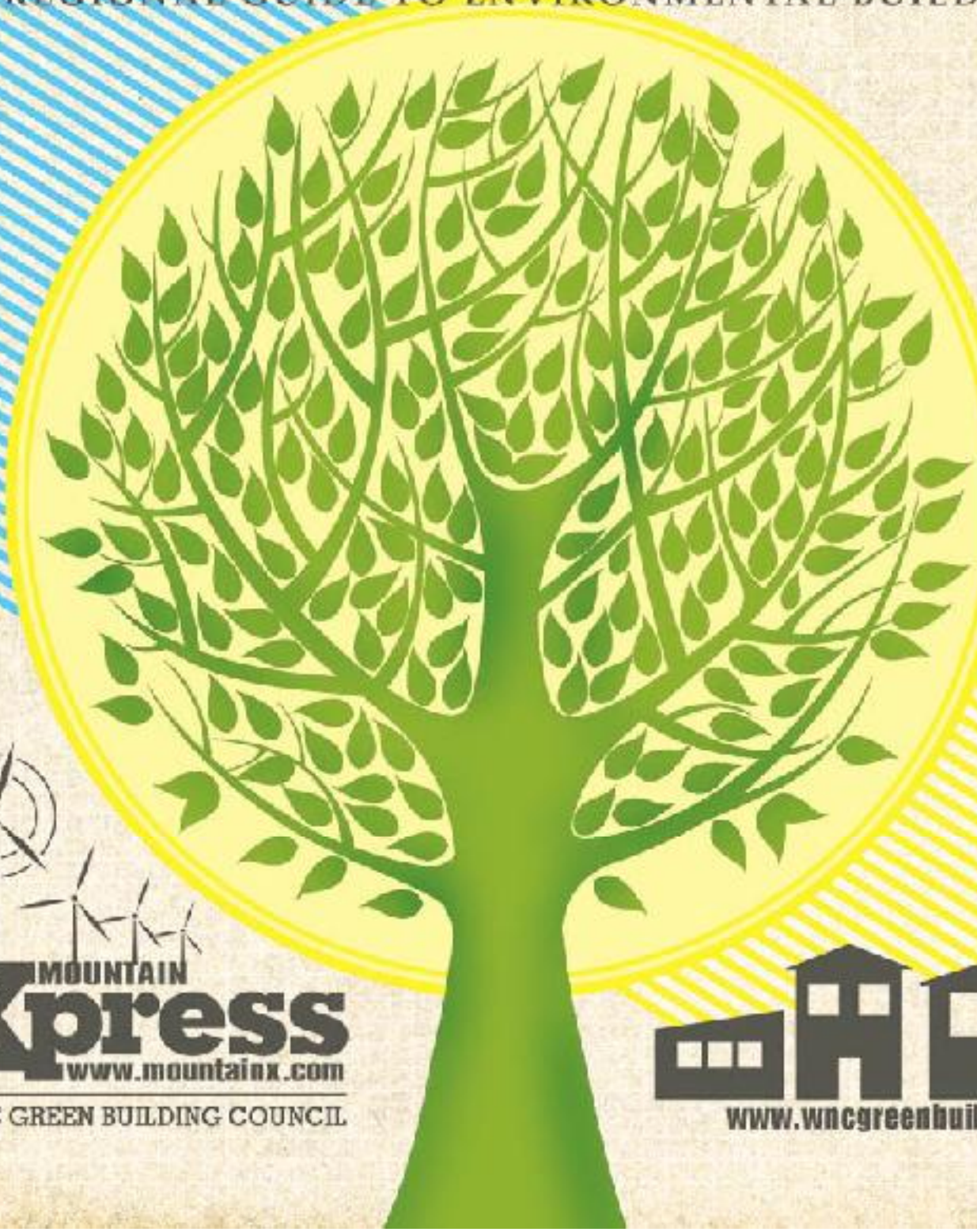
2010 WESTERN NORTH CAROLINA

GREEN BUILDING DIRECTORY

A REGIONAL GUIDE TO ENVIRONMENTAL BUILDING



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Introduction to the 2010 Directory

The right way, even in hard times

by Margaret Williams

Build for the environment. Build for people. Build it *right*, from the ground up.

In a green-built universe, school kids read by natural light in classrooms warmed by solar power and work at tables containing no formaldehyde-laden wood products. In a green-built home that complements its environment, water from heavy rains disperses nature's way — slowly, through gardens and bioswales instead of rushing across asphalt parking lots or down already eroded stream banks. On a football field in Madison County, players share the plot with a towering windmill that feeds electricity onto the grid.

And in a green-built universe, even in tough economic times, builders, homeowners, businesses and public institutions embrace sustainable principles. In the past year, when new construction slowed and real-estate sales stalled, the number of NC HealthyBuilt Homes rose — up 20 percent from the previous year.

The Asheville-based WNC Green Building Council (WNCGBC) certified 137 and registered 241 NC HealthyBuilt Homes in 2009. Since 2004, the Council has certified a total of 372, and 400 are currently registered.

This data demonstrates how green building principles have caught on and are thriving. HealthyBuilt Homes — which help provide standards for how "green" a house is — have become more common, and it's estimated by the local company Ecohouse Realty that these homes sell in half the time of non-green ones. That's perhaps a sign that green building is on its way to being "the way we build things," to borrow a phrase from local architect Diana Bellgowan.

LEED certifications also increased, with the Council being recognized as an official provider for LEED for Homes in January 2009. One year later, 14 projects are in process and three of those are pending certification. Commercial and public projects are pursuing LEED certifications too, such as Henderson County's two newest elementary schools, featured in this year's directory.

There's also more innovation, such as the first-ever hempcrete house in the Southeast cropping up in West Asheville (and another on Town Mountain Road; both homes use hemp as a base for a high-efficient concrete). There are also efforts under way to build passive homes — built so tight and so efficiently, it takes little energy to warm and cool them.

You'll find some of these initiatives in this year's directory, as well as details about the financial incentives that make many green building projects possible. According to the Council, some of those incentives include:

• Federal and state incentives that help homeowners, businesses and institutions buy energy-efficient water heaters, furnaces, air conditioners, windows and other fixtures and appliances.

• Incentives for renewable energy, such as Progress Energy's SunSense program, which offers a $1,000 rebate for solar thermal systems, or Duke Energy's SmartSaver rebate for HVAC upgrades.

• North Carolina tax credits for such alternative energy sources as biodiesel and geothermal.

With the Council entering its 10th year in Asheville, it's also worth noting some of the initiatives that have kept the momentum going:

• Launching the community certification program, which promotes environmental sustainability by giving developers third-party certification to back up their green claims.

• Implementing a three-year strategic plan that aims to expand the Council's reach both geographically and in terms of its audience.

• Upgrading educational programs to include Home Energy Rater System (HERS) and Building Performance Institute certifications, as well as other training that helps prepare people for green-collar jobs.

How will green building fare in 2010? Federal, state, local and nonprofit initiatives could grow the energy retrofit industry by leaps and bounds. New and improved building products and technologies pop up every day. And the word is out that green building can save money, help the environment and create sustainable places for us to live, work and play.

Margaret Williams is an editor for Mountain Xpress. *She can be reached at mvwilliams@mountainx.com or (828) 251-1333, ext 152.*

Case**Studies**

Queen Branch cottage

Land conservation, historic renovation & green building

by Diana Bellgowan

In a south-facing cove, where a small stream called Queen Branch meets the Little Tennessee River, the Dean family built their home more than 100 years ago — sometime around 1880. They lived in the house, ran a general store and farmed the surrounding land for many years, but when plans for a proposed dam on the Little Tennessee River would have submerged the house and much of the property, the family decided to sell to the Nantahala Power Company (now part of Duke Energy). Luckily, the dam was never built, and in 2004 Duke Energy gifted the Queen Branch property to the Land Trust for the Little Tennessee.

Home sweet home: The Dean family built their house on Queen Branch more than 100 years ago, and though the years weren't kind to the house, enough structure remained for a green make-over.

HISTORIC PHOTO COURTESY OF LAND TRUST FOR THE LITTLE TENNESSEE
RECENT PHOTOS (FACING PAGE) BY DIANA BELLGOWAN

The Land Trust kept the property directly adjacent to the Little Tennessee River and created the Queen Branch Preserve as a place for the public to access and enjoy the river. Then the organization set about protecting the natural landscape and improving the water quality along the remainder of Queen Branch by removing invasive non-native plants and several human-made impediments (including a two-seat outhouse that spanned the stream). The folks at the Trust believe that preserving our Southern Appalachian cultural heritage is an important part of their mission, so they also decided to save the Queen Branch cottage. To do this, they partnered with the Preservation North Carolina Foundation to find someone to purchase and restore the building according to specific historic guidelines.

That's where our part of the story begins.

The first time my husband, **Charlie,** and I saw Queen Branch cottage with **Paul Carlson**, executive director of the Land Trust for the Little Tennessee, we were struck by the beauty of the setting, the simple elegance of the home's details and floorplan, and the smart site orientation. The environmental sensitivity, the cultural significance of the site and the good design of the original house made us think Queen Branch would be a great place to combine historic preservation with green building technologies. And that's when we decided to embark on a home-renovation adventure.

It's not that we weren't aware that the house needed a complete renovation, including a new water source and septic, plumbing, mechanical and electrical systems. And we expected some structural upgrades would be required — the floors bounced, and there were some visible signs of termite damage. But I'm an architect and had worked on several complicated renovation projects. How hard could it be?

We contacted **Maggie Leslie** at the Western North Carolina Green Building Council, and she introduced us to the NC HealthyBuilt Homes pilot program for gut rehabilitation projects. Then we asked VandeMusser Design for help with some green building system design and HERS testing. Before starting the renovation, VandeMusser suggested getting a baseline reading on the building envelope for a "before" and "after" comparison. When **Matt Vande** performed the initial blower-door test on the house, it was so drafty his equipment wouldn't give him a proper reading, so he had to extrapolate a rating number. Later, **Amy Musser** helped us design a new and efficient HVAC system that would fit within the tight physical constraints of the shallow floor framing and the low ceilings of the house.

Then we started the renovation. First, we removed the wallboard and flooring to determine any weak structural areas, and that's when things got really ugly. The demolition exposed both the inadequacy of the original structure and the full extent of termite-related damage.

The house was not a typical framed structure, but a "plank structure" with exterior walls consisting of one-inch thick, rough-sawn planks nailed to the sides of a platform floor, and upper floor and roof joists set in holes cut into the wall planks. The structure was seriously under-designed by modern standards, but it had endured more than 100 years of wind and weather. It might have been salvageable, except for

the extensive termite damage. Over the years, poor roof drainage and a damp crawlspace had allowed entry for termites to destroy most of the main floor framing and many planks. Thankfully, sometime in the 1950s, the exterior walls were furred out with two-by-fours to hide electrical wiring. That furring was all that was left holding up the house.

To restore structural integrity and improve the building envelope, we decided to install new pier foundations and eliminate the enclosed crawlspace; this would also help to reduce the possibility of future termite damage and restore the building's original look. Working with structural engineer Bernie Feinberg, we figured out a way to retrofit framing for the floors and restructure the walls while keeping the planks intact.

Once plans were in place for the structural retrofit, it was obvious that the project was too big for us to handle alone, so we asked **Ward Griffin** of Griffin Realty & Construction to be our general contractor. I had consulted with Ward on a couple of renovation projects in West Asheville and knew he was capable of saving this old house. Ward's crew worked quickly to stabilize the building. Then they began installing new footings, re-building the floors and adding framing at the interior and exterior bearing walls.

Then with the new structure in place, we could concentrate on incorporating green building solutions, including low-VOC interior paints, site-salvaged and local reclaimed oak flooring, spray-foam insulation, site-salvaged stone veneer, re-use of the original metal roofing over a new protective roofing, a whole-house exhaust system, Energy Star appliances and a high-efficiency heat pump (15.75 SEER and 9 HSPF). A hot-water heat pump was installed to improve the efficiency of the electric water heater and help in dehumidification; it also puts out cool air, which is distributed across the refrigerator coils to increase that appliance's efficiency. The lighting utilizes compact fluorescent light bulbs, and all exterior lights are Dark Sky-rated. The toilet and bathroom faucet are low flow, Water Sense fixtures. The air handler and all ductwork are located in the conditioned space to improve efficiency, and the existing, historic windows were restored with new weather stripping added.

Finally, **Shawn White** from Pisgah Pest Control developed a site-specific solution for termite control that will protect the house in a way that will be effective in the site's rocky soil, safe for the nearby stream and nontoxic to humans and animals.

The house is still a work in progress, and we hope to complete the final testing for the NC HealthyBuilt Homes program and Energy Star certification soon. But for now, we're happy to have the house habitable again, and we're proud to think that employing green building technologies in this historic renovation will ensure Queen Branch cottage is still around in another 100 years.

Diana Bellgowan is an architect based in Asheville, N.C. She can be reached at (828) 281-4626 or diana@dianabellgowan.com.

Henderson County schools

Let the sun shine in

The greener learning environment: These school children get the benefit of natural light in the classroom, made possible by a number of green building techniques, such as large but high-efficiency windows.

PHOTO COURTESY JIM MOSELEY ARCHITECTS

by Margaret Williams

At two of Henderson County's newest elementary schools, sunlight makes every room glow, even on a cloudy winter day when the powered lights are off. The abundance of natural light at Mills River and Hillendale — and the many methods used to achieve it — are just a few green features that have earned the schools a Leadership in Energy and Environmental Design (LEED) silver rating (platinum is the highest). From sun tubes to solar panels, from low-flow toilets to sustainable wood, from low-VOC paints to recycled building materials, the two schools are a study in what it means to build green from the ground up and create a better learning environment at the same time.

At Mills River, the green theme started early in the process, beginning with the bricks from the old school, which was more than 100 years old. Instead of being hauled away and likely dumped into the county landfill, the "memorabilia" bricks became part of a fundraiser for the community, says **Jes Stafford**, construction project manager for the county school system. While the old school — and most of the buildings added to it over the decades — were demolished, those bricks served a useful purpose, says Stafford. And the grounds became a play area for the new school.

Some of the 1970s additions to the old school remain standing, but the block-industrial architecture common in that period contrasts with the new school, which boasts 20 rooftop solar panels, sports an entrance roof that curves upward like the surrounding mountains and marks its halls with color-coded floors that make it easier for new kids to figure out what hall they belong on.

On a December tour, Stafford points to the solar panels, which heat all the hot water used at the school: "That's the bread and butter of our LEED rating," he says. Even on this cold cloudy day, the solar system heats the incoming water supply to a toasty 124 degrees, he explains. In a large room near the solar-paneled roof located at the back of the school, Stafford points out how it all works. Huge water tanks sit in the middle of the room, a series of pipes running in and out of them, connecting them to lines filled with water heated by the energy captured by the solar panels. There's something missing, Stafford mentions: "In an older building, those tanks would have gas burners under them, heating up the water.

"But that's wasteful. You're keeping all the water hot whether you're using it or not," Stafford continues. With Mills River's solar hot-water and heating system — and for a near-identical one at Hillendale — sun energy preheats the water, which is stored in the highly insulated tanks and kept warm until needed. Small but efficient natural-gas boilers make up the temperature difference on demand, he continues, pointing to a row of plain, box-like fixtures. "We don't use all six as you traditionally would," Stafford adds, explaining the process by which only as many boilers operate at a time as necessary and in an alternating sequence that reduces wear and tear on each boiler.

In this way, the system helps heat the school and provides hot water for the kitchen and restrooms.

It's just one of many touches that gained the project points on its way to being LEED-certified.

The process started with an idea presented first to the Henderson School Board and then to County Commissioners: Design and build the new schools with green-building principles in mind at every step, says **John Nichols**, senior sustainability coordinator for the firm Jim Moseley Architects. With support from the local Sierra Club, designs and technical assistance by Moseley and a little extra funding added by commissioners, both projects were under way by late 2007 and opened in August 2009.

"A number of project requirements — including the schools' solar thermal arrays, tied to high-efficiency, water-source heat pumps — were already envisioned before the decision to pursue LEED certification was made," says Nichols. Facilities Senior Director **Bo Caldwell** and Stafford, an architect, "were instrumental in their direction on the different technologies and strategies they wanted to see incorporated into the school."

One of those elements is the daylighting design, which includes such features as enlarged windows made with high-performance glass and exterior sunscreens that shade the building interior from most direct sunlight during the cooling season, along with interior light shelves that redirect visible light deep into each room and prevent glare from strong summer light. Reflective

ceiling paints further help diffuse the natural light, reducing the need for powered light (and even those are high-efficiency models that are less tiring on the eyes of young students; the lights are also set up to dim when there's sufficient natural light in the room).

Stafford adds that all the classrooms are oriented east to west, which helps them get the most benefit from sunlight too: North-facing windows aren't shaded, which allows more light in and helps warm the building walls; south-facing ones have exterior shades that deflect the brightest light of spring and summer.

Green features at the new schools include:

- dual-flush toilets, pint-flush urinals and ultra low-flow lavatories projected to reduced water consumption by 47 percent — about 464,000 gallons per year
- partial ceilings that give the effect of a fully enclosed ceiling but use less material
- between classrooms, full wall structures that reduce noise transfer from room to room, as well as cut down on the noise coming from the HVAC system
- for doors, furniture and such, no particle board and all FSC-certified wood
- low-VOC paints and floor finishes
- building materials from local and regional sources, typically no further than 300 miles away, and the recycling of construction materials onsite whenever possible
- carbon dioxide sensors and outdoor airflow monitors to improve the ventilation of indoor air spaces
- green housekeeping and integrated pest management plans to enhance and protect indoor air quality

And on the metal roof, there are 78 Solatube skylights — visible as large rooftop bubbles that allow light to stream inside through tubes, then temper it with interior glass fixtures that look a bit like a collection of large bug eyes. "That diffuses the light instead of giving you the spotlight effect," says Stafford.

Meanwhile, the kids just know there's work to do, ball games to play at recess and plenty of chances to catch the sun's rays.

Margaret Williams is an editor for Mountain Xpress. *She can be reached at mvwilliams@mountainx.com or (828) 251-1333, ext 152.*

TECHNOLOGIES EXPLAINED

What are VOCs?
VOCs, or volatile organic compounds, are chemicals that are released into the air as a product dries or cures. They are the smell of paint, adhesives, carpet, bleach and other cleaning products. VOCs are a suspected carcinogen and can cause other health problems, including headaches and nausea. Some products containing VOCs will "offgas" for a certain period of time and then not release any more VOCs into the air, while others take years to completely cure. Look for low- or no-VOC products, and then ventilate the home and filter the air properly to minimize the pollutants concentration.

— E.K.

The Nauhaus

Tackling climate change, one Nauhaus at a time

by Tracy Rose

If you drive by the Nauhaus home under construction in a quiet neighborhood off Brevard Road in West Asheville, you might not notice anything radically different about it.

But if you could peer into the walls, even the untrained eye probably could spot something unusual. On a frigid December day, a 16-inch-thick gray wall that looks like it's made of ground-up straw mashed together into blocks is taking shape on the house's ground floor. But instead of straw, the blocks actually are made of hempcrete — chopped hemp fibers called shiv that have been mixed with a lime-based binder onsite and poured into forms.

The hempcrete walls offer perhaps the biggest wow factor about the Nauhaus, a prototype home on Talmadge Street being constructed by the Nauhaus Group, a collection of local companies offering design, building and development services from its West Asheville headquarters.

Hemp team: Mix bags of hemp fiber with a lime-based binder, add a crew of enviro-builders, and you get a hempcrete house in Asheville.

PHOTOS BY JONATHAN WELCH

What may be more remarkable, however, is the project's goal — carbon neutrality — and the combination of high-tech building science and natural materials being used to achieve it.

"Our agenda is basically affordable, carbon-neutral building solutions," explains **Clarke Snell**, the managing director of The Nauhaus Institute, the nonprofit research/education arm of the group.

Snell has deep roots in natural building, an approach that uses close-to-the-earth materials such as bales of straw and, well, earth. He's authored two books on the subject (*The Good House Book: A Common-Sense Guide to Alternative Homebuilding* and *Building Green: A Complete How-To Guide to Alternative Building Methods*), the latter with Nauhaus architectural designer **Tim Callahan**.

But while Snell loves natural materials — and is employing them when practical in the Nauhaus — he says that getting serious about carbon neutrality and solving environmental problems means taking a more technical approach than natural building alone affords. The labor-intensive nature of natural building usually relegates the techniques to owner-builders, he says, since it's either very expensive or time-consuming otherwise. The Nauhaus Group aims to combine the advantages of both the natural and high-performance building worlds into a hybrid system.

So hempcrete — chosen largely for its vapor-permeable quality — has a foot in both worlds: It's a natural material, but one that's been lab-tested and is acceptable to building-code officials. Essentially, hempcrete walls can absorb or shed water in response to the changing humidity levels in the air. For its part, the lime wicks water away from the cellulose and

inhibits mold growth, Snell notes. On the downside, since hemp can't legally be grown in the United States, the product whose brand name is Tradical Hemcrete has to be imported from England.

"This is the only product that we know of in the world right now that has the properties that we want that you can buy in a bag," says Snell. "And that's the transition that we're trying to make … out of these sort of impractical but wonderful site-made materials into comparable commercial products that can be installed quickly for a quoted price."

But why aim to be carbon-neutral in the first place? Snell says that once you accept the science of climate change, the solution is simple: Reduce the amount of fuel you're burning to cut carbon-dioxide emissions. And since buildings make up a significant part of our carbon footprint, builders have it in their power to address a large part of the problem.

