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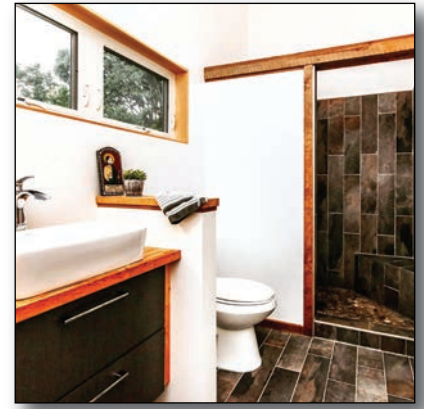
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On the Cover:

Natalie Pollard, owner of Villagers in West Asheville, in her tiny home built by Nanostead (see article page 23).

Max Cooper photo



With a heavy heart, we dedicate the 2015-2016 WNC Green Building Directory to Ron DeSimone. Ron passed away in July 2015 in a tragic construction accident. Ron Desimone has been a member of WNCGBC since 2008, having built several certified homes and was one of the few green builders and council members in Haywood County. Ron was former president of the Haywood County Home Builders Association and was currently holding office as mayor of Maggie Valley, where he worked tirelessly to make Maggie Valley a better place.



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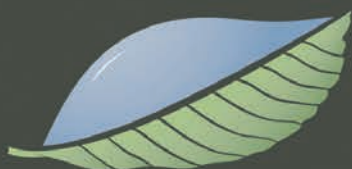


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Welcome to the directory

Welcome to our 11th edition of the WNC Green Building Directory. The Directory is a partnership between the WNC Green Building Council and The Smoky Mountain News, and is a primary tool for education, outreach and expansion of the green building industry in Western North Carolina. The Directory provides a free, non-biased resource of the latest information on green building to the general public and building professionals. The articles in the publication span the range of very technical fact sheets for professionals to case studies and green building "basics" to help homeowners get started building or renovating a home. Within these pages are your keys to successful green building projects. Each year all of the articles are archived and will continue to live online as a living resource.

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 must meet minimum criteria to be listed in this guide and are all members of the

WNCGBC, to prevent green washing as much as possible.

Over the past 14 years the WNC Green Building Council, a nonprofit, has made incredible strides in expanding the knowledge about and implementation of green building in our region through certification of over 1,200 new homes, organizing green open house tours, creating new programs for existing homes and educating the public in many ways. The WNC Green Building Council also offers a free hotline for your questions, many online resources and provides assistance through its many programs.

If building new, the WNCGBC can help you through the process of certifying your home through Green Built or LEED-Homes. If renovating, consider our new Green Gauge Assessment tool. As a membership supported non-profit organization, the WNCGBC has been able to serve the community thanks to our business and individual members' continued sup-

port. We hope that you find the Green Building Directory a valuable resource and support its continued publication through membership with the WNCGBC.

How to use the Guide:

This Guide has something for everyone. The articles in the front of the Guide include case studies of regional projects both in the residential and commercial settings, feature articles on a variety of themes in green living and technical articles on emerging technologies for professionals.

In the back of the Guide you will find a vast directory of local green businesses that are there to help you live a more sustainable life. There are specific requirements for many of the business categories in an effort to keep high standards and provide a truly valuable resource.

Of course the Guide – both current and archived articles from past issues – is always available online at www.wncgbc.org just in case you accidentally lose the hard copy.

Maggie Leslie,
Director WNCGBC



An overview of WNCGBC

The Western North Carolina Green Building Council (WNCGBC) is a membership supported, 501C3 nonprofit organization whose mission is to promote environmentally sustainable and health conscious building practices through community education. The WNCGBC began as a casual gathering of five building professionals in the spring of 2000. A common desire to educate others on the health and environmental impacts of design and construction led to the official formation of the council in 2001. Throughout its existence, WNCGBC has educated thousands of building professionals and homeowners by providing building science and weatherization trainings and has worked with local governments and utilities to provide training and incentives for green buildings.

The WNCGBC hosts classes and events throughout the year to teach builders, architects, realtors, and the general public how they can build green, sell green, and live in green homes. The primary and most valuable educational tool the WNCGBC produces is this annual

Green Building Directory, a resource guide and directory of professionals. The Directory is available online and distributed throughout WNC. The online directory and website also includes articles, a blog, industry news, "how-to" videos and links to many resources around the web.

The WNCGBC also administers the Green Built NC Home Certification Program. Green Built NC is a voluntary, statewide program that aims to educate and provide third party quality assurance that the home is built to green construction standards. Similar to Green Built, but national in scope, the WNCGBC is also a provider for LEED-Homes, a national green building certification program of the U.S. Green Building Council.

Our newest program is Green Gauge. This simple and affordable tool assesses how "green" a home actually is and is open to both new and existing homes. Participants receive a one-page "Gauge" highlighting the green features of the home and illustrating how the energy and indoor water use of the home com-

pare to average homes in the region.

WNCGBC hosts the Living Building Challenge Collaborative-Asheville. The Living Building Challenge certifies buildings that are net-zero energy, net zero water, have locally sourced materials and zero red list chemicals.

Buildings are responsible for 39 percent of annual carbon emissions, 65 percent of waste, 12 percent of water use and 71 percent of electricity use in the US. Not only do green building techniques help the environment, they also save money and protect health by reducing toxic chemicals, providing adequate ventilation and promoting more durable materials in the places where we live and work.

The WNC Green Building Council offers a free hotline for your questions, many online educational resources and provides assistance through its many programs. If building new, the WNCGBC can help you through the process of certifying your home through Green Built NC or LEED-Homes. If renovating or buying consider our new Green Gauge Assessment.

Become a member online at www.wncgbc.org.

Year in Review Accomplishments of the WNCGBC:

- Hotline – Answered more than 200 hotline questions for the general public. Most common questions were on financial incentives, business referrals, financing and appraisals, tiny homes and codes.
- Certified 165 homes through LEED Homes and Green Built NC, saving over 29,952 pounds of coal and \$49,500 on utility bills.
- Partnered with the Asheville HBA and The Asheville Area Board of Realtors to launch Building Green Real Estate (BGRE), and education program offering a designation and construction rebate.
- Certified our 1,000th Green Built NC Home in WNC; built by JAG and Associates.
- Received a \$50,000 grant from the Z. Smith Reynolds Foundation to be used over the next two years to launch Home Energy Score with Green Gauge statewide. WNCGBC will be hiring a new staff member and an intern in 2016 to help us with this effort!
- Began work on a speakers bureau to expand our educational outreach. If you are interested in participating in the work of the WNCGBC by giving short education presentations in WNC, let us know! Email info@wncgbc.org.
- Quarterly classes to On Track Financial, empowering homeowners to understand weatherization and how to save money on utilities.
- Annual networking event at Highland Brewing with over 350 attendees – raising money and providing networking for our members.
- 25,000 copies of the WNC Green Home and Living Guide distributed throughout Western North Carolina with business listings and educational articles.
- Tours of homes and businesses open to the public and free of charge.
- Monthly social events.
- Continued work a local collaborative for the Living Building Challenge – a Net Zero Energy, Net Zero Water, Zero Waste building program. The Collaborative is currently working with local partners on a Student Design Competition. More to come in 2016.
- Weekly blog posts by local experts.
- Partnered with Asheville Green Drinks on quarterly educational programming.
- Cider Fest NC – our second annual Cider Fest NC fundraiser was a continued success. The event featured local cider makers, cheese makers, music, crafts, a tiny home tour and activities for kids.



