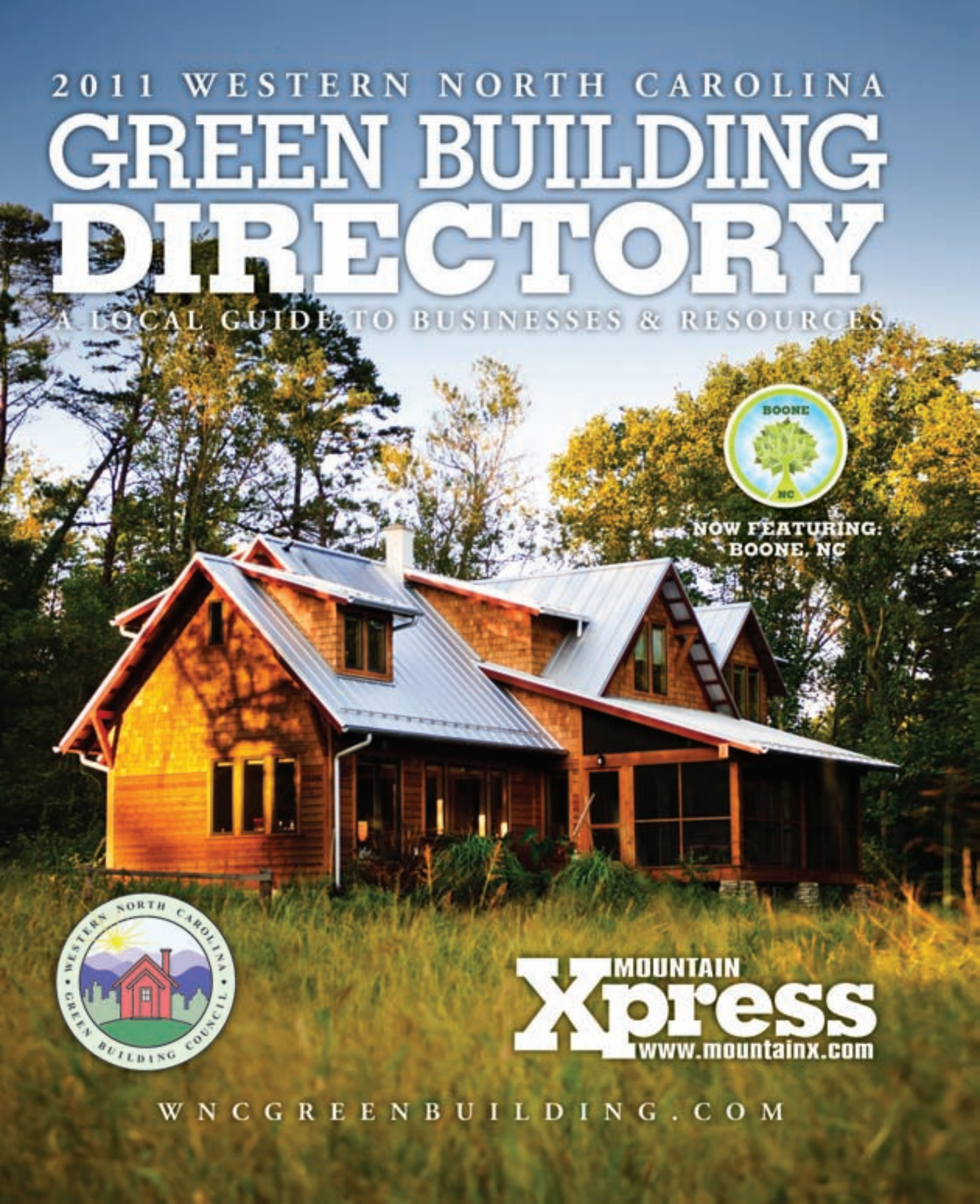
2011 WESTERN NORTH CAROLINA

GREEN BUILDING DIRECTORY

A LOCAL GUIDE TO BUSINESSES & RESOURCES



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Contents

The **Green Building Resource Guide** *and more articles, "how to" checklists and other information are now online at www.wncgreenbuilding.com.*

Boone & beyond

For the first time in the Green Building Directory's history, we've included articles focused on Boone, N.C., where environmentally friendly ideas in construction, homes and schools are blossoming. There's the Green Building Committee, organized by the High Country Home Builders Association (www.hchbagreen.com) and focused on providing ideas and resources. There's the High Country Green Team, an alliance of Boone-area Realtors committed to "raising awareness of the growing methods of 'green' construction" (http://blueridgegreeninitiative.blogspot.com). And (among many others we don't have room to name), there's Appalachian State University. In this guide, we report how the college is leading the way — redesigning a dorm to meet LEED standards and breaking into a world-renowned competition, the Solar Decathlon. We'll be on the lookout for more green-building news and adventures from Boone in the coming year, so stay tuned at mountainx.com and wncgreenbuilding.com.

— *Margaret Williams, editor*

Masthead

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Introduction

The Green Building Directory, 10 years strong

by Matt Siegel

It is such an honor for me to be part of the WNC Green Building Council as the organization completes its 10th year of helping to create a more sustainable Western North Carolina. The Green Building Directory has been a primary tool for education, outreach and expanding the green building industry in this region since its first year. Through our partnership with the *Mountain Xpress*, the directory provides a free, non-biased resource of the latest information on green building for both the general public and building professionals. The directory content spans the range from very technical fact sheets to case studies that focus on affordable green homes and buildings.

Within these pages are your keys to successful green building projects.

For those of you ready to take that next step and either build a new green home or green your existing home, the business listings will connect you with the many great local companies that are greening WNC each day. All businesses listed must meet minimum criteria to be listed in this guide.

Enjoy, share and spread the directory and the news that green building is here to stay.

To find out more about what the WNCGBC has accomplished over the past decade and what its current programs are, see the feature article, "10 Years Greening WNC."

Uncovered: During the demolition stage, contractors discovered cast-iron support columns, embellished with floral designs. Such features hint at the building's early days at the turn of the 20th century.

photos by Jonathan Welch

Playing now

Sustainability meets historic preservation at The Altamont

by Tracy Rose

The challenge: Take a four-story, brick-and-timber building with a failing roof erected more than a century ago in downtown Asheville and transform it into a model for environmental responsibility and historic preservation.

Brian Lee and **Tiffany Hampton** took on that challenge. When they first bought the building, the husband and wife duo planned to create the Altamont Theatre, a new venue on Church Street for musical theater, where Lee serves as the nonprofit theater's executive director and Hampton acts as artistic director.

"It's sort of got the best of both worlds — the old and the new," says Hampton, surveying the building's exterior one rainy fall morning amid the hum and clang of renovations.

Specifically, the $2 million renovation project aims to meet two exacting sets of standards: those required to qualify for state and federal historic-preservation tax credits and those necessary to achieve LEED (Leadership in Environmental and Energy Design) certification from the U.S. Green Building Council.

In fact, it's the first downtown renovation project on course to receive this certification, says architect **Patti Glazer**, principal-in-charge of Glazer Architecture, the firm hired for the job. LEED certification offers "independent, third-party verification that a building project meets the highest green building and performance measures," notes the U.S. Green Building Council's website.

"A forest of 4x4s"

The building at 18 Church St. — now known as The Altamont, a nod to Thomas Wolfe's thinly disguised name for Asheville in his epic novel, *Look Homeward, Angel* — was built in 1895 and needed serious TLC when the couple bought it about three years ago.

Project architect **Chris Rogers** of Glazer Architecture figures the building's stoutness reflects a semi-industrial past, built perhaps as a wagon-repair shop. The load-bearing masonry walls are about 18 inches thick, while the floors are supported by heavy timber beams set 8 feet apart, spanned with stout timber decking.

"I always remind people on the job … while European stone carvers were out there at the Biltmore, they were laying bricks down here downtown, and that all the materials were brought on horse-drawn wagons," Rogers says. "This was a different time and era."

In later years, the building housed the Van Winkle Law Firm offices (1952-1986), followed more recently by the Asheville Savings Bank, which used it as a temporary headquarters while its main office underwent renovations, according to online histories of the businesses.

Although the building was essentially solid, the roof was collapsing despite a "forest of 4-by-4s" — hundreds of wooden posts on the top floor propping up the roof amid strategically placed buckets to catch rainwater, says Rogers.

"It was really pretty extreme," observes Glazer.

The roof had to be torn off and replaced. Only then they could get to the job of rehabbing the top floor. Unoccupied for 80 years, it had once been a meeting hall for the Independent Order of Odd Fellows, Rogers mentions.

Another quirk: The building is wedge-shaped, which makes construction "interesting," Glazer says. "Things are not plumb, or level or square," she adds. "And so you have to custom-build a lot of things."

Something old is new again

For The Altamont's latest incarnation, contractors created an open space on the first floor for a small lobby and black-box theater, a performance space with no fixed seating that will accommodate 120 people. (The room will double as a multipurpose event space when no shows are scheduled.) The performance space required a structural reconfiguration, since a row of support columns down through the middle of the space had to be removed.

To fulfill both LEED certification and historic-preservation requirements, workers sandwiched the old beams between new, deeper beams that could span the full width of the building. They also saved the original oak flooring, where the cutouts for the columns could still be seen during renovations last fall.

An open staircase descends to the lower level, with room for a bar, gallery, public restrooms, dressing rooms and a green room, with help from a small addition at the rear of the building.

Two doors with peepholes were salvaged from the Odd Fellows hall upstairs and resized as dressing-room doors, says **Rick Fleming**, president of RPF Construction, the general contractor. He and Lee speculate the doors once concealed a speakeasy at the top of the building.

A gleaming four-stop elevator carries visitors to the top two floors, which have been renovated into six apartments that will double as both vacation rentals and short-term housing for out-of-town actors in Altamont Theatre Company productions. The apartments include recycling closets, all-new exterior windows and doors that are energy-efficient, insulated and tightly sealed, says Rogers.

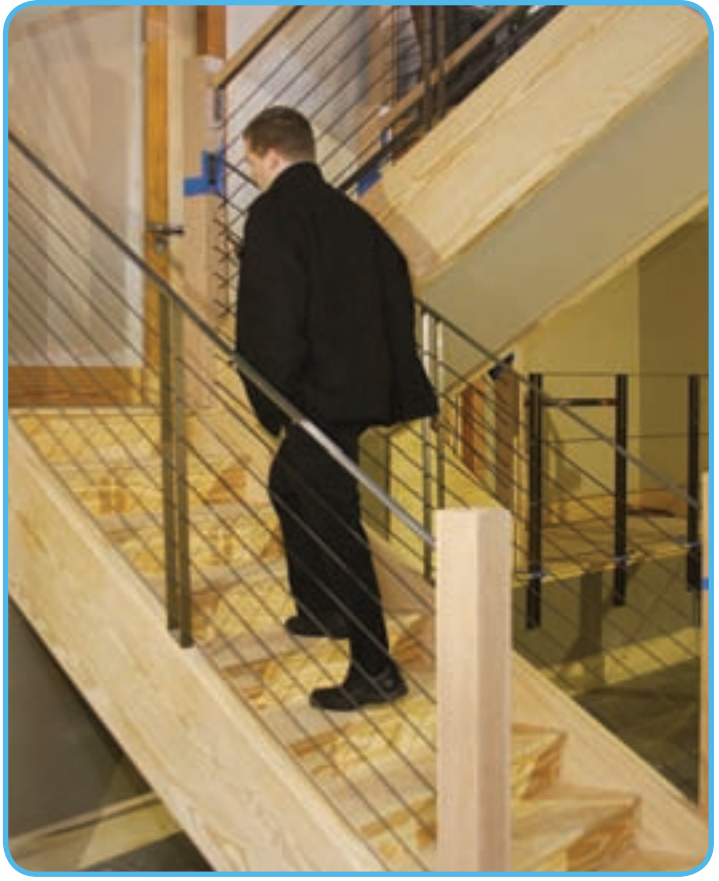
In another victory for historic preservation, Fleming says that they were able to save trim from the Odd Fellows hall and reuse it in one of the apartments.

While restoring the facade, contractors uncovered cast-iron columns — embellished with floral designs — that had been covered up by a "horrible, closed-in brick" 1970s street-level modification, Rogers mentions. Once the brick had been removed, they added storefront windows to better keep with the original look of the building.

Such tasks in the renovation required the coordination of a small army of contractors and major sub-contractors: Essential Systems Engineering (plumbing, mechanical and electrical engineering); Mady Engineering (structural engineering); Hill's Plumbing Contractors (plumbing); White & Williams (mechanical); Barlow Electrical Services (electrical) and Sundance Power Systems (solar installation). **Johnny Bennett** served as job superintendent for RPF Construction, the general contractor.

Sustainability + preservation = challenges

Energy efficiency is foremost in the LEED certification requirements, which fall into two parts: the building's envelope



Green on many levels: An open staircase descends to the lower level, with room for a bar, gallery, public restrooms, dressing rooms and a green room, with help from a small addition at the rear of the building.

and its mechanical systems, Rogers explains. Rigid foam insulation on the roof and brick walls stem the building's heat loss, he says.

The building generates its own hot water for the apartments and the theater through rooftop solar panels.

Yet to look more historically accurate, the mechanical systems and solar panels had to be set back from the roof and the panels' angles flattened to be less visible from the street — all without compromising efficiency.

"The historic guys would prefer not to see any rooftop anything," Glazer says, referring to State Historic Preservation Office employees she has often worked with. "It's a challenge … trying to please them on all fronts."

Natural gas heats the building via a high-efficiency heating system, Rogers says. And all of The Altamont's toilets, faucets and showers are low-flow fixtures.

Meanwhile, an energy recovery ventilation system on the roof brings in fresh air for the theater and exhausts its old air while a heat exchanger captures energy from the outgoing air. Smaller ERVs in each apartment bathroom do the same for the residential units.

"Fresh air is a critical piece of environmental quality," notes Rogers.

An inviting space: The public space at The Altamont relies on green elements too, from the eco-flooring to the choices in fixtures.

Using regional materials also scores LEED points. The Altamont incorporated carpet from Georgia and ceramic tile from Tennessee. Reusing material within the building or in another project also is key.

"The trick is to not just throw it in the landfill," Glazer says.

Extensive documentation is required for the LEED application, including details like the amount of construction waste diverted from the landfill, air-quality testing and the building's proximity to public transportation, the architects point out.

Although LEED certification is useful for verifying that green-building practices were used, the architects take issue with some aspects of its rating system.

"The ultimate recycling is renovating an old building," says Glazer, yet the project earned only a single point in the LEED scoring system for reusing the entire 11,130-square-foot building.

The show must go on

By late November, renovations neared their final stages, and plans were being firmed up to launch Altamont Theatre Company's inaugural season in February. Apart from the renovations, necessities such as seats and professional lighting brought the project's price tag to about $3 million.

Beyond the satisfaction of being a steward of the environment, Lee hopes to use the LEED certification as a marketing tool.

"If we were doing this in another town, nobody would care about LEED certification ultimately," Lee says. "Eventually they might, but Asheville has got such a forward view … that LEED is more significant here than it would be anywhere else I think in the state."

For more information, visit glazerarchitecture.com or call RPF Construction at (828) 236-9531.

Freelance writer/editor Tracy Rose is based in Asheville.

Budget conscious

Creating a net-zero home

by Anne Fitten Glenn

When **Ben Edson** and **Emily Mahowald** decided to build a green home, they took a few extra steps: They chose not to own a television or clothes dryer.

After all, even in a well-built, energy-efficient home, the results depend on the behavior of the people who live there. If your goal is to build a net-zero energy home (producing as much energy as you use, in other words), you must reduce your energy use to the least possible.

That's essentially what the couple did for their home. It's a net-zero "cost" structure, which means the expense of purchasing energy is balanced by the income from selling the electricity generated on site.

For homeowners like Edson and Mahowald, getting to zero (however you figure it) translates into a simple notion. "You basically need to be willing not to live like most Americans," says energy analyst and mechanical engineer **Amy Musser**, one of the team members who helped design the couple's house.

Among several green features applied at the home, Edson and Mahowald's open yard sports a large umbrella drying rack for clothes drying. In addition to clothing, the couple wash and sun-dry all their 5-month-old baby's diapers and wipes. "There's always room for improvement in living efficiently," Edson says — though even the most energy-conscious folks might quake at the thought of daily sun drying, he concedes.

Selling solar power: This dual metering system lets homeowner Ben Edson see both how much solar-generated electricity his home uses and how much of this electricity he and his wife are selling back to Progress Energy at a rate of 24 cents per kilowatt hour.

photos by Anne Fitten Glenn

There's a mix of ways to meet the zero-to-minimal energy expenditure goal. For Edson and Mahowald's home, photovoltaic panels generate enough electricity to compensate for the amount they use and still have a little extra: The couple buys energy off the grid for about 10 cents per kilowatt hour and and then Progress Energy pays them 24 cents per

Net zero home building team: Builder Hans Doellgast, left; co-owners Ben Edson and Emily Mahowald (holding Landon Edson, center); architect Matthew Vande; mechanical engineer and energy analyst Amy Musser, right.

kilowatt hour, or about $1,100 per year, for the electricity they produce.

Typically, about 60 percent of a home's energy use comes from its systems, such as heating, cooling and hot water, according to Musser. The rest comes from powering the lights and appliances. Homeowners can cut their usage by one-third to one-half by living efficiently — such as installing low-energy lighting and relying on fewer appliances (or reducing their use).

To get to net zero, Edson, Mahowald and their fellow Warren Wilson College graduate **Hans Doellgast**, owner of Jade Mountain Builders, schemed and planned for almost four years before starting construction on the 115 Carrier St. home.

Part of the efficiency equation of the home's construction includes having a group of folks planning for both its sustainability and affordability from the get-go. In addition to the homeowners and Doellgast, the team included Musser and her husband, **Matthew Vande,** the architect for the home and co-owner of Vandemusser Design, an energy-analysis and home-systems design company. (See "Project Energy Efficiency" elsewhere in the Case Studies section.)

Early in a project of this kind, Musser and Vande start thinking about the systems that the homeowners need for comfort, efficiency and indoor air quality before they start designing the home's form, they explain. Once they have a plan for the primary systems, Vande can integrate that seamlessly into the design, which is how the Edson/Mahowald home plans developed.

"I try to see what people really need," Vande says. "I ask, 'Where do you think you're going to be in five years?' Most people can live in much smaller spaces than they think."

In this case, the homeowners had decided they wanted to start a family, and soon after construction started, Mahowald became pregnant with son Landon, so the couple added a room over the garage for a little more space.

Completed in Sept. 2010, the couple's home is approximately 1,650 square feet and includes an additional 400 square feet of unfinished space in the garage. According to Doellgast, the home cost about $160 per square foot to build. In WNC, most of the smaller, net-zero homes

Budget conscious: Ben Edson and Emily Mahowald created their new highly energy-efficient home in West Asheville.

tend to cost about $200 per square foot, he says.

However, Musser suggests that cost per square foot "is a bad way to think about home prices. Getting the most out of your square footage and using less resources and materials is the best way to maximize your enjoyment of a home."

So how did this team create such an energy-efficient home while keeping costs down?

They spent a lot of time thinking about both energy-efficient systems and what the homeowners truly needed before breaking ground. Plus, according to Musser, Doellgast's construction crew really "gets it and can take responsibility for the big picture, such as keeping the home airtight and making sure that the systems are integrated during building." Because the builder has experience building this type of home and was realistic about the homeowners' budget, the construction costs stayed on track — and in some cases, as with the plumbing and lighting fixtures, came in under budget.

"Having a working relationship with Matt and Amy was a really important part of the process," Doellgast says. "If there isn't a cohesive working process, something will fall apart at some point."

The team also hunted down low-maintenance and affordable building materials, such as Hardie-board siding, a fiberglass shower insert, plumbing and lighting fixtures and even broken-up former sidewalk concrete to build retaining walls.
At one point, all the interior door sizes were changed when Doellgast and Edson found and purchased a stack of inexpensive doors. But according to Musser, who was on-site when the call came to redo the door sizes, it wasn't a big deal because she and Vande were willing to stay flexible in order to save money — especially if the energy efficiency of the home remained uncompromised.

According to Doellgast, the Carrier Street home is the first Platinum level, NC HealthyBuilt home in North Carolina. When he accepted the NC HealthyBuilt award for the home, he said, "I want to thank my friends for letting me put a $300 tub insert in a [home with a] $3,000 PV system." In other words, the couple spent their cash on energy efficiency as opposed to fancy tile work or an expensive tub. For Doellgast, that's what energy efficiency on a budget is all about.

And there was another bonus to the extensive research of the systems that the home's team put in. Solar provider FLS Energy hired Edson during construction of the home. He's now their sales director and clearly knows from personal experience how well the Asheville-based company's solar systems work. After all, his family lives with them every day.

For more information, visit jademountainbuilders.com.

Freelance reporter and columnist Anne Fitten Glenn lives in Asheville.

WHAT MAKES IT GREEN

Here are some of the specific technologies and systems in the 115 Carrier St. home:

- Solar hot water for radiant floor heating and hot water connected to 190 gallons of storage with capacity to generate 90,000 BTUs of heat daily

- Solar electricity system generating 350 to 400 kilowatt-hours per month, grid-tied to Progress Energy (so far, the family has used about 260 kilowatts per month, Vande reports)

- Passive solar, south-facing windows and concrete floor for thermal mass

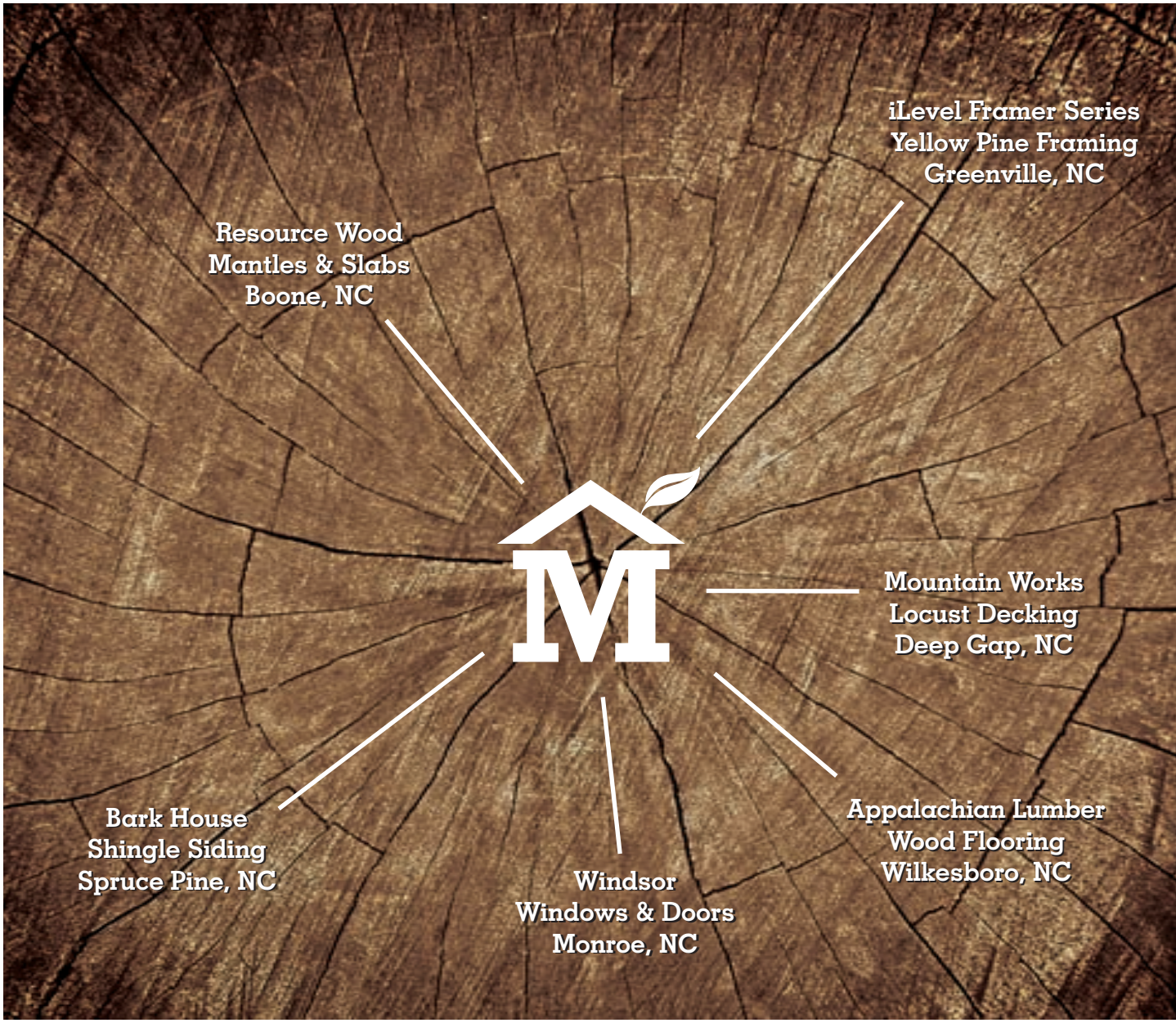
- SIP (structural insulated panels) walls and roof for excellent insulation (R-values for walls vary widely depending on the materials and insulation, but a typical wooden stud wall has an R-value of about 6 per inch, while the SIP typically have R-values ranging from 21 to 58 depending on the materials and thickness of the panels)

- Hardie board (fiber cement board) and batten exterior for affordability and durability (it's strong and needs next to no maintenance)

- Interior posts, trim and build-ins from locust harvested on-site and "junk" oak found by Doellgast

- A 5,000-gallon rainwater catchment system for landscape watering, plumbed for future use for gray water toilet flushing

- Mini-split air conditioning for dehumidification that doesn't need ductwork or central system



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Something old, something new: These are not the same dorm rooms of yesteryear. While the structure for the dormitory, Frank Hall, was built in the 1970s, a slew of new green features earned it a Gold LEED certification.

photos by Mari Fox

Frank Hall gets the gold

Appalachian State aims for the LEED

by Mari Fox

Frank Hall is a place, not a person — a place where about 200 students can sleep safely and comfortably at night knowing that their LEED Gold certified residence hall and eco-conscious lifestyle is a model of green living to Appalachian State Univeristy, the community and the country.

Initiated by the University Housing Office, LEED certification and sustainability in student residence halls has become the new design-and-build standard at ASU, located in mountainous Boone, N.C. A little more than half way through a 14-year renovation plan, state leaders are making sure that every new or renovated dorm will get a green makeover that's LEED certified. Each design will be unique to the individual building and/or site and have its own criteria for budgets, bidding and project team selection.

"The bar has certainly been set high with our first shot at LEED building attaining Gold," said **David Sweet**, director of design and construction, the Appalachian office that supervised the project. "From now on, every new construction and retrofit of any university building will be LEED certified."

Frank Hall was completely renovated in the 2008-2009 academic year. It opened for occupancy in the fall of 2009. Those lucky enough to call the renovated residence hall home get to live in an environment quite different from the original structure, which was built in the 1970s.

For the upgrade, students voted on the design features they wanted, including:

• HE Front Load washing machines with laundry view system that allows students to use their campus debit cards to operate the washers and dryers and receive automatic updates to their cell phones or email alerts when their cycle is finished.

• Common kitchen area with stove, with added safety elements

• Rice-based resilient flooring and porcelain tile

• Recycling centers on every floor

• Natural sunlit study/common area with flat-screen TV

The biggest challenge, expense and most visible part of the project was the installation of the 41 solar panels — "a huge part of the renovation," said Sweet. These panels heat the water used for low-flow showers, HE washing machines, sinks and water-source heat pumps. Project designers, the Asheville-based Calloway Johnson Moore and West, incorporated many less obvious sustainable features to promote student health and safety and earn LEED points including:

• Pervious concrete to reduce rainwater runoff

• Reused and refinished sheetrock, which saved about $700,000

• Zero-VOC paints (no volatile organic compounds)

• Energy efficient (albeit LOUD) hand dryers that dry hands in 10 seconds

• All T-8 or T-5 florescent lighting with wireless motion sensors in public areas

Chancellor **Kenneth E. Peacock**, the students, the employees — the whole Appalachian State community — are all committed to living up to the

Let the light shine: Natural lighting in the common rooms serves multiple purposes, such as reducing the need for electric lighting and helping warm the room in winter.

university's growing reputation for leadership in sustainability, renewable energy and environmental technology. "Attaining LEED certification makes people aware of the university's commitment to sustainability," said **Andy McDonald**, project coordinator of University Housing. "Seeing and hearing the excitement of both parents and students on move in day when Frank Hall reopened made me proud."

New and prospective students coming on campus tours are looking for academic environments that show leadership in sustainability and an environmental focus. In addition to the degree programs and the university's commitment to sustainable practices and policies, student involvement in eco-conscious living has catapulted Appalachian State to fame as a "cool school" and a plethora of other eco-savvy titles. Some top honors include: Sierra Club's America's Top 100 Greenest Schools; The Princeton Review's Guide to 286 Green Colleges (presented in partnership with the U.S. Green Building Council), and the 2009 recognition of the largest wind turbine installation in North Carolina.