To achieve maximum energy efficiency, the Nauhaus group turned to a German certification program called Passive House. Buildings constructed to this rigorous standard are about 80 percent more efficient than those built to code, Snell says.

"A Passive House is a very well-insulated, virtually air-tight building that is primarily heated by passive solar gain and by internal gains from people, electrical equipment, etc.," notes the Web site for the Passive House Institute U.S., an Illinois firm that certifies Passive Houses in this country.

To say the Nauhaus meets the standard seems like an understatement.

"The basic idea is really simple," Snell explains, pointing to the insulated concrete slab on which the house rests. "You wrap the inside of the house in lots of insulation."

That starts with insulating the slab itself, a detail Snell says often goes overlooked by folks who are trying to be energy efficient. In the Nauhaus, polyurethane foam — four and a half inches of it, sprayed on a sheet of plastic under the slab — brings its R-value to 30 (compared to an R-value of zero to 5 to meet code requirements).

On the outside of the slab, the Nauhaus uses insulated, autoclaved aerated concrete blocks for part of the stem wall. The outside wall is sprayed with more insulation.

Inside, the insulation extravaganza continues with the 16-inch-thick hempcrete, which provides additional insulation around the wood framing and brings the R-value to about 40 — significantly higher than the code requirement of R-13. High-performance windows and doors from Serious Materials minimize heat loss. The roof will be insulated to R-75 (almost double the code requirement of R-38) with a combination of cellulose and high-performance structural insulated panels from a local company, Eco-Panels. In addition, breaks in the insulation layer — called thermal bridges — have been eliminated throughout the house.

With the low-arcing December sun shining through the framing in the unfinished upstairs space, it's easy to imagine how toasty the house will be in winter once another design feature — passive solar — comes into play.

In another nod to natural materials, the Nauhaus will feature compressed earth blocks made on site with soil dug up for the foundation that's then mixed with a small amount of Portland cement and shaped with a hydraulic press, Snell says. The blocks will be used for many of the interior partition walls and for much of the finish floor to provide thermal mass, which is needed in passive solar design to hold and then release heat.

If all the Passive House strategies are employed effectively, then a building doesn't need the normal heating and cooling systems, notes Callahan.

For additional heating, the all-electric house will use a mini-split heat pump, powered by rooftop solar electric panels, which will also power the heat-pump water heater. Since the house will be so airtight, an energy recovery ventilator will be used to bring in and circulate fresh air. The ERV and mini-splits will work together to dehumidify the house in the summer.

The building, which includes an apartment — and therefore two kitchens and heating/cooling systems — needs only a 2-kilowatt solar-electric system to produce, onsite, 100 percent of its electricity needs, Snell reports.

Though Callahan reports that the house will cost 5 to 15 percent more to build than a regular house, the energy costs are projected to be so much lower that a buyer could put the money saved on monthly energy bills into the mortgage and still wind up with a lower overall monthly housing cost.

Natural materials will show up in other parts of the house as well. A lime-based plaster will go on the exterior hempcrete, while earth-based plasters will be used on the interior, along with Asheville-based Earthpaint products. Horse-logged hemlock (cut because it was infested with woolly adelgid) from Mountain Works Sustainable Development based in Boone will be used for exterior fascia of the roof overhangs, while all interior wood will either be horse-logged or reclaimed.

Although they weren't able to incorporate local framing wood, Snell notes that the wall system uses less wood due to wider spacing (24 inches versus the typical 16 inches) and less bracing, thanks to the structural support of the hempcrete.

Another green feature of the house is its small size — about 1,400 interior square feet, which takes less energy to heat and cool. (The extra-thick walls bring the home's footprint to about 1,700 square feet.)

An integral part of the home's design is the "urban homestead" landscaping planned for the one-eighth-acre lot. Plans reveal a rain-catchment cistern, pond, butterfly garden, raspberry trellis, grape arbor, blueberry bushes and shitake mushroom logs.

"The 'green' in 'green building' is plants, yet landscaping continues to be an afterthought in most green projects. For us, plants are integral to the home: They're there to nurture the inhabitants in exchange for the inhabitants nurturing them," Snell offers.

Strong stuff: Hempcrete walls have good insulating properties and are vapor permeable — the material can absorb or shed water in response to changing humidity levels in the home.

In another experiment, the Nauhaus team plans to try out insulation from mycelium, the "roots" of mushrooms, in the walls and roof of a garden shed on the property.

Once the Nauhaus prototype is finished, the group's systems engineer **Jeff Buscher** and his family will move in to continue gathering information about the house's performance.

The knowledge the Nauhaus Group gains from the prototype house will be put toward building future homes, mixed-use buildings, apartments and larger commercial projects.

The project has excited plenty of local interest.

"I think one of the unique aspects of this project is the number of people who have been involved in making it happen," says Callahan. From the house's conception to the design and materials, he notes, "It's been a real community effort."

Renee Kirzner, one of the project's volunteers and a massage therapist, helps promote the Nauhaus via social media like Twitter. "It's empowering to know that there are models like the Nauhaus to address climate change so completely right here in our neighborhood," Kirzner says. "I definitely think their approach is so hopeful and inspiring."

Learn more about the Nauhaus at www.thenauhaus.com. You can also check out the Facebook page (search for The Nauhaus Institute) and get Twitter updates (@theNauHaus).

Tracy Rose is an Asheville-based freelance writer and editor.

TECHNOLOGIES EXPLAINED

How do you make windows more efficient?
Anyway you look through it, windows are holes in the thermal envelope of the home and will not be as efficient as insulation. However, window technology has improved in the last few years. Higher thermal resistance is achieved by using a window that has two (or more) panes of glass filled with argon or krypton gas in between. This reduces heat transfer, because of the low thermal conductivity of the gas, which increases its ability to insulate. To further increase efficiency, window manufacturers apply a "low-E" (low emissivity) coating to the glass. The coating is a microscopically thin metal or metallic oxide layer applied directly on the surface of one or more of the panes of glass. Low-E coated window panes utilize radiation to prevent heat loss or heat gain, depending on which side of the glass is coated. Windows are rated by the National Fenestration Rating Council (NFRC).

The U-factor is the first number to look for when assessing a window's efficiency. It measures the overall heat transfer coefficient of a window unit; it tells you how much heat a window will let through. The U-value is the inverse of the R-value (see R-value, page 25). The lower the U-value, the better the product's resistance to heat flow. Look for a U-value of .35 or less. The other number to look for, the solar heat gain coefficient (SHGC), tells you how much heat comes in through the window. Look for a SHGC of around .4 to balance enough heat gain in the winter and not too much in the summer. In passive-solar homes, this value should be higher than in non-passive solar homes, around a .6.

— *E.K.*

Davenport Park

Eco-community sprouts in West Asheville

by Jonathan Poston

In the last decade, West Asheville has made great strides in its revitalization, and that includes green building. Haywood Road, one of the neighborhood's main arteries, is bursting with a medley of trendy eateries, unique shops and micro-brew pubs. Not far from the ever-more popular hub, you'll find Davenport Park, one builder's attempt to create his first green subdivision.

Build with purpose: Jody Guokas, owner of JAG Construction, says green building "means building for a purpose, for people and for the planet, rather than simply for profit."

PHOTO BY JONATHAN WELCH

But the neighborhood's known for its older homes. Near Haywood's trendy Westville Pub is Vermont Avenue, where 1920s bungalows display the neighborhood's traditional character. According to Realtor **Karen Gleason**, it's easy to see that many of these historic homes have been renovated to preserve that character. At the end of Vermont lies Davenport Road, where the neighborhood transitions to 1950s ranches, she continues. Take a right onto Davenport and just down on the left is a JAG Construction project — Davenport Park, for which Gleason, of The Real Estate Center, is the listing agent.

Here, the old growth stops and the green sprigs begin.

In August 2006, JAG developer and Warren Wilson College graduate **Jody Guokas** and a partner purchased the 2.4 acres that is now Davenport Park. Before then, he had built one home at a time. "This is the first large-scale, multi-unit thing I've done," he says. With a crew of seven workers and help from a variety of consultants, he set a goal to "make a green development from the very beginning." Equinox Environmental Consultation and Design became one of the first consultants on the scene. "They designed the shape of the lots and the road to maximize the number of lots we could get in here, while minimizing the impact on the local stream and surrounding ecosystem," Guokas says.

Urban density — though not often considered a direct aspect of green building and often controversial in Asheville — reduces urban sprawl, cuts building costs and otherwise contributes to sustainability. Davenport Park is an infill development: It makes use of a vacant lot in an established residential area.

In Davenport, there are four house plans — all of them designed for sustainability, starting with their cozy size, ranging from 1,250 to 1,600 square feet. An architect can make custom adjustments, but what attracts buyers to this West Asheville eco-development is not so much the chance to upgrade the standard-option package: It's in Guokas' green planning, right down to street level.

"When we develop, we create non-pervious surfaces like roads, driveways, and roofs," says Guokas, speaking of the typical approach to building a subdivision. All the water that hits the non-pervious surface runs off, taking with it non-point source contaminants, he continues. Normally, stormwater would be channeled into pipes and dumped into the nearby creek without any processing, which can create flash-flooding and damage local waterways. He emphasizes, "Ideally, you want to treat that run off water onsite. We try to slow the water down, so our stormwater runs along side of the road, in what we call a bio-swale, and ends up in a pipe that takes it to a bio-retention area. We'll put a special soil mix in there and plant it with water-loving species," Guokas explains.

Those features set up a natural process: Sediment and contaminants — such as oil-drips from cars and household waste —make their way into the bio-retention area. There, special waste-eating bacteria will be waiting, Guokas details. Eventually the water makes it to the creek, but by that time it's been through a methodical, natural cleansing process.

The greening doesn't stop there: "All of our houses were designed to maximize passive solar gain," the builder continues. "A normal planner would place these houses perpendicular to the road, not really thinking about the importance of the long axis facing south. We took them all

and shifted the lot lines so the houses would face south," says Guokas. "Then with the architects, we designed the houses to increase the effect by placing most of our glass on the south side of the house."

Additionally, to create an active solar element, every house is outfitted with a two-panel, solar hot-water system installed by Sundance Power System.

Other green-built features include aluminum-clad, double-pane windows and high-quality, low-VOC paint. "We do high-efficiency framing, which means we leave as much space as possible for insulation," Guokas points out. "We also use Superior Walls for our basements, which is a pre-cast-concrete, basement-wall system." The walls "actually show up on a truck in panels. A crew sets them up with a crane and bolts them together." The method uses a lot less concrete than a poured wall, the structures come pre-insulated, and they're a lot more waterproof than the typical wall, Guokas adds.

Also, spray foam is used as insulation in the roofs instead of standard fiberglass insulation because the spray variety is known to act as a superior air sealant. This is a crucial area to seal too, as most homes lose most of their heat through air leakage. Another green feature is the high-efficiency HVAC systems, partnered with ductwork that's well-insulated and meticulously sealed for maximum operating efficiency.

All of these measures mean less waste and more energy efficiency for the eco-community. In fact, toward the end of the building process, each home gets a blower-door test, which entails putting the house under pressure and testing the airflow through the house. A passing score indicates that the house is sealed tight and protected against leakage, which is a strict requirement of the NC HealthyBuilt Homes certification Davenport homes earn. Going back in and attempting to fix leaks after a failed blower-door test can be a huge drain of energy and time, but thankfully Goukas has never received an unsatisfactory score. "We build a very tight house," he says.

Size matters: Davenport Park homes range in size from 1,250 to 1,600 square feet and are sited to take advantage of sunlight in the mini-neighborhood.

PHOTO BY JONATHAN POSTON

There's another design touch that balances urban density with a very Western North Carolina aesthetic: Davenport includes a city-greenway easement along Rhododendron Creek and West Asheville Park along

the property perimeter, so that these HealthyBuilt-certified homes — situated on their respective, small .08 to .12-acre lots — appear to be tucked away in a wilderness of their own.

But a big green challenge of another sort, perhaps, for the new, 15-lot development — which began back in 2006 — has been the economy. When JAG first broke ground back in late 2006, real estate was still booming. "We were taking building reservations and as of the end of 2006, we had all these houses spoken for."

Sales commitments slowed, however, and, to further complicate the project, Guokas wasn't able to complete the infrastructure in the few months he had estimated. The reality of planning, combined with the looming economic crisis, slowed him down: "It took us a year and a half to get all our city approvals and the water, sewer and roads all in. By the time that year and a half rolled around, every single one of those [initial] buyers was gone. It's challenging in this economy, but now we're doing well," he continues. In 2009, he sold six houses.

Prices in Davenport range a bit higher than average in Buncombe County, but the combination of multiple tax credits and home-energy savings presents an enticing package. "We love living here," says homeowner **Jim Grode.** "We have a beautiful house, and our utility bills are next to nothing. We and our neighbors have developed a real sense of community through doing our small part to help keep the planet healthy."

Jonathan Poston is a freelance writer and regular contributor to Mountain Xpress.

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Features

Forestry mulching

The benefits of mulch clearing

by Frank Vogler

Say you have a seriously overgrown field or lot, or a massive pile of tree crowns, or maybe a tangled snarl of beetle-killed pines — or any number of brushy, scrubby scenarios requiring a serious mechanical solution. Traditionally, this has meant you would embark on a tedious, destructive and expensive process — one that usually involved a permit and site plan, hours of inefficient hand work, a bull dozer and/or track hoe to rip and push vegetation, additional track-hoe hours for burning (if allowed), a dump truck for hauling stumps, and then? Well, you'd only be half way home.

Before and after: For Luba Sharapan and Erik Haagensen in Greene County, Tenn., forestry mulching created this west-facing knoll on their property.

PHOTOS BY FRANK VOGLER

You'd have a muddy, topsoil-less swath ringed by expensive silt fencing and retention structures that would require constant maintenance. You might believe the best way to remedy the situation would be to spray everything with a noxious mixture of fertilizer, glue, liquid lime and seed, at a cost of around $2,000 per acre, with the hope that something will "come up." Maybe you can't afford to hydro-seed, so you decide to do it the old-fashioned way: on your own. After three or four tries, dozens of bales of straw, complaints from neighbors and perhaps a visit from local Department of the Environment and Natural Resources officials, you finally begin to see those delicately reassuring blades of grass poking through the straw-covered landscape. You breathe a sigh of relief — but then, it just doesn't rain, or it rains too much. It all begins to seem reminiscent of the ubiquitous pink bathtub ring in Dr. Seuss' *The Cat in the Hat Comes Back* ... only without Little Cat Z to pop out in the end and clean everything up.

Why — with all the outpouring of human energy and interest in green building — has no truly thoughtful strategy for green clearing emerged? But it has. It's called forestry mastication, or in layman's terms, mulching. In fact, if you've traveled in parts of Buncombe, Madison and Henderson counties and noticed fresh carpets of mulch along the highway, you've witnessed the process.

Forestry mulching is accomplished with a variety of equipment, usually tracked, and specially fitted with rotary cutting drums that resemble giant rolling pins with teeth. Unlike chippers and tub grinders that involve additional removal and handling procedures and associated costs, these machines just drive around and eat. The idea is simple: Grind vegetation in place, flush with the ground, leaving a protective covering of mulch. The entire process happens in a single step, and topsoil is left virtually undisturbed.

In addition, the mulch layer retards future growth. As the mulch decays, soils receive nutrients from the returning biomass. It is the very essence of sustainability when compared to traditional methods. It can be done on steeper, more difficult terrain, as well as in delicate riparian zones that would preclude the use of traditional clearing methods altogether. When applied as a forestry practice, the process even resembles an accelerated version of succession, with under-story returned as food for more desirable but slower growing tree species. This application can literally transform logging cuts from unsightly wastelands to property improvements, greatly diminishing the possibility of erosion along the way. Likewise, when the practice concerns the protection of valuable resources like timber, wildlife and homes, mulching is of equal value. **Leon Knoz**, wildfire/urban interface expert and Firewise Coordinator for the Smoky Mountain region of Tennessee, now recommends mulch clearing as the preferred method for fire-buffer creation.

Mulching is also the obvious choice for pasture restoration, as the ultimate goal is not just to clear the land and plant forage, but improve soil fertility. On this matter, regional agriculture guru **Joel Salatin** writes: "Wood wastes are, I believe, a poorly tapped resource in speeding up this building process. We piled wood chips on some grass and removed it a year later. Today, that spot still grows unbelievably lush grass and has earthworm castings two inches high."

Seeing the forest for the trees: Forestry mulching preserves and builds the topsoil layer, doesn't involve burning or create brush piles and recycles the existing biomass.

In order to verify the results of Salatin's assertion, we conducted a slightly more controlled experiment of our own. We mulched an acre of south-facing former pasture covered with 18- to 20-foot closely spaced pines. Beside this area, we marked out a nearly identical acre and cleared it with a small bulldozer, taking special care to minimize the dislocation of topsoil. Two years later, the results are astonishing. Both areas are sparsely covered with grasses, clover and wild strawberry; however, the mulched area boasts nearly two inches of rich black topsoil, the equivalent of many decades worth of leaf litter in a typical Appalachian forest. In addition, the pH level of the mulched site is higher, indicating lower soil acidity. The bulldozed acre has exactly zero topsoil, with bits of parched red earth still poking through despite having been limed, fertilized with compost and seeded in an effort to encourage re-growth and minimize erosion.

It doesn't take a soil scientist to clearly see that these results are applicable not only to agricultural pursuits, but also to the region's, at times, damaging and controversial practice: development. According to the National Resources Inventory — the governing body that tracks soil conditions — millions of cubic yards of precious topsoil find their way from our ancient mountains to the sea every decade.

So why are traditional clearing methods still being used in situations where forestry mulching offers a clearly superior outcome? Is it more expensive than conventional practices, like organic foods or sustainably harvested wood products? The answer is no. Remember the practice takes place in a single step, tailored to the specific needs of the landowner, such as pasture applications or rights of way where Mother Nature, livestock and/or required mechanical practices like bush hogging finish the job at little or no additional cost. Or the mulch can be left finely and evenly ground for a neat, finished look appropriate for real-estate presentations or equestrian activities. In either case, it costs less than traditional clearing, requires few if any permits and no immediate maintenance. Furthermore, it can be done in adverse weather conditions that would leave other equipment track deep in the mud. Mulching equipment literally makes its own tractable footing as it goes.

The reason forestry mulching is only now gaining a foothold is its relative newness. Industry expert **Dennis Goldbach**, operations VP at Fecon Industries (manufacturer of the popular Bull Hog mulching head), points out that the technology didn't arrive until the mid-1990s from Germany, where it was developed for agricultural applications. "The original machines were PTO-driven cutters for tractors and relatively weak

Half-way there: Sharapan and Haagensen look on as the site is cleared. Material is in "rough" phase.

compared to modern hydraulically powered units," which are capable of pushing more than 150 gallons of fluid through a closed hydraulic system in a mere minute.

Even now, the emergent nature of the technology is its only real weakness. Without industry standards or well-defined protocols, the field is something of a wild frontier. Visit Internet mulching chat rooms (if you're that bored), and you'll read hotly debated opinions surrounding topics like hydraulic cooling, tooth ware, head balancing and track performance. Many have entered the field in recent years, only to find they did not have the patience or budget to match the requisite maintenance demands and intensive nature of the equipment. In our current economic climate, some would-be providers have been unable to weather the learning process. Nonetheless, mulching is gaining a remarkable foothold in the land-management and forestry industries and will no doubt become commonplace.

For most, this is more than they care to know. They simply want the best product with the least possible damage to their bank accounts and their property. Many converts to mulching are the region's numerous transplants and second-home buyers. They may be skeptical of traditional practices and have the time and resources to investigate alternatives.

Potters **Erik Haagensen** and **Luba Sharapan**, owners of MudFire Clayworks in Atlanta, Ga., recently decided to have their property mulched as part of the site prep for their modest mountain getaway. They wanted to be able to position their house to take advantage of the dramatic mountain views without burning, creating erosion problems or pulling unnecessary permits. At the end of their rain-soaked visit, 90 percent of their target area was rough-mulched, and Haagansen gave the nod to put in one more day with a Fecon FTX 140 steel-tracked mulcher.

"We were excited to build on our new hilltop, but more than a little sickened at the thought of letting loose the dozers, leaving a big naked scar and creating a runoff nightmare," says Haagansen. "It was amazing how quickly V & V opened up our building site and viewscape with their mulching equipment. They left select hardwoods standing that'll spring up quick without having to compete with all the weed trees and invasives that were taken down."

He continues, "The mulch is thick, springy and smells wonderful. We like walking on it and thinking of how its feeding the soil and getting it ready

Mulch Clearing

- Single-step process
- Seldom requires permitting
- Preserves and builds topsoil layer
- Low ground pressure
- Creates natural erosion control
- Workable in wet and snowy weather
- No burning, chipping or hauling
- No windrows or brush piles
- Recycles biomass
- Extremely selective
- Visually appealing
- Sustainable
- Less expensive

Traditional Clearing

- Multi-step process
- Requires permitting and site plan
- Damages and dislocates topsoil layer
- High ground pressure (compaction)
- Requires additional erosion control (silt fencing and catch basins)
- Highly weather dependent
- Often necessitates burning and/or chipping and hauling
- Leaves windrows and brush piles
- Discards biomass
- Damages nearby trees and vegetation
- Unsightly scarred appearance
- Unsustainable
- More expensive

for the fruit trees and vegetable gardens we'll plant in a few years. We feel very lucky to have learned about mulching as an alternative to traditional clearing methods. It allowed us to enhance and sustain the natural habitat and not destroy it, so we could feel good minimizing our impact while building."