Located in the Riverside Business Park in Asheville, the future home of the French Broad River Academy is currently under construction. Utilizing renowned structural components and designs from Deltec Homes in Asheville, the school will not only have optimum functionality, it will also have the highest standard of green building materials for an eco-friendly and economical alternative to traditional building methods. Garret K. Woodward photos

Education, economics and eco-friendly

□ BY GARRET K. WOODWARD □

The smile on Will Yeiser's face is ear-to-ear.

"We believe the time is now," he said. "Everything we've pursued in this project is aligned with my personal philosophy, and with the core mission of the school."

Director/co-founder of the French Broad River Academy, Yeiser has spent the last few years preparing, planning and perpetuating his ultimate vision for the institution. Founded in 2009 within the River Arts District of Asheville, the all-boys middle school emphasizes a core of progressive education, one that is nurtured by a keen sense of outdoor recreation and agricultural responsibility.

Originally housed in a large structure in the RAD, alongside art galleries and other businesses, the space began to get cramped with

the growing popularity of the school and its rising enrollment numbers. So, Yeiser began to plot the next move – their own building on their own piece of property.

"Since day one, we've envisioned a true waterfront campus, one that is autonomous and safe," he said. "And we didn't have water access for our outdoor activities in the beginning, and needed to get our own space on the French Broad River."

Eventually, through a gracious three-acre riverside land donation, FBRA now had their dream property. Though on a flood plain, the property was ideal to the school's needs. All that remained was figuring out the appropriate structure to place on it, one that was green built, eco-friendly and cost saving.

Cue Deltec Homes.

"Here at Deltec, we focus on



building a high performance building envelope: the walls, floors and windows – what separates the outside from the inside, for homes and smaller commercial buildings,” said Deltec President Steve Linton. “For FBRA, we are using the products we already make, but re-imagine them into a larger structure, where we focus on air-tight walls and high-grade insulation to provide the best product possible.”

Based out of Asheville, Deltec is a 47-year-old company that is at the forefront of the green building movement. With their signature round homes and structural integrity that can withstand any hurricane or wind load, the buildings are produced to a much higher standard than what it normally offered for residen-

Ceiling: R43 Spray Foam Insulation
Walls: R19 fiberglass batts in the cavity, plus R7.5 continuous EPS insulation on the outside

Floor: R38, combination spray foam and fiberglass batt system
Insulation: Delkote Machine Finishing

Windows: Marvin Integrity, double-pane with argon gas low-E coating, U-Factor 0.27

Prefab Building Kit: manufactured by Deltec Homes

Foundation: Pre-cast Superior Wall XI, a pre-insulated, panelized system with built-in R12 (Foundation is an unheated parking space)

Plumbing: Bartlett Construction
PVC piping: donated by Silverline Plastics

HVAC installation: Gentry Heating and Cooling

Insulation installation: Delkote Machine Finishing

Architect: Red House Architecture
Engineer: Innovative Structural Engineering

General Contractor: Jack Eller

tial and commercial structures.

And with FBRA – which needed a 10,000-square-foot structure – Deltec found itself putting together the largest product they’d ever come across. Assembling a team of architects, engineers and contractors from previous projects, the “A-team” turned Yeiser’s vision into a reality.

Taking the key green components from a Deltec home – sustainable manufacturing and materials (the factory is solar powered, with 81.2 percent of waste diverted



from the landfill) and an energy efficient shape – the model was stretched and formatted to sit seamlessly on the 12-foot superior concrete walls (the only part of project constructed onsite), which are ideal for the flood plain.

“Even though the school is a commercial building, we’re able to get a better value for the dollar using a more residential style system,” said Robert Todd of Red House Architecture in Asheville. “A 10,000-square-foot school can be considered a 10,000-square-foot home, so it worked well, seeing as when you tend to step up to commercial without utilizing green building techniques, you tend to lose efficiency unless you build to a higher level.”

Todd noted the school is equipped with high R-values, air tight construction, efficient lighting and lighting controls, all of which is blanketed on the outside with rigid insulation and an outer skin of vertical metal siding. Plans are also currently in the works for solar panels.


“With Deltec, you get a locally made product, engineered to be of higher strength compared to other framing options,” Todd said. “It comes in at a price point per square foot that a school can afford, is put together in a green facility, and will have long-term sustainability and energy-saving factors.”

For Yeiser himself, an added bonus is having his students able to experience and interact with how their school is coming to fruition. The pupils were able to tour the Deltec manufacturing floor, and see first-hand how sustainable materials are created and put together.


“To see how the building is made is an unforgettable life lesson about the processes involved, and how waste products are reused,” Yeiser said. “It’s all about, ‘What kind of world are they going to inherit?’”



From left, Robert Todd (Red House Architecture), Steve Linton (president, Deltec Homes), Will Yeiser (director, French Broad River Academy), Jack Eller (general contractor), Leigha Dickens (green building and sustainability manager, Deltec Homes) and Ben Poss (engineer, Innovative Structural Engineering).



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A little goes a long way



The Southern Alliance for Clean Energy in downtown Asheville. Basement encapsulation to reduce moisture in the SACE office. (below) Garret K. Woodward photos

Solar/Green Consulting: Clean Energy for US (formerly Solarize Asheville)
Solar Panels: Sundance Power Systems
Solar Modules: SunPower (E20-327)
Solar Module Efficiency: 20.4%
Solar Module Rating: 327 watts
 Initial Solar Module Production (25 years): 87%
 Initial Solar Module Production (40 years): 70% (+)
Projected Annual Solar Output: 14,941 kilowatt hours (kWh)
 Solar GPS System: AllSun Tracker (24 panels at 25'x25')
Windows: Window World (Energy Star-rated)
Fiberglass insulation (Basement Ceiling): R-19 (after insulation) (Attic): R-10 (before) to R-48 (after)
Temperature (Attic): 124 degrees (before insulation) to 90 degrees (after)

□ BY GARRET K. WOODWARD □
 A local nonprofit organization, which promotes “responsible energy choices that create global climate change solutions and ensure clean, safe and healthy

communities,” the Southern Alliance for Clean Energy has been a pioneer in green energy and initiatives for 30 years, with offices dotting the Southeast.

And at its Asheville office, SACE’s

early 20th century building was in need of not only retrofitting, but also energy efficient renovations that fell in line with the ideals and pursuits of the organization.

When it moved into the Asheville office, SACE brought in Green Opportunities, a local organization that provides green job training and job placement services for low-income individuals. A blower door test, air blaster test and visual inspections were done on every corner of the building, all in an effort to find energy inefficiencies and provide solutions to the structural issues. The basement was found to have 93 percent humidity when it should be 9 percent, as well as 50 percent duct leakage down there and 20 percent in the offices upstairs.

The building soon underwent renovations, which included basement encapsulation, where the walls and floor are sealed up, preventing any moisture from getting into the space. During renovations, SACE also installed Energy Star-rated windows, used low-VOC paint inside the office, mounted programmable thermostats, and insulated the water heater tank. Today, the staff regularly changes air filters and uses natural ventilation by opening windows and turning on ceiling fans instead of solely relying on air conditioning.