To earn a spot on the "green" campus lists, the following initiatives are taken into consideration:

- Alternative energy sources
- Environmentally friendly construction
- Green cafeteria choices
- Alternative transportation
- Green courses built into the curriculum

In addition to the eco-friendly building itself, Frank Hall is home to the university's popular "Living Green" community, which has prompted further eco-conscious personal living and campus-wide changes, such as a compost station, future hydration station (a new fangled drinking fountain that also fills water bottles) and a petition to on-campus restaurants for eco-friendly to-go containers.

And, there's the campus-wide, student-led REI (renewable energy iniative) program that encourages students to donate $10/semester to propel environmental health and energy efficiency changes around campus.

State of the (washing) art: The laundry view system allows students to use their campus debit cards to operate the washers and dryers and receive automatic updates to their cell phones or e-mail alerts when their cycle is finished.

"Being a role model in eco-living feels good," says freshman **Tyler McDonald** when asked what he likes best about living in Frank Hall. Besides the slow elevators, he has only compliments about living in his LEED Gold dwelling with his eco-friendly student colleagues.

The future of sustainable building at Appalachian State seems bright. Cohn Hall was completed in August 2010 and will also help create a campus legacy in environmental design. All involved are anxiously awaiting notification of LEED status for Cohn Hall. "We have some exciting new features that push the limits of conventional green design — reflective metal/solar roofing and living roofs are just a couple of things that are showing up in future designs," said Andy McDonald.

Before the end of the year, a presentation ceremony will take place at Frank Hall to commemorate the first LEED plaque awarded to the university. The plaque will go on display as a symbol of the major accomplishment in sustainable building for the school. "For me, when the notice came from the U.S. Green Building Council that we had achieved LEED Gold certification, that was the shining moment of the entire process," said Sweet.

"All future buildings will have to measure up or exceed what we've accomplished so far."

For more information, visit appstate.edu.

Green-business owner and freelance writer Mari Fox lives in Weaverville. She can be reached at mari@shecology.com.

THE LOWDOWN ON LEED

Leadership in Energy and Environmental Design is a third-party certification program administered by the Green Building Certification Institute (GBCI) for the U.S. Green Building Council. It's the nationally accepted benchmark for the design, construction and operation of high-performance green buildings. LEED promotes a whole-building approach to sustainability.

Points for commercial LEED, New Construction, are awarded on a 100-point scale, and credits are weighted to reflect their potential environmental impacts in the following 5 categories: **sustainable site development**, **water savings**, **energy efficiency**, **materials selection** and **indoor environmental quality**. Ten bonus credits are available.

LEED-NC point system

- Platinum 80+ points
- **Gold 60+ points = Frank Hall**
- Silver 50+ points
- Certified 40+ points

The Esselstyn's motley roost

An old central Asheville house goes green

by Susan Andrew

Between the UNCA campus and the five-way intersection known as Five Points — where Broadway and Chestnut Streets meet Mount Clare Avenue — there lies a neighborhood of small but charming bungalows, many built in the 1920s. From an era when working families could enjoy a modest home with wood floors and a fireplace, it's a central Asheville neighborhood where folks in search of a neat old fixer-upper might find just the right thing.

The charm of these older homes lies in their original features: the smooth plaster walls, the wood siding and door casings and window trim, the wavy old glass held in a frame of molded wooden mullions. Such handiwork is a labor of love from the builders of previous generations.

Yet for modern families eager to conserve energy and reduce their carbon footprint, such older homes present some challenges. Most builders will tell you it can be easier (and therefore cheaper) to "go green" when you're starting from scratch. Retrofitting an old house to accommodate today's green features — such as extra insulation, low-E or high efficiency windows, solar hot water, and the infrastructure to support it all — can get complicated.

But for those who love the architectural details of days gone by or who are motivated by a desire to refrain from casting into the landfill the "embodied" energy of the materials and labor of the builders and craftsmen of yore, green renovation offers many rewards.

Those twin goals are in evidence throughout the renovated house at 49 North St., home to **Blake** and **Cindy Esselstyn**, their 3-year-old daughter and their German shepherd rescue dog, Loretta.

Love at first sight

The couple bought the vintage house in 2004. They loved the little bungalow's front porch, its stone foundation and fireplace. The yard drops off on one side, offering a steep slope for gravity-fed rainwater, delivered from the house gutters to the flat garden area below. And there was the original wood siding hidden under a more recently added skin of aluminum.

With professional guidance from Asheville architect **Jane Mathews** and general contractor **Kevin Ward** of SouthEast Ecological Design, the Esselstyns enlarged the original 1,000-square foot, single-level house. It grew to 1,700 feet when they added a master bedroom and bath at the rear of the main level, plus a partial second level that created two more bedrooms and a bath.

"Blake and Cindy did a great job of communicating their needs in words and pictures," recalls Mathews. "Our job was to be great listeners and then take their needs and ideas and make them real. The house had an inherent funkiness that the Esslestyns loved. [It] was a challenge that allowed for some creative solutions."

"The renovation was a real labor of love for Blake and Cindy, as well as for our crew," says Ward. "It was really gratifying — though arduous — to invest so much care into that quirky old house."

Let it burn: Blake and Cindy Esselstyn installed a fireplace insert which burns wood pellets — made from reclaimed sawdust created in the furniture industry — as a supplemental source of heat in the living room. The stone fireplace is original to the house.

photos by Jonathan Welch

The house came with forced air heat provided by a furnace. The Esselstyns wanted to harvest the sun's energy to heat rooms and provide hot water. It's one thing to put a solar collector on your roof — the Esselstyns purchased an active solar evacuated tube system installed by Thermacraft — but it's another thing to route that heat evenly to every room in the house, says Blake.

Bringing radiant in-floor heat with solar-heated water to the new part of the house was fairly straightforward. But getting the tubing into place beneath the floor of the existing house was tricky. The house had been added on to before; floor joists for some sections ran east-to-west, while others ran north-south. To accommodate the heating system, cutting through the joists required supplementary bracing for support in the basement, as did the added weight of a second level.

That's where careful engineering was critical. "In defining how we would carry any form of a second floor," Mathews explained, "we had to think our way down through the first floor and basement to allow for structural support that wouldn't create problems with use of space at those floors. We then took these concepts and worked with [the engineers at] Medlock and

Gaining control: Water heated in an evacuated tube system on the roof provides radiant in-floor heat organized in four zones in the house, as Blake Esselstyn explains. Natural gas provides backup on cloudy days. Solar collectors, a second-floor addition, and original rock work are visible at this updated 1920s cottage.

Associates to finalize a structural direction for the renovation."

Low profile

An overarching theme of the project was to keep the overall carbon footprint — including the distance materials had to be transported — as small as possible.

The Esselstyns used locally produced and reclaimed materials at every opportunity. A large black walnut tree had to be taken down next to the house; with wood from additional walnut trees felled by a neighbor, tthe Esselstyns got stair treads, built-in shelves, cabinets and trim. Bead board salvaged from a demolished closet was re-used for two ceilings. The kitchen cabinets were made from flooring reclaimed from the old Marshall High School auditorium as it was being renovated.

"In general, the re-use and preservation of the existing house was a strong focus for the project," says Ward. The floor plan placed a heavy priority on preserving the existing wall structure, including the plaster, wherever possible.

Two chimneys were removed, and the bricks used for a walkway. A small retaining wall was built from reclaimed sidewalk concrete fragments from the Health Adventure project site three blocks away. Doors that were removed when walls came down were re-purposed as pocket doors in the new construction. A local potter made the sink basin in the new master bath. Twenty windows original to the house were restored and made more airtight, rather than sending them to the landfill and installing new windows. Flooring harvested from one part of the house was re-used elsewhere, while poplar flooring milled on a nearby construction site was used in another part of the house.

Water conservation came by installing low-flow toilets and fixtures. Additionally, a new single-drawer dishwasher uses just 2.5 gallons per load, while a gray-water system captures water from tubs and showers for flushing toilets. A 660-gallon outdoor cistern collects storm water from the roof to provide irrigation to outdoor plants.

The Esselstyns are seeing some results from all this "greening," starting with significant savings compared to comparable homes in the area. Their electric consumption is 300 kWh per month, while their water bill is 4 CCF for two months. Their gas bill from January, 2010, was $89.84. They do use some natural gas, as a gas-fired tankless hot-water heater provides hot-water backup on cold/cloudy days.

To put these figures in perspective, consider that a typical older house of this size — lacking modern insulation, energy-efficient windows, and other "green" retrofits — can easily consume 10 times that amount, especially if air conditioning or other high-consumption appliances are in use. The Esselstyn's electrical consumption puts them in the same league as the best high-efficiency, low-emissions homes built from scratch. (To see how your house compares, readers can call Progress Energy to determine their annual consumption, and divide by the square footage of your home.)

The house is not air-conditioned and doesn't need to be, Blake explains. "We thought carefully about the relationships with the existing trees for shade. The house was designed to encourage natural fresh air ventilation in the warmer months." The family also follows the old-time practice of opening windows at night for cool air and closing them during the heat of the day.

One of a kind

"Our house is truly unique," Blake says. It solves problems in unconventional ways, such as an original window partly obscured by the new staircase to the second floor, and it has some features he feels others might avoid — for example, the spacious new back deck is accessed through the master bedroom, rather than from a common room, so the view from the original window over the kitchen sink now leads the eye through the bedroom to the trees beyond the new deck.

"But we plan to stay here the rest of our lives," Blake says. "Re-sale value is not really a concern. We love the location: the proximity to the UNCA woods and the Botanical Gardens, downtown, the greenway [on Broadway],

Let there be light: The original kitchen window still allows natural light, thanks to the large windows of the new master bedroom added at the rear of the house. Tubular skylights provide additional light over kitchen work areas. "We don't have to use electric lights during the day," says homeowner Blake Esselstyn. Countertops are made from recycled paper.

the future Health Adventure. We love the efficiency of the house," he continues. "Not just the energy efficiency, but the economy of space, where every room gets well-used and the flow of our lives just seems to work well."

Cindy concurs. "If we can teach our children about conservation, using father sun for power, avoiding unnecessary consumption, saving rain water, treating this planet as our one true home and loving her up, then I think it's all going to be pretty darn beautiful soon."

For more information, visit mathewsarchitecture.com or ecologicaldesign.net.

Susan Andrew is an environmental reporter at Mountain Xpress*; she can be reached at sandrew@mountainx.com..*

GREEN FEATURES

- Low- to no-VOC finishes and adhesives throughout the home
- Recycled-paper countertops
- LED recessed lighting
- Several sun tunnels for daylighting in every room of the house
- Marmoleum flooring
- Pellet stove for supplemental heating
- Earthen plaster in master bedroom
- Careful and diligent restoration of existing plaster
- Interior electricity usage monitoring system
- Deck lumber from locally sourced black locust.
- Sealed crawlspace
- Hybridized insulation for best use, including closed-cell foam, open-cell foam and Air Krete

Happy, green and bermed: In WNC, we call it a walk-out basement; Amy Musser and Matthew Vande say the house is bermed — being built into the hillside (and having a geothermal system) uses the earth's relatively constant temperature to heat and cool the house.

photos by Jonathan Welch

Project energy efficiency

How the pros green their own home

by Tracy Rose

When **Matthew Vande** and **Amy Musser** bought their home in Asheville's Montford neighborhood six years ago, they had a built-in advantage over most homebuyers: two in-house energy-efficiency experts.

Both Vande, a licensed architect, and Musser, a licensed mechanical engineer, earn a living by trying to make other people's houses greener, healthier and more energy efficient — they run VandeMusser Design. With the purchase of their own home, the couple had a ready-made test project — with some advantages from the get-go.

"When we bought the house, we selected it to not have problems that a lot of houses have," Musser says.

This old house

Sitting in her comfortable living room one recent rainy morning, Musser described the home's less-than-obvious selling points along with the work they've done to improve it. Vande, meanwhile, worked in the couple's home office downstairs, a pair of white German shepherds at his feet.

"It was a good, normal house when we bought it," Musser says.

The Melbourne Place bungalow got high marks right away for its new, high-quality construction, meeting all the requirements of 2004's new building code. But the 1,600-square-feet house also scored well in the couple's professional judgment because a quarter of it is built into the ground. In green-building terminology, the house is "bermed," but in Asheville lingo, the house has a "walk-out basement," Musser says. Whatever the term, the earth helps insulate and shelter the house, since the soil temperature stays around 52 degrees year round.

Another positive was that the house didn't have too many windows — which are poor insulators and let in too much solar energy during the summer, Musser points out. A lot of the windows it did have were on the house's south side, which helps passively heat the house in cooler months.

The absence of a crawlspace also was a bonus: "To us, a crawlspace … has all of the potential problems that a basement has but absolutely none of the benefits," Musser says. Crawlspaces aren't big enough to do much with, she says, and they're prone to moisture problems — which is why VandeMusser Design typically advises its clients to seal their crawlspaces.

All of the house's ductwork was contained between the two conditioned floors, which is another mark in the house's favor for energy efficiency. "Even if it leaks, it leaks into conditioned space so there's not an energy loss," she says.

If ductwork isn't airtight and it's not in conditioned space, then the conditioned air will be lost to a home's attic or crawlspace.

Go low-flow: Switching to low-flow fixtures is one of the least expensive changes homeowners can make for energy efficiency.

crawlspace.

Starting with the easy steps

When it came time to launch their energy-efficiency plans, Musser and Vande started small — with easy, inexpensive "no-brainers" — such as using a can of spray foam to seal around a hole cut for pipes coming out of their mechanical room.

They also weather-stripped and insulated their attic hatch, where substantial heat can be lost. If an attic is insulated to code (R-38), for example, and the hatch is not insulated, the attic functions less efficiently at around R-24, Musser observes.

A few feet away, they used their thermal camera to discover that the upper part of their living-room wall was hemorrhaging heat. The attic space on the other side of the wall had fiberglass insulation that wasn't doing the job. The fix? A quarter-inch of blue insulation board installed on the attic side of the wall.

"A simple thing like that — putting a really inexpensive backer on a wall that we just knew wasn't working well — really helped this room a lot," Musser says.

Other easy energy-efficiency upgrades included installing compact fluorescent light bulbs throughout the house, along with low-flow showerheads and low-flow bathroom faucet aerators.

"Actually, a low-flow showerhead is one of the fastest-paying-back things you could do in your house, and it's super easy," Musser says.

The big-ticket items

When Vande and Musser got their $1,200 economic stimulus check in 2008, they gave themselves a challenge: "Let's use this free money to make our house as efficient as we can for $1,200," Musser recalls.

They settled on replacing their electric water heater with a heat-pump water heater. Because it moves heat from the home's interior rather than generating it, it's twice as efficient as a regular hot-water heater.

"It's one of those little quantum leaps in efficiency that we're able to make with

The heat-pump water heater is most efficient in the summer, when it serves a dual purpose of lowering a home's air-conditioning bill. Overall, the unit saves at least $200 per year for most homes, so she calculated a five-year payback for the unit.

After the economic stimulus money was spent, there was still work to be done. By far the biggest investment was installing a geothermal heat pump, which cost $7,000 after federal and state tax credits (of 30 and 35 percent, respectively). A big part of the cost (roughly 40 percent) came from drilling a 300-feet well in the middle of a flowerbed in the front yard for the underground heat-exchange loops, which extract heat from the earth to heat the house via an electric compressor and heat exchanger.

The beauty of geothermal is that it uses somewhere between half and a third of the energy of a conventional system. For example, the couple's heating portion of their electric bill for the brutal month of January 2010 was only $40. During the hottest month, the air-conditioning cost was just $25.

"It's actually the least expensive way to heat your house around here unless you have a lot of solar," Musser says. She estimates that the system will pay for itself in about 10 years. "Really, if you can get under a 10-year payback, you should feel pretty good about yourself," she offers.

The lowdown

Professionals that they are, the pair tracked improvements by using a Home Energy Rating System index, a scoring system that compares a home to the specifications of a reference home that meets the 2006 International Energy Conservation Code. (A score of 100 meets code; each 1-point decrease corresponds to a 1-percent reduction in energy consumption, according to the ENERGY STAR website.)

When the couple bought their house, it scored about 92. The no-brainer changes dropped the HERS score to about 88, and the heat pump water heater brought it down an additional eight points. The upgrade to the geothermal heat pump lowered the score to 60.

What's that mean for the homeowners? "We're now using about 40 percent less energy than a typical house," Musser says.

Even for a new, energy-efficient home, Musser says it's nearly impossible to score less than 50 without using renewable-energy sources to generate electricity, since a house their size eats up about 40 to 50 percent of its energy for lights and appliances.

"On an existing house, to go to 60 is actually pretty remarkable," Musser says.

Apart from energy-efficiency upgrades, the couple added a few more green features to the home as well, such as a whole-house ventilation system, a showerhead filter (to remove chlorine) and a reverse osmosis filter (for more complete filtering of their drinking water), zero-VOC paint, raised beds in the back yard for gardening and drought-resistant turf.

Challenges met, are Vande and Musser finished with their home-improvement projects? Yes and no. Though they've eked out all the energy savings they can manage from this house, they are thick in the middle of their next challenge: building a new, energy-efficient home for themselves.

But that's another story.

For more information, visit www.vandemusser.com.

Freelance writer/editor Tracy Rose is based in Asheville.

WHERE TO GET GREEN GADGETS

Need a quick and easy green upgrade? Or more in-depth information on green building?

The Western North Carolina Green Building Council offers a limited number of items for sale at its office on Haywood Road in West Asheville, says Residential Outreach Coordinator **Jake Sadler**. Those include:

- 1.7-gallons-per-minute chrome showerheads ($5)
- 2-gallons-per-minute hand-held chrome showerheads ($15)
- Half-gallon-per-minute faucet aerators ($1)
- Radon test kits ($8)
- *Builder's Guide to Mixed Humid Climates*, by Joseph Lstiburek ($50)

Interested? Call ahead — (828) 254-1995 — to make sure someone will be available to help you.

Aging in place

The boomers' green-building priority

by Victoria Schomer

As a growing percentage of our population ages, so will its unique need for housing. Not many older folks really want to leave the home they have lived in and loved for many years. Yet, in the past, there has been little alternative for our elders than to move into assisted living and more medically supportive environments.

Not so for the feisty baby boomers. We are not satisfied to leave the places we have painstakingly designed to perfectly fit our domestic needs, nor surrender to a future in some homogenized version of an old folks home. We want aesthetically beautiful, safe and stimulating places to live, where we can continue to entertain and have our families visit. We want to stay put.

The same generation that originated and was weaned on Earth Day, solar panels and CFLs is now demanding that same level of environmental integrity and balanced living in the homes in which they plan to live out their lives.

Open space: This bathroom sink allows a wheelchair-bound resident to roll up to the vanity.
photos by Dale Lang

Ergonomics: A gathering place in any home, a green-designed kitchen for older and/or disabled residents is open, inviting and barrier-free.

The baby boomer population is already asking for more flexible home space that accommodates their changing lifestyles, empty nesting and the future's inevitable uncertainties, which include not just health issues, but, just as likely, rising oil prices and a fixed income.

A 2009 American Institute of Architects design-trend survey found that there is growing demand for, finally, "Less living space and overall smaller-sized homes, more livable homes, in-home accessibility, open-plans, single-floor and blended indoor/outdoor living" (*Custom Home Magazine*, June 30, 2009).

Many of these features sound very familiar to those of us in the green design and building field. In addition to energy efficiency and good indoor air quality, important tenets of green building include a smaller

carbon footprint, better connections to the outdoors and a floor plan that is open and multipurposed to maximize the use of every square foot of space.

The sooner we put in place these green-building attributes, the better able our existing housing stock will be to meet the boomers' growing needs.

New housing and renovations that are green for all — or "universally" green, and set up for aging in place, would include many of the following:

- Single-story homes with a master bedroom on the main floor
- Small (or no) thresholds to enter and maneuver from room to room
- A home that is easy to maintain and clean
- Kitchens that allow for safe and easy movement while cooking and preparing meals, with potential to change out appliances for more accessible fixtures
- Easy-to-reach kitchen storage
- Doors (cabinet and passage) that "disappear"
- Easily navigable bathrooms with threshold — open showers
- Consistent warmth (for aging bodies)
- Better indoor air quality for weaker immune systems

Accessibility: A sill-less shower is level with the floor for easy entry and adds drainage to the bathroom.

• Efficient and effective lighting for older eyes

A new building and adaptive reuse platform can take into account the needs for the aging, keep what is working and redesign what is not. It can allow for the future needs of any individual. While we are planning for the future compromises of aging, we should also be thinking about these same possibilities for anyone. I like to know that I have a home that my 90-year-old mom can safely visit, that my friends with limited mobility can come to, or that I can move through should I (knock on wood) break a leg!

One last thought: At the New Aging Conference held October 2010 at the University of Pennsylvania School of Design, the presenters challenged architects to design spaces to accommodate a population that could potentially live, by the year 2050, to the very ripe old age of 125!

That isn't very far away. Any well-constructed home on the drawing board today should still be a very usable structure in these short 40 years. And a home designed or renovated using any of the better green-building programs should addressing equally issues of energy efficiency and aging in place.

For more information, visit interiorconcerns.com.

Since 1988 Victoria Schomer, an activist and spokesperson for the green design and building profession, is an ASID Distinguished Speaker, USGBC REGREEN Faculty, REGREEN co-author, lecturer, designer, consultant for sustainable planning, remodeling and green-product selection for beautiful and healthy interiors — and a baby boomer.

10 quick and easy steps

Saving green while living green

by Wayne Robertson

As anyone responsible for overseeing corporate utility costs can attest, steadily rising energy costs can quickly and adversely impact a company's bottom line. While prices for some energy sources, including gasoline and natural gas, have backed off from last year's highs, the indication is that the upward trend will continue for these and other resources (including propane), which, in turn, impacts other utility (e.g., electricity) costs.

Added to these potential financial woes is the environmental impact attributed to the very buildings occupied by corporate America. In fact, buildings currently represent the largest source of energy consumption in the world, accounting for 48 percent of all greenhouse emissions — compared to 27 percent for transportation and 25 percent for industry.

Faced with numbers like these, corporate moves towards energy conservation are an essential way to improve the financial (and environmental) bottom line.

There are only two ways to save money on energy: pay less (by finding the best rates) or use less (by reducing waste and increasing efficiencies). In descending order, here are 10 tips to do both:

10. Put your computers to sleep: The EPA is offering free, easy-to-use software to help your computers get automatic shut-eye. A company with 100 monitors can save approximately $1,700 a year (approximately 20,000 kWh). For more information, visit www.energystar.gov/index.cfm?c=power_mgt.pr_power_management.

9. Stop flushing money down the drain by fixing water leaks ASAP. Even a small leak wastes a surprising amount of water and money.

8. Cool it! Simply put: Lower thermostat temperatures in the winter and raise them in the summer. A one-degree change may save up to 3 percent in small buildings. While some employees may complain, remember: It is impossible to please everybody.

7. De-lamp overlit spaces: That is, remove some fluorescent lamps from existing fixtures., but follow this rule of thumb — maintain two to four lamps per 64 square feet. Also, remember to disconnect the unused ballast.

6. Stop burning midnight oil: Reduce unnecessary facility lighting by using occupancy sensors and tuner switches (as well as some coaching of the overnight custodial staff). For new facilities, current energy code requires the use of lighting schedule control devices.

5. Don't be in hot water! Turn down hot water temperatures:

- Hand washing: 105 F (code max is 110 F)
- Showers: 110 F
- Dishwashing: 160 F

And consider putting time clocks on any circulating pumps; if using electric water heaters, consider timing them out during peak electric periods.

4. Practice paper conservation by following these simple rules of thumb: Don't print e-mails; save documents as PDFs instead of printing them; buy a duplexer for your printer, so you can print two sides; save paper printed on one side to feed into the printer for use on the other side, (e.g., for in-house copies).

Delamped: Removing some fluorescent lamps from existing fixtures can reduce costs; but try to keep two to four lamps per 64 square feet (and disconnect the unused ballast).

photo by Wayne Robertson

3. Really read the utility bill: Track your bills monthly to identify patterns of use, spot any unexpected increases or decreases in consumption and determine how specific energy-saving initiatives translate into utility cost savings.

2. Pick the low-hanging fruit: Take advantage of energy tax incentives, as well as resources like utility rates analysis, to generate cost savings or even cash back. To keep track of energy use and related costs, create or buy an energy accounting system and/or a Web-based utility tracking system (with sub-metering and data-logging capabilities).

1. Recommissioning: This service — which includes tuning up HVAC systems, running tests and making necessary adjustments — is recommended for buildings five years or older, or where major renovations have taken place. Recommissioning identifies problems that may have occurred during construction or that developed during the building's life. A study (conducted by Lawrence Berkeley Laboratory) found an average payback of less than one year.

Wayne Robertson founded Energy Ace, a premier sustainability consulting firm helping architects, engineers, building owners and developers design, create and operate sustainable environments (energyace.com) . Under Robertson's leadership, Energy Ace was listed at No. 510 on the Inc.com 5,000 list of fastest growing private companies in the United States. Energy Ace has provided sustainability consulting for more than 140 LEED projects and more than 100 Commissioning projects. Mr. Robertson is a Professional Engineer (PE), Certified Energy Manager (CEM), Certified Commissioning Agent (CxA) and LEED Accredited Professional (AP).

Green-building classroom

Job-training programs in WNC

Compiled by Maggie Leslie and Matt Siegel

With the anticipated growth in green building industry, and the efforts to transition to a more sustainable economy, there are more opportunities available for training in green building, from single courses to degree-level programs. Much of this training is subsidized through governmental funding and result in a certification or degree that will enhance skills and employment opportunities. Whether you are looking to learn about a single theme in green building, get into the green building field or enhance your current knowledge, there is a wide array of classroom training in Western North Carolina.

Green Opportunities

Program description: A paid pre-apprenticeship program designed to prepare low-income, unemployed young adults (ages 16-24) for living wage jobs in the rapidly expanding green economy that includes life skills training, service-learning projects, apprenticeships, community college coursework and mentoring.

Certification/degree: OSHA 10-hour construction safety certification, Building Performance Institute (BPI)-Air Sealing Technician certification and CPR/First Aid training are offered.

Number of graduates: 80.

Hands-on, academic or both: Hands-on.

Highlights: GO's weatherization technician training is part of a pilot "Air Sealing Controller" program offered through the Building Performance Institute and results in a nationally recognized certification. The class involves hands-on practice performing measures typical to weatherization work sites in a controlled environment. The GO Training Team and GO WATT offer participants stipends and a wide variety of hands-on technical and life-skills training experiences.

www.greenopportunities.org
(828) 398-4158

Construction Management Technology

Program description: A building-science program that explores advanced framing techniques and building performance issues in residential construction, the program uses a combination of hands-on projects, field-trips, multi-media and lecture/classroom teaching methods to give students the knowledge to build energy efficient residential buildings. The program also focuses on community collaborations with live projects that focus on sustainability issues. The program also covers some alternative and natural materials and methods for residential construction.

Certification/degree: Diploma or basic certificate program.

Number graduates: Hundreds.

Hands-on, academic or both: Both and more (field-trips, multi-media, lecture and plenty of hands-on).

Highlights: The program's live projects and community collaborations are exceptional. Students built a "N.C. HealthyBuilt" modular home which was sold to the Asheville Police Dept. for an Oakley police substation. Students also built a cob/strawbale playhouse/outdoor class at Evergreen Charter School in collaboration with the Artisan Builders Collective and others. The program has helped many non-profits build everything from food pantries for feeding the hungry to a pavilion shelter for a community garden in Shiloh. Students have also performed home inspections and are currently building the smallest LEED certified house in the country (275 square feet) to help address urban infill and affordable housing.

www.abtechconstructionscience.com
www.ashevillegreenbuildingschool.com

Sustainability Technologies

Program description: The Sustainability Technologies curriculum is designed to prepare individuals for employment in environmental, construction, alternative energy, manufacturing or related industries, where key emphasis is placed on energy production and waste reduction along with sustainable technologies. Courses include alternative-energy technologies, sustainable manufacturing and green building concepts and technology. Additional topics may include sustainability, energy management, waste reduction, renewable energy, site assessment, and

environmental responsibility. Graduates should qualify for positions within the alternative energy, construction, environmental, and/or manufacturing industries. Employment opportunities exist in both the government and private industry sectors where graduates may function as manufacturing technicians, sustainability consultants, environmental technicians or green building supervisors.

Certification/Degree: Two-year Associate Degree in Applied Sciences.

Number of graduates: 35, currently.

Hands-on, academic or both: This program offers a combination of academic classroom learning as well as hands-on experience, including field trips, construction site visits and hands-on experiences.