Frank Vogler is a partner in V & V Land Management and Resource Recovery LLC, promoting sustainable land-management practices in the Southeast. He believes that one of the biggest impacts you will have upon future generations are the decisions you make with regard to your land.

TECHNOLOGIESEXPLAINED

What is R-value?
The R-value is a unit of thermal resistance used to compare the insulating values of different materials. R-values are most commonly used in rating the effectiveness of insulation. The higher the R-value is, the better the insulation (if installed properly). The R-value needed for a building depends on the climate of that area. The U.S. Department of Energy has separated each county in the nation by climate "zone." The zones indicate what type of insulation R-value is recommended. Find your county online at www1.eere.energy.gov/consumer/tips/insulation.html. See the insulation chart and installation checklist on page 66 for more info.

— E.K.

Solar Decathlon

Cozy solar homes: Decathletes are charged with building small, energy-efficient homes.

PHOTOS BY BOONE GUYTON

by Boone Guyton

In October 2009, Claudia Cady and I traveled to the fourth Solar Decathlon in Washington, D.C., to check out what is new in the energy-efficiency, renewable-energy and smart-house market. We spent two days waiting in lines longer than those at stores on Black Friday. There were some really creative and innovative projects by 20 university teams from four countries. Most of the products were commercially available, though a few "will be out soon."

The Solar Decathlon is billed as "a competition in which 20 teams of college and university students compete to design, build, and operate the most attractive, effective, and energy-efficient solar-powered house." The houses were up to 800 square feet — models of another green principle: building small.

The event has several goals:

• Educate the student participants — the "Decathletes" — about the technologies behind energy efficiency, renewable energy and green building. As the next generation of engineers, architects, builders and communicators, the Decathletes will be able to use this knowledge in their studies and future careers.

• Raise awareness among the general public about renewable energy and energy efficiency, and how solar technology can reduce energy usage.

• Help solar-energy technologies enter the marketplace faster. The Solar Decathlon competition encourages research and development.

• Foster collaboration among students who often don't work together until they enter the workplace, particularly those from different academic disciplines, such as engineering and architecture.

• Promote a "whole building design" (or integrated) approach to new construction. This differs from the traditional design/build process, because the design team considers the interactions of all building components and systems to create a more comfortable building, save energy and reduce environmental impact.

• Demonstrate to the public the potential of zero-energy homes, which produce as much energy from renewable sources, such as the sun and wind, as they consume. Even though the home might be connected to a utility grid, it has a net-zero energy consumption from the utility provider.

What we expected and saw were lots of photovoltaic or PV panels to generate electricity, ranging from 4.2-kilowatt to more than 14-kw systems that produced all the needed electricity — and in some cases more than double what was needed — to operate the house. The Spain house had an inverted pyramid tracking roof system that automatically

kept the PV-clad roof at the optimum solar alignment. Two houses used double-sided PV panels that collected reflected light from the backside, as well as the direct sunlight.

All had solar-thermal water-heating systems for domestic water use, and many had oversized systems of either vacuum tubes or flat-plate collectors that also helped with space heating, usually in radiant-floor systems.

Most had computerized system monitors that allowed the user to see the energy use and to control the systems from one display monitor. Several were also connected to the Internet for remote control while away.

Most homes had a passive-solar orientation, along with some unique means to control the light so that it did not overwhelm the small interior space. There were a lot of louvers and screens and the return of the Trombe wall (a masonry wall designed to absorb and release solar heat) within south-facing window units. One home from Arizona had clear plastic modular units that were filled with water by vacuum. Germany, which ultimately won the Decathlon, included phase-change material in both the walls and the ceilings as a means to store heat or cold.

There were also a lot of plants and carefully oriented planters, both interior and exterior, which helped with water filtration, air filtration and food production. Some planters doubled as railings and

Look of the future? Every home at the Solar Decathlon used solar-thermal water-heating systems, and all featured their own unique look.

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Living wall: Indoor plants help improve air quality, as with this kitchen's "living" wall.

some as visual screens and herb gardens. The Penn State house had a green roof under one translucent PV array, and the plants helped cool the panels as well as the house. The array involved glass cylinders with thin-film PV inside that was curved, which provided optimum orientation throughout the day for some section of the film.
There was a lot of flex space, created through moveable walls, beds (one that lifted to the ceiling) and dividing cabinetry that allowed for multi-use space and interior/exterior space connections that gave a feeling of expansiveness.

There were some windows with aerogel, a super-insulating substance also used in wall construction. Most windows were triple-pane, low-E and filled with argon or krypton gas.

The wall systems were usually around R-40, through the use of SIPs panels or spray foam. The Illinois house was the only one likely to be certified by the Passive House Institute U.S., which means it will use 90-percent less energy than typical construction.

There were a lot of high-efficiency heat pumps, both air-to-air and geothermal. The Minnesota house had radiant-floor heating that used hot water supplied by flat-plate solar collectors to warm the house in winter and recharge an innovative desiccant dehumidification system in the summer.

There were an abundance of LED (light emitting diodes) lights as well as induction stoves, which are new and expensive, but very efficient.

There was one solar-powered popcorn popper and a smart TV (no, it wasn't permanently off — when no one's in the room, it shuts off).

Nearly all houses had some form of rainwater catchment and reuse that went to landscaping or toilets.

All in all, the homes provided examples of a great variety of possibilities, with some being more manageable and affordable than others. The most likely, practical takeaways for Claudia and me were the use of plants and planters for multiple uses, Kirei board that was made from sorghum straw, built-in clotheslines connected to deck railings, the Trombe wall and phase-change materials resurgence, a new type of solar-water heater that needed no pumps, and the designs that provided flexibility to make small spaces more useful and meet federal standards for accessibility.
The use of smart meters that displayed the energy use in real time and

allowed for a centralized control of the whole house seemed useful for conserving energy use and raising awareness of the consequences of appliances and mechanical devices we take for granted.

The Solar Decathlon provided good insights into what we will all hopefully be seeing next door in our own communities in the not-too-distant future.

For more information, visit www.kireiusa.com/kirei_viewer/kirei.html, www.sunnovations.com/howitworks.html, www.aerogel.com/markets/building.html, www.ada.gov, www.solardecathlon.uiuc.edu/gable.html#passivehouse and www.solardecathlon.org/about.cfm.

Boone Guyton is a partner in Cady and Guyton Construction, a HealthBuilt Home builder. He is also a founder and current board member of the WNC Green Building Council.

GREEN MEANS?

To me, "green" refers to plants, a metaphor for life. Green building, then, is about sustaining life. In my work, that means combining building science (energy efficiency/integrated systems design) with low-tech strategies (site-made and local materials/permaculture) to create built environments that work with their local ecosystem.

— Clarke Snell, managing director, The Nauhaus Institute

Solar farm update

On the grid: Western North Carolina's first solar farm is up and running, providing enough power for about 51 homes, says FLS President Michael Shore.
PHOTO COURTESY OF FLS ENERGY

by Margaret Williams

The first phases of Western North Carolina's first solar farm are harvesting the sun's energy and producing electricity, just two years after Progress Energy and First Light Solar signed the agreement to create it on a seven-acre Haywood County site once used as Evergreen Packaging's landfill. Under the agreement, Evergreen leases the land to FLS for 20 years, FLS owns and operates the 3,288 SunPower photovoltaic-panel system, and Progress agrees to purchase the produced electricity — almost 1 megawatt, enough to power about 51 homes for one year.

Last year, WNC Green Building Council Director **Matt Siegel** and FLS President **Michael Shore** noted that the project owed its creation, in part, to a North Carolina bill that requires public utilities to increase the percentage of renewable-energy electricity they produce — from the current 1 percent to 12.5 percent by the year 2021.

Says Shore: "The time is right for solar. FLS started with three employees in 2006, and we just hired our 50th employee. Even in a down economy, the solar age has arrived."

The $5 million solar farm has generated about 45 jobs, uses steel made in WNC and runs on panels made in the Southeast, Shore reported in late 2009. By the end of 2010, the last of five construction phases will be complete.

Margaret Williams is an editor for Mountain Xpress. *She can be reached at mvwilliams@mountainx.com or (828) 251-1333, ext 152.*

Top performer

Madison County schools find the tools for efficiency

A green plan: Madison County School Superintendent Ronald Wilcox (far right), started with one idea — increase building efficiency. (Maintenance Director Richard Paxton, left, and WRP Advisor Larry Schwake, right).

PHOTO BY JONATHAN WELCH

by Larry Schwake

Back in 2005, **Ronald Wilcox**, superintendent of the Madison County School System, requested an energy-efficiency assessment from Waste Reduction Partners, an advisory team of retired engineers based in Asheville. This assessment revealed several areas of opportunity for improvements and cost savings at most system facilities, including a high school, a middle school, three elementary schools, a special-education building, administration and a maintenance facility with a bus garage.

The 2005 assessment identified attractive areas for upgrading and correction in all facilities, giving both cost and payback estimates for most of them. Using this and many other inputs, Wilcox, the school administrators and the school board began to tackle some of the most pressing issues and under-funded areas.

The Hot Springs Elementary School had a failing central boiler system. The middle school's HVAC system was designed with inadequate controls, causing some rooms to be too warm and others too cool. The high school needed new windows, new lighting and HVAC controls improvements. With lots of opportunities for comfort, performance and efficiency improvements, school officials sought avenues to fund this multimillion-dollar need.

In 2008, the Waste Reduction Partners team received another request for help, but this time Wilcox wanted to see if an Energy Saving Performance Contracting approach could help the school system achieve energy-cost improvements as well as improvements to the quality of the school environments. The organization includes Maintenance Director **Richard Paxton**, who brought with him training and experience in building maintenance and construction. As a WRP advisor, I joined Paxton in revisiting the 2005 audit to update and understand the tasks needed. The buildings were generally cleaner and better maintained but still had the same update needs, as the 2005 audit had detailed.

Wilcox and Paxton agreed on one principal need from WRP: "Please help us get hold of this 'greased pig' called performance contracting" — a unique project approach, differing from conventional contracting: The performance contractor scopes the energy project to generate cost saving, which pays for the project loan over time. School officials' comfort level with having the energy-saving company (ESCO) "experts" come in and take over, tell them what they were going to sell them, and then measure what they did — so they could be handsomely paid — just did not fit well with the conservative folks on the board at first. The feedback from other school districts that had used this process was not that good.

The approach chosen for this project drew heavily on the experiences of WRP with performance contracting and facilities management projects in the region. One of WRP's volunteers had extensive experience serving as a mentor/facilities manager in a nearby county. WRP also had produced a detailed manual and lessons-learned guide on a balanced approach to energy-saving performance contracting for schools and local governments.

Using these suggestions, Wilcox formed a committee from within his organization, which he chaired. This committee included a school-board member (a lawyer with competence in finance), the financial officer from the schools, the maintenance manager and me. This committee was responsible for preparing a Request for Proposals, which was submitted to the appropriate, state-approved ESCO for bid.

We chose to diverge from the prescribed approach and take a more directed one: "This is what we have identified as needed, and these

A better heat pump: Hot Springs Elementary replaced a failing central boiler system with classroom heat pumps, providing numerous performance benefits and energy savings.

PHOTO BY LARRY SCHWAKE

are the approaches we would like included in your evaluations and suggestions." While this presented some problems for the ESCOs in quoting their estimates, since they all had their forms ready to run, we did, in fact, get a much better package for the effort and were able to control/reduce incremental and overall costs substantially by becoming well-informed buyers.

The key to the success of this project was, most likely, the insistence by both Wilcox and Paxton that *they* were responsible for its success and that they would make the decisions necessary for accomplishing what was needed. While they were relying on the project management of the ESCO, which is performing well, the coordination with responsible individual decision makers at the school brings this into much improved focus.

We have a very knowledgeable buyer using a very knowledgeable seller to both their advantages.

Initial installations were started the summer of 2009 and are ongoing, with a completion date for this $5 million project scheduled for summer 2010. HVAC work was started, in which we were able to prevail on the ESCO to use our data from other area schools to install individual room units with sensors in lieu of large central systems with massive expense and difficult controls. This change alone made operating costs reductions of 50 percent in the beautiful old building where we were able to apply it efficiently. The contractor estimated energy saving to be 36 percent across nine buildings, saving $5.9 million in utility costs over the 15-year contract.

The ESCO also presented an initial training program to the teachers and staff at start up last fall and will provide further training for teachers and for the class levels of all grades upon completion.

The contract also provides ongoing training for the entire maintenance crew on building-maintenance items and controls systems for the next five years.

When a performance contract can provide these kind of improvements to the classroom environment and also become a teaching tool, what more could one ask than to grab this "greased pig"? There is more. The Madison County schools are already operating a new wind turbine at the high school to generate a small amount of power back into the grid, coupled with a computer to measure what it does and how effective it is. And the middle school has PV (photovoltaic — solar panels that provide electricity directly) on its roof and is available for the students and their teachers (and parents) to study, understand, and perhaps use.

It is rewarding to know of the green shoots that started here. When you visit a classroom in Mars Hill Elementary, the first graders are now in a cool comfortable room and just bubbling with energy — that's the best! The whole school is now better off because it has taken action to make this happen. Saving money is good too.

Larry Schwake is an Energy Advisor with Waste Reduction Partners of the Land-of-Sky Regional Council in Asheville. WRP can be contacted at (828) 251-6622 or www.wastereductionparteners.org.

Water conservation during floods

It's still important

Waste not: Switching to a low-flow faucet aerator can save more than 1,000 gallons of water per year.

by Matt Siegel

It is interesting the way the human mind stores memory. I am quite convinced that humans have a relatively inaccurate sense of the past, both short- and long-term. One week this summer, it rained for four straight days, then there was a sunny day, and on the sixth day … it rained again. What are the words I heard from people as I complained that yet another one of my croquet games was being canceled?

"Well, we need the rain." It was the same during the drought. After a couple days of drizzling rain, people would be saying, "What drought? It's rained a lot this year."

In the world of green building, we pride ourselves on long-term thinking. So after three consecutive years of drought, I decided it was finally time to invest in a 650-gallon rainwater catchment system for irrigation. Yet in the summer of 2009, the tomatoes in my garden were more likely to get some fungus from being too wet than needing to be watered. I certainly don't regret my choice to put in the system, but I wanted to help others understand why — as the French Broad River overflows — I still push just as hard for low-flow showerheads and rainwater catchment.

Some people reading this have the pleasure of knowing the water that flows from their faucet comes from a clean well no more than 100 yards from their home. For the majority of us, on the other hand, our water is impressively supplied via miles of infrastructure and a complex process of treatment to guarantee it is safe to drink, with the source being some reservoir who-knows-where. Without understanding what happens behind the scenes, it is often hard to appreciate what it takes — besides the 21 million gallons of water that the Asheville Water Resources Department typically delivers each day from its two reservoirs (North Fork and Bee Tree) and the Mills River — to supply that nice hot shower we tend to take for granted.

The process goes like this:

From the reservoirs or river, the water is pre-chlorinated and mixed with aluminum sulfate to coagulate suspended particles coming from the lake. After mixing, the water flows through the filters, which remove coagulated particles. Following filtration, the pH level is adjusted, fluoride is added for dental health purposes, corrosion-inhibitors zinc orthophosphate and sodium bicarbonate are added (to reduce the potential of lead entering water in older home plumbing systems), and the water is once again chlorinated for further disinfection. After treatment, the water travels through a portion of more than 1,643 miles of water lines and is stored in one of 33 storage tanks located throughout the distribution system. In order for the water to have enough pressure to more than dribble out of the faucets, it must go through one of 35 booster pump stations that increase the pressure in the lines.

According to data supplied by **Maggie Ullman,** energy coordinator for the city of Asheville's Sustainability Office, the process requires one kilowatt hour for every 570 gallons of water supplied by Asheville Water Resources. The average person uses about 60 to 80 gallons of water a day at home. Average water usage throughout the Asheville Water Resources area is about 170 gallons per person, per day (including business and industry use).

After being used, most of this water flows down the drain toward its eventual arrival in the French Broad River — but not before it's treated at the Metropolitan Sewerage District's French Broad River Water Reclamation Facility.

Gravity, or sometimes pumps, sends the wastewater through a portion of the near 1,000 miles of sewer lines that comprise MSD's collection system. At the treatement plant, the wastewater first travels through bar screens that remove debris and solid waste, which is sent to the county landfill. The wastewater is then pumped to a process designed to remove grit and inorganic solids, which is sent to the county landfill as well.

The wastewater then goes through a series of rotating biological contactors, which is the true heart of the treatment process. After the RBCs, the wastewater is pumped to a clarification or settling tank to remove solids; these "biosolids" are then de-watered and incinerated onsite. In the final steps of the treatment process, the reclaimed water is disinfected via chlorination and then de-chlorinated before it is returned to the French Broad River.

According to MSD Director of Administration **Peter Weed,** the cost per million gallons of wastewater treated is $175 or 1,750 kwH.

So after all that work to get water to our homes and businesses and then treat what we put down the drain, it only makes sense to use every drop as efficiently as possible and minimize our impact. It is important to think about resource use in a holistic way — recognizing that everything consumed takes many other resources in its production and disposal. Just as it's been illustrated here that water conservation is in fact energy conservation too, energy conservation reduces water use.

Matt Siegel is director of the WNC Green Building Council. He can be reached at matt@wncgbc.org or (828) 254-1995.

BY BRENT BROWN

Large rainwater catchment systems explained

Size: 6,000-gallon underground system capturing rain water and HVAC condensation off 9,000 sq. ft. office
Use of water: Used for landscape irrigation
Where: Asheville Eye, Hendersonville, N.C.
System installed by: Water Solutions by Icenhowers Farm Inc.
photo by Rick Icenhower, owner, Water Solutions by Icenhower's Farm

Size: 5,000-gallon cistern (two 2,500 gallon tanks) located in basement capturing rain water from roof of 2,400 sq. ft. house
Use of water: Toilet flushing and landscape irrigation
Where: Mars Hill, Madison County, N.C.
System installed by: Blue Ridge Energy Systems
photo by Duncan McPherson, Samsel Architects, P.A.

Size: 2,000-gallon above-ground system
Use of water: Used as landscape irrigation for gardens
Where: Calvin Allen & Maria Fire Residence, Asheville, N.C.
System installed by: Cistern Sister
photo by Kathryn Cartledge Allen

Size: 3,400-gallon below-ground system
Use of water: Irrigation, especially grape vines
Where: Nery residence in Beaverdam, Asheville, N.C.
System installed by: A2Z Plumbing
photo by Miranda Efird, A2Z Plumbing

Efficient hot-water heating

by Amy Musser and Matthew Vande

Domestic hot water — used by showers, faucets, clothes washers and dishwashers — is the second largest energy-using system in most homes, after the heating and air-conditioning system. Efficient hot-water systems are often one of the shortest payback upgrades you can make to an existing home or to your plans for a new home. Even better, there is an efficient choice out there for every home and budget.

Solar hot-water systems

Most people are familiar with solar hot-water panels that can be used to harness the sun's energy for hot-water heating. When the house orientation allows for good southern exposure, this can be a highly efficient way to produce the majority of your domestic hot water. The typical sytem includes one or two solar collectors on the roof, a solar storage tank and a pump to circulate the solar fluid through the collectors.

Pros

- Low operating cost and carbon emissions
- Can augment space-heating systems
- Federal and state financial tax incentives can make this a quick payback item

Cons

- Larger storage tank required to hold water (usually 80 to 120 gallons)
- Backup system required for cloudy days or peak water usage
- Occasionally difficult to integrate into an existing home
- Must have un-shaded southern exposure available

Solar thermal systems: This one, with evacuated tubes, can provide 75 percent of a family's hot water needs.

PHOTO COURTESY OF SOLARPLUSGREEN.COM

Geothermal systems

A geothermal heat pump is primarily used as a central heating and/or cooling system that pumps heat to or from the ground. It uses the earth as a heat source (in the winter) or a heat sink (in the summer). Homes with geothermal systems have two options for generating hot water using their geothermal heat pumps.

The first is a device called a desuperheater that recovers heat from the air-conditioning process and uses it to pre-heat hot water. Desuperheaters don't make all of a home's hot water; they just preheat it to lower the home's energy use. Savings with these systems are largest in the summer. The second is a full-time geothermal unit that can make all of a home's hot water. These are about three to four times more efficient than a standard electric water heater.

Pros

- Once installed, extremely efficient way to heat water
- Fast payback for this option (as an add-on to geothermal system)
- Federal and state tax credits available to offset high installation cost

Cons

- High upfront cost to install new geothermal system
- Typically not cost-effective, unless geothermal HVAC is also installed

On-demand water-heating systems

Also called "instantaneous" or "tankless" water heaters, this type of system usually heats water with natural gas or propane, although electric models are also available. Since on-demand water heaters have no tank, there is no standby loss, and they can save energy in a house with low hot-water usage. Natural-gas models have lower expected operating costs and lower carbon emissions than standard electric tank hot-water heaters. Propane models have similar carbon emissions, but at recent propane rates there is little operating cost savings. Electric tankless water heaters are only slightly more efficient than regular electric tank-style heaters and should generally only be used for isolated low-use fixtures.