The final piece to the upgrading puzzle came with the installation of a dual axis tracking solar system on the property. Installed in April 2014 and commissioned the following month, the 7.8 kW-dc (6.9 kW-ac) system generated an average of 1 MWh of power each month during its first year. Since May 2014, the panels have helped the office save more than 10,400 kg of CO2 emissions.

With more and more people looking into energy efficiency in their own homes and businesses, SACE notes that the average U.S. home has between 30 and 50 percent duct leakage. In these buildings even the smallest of changes, whether it be proper insulation or caulking, can make the biggest of differences in one’s quality of life, personally and professionally.





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What's the deal with SIPs?

□ By GARRET K. WOODWARD □

Just a couple miles from the bustling center of Biltmore Village, high up a quiet wooded hillside, contractor Bob Callahan is hard at work on his latest project, a 2,700-square-foot home.

"We're building a better product than what others may find out there," he smiled.

Standing within the large two-story structure, Callahan (of BuiltSmart by bob) points out every green building detail of the abode, from mini-split HVAC heating/cooling equipment to custom wood work from trees harvested on the property, energy efficient windows to money saving lighting fixtures. But, he's most proud of what supports all of these items, the skeleton of the entire building – structural insulated panels (SIPs).

"Buildings account for 39 percent of the energy used in the country, and with green building we can not only save energy, but also money in the process," he said. "And with SIPs, you can provide a structure that is air tight and contains more insulation for a better, more efficient building."

These SIPs are made up of three layers, an oriented strand board (OSB) outer skin, expanded polystyrene (EPS) core and another panel of OSB. When put together (kind of like an ice cream sandwich), an extremely strong panel is the result, one that requires no additional frame or skeleton for extra



Located near Biltmore Village, this residential home utilizes green materials, with the key to the structure being structural insulated panels (SIPs). Bob Callahan (below). Garret K. Woodward photos

support (contrasted with beams placed high up in stick framed houses).

"EPS is basically like beer cooler foam, but it is made with heat and steam, and contains no chlorofluorocarbons (CFCs). The foam gives you more insulation than is required to meet code, and makes the walls and ceiling as air tight as you can get," Callahan said. "With the two OSB layers that make up the panels, you can eliminate a lot of the wood needed in stick framing. This cuts down on thermal transfer through the framing."

SIP homes are as much as 15 times more airtight than stick framing. Callahan noted that with conventional spray foam insulation, you never are completely able to get every nook and cranny, and you also have extra wood within stick framing that doesn't get insulated, resulting in compromises in the heating, cooling and air quality

itself.

"With stick framing you get all those leaks in a house, and that's where your fresh air tends to come from, through the wood and all sorts of nasty dust, chemicals and glue within the walls," he said. "With SIPs, there is no air leakage, so with a heat or energy recovery ventilator, you can pull fresh, filtered air from the outside. This also means you can use smaller heating and cooling units due to no thermal transmission within the walls."

When putting up a SIPs building, Callahan advises that it is easier when one has enough space on the property to be able to layout the large panels to prep them, and

also allow for a crane to come to lift and sit the walls and roof.

"One of the walls we lifted was 2,000 pounds and the crane 48 feet away," he said. "But, if you can provide that space, you can have the walls and roof up in record time. Three lifts with the crane and we had the main roof done."

And with SIPs being prefabricated in the factory, there is little to no onsite waste headed for a landfill. In terms of design, one is able to expand on spacing more, seeing as with SIPs there is no need for support beams, leaving endless opportunities for wide open, vaulted ceilings. The double layers of OSB, versus having only

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one in stick framed homes, provides a strong structure for wind and snow loads one will experience in the mountains of Western North Carolina.

"You also get rid of mold issues common here in the South, and you increase the longevity of the home itself, from a 100-year house to a 150 to 200-year house – these SIPs aren't going anywhere," Callahan chuckled.

In recent years, the "tiny house" movement has taken the green building industry by storm. People are not only looking for more efficient ways to build and save resources, they're also downsizing their lives in general. But, there still is a majority of society that wants enough space to properly suit their growing families. That said, SIPs provide energy savings within a larger structure, where one could feasibly have a 2,700-square-foot home but still function – monetarily and sustainably – on a smaller scale.

"I looked at smaller homes, at tiny homes, but I also looked at the realities of the market," Callahan said. "A lot of people aren't ready to do a tiny home, but those same people would buy a house that is comfortable, energy efficient and would save them money."

Walls: 8" SIP panels, R30

Roof: 10" SIP panel at R38 + 1" poly-isocyanurate panels at R6 = R44 total

Basement: concrete walls = R25 (R10 continuous from foam sheets and R15 from the fiberglass batt in the framed wall and the under floor foam sheets yielded R15 at the outer 4' wide perimeter and R10 in the middle. The foam for foundation and under slab is Owens Corning XPS (HCFC free) and R5/inch.)

Projected whole house HERS score: 55 or less

Project blower door test: 0.60ACH50 or lower

Projected HVAC costs:

\$40/month

Projected total electric bill: \$85-100/month

Suppliers

Windows: Anderson 100 series from Pro Build (Scott Lewis)

Mini-split HVAC equipment: Samsung (Mikhail Lebed, Quality Comfort)

Designer: Aaron Wilson, Wilson Architects

Cabinet box material: Columbia Forest Products

Cabinetry: Case Green Cabinetry

SIPs: Premier SIPs

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Downsizing your home, upgrading your life

▣ BY GARRET K. WOODWARD ▣

It wasn't the initial idea Josh Scala had in mind.

"This is the smallest certified green built house in North Carolina," he said. "Which was not the original plan, but as the thing started to progress, it just turned out that way."

Standing in his driveway in Black Mountain, Scala scans the one-acre property. There is a clearing to the right for a future green built home, which would sit seamlessly in the quiet, mountain neighborhood. To the left, huddled underneath a grove of trees, is a 440-square-foot structure – home to the Scala family.

"It's my wife, three kids, a cat, dog, and myself," he chuckled. "For

us, we used to live in a 1,300-square-foot home and be at arm's length, but it doesn't feel any different in a smaller house."

Owner/builder of GreenSource Construction Management, Scala specializes in energy efficient building practices. Years earlier, before the kids, he was creating green homes around Western North Carolina. And yet, though he was promoting green building, he wasn't yet practicing it himself.

"The first house my wife and I bought wasn't efficient," he said. "It had metal framing, heat and cold leaking through the walls. And there I was, building green homes and not doing it myself – that bothered me."

Soon, a piece of property was located a couple blocks from Scala. When his house sold faster than

Vaulted ceiling: R25.9
Above grade walls: R18
Exposed floor: R25
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Windows: Window Guy
Insulation: R-Pro
Roofing/Ceiling: Best Buy Metals
Floor heat system: Radiant Floor Company
Heating: Fuel-fired hydronic distribution, natural gas, 95.0 AFUE
Water heating: Instant water heater, natural gas, 0.95 EF, 0.0 gal
Ventilation system: Exhaust only, 91 cfm, 15.0 watts

expected, he found himself with a little more than two months in March 2015 before he had to find another place to inhabit. A fan of the "tiny house" movement, which is green-built home on a very small and efficient scale, Scala put a quick design together on a napkin and jumped on the nearby one-acre property for sale.

"I didn't want to rent when rent can be just as high as a mortgage payment, so let's build a tiny house in the interim," he said.