Highlights: Currently students are working on collaborative projects with the Asheville Office of Sustainability to design an interactive recycling bin project to be constructed and placed in the Civic Center sometime next year. Other experiences include site visits to LEED designed projects and other sustainable projects around the Asheville area. A recent visit to the offices of the National Oceanic and Atmospheric Administration (NOAA) located here in Asheville was very useful to the class and informative about global warming and the issues of climate change.

www1.abtech.edu/sustainability

ABCCM Green Jobs Program

Program Description: The program provides training and job-placement assistance into specified green jobs. Applicants must also be over 18 years old from high poverty areas of Asheville and be unemployed with no high school diploma or GED, have a criminal background or come from a low income household. Qualified individuals can be trained for one of the following career pathways: Weatherization Technician, Biofuels Technician, Solar Thermal Installer and LEED Green Associate. Individuals who qualify will also be put through other life skills support as necessary to prepare them to be "job ready," meaning that they not only have the qualifications of their career tracks, but also the skills to succeed in the work environment. Case management services are included.

Certificates/Degrees: There are five basic phases in the program and the amount of certificates an individual obtains depends on how many courses s/he takes. Of course, each individual will have the certification for their career track (for instance, Weatherization Technician). Other certifications that may be obtained are classes such as Essentials Skills of the Workplace, Basic Computer, Beginning Carpentry and others.

Number of graduates: Weatherization Technician — 51; Biofuels Technician — 19

Hands-on, academic or both: Official training for career tracks are both classroom and hands-on. Supportive services are classroom or individual.

Highlights: In addition to excellent classroom instruction, clients are exposed to hands-on training, which will include apprenticeship.

www.abccm.org

jonathan.mcdonald@abccm.org

(828) 259-5333 or 777-7399

HAYWOOD COMMUNITY COLLEGE

Low Impact Development Program

Program Description: The Low Impact Development curriculum is designed to prepare students interested in sustainable development and natural resource management with the technical skills to serve as specialists in the analysis of land and in the preparation of LID recommendations. Graduates will be prepared for a growing number of careers in the public and private sector that require an understanding of environmental biology, geospatial technology, drafting and the principles and practices of LID. The POS requires a multidisciplinary core of coursework including the study of land planning software programs, soils, site analysis, hydrology, geospatial technology and environmental regulations. Students wishing to pursue the LID POS should have an interest in the outdoors, technology, planning, natural resource conservation and in working with the public and professionals from many fields.

www.haywood.edu/natural_resources_management/low_impact_development

(Green) Building Construction Technology

Program description: The Building Construction Technology curriculum is designed to provide students with an overview of the building construction industry. Construction labs/lecture courses and other related classes, provide students with up-to-date knowledge on

materials, trends, and techniques of the ever-changing construction industry. Course work includes basic construction concepts such as general construction, blueprint reading, construction estimating and project management. Students will also diversify their knowledge of construction in other areas like electrical wiring, construction surveying, plumbing, statics/strength of materials, and HVAC. The construction industry has embraced green concepts in materials, practice and design over the course of the last decade. The Building Construction Technologies program at HCC allows students to learn the building process in preparation for the residence built to the standards of the future. Graduates should qualify for entry-level jobs in any general construction setting and be able to advance quickly to management positions such as supervisors, superintendents, project coordinators, project planners, estimators and inspectors.
www.haywood.edu/advanced_technologies/building_construction_technology

Green Building Certificate

Program description: Green building is the practice of construction that minimizes the impact on the natural environment while making buildings more energy efficient and healthier for humans. This certificate is designed to provide students with an overview of the trends and techniques used in the green building industry. Classroom lectures and laboratory exercises will provide hands-on experience in design, construction, and certification of green buildings. Course work focuses on green construction practices, blueprint reading, building codes, energy efficiency and sustainable site development. Individuals in this program should have an interest in building construction, conservation of natural resources, and in working with the public and professionals from many fields. The program is available through Curriculum or Continuing Education.
www.haywood.edu/fundamentals_of_green_construction

Certification/degree: Certificate, Diploma, or Associates Degree, depending on the program. The Green Building Certificate Program also offers : NAHB Certified Green Professional Certification, EPA Lead Based Paint RRP Certificate, Certified Aging In-Place Specialist Certificate.
Number of graduates: Hundreds of students have been through the Construction Technology with the first students just graduating from the Green Building and LID Programs.
Hands-on, academic or both: Both.
Highlights: Extensive field lab activities on green construction projects and sites.
www.haywood.edu/
www.haywood.edu/sustainability

Building Science Program

Program Description: For over 25 years, Appalachian State University has been a leader in construction education, outreach and research with a continued commitment to sustainable design and energy efficient building techniques. Students in the Building Science program receive a very comprehensive and diverse educational experience, which prepares graduates for a variety of careers within the residential, commercial, industrial, performance and design fields of the building industry. The program has two concentration areas, Construction Management and Architectural Technology & Design, allowing students to specialize in a specific area of interest. Coursework emphasizes the importance of energy efficiency, sustainable design, construction processes and innovative materials using applied learning techniques and the most current computer software, such as Building Information Modeling (BIM), which is applied to building design, estimating, engineering and scheduling. The Masters of Science in Technology offers a concentration in Building Science and Building Energy Engineering. The Building Science concentration focuses on developing construction management expertise and is also recognized for its emphasis on energy efficient building design, construction, and testing, as well as use of alternative building materials. Building Energy Engineering concentration is designed for individuals with an engineering or science background interested in a program with a strong technical emphasis on design and construction of buildings and systems for energy efficiency and healthy indoor air quality.
Certification/degree: Bachelor of Science in Building Sciences with concentrations in Architectural Technology & Design and Construction Management OR Master of Technology with concentrations in Building Science and Building Energy Engineering.
Number of graduates: Hundreds.
Hands-on, academic or both: Academic program with hands-on labs and studios.
www.tec.appstate.edu/building-science

Appropriate Technology Program

Program Description: Appropriate Technology reflects an approach to technological development, characterized by creative and sound engineering that recognizes the social, environmental, political, economic and technical aspects of a proposed technological solution to a problem

facing a society. Generally appropriate technologies are smaller scale technologies, that are ecologically and socially benign, affordable and often powered by renewable energy. The field is an interdisciplinary one drawing from the physical and social sciences as well as Engineering, Architecture and Technology. This concentration provides the most general technological background that the technology department offers. Students will develop knowledge and skill in many technological areas, including drafting and design, wood and metal working, computers, architecture, construction, graphic arts as well as renewable energy technologies, energy efficient solar building design and construction, waste management, research methods and contemporary technological problems. Students could pursue many careers with an Appropriate Technology background. These could include careers in the renewable energy field: energy management, designing, building and/or maintaining renewable energy equipment, work in solid waste or recycling industry, designing and building sustainable buildings, selling AT products, manufacturing AT products, working for utility companies or government research labs or sustainable-development work in developing countries.

Certification/degree received upon completion: Bachelor of Science.

Number of students: Hundreds.

Hands-on or academic or both: Academic, with hands-on labs and studios.

www.at.appstate.edu

Building Performance Institute (BPI), Building Analyst Professional

BPI's nationally recognized credentialing program identifies individual excellence in house-as-a-system evaluation, diagnostics and installation. Stringent technical standards and requirements mean that BPI certified professionals are in demand – from homeowners, state and utility energy efficiency incentive programs and weatherization assistance programs. Go beyond a traditional energy audit to perform comprehensive, whole-home assessments, identify problems at the root cause and prescribe and prioritize solutions based on building science.

www.homeenergypartners.com/pages/training.php
Info@homeenergypartners.com
(828) 350-1155

Energy Smart Contractors

This one-day, eight-hour course will prepare you for the RESNET Qualified Contractor Exam. A RESNET Qualified Contractor is credentialed to complete home performance improvement work in compliance with RESNET's work scope standards of practice. Once qualified, the contractor is eligible for listing in the RESNET Registry of Qualified Contractors and can proudly display the RESNET Energy-Smart logo on website and marketing materials.

www.natresnet.org
info@Vandemusser.com
(828) 348-4723

For a more comprehensive list of educational training programs, including online training and webinars, visit the educational resources at www.wncgbc.org.

Other local training programs

Home Energy Rater Training (HERS)

This is a 5.5 day (Sunday-Friday) intensive training that will provide the student with the core skills required to perform energy ratings. As the basis for conducting a thorough home energy rating, students will learn how the house acts as a system. You will learn to professionally and scientifically evaluate any home's energy performance and offer recommendations for improvements. You will learn how to utilize powerful diagnostic equipment and updated software to aid you in the energy analysis. You will also learn the latest energy finance and incentive programs that can help you expand your business.

www.homeenergypartners.com/pages/training.php
Info@homeenergypartners.com
(828) 350-1155

Beyond the code

One small (but important) step to green building

by R. Christopher Mathis

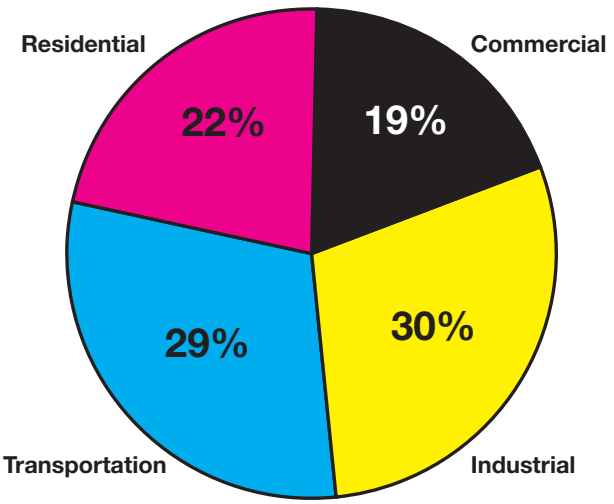
Green builders know that truly building green means going beyond the code. The code defines the minimum attributes a building must have — the minimum structural performance, the minimum energy performance. Green buildings must be, by definition, beyond code. And the code constantly changes.

About every three years, North Carolina reviews and adopts new codes governing building construction. In September 2011, a new array of building, mechanical, plumbing and electrical codes will go into effect in the state. There will also be a new energy code. The most recent version of the North Carolina Energy Conservation Code will play a key role in our state's energy future.

At this writing, the proposed changes to the new energy code have been approved by the N.C. Building Code Council. Barring any actions to stop the implementation of the new code, it will be mandatory for new residential and commercial construction beginning March 1, 2012.

Why do green builders (and North Carolina citizens) care about this new code? What does it mean for our state? Why does it matter? Let's look at the big picture to get some context.

End Use Sector Shares of Total Consumption, 2009



The energy pie

Buildings are the single largest energy-consuming sector of our economy. Our nation's buildings demand more energy and power than the transportation sector and more than the industrial sector. This immense energy demand, somewhat evenly split between residential and commercial buildings, plays a key role in our nation's and our state's energy security.

For more than 30 years now, we have been advised to add more insulation, to seal up leaks and to install more efficient home heating systems. Unfortunately, during this same period our demand for electricity has grown unchecked. In 1973 less than half the homes in America had air conditioning. Today more than 90 percent of the homes we build have AC. During this time we have added even more devices that demand precious electricity. Each new electrical gizmo we plug in adds to the total load that our local utilities must meet. Utilities, in turn, must look at the region's growth, the implications of that growth on their own planning and must decide — years in advance — when and how much additional generating capacity they will need. Sound familiar?

Here in North Carolina, we are blessed with a great state that offers a wonderful diversity of climate and incredible opportunities for businesses, families and individuals to flourish. These facts are reflected directly in our state's population growth expectations. Even in a down economy, the state is averaging annual growth rates of 15 percent to 16 percent per year. Population projections estimate that between 2000 and 2030, an additional 4 million people will move to North Carolina.

That is 50 percent total growth — from 8 million people to 12 million people — in just 30 years.

Code changes: problem or opportunity?

The state's new energy code will be seen by many as a problem — more unwanted regulation. Why can't we just go on building as we have been? There are many answers to this question.

Our state imports essentially all of the raw materials necessary for energy production — all of the coal, oil and gas we need for electricity and heating fuel. Our state's "energy security" is directly tied to the energy demands of our buildings — buildings that will require energy and power for their expected 100-year life span.

The No. 1 source of air pollution is electricity generation. Here's a surprising statistic: The electricity we use at home is responsible for more than twice as much air pollution as our cars.

The energy consumption of our buildings matters.

And did you know that it takes about 30 gallons of water to produce 1 kilowatt-hour of electricity? Our power plants (nuclear and coal) are typically sited on lakes and rivers to provide cooling water used in electrical generation. In recent years, the Southeast has been victim to terrible drought conditions, impacting crops as well as the capacity to generate electricity. During the recent drought, how many people thought to conserve water by turning off a light?

At the national level, the importance of our buildings has been clearly recognized. Recently our nation's building officials met in Charlotte, N.C., and passed a national model code that improves the minimum efficiency of all buildings by at least 30 percent. While the N.C. Building Code Council was unable to embrace these same 30 percent advances for new homes in our state, the 2012 state energy code does take some small but important steps toward better energy efficiency for homes. And the new code contains some unique opportunities for North Carolina's green builders.

Good news/bad news

Most of the residential construction changes embodied in the new code are already common practice for most green builders. These will include:

• Total duct leakage less than or equal to 6 CFM (12 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area.*

• Building envelope air leakage is less than or equal to one of the two following performance measurements:

1. 0.30 CFM50/Square Foot of Surface Area (SFSA) or
2. Five (5) air changes per hour (ACH50)

There is, however, one aspect of the new code that should make green builders very excited. The new code includes the 30-percent-improvement package as a voluntary appendix, which creates a new landscape for opportunity and amplifies the ability for green builders to further differentiate the value of their products in the marketplace.

In a last-minute set of compromises negotiated among the governor's office, the home builders association, green builders and efficiency advocates, the 30-percent-improved code didn't just get thrown away — it will be included in the new code as an appendix and available for voluntary use by all. Those who are building their new homes to the 30-percent code appendix can clearly and publicly demonstrate that they are doing "more than the minimum" and will be positioned for an array of programs and benefits that are in the works.

The 30-percent appendix is defined as the "high efficiency residential option," and talks are underway to recognize early adopters as Energy HEROs. These early adopters may also be able to avail themselves of appraisal, mortgage, utility and other programs specifically designed to recognize these energy HEROs. Since many of the state's green builders already build according to efficiency minimums (and sometimes exceed the standard) defined in this appendix, they will be ready from day one for the recognition and programs for Energy HEROs.

Be an energy HERO

While the recipes for achieving these new efficiency levels are many, there are several simple prescriptive requirements embodied in the 30-percent appendix (see the next table).

As you can see, these requirements recognize the value of additional insulation in ceilings, on all walls (above grade and below grade) and for slabs, as well the value of better windows to reduce air conditioning and heating loads. The HERO appendix includes other requirements that should be familiar territory for most N.C. Green Builders.

• Total duct leakage less than or equal to 4 CFM (12 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area.*
• Building envelope air leakage is less than or equal to one of the two following performance measurements:
• Envelope air leakage less than 4 ACH 50

Those builders involved in ENERGY STAR, Building America, NC HealthyBuilt Homes and other beyond-code programs will likely find that the new minimum code and the new appendix would require less than their current practices. But the new code is a step — a small step, but a step — toward recognizing the importance of buildings to the energy future of our state and our country. One additional benefit is that most of the products needed to meet these new code minimums are made right here in N.C., which will put more North Carolinians back to work.

Energy-savvy consumers are increasingly the norm, demanding the monthly savings and return on investment that energy-efficient homes

HIGH EFFICIENCY RESIDENTIAL OPTION: PRESCRIPTIVE REQUIREMENTS

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value	Crawl Space Wall R-Value
3	0.32	0.65	0.25	38	19, 13+5, or 15+3	5/10	19	10/13	5	10/13
4	0.32	0.60	0.25	38	19, 13+5, or 15+3	5/10	19	10/13	10	10/13
5	0.32	0.60	(NR)	38	19, 13+5, or 15+3	13/17	30	10/13	10	15/19

deliver. The costs of the 30-percent-efficiency improvement will be between $1 and $2 per square foot for most builders and will pay for itself in energy savings in less than five years. Buyers will be putting $10 to $20 per month more into their largest and most valuable investment and will reap the utility savings for as long as they live there. And at resale time, those lower-than-the-neighbor's energy bills will play a key role in which home will sell the quickest. And do we really expect the price of energy to come down?

What does the future hold?

Our builders play a key role in shaping our nation's energy future. They have a direct and immediate impact on our utilities. They help define how much foreign oil we will import and what it will be used for. Our builders have the potential to be our country's next heroes — providing additional security for our way of life, strengthening our economy and shaping the lives of our children, grandchildren and great grandchildren: They're the ones who will be living in the homes, attending the schools and working in the offices we are building today. The energy consumption of our buildings matters.

In many ways, the future is in the hands of our builders. And our green builders are already poised to lead the way.

R. Christopher Mathis is a building scientist in Asheville, N.C. (mathisconsulting.com). He has spent the past 30 years conducting research and training builders in better construction techniques and improved energy efficiency. He is the author of Insulating Guide, *a book for builders, and has written over 30 articles on a variety of energy and sustainability topics. He is co-author of the* 2012 N.C. Energy Conservation Code.

Samsel Architects

www.samselarchitects.com

- 1st LEED Platinum project in Western North Carolina
- Over 1,000,000 lbs of carbon output reduction since 2000
- Founding Member- Western NC Green Building Council
- Achieving Energy Cost reductions up to 70%

NC HealthyBuilt Homes Program

Well insulated: SIPs are one way to achieve maximum insulation in a wall and decrease thermal bridging. photos by Matt Siegel

Which wall system is right for you?

A comparison of five common systems for new construction

by Marcus Renner

Do you want to build a house that's more energy-efficient but doesn't cost an arm and a leg? It may be easier than you think. Most homes today are built using a method called **Western platform framing**; you may know it as two-by-four or stick framing. It is a time- and cost-efficient way to build a home, but it is by no means the only one. During the last half century, other wall systems that have considerable advantages over our current form of building have been developed and tested. These systems are also accepted by the building code officials in most areas of the country.

First, let's address stick framing and how it can be made more energy efficient. Engineers studying building science have created a system known as **Optimal Value Engineering (OVE)**. This idea, commonly called Advanced Framing, restructures the way a stick-framed wall is built. The amount of wood is minimized and the space for insulation is maximized, increasing the overall efficiency of the building envelope.

Platform framing is the most common form of house construction in the United States, but there are other methods that have been developed, many with great advantages. Although a home can be framed to perform well, we have to understand that we, the consumer, often place cost and quantity (square footage) over quality. This often leads to homes built to minimum building-code standards. Imagine putting your family in a car built to minimum highway-safety standards and going on your summer vacation. Would you do it? That is what many of us are living in: a home built to the minimum required standards of health and safety.

Enter the engineered wall system. These are wall systems that have been engineered to improve quality, efficiency, durability and sometimes even

cost. As we will see below, they often incorporate insulation and structure into one system. The structural, insulating and sealing qualities of the product were developed at the same time by the same person, unlike framed homes. Although these systems may seem more costly, we have to make sure that apples are being compared to apples.

First, keep in mind that the walls of a home generally account for only 12 percent of the overall cost of a home. Second, many of these wall systems incorporate more than one phase of construction. For instance, a framed wall only provides the wall structure for a building. Insulation still has to be added. In the case of structural panels, for instance, you get both structure and insulation. Both designed for optimal performance. We'll see more examples below. Let's review some common engineered wall types.

Structural insulated panels are the most popular form of construction after stick framing. They are composed of foam insulation sandwiched between a "skin" of **oriented strand board**. Together the foam and wood create a strong wall section that provides a continuous layer of insulation. Few if any structural members divide the insulation. The layer of OSB on the two sides also provides a continuous nailing surface for drywall and siding.

There are two different types of foam insulation that are used between the layers of wood; the most popular and least expensive is **extruded polystyrene**. You know it as bead board or by the brand name, Styrofoam. When we look at all types of insulation, we use the R-value measurement. The "R" of a material is its "resistance" to heat transfer. The higher the R-value, the better a material will be at insulating the home from the heat or cold. EPS foam, which is glued to the OSB, has an R-value of about 3.5 per inch. Individual panels can be factory cut to the specifications of the plans or can be cut on site. An average home can be erected within a few days, which is an advantage in our rainy climate.

Polyurethane-foam SIPs have insulating foam that is injected into a mold, adhering the OSB to the foam. The foam hardens and has an R-value of about 7 per inch. Although their insulating value diminishes slightly over time, polyurethane panels are better insulators. Being stronger, there is no need for structural wood in the panel like what is needed in EPS SIPS. This creates an unbroken layer of insulation around the envelope of the home. SIPS homes are a favorite of some green builders because they are well insulated, create a superior air seal and offer fast "dry in" times during construction.

Another popular form of engineered walls is **insulated concrete form** construction. ICF walls are a solid concrete based form of wall construction that uses foam blocks to create a form into which concrete is poured. Unlike conventional concrete work, the form stays in place, providing a layer of insulation on either side of the wall. This interesting configuration creates a layer of thermal mass that essentially becomes energy storage since it is insulated on both sides. ICF homes can be 50 percent more energy efficient during the life of the home and much quieter than a common stick-framed home. Concrete walls also make the home stronger, allowing it to better survive severe storms and earthquakes.

There are as many as fifty manufactures of ICF form systems. Most use EPS foam to create the form walls and plastic to separate the foam, creating space for the concrete. The blocks are stacked like Legos, reinforced with rebar and then filled with concrete. Some ICFs are made with recycled materials, such as mineralized wood chips and recycled EPS foam and cement.

An engineered wall system that is gaining popularity is a **pre-cast concrete** wall. Pre-cast concrete is mostly used for earth-bermed basements and lower floors, although they can be stacked three stories high.

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

A product that truly incorporates insulation and structure together is **autoclaved aerated concrete**. AAC uses cement to create a lightweight material that is filled with tiny air bubbles, one description calls it "foamed cement." The material comes pre-cut into blocks or panels. For residential construction, blocks that are from 8 to 12 inches thick are used for the walls. AAC provides both structure and insulation — the only product that does both! Any type of interior and exterior finish can be used, but plaster and stucco are the easiest and most popular.

AAC construction is fast and easy. Common carpentry tools can be used and the process is quickly learned. The material is easy to sculpt and architectural details can be adhered anywhere with the glue-like mortar. AAC walls are also very soundproof, since the tiny air bubbles act as thermal and sound insulation. AAC has been found to perform best in climates that require more cooling than heating. Your location and the configuration of the blocks may affect the wall's performance.

A SIP at a time: Structural insulated panels are composed of foam insulation sandwiched between a "skin" of oriented strand board — the combination creates both a strong wall section and a continuous layer of insulation.

These are a few of the most popular forms of wall systems. Each has advantages and disadvantages, and each should be studied and understood by the builder before the decision is made to use them. Keep in mind that a house is a system made up of many other systems. A holistic approach needs to be taken to understand how all these systems interact. Framed walls that are sealed well combined with well-built, engineered wall systems inherently provide a tighter building, and we have to allow the home to breathe through a well-designed passive or mechanical ventilation scheme to avoid moisture build-up on the interior of the building and to provide fresh air.

Today's wall systems can be designed to provide more insulation, a tighter building envelope and a stronger wall than a minimum building code stick-framed building of the past. By utilizing these products and methods, we can save money and the environment — and be comfortable at the same time.

Marcus Renner is a trainer and program manager at Green Opportunities, a nonprofit green collar jobs training program. He has been a green builder, consultant, educator and energy auditor. Currently he is continuing to strive for sustainability in existing buildings. He can be reached at marcus@greenopportunities.org.

A winning design? Appalachian State University's team of professors and students hope to win the Solar Decathlon, which will be held in Washington, D.C., Sept. 23-Oct. 2, 2011.

image courtesy of ASU

Off to the races

Appalachian State aims high at Solar Decathlon

by Mari Fox

Some of you may remember the 2010 WNC Green Building Directory *article "Solar Decathlon," which detailed* **Boone Guyton's** *visit to Washington, D.C., for the biennial, international competition (of the same name) sponsored by the U.S. Department of Energy. Now the story continues: One of our own — Appalachian State University — is entered in the event, likely one of the most prestigious solar competitions in the world. The final round takes place in D.C. at the National Mall, Sept. 23-Oct. 2, 2011.*

Never heard of the Solar Decathlon competition? To sum up: A Department of Energy-appointed panel of scientists, engineers, and architects evaluate school proposals and select teams to design and build energy-efficient houses powered exclusively by the sun. Each proposal is evaluated and ranked by the following criteria:

• Technical Innovation & Design — 30 percent

• Fundraising & Team Support — 25 percent

• Organization & Project Planning — 25 percent

• Curriculum Integration — 20 percent

Each team works on the project for approximately two years before the crescendo at the National Mall, where the judging takes place and houses are on display free to the public. It is renewable energy education and innovation at its finest — and all done with products available now.

In the end, the winning team produces a solar-powered house that:

• Is affordable, attractive, and easy to live in.

• Maintains comfortable and healthy indoor environmental conditions.

• Supplies energy to household appliances for cooking, cleaning, and entertainment.

• Provides adequate hot water.
• Produces as much or more energy than it consumes.

In 2011 the 20 Solar Decathlon teams will compete in a new contest: affordability. The goal is to design/build a house that costs less than $250,000 — making solar-powered living financially viable for the common person. The other individual nine contests that the houses/teams are judged on are: architecture, market appeal, engineering, communications, comfort zone, hot water, appliances, home entertainment and energy balance. As part of the contest, the Solar Homestead team will have to host a dinner party and entertain other student guests, wash clothes, boil water — and perform a myriad of daily tasks that allow the judges to evaluate the building's energy performance and mass appeal.

The push is on in the converted Mitsubishi Dealership where students, faculty, supporters and volunteers gather around the clock to hash out the final details for Appalachian State's 1,000 square foot Solar Homestead — a totally solar-powered home the ASU team has entered into the most prestigious solar competition in the world: the U.S. Department of Energy's Solar Decathlon.

The whole project started last fall when the Department of Technology's assistant professors **Jamie Russell** and **Chad Everhart**, along with a group of graduated students, submitted a detailed and lengthy proposal. To cull down the list of 45 proposals received from around the globe, Solar Decathlon organizers requested a conceptual design — including a presentation board and a scale model. ASU's Team Solar Homestead sprung into action and brought their vision to life. "Being selected is a fantastic honor, but we are going with the intent to win," said Russell.

Appalachian State University was selected to be one of 20 schools competing against teams from Canada, New Zealand, China, Belgium and various U.S. universities.

"To get the ball rolling, we basically had to form a company that included engineering, architecture, finance, communications, project management and interior design departments," said **Ed Pavia**, communications team member.

Students were recruited through freshman seminars and campus notices; they had to submit an application for enrollment in the project. Candidates were then interviewed and hand-selected. A special curriculum was designed so students get credit. "The courses are very hands-on," said Pavia. "I now know how to do plumbing, soldering and start a business."

At the end of the day, the Solar Decathlon Team will involve about 130 students who are coming together to do something better for the world. "The teamwork just blows me away," said Pavia. And for those students who graduate while the project continues, they can still be involved. Just about everyone who began this project a year ago will help bring it to a close next fall, he explained. And some will walk away with patents.

In addition to the $100,000 each team receives as a grant from the DOE, the Solar Decathlon team has to raise the remaining $800,000 estimated to finish the job. North Carolina-based Lowe's Home Improvement has stepped up as the main sponsor, donating upward of $350,000 so far in building supplies, tools, appliances and equipment. Both private sector and university support, along with and other donations of computers, printers, plotters, and such, have made it possible for the team to progress thus far.

But there's much work to be done.

Command central: Students come and go 24/7 to work on the project – working anywhere from 40 to 70 hours per week. A live webcam will document the construction journey of team Solar Homestead.
photo courtesy ASU

Fundraising is a major factor in the team's success. Although the actual construction of the house should only come in at about a quarter of the total costs, donations and sponsors are still needed for a multitude of other needs, such as equipment, interior finishes and furnishings, transportation, and housing/feeding up to 40 students in D.C. for 22 days during the competition.

The Solar Homestead will certainly propel Appalachian State University to the next level in sustainability and learning. Plans to use the Solar Homestead for educational purposes are already under way. "The chancellor is very interested in this project. It's his baby," said Pavia.

Appalachian State University is certainly living up to its reputation as a leader in sustainable technology by being accepted into what's probably the world's largest and most recognized green-building competition. It shows the university's commitment as a leader and breeding ground for the next generation of leaders in sustainable technology.

Some of the unique solar technology includes:

• A series of technologically advanced outbuilding modules (OM's) that function as stand-alone solar collection sites, generating both photovoltaic electricity and solar thermal energy. These small spaces can be added/removed as needed to offer flexibility in design.

• Trombe walls that collect and store heat, releasing it when needed.

• Bi-Facial PV Cells that collect sunlight from above and below.

To learn all about the competition and see the Solar Decathlon entries visit www.solardecathon.gov.

For detailed information on Appalachian State's Solar Homestead and to learn how you can help, visit www.thesolarhomestead.com.

Green business owner and freelance writer Mari Fox lives in Weaverville. She can be reached at mari@shecology.com.