Pros

- May last longer than traditional tank (20 years vs. 10 to 15 years)
- Ideal for second homes since system shut-off is greatly simplified, yet provides endless hot water when house is in use for large gatherings

Cons

- Electric version can require larger electrical service
- May actually use more hot water (for example, someone takes a longer shower because they haven't run out of hot water!)
- Energy savings diminish with increased hot-water usage

Heat-pump water-heating systems

The latest development in efficient water heating is the heat-pump water heater. This often misunderstood device will most likely make conventional water heaters obsolete in the next 5 to10 years. Heat-pump water heaters use the same technology as a heat pump that heats and cools your home, but they're a completely independent device. Heat pump water heaters are much more efficient than conventional electric-resistance water heaters and have very low operating costs. They extract heat from the air in your home and transfer it to water in a storage tank, in much the same way that a traditional heat pump extracts heat from the outside air and transfers it to the inside for heating purposes.

Heat-pump water heaters have been available since the 1970s, so the technology is not new. The first models were available as "add-on" components that can be used to retrofit an existing tank water heater. These systems can still be purchased for about $700, and most people will need a plumber to help them install it and properly integrate it with their existing water tank. For new homes, or if your tank needs to be replaced, several major manufacturers now sell integrated units that come with their own tanks. These are sold for between $1,500 and $2,000, plus installation.

Water heater type	Two 40 sf solar panels with electric tank backup	One 40 sf solar panel with electric tank backup	Full-time geothermal heat water heating	Electric heat pump water heater	Tankless natural gas	Tankless propane	50 gallon electric storage tank	50 gallon natural gas storage tank	50 gallon propane storage tank
Efficiency factor	N/A	N/A	4.2	2.5	0.82	0.82	0.92	0.92	0.62
Est. annual operating cost	minimal	$75	$71	$114	$230	$230	$310	$304	$381
CO2 emissions Tons per year	minimal	0.5	0.5	0.5	0.8	0.8	2.1	1.0	1.0

Pros
• Highly efficient way to generate hot water (two to three times more efficient than standard electric tank water heaters)
• Produces a small amount of cool air, which can be used in other areas of the home
• Federal tax credit available

Cons
• Recommended for use with larger storage tanks (50 to 80 gallons)
• Slower recovery time (can be several hours, depending on size of tank)
• Slightly noisy, so best to locate in a mechanical or storage room
• Reverts to traditional electrical tank operation when demand exceeds supply
• High upfront cost (for now)

With all of these efficient options, we rarely recommend standard tank-style gas or electric water heaters for our clients. With alternatives having payback times of three to five years, it's difficult to justify buying one. However, if you do, check the yellow "Energy Guide" label and choose a model that is more efficient than the average.

The table below shows the estimated operating cost and CO2 emissions for several types of domestic hot-water systems. Simulations were performed using Asheville area utility rates, propane at $2 per gallon, and a generic 2,000-square-foot, 3-bedroom home. Although the gas and propane tank water heaters have about half the CO2 emissions, there is little or no operating cost savings over an electric tank water heater. The tankless gas and propane water heaters and the heat-pump water heater all have similar CO2 emissions (about 60 percent less than the electric tank), but they vary significantly in operating cost. Simple payback for the heat pump water heater with no tax credits is about five to eight years, but with the current tax credit, it is three to five years. The solar system has the lowest CO2 emissions and operating cost. With current tax credits, its payback could be as low at four years.

Currently, there are federal tax credits of 30 percent and state tax credits up to 35 percent (with some limits) available for solar hot-water systems. Most tankless gas water heaters and heat-pump water heaters are eligible for a federal tax credit of 30 percent of the cost — up to $1,500 — if installed in your principal residence. Since tax credits can only be used to offset taxes that you would have been required to pay, we recommend researching the rules and talking to your tax professional if your eligibility is not clear. The federal tax credits are summarized at the following Web site: http://www.energystar.gov/taxcredits.

Amy Musser and Matthew Vande are co-founders of Vandemusser Design, PLLC, an Asheville-area energy-efficiency consulting and home-energy-rating company. Musser is a licensed mechanical engineer, and Vande is a licensed architect. Both are certified home-energy raters. They can be reached at info@vandemusser.com or (828) 348-4723.

feature

Water paybacks

Savings are only a drop away

Water hogs? A few update can save water and money.

PHOTOS BY DAVID LEHLBACH OF PARALLEL RAIL PHOTOGRAPHY

by Matt Siegel

Basic assumptions

For ease of understanding, let's say water costs 1 cent/gallon. We are also assuming a two-person household, averaging five toilet flushes per person per day, one 10-minute shower per person per day, four loads of laundry per week and 1 minute of running the bath faucet per person per day. So for a family of four, you can cut these payback periods in half.

Note: None of these paybacks take into account the energy savings from reduced hot water use. Hot water costs an additional 1 cent per gallon to produce, thus making payback periods even shorter.

Water rates in Asheville and Buncombe County:
- Basic rate for water: $3.45/CCF (1 CCF = 748 gallons)
- Sewer treatment MSD: $3.51/CCF
- Total cost for a gallon of water: $6.96/CCF or $.009/gallon

Faucet aerator:
Assume the bath faucet is on 1 minute per person per day.

Standard faucet aerators use 2.2 gallons/minute, and low-flow aerators use as little as .5 gallons/minute with a net savings of .7 gallons/minute. Assuming two people use the faucet 1 minute each everyday, that's a savings of 1,250 gallons of water and $12.50 a year. With a cost of only $1, the payback period is four weeks.

Showerhead:
Assume one 10-minute shower per person per day.

Standard showerheads use 2.5 gallons/minute and low-flow showerheads use 1.75 gallons/minute with a net savings of .75 gallons/minute. Assuming two people take 10-minute showers each, that's a savings of 5,475 gallons of water and $54 a year. With a cost of $5, the payback period is five weeks.

Toilet:
Assume 5 flushes per person day per day.

Older toilets use 3.5 gallons/flush, and new standard toilets use 1.6 gallons/flush. Low-flow toilets use 1.28 gallons/flush. Net savings from installing a new low-flow toilet in place of an old toilet is 2.2 gallons/flush. Net savings for buying a low-flow versus a standard toilet is .3 gallons/flush. Assuming two people flush the toilet a total of 10 times a day, the savings from switching to a low-flow toilet from an old toilet is 8,030 gallons of water and $80 a year. Savings from buying a low-flow versus a standard toilet is 1,095 gallons of water and $11 a year. With a cost of as little as $110 for a low-flow version, the payback period for replacing an old toilet is 16 months. The payback for choosing a low-flow versus a standard toilet is immediate, since there is no cost difference.

Washing Machine:
Assume four loads per week for two people.

Standard washing machines use 33 gallons/load and front-loading Energy Star washing machines use 15 gallons/load with a net savings of 18 gallons/load. Assuming two people do four loads of laundry a week, that's a savings of 3,744 gallons of water and $37 a year. With the cost of front-loading washers being $300 more than standard machines, the payback period is eight years.

Source: USEPA consumer calculator spreadsheet.

Matt Siegel is director of the WNC Green Building Council. He can be reached at matt@wncgbc.org or (828) 254-1995.

GREENMEANS?

What do I like most about my home? Low maintenance, durability, but primarily, energy efficiency.

— Herman Lankford, homeowner

Closed crawlspaces

Reducing your energy use

Problems galore: Vented crawlspaces can lead to mold and moisture problems.

PHOTOS BY HOME ENERGY PARTNERS

by Maria Mauceri

Each year, tens of thousands of homes are built on crawlspace foundations in the Southeast. In most of these homes, the spaces are built with wall vents, which are supposed to reduce moisture problems — but recent research has shown this approach actually brings in more moisture than it lets out. Building scientists have consistently found that when warm, moist air (typical in humid climates) enters a crawlspace, it cools and significantly increases the relative humidity (RH).

High-moisture levels can cause many problems in homes, including:

- Mold or moisture damage in the crawlspace or living area
- Musty odors in the living area
- Condensation on air-conditioning ductwork or equipment
- Condensation on crawlspace insulation, water pipes or truss plates
- Buckled hardwood floors
- High humidity in the living area
- Insect infestations
- Rot in wooden framing members

Research by Advanced Energy indicates that a properly closed crawlspace system (also known as a sealed or unvented crawl system) — with no vents to the outside — can provide greatly improved moisture control when properly installed. Depending on climate, duct location and insulation placement, closed crawlspaces can also provide significant energy savings.

From 2001 to 2005, Advanced Energy conducted a study in North Carolina to test the theory that the closed crawlspace design really can solve moisture problems and save energy. The study compared three groups of homes with different crawlspace designs: one group of homes with wall-vented crawlspaces and two groups of homes with two different closed crawlspace designs. The study showed that RH in the wall-vented crawlspaces often exceeded 80 percent in the summer months. On the other hand, the RH in closed crawlspaces barely exceeded 60 percent and reduced energy consumption by 15 to 18 percent.

The results of the research supported a complete revision of the North Carolina Residential Code to allow closed crawlspaces and improve minimum requirements for vented crawlspaces.

In a more recent study, Advanced Energy showed that closed crawlspaces are a great moisture-control strategy and can reduce energy consumption in varying climates nationwide.

An increase in complaints and legal action related to mold growth in homes has made homeowners and builders more aware of the need to control moisture levels. More and more often, homeowners and builders are investing the additional time and money to install closed crawlspaces in both new and existing homes.

It is critical, however, that professionals interested in installing closed crawlspaces choose the right materials and tools and get the training necessary to ensure proper installation.

Recommended design components include:

- Moisture management
- Pest control
- Combustion safety
- Thermal insulation
- Fire safety
- Radon safety

Sealed is better: Closed crawlspaces are a great moisture-control strategy and can reduce energy consumption.

An Advanced Energy publication — *Closed Crawl Spaces: An Introduction to the Southeast* — features sample closed crawlspace designs and descriptions of each design component. Altogether, the design components presented are not definitive specifications, but they have proven their performance in real-world field tests. To ensure success, installers will likely adjust designs to accommodate local site conditions, code requirements, home design, construction processes and occupant needs.

The biggest challenge to getting a properly closed crawlspace is finding a qualified installer. Advanced Energy is developing a training curriculum that it plans to offer through electric utilities and other building groups. The cost for a closed crawlspace in new North Carolina homes is typically less than $2 per square foot. While the air quality and durability benefits alone can make this a worthwhile investment, an added benefit is that the energy savings may pay for the system well before the owners pay off the mortgage.

For more information about closed crawlspaces and Advanced Energy's study results, visit www.crawlspaces.org.

Advanced Energy is a Raleigh, N.C.-based nonprofit committed to a future in which energy needs are met at reasonable costs and with the least negative consequences. The organization continues to work collaboratively to demonstrate that industry, government and nonprofits can successfully work together to improve the environment and encourage the economy. For almost 30 years, Advanced Energy has created economic, environmental and societal benefits through innovative and market-based approaches to energy issues. For more information, visit www.advancedenergy.org.

GREENMEANS?

Green building means building for a purpose, for people, and for the planet, rather than simply for profit.

— Jody Guokas, owner, JAG Construction

feature

Financing for green building

Showin' you the money

by Matt Siegel

As if doing the right thing, increased financial security, improved health and lower utility bills weren't enough to drive you to implement green building, now cold hard cash is being thrown your way from every direction: Tax incentives, rebates and quick paybacks abound as the government, utilities and product manufacturers work to increase energy efficiency throughout the country. In recent history, there have never been more financial incentives available for green building, energy efficiency and renewable energy.

Tax incentives

Federal

Individuals

Energy efficiency

• 30-percent tax credit — up to $1,500 — for 2009 to 2010 toward purchasing energy-efficient appliances and fixtures, such as water heaters, furnaces, boilers, heat pumps, air conditioners, building insulation, windows, doors, roofs, biomass stoves and circulating fans used in a qualifying furnace.

Renewable energy

• Through the end of 2016, a 30-percent tax credit for solar water heat, photovoltaics, wind, fuel cells, geothermal heat pumps and other solar electric technologies with no caps.

• N.C. Green Power will pay a per kWh rate for electricity generated from a renewable resource that is fed onto the grid.

Businesses

Energy efficiency

• A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install 1) interior lighting; 2) building envelope; or 3) heating, cooling, ventilation or hot-water systems that reduce the building's total energy and power cost by 50 percent or more in comparison to a building meeting minimum requirements set by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2001. Deductions of $0.60 per square foot are available to owners of buildings in which individual lighting, building envelope or heating/cooling systems meet target levels that would reasonably contribute to an overall building savings of 50 percent if additional systems were installed. Available through the end of 2013.

Renewable energy

• A 30-percent tax credit is available for investing in solar water heat, solar space heat, solar-thermal electric, solar-thermal process heat, photovoltaics, wind, biomass, geothermal electric, fuel cells, geothermal heat pumps, Combined Heat and Power (CHP)/cogeneration, solar hybrid lighting, direct-use geothermal and microturbines. Available through the end of 2016.

• Accelerated depreciation (Modified Accelerated Cost Recovery System — MACRS) for eligible renewable energy technologies.

North Carolina
Individuals

Renewable energy:

• A 35-percent tax credit for passive-solar space heat, solar water heat, solar space heat, solar-thermal electric, photovoltaics, wind, biomass, hydroelectric, geothermal heat pumps, solar pool heating and daylighting. Available through the end of 2015. Caps vary by technology.

Businesses

Renewable energy

• A 35-percent tax credit for passive-solar space heat, solar water heat, solar space heat, solar-thermal electric, solar-thermal-process heat, photovoltaics, landfill gas, wind, biomass, hydroelectric, renewable transportation fuels, geothermal heat pumps, spent pulping liquor, direct-use geothermal, solar pool heating, daylighting, anaerobic digestion, ethanol, methanol and biodiesel. Available through the end of 2015. $2.5M cap for all technologies.

Utility incentives

In 2007, the North Carolina legislature passed a Renewable Energy Portfolio Standard, which requires utilities to increase their use of renewable energy. Utility providers are now creating impressive incentive programs to meet those requirements.

Progress Energy

Residential

• The SunSense program is piloting a $1,000 rebate program for solar thermal systems.

• The Home Energy Improvement Program will pay rebates for a variety of energy upgrades, including ductwork testing and sealing, attic insulation, HVAC replacement and maintenance, and new windows.

• The Home Advantage program will pay $400 to $1,000 for new ENERGY STAR-certified homes.

• A 5 percent discount on electric bills for all ENERGY STAR-certified homes.

Commercial

• The SunSense program will pay $.18/kWh for solar PV projects. Large solar thermal projects are paid $20/REC for metered thermal energy.

• The Energy Efficiency for Business Program offers rebates for everything from lighting replacement to energy modeling for LEED-NC in existing and new construction commercial buildings. Rebates can pay for up to 75 percent of project upfront costs.

Duke Energy

Residential

• The SmartSaver program offers $200 rebates for upgrades of HVAC equipment on existing homes and $300 for high-efficiency equipment in new homes.

• A 5-percent discount on electric bills for all ENERGY STAR-certified homes.

Commercial

• Commercial customers are eligible for rebates on upgrades of a wide variety of equipment, including but not limited to: lighting, HVAC, process equipment, pumps and motors.

PSNC

Residential

• Residential customers whose homes meet the EPA's ENERGY STAR for New Homes guidelines are eligible for PSNC's Residential Rate Schedule 102, which is a discount of $0.05 per therm.
• The company has implemented a $100 rebate for replacing older gas water heaters and furnaces with high-efficiency versions in residential buildings: www.psncenergy.com/rebate.

Commercial

• Commercial customers whose buildings meet LEED-NC certification are eligible for PSNC's Rate Schedule 127, which is a discount of $0.05 per therm.
• A $100 rebate for replacing older gas water heaters and furnaces with high-efficiency versions in commercial buildings: www.psncenergy.com/rebate.

Local government incentives

City of Asheville

• A $100 permit-fee rebate for NC HealthyBuilt Homes certification; $100 for ENERGY STAR certification.
• A $50 permit-fee rebate for each of the following: geothermal heat pump, solar energy system, wind energy system and stormwater/graywater collection device to be used for irrigation.
• 50-percent rebate for plan review fees for commercial projects seeking LEED certification.

Town of Black Mountain

• A $500 permit fee rebate for buildings certified under the NC HealthyBuilt Homes or LEED programs.

For detailed information on financial incentives, visit www.dsireusa.org.

Matt Siegel is director of the WNC Green Building Council. He can be reached at matt@wncgbc.org or at (828) 254-1995.

TECHNOLOGIES EXPLAINED

How does hydropower and microhydro work?
Hydropower is a form of alternative energy derived from flowing water. Smaller scale hydropower systems that generate up to 100kW hours of electricity are considered microhydro generators. Microhydro systems usually utilize run-of-the-water systems, instead of large dams or holding tanks, which are commonly associated with larger hydropower projects. Water is diverted into a channel and to a turbine or water wheel. The moving water turns the turbine or water wheel, which turns the shaft that the wheel is attached to. This turning creates energy that can power an alternator or generator to create electricity. Microhydro is a great option if you have enough drop and flow, because the water is constantly moving and not as dependent on weather conditions to provide electricity.
— E.K.

AmeriCorps Recovery Project Energize in WNC

Good works: These volunteers are sealing the windows to prevent drafts and save energy

PHOTOS COURTESY OF AMERICORPS RECOVERY PROJECT ENERGIZE

by Elizabeth Koenig

What is AmeriCorps?

A federal program, AmeriCorps is intended to improve the country though dedicated volunteer service. It formally began in 1993 when President Bill Clinton signed the National and Community Service Trust Act.

Much like Peace Corps members, AmeriCorps volunteers commit to a term of service (usually one or two years) and work with nonprofit organizations focused on addressing critical needs in communities across the United States. Volunteers receive a stipend and are required to complete a designated number of service hours during their AmeriCorps term. If all obligations are met in that time, the volunteer receives an education award to be used for school loans or future academic tuition.

Since its inception in 1993, AmeriCorps has grown from a corps of 20,000 members to — following legislation passed in 2009 to expand the program — 250,000 positions each year. There are currently about 400 AmeriCorps members working across the state of North Carolina.

Twelve of them work in Western North Carolina, where they work with the WNC Green Building Council, North Carolina Interfaith Power and Light, Green Opportunities, Community Action Opportunities, Carolina Mountain Land Conservancy, Mountain Projects Inc., and Mountain Valleys Resource Conservation and Development.

AmeriCorps Recovery Project Energize has the goal of weatherizing 300 critical-need homes in WNC over an 11-month service period. To reach this goal, program members work to educate community residents about weatherization and weatherization-assistance programs, while also actually weatherizing homes. Homeowners get the work done for free, but they must qualify based on income.

What is weatherization?

Weatherization, sometimes known as "winterizing," involves taking measures to make a house more efficient in its energy use. The energy it takes to heat or cool a house is significant and can be reduced through air sealing (sealing up air leaks in a house), adding insulation, duct sealing, light-bulb replacement (with CFLs), and sometimes even heating system and refrigerator replacement. An energy audit is performed with a visual inspection and blower-door test to determine which measures will be most beneficial to the household to maintain or improve the indoor air quality.

These measures can save up to 32 percent on a home's energy bills, according to the U.S. Department of Energy. This savings is direct to the homeowner and can kick in as soon as the work is completed. Many pre-1980 homes were built before energy efficiency was a consideration. These homes especially need to be retrofitted to today's efficiency standards.

Free weatherization services have been available since 1976 for qualifying homeowners looking to cut heating costs, with the federal government providing $225 million in 2008. Through the American Recovery and Reinvestment Act of 2009, $5 billion has been allocated toward the project over three years.

The increase in federal funding is due, in part, to the cost-effectiveness of the program. With more money, more weatherization jobs will be created. Homeowners who receive the service will save energy, lower their bills and benefit the environment at the same time.

What's it mean for Asheville?

In conjunction with the AmeriCorps Recovery Project Energize program, the WNCGBC and Green Opportunities received a Community Development Block Grant from the city of Asheville's Community Development Division. The grant is dedicated to weatherizing 60 homes in the "Weed and Seed" area around Burton Street in West Asheville. Part of the project mission is "to improve quality of life by 'weeding' out crime and 'seeding' positive community change through resident leadership and creation of sustainable partnerships."

Revitalization happens through four basic components: law enforcement; community policing; prevention, intervention and treatment; and neighborhood restoration. In West Asheville, identifying community leaders and creating programs to identify youth leaders is the name of the game. Green Opportunities is focusing on the neighborhood restoration through education and outreach in the community.

The grant money funds two part-time Green Opportunities members and a full-time coordinator shared by Green Opportunities and Community Action Opportunities.

The WNCGBC and GO work with Community Action Opportunities, the organization that has been in charge of weatherization services in Buncombe County since 1970. Green Opportunities members learn about weatherization and building science through hands-on work.

This project seeks to not only conserve energy and save money in a specific neighborhood, but it also is getting the community involved

GO green: Green Opportunities members work on air and duct-sealing techniques, which save energy and cut utility bills for low-income homeowners.

and educated about energy conservation. AmeriCorps Recovery Project Energize members collaborated with Asheville GO and organized a volunteer event on Oct. 24, 2009, to weatherize five homes in this neighborhood. Both organizations are actively educating homeowners and recruiting qualifying homes for the program with the hope to improve homes and ease the financial burden of excess electric bills.

Through these initiatives, weatherization will help to fill an important community need and make an important and lasting difference in the lives of many people in WNC.

Elizabeth Koenig is an Americorps Recovery Project Energize member with the WNCGBC through May of 2010. She may be reached at (828) 254-1995 or elizabeth@wncgbc.org.

Certification programs

Finding the green label that's right for you

by Maggie Leslie

Green labels for your new home

When shopping for a new green home, there are many local and national labels out there. How do you know which is the best?