While clearing some of the new property, Scala was asked if he thought about a tiny house in a small opening under a grove of trees in front of the driveway. He took some stakes and marked the

Located in Black Mountain, this 440-square-foot structure is currently the smallest certified green built home (or “tiny house”) in North Carolina. The home was built in just over two months this past spring by Josh Scala (owner/builder of GreenSource Construction Management), who also lives in it with his family. Garret K. Woodward photos

perimeter of the tiny house, with not one tree selected for removal.

“I built the entire house by myself in about two months, with my wife helping to raise a few walls on her lunch break while studying for her master’s degree,” Scala smiled.

Of the wood used on the tiny house, all of which came from the other side of the property. Milled locally and constructed onsite, the structure has pine siding and a poplar interior, as well as numerous panels used for the deck.

“Every stick of wood, I cut it, shaped it and sanded it, every piece in this house was made with love, and that means a lot to us,” he proudly stated.

With the walls up, Scala wrapped one-inch of rigid foam around the



“Every stick of wood, I cut it, shaped it and sanded it, every piece in this house was made with love, and that means a lot to us.”

— Josh Scala

exterior, ultimately covering what little thermal breaks existed with the outside studs. Inside, there is a bottom floor of a kitchen/living room, two children’s bedrooms, bathroom, closet and master bedroom loft. The ceiling is metal, run-

ning vertical rather than horizontal, thus providing an illusion of a bigger space, and also offering a strong, steep roof against impending snow loads (not to mention that steep pitch of the galvalume roof reflects a lot of heat from the sun).

Instead of using 2-by-12 boards for his rafters, Scala went with 2-by-6s, and added six inches of spray foam insulation in the roof deck.

“With the insulation coming down to six inches, the thermal bridging is now not after every rafter,” he said. “Now, it’s only where the rafter and the blocking meet – cutting down your thermal bridging by about 75 percent or so.”

Due to the shaded tree grove, the tiny house isn’t able to use solar power, at least not just yet. In terms of heat and water, the home is heated with a gas tank-less water heater and radiant floor system. Putting a heat sink below the floor, heated water flows continuously through the system, where warmth now moves from your feet upward, not from your head down like with conventional forced air from ceiling duct.

“If the water is 70 degrees, the floor is 70 degrees,” Scala said. “The pump kicks on and tells the water how to get through the system and up to the needed temperature – hot water leaves the system, with fresh cold waters coming into it, so it’s never stagnant.”

When it came to the HERS score, Scala’s project came in at 52 – an impressive number for such a small home (compared to 100 as the less energy efficient, 80s for meeting building code requirements). Between the structural green energy initiatives, efficient appliances and lighting, the score allowed Scala to receive a \$4,000 Duke Energy rebate for energy efficient building.

“When you’re on a budget, trying to build inexpensively and sustainably, to move in quickly, too, it’s pretty great getting that rebate check from the power company,” Scala said. “Especially if you have a mortgage, all of those green energy savings and rebate programs add up – every month you’re saving.”





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This home was built by Wishbone Tiny Homes of Asheville.

Small and tiny houses

□ By **OLGA RONAY** □

All of a sudden there's lots of small talk. Small and tiny houses are everywhere — on TV, in the movies, in the blogosphere, at conferences. Maybe there's even one near you.

Not that living small is something new. Historically there's a long tradition of people living in small dwellings, including movable ones. Apartments in cities like New York and San Francisco tend to be small — even more so in European and Asian cities. Call it a response to the financial crisis, or to the ever-expanding size of new houses (averaging 983 square feet in 1950; 1,780 square feet in 1978; now 2,662 square feet), but there's something about the idea of smaller houses that has caught the imagination of Americans lately.

How big is small? Most define

small as 400 to 1,000 square feet. Houses under 400 square feet are considered tiny. RVs and tiny houses on wheels may be even smaller; some are less than 100 square feet. For comparison, a 2-car garage is about 440 square feet.

Why build small?

The advocacy group Small House Society cites "... economic conditions, concern about the environment, and a desire for simple more effective living." For some, it's an opportunity to build their own home — and perhaps move it if work, family, or curiosity beckon.

For Laura LaVoie and her husband Matt, it was all of the above. They live in Madison County in a 120 square-foot house they built themselves. "I had been working in a career for 15 years that I was good at but didn't find fulfilling," she says. "At the same time, I had mounting

debt and felt trapped. I needed something to give me confidence to make major changes in my life. The tiny house was just the catalyst. It gave me the opportunity to reduce my expenses, pay off my debt, and quit my job to pursue a new career in freelance writing, something I had always wanted to do."

Who's living small? A poll by Ryan Mitchell of The Tiny Life found that all age groups are well-represented in the tiny house community. Millennials, along with Baby Boomers, make up the majority of Wishbone Tiny Homes' clients. Owner Teal Brown says, "The Millennials are looking for an affordable first home option, while the Boomers are looking to simplify and downsize. Within these groups it's mostly women and couples who are interested."

The movement for smaller hous-

es got a big boost with Sarah Susanka's 1998 book, *The Not So Big House*. "Build better," she counseled, "not bigger." Builder Jeremy Stauffer of Nanostead agrees, noting "Building small allows you to become really creative in small ways. While building something really neat that would go into a large home might be cost prohibitive, those options can be feasible with a very small space."

Inspired by small houses he'd seen in Seattle, Barry Bialik started Compact Cottages Company in Asheville in 2008. While remaining conscious of affordability, he incorporates a number of green features. All are site-built on a foundation, with floor plans ranging from 768 SF to 960 SF—and "growable" he says.

Asheville's Wishbone Tiny **continues on, page 25**

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Small homes as urban infill

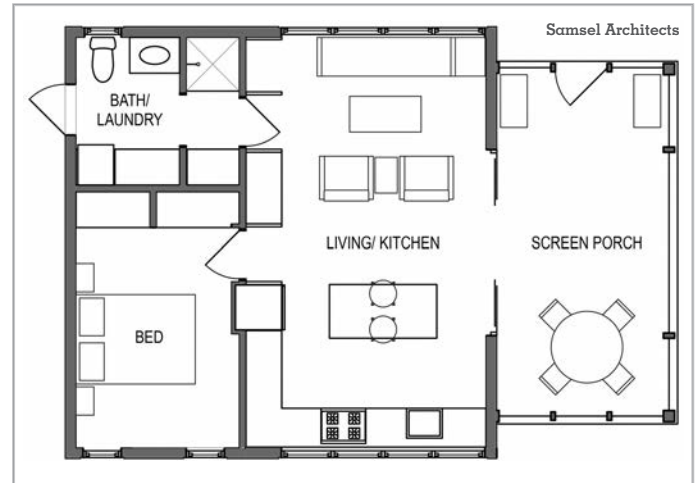
□ BY MARGARET CHANDLER □

As Asheville's population grows, housing in the urban areas becomes more difficult to find. Small homes provide an excellent opportunity to take advantage of smaller infill lots within these urban areas. Where an average-sized new home would completely cover these lots, a home with a smaller footprint can provide a balance between interior square footage and usable outdoor space.