Places of abundance

Permaculture and the evolution of the American landscape

by Chuck Marsh

"I am convinced that creativity is a priori to the integrity of the universe and that life is regenerative and conformity meaningless."
— R. Buckminster Fuller

"Build it, and they will come." A permaculturalist would say, "Design it, build it and they will come."

Last year my wife, **Marjorie**, and I — with the help of a visiting permaculture class from North Carolina State University — designed and built a small pond in our garden that is filled with roof water runoff from our garden shed. Within days of the pond's filling, our garden toads had found it and were busily laying eggs and softly trilling through the night to invite others to their newfound breeding pool party. Like doting parents, we watched closely as the resulating tadpoles grew and later crawled forth to seek their way in the world. When these baby toads were first emerging, we had to watch every step to avoid squashing the little cuties before they had a fair chance to grow and prosper.

As the summer went on, I found these young toads radiating out from the pond for hundreds of yards in every direction. This summer the toad egg-laying orgies were followed by a succession of at least three different species of tree frogs laying eggs in our pond. Our backyard pond was teeming with tadpoles. I'm estimating it hatched out 15 to 20,000 new toads and tree frogs. They are true friends in our gardens, helping to control slugs and pest insects. All we had to do was design and install the system to help our allies survive and thrive.

This is the practice of permaculture.

Meanwhile, the pond itself continues to become ever more diverse. Aquatic bugs and dragonflies found the pond and control mosquitoes quite effectively. Mosquitoes now equal food for the system. Problem solved. This summer I added a cranberry and pitcher-plant bog to the pond. The overflow water during rains, rich with nutrients, is directed to nearby garden beds. The simple act of designing and hand digging a pond has enriched our lives and our garden, all the while increasing our site's diversity and using our roof water to support our amphibian friends who support us. Our pond illustrates the permaculture principle of multiple functions: Every element in the landscape should perform at least three functions. A landscape element can be living, like a fruit tree or shrub, or nonliving like a path, shed or fence. Each element contributes its share to homemade abundance.

It's time to re-envision the place of humans in the landscape. We have too long been absent as caretakers of the life that surrounds us. It's as if we went into the house, or office, and too many of us then became observers, not co-participants with the natural world that surrounds us. Too often our presence has become life destroying, not life enhancing. We went to war with nature. This has not turned out to be a winning strategy. For the sake of future generations, this separation of humans and place must be healed. Our gardens and landscapes can be places where a relationship that has been thwarted can be rewoven and renewed.

A living demo: This Ashevillage Institute demonstration site features an aquaponic greenhouse, recirculating water catchment ponds, recycled patio and stairs and an edible and medicinal landscape.
photo by Janell Kapoor

Gardening is re-evolutionary activity. Gardeners and gardening may yet be the salvation of our world. While the challenges we face may seem complex and overwhelming, the solutions are often quite simple. Build soil. Catch water. Grow our plant and animal allies. Invest in biological systems. Cultivate interdependence.

Permaculture provides a conceptual framework and a toolbox for the manifestation of regenerative design. I am often asked "What is permaculture?"

It's a commonsense ecological design system for the creation of regenerative human habitats. Using permaculture principles, strategies and techniques, we can feed and care for our selves, our communities and our world. Permaculture design as a regeneration strategy is the next evolutionary step beyond sustainable design. Its premise is that, through applied ecological understanding, landscapes become richer, more abundant, resilient and ecologically diverse. This happens through the intelligent presence of humans engaged in caring for the landscapes they occupy.

As you know, the age of excess consumption is rapidly drawing to a close. The regenerative design movement, using biologically based

solutions, can help us all adapt and thrive during an age of resource depletion and energy descent. What better place to begin than in our own home landscapes, neighborhoods and local communities. Once you begin, you may just find your life's purpose and delight in this work.

I continue to be appalled by the state of the conventional American home and commercial landscape. They are, by and large, abysmally boring, polluting, resource and energy drains. Our home landscapes have often been reduced to Lawn Order, little green balls around the house foundation, some gaudy annual flowers and a few nonproductive, ill-tended trees. I rarely see people truly occupying these landscapes unless they're tooling along behind some sort of infernal combustion powered lawnmower, Weedeater or leaf blower. The American home landscapes consume more fossil fuels, chemical fertilizers, herbicides and pesticides than all of American agriculture. They are often resource sinks for our time and money with very little reward or satisfaction to show for it. Surely the green homes (and landscapes) movement can do better than this.

The important thing is to begin. If you're an existing homeowner, your task is one of restoration and redesign. First, do your research and educate yourself to fill in your knowledge and experience gaps. Go to the Organic Grower's School. Take a permaculture course or workshop. Read a permaculture book. I recommend *Gaia's Garden* by Toby Hemmenway as a good introductory text. If you feel your skill set is not yet adequate enough for the task, consult with an experienced permaculture designer or permaculture-literate design professional who is familiar with local soils, plants and microclimates. Employing an experienced design consultant early on will save you money in the long term and prevent costly mistakes along the way. You may want to contract for a more complete design plan for your property including strategic approaches and timelines that mesh well with your available skill set, free time and financial means. If you need help with the installation, your consultant/designer can help you find a qualified local gardener, landscaper or arborist to work with.

If you are considering building a new home, I would strongly recommend that you work with an experienced permaculture designer before you purchase your land or as soon as possible. This will save you lots of unnecessary expenses and assure that you end up with an integrated home and landscape that meets both your needs and the needs of the land. Your designer can help you choose a suitable property, develop your site in environmentally conscious ways, and guide the evolution of your productive landscape and integrated home system.

Our landscapes should not be an afterthought of the green-homes movement, but the sacred ground within which we sensitively and humbly embed our homes and communities. From this place, our home life can be nourished on many levels and community resilience can grow. We can truly design our way home again.

Chuck Marsh is an elder Permaculture practitioner, teacher, designer and bioregional inhabitant. He is the senior partner of Living Systems Designn (www.livingsystemsdesign.net) a local permaculture design/consulting group, and the founder of Useful Plants Nursery, usefulplants.org, your source for permaculture and edible landscaping plants. Contact him at (828) 669-1759 or chuck@livingsystemsdesign.net.

Affordable quarters

WNC nonprofits build sustainability

by Susan Andrew

Green building is available to all income levels, and four nonprofit agencies in Western North Carolina are demonstrating how.

Mountain Housing Opportunities, Asheville Area and Hendersonville Area Habitat for Humanity and Hendersonville Housing Assistance Corporation offer certified energy-efficient, NC HealthyBuilt homes to low- and moderate-income residents. "We realized a long time ago that it is responsible to build green, so we wanted to do that if we could," says **Joe Quinlan**, self-help program manager at MHO.

About four years ago, MHO linked up with the Raleigh-based Advanced Energy program, which provides technical building specs and funding through the U.S. Department of Agriculture, he explains. With green homes potentially costing more up front in building costs (although the long-term savings compensate), "We always run the numbers very carefully, and only use the components that really pay back on an annual basis," Quinlan says.

The results are promising.

First, the basics: The homes being built by these four organizations offer the technical performance of NC HealthyBuilt and ENERGY STAR standards — a certification process that means significantly reduced utilities, maintenance costs and health expenses, all of which will save money over time even as fuel prices rise. And the homes come with guaranteed energy savings — heating and cooling bills as low as $25 per month, depending on the house's size. If a home exceeds its guaranteed usage at the end of the year, Advanced Energy pays the difference to the homeowner.

Happily relocated: Elaine Sargent settled her family into this NC HealthyBuilt, ENERGY STAR-certified home in Enka Hills after moving from New Orleans in the wake of Hurricane Katrina.

photos by Jonathan Welch

The guarantee is offered through a program called SystemVision, a partnership between Advanced Energy, which provides the training and

the technical specifications for building affordable green habitats, and the NC Housing Finance agency, which helps finance construction costs.

Elaine Sargent lives in an Asheville Area Habitat for Humanity house built through System Vision in an Enka Hills development. Energy efficiency "was definitely a bonus for me," she says. "I'm interested in permaculture and being environmentally conscious. Habitat didn't *have* to go in that direction," Sargent continues, "but they care enough about the people they are housing to make that a priority. They don't just build the house, put you in there and walk away."

Ariane Kjellquist, communications manager with Asheville Area Habitat for Humanity, concurs. "We do what we can to ensure that Habitat communities remain safe and well-kept long after construction has ended."

SystemVision homes are certified through ENERGY STAR, a federal program administered jointly by the Environmental Protection Agency and the U.S. Department of Energy. In North Carolina, both Progress Energy and Duke Energy customers living in certified ENERGY STAR homes qualify for discounted utility rates. ENERGY STAR homes are at least 15 percent more efficient than the state's energy code requires for new buildings. Builders typically achieve the savings by a combination of methods, such as tightening the building envelope, installing better windows, controlling air infiltration, installing more efficient heating/cooling systems and water heaters and making duct systems more efficient.

SystemVision homes also carry a "comfort guarantee," wherein comfort is defined as a temperature difference of no greater than 3 degrees Fahrenheit from the thermostat location to the center of any room. The guarantee is in force for a two-year period after the original homeowner purchases the home. As part of the bargain, the homeowner agrees to prudent use of windows and doors when the heating/cooling system is in operation, with thermostat settings no higher than 72 degrees during the heating season and no lower than 76 during the cooling season.

To achieve all these benefits, Sargent's house is built with such features as energy-efficient windows, extra insulation, ENERGY STAR appliances and paints containing no toxic compounds. She says the energy efficiency has definitely lived up to its promise. During the big snowstorm of early 2010, "the power went out for over 12 hours, and we were so comfortable inside, I actually wrote Habitat a note. It was comfortable enough to wear only sweatshirts. We were not cold."

Sargent initially thought her income would disqualify her from Habitat for Humanity's program, but she was surprised to discover that wasn't so. "I applied online on their website, [and] got a letter back in a few days," she says. "It took a little over a year from the very beginning, including the building time of six months. I feel very lucky."

Shelley DeLapouyade lives in an affordable green development in Flat Rock called Three Seeds. Like Sargent, she moved here from New Orleans with her children after Hurricane Katrina hit. While she can't cite chapter and verse about all the technical details that make her home both HealthyBuilt and ENERGY STAR certified, she knows it works. "I would say the highest bill I've had, even in the heat of the summer, was $79 — even while keeping the thermostat at 69 degrees," says DeLapouyade, smiling. "I'm sure the [extra] insulation is a factor — we hung it ourselves, thank you very much!"

Future homeowners get involved in the work of building these houses

Low-cost: Shelley DeLapouyade loves her affordable, highly efficient home in the Three Seeds development in Flat Rock. She says the highest heating/cooling bill she's had was $79.

from the ground up, committing 15 hours of work a week during the construction phase, through the national nonprofit Housing Assistance Corporation, which coordinates with the USDA Self-Help Housing Loan program. "We hung insulation [and] helped set the footers, " says DeLapouyade. She also notes helping set cement and tar on the foundation for moisture protection, as well as adding heavy plastic in the crawlspace and painting. "Every phase of it, we had a part in," DeLapouyade says with pride. "I recommend the whole program — everything about it has been top quality."

In part, that's because the homes are certified. "Most of the truly green features are behind the walls, making it difficult to see them," says **Maggie Leslie**, program director for the WNC Green Building Council. "The certification process requires a level of efficiency and green features, plus inspections to make sure it is achieved, including testing for air leakage and duct leakage."

Third-party inspectors test the finished houses using a set of building diagnostics, including a pressure test, that establish a minimum level of air-tightness after all obvious openings are sealed.

Another way these houses earn their green status is by making use of engineered products that reuse and recycle materials rather than tossing them away. For example, the homes built by Habitat for Humanity use engineered wood framing components manufactured from material that would otherwise be sent to the landfill but instead have been re-manufactured. Such components are actually stronger and more consistent than the solid wood components they replace.

Sean Rose, the housing construction supervisor for Housing Assistance Corporation of Hendersonville, has worked on many green homes, including DeLapouyade's house. "I've worked with housing assistance for eight years," he says, "and we've just sort of progressed into including green features in our self-help homes. I've done 50 or 60 homes like these, and this development was the first."

MHO anticipates building nine new affordable green homes per year — six built with labor provided by a team of prospective homeowners, and three built by a contractor — in 2011 and 2012.

Susan Andrew can be reached at sandrew@mountainx.com.

THE TECHNICAL SIDE TO AFFORDABLE GREEN HOMES

Here's what one nonprofit — the Asheville Area Habitat for Humanity — makes homes green in the program.

Site Development

• Tree clearing is done per lot rather than over the entire subdivision with an attempt to save border/backyard trees

• Trees and brush are ground for mulch, or saved for firewood

• Jobsite recycling of cardboard, aluminum and beverage containers

• Drought-resistant and native plants used in landscaping

Heating/cooling, appliances, energy usage

• Duct work is mastic-sealed and third-party certified for leakage less than 3 percent

• Air flow to each room is balanced and third- party certified to ensure comfort

• High-efficiency (15 SEER1/8.5 HSPF2) heat pump exceeds ENERGY STAR requirements

• High efficiency (.95 EF) water heater exceeds ENERGY STAR requirements

• ENERGY STAR-rated refrigerator

• ENERGY STAR -rated low water usage washing machine

• Low-flow kitchen and shower/bath faucets

• Third party certification and guarantee of the average monthly energy consumption for heating and cooling ($25-$35 per month, depending on square footage)

• Progress Energy discount on electric rates

Building envelope

• Vapor-permeable, draft-stopping housewrap

• Sealed exterior wall plates and outside corners

• Flexible gasket insulation around windows, exterior doors, and between the floor system and foundation

• House tightness certified to less than .30 cubic feet per minute (air pressure)

• Insulating (R-34) styrofoam wall sheathing rather than OSB5/plywood on most exterior walls

• 12" raised heel trusses to allow full insulation value (R-38) in the attic

• Insulated (R-38) and weatherstripped scuttle hole rather than uninsulated pull-down stairs

• High efficiency vinyl windows that exceed Energy Star requirements

• 2-foot roof overhangs that provide solar shading

Indoor air quality

• Low-VOC6 Advantech subflooring

• Low-VOC carpet and recycled content carpet padding

• Formaldehyde-free insulation

• Recycled newspaper cellulose wall and ceiling insulation treated with natural borate insecticide

• Range hood and bath fans directly vented to the outdoors

• Direct fresh air intake for the heating/cooling system

• Third-party certification for all vent performance

• Water based, low-odor interior wall primer, paint and exterior wood stain

Green materials

• Engineered I-joists, main girder, and band joist8 rather than dimensional lumber for floor framing system

• Engineered roof trusses rather than dimensional lumber for all roof framing system

• Compact florescent bulbs used in 95 percent of light fixtures

• Non-tropical birch plywood underlays vinyl flooring

• Non-tropical recycled wood content interior doors

• Surplus building materials are either saved for future houses or donated to the Habitat Home Store for resale

Other notes

• SEER is a measure of a heat pump's cooling efficiency; 12 SEER is Energy-Star level

• Heating Season Performance Factor measures the heat pump's heating efficiency. An HSPF rating of 9 is ENERGY STAR level (lower numbers are more efficient)

• Energy Recovery Factor measures water heater efficiency. An ERF of .90 is ENREGY STAR level.

• R-value refers to the resistance (R) to heat flow of a product and measures its insulating value.

• Oriented Strand Board (OSB) is a composite material made of compressed and glued scraps of wood that would otherwise be discarded as waste.

• Volatile Organic Compounds are chemical vapors released by many manufactured construction products such as paint, cabinets, and composite wood products. Those with chemical sensitivities or respiratory problems sometimes have negative reactions to VOC exposure.

For more information, visit healthybuilt.org or advancedenergy.org.

Global climate change and the water cycle

Innovative stormwater practices help address future impacts

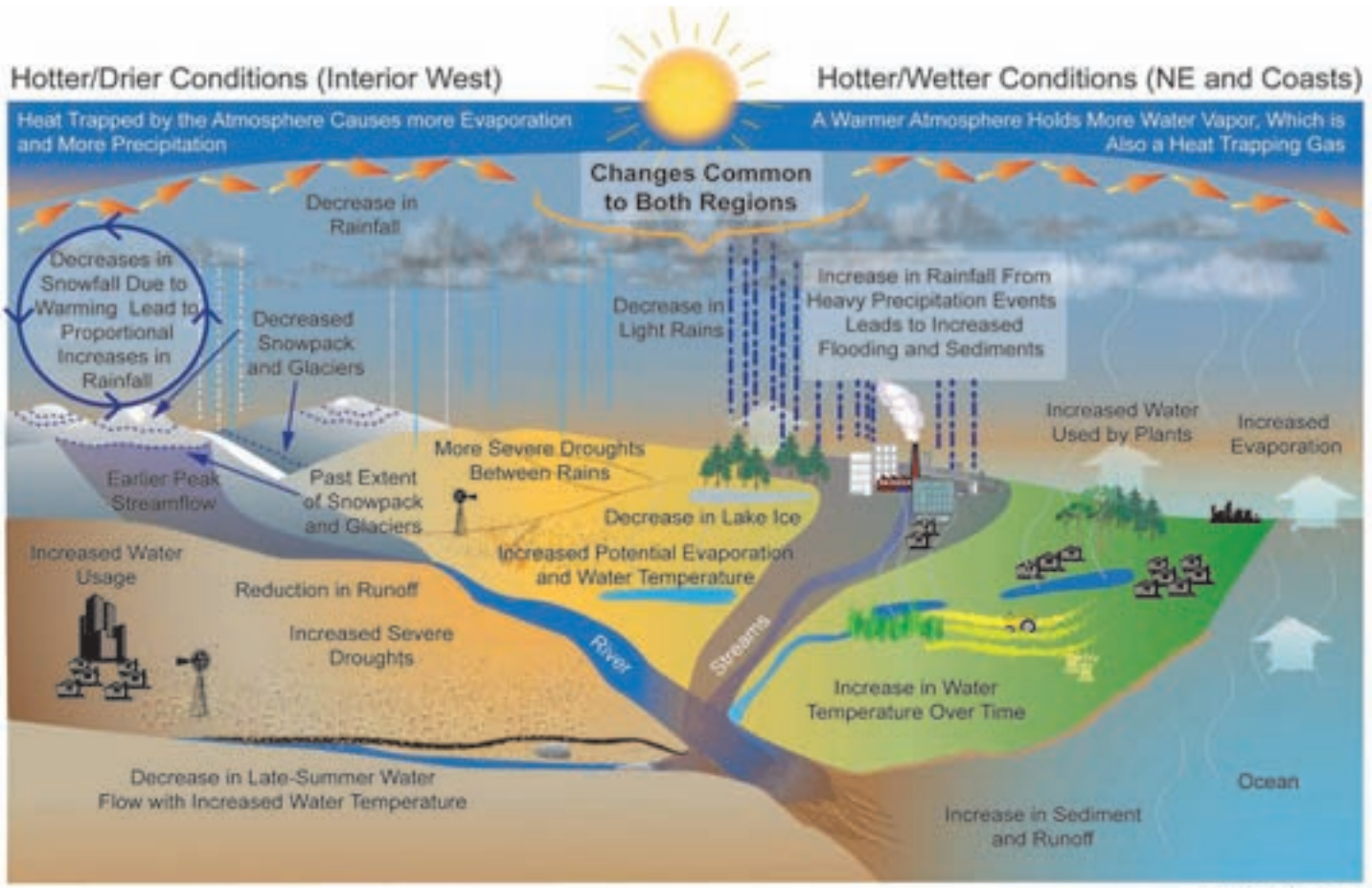
by David Tuch and Fred Grogan

When most people think of global warming, they think warmer weather. While temperature change is the most obvious result of climate change and global warming, a less commonly known effect is how warmer weather will influence the water cycle and water resources such as drinking water and freshwater ecosystems, which is highly affected by climate.

As most of us probably recall from our high-school science class, the water cycle works through a five-phase process: evaporation, condensation, precipitation, infiltration and transpiration. Regardless of the debate regarding causes of climate change, the replacement of forest systems with buildings, roads and parking lots — what is referred to as impervious cover — is unequivocally a result of human involvement. Such changes to the fundamental surface impacts the state water resources, without or without climate change.

This past year there have been severe floods in Tennessee, Arkansas, Georgia and Oklahoma, all of which resulted in loss of life and property damage. While the increase in major flood events in the past few years is startling to some, climatologists expected such a change. According to the 2009 report by the U.S. Global Change Research Program, the number of days with heavy rain events has increased by 18 percent between 1958 and 2007. The same study indicates that flood and drought are likely to become

School lessons: Bethel Elementary School in Bethel, N.C., uses a Best Management Practice for collecting stormwater runoff from the school's roof and paved surfaces so it can slowly seep back into the ground.
photo courtesy of Equinox Environmental



more common and more intense as precipitation patterns change. In the Southeast, this means we can expect long, hot periods of drought and fewer light, saturating rain events. When the steady rains do come, they will likely be severe "gully washers," providing little groundwater recharge and overwhelming stream and river systems. In addition, the model that has been utilized in traditional stormwater infrastructure calculations over the past 50 years is becoming extremely vulnerable to these changes.

Historically, pipe systems have been designed to accommodate volumes determined by calculations using a "designed storm." These simulations are based on historical data that has remained static for close to 50 years. However, based on climate change forecasts and the 2007 study, *Stormwater Management as Adaptation to Climate Change* by Laura Funkhouser, what was previously called the "100-year storm" could eventually be the new "10-year storm," and the "20-year drought" could be the "new normal." Recognizing that a large percentage of existing stormwater infrastructure is not only reaching the end of its life cycle, but that it is was likely undersized for the storms of the future and will be overwhelmed more regularly by the intensities of these storms, the need for retrofit solutions is becoming apparent.

When the ground that is extremely dry is subject to heavy rains, the surface cannot absorb the water sufficiently, resulting in floods and stormwater runoff that are rife with sediment. (Sediment that is conveyed by stormwater is one of the major sources of pollution in our rivers, streams and lakes; it damages water-quality and habitat.) In order to support the displacement of forest cover with impervious surfaces, and the incidental changes in the water cycle, we need to implement innovative stormwater management strategies. These management strategies, generally referred to as stormwater Best Management Practices, offer an opportunity to adapt to the changes in the patterns of precipitation.

Using BMPs in new and existing construction is an opportunity to replace aging (and undersized) infrastructure while also addressing pollution, stormwater runoff and groundwater recharge. For example, installing constructed wetlands and bio-retention areas (also known as rain gardens) treats water quality and quantity, while simultaneously enhancing the aesthetics of a site. BMPs are implemented to offset some of the impacts of impervious cover by acting as storage areas. These practices also support the filtration of pollutants such as nitrogen, heavy metals and phosphates, with varying efficiency amongst different techniques. BMPs can mitigate stormwater impacts by capturing runoff, in some cases encouraging infiltration and storing water on-site.

Implementation of these strategies is becoming an imperative to controlling the rate at which stormwater is released. By designing and installing systems to mimic pre-development hydrology, the amount and intensity of stormwater discharge is kept under control. Traditional systems concentrate runoff through a system of pipe networks to a central outfall location. This increases the velocity at which the water is leaving a site.

But these systems do not filter pollutants and can increase volume and intensity of outgoing water, leading to destabilized stream channels. As a result, vegetation cannot take root on stream banks, and sedimentation increases in waterways. BMPs are utilized to offset some of the impacts of impervious cover by intercepting

stormwater and acting as storage and treatment areas at the source prior to the water gaining momentum.

An additional example of stormwater BMP is the use of rainwater collection. Capturing rainwater from roofs and other surfaces and storing it in cisterns or water tanks above or below ground addresses both drought and floods. In the event of a drought, rainwater collection provides water for future use. In a heavy rain event, the amount of rainwater runoff is reduced because it is being captured at the source.

There are many other stormwater BMPs that can be used a part of a strategy to cope with changes in the water cycle. Practices that mimic our natural ecosystems are best. Exemplary structures include natural buffers, which act as filters, slow the runoff along our waterways or wetlands, and hold, absorb and replenish the groundwater. The use of multiple and integrated stormwater BMPs is the ideal approach to the changes just now beginning to unfold. If we do not start to implement stormwater BMPs and other adaptation strategies, future drought or flood events could be even more severe than the most catastrophic recent events.

For more information, visit equinoxenvironmental.com.

David Tuch, RLA and Fred Grogan, RLA are both landscape architects with Equinox Environmental, which focuses on resource conservation and sustainable development. They help clients protect and restore habitat, land, water and air quality. They create landscape-based design solutions in an environmentally responsible way.

Size matters: In perhaps a return to a very green idea, new-home sizes have decreased for three consecutive years, according to U.S Census data. Ergonomically designed smaller homes such as this one in Brevard, N.C., are helping to reduce the average new home size.

photo by Steve Linton

Analyzing home size trends

How much home do we need (or want)?

by Steve Linton

Many of us can recall a time when we visited a historical site that showcased homes from yesteryear. The image in my mind is a one-room cabin for a family of eight. A fireplace and table on one end served as the kitchen, and several beds lined up on the other end provided family-style sleeping arrangements. "How did people live this way?" we ask as we look around the one-room space.

Certainly the quality and size of today's homes are a far cry from these century-old living arrangements, but have we gone too far in our quest for the bigger and better home? Although far from a secret, not everyone realizes the power of the most cost-effective green building tool out there. The granddaddy of all green building strategies — the green idea so powerful, it saves on both energy and construction costs? That's right — the smaller home.

A turning point or a temporary shift?

After decades of homes trending larger and larger, we are now seeing the opposite: New home sizes have decreased for three consecutive years, according to U.S. Census data.

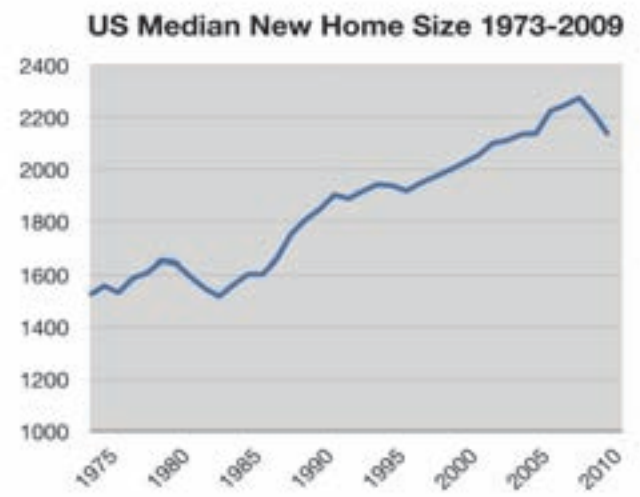
In its quarterly survey, the American Institute of Architects asked a panel of 500 residential firms about key changes in the housing market. According to AIA's most recent survey, even as market conditions improve, home sizes are still declining. "We continue to move away from the 'McMansion' chapter of residential design, with more demand for practicality throughout the home," says AIA Chief Economist **Kermit Baker**. In fact, 57 percent of respondents said that home sizes were declining, compared to only 3 percent who said square footage was increasing. Each year since the survey began in 2005, the AIA has reported an increasing share of responses that home sizes are declining.

There is a case to be made that this is solely due to our recent recession. One can see from the graph that during other recent recessions, home-size growth suffered a temporary setback. So how is our current situation any different?

At some point, just like population growth in an ecosystem, unchecked home-size growth becomes unsustainable. In the same way, it appears that smaller new homes will likely be a trend for some time to come.

Three key factors are positioned to continue this movement for the next 10 years or more. First, the recession is an obvious force in reducing home size because, quite simply, people want to pay less for their homes. Entry-level homes are typically the first segment of the market to recover, since first-time home buyers do not have a home to sell.

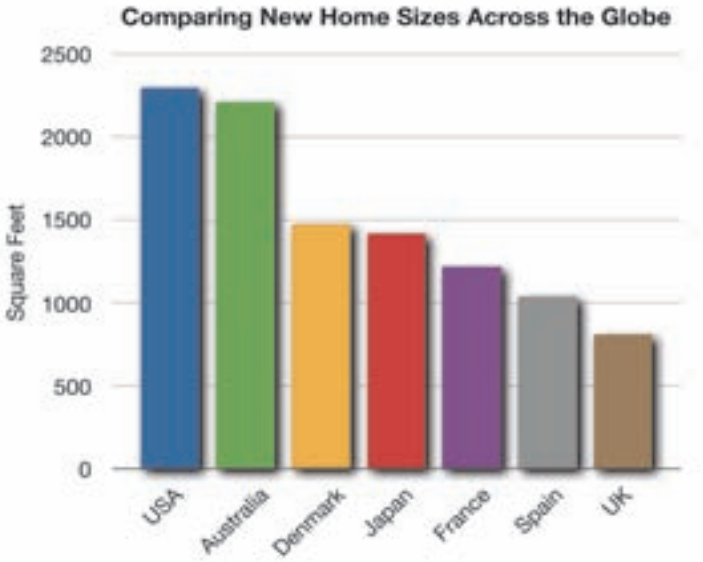
Second, the green building movement has never been stronger. This growing passion among homebuilders and consumers alike is leading us to reconsider the question, "How much space do I really need?" With energy costs so closely linked to the size of a home, building smaller is one green strategy that gets noticed during the budgeting process.