First, it is important to identify why you are interested in a green label for the home. As a homebuyer or builder, is it because you are interested in the educational opportunities offered through the programs, the marketing or resale value, or is it the third-party inspection and quality assurance offered? Is there a specific attribute, such as indoor air quality or water savings, that is most important to you?

Some of the programs have a specific focus, while others encompass all aspects of green construction. Some are national; others are regional. They vary in price, scope and ease of execution. How are you supposed to decide?

It is already difficult enough to choose what green features to incorporate, much less what program to certify them through. Any certified home must meet certain construction standards and should result in energy efficiency, healthy indoor air and lower operating costs. The most important aspect of any certification program, however, is that it is third-party inspected to make sure that the green components are actually in place and installed correctly.

Review the information below, then use the list of certified home energy raters (the third-party inspectors for green homes) in this directory's "Listings" to identify a rater. They will be able to guide you through the choices and help make sure your home is all it is marketed to be.

ENERGY STAR Homes

Who runs its: The Environmental Protection Agency and a Home Energy Rater

What it does: A third-party certification for energy-efficient homes. Each house is built to be at least 15 percent more energy efficient than if the same home were built to code. This standard is achieved through a combination of well-installed and efficient insulation, HVAC equipment, lighting, water heaters and windows.

How it works: Contact a Home Energy Rater (refer to the directory's "Listings" or visit EnergyStar.gov) to sign up. Each home is first computer-modeled to determine its energy usage, then inspected by a nationally trained Home Energy Rater to ensure the home will perform as planned.

Special features: ENERGY STAR is the baseline standard for many green-building programs, including NC HealthyBuilt Homes and LEED-Homes.

Incentives: Progress Energy and Duke Energy currently offer utility-rate discounts for certified ENERGY STAR homes. Additionally, Progress Energy offers a $400 rebate for any certified homes that have a 14 SEER or greater heat pump. The city of Asheville also offers an additional $100 permit-fee rebate for ENERGY STAR homes.

More info: www.EnergyStar.gov

The NC HealthyBuilt Homes Program

Who: A collaboration between the N.C. State Energy Office, the N.C. Solar Center and locally administered by the WNC Green Building Council. Homes are inspected by locally certified, third-party green raters

What: A statewide, third-party-inspected green-building program. Every HealthyBuilt home is also required to be a certified ENERGY STAR home, but the program goes above and beyond energy efficiency. NC HealthyBuilt homes start with a menu of items, divided into seven sections: site; water; building envelope; comfort systems; appliances, lighting and renewables; indoor air quality; and materials. Each home must attain a certain number of points in each section to qualify for the certification. In this way, builders are required to approach and improve all aspects of environmentally friendly construction. The more points accrued, the higher the level of certification: certified, silver, gold or platinum. These homes are then inspected to ensure each goal is actually achieved.

How: Contact the WNCGBC to review your checklist and register the home, then work with a locally approved green rater to inspect the home.

Special features: The program is locally administered and is geared to address the local climate, terrain and needs of the WNC area.

Incentives: Rebates for permit fees —$100 from the City of Asheville and $500 in the town of Black Mountain

More info: www.HealthyBuiltAsheville.org

Leadership in Energy and Environmental Design (LEED) for Homes

Who: The U.S. Green Building Council, provided locally by the WNC Green Building Council. Homes are inspected by nationally approved green raters

What: A national, green-building standard, inspected by a third party. ENERGY STAR performance is a baseline, with minimum requirements for all aspects of green construction similar to those described in NC HealthyBuilt Homes. There are more prerequisites than for HealthyBuilt, but there aren't as many minimum point requirements per section. But the larger the home, the more points that are required. The more points accrued, the higher the level achieved: certified, silver, gold or platinum.

How: Contact the WNC Green Building Council for a list of approved LEED-H Green Raters and then register the home with the U.S. Green Building Council.

Special features: A national program with market recognition of the LEED brand. LEED aims to be the nation's top 25 percent builders

Incentives: Rebates for permit fees —$100 from the City of Asheville and $500 in the town of Black Mountain

More info: http://greenhomeguide.com/program/leed-for-homes

National Green Building Standard

Who: National Association of Home Builders and Green Verifiers

What: A national program facilitated by the National Association of Home Builders in collaboration with the International Code Council that ensures a code-enforceable standard for green building The program contains six sections with many mandatory items and is a point system similar to NC HealthyBuilt and LEED. However, in order to achieve higher levels (bronze, silver, gold and emerald), the home has to

reach higher levels of efficiency. Larger houses also require more points.
How: Visit the NAHB Web site, review the checklist, and contact a verifier for inspections.
Special features: American National Standards Institute (ANSI)-approved standard, code driven for ease of local implementation and aims to reach the mainstream
Incentives: None at this time
More info: www.nahbgreen.org/Guidelines/default.aspx

Environments for Living (EFL)

Who: Masco Corporation, inspected by certified raters
What: A national certification program for high-performance homes. The program is founded on building-science principles that focus on energy efficiency, ventilation and combustion safety. Unlike other green-building programs, there are no point requirements. The checklist is prescriptive, meaning each item is mandatory, though there are multiple levels of achievement. There is now a "Green" level, with expanded requirements for resource efficiency and air quality. The signature feature of EFL is its guarantee for energy use and thermal comfort: If the home doesn't perform as intended, Masco will pay the difference and will assist with investigating the source of the problem. The program has historically been geared to the production-home market, but is currently piloting the program for custom homes.
How: Visit the Web site listed below to request more information. Locally, contact VandeMusser Design.
Special features: A national program with a performance guarantee
Incentives: None at this time
More info: www.environmentsforliving.com

SystemVision

Who: Advanced Energy Corporation
What: A national certification program for high-performance homes, but with a focus on affordable housing. Similar to EFL (and with the same origin), SystemVision focuses on building-science principles, with a prescriptive checklist of mandatory items for energy efficiency and indoor air quality. SystemVision, however, is focused on affordable homes and offers an energy-use and thermal-comfort guarantee to those who need it the most. The program is third-party inspected by HERS raters and approved through Advanced Energy Corporation. All homes are also ENERGY STAR certified.
How: Contact Advanced Energy and the N.C. Housing Finance Agency.
Special features: Guarantees the heating and cooling costs of affordable homes, typically at less than $30 per month
Incentives: The N.C. Housing Finance Agency offers a rebate of $4,000 to nonprofit developers of affordable housing, with an additional $1,000 rebate if the home is also certified through NC HealthyBuilt Homes or another approved green-building program.
More info: www.nchfa.com/Nonprofits/HPsystemvision.aspx

Indoor Air Plus (IAP)

Who: The Environmental Protection Agency though certified HERS raters
What: A national program focusing on indoor air quality. The IAP checklist is a prescriptive checklist of mandatory items contributing to healthier indoor air. The program is single level and covers HVAC, moisture control, combustion safety, pest management, radon and building materials. IAP Homes must also certify as ENERGY STAR to participate.
How: Contact your HERS rater, and download the checklist from the link below.
Special features: Focuses specifically on air quality
Incentives: None at this time
More info: www.epa.gov/indoorairplus/building_professionals.html

Water Sense

Who: The Environmental Protection Agency through certified HERS raters
What: A new national program focusing on water efficiency. The WaterSense checklist is a prescriptive checklist of mandatory items. The program is single level and covers indoor water use, including plumbing, plumbing fixtures and fittings, appliances, other water-using equipment and outdoor water use, including landscape design. Locally, Nappier and Turner Construction was one of seven builders in the country that participated in the pilot program prior to its launch in December 2009.
How: Sign an EPA partnership agreement and contact a licensed WaterSense Certification Provider.
Special features: Focuses specifically on water efficiency
Incentives: None at this time
More info: http://epa.gov/watersense/pp/new_homes.htm

Passive House

Who: The Passive House Institute
What: A home standard developed in Germany and focused on high performance and super insulation. Passive Houses are designed to have a maximum source energy use for all purposes of 11.1 kWh per square foot, thus

performance and super insulation. Passive Houses are designed to have a maximum source energy use for all purposes of 11.1 kWh per square foot, thus the home can be heated and cooled using a mechanical ventilation system. In order to accomplish this, the standard requires very low levels of air leakage (no greater than 0.60 AC/H @ 50 Pascals), very high levels of insulation and windows with a very low U-factor. The standard is not a typical certification program with a prescriptive list of requirements; rather, the standard focuses the design of the home on a final performance goal.
How: Visit the Web site listed below or contact local Certified Passive House Consultants at The Nauhaus Institute: info@thenauhaus.com.
Special features: Comfort is improved through increased mean radiant surface temperatures. Super insulation and air-sealing techniques reduce energy use by 70 to 80 percent without active renewable energy systems, making the shift to a net-zero, carbon-neutral home much more economical.
Incentives: None at this time
More info: www.passivehouse.us/passiveHouse/PHIUSHome.html

WNC Sustainable Communities

Who: WNC Green Building Council
What: A certification program for entire communities in Western North Carolina. Currently in the pilot phase, the program certifies the design and construction of entire developments to encourage environmentally sensitive development and discourage greenwashing. The program has some mandatory items, with a checklist of items eligible for points in four sections: Context; Environment; Site and Design; Construction and Resource Efficiency; and Innovation. ENERGY STAR is a minimum for most home construction, and third-party review in each development phase is required.
How: Currently in the pilot phase. Contact the WNCGBC and review the checklist with their technical experts.
Special features: Focuses on entire communities
Incentives: None at this time
More info: www.wncgbc.org

REGREEN

Who: The USGBC and American Society of Interior Designers (ASID)
What: Remodeling guidelines for residential renovation and remodeling. REGREEN is not a certification program; it's a set of guidelines addressing the major elements of any green renovation project. These guidelines include resources on product selection, technologies and building systems for the site, water efficiency, energy and atmosphere, material and resources, and indoor environmental quality. The guidelines can be applied to everything from a small kitchen remodel to a gut rehab for the do-it yourselfer or the design professional. REGREEN does offer a certificate program for trained professionals, but it applies to people not projects.
How: Review the guidelines and resources available on their Web site.
Special features: Guidelines for remodel projects
Incentives: None at this time
More info: www.regreenprogram.org

For additional information about the certification programs, visit www.wncgbc.org or www.greenbuildingadvisor.com/ratings.

Maggie Leslie is program director of the WNC Green Building Council. She can be reached at maggie@wncgbc.org or at (828) 254-1995.

Smaller, smarter, greener

Designing homes for the new economy

by Scott Huebner, AIA

In response to a slower economy, many homeowners are finding ways to stretch dollars, trim excess spending and be resourceful with what they already have. The economic crisis is also having an effect on new home design and construction. Historically, the average square footage of single-family homes has been on a steady increase year after year in spite of the steady decline in family size.

But for the first time since the 1950s, home size has dropped significantly since last year. While proponents of green design have long proclaimed that smaller homes are greener homes, their message is finally finding an audience.

So what is this new paradigm all about? Savvy homeowners are not simply trading in their larger houses for smaller ones, they are demanding more from architects and designers, asking them to create homes that perform all of the tasks of their larger counterparts, but in a smaller package. Much the way that larger SUVs have lost their appeal in favor of smaller, more fuel-efficient vehicles, homeowners are seeking stylish, well-built homes that cost less to construct and operate, while still providing ample space and a healthy and comfortable indoor environment.

Smart design: Through good design, the size of a home's footprint can be smaller without reducing amenities.
PHOTO BY CHRISTOPHER ERMIDES, COURTESY OF SAMSEL ARCHITECTS

Using a skilled architect can help homeowners realize their dreams of a finely crafted, well-designed home that meets their unique and personal needs without unnecessary square footage. An architect can also guarantee that your home meets the requirements of ENERGY STAR, LEED or the NC HealthyBuilt Homes program. These programs are the best tools to ensure that your home is well-built, energy efficient and healthier for you and the environment. Record participation in these programs in 2008 and 2009 — despite one of the deepest recessions in U.S. history — points to a real shift in consumer opinion that green building is no longer a pricey, boutique market, but one that saves money, adds value and offers a higher quality of living.

For a home to be smarter, it must break the mold of traditional homes that have many highly specific spaces that only get occasional use. These rooms are expensive to build and require full-time heating, cooling and maintenance. Many of the smaller homes we design have spaces that are not specific to a singular use but can accommodate a variety of uses while still functioning as a coherent space. This allows the home to live larger than its square footage implies.

A few design techniques that help smaller homes live larger:
- Multifunction or flex spaces that can accommodate several uses
- Main living spaces that connect directly to outdoor spaces
- Planning for future additions so a house can grow as a family grows
- Daylight basements or bonus rooms to accommodate space needs

Smaller homes are not only more practical, they permit homeowners to reapportion those saved dollars (normally spent on under-utilized square footage) for upgrading to better quality finishes and higher efficiency equipment, appliances and lighting. These items get daily use and afford homeowners a greater return on their investment with lower operational costs.

Smarter and greener homes also take advantage of newer or time-tested technology to increase comfort while saving energy. Zoned heating, ventilation and air conditioning systems and programmable thermostats allow the user to more efficiently control and tailor the comfort of the house to meet the needs of its occupants.

Tremendous strides in lighting technology have brought low-voltage halogen, fluorescent and LED lighting to residential markets. Long used in commercial settings for their cost-savings properties, these fixtures now provide the convenience of dimming, long life, natural color rendition and lower costs more comparable to the traditional incandescent.

A green home cannot depend solely on technology, renewable energy sources or more energy-efficient products to compensate for an oversized home. Overcoming our desire to live in larger homes may be the greatest obstacle to achieving a sustainable future. However, a marked shift in our views on how we live and view our planet and a faltering economy may provide the perfect storm to get us there.

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Green building in photos

by Margaret Williams

Green building comes in many shapes and sizes, from the smallest details to the largest. It often starts with considering how the structure will relate to its surroundings, how it will be placed on the land to take advantage of natural features (such as sunlight) and how it will complement the neighborhood.

There are choices at every step, such as choosing local stone — including a massive rock or two found on the property. There are high-performance windows that keep the cold winter air out or the cool summer air conditioning in ... yet also give a view of the natural landscape. And of course there are solar panels.

Here's a sampling of a few green-built features and homes that caught our eye.

Margaret Williams is an editor for Mountain Xpress. *She can be reached at mvwilliams@mountainx.com or (828) 251-1333, ext 152.*

1. photo courtesy of Sundance Power Systems 2. photo courtesy of Home Energy Partners 3. photo by Margaret Williams 4. photo courtesy of Asheville Treecyclers 5. photo by Margaret Williams 6. photo courtesy of SPG Architects 7. photo courtesy of Springtime Homes 8. photo courtesy of SPG Architects 9. photo courtesy of Sundance Power Systems 10. photo courtesy of Appalachian Design

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Pervious pavement

Worth considering on your next project

by G. Carroll Hughes, AIA

For your next project, consider installing pervious pavement. Recent test results gathered from various sites, such as universities, prove the validity of using pervious pavement in our area. Since Western North Carolina is considered a cold climate, there are many local concerns and misconceptions about the applicability of pervious pavements in freeze-thaw environments. As a practicing architect, I understand those concerns.

Beneficial surface: This pervious concrete parking surface at Western Carolina Retinal improves safety, reduces runoff and is a cost-efficient approach to treating water quality.

PHOTO BY G. CARROLL HUGHES

Before we look at some of the new research data, I want to acknowledge that I am also an avid trout fisherman, and as such, I am very concerned about the stormwater runoff from parking lots that enters and pollutes our streams. There are petroleum products, asbestos from brake linings and other automobile pollutants that are washed into detention ponds and underground retention piping under parking lots. Many of these pollutants ultimately wash into our municipal storm piping systems and are discharged in our waterways.

Stormwater management is a very valid and often code-required goal for projects. When land costs are low, open stormwater detention pond areas are the often-chosen design. However, when the availability of land is scarce and land costs have risen, underground retention piping designs are typical solutions. Pervious pavements are not commonly accepted solutions for stormwater management in our region due to the misconception of incompatibility with freezing temperatures, the high initial cost, and the fact that the installation requires a higher level of technical expertise.

Municipalities and states are changing because of federal mandates; therefore, traditional approaches are changing and pervious pavements are able to meet those new criteria. In addition to all of the other benefits of pervious pavements, test results predict that they will last more than 30 years, versus an average service life of 12 to 15 years for standard pavements.

There has been significant research done on the practical applications of pervious paving in cold climates at the University of New Hampshire Stormwater Center in Durham, N.H. Over the last few years, test sites of various Low Impact Development (LID) solutions, including pervious asphalt and pervious concrete, have been installed and evaluated. Both pervious types have been reported to have performed well, even under sub-freezing temperature cycles.

The following lists attempt to summarize and compare some of the data from this and other recent research conducted, specifically, on pervious concrete and pervious asphalt pavements.

Pervious Asphalt Pavement	Pervious Concrete Pavement
• Mix production is more difficult	• Simple to produce
• Easier to place	• Trickier to install
• Allows non-certified installers	• Requires certified installers
• Absorbs more heat, thus less de-icing required	• Absorbs less heat, thus more de-icing required
• Absorbs more heat, thus high urban heat island effect	• Absorbs less heat, thus low urban heat island effect
• Performs better in winter	• Performs less well in winter
• More nighttime lighting required	• Less nighttime lighting required

It is common knowledge in the design community that non-point source pollution is the primary problem with unfiltered stormwater runoff. Thus, there are incentives for using pervious pavement. Following are some valid reasons:

- Lower winter maintenance (i.e., sand, plowing, salting)
- To meet EPA requirements
- Public health (i.e., fewer ponds or wetlands)
- These are Low Impact Development (LID) systems
- Safety (less standing water to freeze)
- Reduction or elimination of retention/detention areas
- Recharge local aquifers
- Twice the service life of regular pavements
- Reduced freeze-thaw susceptibility
- Greater load bearing capacity
- Cost-efficient approach to treating water quality
- Efficient approach to reducing the volume of runoff

Pervious concrete pavement was installed at a medical facility in Asheville in 2000. The parking area is 22,000 square feet of 6-inch design mix in the parking areas and 7-inch in the heavy traffic lane. The maintenance is low, there is no sign of raveling, and the performance and appearance have not diminished.

Lessons that were learned on this project:

- High quality concrete products must be used in the design mix
- Proper design mix required
- Proper sub-base required
- Proper placement required

• Voids must be 20 percent to 35 percent
• Thickness can vary depending on the traffic loads
• Can accommodate approximately 10 times the amount of runoff in a 100-year storm
• Igloo effect (sub-base warms the surfaces above)
• If designed and installed correctly, pervious concrete can last 25 to 40 years, even in cold environments

Before your next paving project, educate yourself on the options and consider the use of pervious pavement. Like most products, the skill of the installation crew is the key to success.

G. Carroll Hughes is a practicing architect and CEO of Spaceplan Architecture, Interiors & Planning. He is also managing partner of Kestrel Construction Company and Moisture ID, a building investigation and diagnostic firm. Mr. Hughes is a member of the American Institute of Architects, the National Academy of Forensic Engineers, ASHRAE, International Code Council and past president of the Portland Cement Pervious Association. He resides in Asheville, N.C., and may be reached at (828) 252-9649.

Checklists

What makes a product green?

Recycled: This split walnut log comes from a storm-downed urban tree.

PHOTO COURTESY OF ASHEVILLE TREECYCLERS

by Victoria Schomer and Penny Bonda

An important tool in the effort to build greener buildings and live greener lives is the selection of products that were made using environmentally friendly processes and are used in environmentally friendly ways.

Green products are available for just about any daily need, and the ways they are green are many and varied: They are energy or water efficient; they use healthy, nontoxic materials; they are made from recycled or renewable sources; they make current products you use more efficient or more durable; and they are recyclable or biodegradable, among many other things.

But among all the truly green products comes the risk of "greenwashing;" that is, products that are advertised as green without truly offering environmental or health benefits. The checklist below — and directories on the next page — will help you sort through the claims and find the products that best meet your needs.

Manufacturer commitment to sustainability

☑ Is there a written, working environmental policy in place? Is it easy to find on their Web site or product literature?

☐ Does this policy strive to make important improvements in manufacturing, reducing and reusing first, then recycling?

☐ Do they comply with their industry's voluntary testing programs?

Examine the product's composition

☑ What are the raw materials used to create the product?

☐ Where did the materials come from?

☐ Did the materials come from renewable resources? Is the manufacturing process energy efficient?

☐ Does the manufacturing process release harmful substances?

☐ Are adhesives needed to make the product viable? What are they using?

☐ Are coatings or finishes needed to make the product viable?

☐ What are they using?

Examine other aspects of the product

☑ Does the product nurture the health and well-being of its occupants?

☐ Does the product do the job well?

☐ How much energy does it use?

☐ Does the product release VOCs? At what rate?

☐ How is the product packaged and transported?

☐ How is the product installed and maintained?

☐ Does it have a color or texture that can lead to reduced lighting energy or an expanded range of thermal comfort conditions?

☐ Can the product be maintained in a benign manner?

☐ Using safe cleaning products?

Examine strategies for disposal

☑ Is the product durable? Biodegradable? Recyclable?

☐ Can the parts be separated for recycling?

☐ Can it be made into something else?

☐ Can the product be returned to its manufacturer at the end of its useful life?

Cost considerations

☑ What is the price range for the product?

☐ Does the manufacturer provide life cycle cost analysis on this product?

Directories

Note: Inclusion or exclusion of any product in these directories does not represent endorsement by ASID or the U.S. Green Building Council.

GreenSpec Directory: The online GreenSpec Directory lists product descriptions for more than 2,100 environmentally preferable products. Products are chosen to be listed by BuildingGreen editors. They do not charge for listings or sell ads.