Samsel Architects recently com-

pleted a small home on a sloping tenth-of-an-acre lot, located a block from Haywood Road in downtown West Asheville. The 816-square-foot home includes an ample kitchen that is open to the living/dining room, a bedroom, full bath/laundry and full-height multipurpose loft. The homeowners initially wanted to build even smaller, but the usable square footage needed to be increased so they could secure a home loan.

ous, and a screened porch expands the living area and provides an extra 200 square feet of living space for three seasons of the year. Small homes can have a higher cost per square foot when compared with a typical new home. In a small home, all the functions of an average-sized home are condensed into a much smaller footprint. The economy of scale simply does not work in favor of a small-scale home and as such, the overall cost per square foot can seem high.



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The minimal 24-foot-by-24-foot x 24' footprint allows for enough yard to provide privacy and separation from the road and adjacent homes, as well as a sunny area for a garden. Non-essential interior space is eliminated, and most spaces serve multiple functions. The open loft above the bed and bathroom has tall windows across all three walls, allowing a view of the sky from the living area. Large windows and a light interior color palette help the space feel gener-

T This is offset by the fact that there is far less home to frame, insulate, and finish out, which can often allow for small upgrades — a high-end shower, for example, is more financially feasible if there is only one to be built.

Building smaller homes within the existing urban infrastructure presents many advantages. These types of homes grant more people access to downtown and other walkable community amenities, while also helping to preserve the surrounding landscape by reducing residential construction sprawl. Small homes are not for everyone, but can be an excellent solution for urban living.

Margaret Chandler is a nearly-licensed intern architect with Samsel Architects. She has worked in sustainable design since earning her degrees at Clemson University, and briefly lived in a treehouse off the grid in Austin, Texas. Margaret currently serves on the WNCGBC Board of Directors and the AIA AVL Executive Committee.

continued from page 23

Homes, led by father and son team Gerry and Teal Brown, builds custom houses ranging from 150 to 1,000 square feet, both on trailers and on foundations. Brown says building small and green presents both opportunities and challenges. "We focus on energy efficiency because it is the most impactful over time due to low energy consumption. Indoor air quality is probably the biggest challenge. Small, tight spaces are subject to moisture in the form of condensation."

Many residents of smaller houses find that having less indoor space opens up a bigger world beyond their doors – both literally and figuratively. Small houses are often designed to take advantage of outdoor space, whether decks, or gardens, or surrounding natural areas. And it's not only connections with

which allow for one smaller residential structure (such as garage apartment) to be built next to or within a single-family house. The changes will make ADUs legal on more city lots, while capping size and height to increase compatibility with neighboring houses. As it updates its comprehensive plan over the coming years, Asheville will be considering smaller houses as one way to increase affordable housing, according to planner Vaidila Satvika.

As for the future of small houses, Brown hopes "... to see more legal parking options open up for the tiny homes on wheels. More financing options would also be great. Building standards need to be a part of that discussion." Stauffer agrees about financing options, but also hopes that as smaller houses enter the mainstream "there will be more interaction between small-scale farming and gardening."



LaVoie residence (above). Green Dreams photography

What are the rules?

Four different types of rules may apply to small and tiny houses. Building codes set a minimum size for dwelling units. In North Carolina the minimum is 120 square feet – provided that other code requirements including construction standards, mechanical systems, and energy are met. In addition, many cities and counties have local zoning codes, which may require a larger minimum house size than the building code does, may limit where smaller houses can be built, and in the case of houses on wheels, where and how long they can be parked. Yet another set of standards may come from deed restrictions, which may vary from subdivision to subdivision. Finally, construction standards for RVs and tiny houses on trailers may be regulated under RV standards, which include a maximum width of 8.5 feet for travel on roads. Structures certified as RVs may be located wherever RVs are allowed by local zoning or deed restrictions.

the natural world that are strengthened. LaVoie says, "I have been most satisfied, and surprised, by the way that the tiny house has facilitated my connection to community." Jay Shafer, who jump-started the tiny house movement with a single tiny house on wheels, is now developing a community in California where tiny houses can be part of a larger context. Several tiny-house communities have been started as a way to house formerly homeless people and address challenges of affordable housing.

A member of the Asheville Small Home Advocacy Committee, LaVoie says, "I would like to see small and tiny homes recognized by cities and municipalities as one of many paths toward affordable housing." In a move supported by LaVoie's committee, the city of Asheville recently adopted changes to its Accessory Dwelling Unit (ADU) provisions,

Thinking small? "Try a few out on Airbnb," advises Brown. Then tap into the knowledge of the very active and very helpful community of people who support living smaller.

Jay Shafer, in a documentary produced by faircompanies.com, says, "I want to make it clear that I'm not talking about trying to shove every family of four into 120 square feet. When I talk about small houses, I'm talking about houses where all the space is being used and used well. When you get rid of all the stuff you aren't using or don't need, it's easier to see where your happiness lies." Good advice for a house of any size!

Olga Ronay is a city planner and co-founder of High Cove, a North Carolina mountain community with a focus on the arts, environmental stewardship, and lifelong learning. High Cove welcomes tiny, green-built, well-crafted houses—along with their small and medium-size brethren.



Wishbone Tiny Homes.



Making a healthier home

□ BY RICK BAYLESS □

Many homeowners have adverse healthiness symptoms: odors, congestion, coughing, fever, shortness of breath, fatigue, headache, fogginess of thought. Some occupants have confirmed healthiness challenges like allergies, asthma, mold sensitivity, multiple chemical sensitivity, emphysema, chronic fatigue syndrome, fibromyalgia, multiple sclerosis, may be on a cancer-fighting regimen, or have an otherwise stressed immune system.

Examination of a home often identifies pollutants that are working against the healthiness of those who live in even the greenest home. What pollutants? Human dander, pet dander, dust mites, sprays, fragrances, cooking odors, bathroom odors, material and product chemical off-gassing (VOC), bacterial and fun-

■ Mold – Understand the ecologies of mold, virus, and bacteria. Make the house less friendly to microbes.

■ Dust – Improve air filtering especially of respirable dusts. Simplify bulk dust clean-up needs.

■ Air cleaning – Allow for air cleaning abilities (not the same as air filtering).

■ Pests – Understand insect, mouse, and other intruder behaviors. Make the house unfriendly to them.

■ Use – Anticipate occupant use patterns of the house and its systems. Occupants have to understand and do their part too.

■ Maintenance – Simplify and arrange for maintenance needs of the house and its systems. Occupants and service groups have to understand and do their part too.

All contractors have a part to play in

this: plumbers, electricians, framers, material suppliers, finish contractors, site-prep contractors, landscapers, clean-up specialists. Yet the most critical guides are the architect, HVAC contractor, and the environmental health specialist. It is this team that green builders can rely on to keep the “healthy” in green home construction.

PS: “Fresh air ventilation” is a misnomer. I am careful to call it “outdoor air ventila-

tion”. Outdoor air is “fresh” only on limited weather moments within the season. Unhealthiness from outdoor air includes: too hot, too cold, too humid, too dry, pollen, mold, dusts from farms and gravel roads, pollutants from highways, worksites, industrial plants, smaller places of businesses, and burn piles.

Rick Bayless is the founder of EnviroVention™ and A Healthier Home™. Bayless provides healthiness-oriented examinations of the home and work-place to identify sources of irritants, allergens, pollutants, and other environmental stress factors, supplying health care professionals with information about their client's indoor environments, and guiding occupants through corrective measures. He is also an instructor at Blue Ridge Community College, has inspected more than 7,000 properties and has 35 years of experience in the profession. Contact him at 828.243.5192, email him at baylessnc@att.net, or visit www.envirovention.coe or rickbaylesshealthyhome.com.