Third, American families are getting smaller. In a 5,000-square-foot home sheltering a family of three, family interactions may be few. American families appear to be tired of this lack of connectedness. Discerning homebuyers also realize the time and cost penalties for cleaning and maintaining large structures. Between 1970 and 2007, the average household size decreased from 3.1 to 2.6 people. This translates into a jump from 483 to 875 square feet per person — an increase of 81 percent.

Overseas housing trends

One area to look for perspective on home-size trends is across the seas. Comparing new-home sizes between the U.S. and other



countries is striking: We definitely have the biggest house on the block. In many of these countries, a limited supply of available land has forced new homebuyers to accept smaller spaces. As the need for more sustainable homes grows in this country, a look at Europe and Japan can provide a glimpse into the future. [Source: Commission for Architecture and the Built Environment]

What this means for the industry

As builders, architects, and developers look into the future, recognizing home-size trends will be vital to success. Those who reinvent themselves and offer well-designed, smaller homes will find new customers who are excited to give up quantity of space for quality of space.

Taking existing home plans and shrinking each room is one path forward, although the best smaller home designs will be originally crafted with size in mind. Here are a few elements to consider for smaller, more ergonomic designs:

A few "do's and don'ts"

• **Utilize outdoor spaces**. Increasing outdoor space is a prominent trend according to the AIA. These spaces are less expensive to build and require no energy to operate — a powerful combination.

• **Forget formal rooms**. Consider losing formal rooms such as living and dining rooms that are used infrequently. Trends toward open living space where kitchens, dining and family areas are all interconnected provide myriad options for reconfiguring spaces.

• **Dynamic double duty**. Somewhere along the way, we thought that each activity needed its own room. Instead, investigate ways to allow multipurpose use of rooms. In her 1998 book, *The Not So Big House*, Sarah Susanka provides great examples such as multiple ways to integrate an office with a bedroom.

• **Don't neglect storage needs**. Americans have a lot of stuff, and a lack of adequate storage space creates constant clutter and profound frustration. A healthy combination of bulk storage (attic space or large closets) and purposed, everyday storage (such as built-ins, mail desks, etc.) can make the difference between comfort and chaos.

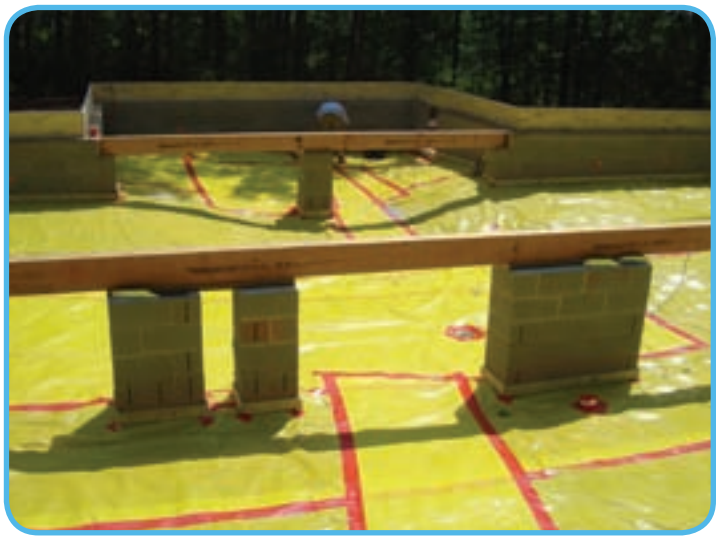
• **Rethink the master bedroom**. The master suite has gained great popularity in new homes over the last few decades. However, how much time to we really spend here? Usually, other areas of the house have already been intentionally designed for cozy reading, office work or play. By not repeating these areas throughout, we can instantly reduce a home's square footage.

Final Thoughts

While Western North Carolina has many good examples of carefully designed, smaller homes, it also has a plethora of super-sized dwellings. The challenge? Continue to design, build and purchase these not-so-big homes, encouraging more homeowners to consider the synergy they create. Whether driven by space limitations, financial restrictions, conservation-mindedness, or family needs, the average homeowner will continue to seek a smaller home. By planning for and designing with this trend, the transition can be positive for our people and our planet.

For more information, visit deltechomes.com/ecofriendly.

Steve Linton is director of Sustainable Technologies for Deltec Homes, which builds energy efficient, durable and beautiful round homes using components produced at its manufacturing plant in Asheville, N.C. Linton is a LEED Accredited Professional and a BPI Certified Professional.



Details: Every step matters, from well-sealed crawlspaces to keeping the building site organized.
photos by by Jim and Kris Forward

True green

Common sense and careful work go a long way

by Jim and Kris Forward

We all hear the word "green" frequently these days; it is used in so many different ways that its true meaning has become somewhat confusing for many. For me, green signifies an awareness of the balance which exists in this incredible world we live in and being conscious of the impact that our actions have on that balance.

One of the most important ways that we can be green is to pay close attention to all details, even the smallest, when we are building or remodeling a home. Just as a river is made from countless drops, a home is made from hundreds of thousands of details. Each one is important to the whole as they all must work together toward a trouble-free result. If even one aspect is not executed well, it will compromise the whole in some way. The cumulative effect of small failures will result in an inferior building that will have a negative impact on the quality of the living environment.

An excellent example of an important detail in new construction or remodeling is the "weatherization plane" behind the siding material. Often this consists of a single layer of housewrap which is installed to combat air and water intrusion into the home. If done well, this plane can do a great deal. If done poorly, it will do very little.

To install this layer correctly, one should always start at the lowest point and all horizontal joints are overlapped from higher to lower to help shed water. Then snap a chalk line at the top of the first course and each succeeding course, and then unroll the roll aligning the top edge with the line. The material is stretched somewhat to help it lay flat and shed water, and nailed with enough button caps (nails with large plastic heads which help hold and seal) to keep it in place until the siding material can be installed. All joints are taped with the manufacturer-recommended tape, and caulk under the top edge that terminates on the sheathing itself and will be covered by the soffit framing. The tape must be firmly rubbed, especially the edges, to ensure a good bond.

Good barriers: Gluing exterior walls can make the difference in creating a good air barrier.

When installing housewrap under stucco or stone, it is best to add a secondary "sacrificial" layer to protect the main layer from the effects of the mortar. Any penetrations through the housewrap, such as electrical boxes and pipes, should be flashed in such a way that the flashing becomes part of the drainage plain. Windows need to be installed and flashed with great care to include them in the drainage plain. It's best to install our housewrap before the window installation, and carefully prepare the window openings just before installing the windows.

Simply using common sense and taking the time to perform each step with care — such as firmly rubbing the housewrap tape with a rag or a squeegee to make sure it is well adhered or not letting debris fall behind the wrap when drilling or cutting openings for boxes and pipe — will ensure a strong layer of protection and will greatly benefit the health of the house.

A few other examples of the countless important steps, which include countless other details, that help guarantee a long-lasting, truly green home are:

- The way the lot is cleared and graded for drainage
- How the house is sited on the lot
- How the crawlspace is finished
- How the foundation is built and waterproofed
- How the framing is fitted, glued and nailed together
- How the roof is framed, sheathed and covered
- How the exterior walls are sheathed and weatherproofed
- How the insulation is installed and what material is used
- How the plumbing and electrical are installed and what materials are used

Wrapped up: Careful application of the housewrap helps ensure a tight home that will last for years.

• How interior finishes are installed

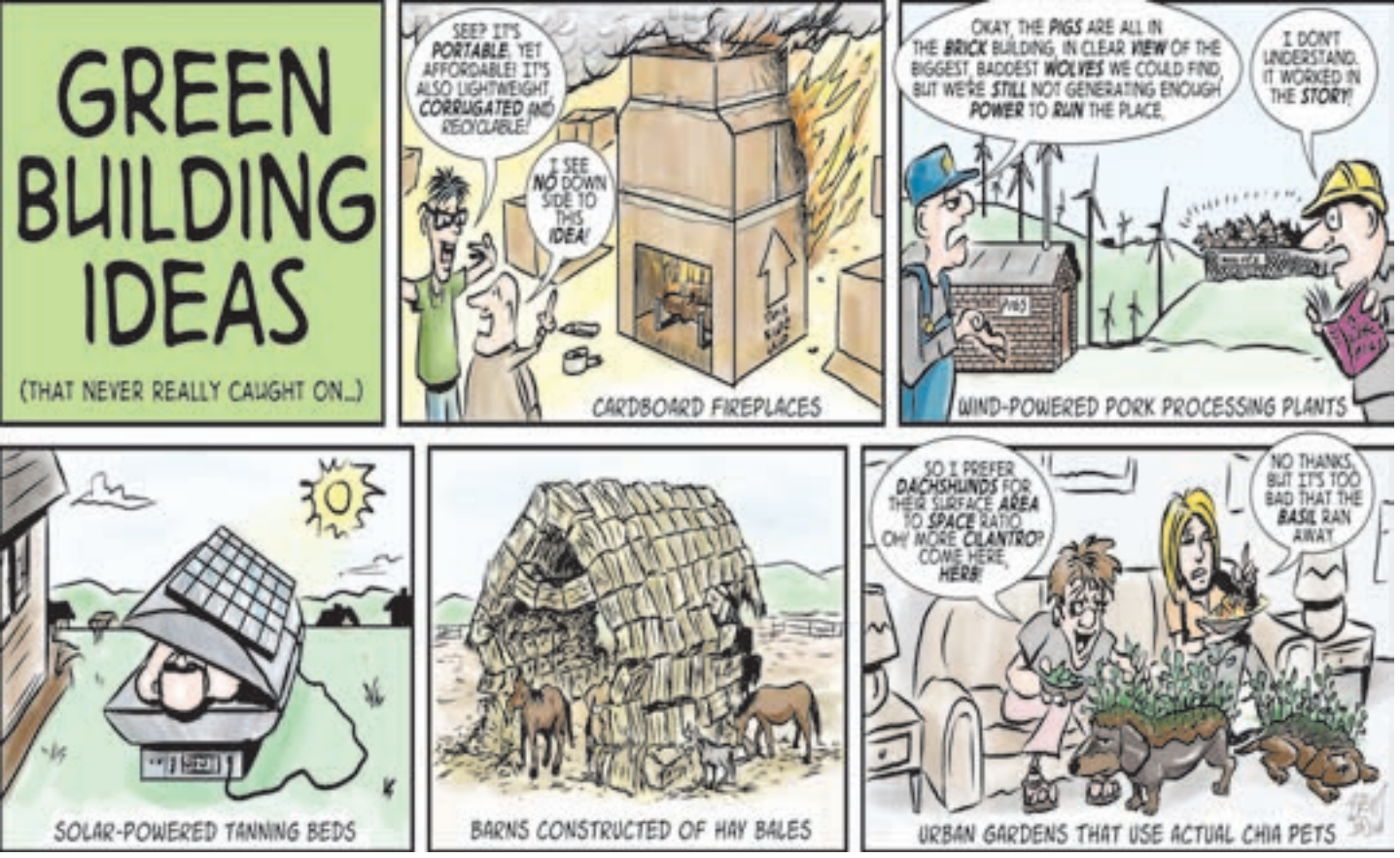
Only real caring from the beginning to the end of every project will make this a possibility.

There is no such thing as a "mindless" task in homebuilding. Every member of the team needs to have the conscious intention, the know-how and the tools to execute every detail effectively. An architect or designer can work up a durable, efficient home on paper, but if the design isn't executed with the highest level of accuracy and attention to detail, it might not be quite what the owner had in mind. Having one experienced and dedicated contractor/foreman on-site at all times, who has in mind the entire plan for the finished project and can provide consistent and quick decision-making capability, ensures that every detail is attended to with the care it needs.

At times, the people actually doing the bulk of the physical work feel detached from what they are actually building. For a company to be truly green, everyone involved has to be making a conscious commitment to doing their best. It is much more satisfying for a carpenter to work on a project where things are organized, shortcuts aren't taken, and the main tools are attention to detail and the satisfaction derived from a job well done. The natural outcome of such an environment is a project that will have few, if any, problems that will contribute to the long term burden on our planet's resources.

When we consider the impact of creating, transporting, installing and maintaining each aspect of a home, having to repair or replace items due to initial lack of attention to detail is not "green." The simplest step we can all take towards being green is to take pride in all of our actions and to truly pay close attention to what we are doing. If it's worth doing, it's worth doing in the best way that we can!

Forward Construction Inc. is a family-owned-and-operated business that has served clients for more than 35 years. To learn more, visit forwardconstruction.com.



THE DISCLAIMER'S CARBON FOOTPRINT IS HUGE, AND YOU KNOW WHAT THAT MEANS.

asheville disclaimer

The Greenest Guide

Questions to ask when shopping for a Green Builder:

* "How flexible are you as far as color -- and building codes -- goes?"

* "I have a coal-burning furnace. Can you install some solar lights in my basement so I can see it?"

* "Did something I said upset you, Dr. Banner?"

* "Can just one of you hippie green builders use some soap and water at any point during the six-month build?"

* "How would you differentiate yourself from, say, a chartreuse or okra builder?"

* "Are your employees certified "verde" with cards that establish skill level and residency?"

* "If a new, profitable trend came along that replaced green building with environmentally hazardous practices, would you either ... you would? 'In a heartbeat?' Let me get back to you after I talk to the other green builders I'm considering for our baby nursery."

* Check their business card and their Web site: Is the word "Green" prominently displayed? Check again to be sure.

THOUGHT THINKING WITH BRANDY

Talkin' 'bout Global Hotting, y'all!

I dont' know why everyone is so freaked about about Global Warming, I mean warm stuff is better than cold right? Like Soup. OMG, I mean cold soup is so totally bad. Plus if the Earth is like warmer and stuff, I can get tan and be totally hot all year long. I mean I'm sorry the polar bears will melt and the penguins will have to leave Santa's workshop, but they can all just move down here and live in our freezers.

Plus, why is carbon so bad and mean -- it's what makes drinks bubbly! I don't like my Coke without bubbles. Warm Coke is bad, but not as bad as cold soup. We'd have to drink warm Coke if the world heated globularly, but we can just put ice in our warm drinks from our refrigerators and maybe we can pay the penguins to do that. They're so cute! So Global Hotness is great, it means you can tan all year, eat warm soup, and then get served cold Cokes from a penguin in your refrigerator. Go, Fighting Tigers, defense!

The Asheville Disclaimer *is parody/satire.*
editor@ashevilledisclaimer.com.
Contributing to the Disclaimer Green Building Directory: Michele Scheve, Cary Goff, Joe Shelton, Tom Scheve

When winter's over, it's time to *de-winterize* your house!

* Replace in your attic or basement all cellulose or recycled denim insulation with old-fashioned R-1 flower-print wallpaper.

* Taunt passing gangbangers until walls are bullet-riddled with air holes. Now that's better!

* Cover floors with sand, establish indoor location of tiki bar, prepare frozen drinks.

* Turn pipe-wrap insulation into electrified-mummy disguise to scare off green creditors.

* Replace programmable thermostat with "Wheel of Temperature Fortune" randomizer.

* DO NOT attempt to simultaneously autumnate, springify, and summarize house.

* Place large, decorative ice sculptures throughout house. This will help keep the temperature cool during those hot summer months until the ice sculpture melts an hour later.

* Dress winterized house in low-cut sundress that exposes shingles to lurid daylight.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10 years greening WNC

Looking back and looking ahead

by Matt Siegel

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has," anthropologist Margaret Mead said. The Western North Carolina Green Building Council — its members and its founders — demonstrates the truth in those words: About a decade ago, the council literally started as a conversation between two people. It then grew into a group of several people, who started out sitting around a table and discussing how to grow green building in the region.

In 2011, the organization celebrates its tenth year of helping create a more sustainable and healthier WNC. **Boone Guyton** remembers "going to the [Western Carolina] Home Show and looking for people with any green products or services. **Cindy Meehan-Patton** was there, and we had our first conversation about the possibility of a green building group."

According to **Duncan McPherson**, another WNCGBC founder, "The primary need was education at that point, which included educating the city, inspectors, builders and architects. ... We needed to provide the general public with a single resource for reliable information. We applied for our nonprofit status sometime in 2000. By 2001, about a year after our first meeting, we were pulling together the first Green Building Directory; we had about 15 or more folks showing up at meetings and were forming multiple committees."

Ten years later, WNCGBC is a well-established, respected and far-reaching regional entity with hundreds of members. New groups from all over North Carolina have called to ask us, "How did you do it?" Of course, we're happy to help, although sometimes it's hard to quantify the accomplishments of an organization that educates and advocates.

Here are some achievements from the past 10 years that the Council can put numbers to:

• **First HealthyBuilt Homes in North Carolina:** As part of a State Energy Office grant, WNCGBC helped green the Mountain Housing Opportunities development Prospect Terrace and certify it as the first HealhyBuilt Home development in the state.

• **HealthyBuilt Homes:** During the past five years, WNCGBC has certified 490 homes, which represents 85 percent of the total homes certified in North Carolina.

• **LEED for Homes:** Since becoming a provider, WNCGBC has certified seven homes and registered 22 more.

• **Appalachian offsets:** As the nation's first locally based carbon-offset program, we have offset more than 2,600 tons of carbon through local projects paid for through local donations.

• **Neighbor Saves:** Thanks to a grant from the Community Foundation of WNC, we will be launching an innovative new self-help program to encourage energy efficiency in existing homes. (Check out our music video at neighborsaves.org!)

• **Classroom training:** More than 2,000 building professionals and homeowners have attended our classes and expanded their knowledge of the many facets of green building.

• **Weatherization program:** Thanks to a Community Development Block Grant from the city of Asheville, WNCGBC partnered with Asheville Green Opportunities and Community


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Action Opportunities to weatherize 60 low-income homes.

• **Home-town green:** With help from a State Energy Office grant, a 16-minute video on how to begin the process of greening a small town was produced and distributed.

• **Community projects:** Volunteers completed a green bus stop on Clingman Avenue, with support from a grant from the Community Foundation of WNC.

• **Permit-fee reductions:** WNCGBC worked with the town of Black Mountain and city of Asheville to get permit fee rebates for certified green homes.

We haven't done it alone. We would like to give special thanks to Boone Guyton, **Claudia Cady**, Cindy Meehan-Patton, **Bobbi Tousey**, Duncan McPherson, **Ashley Featherstone** and **Terry Albrecht** for their vision and hundreds of hours of work in the infancy, early childhood and adolescence (hopefully we'll be getting out of that soon) of the WNCGBC. A lot of recognition and appreciation also needs to be given to Land-of-Sky Regional Council for their incredible support in helping to start and house the Green Building Hotline and offer the infrastructure needed to build the organization to what is has become today. Over the years, all of the many people who have volunteered on the WNCGBC's board have made this organization a success — through good times and bad.

Of course, we could not have achieved all of the incredible gains in momentum without the years of commitment of the WNCGBC staff, including **Matt Siegel**, **Maggie Leslie**, **Rachel Della Valle**, **Candice Black**, **Shifra Nerenberg** and **Jake Sadler**.

And most important, we wouldn't be here today or see a long and bright future ahead for green building without ... you, the members! Some have been members since the very first day; some have just joined.

All are essential in helping to grow the movement of green building to the point when we are no longer needed because everyone is already doing it.

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

1. Green Opportunities members weatherizing homes as part of a grant received by WNCGBC.

2. Matt Siegel hard at "work."

3. Longtime green building supporters Ske & Kitty Boniske show off their solar panels.

4. UNCA students helped change out 13,000 light bulbs as part of the Appalachian Offsets program.

5. Clark Snell's natural building demo house on the SEE Expo tour.

6. Ashley Featherstone and Jon Senechal representing WNCGBC at Earth Day 2001.

7. The first official meeting of the founders and early board members.

8. Matt Siegel and Maggie Leslie performing HealthyBuilt Homes inspections for Mountain Housing Opportunities.

9. Duncan McPherson gives a tour of the Warren Wilson EcoDorm.

10. WNCGBC"s first annual solar home bike tour.

11. Rachel Della Valle and Clark Snell enjoying the Green Home Tour.

Some incentives not extended

Updated smaller list of green-building incentives

by Matt Siegel

As I sit updating this summary of green building incentives, I sincerely hope this article is out of date by the time the 2011 Green Building Directory goes to print. The federal government has failed to renew the existing home energy efficiency tax credit that gave a 30 percent tax credit for much-needed energy-efficiency upgrades. The much-awaited HomeStar program — which would give sizable direct rebates to homeowners for upgrades depending on how far they went — still does not exist. The Property Assessed Clean Energy financing program, which the city of Asheville and Buncombe County were preparing to pilot and would have provided an easy financing mechanism for homeowners to make energy efficiency and renewable energy upgrades, was thwarted by the financial entity Freddie Mac; the organization stated that it would not purchase mortgages that had PACE financing in the first lien position.

Fortunately, the federal and state renewable energy tax credits will be in place until 2016, and utility and local government incentives are still intact. In terms of energy efficiency, benefits like reduced utility bills and improvements to comfort and health — not government incentive programs — will once again drive implementation … for now.

Tax incentives

Federal

Individuals

Energy efficiency:

• There is a tax credit of 10 percent, up to $500, for energy-efficiency improvements such as windows, some heating equipment and water heating equipment until the end of 2011.

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-kilowatt-hour rate for electricity generated from a renewable resource that is fed onto the grid.

Businesses

Energy efficiency:

• A flat $2,000 tax credit was reinstated retroactively for 2010 and through the end of 2011 for builders who build homes projected to save at least 50 percent of the heating and cooling energy of a comparable home that meets the standards of the 2004 International Energy Conservation Code.

Energy efficiency:

• A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install interior lighting, building envelope or 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 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, day-lighting, anaerobic digestion, ethanol, methanol and biodiesel. Available through the end of 2015. $2.5 million 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 offering a limited-time $1,000 rebate program for solar thermal systems. The SunSense program is giving a rebate of $1,000 per kW capacity for photovoltaics and $4.50/month credit on the system owner's bill.

• The Home Energy Improvement Program pays 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 with minimum 14 SEER HVAC systems. Home Advantage homes receive a 5 percent discount on electric bills for the life of the home.

Commercial

• The SunSense program pays $.18/kwh for solar PV projects. Large solar thermal projects are paid $20/REC for metered thermal energy (www.progress-energy.com/sunsense).

• The Energy Efficiency for Business Program offers incentives ranging from qualified lighting replacements to energy modeling for retrofit or new construction of commercial, industrial or government buildings. Financial incentives can pay for up to 75 percent of project costs (www.progress-energy.com/carolinasBusiness).

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: 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: psncenergy.com/rebate.

• PSNC offers $25 home energy audits for natural gas customers. psncenergy.com/audit

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 dsireusa.org.

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

Buying locally

What is it, how do you do it and why

by Jake Sadler

Buying locally has become an increasingly popular trend, and evidence of this can be seen in town after town. Just a quick trip into your local downtown will probably reveal restaurants that are buying food from local farms. Artists, potters, furniture makers and even clothing retailers are advertising locally made products. So why is buying locally becoming increasingly popular? How do you define buying locally? And what does buying locally mean for building a home?

The process of buying locally is not necessarily as straight forward as it may seem, and defining it can be difficult. Here are a few simple guidelines. We can divide local products into three major categories: locally sourced, locally produced and locally sold. Sourced means where the materials are found produced is where a product is made, and sold is the location where the product is purchased. Each of these categories, however, depends on defining local. Using LEED criteria, local is defined as any material extracted, processed and manufactured within a radius of 500 miles.

However, 500 miles from Western North Carolina can take you as far as Arkansas to the west or Pennsylvania to the north, which many of us would not consider local. Nevertheless, keep in mind that many of the benefits of buying locally are realized the closer to your home they are sourced, produced or sold.

The benefits of buying locally are increasingly seen and valued by consumers, and the practice is gaining popularity. In addition to supporting your local economy by securing jobs and keeping money circulating within a community, locally made products are often of high quality and, in many cases, made sustainably. Additionally, buying locally can also reduce the total distance goods must travel and reduce the carbon emissions associated with transportation.

Using your hard-earned money to purchase local goods benefits you as a consumer and plays a vital role in allowing future generations to enjoy a healthy and vibrant local economy. Buying locally is an excellent way to get the products you want and need, and it will help enable consumers in the future to do the same thing.

There is perhaps no better time than now to begin using locally made, sourced or sold products when considering home construction. Whether you're building an addition or breaking ground on a new home, local building-industry businesses need your support in this tough economy, and spending your money locally will benefit you now more than ever with competitive prices and high quality.

Buying locally, however, is easier said than done, especially when working on your home. For example, there are certainly products you will need for your home that you cannot buy locally. It can also be confusing to use the term buying local, when, for example, a non-local retailer is selling local products or vice versa. To address some of this confusion, and help define buying locally, let's look at some of the ways you can benefit from your local economy when working on a home.

Locally sourced

This means that the basic material components of a product are found, extracted or harvested nearby. Some examples of locally sourced products include the following: locally harvested and milled wood products including lumber, siding, trim, etc.; locally extracted rock and mineral resources; and locally grown native plants and landscaping features.

PRODUCT	DESCRIPTION	LOCATION
Earthpaint	Specializes in manufacturing nontoxic, low- and no-VOC paints, stains and finishes	Asheville, N.C.
Safe Home Filters	Produces home air filters that reduce or eliminate chemical compounds, VOC's, formaldehyde and other odors and gasses	Asheville, N.C.
Columbia Forest Products	North America's largest manufacturer of hardwood plywood and hardwood veneer, a leader in sustainability, and innovator of formaldehyde-free PureBond technology	Old Fort, N.C.
Colbond	Leading producer of nonwoven fabrics and geosynthetic products for carpet backing, green roofs, subsurface drainage, erosion control, radon control and more.	Asheville, N.C.
Green Fiber Cellulose	A great way for homeowners to insulate more efficiently using recycled materials; strong selection of products and accessories for your home	Charlotte, N.C.
Meld USA	Develops and produces innovative, award-winning concrete materials such as countertops and products for the modern lifestyle	Raleigh, N.C.
New River Concrete	Produces countertops made of sand and gravel from the New River, which is collected during regular, low-impact dredging to maintain two dams in Grayson County	Independence, Va.
Crossville Tile and Stone	The largest domestic manufacturer of porcelain stone and recycled tile	Crossville, Tenn.
Silverline Plastic	Manufactures PVC pipe for pressure and nonpressure water applications and for electrical conduit, as well as polyethylene (PE) pipe; recycled content	Asheville, N.C.
Cunningham Brick	Oldest family-owned-and-operated brick manufacturer in North Carolina; specialists in producing bricks from bioremediation and contaminated soil	Lexington, N.C.
Tamarin Tile	Produces custom and hand-crafted tiles for your home or business	Clyde, N.C.
Shaw Flooring	National leader in flooring solutions; committed to sustainability for carpet, hardwood, tile and laminate floors	Dalton, Ga.
Kobe Copper	Copper piping, tubing and wiring manufacturer	Pine Hall, N.C.
Polymer Recovery Corporation	Leader in recycling of plastics, manufacturers of Enviroguard gutter screens and lawn-edging	Charlotte, N.C
Antique Reclaimed Lumber	Specialists in reclaimed wood products, custom engineered floors & wood interiors	Nebo, N.C.

PRODUCT	DESCRIPTION	LOCATION
EEE ZZZ Lay Drain Co.	Makes expanded polystyrene drainage systems made from recycled plastics	Pisgah Forest, N.C.
R24 Lumber	Manufactures finger-jointed wall studs made from scrap lumber	Charlotte, N.C.
Velux Windows	Manufactures solar hot-water equipment, skylights and solar tubes	Greenwood, S.C.
Recycled Paints Inc	Produces recycled latex paint products	Davidson, N.C.
Plastic Tubing Inc	Specialists in plastic corrugated drainage, made from recycled plastics	Roseboro, N.C.
Blue Ridge Plastics	Distributors of reconditioned carpet made from recycled and used materials	Monroe, N.C.
American Rockwool	Manufactures insulation made from recycled steel slag	Spring Hill, N.C.
Joiner Company	Manufactures wood flooring and cabinets from recovered heartwood pine	Tarboro, N.C.
Appalachian Antique Hardwoods	Produces reclaimed wood products, hardwood and engineered wood floors, reclaimed wood beams and timbers and reclaimed lumber	Waynesville, N.C.
Whole Log Lumber	Specialists in reclaimed wood products, custom reclaimed engineered floors and reclaimed wood interiors	Zirconia, N.C.
Barkclad Natural Products	Produces kiln-dried bark siding, harvested from logs already cut for the furniture industry	Canton, N.C.
Highland Craftsmen Inc	Makes bark shingles; designs, sells and manufactures Bark House brand architectural elements	Spruce Pine, N.C.
BDWG Concrete Studio	Manufactures sustainable concrete elements for many home applications	Boone, N.C.
Briggs Idustries	Makes bathroom products, toilets, bathtubs and sinks	Knoxville, Tenn.
Eagle Metals	Manufactures metal roofs and walls	Spartanburg, S.C.
Moss Supply Company	Produces vinyl and aluminum new construction and replacement windows	Charlotte, N.C.
Mullican Flooring	Produces precision milled, kiln-dried hardwood floors; FSC member since 2007; helped develop NWFA Responsible Procurement Program	Johnson City, Tenn.
EnGuard	Manufactures recycled PET batt insulation	High Point, N.C.
BJ Green Insulation	Produces recycled denim and cotton fiber insulation; uses over 85 percent post-consumer product and all-natural fiber	Wilson, N.C.
Nydree Flooring	Manufactures acrylic-wood flooring products; FSC certified and most products are LEED approved	Forest, Va.