Green Building Pages: Green Building Pages is an online sustainable design and decision-making tool for building industry professionals and environmentally and socially responsible consumers.

Green2Green: Green2Green.org features comprehensive information regarding green building products, materials and practices. The site offers side-by-side comparisons of products using a variety of environmental, technical and economic criteria.

Oikos: Oikos is a World Wide Web site devoted to serving professionals whose work promotes sustainable design and construction.

The Green Guide: National Geographic's Green Guide offers staff-written reviews of a host of products, ranging from appliances, home furnishings and home-improvement products to personal care and pet supplies.

Good To Be Green: Good To Be Green is a directory of green-building products, sustainable-building materials and green-building service providers. Products must: be made out of recycled materials; ensure a low environmental impact during the construction, operation and/or demolition of the building; conserve natural resources like energy, wood and water; and improve air quality.

For more information, visit www.regreenprogram.org.

Developed by Victoria Schomer, ASID and owner of Green Built Environments, with additional contributions from Penny Bonda, FASID. Find out more about Green Built Environments at www.greenbuilt-e.com.

Installing insulation the right way

Stacked: Various types of insulation are available for green building.

PHOTO BY JONATHAN WELCH

by Maggie Leslie

There are many types of insulation. The most common type is batt, or blanket-type insulation (typically fiberglass). This is the least expensive but requires careful installation to ensure 100-percent coverage. Blown types, such as fiberglass, cellulose (made from recycled newspaper) and foams are more easily installed, and each one does a good job of filling in gaps, cracks and areas around pipes and wiring. Foams have an added benefit: They air seal all the gaps and cracks in the walls for more of an airtight outcome. Below is an insulation installation checklist.

☑ Insulation is installed to be in full contact with the air barrier (the Sheetrock to the inside and the sheathing to the outside). If the insulation is not encapsulated by a rigid material on all six sides, it will not insulate properly.

☐ Insulation is installed to fill 100 percent of every cavity.

☐ If batts are installed, the batt is cut to fit around all plumbing, heating and electrical penetrations and other obstacles. It is split to go behind and in front of wires and plumbing. This is done in such a way as to fill all cavity spaces and gaps, while *not* compressing the insulation.

☐ The space behind electrical boxes is fully sealed and insulated.

☐ If faced (Kraft or paper) batts are used in walls or cathedral ceilings, the flanges are stapled to the face of the studs or rafters, not the side of the surface facing into the cavity (this is known as inset stapling).

☐ Attic insulation extends all of the way to the exterior edge of the top plate of the wall below without compression. Roof-framing details, such as raised-heel trusses or oversized trusses, must allow for this.

☐ Insulation baffles are installed to prevent overblow into soffits and to prevent wind-washing through the insulation. This means that baffle height is no less than the thickness of the insulation.

☐ Attic-access openings (hatches or pull-down stairs) are insulated to at least R-30 and weather-stripped to prevent air movement between the attic and the living space. The insulation is glued or stapled to prevent misalignment. This is a great application for rigid foam.

☐ Floor insulation is in continuous contact with the subfloor above. It should provide continuous coverage, with no compression of the insulation and with no gaps. Batt insulation is cut to fit around pipes, blocking and bridging and other obstacles, so as to provide the full R-value in all spaces (the measure of how well your insulation resists heat flow).

☐ Band joists are insulated to at least the level of exterior walls and cover the entire band-joist area.

☐ Walls between conditioned space and attic space, such as knee walls in bonus rooms, have a rigid material on the attic side, preferably rigid-foam insulation, which will prevent air flow through the wall cavity and allow the R-value of the wall insulation to perform as intended. This rigid material is sealed with caulk or spray foam at all connections to the framing.

☐ Single-ply headers are used where possible to allow for insulating headers above windows and doors. Headers are insulated by using rigid foam sheathing as a spacer instead of plywood or oriented strand board, either between or on one side of double headers.

☐ Interior/exterior wall intersections are framed using ladder T-walls in order to maximize the area of insulation on the exterior wall.

☐ Outside and inside corners: Two-stud corners or "California" corners are used to decrease lumber use and increase insulation levels, compared to typical practice. Wood nailers and/or drywall clips are used to ease the installation of exterior and interior finishes.

Sources for this checklist include Advanced Energy System Vision Guidelines, Southface Energy Institute Technical Bulletins, HealthyBuilt Homes program guidelines and Energy Star guidelines for homes and indoor quality.

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Properties of Common Insulation Types

Insulation Type	Installation Method	R Value/ In	Raw Materials	Pollution from Manufacturer	IAQ Impacts	Air Barrier	Comments
Cellulose	loose fill/blown in, dense pack, wet spray	3-4.2	recycled newspaper, borates and ammonium sulfate	negligible, virtually no waste during install	fibers and chemicals can be irritants	no	high recycled content, low embodied energy, common for retrofit in existing walls
Fiberglass	batts, blown in	2.5-4	silica, sand, borax, phenol formaldehyde, sulfuric	energy use during manufacture, formaldehyde emissions, no waste during install of blown in	fibers and chemicals can be irritants	no	some recycled content, some formaldehyde free products are available
Cotton	batts	3-3.7	cotton and polyester mill scraps	negligible	considered very safe	no	
Open Cell Spray Polyurethane Foam	sprayed in	3.4-4.5	fossil fuels, water based blowing agent	energy use during manufacture, waste during install, less material use per volume than closed cell	toxic during installation, considered safe once cured	yes	expands to fill cavity and create an air tight wall, some products available with 20% agricultural based oils to offset fossil fuels
Closed Cell Spray Polyurethane Foam	sprayed in	5.5-7	fossil fuels, HFC-245fa blowing agent	energy use during manufacture, waste during install	toxic during installation, considered safe once cured	yes	expands to fill cavity and create an air tight wall, some products available with 20% agricultural based oils to offset fossil fuels, considered a vapor barrier
Air Krete	spray in	3.9	magnesium oxide from sea water, ceramic talc is mined	negligible, ceramic talc is mined	considered very safe	yes	highly fire-resistant, non-expansive "Natural mineral"
Polyisocyanurate Foam	foil faced rigid board	6-6.5	fossil fuels, pentane blowing agent, flame retardant	energy use during manufacture	negligible	yes	non-HCFC blowing agent
Extruded Polystyrene (xps)	rigid board	5	fossil fuels, HCFC blowing agent, flame retardant	energy use during manufacture, ozone depletion	potential release of styrene monomer (a carcinogen)	yes	last remaining insulation with ozone depleting blowing agent
Expanded Polystyrene (eps)	rigid board	3.6-4.4	fossil fuels, pentane blowing agent	energy use during manufacture, pentane emissions contribute to smog	potential release of styrene monomer (a carcinogen)	yes	white foam board- same as used for styrofoam cups

Adapted from Environmental Building News: Insulation Materials – Summary of Environmental and Health Considerations, January 1, 2005

Indoor air quality

Fresh system: An Energy Recovery Ventilator is an efficient way to provide fresh, prefiltered air throughout the home.

PHOTO BY MARCUS RENNER

by Maggie Leslie

Ensuring healthy indoor air quality in a home starts with the very foundation. Many simple building techniques, from radon-resistant construction to drainage planes, can prevent unwanted air-quality problems in the future. To prevent unwanted moisture and contaminants from entering, it is very important to build a tight home, but it is also crucial to provide ventilation to the home to facilitate fresh-air exchange. Once the home has been constructed as healthily and durably as possible, consider the interior finishes and the chemicals used in glues, paints and stains. Below is an indoor air quality checklist.

Moisture Management

☑ A continuous drainage plane is installed behind the exterior cladding.

☐ A capillary break is installed between foundation and framing.

☐ Windows, doors and roofing are fully and properly flashed.

☐ A surface-water management system is installed. Final grade is at least a half-inch per foot sloped away from the house. Gutters are present and functional, and they drain onto a finished grade at a minimum of five feet from the building foundation.

☐ Crawlspace flooring has 100 percent coverage with a sealed vapor barrier. Consider a sealed, nonvented crawlspace for added durability.

Ventilation

☑ The home is as tight as possible through proper air sealing.

☐ Fresh-air ventilation is provided mechanically to the home. The American Society of Heating, Refrigerating and Air Conditioning Engineers requires 7.5 cubic feet of air per minute per person (i.e., per bedroom) plus 7.5 cfm, plus an additional 1 percent of total floor area of fresh-air ventilation.

This isn't as complicated as it sounds. The two most common methods for achieving this are: 1) Run a supply duct from a clean source outside of the home into the return duct of the HVAC system. Then install a controller that will make sure your home gets plenty of fresh air even when the air handler is not running often. 2) Install a balanced system. Commonly known as Heat Recovery Ventilators or Energy Recovery Ventilators, these high-tech systems bring in fresh air while exhausting stale air to the outside. Heat (and moisture, in the case of the ERV) is transferred in the process, making it the most energy-efficient ventilation option.

☐ A properly sized and sealed HVAC unit is installed (see HVAC checklist). The home needs to maintain less than 60 percent relative humidity.

☐ All ventilation exhaust fans (bathrooms, range hoods and clothes dryers) are vented outdoors. Kitchen-range hoods do not exhaust more than 350 cfm. Bath fans exhaust at least 50 cfm, so installing a 75- or 90-cfm bath fan is recommended to make up for duct length. Consider installing low-sone fans on a timer or a humidistat.

☐ Minimum Efficiency Report Value (MERV) 8 or higher HVAC filters are installed and the equipment is designed to accommodate pressure-drop from the filter.

☐ Ducts are protected from dirt and debris until construction is completed.

Combustion Safety

☑ Combustion equipment, such as gas furnaces and water heaters, is either sealed combustion, power-vented or installed outside the conditioned spaces. There are no unvented fireplaces installed.

☐ One hardwired carbon-monoxide detector is installed per 1,000 square feet of living space (minimum one per floor) in all houses where there is an attached garage or where any combustion appliance is used in the structure.

☐ Common walls to the garage are properly air-sealed, and doors to garages are weather-stripped.

Radon and Pest Resistance

☑ A radon-mitigation system is installed to depressurize the slab. All penetrations are properly air sealed from the foundation to the home.

☐ A radon test was performed before moving in. For more information, visit www.epa.gov/radon.

☐ Termite flashings that provide a physical barrier between the foundation and the wood structure are installed.

☐ Consider nontoxic borate treatment or bait/monitoring systems for termite control.

Materials

☑ Formaldehyde-free building materials are used wherever possible.

☐ Low-VOC (Volatile Organic Compound) paints are used.

☐ Low-VOC stains and finishes are used on all wood work.

☐ Solvent-free adhesives and glues are used.

☐ No carpet is installed. If carpet is installed, a low-VOC carpet rated by the Carpet and Rug Institute is used.

For more information, review the ENERGY STAR Indoor Air Plus requirements at www.EnergyStar.gov.

Sources for this checklist include Advanced Energy System Vision Guidelines, Southface Energy Institute Technical Bulletins, HealthyBuilt Homes program guidelines and Energy Star guidelines for homes and indoor quality.

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checklist

HVAC

A clean start: Sealed crawlspaces are one effective method for getting HVAC equipment into the conditioned space.

PHOTO COURTESY OF HOME ENERGY PARTNERS

by Maggie Leslie

A home can be heated or cooled using electricity, gas, geothermal energy, solar energy or a combination of energy sources. Radiant floor-heating systems are an inherently efficient way to heat, since there is no heat lost through ductwork, but a forced-air heating system can also be a very efficient option if designed and installed properly. The items on this checklist should be considered when installing any type of ducted system.

First off, a room-by-room Manual J heat-loss/heat-gain calculation must be completed. The maximum-oversizing limit for air conditioners and heat pumps is 15 percent. Adhering to the maximum-oversizing limit both ensures that you are not paying for more capacity than you need and that the system will properly dehumidify the home and run efficiently.

☑ Heat pumps and air conditioners have a Seasonal Energy Efficiency Ratio rating of at least 14 SEER and a Heating Season Performance Factor of at least 7 HSPF. Gas furnaces used for either primary heat or backup heat have a rating of at least 90 Annual Fuel Utilization Efficiency.

☐ Ductwork and the mechanical unit are located in the conditioned space, if possible. All ductwork has an insulating value of R-8.

☐ Use rigid-metal ductwork for increased durability and indoor-air quality. Rigid metal is easy to clean, and will not trap dust or absorb moisture.

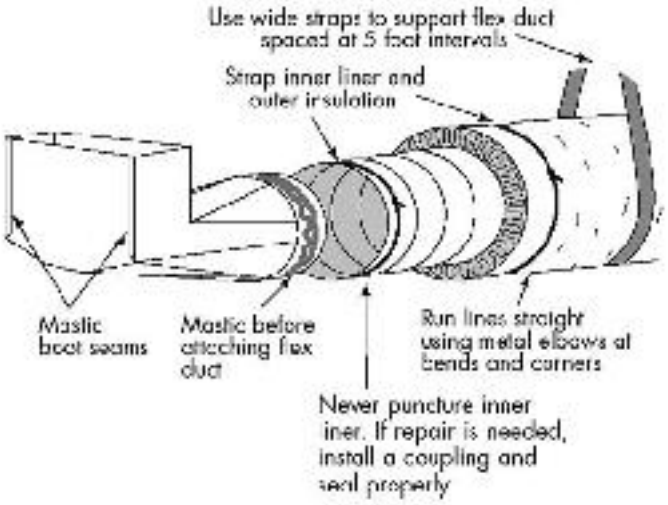
☐ Building cavities, such as floor joists, are not used as part of the forced-air supply or return system.

☐ All joints/seams in the air-distribution system are sealed using fiberglass mesh tape and duct mastic; this includes duct connection to metal boots (in subfloor), trunk lines and air-handler units. The insulating liner of the ducts is also sealed with mastic.

☐ Indoor and outdoor HVAC units are matched according to the Air-Conditioning & Refrigeration Institute Directory or the manufacturer's listing.

☐ The correct charge of refrigerant has been installed per the manufacturer's specifications.

☐ Registers and diffusers have proper throw and spread to keep rooms properly conditioned as the load specifies.



☐ Duct dampers are installed and accessible on supply vents. The dampers make it possible to adjust the flow and spread of air from the registers.

☐ Ducts are sealed and tested by a Home Energy Rater to have no more than 5 percent leakage.

☐ If installing a heat pump, an outdoor thermostat is installed to control when the electric heat strip's power is on. This will maximize your efficiency.

☐ A programmable thermostat is installed.

Sources for this checklist include Advanced Energy System Vision Guidelines, Southface Energy Institute Technical Bulletins, HealthyBuilt Homes program guidelines and Energy Star guidelines for homes and indoor quality.

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Air sealing

Seal it: Air sealing is essential to an energy-efficient home.
PHOTO BY JAMES PADER WINTER SUN CONSTRUCTION NC HEALTHYBUILT HOME

by Maggie Leslie

Air sealing is a crucial part of building a healthy, energy-efficient home. Below is a checklist of items to use to ensure proper air sealing when building or renovating a conventional stick-frame home. A leaky home will decrease the R-value of your insulation (the measure of how well your insulation resists heat flow), create unwanted drafts and comfort issues, and bring moisture and pollutants into the home. As the saying goes, "Seal it tight, and insulate it right!"

☑ All holes or penetrations in the building envelope are sealed with a material capable of stopping airflow, such as caulk, foam or rigid material (fibrous insulation does not stop airflow).

☐ Windows and exterior doors are sealed with backer rod, caulk or non-expanding spray foam.

☐ Electrical, plumbing and HVAC penetrations between conditioned and unconditioned space are sealed with caulk or spray foam.

☐ The bottom and top plates of exterior walls and walls to the attic are sealed with caulk or sill seal.

☐ Band joists are sealed with caulk, spray foam or gaskets between the top plate and band joist, between band joist and subfloor and at any penetration. Any joists or other cavities that span from conditioned to unconditioned spaces are blocked off and air sealed.

☐ All chase ways that would allow unconditioned air to enter into the conditioned building envelope are capped and sealed.

☐ Exterior walls behind tub and shower enclosures are insulated. Prior to installing the tub or shower, a rigid, durable air barrier is installed in direct contact with the insulation.

☐ Insulation wind baffles are installed to block windwashing at all attic eave bays in roof assemblies with soffit vents.

☐ An air barrier is blocking any exposed edges of insulation, particularly for cantilevered floor systems and floors above a garage.

☐ For fireplace cavities on exterior walls a rigid air barrier is fully aligned with the insulated framing in the framed shaft behind the fireplace and any gaps are fully sealed with foam, caulk or tape.

☐ For porch roofs, a rigid air barrier is installed at the intersection of the porch roof and exterior wall.

☐ For dropped ceilings, a rigid air barrier is fully aligned with insulated framing and any gaps fully sealed with caulk or foam.

☐ Recessed light fixtures (if installed in insulated cavities, such as the ceiling between the house and the attic) are rated ICAT (Insulation Contact, Air Tight). Once installed, they are sealed to the drywall with gasket, caulk or foam.

Sources for this checklist include Advanced Energy System Vision Guidelines, Southface Energy Institute Technical Bulletins, NC HealthyBuilt Homes program guidelines and ENERGY STAR guidelines for homes and indoor quality.

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A primer for passive solar

Aligned to the sun: Warren Wilson College's eco dorm, shown here at twilight, utilizes several passive solar techniques.

PHOTO BY DUNCAN MCPHERSON, SAMSEL ARCHITECTS

by Maggie Leslie

If designed properly, a home can be heated with minimal additional cost by using passive solar. By simply siting the home and allocating glazing properly, a home can take advantage of our free, readily available heating source: the sun.

☑ The building envelope is energy efficient. A well-sealed and insulated home is the first component of any passive-solar home. By reducing these energy losses, you can more easily meet the heating and cooling needs of the home using passive heating techniques.

☐ The home is oriented to the south. To maximize the amount of solar gain in the winter, site the home so that the longest wall of the home faces within 15 degrees (plus or minus) of true south. If 15 degrees is too much of a design constraint, 30 degrees off of true south can still provide about 85 to 90 percent of the optimal winter heat gain. Make sure there are no large obstacles such as buildings or trees that will block heat gain in the winter. Deciduous trees are acceptable and actually provide an advantage by providing shade in the summer.

☐ Glazing and thermal mass are sized properly. Passive-solar homes are typically either sun-tempered or direct-gain systems. Sun-tempered homes do not have thermal mass, a material that stores heat. These designs should have no more than a 7-percent ratio of glazing (glass area) to floor area on the south side of the home. With direct gain, the system should have 7- to 12-percent glazing to floor area of south-facing glass. For each square foot of glass above 7 percent, there should also be 3 to 6 square feet of 4-inch-thick masonry to act as thermal mass. However, surface area or square footage of thermal mass is more important than thickness. The surface absorbs heat during the day and slowly releases heat as the temperature drops. Additionally, comfort is improved if the mass is evenly distributed in the room. For either design, to reduce overheating in the summer, minimize the amount of east- and west-facing walls and glass. To prevent overheating, east and west glazing should be less than 5 percent of the floor area.

☐ Windows are chosen to maximize heat gain and minimize heat loss. On the south side of the home, choose a window with a high Solar Heat Gain Coefficient (about .55 or higher) and a low U-factor (about .35 or less). This will maximize heat gain, but minimize heat loss. On the east and west, choose a window with a lower SHGC and a similar U-factor. This should be accompanied by a vertical shading element, such as an insulating blind (insulating blinds are also a great option for evening use on south-facing windows).

☐ Overhangs are sized properly. South-facing windows should be accompanied by properly sized overhangs to prevent overheating in the summer. In general, for our area you need about a 2-foot-wide overhang

within two feet from the top of an average size window. For an exact measurement see the sizing rules below. Mature deciduous trees are also a great addition to overhangs — they permit most winter sunlight to pass through (60 percent or greater) but provide nice shade in the summer. Evergreen trees, on the other hand, should be placed on the north and west sides of the home to buffer winds and afternoon sun.

Overhang sizing rules:

☑ Draw the wall to be shaded to scale.

☐ Draw the summer sun angle upward from the bottom of the glazing.

☐ Draw the overhang until it intersects the summer sun angle line.

☐ Draw the line at the winter sun angle from the bottom edge of the overhang to the wall.

☐ Use a solid wall above the line where the winter sun hits. The portion of the wall below that line should be glazed.

☐ Design rooms to match the passive-solar design. Place rooms that have minimal heating and lighting requirements (such as garages and storage rooms) on the north side of the home. The kitchen is also a great choice for a room on the northern side because it produces its own heat. Keep in mind that furniture, rugs and tapestries will affect the thermal mass performance. Daylighting is an added benefit of passive solar design. Generally, a ratio of 5-percent glazing to floor area provides enough light for the room. Skylights admit light — but can offer unwanted heat in the summer. Solar tubes may be a good alternative.

Sources for this checklist include N.C. Solar Center: Passive Solar Home Design Checklist, www.ncsc.ncsu.edu/include/_upload/media/pubs/PassiveDesignChecklist.pdf; Southface Energy Institute: Passive Solar Design Technology Fact Sheet, www.southface.org/web/resources&services/publications/technical_bulletins/PSD-Passivesolar%2000-790.pdf; and Re-Arch: The Initiative for Renewable Energy in Architecture Fact Sheet, www.rearch.umn.edu/factsheets/PassiveSolarFactSht.pdf.