Samsel Architects photo

gal off-gassing (MVOC), pest deposits, micro fibers, construction dust, wood smoke, candle soot. Green Homes are not immune from this accumulation of pollutants and irritants.

The next phase in the evolution of green home construction is to design specifically for healthiness of conditions inside the home. Opportunities for improvements are in the following areas:

■ Healthiness – Understand the environmental conditions that those with healthiness challenges need more control over.

■ Airflow – Be aware of air movement into, out of, and within the house.

■ Ventilation – Improve “Fresh” air ventilation methods. Reduce raw air dump to inside. Circulate it better.

■ Humidity – Improve humidity-lowering: Remove dampness, add warmth, “soften” hot-cold interfaces.

Mold control “how-to”

Wetness and dampness are primary drivers of mold activity. In the southeast mountain region, outdoor rainfall and humidity are high. Opening windows and outdoor air ventilating can cause the building interior and all of your possessions to be as damp. This is what allows mold to be active and more thoroughly colonize your indoor living space. Mold can ruin your health, your stuff, the value of your home, and your peace of mind. The following measures are helpful in reducing mold activity inside your home:

- Inspection – Inspection will identify mold conditions in your home. Mold testing is not the place to start.
- Rainwater – Monitor roof, gutters, downspouts, rain barrels, drains, surface grade, and groundwater.
- Plumbing leaks – Water supply lines, sinks, tubs, toilets, drains, septic lines, irrigation, fire sprinklers.
- Water devices – Dishwashers, icemakers, dehumidifiers, humidifiers, fish tanks, AC cooling coils, pools.
- Wetness target – 20 percent moisture content of wood, drywall, flooring, and other building components.
- Dampness target – 52 percent air humidity air in rooms, closets, basement, crawl space, storage rooms, garage.
- Air – Manage the air circulation, temperature, cleanliness, and dampness.
- Dust – Clean up accumulations of dust. Molds are in dust. Molds can feed on the organics in dust.
- HVAC – Maintain your HVAC system. It is central to mold control. Sometimes it is the mold source.
- Duct system – Inspect, secure, seal, insulate, and possibly clean this respiratory system of your house.
- Items – Molds are “item-specific.” They prefer certain materials over others as a food source. Manage items and materials that mold favors. Discard items heavily colonized by mold (old suitcase, old shoes, old papers). How and where you store these items can make all the difference (warm spot, cold spot, in a sealed container).
- Layers – Avoid layers that trap dusts and moisture (ex: drywall, plus wallpaper, plus paneling on a wall).
- Simplify – Smoother surfaces with less detail and trim reduce mold-harboring dust build up.
- Clutter – Reduced clutter limits mold-harboring dust levels, simplifies clean-up, improves air circulation.
- Preventives – Certain paints, oils, and finishes discourage mold. Certain air cleaners reduce mold growth.

You can see that there many work projects that have an impact on mold. No doubt there are many questions that this list leaves you grappling with: Where do you start? Which projects are most needed at your place at this time? Which items can you afford to do? Which ones can you do yourself? Where do you learn how to do some of these projects? Which ones will you need help with? Who is best suited to getting this or that project done? What should it cost? What are the consequences of not doing some of these at this time?

The first item on the list is the place to start. If done well by a guide with well-rounded experience, a good mold inspection will be the basis on which you define your house's mold control work list.

A mold test can be sometimes helpful and sometimes useless. It may lead you to a misleading conclusion and on to unnecessary expenses. It will totally miss the presence of some other indoor pollutant such as flue gas, formaldehyde, sewage gas, carbon monoxide, and many others. You may be putting efforts toward the wrong issue. It is a mold inspection that confirms where mold is, how heavy is it, what trouble is it causing, how to clean it up, what allowed it to be active, what corrective measures are needed, how to stay out of mold trouble in the future.

– By Rick Bayless



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Structural insulated panels (SIPs) on a Superior Wall foundation for a passive solar home. VandeMusser Design photo

The right wall system

A comparison of five common wall 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 2-by-4 or stick framing. Stick framing 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 (see the next page for a checklist on Advanced Framing). Platform framing is the most

common form of house construction in the U.S., 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 (SIPs) are the most popular form of construction after stick framing. They are composed of foam insulation sandwiched between a "skin" of oriented strand board (OSB). 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 (EPS). 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 engi-

continues on, page 30

Advanced framing

□ BY MARCUS RENNER □

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. 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.

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 to.

■ **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 dry-wall 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.

■ **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. 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 inline framing, the double top plate can be eliminated and a single top plate will suffice. Metal plate or wood splice connections can be made at partition wall intersections and top plate



Ladder T wall's use scrap wood as a nailer for drywall and increase the amount of insulation at every interior-exterior wall intersection.

Jim Forward, Forward Construction photo

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. 1 type 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.

continued from page 28

neered walls is Insulated concrete form (ICF) 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 fifty 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 50 manufacturers 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 two to three inches thick and 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). This product 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 eight to twelve inches thick are used for the walls. AAC provides both structure and insulation; one 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, however; your location and the configuration of the blocks may affect the wall's performance.

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

insulation, a tighter building envelope, and a stronger wall than a minimum building code stick-framed building of the past. By uti-



SIP panel installation.
Vandermusser Design photo

be taken to understand how all these systems interact. Framed walls that are sealed well and 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

lizing these products and methods, we can save money and the environment while being comfortable.

After 20 years in the green building industry Marcus Renner became co-owner of Conservation Pros, Inc. a local building performance contractor. Conservation Pros conducts energy audits and performs the work to make buildings more efficient, comfortable, healthy and durable. He can be reached at marcus@conservationpros.com or 828.713.3346. www.conservationpros.com.



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Hempcrete

An innovative wall system

□ BY TIM CALLAHAN □

Marcus has done a wonderful job of outlining some of the more common wall systems and the pros and cons of each.

Another type of wall system that is gaining acceptance and popularity is hempcrete. This is an insulative, monolithic system that is made up of a combination of industrial hemp mixed with a lime binder. Hempcrete has been used extensively in Europe for over 25 years in commercial residential and affordable housing projects. Hempcretes entry into the U.S. market was in 2009, right here in Asheville, NC.

In the US, hempcrete currently costs more than common walls

tural insulated panels (SIPS). Due to the unique hygroscopic characteristics of the lime admixture, this wall system is able to mitigate and prevent vapor condensation inside of the wall and inhibit the growth of mold, making it particularly attractive to individuals with chemical and mold sensitivities; this is a distinct advantage, particularly in local humid sub-tropical climates. Typical hemp walls have an R-value of 26; the thermal performance of the wall is adjusted to project-specific requirements by adjusting the thickness of the wall.

Hempcrete is usually finished on the exterior with a lime stucco, though other finish materials may also be used. The interior may be either lime-stucco, or clay plaster -



Hempcrete installation. Alembic Studio, LLC photo

types since industrial hemp is not federally approved for cultivation in all states. Based on support for currently pending House Bills in North Carolina, we anticipate local production of industrial hemp within the next two years. Local production holds the promise of reducing material transportation costs and stimulating the regional economy.