The energy you use in your home can also be sourced locally through the use of local renewable generation directly tied into your home.

Finally, it is very important to locally source your labor. When possible, try to utilize contractors, sub-contractors and skilled-laborers within your community. Not only will your community benefit from using local labor, but local builders and tradesmen can offer knowledge and experience specific to building in your area. Ultimately, locally sourced goods and services will also reduce transportation and energy costs and lower carbon emissions.

Locally made

Products that are fabricated nearby can be considered locally made. In some cases, locally made products also use locally sourced materials, but in many cases the raw materials for locally made products are brought in from more distant locations.

Nonetheless, locally made products are beneficial in a few important ways. First, they're made by local workers — in effect, locally made products create new jobs. Second, buying locally made products drastically reduces the amount of energy required for shipping. Finally, locally made products can often be produced specifically to address building issues in your area. (See sidebar for more information.)

Don't see your product here? Please contact the WNC Green Building Council at (828) 254-1995.

Jake Sadler, residential outreach coordinator with the WNC Green Building Council as part of the Advantage West/Advantage Green internship program, has a background in residential energy conservation and community-based energy issues: www.wncgbc.org, jacob@wncgbc.org or (828) 254-1995.

Green is good: Termite baiting systems offer an environmentally friendly way to beat these wood-devouring pests.

photo by Matt Siegel

Termite baiting

A green solution without harmful chemicals

by Russell Barnes

Scores of environmentally responsible products are now being offered: hybrid vehicles, energy-efficient light bulbs and even termite control. That's right, even termite control can leave a smaller footprint on the environment.

Right now, subterranean termites are thriving in multiple colonies in the ground. A common treatment involves adding liquid chemicals to the soil around and beneath structures. While this offers termite protection for a finite amount of time, these chemicals have some environmental implications. In part to encourage and recognize development of pesticides with lower environmental impact, the U.S. Environmental Protection Agency created the Reduced Risk Pesticide Initiative, a program that expedites the review and regulatory decision-making process of chemicals that pose fewer risks to human health and the environment than existing, conventional alternatives.

Customers can "go green" by selecting an alternative to liquid chemical treatments: termite-baiting technology. The bait used in the system was the first termite treatment active ingredient accepted for registration by the EPA's Reduced Risk Pesticide Initiative.

The baiting system is environmentally responsible because it uses mere grams of termite bait to eliminate pest colonies, compared to several gallons of material for liquid chemical treatments. There is nothing to break down in the soil in the way that liquid treatments do over time. Furthermore, the switch from liquid chemicals helps reduce the impact of pesticides on the environment. The termite-baiting system also provides better control than liquid chemical treatments because it's monitored on an ongoing basis by an authorized operator, and it will not break down over time. Control of termites lasts as long as the system is maintained, and the active ingredient, which is the quantity of a packet of sugar, is not put in the station until there is an indication of termite activity.

Termite-baiting stations are placed discreetly around the structure, and this is less of an aggravation than traditional liquid chemical treatments because it does not require drilling floors and foundations, digging or trenching, nor hundreds of gallons of chemicals applied to the soil. The approach is also less of an aggravation to builders because pretreating a structure for subterranean termites only requires a single trip by the installer instead of multiple visits and applications for liquid chemicals. This also means there are less scheduling hassles and, since the installation is done after the final grading of the structure is complete, there is less down time for on-site workers waiting for a liquid pretreatment to be completed and dried before the next stage of construction can begin.

Baiting systems can cost slightly more over the long term, however, because they are inspected every three months, instead of a liquid sprayed only once a year.

But to prove this alternative is really catching on, one local pest treatment company reports having more than 9,600 contracts for baiting systems in the mountain region, which represents 40 percent of the market.

Using a termite baiting system to treat existing termite infestations or as a pretreatment option for new construction is an environmentally safe, long lasting and effective method.

For more information, call (828) 253-3816.

Russell Barnes is the regional manager of Mountain Region Terminix Service, Inc.

Solar innovations

Making the most of your investments

by Peter Phelps

The micro-inverter revolution is one of the most innovative recent changes in the solar industry. Originally developed by Ascension Technology in 1991, the first working model was built by ZSW of Germany and tested at the Sandia National Laboratory in 1994. Trace Company (now known as Xantrex) later marketed the inverter as the Trace Microsine 100 but then discontinued the product.

Enphase Energy breathed new life into the micro-inverter revolution. In 2008, Enphase launched the first micro-inverter that could compete on price and robustness with central-inverters. Two years later, Enphase is still the leader in micro-inverters and monitoring equipment, although there are a growing number of entrants.

What led to this switch in the fundamental nature of solar photovoltaic systems? Traditionally, solar photovoltaic systems required that DC power be converted to AC by a single large central-inverter. While not expensive, there are a number of characteristics unique to central-inverters that kept research and development alive over the years in pursuit of a better solution. Output to a central-inverter must be uniform from each panel to work correctly, and if one panel goes down or has a decrease in power production due to shading, the whole system is forced to reduce production to that level. The Maximum Power Point Tracking capability of the central-inverter has to respond to all the panels in the same way. In addition,

Just a little black box: One of the most innovative changes in the solar industry is the micro-inverter, which can — among several functions — report on the output or any malfunctions in its panel individually. photo courtesy of Johns Hopkins physics deptartment

central-inverters require noisy cooling equipment that limits placement in some situations.

In contrast, a micro-inverter only interacts with the power from a single solar module because it focuses on only one panel; a micro-inverter can perform MMPT individually, drawing the maximum power possible from each panel.

The micro-inverter can also report on the output or any malfunctions in its panel individually. Much of the current innovation in the micro-inverter industry in the U.S. is focused on monitoring hardware and software. This system was developed to allow the user complete tracking capability of the output and power production which is then converted to real-world representations of carbon offsets. The complete historical output of each individual inverter and panel as well as the total system output remains stored.

Another advantage to the micro-inverter over the central-inverter is that panels of differing power, size and orientation can be mixed in one system, and additional panels and micro-inverters can be added at any time. The increase in system-design flexibility is a huge driver of the demand in the micro-inverter market.

That said, inverters in general are the weak point in any solar system, whether large or small. A typical warranty on a micro-inverter is 15 years, and central-inverters usually around 10 years — compared to a photovoltaic module warranty of 25 years.

The distributed nature of the micro-inverter system does mean that when an inverter fails, it only takes down one panel and not the entire system. A defective micro-inverter can be replaced at a much lower cost than a central-inverter (usually around $200 per inverter) Due to the individual monitoring of the system, a micro-inverter failure can be detected immediately.

Early on, it was thought that micro-inverters would only be suitable for residential and light commercial application. Instead, they are already in use in utility-scale systems. Enphase is working with Southern California Edison and PSEG (the largest utility in New Jersey) and has struck a deal with Petra Solar to install 200,000 panel/micro-inverters packages as individual solar installations on utility poles. Other companies like SMA and V-Boost are also entering the micro-inverter marketplace.

While micro-inverters still make up a minuscule portion of the solar inverter market, they are expected to grow from $20 million in sales last year to over $80 million this year, which is the largest growth for a segment in the solar supply chain. Expect that massive growth to continue as micro-inverter manufacturers ramp up production to meet the high demand they are currently experiencing.

Trackers: getting the most out of your investment

Tracking the sun using moving racks has been around since the late 1970s. While the lower costs of PV panels are making the investment in tracking more difficult to justify, some people are opting for tracking to increase the output of their investment. There are several manufacturers that use everything from photo sensors to the simple weight displacement of heavy fluid to move these slow-moving focal collectors.

By following the sun through its path throughout the day, the panel maintains an ideal angle to the sun, thereby reducing the amount of reflection off the glaze on the panel, which allows more photons to pass through to the solar cell and thereby produces more energy. This optimal incident angle allows the panel to harvest more of the sun's energy each year, which in turn means more kilowatts produced per year for the same square footage in the collector area.

While typically used for concentrating solar collectors, tracking can find its place into the toolbox of system designers for several reasons. For one, trackers produce 25 to 45 percent more power in the summer, and produce up to 50 percent more water when used for water pumping.

This increased efficiency of trackers over fixed racks translates into up to 45 percent more power for your system than fixed racks offer. It's simple: You get more power for the same amount of money. The greatest benefit of the tracker is that you get better performance from all of your equipment: inverters, pumps, batteries — whatever you are using in your system.

Single-axis solar trackers operate most effectively with seasonal position adjustment, whereas dual-axis trackers do not require seasonal adjustment (they not only track east to west but also change their north-to-south orientation). Both systems require annual inspection and lubrication and, as most trackers are made from mild steel, paint maintenance is typically required and may be critical in highly corrosive environments, such as near saltwater.

For more information, visit sunstuffenergy.com.

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Peter Phelps is the owner of Sun Stuff Energy and Solar Contracting service and has been active in the solar industry since 1978. He has also served two terms on the Board of Directors of NCSEA and currently resides in Asheville.

Tree preservation during construction

Saving the green around your green home

by Mike Riley

It is an all-too-common sight in our area: After a home or development gets built on a piece of land, many of the trees that were left standing are struggling to survive or are already dead.

The trees may not die immediately but can decline over several years. What was once lush, green foliage is now stunted and yellowing. The tops of the trees are dying, and the trunks are scarred. The shade is gone, and the expensive process of removing dead trees or trying to restore damaged trees begins.

The culprit is the construction process itself. The lot clearing, grading, excavation, trenching, material storage and building may have each played a role in the demise of these woody giants.

There are ways to avoid this end result, but preserving construction-site trees can only be accomplished with a commitment from the homeowners, architect, builder, landscape designer and subcontractors. What's the best way to ensure that the trees' greatest chance of surviving the construction process? Hire an arborist during the planning stage of a project.

An arborist can help determine which trees should be kept, prepare a preservation plan and perhaps suggest design changes that can help a valuable tree survive. An arborist can also inspect trees after the project has been completed and recommend ways to ensure the future health of the trees. The tree-preservation plan should be included in the construction specifications for the project before work begins.

Before preservation is discussed, it is important to know how trees are affected by construction. Sometimes, tree damage is immediately evident: broken branches and wounded trunks from land-clearing or grading activities. Most of the time, however, trees are lost because their root system has been compromised. Most tree roots are found in the upper 12 inches of the soil, where they typically extend at least to the drip line of the tree (the area directly located under the outer circumference of the tree branches), though sometimes, roots can extend much further.

Tree saver: Radial trenching uses a compressed air gun to create a path for increasing aeration to a root zone.

photos by Mike Riley

Because roots are shallow and widespread, they are easily damaged. Some examples of how roots are damaged include:

• Being severed or ripped by grading machinery during trenching for underground utilities. Many times, trenches can be rerouted around tree root zones, or utilities can be installed by tunneling under the root zones.

• Soil compaction from heavy equipment driving over roots, storage of materials, or parking on roots which inhibits growth and decreases oxygen availability in the soil.

• Adding soil over a tree's root zone can smother the roots. As little as a few inches of soil over the roots of a sensitive tree species is enough to cause damage. Lowering the grade can remove a large part of a tree's root system and expose it to the elements.

Once the trees you wish to keep are identified by species, age, location and condition, they must be protected through all phases of construction, including landscaping. The best way to protect them is to erect physical barriers — that is, to create a tree-protection zone. This establishes a visual and physical barrier that restricts access to the trees.

The zone: The most effective way to protect a tree during construction is to create a tree-protection zone.

What not to do: Soil piled on a tree's root zone will smother the roots and lead to decline.

The most common method is to use plastic orange fencing and metal T-posts. The fencing should be placed as far out from the trunk as possible — give at least one foot of space for each inch of trunk diameter. An easy way to provide enough space is to protect each tree out to its drip-line.

Once the fencing is in place, the barrier should not be disturbed for digging, grading,soil disturbance, parking or material storage. Signs may help remind contractors, and a penalty system for violating a tree-protection zone may reinforce the importance of preserving the trees.

If tree damage does occur, it is important to address this damage as soon as possible to prevent further decline or death. Many times, damage remediation can be as simple as having an arborist remove dead or broken branches from a tree.

Vertical mulching and radial aeration both improve conditions caused by soil compaction by increasing oxygen and water availability, as well as the amount of pore space in the soil. Vertical mulching consists of drilling holes in the soil with a soil drill or compressed air gun. These holes are made throughout the root zone and are filled with mulch or compost.

One of the simplest and least expensive ways to improve growing conditions for trees, whether stressed by construction or not, is to add a layer of mulch to the root zone no deeper than 4 inches. The mulch retains soil moisture, buffers soil temperature changes, reduces competition from weeds and grass and adds organic matter to the soil. Mulch should not be piled near the trunk of the tree, as this can trap moisture and cause future problems.

It is important to recognize the benefits of trees on building sites and to work toward protecting them during and after construction. Hiring an arborist to help create a tree preservation plan is highly beneficial, but it is critical that everyone involved, from the architect to the landscapers, work together as a team to preserve the valuable trees on-site.

For more information, visit wncarborist.com.

Mike Riley is an International Society of Arboriculture Certified arborist and member of the North Carolina Urban Forestry Council. He holds a B.S. in Forestry and Agroecology from Rutgers University, owns WNC Arborist Tree Care in Black Mountain and provides tree care guidance to homeowners, builders and organizations in the Asheville area.

TREE SAVERS

All of the following measures earn points for home-certification programs, such as NC HealthyBuilt Homes:

- Developing and implementing a tree preservation plan
- Using mulch from lot clearing for erosion control
- Installing fencing for tree protection zone
- Leaving areas of the property undisturbed
- Creating a stormwater control plan

ENERGY STAR 2011

Version 3.0 released

by Maggie Leslie

After several public comment periods, the ENERGY STAR 2011 (version 3.0) guidelines for new residential construction are now in effect. Overall, the vast changes in the program keep step with building codes and to raise the bar for energy-efficient construction. The changes to the program are significant and will have a large impact on current ENERGY STAR builders. Major changes include new requirements related to HVAC, water management and home size.

Large homes use more energy (even if they are energy efficient)

It is important to let large homes participate in ENERGY STAR because these homes are going to get built, and they should be encouraged to be as energy efficient as possible. However, in version 3, ENERGY STAR requires larger homes to work harder for certification. Requirements are based on an ENERGY STAR "Benchmark Home" size and the number of bedrooms. The "Benchmark Home" is one bedroom, 1,000 square feet. An additional 600 square feet is added to larger homes for each additional bedroom. Accordingly, the benchmark size is 1,600 square feet for two bedrooms, 2,200 square feet for three bedrooms, and so on. If the rated home is bigger than the "Benchmark Home," it will have to achieve better performance than if it were the same size or smaller.

Details: Two-stud corners, raised-heel trusses and proper blocking are important construction details of ENERGY STAR home.

photo courtesy of WNCGBC

ENERGY STAR 3.0: Four Checklists instead of one

A major change in the new version is the further development of the checklist system used for certification. Whereas the previous version had only one checklist, ENERGY STAR 3.0 has four, including the Thermal Enclosure System Rater, HVAC System Quality Installation

Contractor, HVAC System Quality Installation Rater and Water Management System Builder checklists.

Version 2 of the program introduced the first checklist: the Thermal Bypass Checklist. This checklist has been expanded and is now called the Thermal Enclosure System Checklist, to be completed by the certified Home Energy Rater. The checklist now includes requirements to minimize thermal bridging in addition to the insulation and air sealing items. This will require conventionally framed homes to use advanced framing techniques or insulated exterior sheathing (see sidebar). All insulation will have to meet "Grade 1" standards, meaning it will have to be a perfect installation in order to pass.

There are two checklists for HVAC (heating, ventilating and air conditioning). One will be completed by the HVAC contractor and the other by the home energy rater. This process requires everything from duct-sizing calculations and air-flow balancing to ASHRAE 62.2 compliant ventilation systems.

The final checklist — the Water Management System Checklist — is one of the most surprising elements of the 2011 program. ENERGY STAR now requires the builder to fill out an inspection checklist of items, including proper flashing details, site grading, drainage planes and other items. This will promote longer durability, ultimately resulting in energy and materials saved and healthier indoor air. Still, it is a major change for a program that previously focused exclusively on energy efficiency. And the enforcement is strict: if one item is missed on any of the four checklists and cannot be remedied, the home will not be able to earn the ENERGY STAR label.

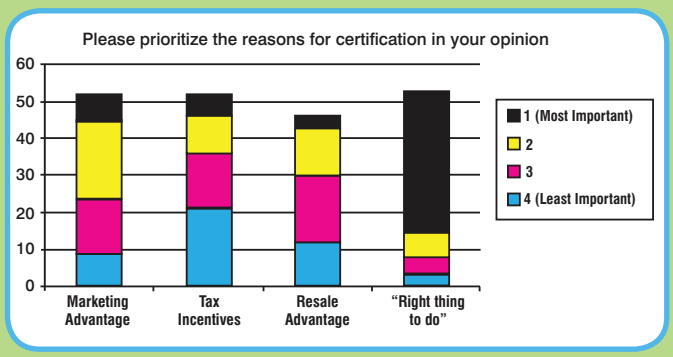
An individual HERS Index for each home to qualify

Maybe the most complicated change, though, is that each home will have an individualized HERS (Home Energy Rating) Index Target to qualify for the ENERGY STAR label, based on a "Reference Design Home." Under the current version, a home has to achieve a HERS Index of about 85 or below, which translates into about 15 percent more efficient than a home built to code. Under the new version, the HERS Index the home must achieve is at least the HERS Index of the "Reference Design Home." This "Reference Design" is a set of specifications for each climate zone, with details including fuel type, which sets baseline efficiency for each home to qualify. Basically, each home will be computer modeled twice. First, it will be modeled as if it has all of the same specs as the reference home, and then again as it is designed.

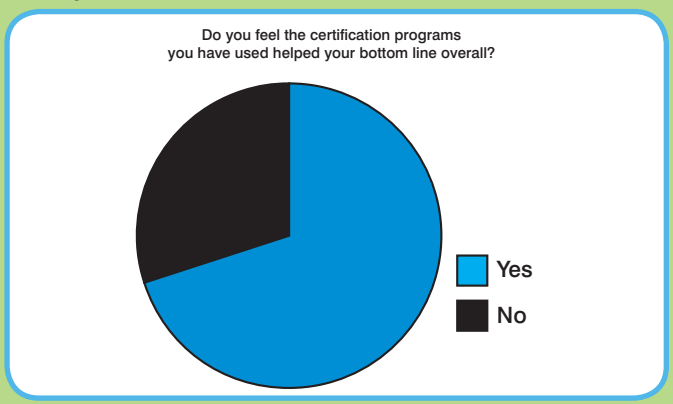
WHY CERTIFY? THE SURVEY SAYS...

In a recent survey of 70 WNCGBC members, we gained some interesting insights into why people choose to certify the homes they build.

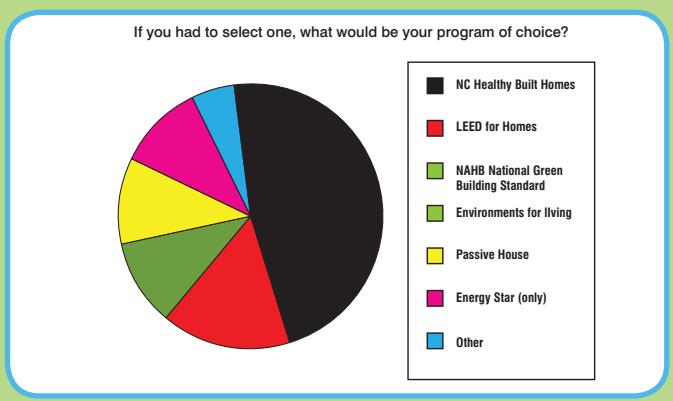
• Most surprisingly, 70 percent of respondents felt that the most important reason for certification was because it was the "right thing to do," with marketing the next most important reason.



• 85 percent of respondents felt that working through a certification program pushed the level of green building that they are previously been building to.



• 66 percent of respondents felt that certifications improved their bottom line overall.



• And last, but not least, 48 percent percent of respondents selected NC HealthyBuilt Homes as their program of choice, followed by LEED-Homes with 23 percent. NAHB, Passive House and ENERGY STAR tied for third, each receiving 10 percent of the vote.

A new requirement: Under ENERGY STAR Version 3.0, a diagnostic test ensures the HVAC system is providing adequate airflow at each room to keep the home comfortable and operating efficiently.
photo courtesy of Home Energy Partners

Timeline

The guidelines go into effect on April 1, 2011, but version 3.0 isn't immediately mandatory. Homes completed between July and December 2011 can use version 2.5, which requires the new reference home but phases in the new checklists (they must be filled out, but aren't inspected). But all homes permitted or completed after January 2012 will have to meet the entirety of version 3.0.

Raters are gearing up to be able to communicate all of the program requirements to the builder and subs as clearly and simply as possible. Look for state and federally sponsored training programs to be available for builders and subcontractors. For existing ENERGY STAR Builders, one thing is certain: You MUST meet with raters earlier in the process than before! For designers, consider contacting a HERS rater to review plans to ensure the home is designed to meet the new certification standard.

For more information and a complete list of requirements, check out the EPA's website on ENERGY STAR 2011: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments.

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

There's no place like a Certified Home.

LEED FOR HOMES

NC HealthyBuilt Homes Program
of Western North Carolina

All certified homes are third-party inspected to meet rigorous standards for sustainability, energy efficiency, comfort and durability. WNCGBC offers the statewide NC HealthyBuilt Home Certification and the national LEED for Homes Certification. Joining either program offers technical and marketing assistance, design reviews, workshops, and field consultation services that enable builders and homeowners to increase their green buillding expertise while building a certified home.

PRESCRIPTION FOR A CERTIFIED HOME:

Every Certified Home Addressess 5 Areas of Sustainable Design & Construction:

• Sustainable Site & Landscape • Energy Efficiency • Healthy Indoor Air Quality • Water Efficiency • Material & Resource Efficiency

BENEFITS FOR A CERTIFIED HOME:

Third Party Verification: Reduce Energy & Operating Costs • Reduce Risk of Mold • Improved Comfort & Durablity • Increased Home Value • Environment Protection

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Just the facts

Asheville's green housing market

by David Mosrie

(research assistance by Mike Figura and Jake Sadler)

Asheville is a funny and wonderful place. There are certain truths that are just unavoidable. Green building is a hot topic. The real estate market has been a little rocky.

And one of the things Ashevillians love to debate the most is the role of green building in the Asheville real estate market.

I set out on an ambitious mission with **Mike Figura**, founder of Mosaic Realty, and the WNC Green Building Council's Residential Outreach Coordinator, **Jake Sadler**, to assimilate all MLS data from Jan. 1, 2007, to the present and draw some meaningful conclusions about what's the true role of green building in the Asheville market.

Just the facts, so to speak.

The local green movement has finally matured to the point that meaningful statistical analysis is possible. But statistics alone can be deceptive; we also tried to merge our personal and professional experiences with the raw data to extract some meaning and perspective. We have seen good times, and we have seen bad. Looking back on it all, this is what we found.

Price

Are green homes actually worth more? It is clear, even to the casual observer, that the market has experienced significant downward pressure since 2008. How have green built home values fared in a declining market?

The chart below shows an interesting anomaly. Note the 2009 New Green Construction average price, compared to the general trend of Green New Construction and Standard New Construction.

AVERAGE SALE PRICE for All New Construction 2007 - 2010

SELL YEAR	AVERAGE SALE PRICE	
	Standard Construction	Green Construction
2007	$407,080.36	$427,778.49
2008	$342,330.64	$440,386.43
2009	$338,665.66	$328,286.95
2010	$269,574.14	$336,255.65

Note how the overall price trend reflects the general market conditions, rising with the broader market from 2007 to 2008, and then falling from there. What is interesting is the fact that in that single year, the average resale price of Green New Construction was actually 2.96 percent less than Standard New Construction. On average, the premium of Green to Standard New Construction over the term of the study was 13.88 percent. In 2007 and 2010, it was 24.91 percent or more.

This was one of those statistics that took some allegorical analysis to decipher. As green building began to really take hold in Asheville, and the number of green builders and green spec homes swelled, a strange trend emerged. An unusual number of green-built homes priced at over $300,000 — and even $400,000 — were erected almost simultaneously in West Asheville, an area that had become the epicenter for the green-building movement but that had rarely seen homes above $300,000 at any previous point in history.

The timing of this trend was perfectly disastrous in terms of the market collapse, but the fact that so many fledgling green builders went to this strategy simultaneously only multiplied the damage. The train wreck of having to unload all those poorly positioned properties in a rapidly descending market caused slashed prices, and this is reflected in this unusual statistic.

In 2009 the market did what it does — it adjusted. To unload houses that seemed like a good idea at the time but all of a sudden were borderline unsellable, some great green homes were sacrificed significantly below-market value and under duress. The statistics bear out our theory in the 2009 West Asheville numbers, and below in the Per Square Foot by Price Category breakout.

Note the obvious anomaly in the $350,000-to-$400,000 and $500,000-to-$600,000 price ranges. Unfortunately, those two categories represented 25 percent of all green sales that year. Also, note the very slight range of per-square-foot averages between $200,000 to $500,000 ranges, with only the one exception.

Price per square foot

Perhaps the most critical question buyers have when considering a green home is related to the premium cost relative to premium price. Since the first green homes were erected in Asheville, the cost to build green has certainly come down with more competition, greater familiarity with the

materials and processes, and the mainstreaming and greater availability of materials.

However, it is a fact that green homes cost more. They offer lower operational expense over time, health and environmental benefits. But how do they stack up strictly as an investment?

The following chart and graph, representing every sale up to $350,000 from 2007 to 2010, clearly tell the tale. The statistics are almost staggering.

2009 AVERAGE PRICE PER SQUARE FOOT: New Construction Only

Sell Price Range	Standard Construction	Green Construction
$0-$100,000	$84	-
$1,000,001 +	$456	-
$100,001-$150,000	$120	$144
$150,001-$200,000	$125	$144
$200,001-$250,000	$147	$182
$250,001-$300,000	$197	$186
$300,001-$350,000	$168	$182
$350,001-$400,000	$201	$158
$400,001-$500,000	$178	$185
$500,001-$600,000	$155	$152
$500,001-$600,001	$348	$213
$600,001-$700,000	$232	$197
$700,001-$800,000	$293	-
$800,001-$900,000	$280	$211
$900,001-$1,000,000	$401	-
Total Average	**$173**	**$176**

Again, placing this information in the general context of the market is important. Note the consistent downward pressure on the Standard Construction sector. What is perhaps the most eye-popping about this chart is the enormous gulf that exists, and continues to widen, between the Standard and Green categories.

As an investment, "non-green" real estate has lost over 15 percent of its value. However, the same investment built green has kept it value, and, in fact, increased slightly. Perhaps, most importantly, the average Standard sale has lost 13.72 percent of its value in relation to the average Green sale over the term.

It is true across every housing market, type and categories that real estate values have been in a perilous state of decline since late 2008.

AVERAGE PRICE per Square Foot - All Sold Under $350,000

YEAR	TYPE	Standard Construction	Green Construction
2007	Resale	$134.57	$115.13
	New Construction	$155.80	$179.42
	2007 TOTAL	$138.00	$175.13
2008	Resale	$131.94	$160.90
	New Construction	$147.23	$178.47
	2008 TOTAL	$134.86	$177.52
2009	Resale	$122.65	$167.28
	New Construction	$143.80	$176.42
	2009 TOTAL	$126.36	$175.79
2010	Resale	$114.68	$167.68
	New Construction	$132.11	$178.09
	2010 TOTAL	$116.96	$175.72

Based on the information, it is without question that the best real-estate investment one could have made prior to the downturn is to have purchased an under-$350,000, green-built home. The numbers are actually quite shocking in the context of the collapse of the national real estate economy.

Asheville has clearly become a major epicenter for green building and is becoming known nationally for its green economy. The facts bear out, whether it is a cause or an effect: Building and buying green continues to benefit owners on many levels. Among the many other advantages — environmental, energy savings, health benefits and (many would argue) better craftsmanship — their owners enjoy a clear strategic advantage on the open market, based on WNC Regional MLS data. We collected an enormous amount of data, and this is merely an excerpt of the most pertinent information.

Please feel free to contact any of us for further data, opinion, information, or discuss how to find, create or design your own state-of-the-art, green-built home in the Asheville area.

David Mosrie, managing partner of acclaimed local sustainable design-and-development firm Push Design, is a near-20-year veteran of the green-building, development and real-estate industries. Push Design builds and designs toxin-free, healthy, high-performance homes and developments. Info: www.pushahead.com, david@pushahead.com or (828) 275-4108.