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TECHNOLOGIESEXPLAINED

What is passive-solar design?
Passive-solar design uses the heat from the sun that enters a house by collecting it, storing it and distributing it. By building in a way that takes advantage of this free energy source and the local climate, one can conserve energy and save money on heating and cooling bills. Passive-solar design does not involve any electric components, fans or pumps. A passive-solar building makes use of the solar gain through natural heat movement mechanisms — conduction, convection and radiation — to distribute heat throughout a living space. Passive-solar techniques include: window location and glazing type (to let solar gain in and keep it in), thermal mass and proper shading. See the checklist on page 73 for more information.

— *E.K.*

checklist

Energy-efficient retrofit

Quick fix: A Project Conserve member seals the duct work, one low-cost, quick to improve energy efficiency.

PHOTO COURTESY OF WNCGBC

by Maggie Leslie

The average American family spends about $1,500 a year on utility bills, according to the Rocky Mountain Institute. This could be reduced dramatically by making a few adjustments and improvements. Some energy-saving measures are simple and inexpensive, while others are more complex and costly. This checklist will help you figure out where to start. Some of the cheapest, easiest retrofits will save you the most. When you are ready to get started, the Southface Energy Institute offers a free downloadable guide called "Home Energy Projects: An Energy Conservation Guide for Do-It Yourselfers." It provides a lot of information on how to perform the tasks yourself, where to get the materials and how much they will cost.

Where to begin

☑ Determine your savings. Collect a year's worth of utility bills, and divide their total by the heated square footage of your home. According to RMI, most bills are about 60 to 90 cents per square foot. If you are in this range, or even higher, the low-cost and no-cost measures will be a great place to start.

☐ Assess your house. Measure the thickness of the insulation in your attic, basement and walls. What is the age and condition of your HVAC system and water heater? Is your home drafty?

☐ Determine the financial incentives. There are currently federal incentives for upgrading water heaters, HVAC, insulation, etc. Visit www.energytaxincentives.org/consumers and www.dsireusa.org for a comprehensive list.

☐ Consider a comprehensive audit. The directory includes a list of Building Performance Contractors (see "Listings"). These trained professionals will come to your home and perform an energy audit. They can recommend improvements and provide contracting services, if you would prefer not to do the work yourself.

	Heating and cooling	Water heating, lighting and appliances
No-cost measures	• In the winter, the thermostat is turned down when not at home or going to bed. • Filters are clean. • Shades are drawn on sunny days in summer and after sunset in winter. • The fireplace damper is closed and sealed when not in use. • The fireplace is not lit when the heat is on if it doesn't have doors. • Remove window air conditioning units after the cooling season.	• Energy-saving settings are used on dishwashers and washing machines, and heat dry on the dishwasher is avoided. • Lights are turned off when leaving a room. • Cold water is used for rinsing dishes, running food disposals and laundry. • Thermostat on the water heater is turned down to 120°F. • Refrigerator condenser coils and dryer exhaust are clean. • Clothes washers and dishwasher are run only when full and clothes are air dried instead of using a clothes dryer.
Low-cost measures	• A programmable thermostat is installed. • Broken window panes are repaired. • Air filter is changed. *Note: Be careful when choosing a new air filter. High MERV filters work great for air quality, but they may adversely affect the performance of your system by causing too much resistance.* • Holes, leaks and gaps through walls, ceiling and floor are sealed using caulk or spray foam. *Note: Some holes may be large enough that they require rigid blocking before sealing.* • Electrical outlets have gaskets. • Attic hatch or door is insulated and weatherstripped. • Vertical walls between the house and attic are insulated and have a rigid backing. • Ductwork is sealed with mastic and heating and cooling system has had a tune up. Duct leakage can increase your heating/cooling bill by 10 to 30 percent and compromise your air quality.	• Low-flow, WaterSense-rated faucets and showerheads are installed. •An insulating jacket is installed on the water heater. • A timer is installed on the water heater so it only heats water when needed. • Leaky faucets and toilets are repaired. *Note: The WNC Green Building Council has tablets available for determining if you have a leaky toilet.* • Hot water pipes are insulated. • A rainbarrel is installed for outdoor watering. • A toilet tank bag is installed to reduce the amount of water used per toilet flush. • Inefficient incandescent bulbs are replaced with energy-saving compact fluorescents. • Appliances are plugged into a power strip that can easily be turned off to reduce ghost loads.
Higher-cost measures with a quick payback	• Ductwork is insulated to R-8. • Insulating blinds and shades or storm windows are installed. • A blower door test has been performed to identify more leaks in the building envelope and found leaks have been sealed. *Note: You may need to consider adding ventilation, depending on the air tightness you reach.* • R-38 insulation in the attic and R-19 insulation in the floors are installed (make sure all holes are sealed first!).	• A high-efficiency or a gas tankless water heater is installed. • Inefficient appliances are replaced with ENERGY STAR-rated refrigerators, dishwashers, washers and dryers. • A dual flush retrofit kit is installed to reduce the amount of water used per toilet flush.
Higher-cost measures with a long-term payback	• Windows are replaced with double-paned low-e windows with a U-value of less than .35. • The central heating and air system is replaced with a more efficient model. • Wall insulation is installed.	• Converted to solar water heating. *Note: Consider integrating it with space heating. The current tax credits available make it much more affordable than ever before.* • LED lighting is installed. • Older toilets are replaced with a WaterSense 1.28 gallon per flush toilet.

Sources for this checklist include Southface Energy Institute, "Home Energy Projects: An Energy Conservation Guide for Do-It-Yourselfers," www.southface.org/web/resources&services/publications/large_pubs/Home-Energy-Projects.pdf and Rocky Mountain Institute, "Home Resource Efficiency," www.rmi.org/sitepages/pid206.php.

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GREENMEANS?

Efficiency and sustainability have become buzzwords for the green movement. They are spoken almost casually these days, but I feel these words are the essence of green building. A building is only as green as it is efficient. The most sustainable method of green building is to take an existing structure and increase its efficiency.

— Eric Krause, president, BioWheels

Advanced framing

Wood saver: Inline framing techniques increase strength and minimize wood use.

PHOTO BY MARCUS RENNER

by Marcus Renner

Although contested, wood-framed buildings are a great American innovation. Developed 150 years ago, wood-framed (also called stud-framed or western platform framed) buildings now account for 90 percent of our homes. Framed homes are cost efficient made with a renewable resource and are relatively easy to construct, many times without the help of an engineer or architect.

As with all technologies, decades of use fostered innovation. One of the latest innovations for framed construction is now called Advanced Framing. Once labeled Optimum Value Engineered Framing, advanced framing addresses efficiencies in speed, cost, materials and energy. Redundant wood is eliminated, layout is simplified and insulation is increased — less wood, more insulation.

The advantages of advanced framing are numerous. By minimizing wood and increasing insulation, the materials and labor cost are reduced. Not only is the construction of the frame faster and less expensive, but the trades people — such as electricians and plumbers — have to drill and cut fewer holes, saving them time. Even the insulators are putting up fewer but bigger pieces of insulation, which means increased efficiency. Joe Lstiburek, preeminent researcher and principal of Building Science Corporation, offers these statistics for advanced framed homes: They use 5 to 10 percent less lumber, up to 30 percent fewer pieces of wood, and are 60 percent more insulated. Advanced framing is a less expensive, faster way to construct homes, saving more energy than conventional framing methods.

Model building codes accept all the advanced framing methods listed here. In the 1970s, a research collaboration between e National Association of Home Builders and the U.S. Department of Housing and Urban Development established what is now advanced framing. Since then, the methods have been allowed through model building codes. As with all nonstandard practices, however, be sure to consult with your building official before starting construction.

Below is a list of all the methods associated with advanced framing:

☑ **2x6 exterior stud walls, 24 inches on center**
Increased room between studs enables more insulation. 24-inch centers (versus 16-inch centers) require less wood, even though the size has increased. Many builders are eliminating interior window and door trim and rounding the drywall to terminate at the window frame. Only a wood sill is installed, saving money.

☐ **2x4 interior walls, 24 inches on center**
Non-structural interior walls don't need 16-inch spacing. Less wood means less work for the framers and trades people.

☐ **Corners constructed with two studs, not three**
Corners inherently carry less of a structural load than the wall. The only reason a third stud is installed is for connection of the drywall, but doing this creates a cavity which can't be insulated. Eliminate the stud and install drywall clips or a smaller one inch board to connect the drywall to. Recently, the building code started requiring two stud corners.

☐ **Ladder bracing where partition walls meet exterior walls**
Additional studs are traditionally placed in the exterior wall on either side of the last interior wall stud. These are placed there for the drywall connection. Ladder bracing is just as strong and allows insulation to be placed in the exterior wall. Small scraps of wood can be used.

☐ **No cripple studs connected to jack studs under windows**
Windows aren't heavy. Follow the framing layout for the small studs under windows but don't add additional wood at the jack or king stud.

☐ **No jack studs for headers**
Jack studs hold up headers. Jacks can be replaced with header hangers. Less expensive than wood, and quicker to install, header hangers allow more insulation in a wall.

☐ **No headers in non-load bearing walls**
If there is no load above a window, why put an expensive header that requires large boards and compromises the insulation? Frame out the opening with one flat 2x6. Non-load bearing openings are usually under gable ends.

☐ **Single headers flush with the outside or insulated headers**
Most homes never have the forces to require a double header. Eliminate the interior board. This will allow the insulators to fill the space in the header. Drywall is less likely to crack when not connected to the larger piece of wood. If you do need to install a double header be sure to fill the center with insulation before constructing and installing it, or stack the headers together and put the insulation in last.

☐ **Raised heel trusses or rafter ends**
Many times, trusses are often designed with no room above the top plate. Site framed homes often have the rafter sitting on the top plate next to the ceiling joist, also providing minimal space above the top plate. Insulation is usually compressed at the edge of the building. Raised heel trusses are designed to allow ample room above the top plate so the insulation can keep its luff. In a framed roof, a ledger board can be placed flat on top of the joist ends and the rafter sits on the ledger.

☐ **In-line framing**
Framing in a way that all the structural elements line up increases strength and minimizes wood. The layout of the floor joists, studs, ceiling joists and rafters are the same. The stud is directly over the floor joist, the ceiling joist is stacked on top of the stud and the rafter is on top of the ceiling joist. This more efficient and stronger way of building also looks better and gives a perception that the building is stronger, which it is.

☐ **Single top plates**
When doing inline framing, the double top plate can be eliminated and a single top plate will suffice. Metal plate or wood splice connections can be made at partition wall intersections and top plate butt joints. Although this is an easy way to minimize wood and increase insulation, many code officials won't approve this method, so be sure to consult with them.

☐ **Floors and roofs framed on 24-inch centers**
With the advent of floor decking that is ¾-inch thick, there is no need to use 16-inch spacing. Two foot centers with ¾ inch decking are faster and have a lower materials cost than other methods. Keep in mind that the trades people will also have less wood to cut or drill through when running plumbing, electrical or other services.

☐ **Insulating sheathing**
Although not a framing method, using rigid insulation as the exterior sheathing is an excellent way to increase the efficiency of the home. Framed homes have a break in the thermal insulation every time a stud is installed. If the walls are insulated with R-19 rated insulation, the effective R-value of the wall is actually around R-13 because of the wood break. Insulation as sheathing actually creates a thermal break and adds additional R-value to the wall. If the seams are caulked and taped, then the house wrap can be eliminated, saving money. Taping the seams also provides an air seal that stops air leakage, the No.one form of energy loss in our homes. Diagonal loading has to be addressed, and there are a

number of ways to do it. Wood sheathing can be installed at corners or diagonal bracing of wood or metal can be nailed into the wall.

Advanced framing is an innovation that has many benefits. If we didn't innovate transportation, for instance, we may all still be traveling by horse. Framing with old methods is like traveling on a horse — slow, costly and inefficient. Building codes are slowly changing to reflect innovation, and soon all new homes will have to be framed with energy in mind. Get off the horse and into the hybrid. Get ahead of the code and do yourself and your customers a favor by using some or all of the methods listed here.

Marcus Renner, LEED AP, NCGC, GPA, MA, RWE. Educator, consultant and building analyst, Marcus has kept abreast of the industry through in-the-field experience, research and tenaciousness.

GREENMEANS?

I began with a desire to do my small part to help save our environment. When my first electric bills arrived, I realized I was also going to save a lot of money.

— Bill LaRocque, homeowner

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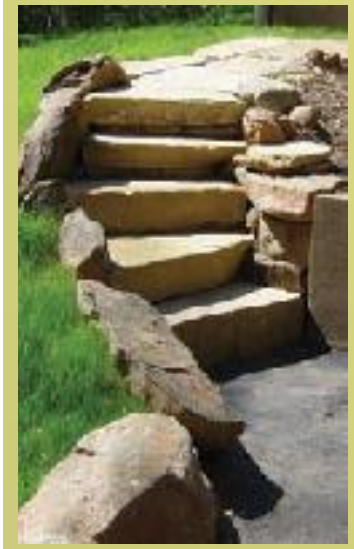

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Top 10 signs of greenwashing

1. **Fluffy language:** Words or terms with no clear meaning (e.g. "eco-friendly").

2. **Green product vs. dirty company:** Such as efficient light bulbs made in a factory that pollutes rivers.

3. **Suggestive pictures:** Green images that indicate an unjustified green impact (e.g. flowers blooming from exhaust pipes).

4. **Irrelevant claims:** Emphasizing one tiny green attribute when everything else is not green.

5. **Best in class:** Declaring you are slightly greener than the rest, even if the rest are pretty terrible.

6. **Just not credible:** "Eco-friendly" cigarettes, anyone? "Greening" a dangerous product doesn't make it safe.

7. **Jargon:** Information that only a scientist could check or understand.

8. **Imaginary friends:** A "label" that looks like a third-party endorsement — except that it's made up.

9. **No proof:** It could be right, but where's the evidence?

10. **Outright lying:** Totally fabricated claims or data.

Source:
www.greenbiz.com/news/2009/08/13/preventing-greenwashing-one-company-time

TECHNOLOGIES EXPLAINED

How does a geothermal heat pump work?
A geothermal, or a ground source, heat pump can serve as a heating and cooling system for buildings. A geothermal system brings heat from the ground into a building in the winter and takes it out of a building and puts it back into the ground in the summer. Even though there are temperature extremes across the world, a few feet below the surface of the ground the temperature remains relatively constant. The geothermal heat pump system works as a giant heat exchanger between the underground and the building that is to be conditioned. Most geothermal systems circulate liquid through a series of underground pipes (a loop) to transfer the heat. An electric compressor heat exchanger takes the heat from the liquid and transfers it to a duct system to use in the building. In the summer, the process is reversed to cool the building.

— E.K.

greenscene

We're on the Green Beat

Every Wednesday in the *Mountain Xpress*, WNC's alternative newsweekly, we bring you The Green Scene, an environmental news column covering:

- Air and water quality/resources
- Endangered species and biodiversity
- Land conservation
- Environmental activism
- Energy alternatives
- Green building and green businesses
- Sustainable living
- Climate change

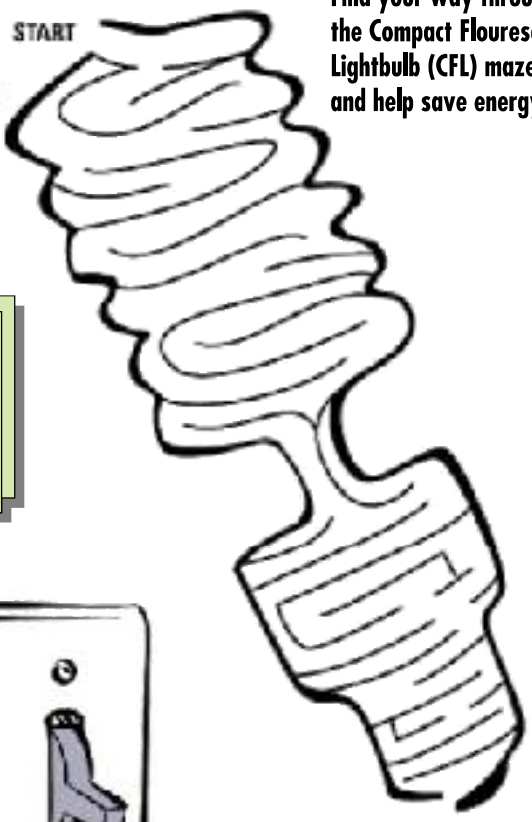
Send your environmental news and ideas to news@mountainx.com

Make a Difference Every Day!

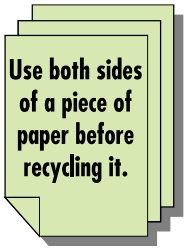
We only have one Earth. That's why it's important for everyone to pitch in and help make our world clean and beautiful. Here are some ways for you to help make a difference. Add your own ideas, too!

Recycle paper, plastic, glass and cans.

Turn off the water when you brush your teeth.



Find your way through the Compact Flourescent Lightbulb (CFL) maze and help save energy!



Use both sides of a piece of paper before recycling it.

Pick up litter.

Turn off lights, the TV, and other electronics when you're done with them.

Don't leave doors to the outside open for longer than necessary.

Talk to your friends and family about saving energy.

Ride a bike or take a bus instead of driving a car.

For more information, games and activities, visit the EPA's Watersense Kids page at http://www.epa.gov/watersense/kids/index.html and the US Energy Information Administration's Energy Kids at www.eia.doe.gov/kids.

Green Building Glossary

compiled by Maggie Leslie

Advanced Framing: Framing techniques that use less lumber, thereby reducing material cost and use of natural resources, and increasing the level of insulation as a result. Also known as Optimum Value Engineering. (9)

Air Barrier: A rigid material installed around a building frame to prevent or reduce the infiltration of air into the interior of a structure. To improve energy efficiency by maintaining conditioned air inside the home and improving the efficacy of insulation, an air barrier is installed. Air barriers are not vapor barriers. (1)

Air Infiltration: Uncontrolled inward air leakage to conditioned spaces through unintentional openings in ceilings, floors and walls from unconditioned spaces or the outdoors. (2)

Batt Insulation: The most common and widely available type of insulation. It comes in the form of pre-cut blankets or rolls and consists of flexible fibers, most commonly fiberglass, but is also available in cotton. It's held together with a binder. (10)

Building Envelope: The exterior surface of a building's construction: the walls, windows, floors, roof and floor. Also called building shell. (2)

Cellulose Insulation: A blown-in insulation material that is a mixture of waste paper and fire retardant. It high in recycled content, has no added formaldehyde and is blown in for easy installation around obstacles in the wall cavity. (2)

Combustion Safety: For health and safety, locate combustion appliances outside of the conditioned envelope or use sealed or direct combustion appliances. Provide carbon-monoxide monitoring. (3)

Daylighting: The controlled admission of natural light into a space through glazing with the intent of reducing

or eliminating electric lighting. Daylighting creates a stimulating and productive environment for building occupants. (2)

Energy Modeling: Process to determine the energy use of a building based on software analysis. Can be used to provide a cost-benefit analysis with upgrades for energy efficiency. (2)

Engineered Lumber: Composite wood products made from lumber, fiber or veneer, and glue. These products can be environmentally preferable to dimensional lumber, as they allow the use of waste wood and small-diameter trees to produce structural building materials, but can also increase off-gassing into the home. (2)

Fly Ash: A fine, glass powder recovered from the gases of burning coal during the production of electricity. Fly ash can be used to replace a portion of cement in the concrete, providing some distinct quality advantages. (2)

Forest Stewardship Council (FSC): A third-party certification organization, evaluating the sustainability of forest products. FSC-certified wood products have met specific criteria in areas such as forest management, labor conditions and fair trade. (2)

Formaldehyde: A colorless, pungent and irritating gas. H2C0 is used chiefly as a disinfectant, preservative and in synthesizing other compounds like resins. It is the component of many types of glue in wood products and may cause respiratory problems. (2, 3)

Graywater Reuse: A strategy for reducing wastewater outputs from a building by diverting the graywater into productive uses such as subsurface irrigation, or on-site treatment and use for nonpotable functions such as toilet flushing. Graywater includes water from bathtubs, showers, bathroom wash basins, and water from clothes-washer and laundry tubs. (2)

Greenguard: Certification that a product meets emission thresholds for formaldehyde, total aldehydes, total volatile organic compounds (TVOCs), and one-tenth of the threshold limit value (TLV) — a regulatory standard — for many other compounds. The program also assesses emissions of other chemicals of concern. (7)

Green Label: A certification program by the Carpet and Rug Institute for carpet and adhesives meeting specified criteria for release of volatile compounds. (2)

Green Seal: A nonprofit that has certified products to an environmental standard since 1992. Green Seal now provides third-party certification for a wide range of products, including paints, adhesives, lamps, chillers, windows, cleaners and occupancy sensors. (7)

Green Roof: Green roofs maintain living plants in a growing medium on top of a membrane and drainage system. Green roofs are considered a sustainable building strategy in that they have the capacity to reduce stormwater runoff from a site, modulate temperatures in and around the building, have thermal insulating properties, can provide habitat for wildlife and open space for humans, and provide other benefits. (2)

Ground Source Heat Pump: A heat pump that uses the ground temperature instead of air temperature to cool or heat a home. Usually this is accomplished with underground water pipes that transfer the ground temperature into the heat pump. (3)

Heating, Ventilation and Air Conditioning (HVAC): General term for the heating, ventilation and air-conditioning system in a building. System efficiency and design impact the overall energy performance of a home and its indoor environmental quality. (2)

Heat Recovery Ventilator: An air-to-air heat exchanger with balanced exhaust and supply fans that is an energy-efficient way to meet necessary ventilation needs without producing drafts or air pressure imbalance on a heating or cooling system. (2)

Indoor Air Quality (IAQ): The nature of the air inside the space that affects the health and well-being of building occupants. IAQ is heavily influenced by both choice of building materials (and cleaning procedures) and ventilation rates. (1, 2)

Infill: Developing on empty lots of land within an urban area rather than on new undeveloped land outside the city. Infill development helps prevent urban sprawl and can help with economic revitalization. (1)

Insulated Concrete Forms (ICF): This wall structural system provides a strong and well-insulated wall system by using blocks fabricated from rigid insulation to create permanent forms for a poured concrete core. (3)

Kilowatt-hour (kWh): A measure of energy equal to the amount of power multiplied by the amount of time the

power is used. It is most often used to describe amounts of electrical energy. A 100-watt light bulb burning for 10 hours uses one kilowatt-hour of power. (3)

Load Calculation: A heat-gain-and-loss calculation necessary to properly size the heating and cooling equipment to adequately and efficiently provide comfort and dehumidification for a particular building. Room-by-room load calculations should be performed, taking into account actual insulation levels, windows, building orientation, number of occupants, system location, air tightness, etc.