Hempcrete may be cast-in-place around a typical stud-frame structure or implemented as a panelized system, in a manner similar to struc-

ture. These finishes provide protection from the weather and maintain the vapor permeability of the system... one of its unique advantages! Hempcrete is a suitable material for a broad range of architectural expressions, but tends to naturally lend itself to a timeless, old-world aesthetic.

Tim Callahan is a partner at Alembic Studio, LLC; the leading hempcrete design specialist in the United States, and founder of Hempsteads.info; a hemp construction knowledge base lab.



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The Villages at Crest Mountain, a solar community in Asheville. Phelps Clarke photo

The economics of solar

Demystifying the hype

□ BY PHELPS CLARKE
& DOUGLAS AGER □

There are a lot of misconceptions about solar energy systems – they need expensive batteries, have high maintenance costs, produce insignificant amounts of power, decrease the value of real estate – and the list goes on.

Like any industry, solar's development has been a messy process, which has helped foster these negative perceptions. We often feel like we're living in the Wild West stage of the industry, but the reality is solar has moved into the mainstream and is getting close to the tipping point of exponential growth.

Background

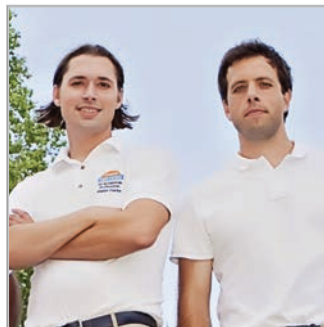
Solar electric systems convert sunlight to electricity using photovoltaic panels. Early on, photovoltaics were very expensive and didn't produce much power per panel. They also required batteries

for storage, which further increased the price of the systems. The technology has undergone significant changes since that time – not only in the panels themselves but also in how they integrate with the grid. Important factors in the recent proliferation of solar installations have been net-metering policies which eliminate the need for expensive batteries and a steep drop in the price of components due to technological advances and scaled production.

Politics

The market for solar has traditionally been heavily reliant on political incentives at both the federal and state levels, although this is becoming less and less of a factor as the pricing becomes more competitive with fossil fuels and nuclear. The current 35 percent North Carolina tax credits are set to expire at the end of 2015 and the 30 percent federal tax credits are set to expire at the end of 2016.

Another important political factor is the issue of third-party sales. Currently, in North Carolina, only the public utility can sell power to the end user (the customer). However, in many states (like California) com-



Phelps Clarke and Douglas Ager.
Bren Photography

panies other than public utilities can sell power. This enables businesses to rent your roof, install a solar system, and then sell that power back to you. This model has accelerated the number of rooftop

solar installations because it removes the significant up-front costs for the consumer. At the time of printing, a bill is currently being debated in the N.C. Legislature about making third-party sales legal in this state.

Grid interconnection policies also play a critical role in the solar market. Currently, only the large utilities are required by law to net meter. In Western North Carolina, you can net meter on Duke Energy Progress's grid but not on French Broad EMC, Haywood EMC, or Rutherford EMC.

Big Picture

Is there really a viable alternative to fossil fuels? Can we generate enough power through renewable sources to supply the growing appetite for energy around the world?

The short answer is yes. But the long answer gets more complicated. The real challenge with energy created through photovoltaics is storage. The large majority

of systems use the grid as a battery by pushing power onto the grid when it produces more than is consumed and taking power back from the grid when it produces less than it consumes.

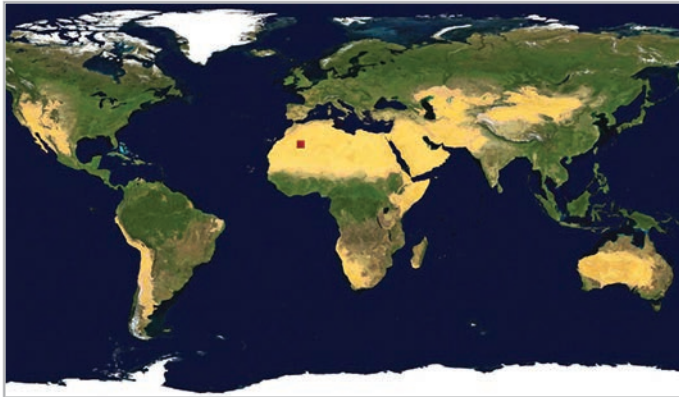
The underlying challenge with this model is that it relies on power plants to maintain grid parity during times when the sun isn't shining. If it's cloudy for a few days, the power company is going to have to have the same number of power plants so that it can supply all the energy needs. One big advantage of natural gas fired power plants (in contrast to coal) is that they are better able to increase or decrease capacity quickly depending on the conditions.

Tesla's recent introduction of a home and business battery pack raises the possibility of storing solar energy at its source (in the home or business where the panels are located) or at a remote location that can help moderate the natural cycles of solar energy production.

Net Zero Homes

As solar systems become less expensive and need less space, the "dream" of a home that can produce as much power as it consumes becomes not only possible but also affordable. Recent advances in inverter technology means partial shading of the array (often a problem in the mountains) does not as significantly decrease the efficiency, and as the price of panels continues to drop, putting panels on east and west-facing roofs begins to make financial sense. And why stop there, why not start building homes that can also produce enough power to charge an electric car or two!

Phelps Clarke and Douglas Ager are cousins and co-owners of a renewable energy company based out of Fairview, NC. Founded in 2010, Sugar Hollow Solar designs and installs solar electric, solar hot water, and radiant floor heating systems for homes and businesses around Asheville. sugarhollowsolar.com.



One percent of the surface area of the world's deserts would be enough to meet our current electricity needs. theecologist.org

Solar Q&A

What is the return on investment for a grid-tied solar electric system?

We tell people it's approximately 10 to 14 years for residences and 4 to 8 years for businesses. The reason it is so much shorter for businesses is that they can take advantage of an accelerated depreciation schedule available for solar which basically means they can write off the entire amount of the cost in the first five years. The majority of photovoltaic panels are warranted to last for 25 years although the inverters may have to be replaced sooner. Even so, when it is time replace the components; the infrastructure is already in place so the labor will be less.

What about replacing shingle roofs under a solar array?

All the systems we install use flashed feet, which increases shingle life and decreases the cost of temporarily removing the panels if the roof needs to get replaced. Additionally, you can now buy shingles with a lifetime warranty and modern metal roofs have extended life spans.

Does it increase the value of real estate?

This has always been a difficult question to answer because there are so many factors. Location clearly plays an important role as well as what type of buyer might be interested in the property. A recent study done through the U.S. Department of

Energy found that in California, solar powered homes on average garner \$17,000 more than comparable homes without solar (<http://emp.lbl.gov/sites/all/files/lbnl-4476e.pdf>), so you could argue that Asheville's real estate market has some similarities to California.

How much do these systems cost?

We generally tell people that we can install a roof-mounted system on their house that will take approximately \$50 a month off their power bill for a net cost of \$7200 (after the 30% federal and 35% state tax credit). For a similar system that will take \$100 a month off their power bill, the after tax credit cost would be \$12,000.

How do the tax credits work?

Unlike tax exemptions, tax credits directly remove tax liability from what you owe, and you have five years after the installation to use them. For example, the federal tax liability for a married couple in NC making \$60,000 a year filing jointly would be close to \$10,800, and their state tax liability would be say \$9,000. So, for a system that will eliminate roughly \$100 from their power bill, they will only owe \$1,793.75 in federal tax and \$4,500 in state tax in the first year (in North Carolina, you can only take half of your tax liability each year), and they can take an additional \$4,500 off their state tax in the second year and then \$1,800 in the third year.