Mike Figura is an ECO Broker and is the owner of Mosaic Community Lifestyle Realty. He is a one of the foremost experts in green-home market research, project positioning and marketing green homes in Asheville. Info: www.mymosaicrealty.com mike@mymosaicrealty.com or (828) 337-8190.

Jake Sadler is the residential outreach coordinator for the WNC Green Building Council. You can reach him at jacob@wncgbc.org or (828) 254-1995.

"DeSiding" on materials

Some considerations for exterior finishes

by Jake Sadler

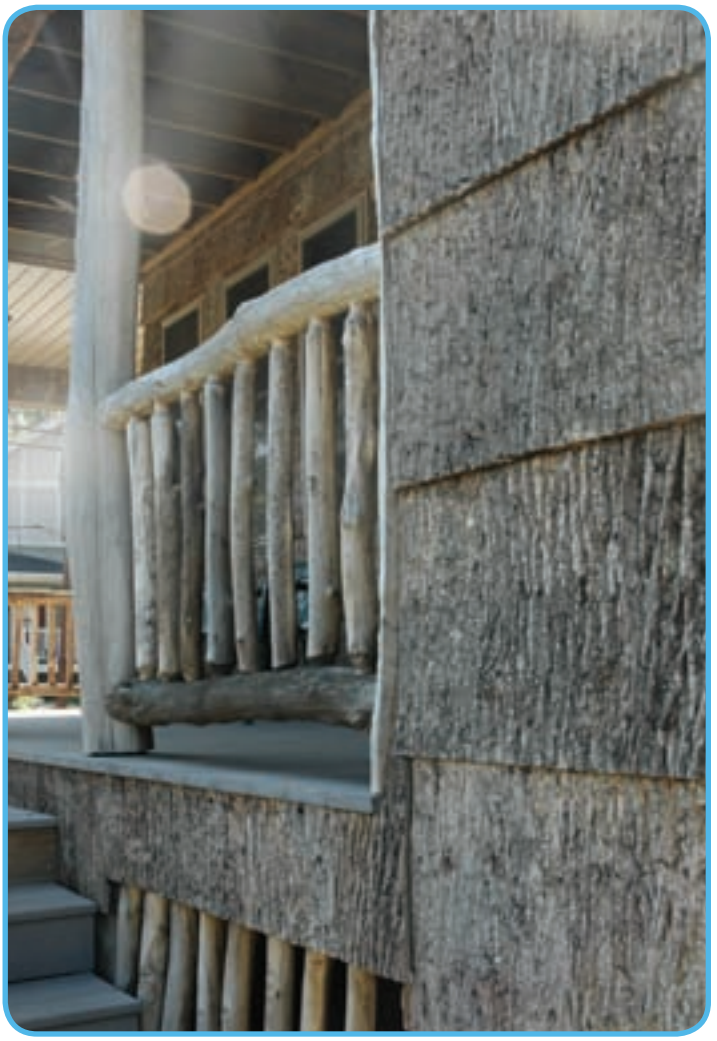
Shelter. Protection. Comfort. Design. The siding we use on our homes is important for all of these reasons. Siding is a home's first line of defense against the elements, and it is the first thing we see from the curb. Over time, builders have experimented with many different types of siding in attempts to combine both form and function when constructing a house. However, not all siding materials are created equal. Each particular type has its own set of benefits and drawbacks.

Current trends can be divided into two umbrella categories: wood-style siding and masonry-style siding. The most common wood styles include solid-wood panels or "shakes," fiber cement and vinyl siding. The most common masonry styles are brick, stucco and, to a lesser extent, stone.

The standard criteria for selecting siding typically concerns cost, durability and design. These aspects are certainly important, whether you are building green or not. But there are a few additional issues to consider when building green and with sustainability in mind: resource efficiency, embodied energy and performance.

First, resource efficiency addresses the material's content and production. A material's recycled or locally acquired content, durability and renewability all benefit the material's overall resource efficiency. Next, embodied energy represents the total energy input into a product, including manufacturing, transportation and installation. The lower the embodied energy, the greener the product. Finally, performance of a material, in the case of siding, relates to its ability to protect a house from the elements, control moisture and minimize maintenance. The better the siding performs, the fewer problems a home will have. Keeping these additional criteria in mind, we can take a look at the common siding types and better understand the green impacts of your material choice.

Wood siding has been a standard and effective siding choice for centuries. As a material, wood is readily available in most parts of the world, and it is strong, durable and visually pleasing. Traditional panel siding — as well as bark and cedar shakes — are all popular siding choices. In recent years, many builders have shifted away from wood siding because of the maintenance required, pest threat and (compared to synthetic alternatives) higher cost. But when building green, wood can be a great choice. It is biodegradable, toxin-free and can be



A bark away: The standard criteria for selecting siding typically concerns cost, durability and design. A few additional issues to consider when building green and with sustainability in mind: resource efficiency, embodied energy and performance.

photo courtesy of Highland Craftsmen Inc./Barkhouse

sustainably harvested and replanted (look for Sustainable Forestry Initiative and Forest Stewardship Council certifications, which are approved wood materials for NC HealthyBuilt homes). With proper installation, and use of low toxicity paints and stains, the green benefits of wood siding are many. Be sure to choose wood that is sustainably harvested and does not require a great distance to travel.

Alternatives to wood siding include engineered products such as **vinyl siding**, fiber cement and other composite siding products. Vinyl siding has become the most popular siding choice in the United States because of its low cost, easy installation, durability and superior moisture protection. It is not, however, the greenest choice. Vinyl siding is made from man-made polyvinyl chloride, which is not biodegradable. Additionally, toxic chemicals used to manufacture vinyl siding severely limit recycling and reuse. Vinyl siding also has a very high embodied energy because of the required processing and transportation involved.

Fiber cement is a common alternative to vinyl siding. Fiber cement is very durable and requires little maintenance. The Portland cement used in its production is energy intensive to produce and wood fiber, the other major ingredient, typically requires long distances to transport and may come from non-sustainably harvested wood. However, engineered composite materials such as Nichiha and LP Smartside siding have done an excellent job to lower their energy use, incorporate higher recycled content and reduce the raw materials used in production, all while keeping the benefits of fiber cement siding, making them a good green siding choice.

Masonry siding is the other common siding style used today. Brick siding, for one, is highly durable, and fire- and pest-resistant. Bricks, most often formed from clay and finished in large kilns, are probably one of the most durable and low maintenance siding materials available. Search locally to find a brick producer in your area. While installation time and overall cost are the most common drawbacks, bricks can be an excellent green-siding solution. Attention to detail in how the bricks are laid and ensuring that moisture barriers are in place will guarantee the best long-term results.

Stucco is another common masonry siding material. It comes in two main varieties — traditional and modern. Traditional stucco is made of all natural ingredients, including lime, sand and water. This type of stucco has been avoided in more recent times due to its more difficult and time-intensive installation, which requires application in three layers, with the outer most layer finished by hand or with a trowel. Modern stucco incorporates Portland cement and, in some cases, chemical binders into the traditional stucco mixture. This reduces the need for additional layering, but necessitates additional material cost and adds to the overall embodied energy. While both types are durable, incorporating proper drainage and moisture barriers will maximize the performance benefits of each.

Stone is most often used as facing on foundations. The most common deterrent for use of stone siding is cost, often priced around $20 per square foot. When it comes to building sustainably, however, stone is hard to beat. Stone is all natural, will last thousands of years, is available locally and is fire- and pest-resistant. But make sure the stone is installed properly to eliminate any moisture problems, and be conscious of how far the stone has traveled to the building site. Also be cautious when considering synthetic stone as a siding choice. This type of stone is fabricated from Portland cement and is often transported longer distances than real stone. Synthetic stone is easy to install, but lacks the aesthetic character of local stone and carries a very high embodied energy value.

Choosing green siding can be simple and rewarding. With just a little consideration and research, you can afford siding that will improve the look and feel of your home, and its health and performance too.

Jake Sadler is the residential outreach coordinator for the WNC Green Building Council. You can reach him at jacob@wncgbc.org or (828) 254-1995.

An inventory of green products

The smart way to choose green

Victoria Schmoer 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: Products 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; or 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 checklists below — and directories at bottom — will help you sort through the claims and find the products that best meet your needs.

Local tree, local wood: This handcrafted bar top was made using locally milled walnut that was removed during construction. Photo by Jody Guokas

Manufacturer commitment to sustainability

☑ Is there a written, working environmental policy in place? Is it easy to find on their website 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.

The 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 is an online sustainable design and decision-making tool for building industry professionals and environmentally and socially responsible consumers.

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 is a website devoted to serving professionals whose work promotes sustainable design and construction.

The National Geographic 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 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.

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Energy saver: An AmeriCorps Member uses a can of spray foam to air seal large holes under the floor to save energy and improve comfort during "Project Energize."

photo by Elizabeth Koenig

Energy retrofit 2011

Where to begin when greening your home

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.

See the charts on the next page for more information.

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

Energy Retrofit Checklist

	HEATING & COOLING	WATER HEATING, LIGHTING & 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.

Conservation – where do I begin?

The choice to be more energy efficient may be clear, but the starting point can be more difficult to determine. The Pyramid of Conservation is designed to help you prioritize steps and develop an action plan that's right for you. By establishing a foundation in energy efficiency and gaining a better understanding about how you use energy, you can more effectively work your way up the pyramid.

Improve Your Home, Save Energy and Money, Build Community with an innovative new program:

- Complete home energy retrofits such as duct and air sealing, insulation and weatherstripping with friends, co-workers and neighbors.
- Save hundreds of dollars a year for minimal upfront cost.

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for more information and to sign up and go to www.neighboorsaves.org

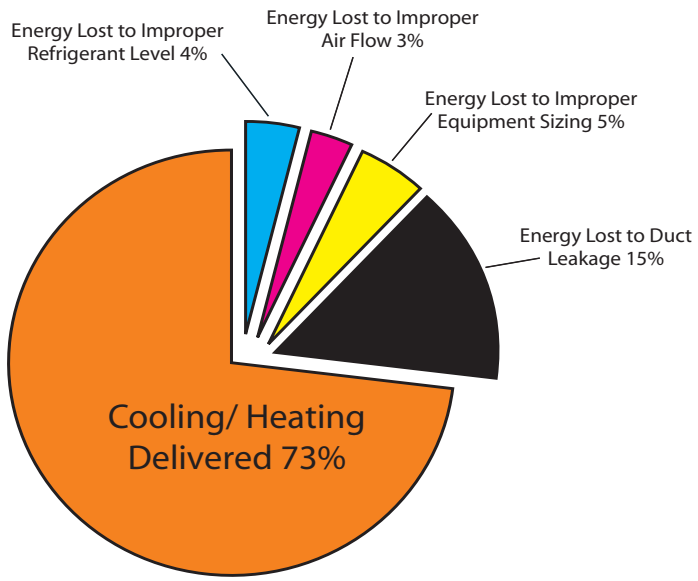
Neighbor Saves is possible thanks to support from: The Community Foundation

Buying a new HVAC system

Don't get left out in the cold

by Jake Sadler

Your heating, ventilating and air conditioning system — HVAC for short — accounts for nearly half of the typical home's energy use. Its operation is fundamental to a home's indoor air quality, and the comfort of its occupants. Because of the importance of an HVAC system to the overall performance of the home, there are some very important considerations to make if you are purchasing a new HVAC system to replace your existing system or as part of a new home under construction.



Step One

is to choose a licensed contractor to assist you. HVAC systems range from complex to very complex in terms of proper installation, sizing and testing. A highly qualified contractor is essential.

When choosing a contractor you will want to take your time and choose carefully. Remember, you won't benefit from even the best HVAC system in the world if it is not installed properly. To help with this decision, follow these important steps when choosing a contractor:

☐ Consult the HVAC listings in the Green Building Directory for a list of contractors.

☐ Ask your friends, family and neighbors for recommendations.

☐ Ask contractors for references — be sure to find out about installation, performance and if the job was finished on time.

☐ Find out about any special offers from your utility providers, potential contractors and state tax incentives. For example Progress Energy offers rebates for a number of energy-efficient HVAC options.

☐ Make sure the contractor is licensed to work on the type of system you need or want. Without a licensed contractor you will most likely void the system's warranty and be unable to claim insurance if something goes wrong.

☐ Be sure that your HVAC contractor is knowledgeable and encourages the use of energy-efficient HVAC systems. Ask them if they will perform a "Manual J" and use mastic to seal the ductwork to start with.

☐ Get estimates! Request itemized bids from different contractors and compare overall costs as well as long term energy costs for operating the system.

☐ Protect yourself by signing a proposal or contract which specifies total time, cost and warranty information.

Step Two

While you are choosing a contractor, you will gain an idea of what kind of HVAC system you will most likely need for your home. Keep in mind that there are a number of different HVAC options each of which you will want to consider according to your needs:

☐ Heat Pumps are the most common systems in our area and can provide both heating and cooling. Heat pumps use refrigerant to transfer heat from one place to another and include both an outdoor and an indoor unit. Heat pumps require a back-up heat source below about 40 degrees. Commonly, heat pumps use electric coils to operate at low temperatures, which will send your electric bill sky high. If you have an outdoor thermostat installed, the electric coils won't kick in until absolutely necessary. Or, consider using a furnace as a back up heat source instead. An even better option is to install a dual-fuel heat pump. When choosing a heat pump, look for a minimum efficiency of 14 SEER and 8.5 HSPF. Because Western North Carolina's moderate climate more often requires heating than cooling, the HSPF-efficiency is the most critical number.

☐ Furnaces are the most commonly used heating system in the U.S. today. Depending on your needs, furnaces typically operate on natural gas or fuel oil. Fuel oil units can run on biodiesel if it is available in your area. Keep in mind that if you are combusting gas or oil you will want to be sure to install carbon monoxide detectors and adhere to building code when installing the system. If you decide on a furnace be sure to purchase a high-efficiency model of 90 percent AFUE or above.

☐ Boilers generate heat by burning natural gas or fuel oil to heat water. Like furnaces, you will want to take proper precautions to limit the potential dangers of combusting fuel in your home. Boilers circulate hot water or steam through baseboards, radiators, or radiant floor systems so they do not require duct work. Look for a minimum efficiency of 90 AFUE.

☐ Central air conditioners are one of the most widely used systems for cooling homes in the U.S. Proper sizing and installation are critical for the performance of this type of system to both cool and dehumidify properly. Look for at least a 14 SEER.

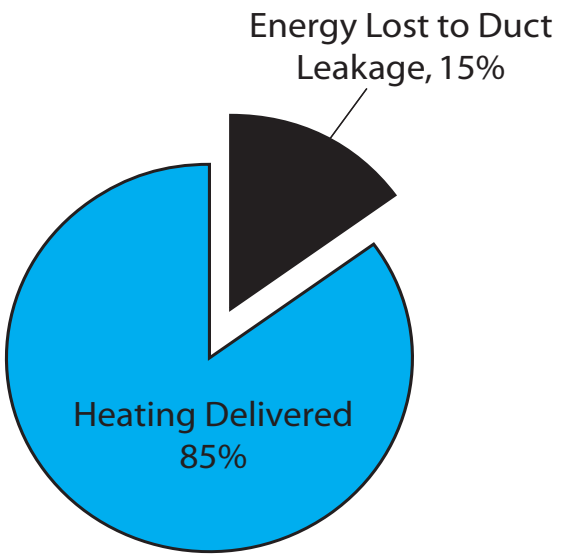
☐ Geothermal heat pumps are very efficient and reliable heating systems. They are expensive up front, but with the many tax incentives currently available it is a great time to consider installing one. Because the ground maintains a constant 55-60 degrees below the surface, drawing heat from beneath the earth is an efficient way to utilize a heat pump system.

☐ Solar thermal heating utilizes the sun's radiant energy through solar collectors and a heat exchange unit. The heated water can then be used in a radiant system of with a heat exchanger in forced air systems. The systems can also supply domestic hot water.

Step Three

Once you have decided on a contractor and a particular HVAC system, you will want to make sure that all the steps are taken to properly size and install your system. There are a number of issues to take into consideration to assure your system is performing to maximum efficiency.

☐ Properly sizing your HVAC system is absolutely critical to the overall efficiency and performance of the system. Without properly



sizing your HVAC you will most likely run higher energy bills and have a hard time making your home comfortable. In order to size your system, your contractor will have to do a Manual J calculation. This is usually required by code, but it is often overlooked, so be sure to request the calculation from your contractor. Keep in mind that oversized equipment is not better, and will cost more upfront, will shorten the system's lifespan, perform poorly and will not properly dehumidify.

☐ Sealing your duct-work to minimize leakage is essential for ducted systems. As seen in the following graphs, leaky ducts will dramatically and negatively affect your HVAC performance. Be sure to have your contractor use mastic adhesive around all duct joints — not duct tape. Consider hiring a third party auditor to test the system's leakage with a duct blaster.

☐ Refrigerant charge is important for systems like central AC or a heat pump. Proper refrigerant charge will assure quality performance, and will reduce your energy costs and improve the system's efficiency.

☐ Airflow optimization is critical for HVAC performance. The air circulating in your duct system must be the proper amount. Ask your contractor about performing a Manual D calculation to make sure your ducts are properly sized and test for proper air flow to allow your system to maximize home comfort.

☐ Install a programmable thermostat. These come in a number of variations which can best suit your needs. A programmable thermostat is easy to use and can improve your HVAC performance and lower energy costs.

Typical Furnace Installation

With your new HVAC system installed, you will want to make sure to take care to properly maintain it and maximize its performance to receive the most possible benefit. Keep in mind these tips once you have your system up and running:

- ☐ Change your return air filters regularly for ducted systems
- ☐ Have your contractor perform routine tune-ups
- ☐ Tighten electric connections
- ☐ Lubricate moving parts
- ☐ Check gas and oil connections
- ☐ Clean the coils
- ☐ Clean the blowers
- ☐ Have your contractor test the refrigerant charge
- ☐ Check your condensation drain for stoppage

For more information and a more comprehensive list, visit energstar.gov.

Jake Sadler is the residential outreach coordinator for the WNC Green Building Council. You can reach him at jacob@wncgbc.org or (828) 254-1995.

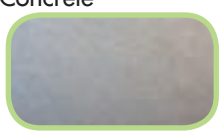
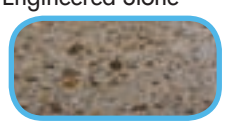
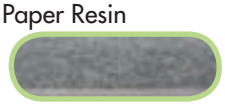
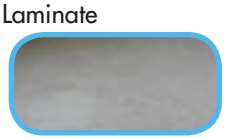
Kitchen remodeling

How To: A Greener Kitchen Remodel

"When you think about remodeling a room in your home, do you think about the kitchen? Most of us do and with good reason, it's the most used room in your home! There are many opportunities to create a green and healthy kitchen. However, with so many products using catch words such as "green" or "low VOC's" to grab attention it is difficult to know what to choose. The information included in this guide will empower informed choices towards the truly green materials. As with choosing any green product, make sure to consider the sustainability of manufacturing and the environmental commitment of the companies.

Compiled by Jake Sadler and Maggie Leslie with help from Shana Combs, director of sales and marketing for Build It Naturally. Photos by Jennifer Kelley-Sadler.

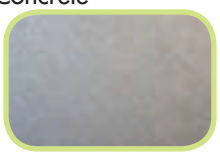
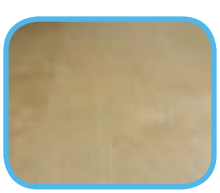
Countertops

Material	Description	Benefits & Drawbacks	Tips
Butcher Block 	Butcher block countertops are made by bonding peices of wood together into a solid and cohesive surface. The environmental impact of these counters is determined primarily by how the wood was harvested.	Can be made from renewable and sustainable materials; can be sanded to maintain new look; porous, requires water sealing periodically; can be scorched	Use reclaimed or third-party-certified & sustainably harvested wood, such as the Forest Stewardship Council (FSC). Look for nontoxic, low-VOC sealers and finishes.
Concrete 	Concrete is a mixture of rock, sand, or other fillers and Portland Cement, which has a high embodied energy.	Durable; can be made locally with recycled materials; recycleable; porous, requires water sealing; very heavy and can require cabinet reinforcement	Choose a concrete that uses recycled fillers like fly ash from coal burning in their mix, & apply a zero-VOC sealant. Some green, engineered options have a similar appearance to concrete but a lower embodied energy.
Engineered Stone 	Typically, engineered stone is a fabricated stone product made from ground quartz crystals, quartz dust, pigment and various binders.	Durable; does not require treatment (low toxicity); very difficult to damage, cut or scorch; typically made from nonrenewable resources; heavy to transport	To reduce unnecessary transportation, use the closest manufacturer.
Stainless Steel 	Stainless steel is alloy metal combining steel with nickel and chromium. Chromium is safe in stainless steel, but alone it is highly toxic.	Easy to clean; reusable; can be made from recycled material and is recyclable; but prone to scratching; must be wiped down regularly; produces chromium, which has negative environmental impacts	To maximize the green benefits of stainless steel, use salvaged pieces, if possible. Restaurants and other commercial facilities are great sources.
Natural Stone 	Natural stone has little input in production outside of quarrying the stone itself. Transportation is expensive, however. Salvaged stone can be found at many salvage yards and can be less expensive.	Tolerates hot surfaces well; durable; reusable; porous and requires sealing; difficult to repair if broken; mining and quarrying is not always done in an environmentally friendly manner	Use local stone, if possible, to reduce travel distance and get the most benefit from this countertop option.
Paper Resin 	Paper resin counters are made from layers of paper bonded together under pressure to form a solid surface.	Hygienic; can be sanded to smooth out scratches; but prone to staining; can be scorched by hot surfaces	Look for high recycled-content paper and low-VOC resins.
Laminate 	Laminate is made from phenolic resin-soaked paper, which is cured under high pressure. Laminates do contain formaldehyde.	Durable; hyygienic; but seams often visible; particle-board substrate is prone to water damage	Look for recycled plastic laminates, whch are bonded with nontoxic glues to a formaldehyde-free substrate.

Material	Description	Benefits & Drawbacks	Tips
Tile 	Ceramic tile is made from clay and fired in a kiln at high temperatures. Tile requires a great deal of energy to extract and produce. It is durable.	Recyclable; reusable; can withstand hot surfaces; but scratch-prone; cleaning grout properly can be tedious; heavy to transport long distances	Use recycled content tile, and use a local tile manufacturer when possible.
Solid Surface 	Solid-surface counters are typically made from a blend of bauxite ore, fillers and resins, typically polyester or acrylic (both of which are derived from fossil fuels).	Durable; small scratches can be sanded; water resistant; hot surfaces can scorch; bauxite mining is not sustainable	Make sure your solid-surface counter is FDA-approved for contact with food and is zero-VOC emission. Paper-resin counters and recycled plastic are a great green alternative to solid-surface countertops.
Terrazzo 	Terrazzo consists of crushed stone and glass set in cement or epoxy, then buffed smooth. Epoxy is petroleum-derived and can contain potentially harmful chemicals. Cement binders have high-embodied energy.	Durable, low maintenance; high recycled content; but heavy to transport long distances	Use local materials and a high recycled content.

References: www.GreenHomeGuide.com and
http://www.ci.seattle.wa.us/dpd/GreenBuilding/SingleFamilyResidential/Resources/RemodelingGuides/default.asp

Flooring

Material	Description	Benefits & Drawbacks	Tips
Tile 	Ceramic tile is made from clay and fired in a kiln at high temperatures. Tile requires a great deal of energy to extract and produce. It is durable.	Very durable; reusable; recyclable; increased cleaning depending on amount of grout; heavy to transport long distances	Look locally for recycled-content tile
Concrete 	Concrete is a mixture of rock, sand or other fillers and Portland Cement, which has a very high embodied energy.	Very durable; many finish styles; eliminates need for additional finish materials; but prone to scratching; cracking is possible	Use concrete mixed with fly ash from coal burning, and try to use nontoxic pigments to color the concrete, rather than surface stains.
Cork 	Cork comes from the bark of the cork oak tree, which can regenerate its bark every nine years. Some cork floors are made from the scraps of bottle-cork manufacturing.	Renewable resource; naturally resilient and easy on joints when standing; imported long distances, primarily from Europe	Look for products with no added formaldehyde and a high recycled content. If sealing, use a low-VOC sealant.
Bamboo 	Bamboo is a fast growing, renewable, member of the grass family. Bamboo is split and made into planks, which are considered equally as strong as hardwood.	Renewable; tougher than most hardwoods; imported typically from Asian nations	Make sure flooring is solid bamboo to assure quality and durability advantages. Look for FSC-certified and products with no added formaldehyde.
Natural Linoleum 	Made from a combination of linseed oil, wood flour, pine resin and plant fiber, natural linoleum is nontoxic and can last over 40 years.	Made from all-natural materials; naturally anti-bacterial; easy to install yourself; typically imported from Europe; odor from linseed oil may irritate some people	Marmoleum is a natural linoleum manufacturer whose products are certified for individuals with asthma and other respiratory issues.
Wood 	Wood is a durable, natural and renewable material. Reclaimed wood has been salvaged, repurposed or recycled from previous use. Certified wood is designated to be sustainably harvested.	Recyclable; reusable; can either be salvaged or sustainably harvested; scratch prone; must be treated periodically; must be refinished periodically to maintain appearance	Use locally harvested, salvaged or third-party-certified wood. Finish with nontoxic, low-VOC products.
Laminates 	A type of floating floor, laminates usually consist of a thin layer of color or pattern over a tongue-and-groove base.	Many different appearance choices, easy to do yourself; but the system beneath the laminate must be installed properly; durability of floating floor is questionable; glues used in laminate can be toxic	Look for laminate floors with high 70 percent recycled content and that snap in place to avoid toxic glues.

Cabinetry

Material	Description	Benefits & Drawbacks	Tips
Bamboo 	Bamboo is a fast-growing, renewable member of the grass family. Bamboo is split and made into planks, which are considered equally as strong as hardwood.	A renewable, fast-growing, natural product; no off gassing; typically comes from Asia and requires long distances to travel	Be sure to use solid bamboo — and not bamboo-covered particle board — to ensure maximum durability and quality.
Compressed Agricultural Fibers 	These agricultural panels are made from the agricultural waste of food production. Common products use wheat, straw or sorghum stalks. Use of eco-friendly binders and its rapidly renewable, recyclable nature make it a good choice.	Naturally renewable; made from waste products; may need a finish to increase durability; some products use toxic glues	Get products with low-VOC, nontoxic adhesives and veneers.
Particle Board 	Particle board is made by binding and pressing wood chips and wood shavings into a dense engineered wood product and, typically, contains formaldehyde.	Made from waste and recycled wood content; urea formaldehyde as well as other off-gassing binding agents are used	Look for nontoxic, low-VOC, and urea formaldehyde-free binders and resins.
Hardwood 	This natural and renewable material comes from hardwood species such as oak, cherry, locust, etc. Local, salvaged and certified wood products are available.	Can be sustainably harvested and is naturally nontoxic; FSC products meet LEED requirements; but non-sustainable timber practices threaten many hardwood species; many sustainable wood products do not have certification	Look for local, salvaged or third-party-certified, sustainably harvested wood. Use low-VOC, natural and nontoxic stains and finishes.
Formaldehyde-Free Plywood 	Plywood panels can be made without any formaldehyde.	Contains no formaldehyde; not all panels are FSC certified; not all manufacturers offer product	Look for nontoxic, low-VOC binders and third-party-certified wood.

The Advanced Framing technique

A classic structure gets an update

by Marcus Renner

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.

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 tradespeople — 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 [WHAT] 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.

Advanced framing 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.

Below is a list of code-approved advanced framing methods:

☑ **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.

☐ **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.

☐ **Raised heel trusses or rafter ends**
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 fluff. In a framed roof, a ledger board can be placed flat on top of the joist ends and the rafter sits on the ledger.

Studded: Two Stud Corner framing reduces wood use and increases insulation.

photo by Marcus Renner

☐ **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.

☐ **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 board. Non-load bearing openings are usually under gable ends.

☐ **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.

☐ **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 in-line 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.

☐ **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.

☐ **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.

Marcus Renner is a trainer and program manager at Green Opportunities, a nonprofit green collar jobs training program. He has been a green builder, consultant, educator and energy auditor. Currently he is continuing to strive for sustainability in existing buildings. He can be reached at marcus@greenopportunities.org.

Green man drawing: Choosing a green builder starts with asking the right questions (Gawain Mainwaring of Smart Builders, Inc., pictured).

photo by Jonathan Welch

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?
- ☐ 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.

Spotlight

Local businesses go solar

Solar is becoming more and more prominent throughout Western North Carolina. Thanks to state and federal tax incentives, as well as direct incentives from utilities and rising energy costs, many small businesses are finding that installing solar has a relatively quick payback. Utilizing renewable energy gives businesses financial savings in the short and long term, creates a more predictable cash flow and provides a very tangible and visible demonstration of their environmental commitment. Here are just some of the local businesses that have decided to "Go Solar" and help WNC have a more sustainable future.