Low VOC: See "Volatile Organic Compound" for more information. (2)

Minimum Efficiency Reporting Value (MERV): A number from 1 to 16 that is relative to an air filter's efficiency. For the cleanest air, a user should select the highest MERV filter that their unit is capable of forcing air through, based on the limit of the unit's fan power. (4)

Mixed-Use Development: A development that includes diverse use types, including elements of housing, retail and office space. (1)

Net Metering: A metering and billing arrangement that allows on-site energy generators to send excess electricity flows to the regional power grid. (2)

Passive-Solar Homes: Homes optimally designed to take advantage of the sun for heating in the winter and are shaded with an overhang, trellis etc. in the summer and swing months. These homes have calculated amounts of thermal mass (concrete, tile, stone etc.) and glass, insulation for the window "collectors," and their solar features are oriented to the south. A passive-solar home is one in which the building itself is the solar collector and heat-storage system. (3)

Payback Period: The time estimated for a capital investment to pay for itself, calculated by relating the cost of the investment to the profit it will earn or savings it will incur. (1)

Performance Contracting: A contracting service that provides customers with a comprehensive set of energy-efficiency, renewable-energy and distributed-generation measures and often comes with guarantees that the savings produced by a project will be sufficient to finance the full cost of the project. (11)

Pervious Paving: Paving surfaces designed to allow water infiltration and reduce stormwater runoff. (2)

Photovoltaics (PVs): Solid-state cells (typically made from silicon) that directly convert sunlight into electricity. (1)

R-value: A unit of thermal resistance used for comparing insulating values of different materials; the higher the R-value, the greater it's insulating properties. (2)

Radiant Barrier: A material (typically an aluminum foil) that is good at blocking the transfer of radiant heat across a space because it has a low emissivity. In a hot climate, it is often installed in attics under the roof decking to keep the attic cooler. (1)

Radiant Floor Heat: A thermal mass floor with pipes laid underneath to transfer heat generated either by a solar collector or other type of liquid heating system. (3)

Radon: A colorless, naturally occurring, radioactive, inert gas formed by radioactive decay of radium atoms in soil or rocks. When trapped in buildings, concentrations build up, and can cause health hazards. (1, 2)

Rainwater Catchment/Harvest: On-site rainwater harvest and storage systems used to offset potable water needs for a building and/or landscape. (2)

Rain Garden (Bioretention): A landscape feature that incorporates deep porous soils and specially designed plantings to gather, store and treat stormwater. (3)

Rapidly Renewable Materials: Material that is considered to be an agricultural product that takes 10 years or less to grow or raise and to harvest in an ongoing and sustainable fashion. Examples include bamboo flooring, biocomposite veneers, fiber-based finishes, wool and cotton insulation. (2, 3)

Recycled Content: The content in a material or product derived from recycled materials versus virgin materials. Recycled content can be materials from recycling programs (post-consumer) or waste materials from the production process of an industrial/agricultural source (post-industrial). (2, 3)

Retrofit: The replacement, upgrade or improvement of a piece of equipment or structure in an existing building or facility. (1)

Salvage: Building materials diverted from the waste stream intended for reuse. Commonly salvaged materials include structural beams and posts, flooring, doors, cabinetry, brick and decorative items. (2)

Scientific Certification Systems (SCS): A third-party assessment body that offers evaluation and certification services to a broad range of manufacturing sectors. Their Eco Product Certifications include: Environmentally Preferable Products, Sustainable Choice, four Indoor Air Quality Certifications and Material Content. (8)

Seasonal Energy Efficiency Ratio (SEER): The measure of the energy efficiency for air conditioners and the cooling side of heat pumps. The higher this number, the better, with code being 14 SEER. (1)

Solar Electric Systems: Electricity-producing systems that directly convert the sun's energy into electricity. Photovoltaic systems consist of solar panels, an inverter and controller, and are either off grid or grid tied. (1)

TECHNOLOGIESEXPLAINED

What is embodied energy?
Embodied energy accounts for all of the energy it takes to produce a product. This includes the energy used in harvesting, processing, manufacturing and transporting all the materials that go into the product. To determine a product's embodied energy, it is important to also consider how long it will be used, where it will end up when its useful life is over, and if it can be acquired locally. Examples of products with high embodied energy include: raw aluminum, copper, plastics, synthetic carpet and glass. Products with lower embodied energy include: wood, brick and local stone. These products are more natural and require less processing.

Example: To calculate the embodied energy of a piece of lumber, consider the fuel it takes to power the machinery to cut the tree down and take it to a mill, the electricity it takes to run the mill, the energy to heat the kiln to dry the wood, and the transportation to take the lumber to the retailer.

— E.K.

Solar Heat Gain Coefficient (SHGC): The fraction of solar radiation admitted through a window or screen, both directly transmitted and absorbed, and subsequently released into the living space. (1)

Solar Thermal Systems: Energy-producing systems that gather the sun's radiant energy to heat air or water for use as domestic hot water or space heating.

Spray Foam Insulation: The insulation is applied as a liquid that is sprayed through a nozzle into wall, ceiling and floor cavities, where it expands to fill every nook and cranny. Spray foam insulation makes it easy to completely fill wall cavities with insulation and to perform air sealing in the same step. (9)

Stormwater Management: To protect the local ecology and hydrology, limit and control stormwater runoff by providing for on-site storage and filtration. Pervious pavement systems, reduced amounts of impervious pavement (concrete, asphalt), rainwater collection, green roofs, rain gardens (bioretention) and constructed wetlands are methods to accomplish this. (3)

Straw-Bale Construction: Alternative building method using bales of straw for wall systems in place of standard construction materials. (2)

Structural Insulated Panel (SIP): Manufactured panels consisting of a sandwich of polystyrene between two layers of engineered wood paneling. SIPs can be used for walls, roof or flooring, and result in a structure very resistant to air infiltration. (2)

Thermal Mass: A mass (often stone, tile, concrete or brick) used to store heat and reduce temperature fluctuation in a space by releasing heat slowly over time. Used in passive-solar design. (2, 3)

Universal Design: The design of products and environments that are usable by all people, regardless of age or physical ability, to the greatest extent possible, without adaptation or specialized design. (6)

Ventilation: The process by which outside air is conveyed to an indoor space. Energy-efficient homes must be air tight, but to maintain healthy indoor air it is necessary to provide controlled fresh air to the building interior at recommended rates. (2, 3)

Volatile Organic Compound (VOC): Carbon compounds that become a gas at normal room temperatures. This class of chemical compounds can cause nausea, tremors, headaches and, some doctors believe, long-lasting harm. VOCs can be emitted by oil-based paints, solvent-based finishes, formaldehyde-laden products and other products on or in construction materials. (2, 3)

WaterSense: Modeled after Energy Star, the EPA's new water-efficiency program seeks to educate consumers about water efficiency through an easily identifiable logo. Products include fixtures, faucets, showerheads, irrigation systems and toilets. WaterSense differs from Energy Star in that a product's conformance to EPA standards must be independently tested before qualifying for the label. (7)

Wind Power: Systems that convert air movement into mechanical or electrical energy. Driven by the wind, turbine blades turn a generator or power a mechanical pump. Wind generators include a tower and wind turbine, and can be off-grid or grid-tied. (2, 3)

Xeriscaping: Landscaping design for conserving water that uses drought-resistant or drought-tolerant plants. (2)

Sources:

(1) Sourcebook Glossary, www.austinenergy.com/Energy Efficiency/Programs/Green Building/Sourcebook/sourcebookGlossary.pdf
(2) City of Seattle, www.cityofseattle.net/dclu/GreenBuilding/OurProgram/Resources/Greenbuildingglossary/default.asp
(3) 2007 N.C. Sustainable Energy Association's Tour Book
(4) www.filterair.info/articles/article.cfm/ArticleID/7AF95A61-EAF8-4C90-BFA98EE04B0DD02B
(5) Environmental Building News*, "Defining Recycled Content," December 2008, www.buildinggreen.com/auth/article.cfm/2008/11/24/Defining-Recycled-Content/*
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(7) Environmental Building News*, "Behind the Logos: Understanding Green Product Certifications," January 2008, www.buildinggreen.com/auth/article.cfm?filename=170101a.xml&printable=yes*
(8) www.scscertified.com/ecoproducts/
(9) www.toolbase.org
(10) http://apps1.eere.energy.gov/consumer/your_home/insulation_airsealing/index.cfm/mytopic=11520
(11) www.energystar.gov/ia/partners/spp_res/Introduction_to_Performance_Contracting.pdf

Choosing a green builder

Ask the right questions

by Hans Doellgast

As people become educated about the benefits of building and owning a green-built home, more builders are advertising themselves as "green" builders. For the most part, this is a good thing. For those of us who have preached environmentally sensitive building practices for years, our voices have been heard. Now that our message has caught on, future green-home owners are presented with a large pool of builders to choose from.

But when choosing a builder, make sure you pick one whose value system and priorities match up with your own. Building a home can be either one of the most satisfying projects you can take on, or it can turn into your biggest nightmare. Make sure that when interviewing builders, you ask questions that reveal their shade of green! Here are some questions to consider asking prospective builders:

☑ What makes your company green? (If you only get a list of products, beware!)

☐ How long have you been building green homes?

☐ Can you tell me about the NC HealthyBuilt Homes program?

☐ What led you to go green?

☐ How many homes have you certified through the HealthyBuilt Homes program?

☐ What level of certification did your homes achieve?

☐ Do you actively use locally produced materials in your homes?

☐ What efforts do you go through to lessen the impact on your job site?

☐ Are your homes efficient? Why?

☐ Have you ever used alternative forms of technology to heat, cool or power your homes?

What makes a good green builder? First, he or she should be willing and able to answer your questions.

PHOTO BY JONATHAN WELCH

☐ Are your homes appropriate places for chemically sensitive people to live? Why? What changes could you make to achieve this goal?

☐ Do you have your own crew, and if so, are they paid a living wage?

☐ Do you employ ENERGY STAR framing techniques, and if so, which ones?

☐ Do you make an effort to keep certain building materials out of the landfill? How? Why?

☐ Do you provide fresh-air introduction to your homes? How? Why?

☐ What type of insulation do you typically use? Why?

☐ What sets you apart from your competition?

☐ Are there any new green products or technologies that you are excited about?

☐ Do you have a list of previous clients that I could call for references?

In my opinion, there are indeed wrong answers that perspective builders can give to most of these questions. Builders who are thrown off by any of these questions — or who consider a question to be unimportant — might not be your best choice. There are, however, quite a few correct answers to all of these questions. Approach each interview as an opportunity to educate yourself.

If a builder's response doesn't seem to make sense, or contradicts another builder's response, call the WNC Green Building Council's hotline at (828) 254-1995. Council staff members are an unbiased source and are available to help you negotiate your way through a dizzying array of products and services. The council also offers a variety of classes to educate both homebuyers and builders. Current class listings are available at www.wncgbc.org.

Hans Doellgast owns Jade Mountain Builders, a committed NC HealthyBuilt Home company.

Listings A DIRECTORY OF GREEN BUILDING BUSINESSES

The contents of this directory are approved by the WNCGBC Board of Directors and are intended for informational purposes only. The WNC Green Building Council and *Mountain Xpress* do not endorse or recommend the products or services mentioned herein, and disclaim any and all warranties, express or implied, in any way related to advertisements, events, businesses, organizations or other information presented within the Green Building Directory.

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Jade Mountain Builders is a team of 16 conscientious craftsmen who build and remodel ecologically sensitive homes with a distinctive natural style.

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Architects

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www.acmdesignarchitects.com
acm@acmdesign.net
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Daryl S. Rantis, Architects, PA
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Griffin Architects, PA
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www.homesmitharch.com
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Ken Gaylord Architects and Black Hawk Construction
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info@kengaylord.com
As architects, builders and developers of LEED projects in WNC, we are a single source for green homes, renewable energy, and green places of business.

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Langdon Architecture PA
William Langdon
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John Legerton, AIA, LEED AP
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Mathews Architecture, PA
Jane G. Mathews, AIA, LEED AP
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Fax: (828) 456-7212
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www.haywoodbuilders.com
sales@haywoodbuilders.com
With three locations (Waynesville, Sylva and Asheville), Haywood Builders Supply and our Design Centers are here to serve you in all of your building-supply needs.

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Fax: (828) 264-8787
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www.highcountrytimberframe.com
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www.sunrisesawmill.com
sunrisesawmill@aol.com

Westall Chandley Building Supplies
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Fax: (828) 254-0135
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www.westallchandley.com
rsmith@westallchandley.com

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www.columbiaforestproducts.com
rpoindexter@cfpwood.com

GBS Lumber Inc.
Lou Hutchings
(864) 288-3627
Fax: (864) 675-5982
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GBS Lumber, a locally owned and operated ESOP company, serves the residential home builder through our strategic locations in North and South Carolina. We offer a wide variety of sustainable products and services.

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ecowaterwnc@bellsouth.net

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Specializes in timber frame design and construction using reclaimed materials, SIPS design and construction, and complete "shop built" high-performance panelized wall systems.

More Space Place
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paul@paulswoodworking.com

West End Cabinets
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GREENMEANS?

I truly hate that we need to have a term for "green building" — it should just be the way we build things, period. To me, it's mainly about finding site-specific solutions to take advantage of the sun, the landscape and other site features to help heat and cool our buildings; utilizing efficient plumbing, mechanical and electrical systems that help us conserve energy and water and to reduce the costs of operating and maintaining our buildings; using nontoxic and local building materials, and being efficient in how we build with those materials; and recycling and using recycled materials whenever possible.

— Diana Bellgowan, architect

Resources

• Alternative/ Renewable Energy

American Wind Energy Association has advocated the development of wind energy as a reliable, environmentally superior energy alternative in the U.S. and around the world since 1974. (www.awea.org)

ASU Small Wind Initiative is Appalachian State University's local wind-energy information and demonstration center, including an anemometer loan program and hands-on workshops. (www.wind.appstate.edu)

Build It Solar is the renewable energy site for do-it-yourselfers. (www.builditsolar.com)

EnergyXchange is a renewable energy center that demonstrates the responsible use of landfill gas as an energy source for small enterprise in craft and horticulture, as well as meeting local energy needs of Western North Carolina. (www.energyxchange.org)

Low Impact Hydropower Institute is a nonprofit dedicated to reducing impacts of hydropower generation through the certification of environmentally responsible hydropower. (www.lowimpacthydro.org)

NC Sustainable Energy Association is a nonprofit association creating a sustainable energy future in North Carolina through the promotion of renewable energy technologies including solar, wind, micro-hydro, geothermal, biofuels and energy efficiency. (www.ncsustainableenergy.org)

NC Solar Center has compiled these fact sheets as a quick reference guide on the technologies, incentives and other informational resources associated with renewable energy and energy efficiency. (www.ncsc.ncsu.edu/factsheets.php)

Renewable Energy Access is a widely recognized source for renewable energy news and information on the Internet. (www.renewableenergyaccess.com/rea/home)

• 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)

ENERGY STAR Appliances includes lists of all ENERGY STAR-certified appliances and products. (www.energystar.gov)

• Lighting

Department of Energy: Energy Efficiency and Renewable Energy is an informational

site on different types of energy-efficient lighting. (www.eere.energy.gov/EE/buildings_lighting.html)

• Windows

Efficient Windows Collaboration 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)

• Green Building Materials

AIA Sustainable Design Resource Guide is a guide to help architects identify and specify green materials. (www.aiasdrg.org/sdrg.aspx)

Green Building Advisor is a very comprehensive resource for building, designing and remodeling green homes, including Q&A, details, blogs and videos from the publishers of *Environmental Building News* and *Fine Home Building*. (www.greenbuildingadvisor.com)

The Green Building Resource Guide is a database of more than 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)

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)

Habitat for Humanity Home Store sells donated building materials to the general public and offers deconstruction services. Donate anything from building materials, to appliances, to tools, to flooring. (www.ashevillehabitat.org/home_store)

USGBC Green Home Guide is a community-based resource of tips, case studies, expert Q&A articles and regional directories of green products and services. (http://greenhomeguide.com)

• Remodeling/ Renovation

Build It Green has a comprehensive green remodeling checklist. (www.builditgreen.org/greenpointsremodel.xls)
Indoor Air Quality

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)

EarthCraft Renovation provides Southface Energy Institute's green remodeling checklist and rating system. (www.earthcrafthouse.com/About/renovation.htm)

EPA Indoor airPLUS is the EPA's new home-improved indoor air quality certification program. (www.epa.gov/indoorairplus)

REGREEN offers the USGBC and ASID sustainable renovation practices guidelines. (www.regreenprogram.org)
U.S. EPA provides this site as a guide about indoor air quality. (www.epa.gov/iaq/pubs/insidest.html)

• Sustainable Communities

LEED for Neighborhood Development is a rating system from the USGBC that integrates the principles of smart growth, urbanism and green building into the first national system for neighborhood design. (www.usgbc.org)

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)

Smart Growth Network was formed by the U.S. EPA and several nonprofit and government organizations 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)

Sustainable Sites Initiative is an interdisciplinary program by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center and the United States Botanic Garden of voluntary national guidelines for sustainable land design, construction and maintenance practices. (www.sustainablesites.org)

WNC Sustainable Communities is local certification program of guidelines for sustainable community and neighborhood development developed by the WNC Green Building Council. (www.wncgbc.org/community-certification.php)

• Water Conservation

American Rainwater Catchment Systems Association helps to disseminate information about utilizing rainwater for outdoor and indoor uses, and is a resource for finding installers and workshops on rainwater collection. (www.arcsa.org)

Earth 911's Water Conservation Tips is a complete list of ways to save water in the home by room and also provides additional resources. (http://earth911.org/water/water-conservation)

Texas A&M Rainwater Harvesting Guide to rainwater harvesting, management and reuse. (http://rainwaterharvesting.tamu.edu)

• Financial Incentives

Database of State Incentives for Renewable Energy offers information on state and federal tax incentives for solar electric and other renewables, alternative-

fuel vehicles and energy conservation. (www.dsireusa.org)

Tax Incentive Assistance Project is designed to give the latest information on federal income-tax incentives for energy efficiency with buildings and vehicles. (www.energytaxincentives.org)

• Green Building Groups

Charlotte Chapter-USGBC represents the Western N.C. region, offering LEED and USGBC information and events. (http://chapters.usgbc.org/charlotte)

Energy and Environmental Building Association 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)

Southern Appalachian Sustainable Building Council is a nonprofit green building educational organization promoting the conservation of natural resources and the advancement of human well being in the southern Blue Ridge Mountains. (www.sasbc.org)

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. USGBC administers the LEED certification programs. (www.usgbc.org)

• Local Resources

Green Drinks Asheville is a networking party that is part of the self-organizing global grassroots movement to connect communities with environmental ideas, media and action. It meets weekly, frequently with a speaker/panel, to discuss pressing green issues. (www.ashevillegreendrinks.com)

Southern Energy and Environment Expo is an annual event designed to showcase renewable energy and sustainable economics in the context of responsible environmental stewardship. (www.seeexpo.com)

Sustainable Asheville promotes sustainability in our community through education and networking. SA provides opportunities to share insights and creative solutions for living interdependently within our local and global ecosystems. (www.sustainableasheville.org)

Sustainable WNC is a Web portal for businesses, nonprofits, citizens and local governments working to promote the principles and practices of sustainability in Western North Carolina. (www.sustainablewnc.org)

• Publications

Back Home Magazine is the magazine that delivers useful do-it-yourself information on sustainable, self-reliant living. (www.backhomemagazine.com)

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)

Environmental Design and Construction Magazine is a bimonthly magazine reporting on the innovative products, strategies and technologies that are driving the green building industry's success.
(www.edcmag.com)

Home Power Magazine offers 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)

World Changing is an online source for news on sustainable efforts.
(http://worldchanging.com)

For a complete and updated list of green building resources, visit the resources list at www.wncgbc.org.

TECHNOLOGIES EXPLAINED

What are carbon offsets?
First calculate your "carbon footprint" through one of the many online tools (simply perform a search for "carbon offsets" using any search engine). You will need to know your utility usage and fuel consumption to get an accurate number. Your carbon footprint is the amount of quantifiable carbon dioxide released into the atmosphere based on the amount of energy you consume by your lifestyle. You may realize that there are certain polluting activities that you can't avoid or reduce any further. You can offset these activities by investing in carbon-reduction projects. Carbon offsets reduce the same amount of carbon elsewhere through energy-efficiency or renewable-energy projects that would not have happened without your contribution. For more information on local carbon reduction initiatives, visit www.appalachianoffsets.org.

— E.K.

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