West End Bakery
System size and type: Four 4x10 thermal flat plat collectors
Energy used for: dishwashing, domestic and cooking
Estimated energy saved per year: 200 gallons of hot water per day for a monthly savings of $75.00-$150.00.
Location: West Asheville
Type of business: Restaurant/bakery
Installation company: FLS Energy
Quote from business owner: "The Solar water system FLS installed has cut our natural gas usage by 24 percent, saving my business hundreds of dollars a year. Our customers notice and appreciate our commitment to minimizing our carbon footprint. Definitely a win-win for the Bakery." — Lewis Lankford, co-owner, West End Bakery

Beatty Solar Farm
System size and type: 10kw photovoltaic completed (out of 100kw planned)
Energy used for: Electricity is sold to the utility and NC Green Power as an investment.
Estimated energy generated per year: 15 megawatts produced annually, offsetting 35,839 pounds of carbon.
Location: Fletcher, N.C.
Type of business: Solar Farm
System Design/ Installation: Sun Stuff Energy/Solar Contracting Service & Amp Electric
Quote from system owner: "Strictly from a financial perspective, this system provides a very good return on investment. Energy prices are increasing, making this investment more and more valuable."

Sunny Creek Farm
System size and type: Sixteen 4x10 thermal flat plat collectors
Energy used for: Raising temperature of water for watering edible sprouts
Energy saved per year: 7 gallons of propane or $12.60 daily which equates to a 37 percent savings and $4,599 yearly.
Location: Tryon, Polk County
Type of business: Sprout Farm
Installation company: Solar Dynamics
Quote from business owner: "With a net project cost of $ 20,250.00 (installed in 2006) the project financial payback is about 4.4 years (in other words: this year the system has already paid for it self)." — Ed Mills, Owner, Sunny creek Farm

Mellow Mushroom Pizza
System size and type: Six 4x10 thermal flat plat collectors
Energy used for: Dishwashing, domestic, cooking
Energy saved per year: 20 percent of hot water energy needed equal to 88 MMBTUs
Location: Downtown Asheville
Type of business: Restaurant
Installation company: Sundance Power Systems
Quote from business owner: "With the installation of our solar hot water setup, we have recognized both the financial and the reduced energy consumption benefits and the marketing benefits are icing on the cake. The system has far exceeded our expectations, and I am baffled why it isn't an integral part of all new and retro-fit construction." — Gerry Mahon, owner Mellow Mushroom

Sundance Power Systems Office
System size and type: 9.45 kW photovoltaic system & one 4X8 thermal flat plate collector
Energy used for: Domestic hot water and sell-all onto the grid
Energy generated per year: 12,615 kWh offsetting 9.73 tons of CO2 emissions.
Location: WeavervilleType of business: Renewable Energy Installer
Installation company: Sundance Power Systems
Quote from business owner: "Sundance Power Systems was founded on the fundamental notion that we all need to take personal responsibility for transforming the way we live on the planet from one of exploitation and destruction to one of sustainability and prosperity. Walking the walk has always been our way, from the first system we installed on our own home in 1995 to becoming a Carbon Neutral Work Place at our Offices." — Dave Hollister, owner Sundace Power

Sunny Point Cafe
System size and type: Four 4x10 thermal flat plat collectors
Energy used for: dishwashing, domestic and cooking
Estimated energy saved per year: 200 gallons of hot water per day for a monthly savings of $75.00-$150.00.
Location: West Asheville
Type of business: Restaurant
Installation company: FLS Energy

The WNCGBC won't be around forever, at least not without YOUR SUPPORT.

Please help us as we continue to innovate and push for the greenest buildings achievable.

Join or Renew Today and help us continue our work into the future. www.wncgbc.org

We have membership levels for every budget from $15 (Student) to $1,000 (Platinum)

For 10 years, the Western North Carolina Green Building Council has worked to grow a robust and growing green building industry with hundreds of businesses employing hundreds of people and increasing the health of our community. We could not have achieved this success without the support of all our members.

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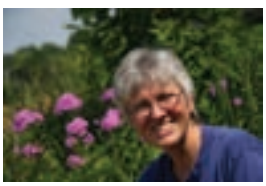

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Sun Stuff Energy / Solar Contracting Service

Peter Phelps
828-277-8557 / 828-505-1485 /
Fax: 828-274-1155
1200 Hendersonville Road
Asheville, NC 28803
www.sunstuffenergy.com
peter@sunstuffenergy.com
Sun Stuff Energy has been the premier retailer of solar energy resources for Western North Carolina since 1984-We specialize in solar water heating,PV and radiant heat. We also provide solar investing

Sundance Power Systems Inc.

Dave Hollister
828-645-2080 / Fax: 828-645-2020
11 Salem Hill Road
Weaverville, NC 28787
www.sundancepower.com
info@sundancepower.com
Serving the region since 1995, empowering residential and commercial customers with quality service to integrate solar electric, solar hot water and radiant floor systems into their daily lives.

Thermacraft Energy Services

Samuel Thompson
828-285-8825
306 Elk Park Drive
Asheville, NC 28804
www.thermacraft.com
gosolar@thermacraft.com
Since 1988, Thermacraft has been installing and servicing Solar Electric, Solar Hot Water, and Radiant Floor Heating System. We are NABCEP Certified in Solar Electric & Solar H20.

Renovators

A & B Construction and Development, Inc.

Jeremy Bonner
828-258-2000 / Fax: 828-254-6126
PO Box 15370
Asheville, NC 28813
www.a-b-construction.com
info@a-b-construction.com

A.W. Builder, L.L.C.

Andrew Weaver
828-776-0959 / Fax: 828-633-0883
7 Enka Crescent St.
Candler, NC 28715
awbuilderllc@yahoo.com
A.W. Builder has been serving Buncombe, Madison, and Henderson counties for 10 years! We specialize in new green construction but, offer energy star and green upfits for existing homes and businesses.

ACI-Asheville Construction, Inc.

Joe Golino
828-776-6909
PO Box 6698
Asheville, NC 28816
www.ashevilleconstruction.com
asheconinc@yahoo.com
Building Asheville since 1983 with quality, craftsmanship and service. Reasonable pricing for your remodel, room addition or high-performance green home. Local workers, subs, suppliers and materials.

Adryana Services

Adrianne Weir
828-275-2534 / Fax: 866-875-1634
PO Box 18714
Asheville, NC 28814
www.adryanaservices.com
adryana.services@gmail.com
Lead paint present at your potential project? Adrianne Weir is an EPA and NC accredited instructor. Local to WNC, I train contractors nationwide, consult, provide lead-safe labor and on-site training.

Bostic Builders

Mike Bostic
828-606-6122 / Fax: 828-338-0308
1735 Charlotte Hwy. PO Box 481
Fairview, NC 28730
www.BosticBuilders.com
bosticbldright@gmail.com
We are a quality construction company with over 40 years in these mountains.For 25 years I have built,and been involved with design of Passive solar homes and additions. Gold Rated homes is our passion.

Brookstone Builders Inc

Richard King
828-230-7972 / Fax: 828-419-0202
PO Box 1105
Black Mountain, NC 28711
www.brookstonebuilders.net
rking@brookstonebuilders.net
Brookstone Builders is a local company that builds Healthy/Green built homes in a variety of price points. Our goal is to build a stylish and energy efficient home that is designed around your needs.

Burdett Building & Remodeling LLC

Bill Burdett
828-674-4455
PO Box 381
Tuxedo, NC 28790
burdettwilliam@bellsouth.net

Carolina Cornerstone Construction Inc.

Scott MacAlister
828-515-0223 / Fax: 828-515-0381
PO Box 6779
Asheville, NC 28816
scott@carolinacornerstoneconst.net
Custom Builder for over 20 years, new construction, restoration, renovations. 51 Energy Star and 47 Healthy Built Homes to date. Some folks talk about "Green" some just do it.

Consolidated Properties Management LLC

Michael Cole
828-225-5888
307 Elk Park Drive
Asheville, NC 28804
mcole@cpmdllc.com
Over 25 years experience in property management and development; licensed GC, site work, footings, foundations, waste management, landscaping, lawn maint., snow removal, home renovations and remodels.

Demos Builders, Inc.

Jim Demos
828-777-2395
Asheville, NC 28801
www.demosbuilders.com
jim@demosbuilders.com
Demos Builders, Inc. specializes in green new home construction and renovations/additions. Fully licensed and insured. Let us build your green home.

Falcon Development of NC Inc

David A Ross
828-274-3055 / Fax: 828-274-7789
30 Hendersonville Road
Asheville, NC 28803
www.falconbuilt.com
david@falconbuilt.com

Forward Construction Inc.

Jim and Sue Forward
828-298-9532 / Fax: 828-298-2444
24 Smokey Road
Asheville, NC 28803
forwardconstruction.com
jtfbuilder@bellsouth.net
Forward Construction Inc. is a family business that has served clients in the Asheville area for more than 25 years. They remain committed to building, remodeling and woodworking with a conscience.

Gary Daniel Builders, Inc

Gary Daniel
828-862-3587 / Fax: 828-862-8970
89 Deerwoode Lane
Brevard, NC 28712
www.gdanielbuilders.com
gdaniel@citcom.net
We have over 35 years experience specializing in home remodeling, restoration, and new residential construction as well as light commercial construction.

Going Green Builders

Ryan Jacques LEED AP
828-577-3472
Brevard, NC 28712
www.goinggreenbuilders.info
greenbuilders@comporium.net
When quality and the environment are as important as your budget. New Construction, Remodeling, Roofing, and Handyman Service. We are licensed, fully insured, and do not use illegal immigrant labor.

Green Built Environments

Victoria Schomer, ASID, LEED AP
828-505-0309
25 St Dunstans Circle
Asheville, NC 28803
http://www.greenbuilt-e.com
vschomer@greenbuilt-e.com
Green Built Environments focuses on interior designing and renovating homes that support healthy, sustainable lifestyles and aging in place.

High Country Homes, Inc.

Nancy Padgett
828-628-0447 / Fax: 828-628-0447
81 Ledgestone Drive
Fairview, NC 28730-7100
hchomes@bellsouth.net
A true custom homebuilder known for personalized service & attention to detail - NAHB Certified Green Building Professional - NC Healthy Built Homes participant - NC Certified Renovation Firm

HomeSource Builders

Tim Alexander
828-252-1022 / Fax: 828-252-1033
172 Charlotte St.
Asheville, NC 28801
www.homesourcebuilders.com
tim@homesourcebuilders.com
HomeSource Builders is an award-winning NAHB Green Professional offering custom home building and remodeling services, including NC HealthyBuilt and Energy Star.

Jade Mountain Builders

Hans Doellgast
828-216-3948 / Fax: 828-298-5428
186 Cisco Road
Asheville, NC 28805
Jademountainbuilders.com
Hans@jademountainbuilders.com
Jade Mountain Builders is a team of 21 conscientious craftsmen who build and remodel ecologically sensitive homes with a distinctive natural style.

Justin Wright Builders, Inc

Justin Wright
828-736-2018 / Fax: 828-497-1188
PO Box 2257
Cherokee, NC 28719
justinwright1@msn.com
General Contracting company interested in providing clean operating, energy efficient, and environmentally friendly homes and light commercial buildings.

Kirk Johnson Construction

Kirk Johnson
828-231-7379 / Fax: 828-251-9373
15 Big Level Drive
Asheville, NC 28804
KirkJohnsonConstruction.com
kjconstruct@bellsouth.net
Since 1995, the design/build firm has successfully completed many residential and commercial projects. These include sustainably built custom homes as well as high end renovations.

Living Stone Construction, Inc.

Sean Sullivan
828-669-4343 / Fax: 828-669-3865
37 Cottage Settings Lane
Black Mountain, NC 28711
www.LivingStoneConstruction.com
information@livingstoneconstruction.com
Living Stone Construction is a first-tier builder of fine custom homes in Western North Carolina. Our mission is to provide our clients with a new or renovated home that exceeds their expectations.

Maple Ridge Construction, Inc.

Joe Yanik
828-681-8880 / Fax: 828-681-9862
2 Dunnwoody Drive
Arden, NC 28704
mapleridgec@yahoo.com

Palladium Builders, Inc.

Jim Selmensberger
828-713-0900 / Fax: 828-277-0669
21 White Oak Road
Asheville, NC 28803
www.palladiumbuilders.com
jim@palladiumbuilders.com

Pioneer Construction & Development Inc.

Duane Liming
828-768-8771 / Fax: 828-254-1537
133-F Thompson St
Asheville, NC 28803
www.pioneerasheville.com
drliming@juno.com

Rare Earth Builders, Inc.

Mark Bondurant
828-646-3561 / Fax: 828-646-3561
221 Pioneer Ridge Road
Canton, NC 28716
www.RareEarthBuilders.com
rareearthbldrs@bellsouth.net
By maintaining a core group of seasoned greenbuilding professionals, REB consistently delivers finely crafted green homes economically and with first-rate service. Now offering tiny home design/build.

River's Bend Construction LLP

Ryan Finney & Patrick Landry
828-702-9423
Asheville, NC 28806
riversbendconst.com
ryanmfinney@gmail.com
Reduce.Reuse.Remodel. RBC LLP specializes in affordable renovations, remodels and outdoor living spaces in WNC. We are committed to sustainable design, reducing waste and reusing quality materials.

SAGE Builders of WNC, Inc

Doug Keefer
828-713-7208 / Fax: 828-683-1224
299 Morgan Branch Road
Leicester, NC 28748
www.thesagebuilders.com
info@thesagebuilders.com
SAGE (Sustainable, Appropriate, Green and Efficient) Builders specializes in custom homes with fine woodworking and solar amenities.

Sineath Construction Company

828-484-8077 / Fax: 828-484-9397
PO Box 1603
Burnsville, NC 28714
www.sineathconstruction.com
info@sineathconstruction.com

SkyTop Builders, LLC

Jack Whealan
828-989-8865 / Fax: 828-345-5038
30 Westgate Pkwy #200
Asheville, NC 28806
www.SkyTopBuilders.net
jack@skytopbuilders.net

Smart Builders, Inc

Gawain Mainwaring
828-252-4345 / Fax: (888) 651-0877
2 Brucemont Circle
Asheville, NC 28806
www.TheSmartBuilders.com
Sales@thesmartbuilders.com
NAHB Certified Green Building Professionals, specializing in SIPs, energy efficient designs, new construction, custom green kitchens, additions, and the highest customer satisfaction. BBB A rating.

SouthEast Ecological Design, Inc.

Kevin Ward
828-768-6448
503 Old Farm Lane
Marshall, NC 28753
www.ecologicaldesign.net
info@ecologicaldesign.net
SEED is an ecological general contracting company and green design/build firm serving WNC since 1999- We are organized to approach land use and custom building holistically and sensibly.

Stewart Builders Inc.

Mary Stewart
828-452-0056 / Fax: 828-452-5849
PO Box 83
Waynesville, NC 28786
www.stewartbuilders.net
marestew@charter.net
LEED AP, Certified Green Professional, AMB, unlimited license, residential & commercial, new and remodels. Excellent reputation throughout WNC. If you build with quality, you will live with quality.

The Eco Handyman

Carl Donovan
828-281-7466
1465 Sand Hill Road, Suite 2020
Candler, NC 28715
www.the-eco-handyman.com
admin@the-eco-handyman.com
The Eco Handyman is a home repair service that focuses on using sustainable, low-VOC and eco-friendly materials in every possible situation. All salvaged materials are recycled or re-purposed

Residential Designers

A. Bailey Design Associates

Andy Bailey
828-400-3882 / Fax: 828-926-4605
594 Owens Road
Waynesville, NC 28785
www.andybaileydesign.com
ab@andybaileydesign.com

Alembic Studio, LLC

Luly Gonzalez
828-333-4647
13 1/2 Eagle St., Suite C
Asheville, NC 28801
www.alembicstudio.com
luly@alembicstudio.com
Progressive designs that distill the essential elements of individual needs and lifestyles to offer sustainable comfort, energy-efficiencies and the promotion of grounded, eco-conscious living.

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Fletcher, NC 28732
www.blueridgeenergysystems.com
info@blueridgeenergysystems.com
Energy efficiency and durability are the pillars of our sustainable building philosophy. For the price of conventional construction our houses condition for under $200/year and will last 200 years.

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www.devittcustomhomedesign.com
devittdesign@charter.net
Designing homes for healthy living and energy efficiency since 1985- Creative & practical design backed up by 25 years of hands-on construction experience.

Kirk Johnson Construction

Kirk Johnson
828-231-7379 / Fax: 828-251-9373
15 Big Level Drive
Asheville, NC 28804
KirkJohnsonConstruction.com
kjconstruct@bellsouth.net
Since 1995, the design/build firm has successfully completed many residential and commercial projects. These include sustainably built custom homes as well as high end renovations.

Old School Design~Build, LLC

Bobby McHugh
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Black Mountain, NC
www.oldschooldb.com
rebaloo@bellsouth.net
Work with designer-builder Bobby McHugh to create your new home, addition or small project. All homes are certified HBH/E-star & feature radiant floor heat, locally milled lumber & artistic touches.

Paint Rock Builders, Inc.

Bryan Sinclair
828-273-4071
147 Jupiter Road
Weaverville, NC 28787
www.paintrockbuilders.com
bryan@paintrockbuilders.com
We are design/build company crafting small to medium sized homes and remodels. Our designs use effective green building options, mountain style, and construction techniques designed to save you money.

Push Design

David Mosrie
828-275-4108
150 Hilliard Ave.
Asheville, NC 28801
www.pushahead.com
pushdesign.david@gmail.com
Push Design engages in the design & development of toxin-free, healthy high performance homes and micro-developments. We also source healthy material options that are breathable and toxin-free.

Sage Concepts LLC

Adam Pittman
828-713-2678
4 Bridle Path Road
Asheville, NC 28804
sageconceptsllc.com
adam.pittman@gmail.com
Sage Concepts is a unique company focused on responsible design, development, and construction of homes that are innovative in their design, green built, and reasonably priced.

Smart Builders, Inc

Gawain Mainwaring
828-252-4345
Fax: (888) 651-0877
2 Brucemont Circle
Asheville, NC 28806
www.TheSmartBuilders.com
Sales@thesmartbuilders.com
NAHB Certified Green Building Professionals, specializing in SIPs, energy efficient designs, new construction, custom green kitchens, additions, and the highest customer satisfaction. BBB A rating.

SouthEast Ecological Design, Inc.

Kevin Ward
828-768-6448
503 Old Farm Lane
Marshall, NC 28753
www.ecologicaldesign.net
info@ecologicaldesign.net
SEED is an ecological general contracting company and green design/build firm serving WNC since 1999- We are organized to approach land use and custom building holistically and sensibly.

Stan Jones Construction and Architectural Design

Stan Jones
828-329-1641
637 Coates Road
Marshall, NC 28753
sdj0011@gmail.com
Thirty years of traditional and innovative design & construction experience, specializing in passive solar, renovations, natural & recycled materials, earthships, energy-efficient & off-grid living.

Studio Dionisi Incorporated

Stephen Beili
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Asheville, NC 28801
www.ashevillemodern.com
ashevillemodern@gmail.com
Green and glam residential design. Finding pleasure in creation and collaboration since second grade. 70 built projects and 37 years later, still enjoying what I do.

Roofers

Living Roofs, Inc.

828-252-4449
www.livingroofsinc.com
info@livingroofsinc.com
Living Roofs, Inc. is the most experienced green roof company in the southeast. We collaborate with designers and developers to provide high quality green roof systems for commercial and residential.

Roofing Materials

Colbond, Inc.

Lenetta Heiland
828-665-5000 / Fax: 828-665-3737
1301 Sand Hill Road
Enka, NC 28728
www.colbond-usa.com
info@colbond.com
Global manufacturer of green roof drainage, water retention, root reinforcement components for 25 years; metal roof underlayments to reduce heat; erosion control. Materials contribute to LEED points.

Salvage

Whole Log Lumber

Jim Stowell
828-697-0357 / Fax: 828-696-2938
688 Blueberry Farm Road
Zirconia, NC 28790
www.wholeloglumber.com
wholeloglumber@hughes.com
Reclaiming Antique Wood since 1984: WNC's oldest supplier. Specializing in Artisan Floors, Mantels and other components of fine wood interiors-including WOCA Penetrating,Hardening Oil. (VOC-free)

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Consolidated Properties Management LLC

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828-225-5888
307 Elk Park Drive
Asheville, NC 28804
mcole@cpmdllc.com
Over 25 years experience in property management and development; licensed GC, site work, footings, foundations, waste management, landscaping, lawn maint., snow removal, home renovations and remodels.

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Mike Taylor
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Mtaylorgrading@att.net
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21 Battery Park Ave., Suite 203
Asheville, NC 28801
www.otterandarrow.com
kevin@otterandarrow.com
Sustainable Land Planning Firm, Erosion Control Plans, Stormwater Plans, City/County Submittals, Native Plant design, Installation, Design/Build, Master Plan Renderings and Graphics. Greenway design.

V&V Land Management and Resource Recovery LLC

Frank Vogler/ Carrie Vogler
828-777-6637 or 423-721-6077
PO Box 7
Del Rio, TN 37727
www.voglerllc.com
carrie@voglerllc.com
Specializing in environmentally sound land clearing and excavating in WNC & TN. We renovate properties of all kinds and minimize construction impact using mulch clearing technologies. Visit our website.

Structural Materials

Colbond, Inc.

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828-665-5000 / Fax: 828-665-3737
1301 Sand Hill Road
Enka, NC 28728
www.colbond-usa.com
info@colbond.com
Global manufacturer of green roof drainage, water retention, root reinforcement components for 25 years; metal roof underlayments to reduce heat; erosion control. Materials contribute to LEED points.

Westall Chandley Building Supply

Josh McGee
828-253-5331 / Fax: 828-254-0135
99 Thompson St.
Asheville, NC 28803
www.westallchandley.com
jmcgee@westallchandley.com

Surveyors

Blackrock Surveying & Land Design

Jamie Brady
828-225-4341 / Fax: 828-225-4342
PO Box 8302
Asheivlle, NC 28801
jbrady@blackrocksurveying.com
Blackrock Surveying and Land Design, PC provides land surveying services to Western North Carolina. Our services include topographic surveying for home or subdivision design.

Kee Mapping & Surveying, PA

Brad Kee
828-645-8275
111 Central Ave.
Asheville, NC 28801
www.keemap.com
info@keemap.com

WNC Professional Engineers & Surveyors

Melanie Brethauer, PE, CFM, LEED AP
828-277-5074
1095 Hendersonville Road, Suite G
Asheville, NC 28803
http://www.wncpes.com
info@wncpes.com
Offering all facets of responsible civil engineering, construction permitting, land surveying, grant writing, construction staking & GPS/GIS services, to generate smart growth and sustainable design.

Sustainable Wood Products

84 lumber

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75 Montgomery St.
Asheville, NC 28806
www.84lumber.com
mng@2306-84lumber.com

Barkclad Natural Products

Danny Heatherly
828-648-6092 / Fax: 828-648-9028
6175 Pigeon Road
Canton, NC 28716
www.BARKCLAD.com
BARKCLAD@bellsouth.net
Barkclad Natural Products brings you Timberclad Poplar Bark Siding™ an all-natural, kiln-dried product harvested from the Tulip Poplar tree. It provides a durable attractive cladding for any home.

Columbia Forest Products

Richard Poindexter, CGP, LEED AP
800-637-1609
Fax: (336) 605-6969
7900 Triad Center Drive, Suite 200
Greensboro, NC 27409
www.columbiaforestproducts.com
rpoindexter@cfpwood.com
Columbia Forest Products is North America's largest manufacturer of hardwood plywood and hardwood veneer. CFP is based in Greensboro and manufactures throughout North America (including Old Fort).

Mountain Lumber Company

Dwight Simmons, LEED AP
828-963-7524 / Fax: 828-963-4997
9877 NC Hwy 105 South
Boone, NC 28607
www.mountainlumbercompany.com
Mtnlumber@skybest.com
A full line building supply offering custom and specialty architectural materials for building professionals, designers and homeowners, with emphasis on locally sourced green building materials.

System Built Homes

Advantage Development Co.

John E. Green
828-215-9064 / Fax: 828-684-4542
91 Distant View Drive
Asheville, NC 28803
www.advdevco.com
johngreen@bellsouth.net
Advantage Development Co. is an award winning custom green home builder in Asheville NC. We are also a Green Realtor and offer custom land/home design build packages to save clients money.

Deltec Homes

Steve Linton
828-253-0483 / Fax: 828-232-4328
69 Bingham Road
Asheville, NC 28806
www.deltechomes.com
slinton@deltechomes.com
We have produced energy-efficient, round homes for more than 40 years. Our homes are panelized in a controlled setting and provide a low-waste, high-performance structure.

Mountain Brook Homes Inc.

J.D. Wallace
828-250-0004 / Fax: 828-250-0888
31 College Place B-121
Asheville, NC 28801
mountainbrookhomesinc.com
info@mountainbrookhomesinc.com
Mountain Brook Homes is a custom modular, panelized and stick built home designer and builder in Asheville, North Carolina. Offering turn key or owner completion and an array of services.

Wall System Installers

MudStrawLove, LLC

Steve Kemble and Mollie Curry
828-775-4823
60 Alabama Ave.
Asheville, NC 28806
www.mudstrawlove.com
connect@mudstrawlove.com
We've specialized in Natural Building since 1990 (straw bale, earthbag, and cob homes; clay and lime-based plasters and paints). Building projects, workshops, design services, and consultation.

Water Conservation

American Water Care / EcoWater Systems

Brad & Susan Morello
828-255-7773 / Fax: 828-452-3996
2344 Russ Ave.
Waynesville, NC 28786
americanwatercareinc.com
ecowaterwnc@bellsouth.net

Blue Planet Plumbing LLC

Georg Efird
828-274-4858 / Fax: 828-274-4891
Asheville, NC
eatsleepplumb.com
georg@eatsleepplumb.com
Specialize in quality, precision & accountability. Plumbing & gas piping, water management systems, grey water & rain water system design & installation, green plumbing. All work comes with a 5 year warranty.

Water Solutions by Icenhower's Farm

Rick Icenhower
828-683-3237 / Fax: 828-683-9155
179 Icenhower Road
Leicester, NC 28748
icenhowersfarm.com
info@icenhowersfarm.com

Colbond, Inc.

Lenetta Heiland
828-665-5000 / Fax: 828-665-3737
1301 Sand Hill Road
Enka, NC 28728
www.colbond-usa.com
info@colbond.com
Global manufacturer of green roof drainage, water retention, root reinforcement components for 25 years; metal roof underlayments to reduce heat; erosion control. Materials contribute to LEED points.

Filters For Tap

Edward Cortright
828-775-9174
PO Box 1273
Asheville, NC 28802
filtersfortap.com
info@filtersfortap.com

Woodworkers & Cabinetry

Architectural Woodcraft Inc

Craig Weis
828-258-9977 / Fax: 828-258-2184
199 Amboy Road
Asheville, NC 28806
www.architecturalwoodcraft.com
archwoodcraft@aol.com
We offer: Custom Woodwork (Green Finishes and purebond plywoods), Cabinets, Energy Star Wood windows double and triple glazed, Doors -Exterior and interior. Energy Star wood windows

Asheville Hardware, Woodworkers Supply

Tom Gholson
828-252-8088
14 Watauga St
Asheville, NC 28801
www.ashevillehardware.com
sales@ashevillehardware.com
7,500 square feet of new and used merchandise; Local hardwoods, reclaimed lumber, reclaimed barn wood, unusual slabs, cabinet-grade plywood, environmentally safe finishes, new/used tools, Fein Multimaster, Festool, Sawstop

Ashley's Kitchen & Bath Design Studio

Ashley Burpeau McElreath
828-669-5281 / Fax: 828-669-7970
2950 US Hwy 70
Black Mountain, NC 28711
www.ashleyskb.com
ashley@ashleyskb.com

Gundersen Woodworking

Sten Gundersen
828-682-2406
36 White Flower Drive
Burnsville, NC 28714
www.stengund.com
sten@stengund.com
Full-service architectural millwork (stairs, doors, beams, moulding) timber-framing, cabinetry, wood countertops and furniture. Now offering 4-axis CNC services for ultimate precision/ versatility.

Paul's Custom Woodworking

Paul M Schmitz
828-712-6234 / Fax: 828-669-2006
190 Eastside Drive
Black Mountain, NC 28711
paulswoodworking.com
paul@paulswoodworking.com
Our woodworking projects include custom timber framing, stairs, doors, counter tops and mantles, etc. Lumber from sustainable sources, milled locally, is available for your project.

Square Peg Construction Inc.

Leslie Humphrey
828-277-5164 / Fax: 828-277-5168
28 London Road
Asheville, NC 28803
www.squarepeginc.net
info@squarepeginc.net
Square Peg creates and installs architectural millwork and custom cabinetry. We install high end custom trim in residential projects within a 75 mile radius of our woodshop in Biltmore Village.

glossary

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 struc ture. 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)

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)

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