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Echo Hills Cottages

Building an intentional, green neighborhood from the inside out

□ BY RON CZECHOLINSKI □

Echo Hills Cottages is an intentional neighborhood in West Asheville that will consist of 11 homes, each with a small footprint starting at 800 square feet. The homes are being certified to the Gold Level of Green Built NC and will be DOE Zero Energy Ready Home Labeled. The site plan and landscape are being designed with permaculture principles. There will also be a variety of common spaces incorporated, including a community garden and a house with common space for gathering and guest accommodations.

This neighborhood has been years in the making, driven by a desire to participate in building a sustainable and intentional culture. That desire took hold in the counter-culture movement in the late 1960s and 70s when I began building with an emphasis on creative passive solar design.

My wife Laurie and I also have rarely lived alone, living in some form of community and/or opening our home to others. We moved to Asheville to further our dream of sustainable development and community formation. Upon purchasing the in-fill lots of adjoining 2-acre and 1-acre parcels in a beautiful neighborhood developed in the 1960s, we knew we had a very special canvas to design an intentional neighborhood from the in-



Echo Hills spec home.

side out. Influenced by various community movements, we wanted to focus on a holistic perspective on sustainable development and a clear intention on collaborative relationships.

Collaborative relationships

True sustainability requires attention to the symbiotic relationship of environmental, economic, and social aspects. From my per-

spective, it is the social component of collaborative relationships that is the most crucial. In the communities of the 1960s and 1970s, an effort was made to move in this direction but they mostly failed due to a variety of dysfunctional tendencies.

The "cohousing" movement started in Denmark and was brought to the U.S. in the late 1980s, sparking new life into the community movement. In the 1990s, Ross Chapin and The Cot-

Holistic Principles for Sustainable Development

- Small house footprint
- High performance construction
- Relative affordability
- Permaculture landscape design
- Non-toxic environment

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tage Company initiated a developer-driven approach to creating communities in “pocket neighborhoods” on infill lots in the Seattle area. With more maturity and stability, cohousing and pocket neighborhoods continue to gain momentum as they bring intentional community into the mainstream and influence sustainable development in a variety of ways.

Seeing some of the relational difficulties in all forms of community development and maintenance, our approach at Echo Hills is to begin with a focus on the relational aspects of “intentional neighbors.” We didn’t just want a walkable neighborhood, we wanted a talkable one!

We started by incorporating the “Blueprint of We,” which is a collaboration document to align people’s needs and expectations and is used as an invitation to intentional co-creation. The Blueprint of We allows each person to contribute to the “story” we create together. It fosters personal transparency in relationships, the alignment of values and expectations, the transformation of conflict, and the terms of relational agreement.

Prior to someone deciding to buy into Echo Hills, we have an extensive interview process to ensure they understand the structure of the HOA agreements and the environmental and relational intent of the neighborhood. The HOA is designed with two foundational committees:

- The architectural committee to address environmental issues.
- The cultural committee to address relational issues.

In addition to the general guidelines, we go one step further to incorporate the “10 Constants of a Wisdom Circle” for community building, guidelines that instill transparency, participation, a sense of safety, and care between everyone.



Echo Hills community residents (above). A kitchen inside an Echo Hills spec home (right).



We also incorporate tools such as mindfulness exercises and compassionate communication to build a foundation grounded in awareness and empathy.

The core group meets regularly to practice Qi Gong, have a potluck meal, and gather in our Wisdom Circle to get to know each other on a deeper level. We imagine that the Cultural Committee will emerge from this gathering to meet and decide what adjustments or changes need to be made as we grow together.

Echo Hills will also utilize the principles of Sociocracy, a method of organizing that values equality and the rights of people to determine the conditions under which to live and work. It is based on the principle of “consent,” facilitating an overlapping range of tolerance for decision-making. Unlike the win/lose framework of voting or the subjectivity that consensus often gets stuck in, Sociocracy allows everyone to share what works for them, and then works toward a win/win solution within that framework.

Sustainable Development

Moving on to the environmental and economic aspects of sustainability, our focus is on small house design, high performance construction, and creative site planning.

We started with the intentional decision not to compromise quality or aesthetics in our home. Affordability was also very important, so we chose to reduce the house footprint rather than quality to meet both objectives.

Our cottages start at 800 square feet and are capped at 1,500 square feet. High performance energy efficiency is optimized while regionally sourced, low-maintenance and non-toxic materials are incorporated whenever possible. We are also turning the oak from the trees we had to cut to clear building sites into beautiful floors.

Although other options are available, our standard specifications include Insulated Concrete Form (ICF) and Structural Insulated Panel (SIP) construction, mini-split heat

pump, energy recover ventilation, tankless water heater, and low E vinyl windows for optimum energy efficiency and to keep operating costs low.

The landscape design is based on permaculture principles and includes water retention throughout the property, native, drought resistant and edible plants, segregated parking area, permeable walkway surfaces, common park and garden areas, and organic and natural care.

Ron Czecholinski began building green in the 1970s with a dream to build his own house and an interest in renewable energy, creative design, and life outside the box. Midlife, Ron returned to school and shifted his primary focus of building to spirituality, relationships, and community building. He returned to building about 10 years ago with a desire to repack his interests and experience. Today, Ron lives with his wife Laurie in Asheville. Together, they are immersed in creating healthy homes, nurturing conscious relationships, and building community at Echo Hills and beyond. To

learn more, visit www.habitatreimagined.com.



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-Gail Craine

buchananconstruction.com

Building or buying green

An introduction to green building certification in Western North Carolina

□ BY MAGGIE LESLIE □

Green buildings use less energy, water, and materials than code-built homes. According to the EPA, the way we build and live in our buildings is responsible for 39 percent of total energy use, 68 percent of total electricity consumption, 30 percent of landfill waste and 12 percent of total water consumption nationally.

However, green buildings are not only better for the environment; the truth is that homes built using green building methods are simply better buildings. The growth of the green building industry can be attributed to the fact that by building green, everyone wins – the environment, the economy, the homeowner and the builder. Homeowners get a healthier, more comfortable home with lower utility bills and less maintenance requirements without having to compromise aesthetics or function. Studies show that green homes are worth more when sold and they hold their value extremely well over time.

According to Mary Love, a local Realtor and Director of Asheville Keller Williams Green Division, “In today’s market more buyers want certified ‘Green’ homes. They are looking for energy efficiency that will help offset house payments. They also are much more aware of indoor air quality and carbon footprints. Buyers appreciate houses that are certified because it removes the fear of ‘green washing.’ Sellers are discovering the value of green improvements and look to certified ECO or GREEN Realtors to help them make wise improvements that will attract more buyers.”

Building or renovating green is one of the best investments you can make. So how do you get started? Luckily, Western North Carolina has vast resources available when buying a new green certified home or renovating your existing home to be more environmentally friendly.

When buying new, look for a third party certified green home. In the absence of a universally approved definition of green, certifi-

cation programs have emerged to prevent green-washing and to provide a marketing edge for builders who are willing to make human health and environmental sustainability top priorities. In WNC, there are four main certification programs for green building: ENERGY STAR Homes, Green Built NC, Leadership in Energy and Environmental Design (LEED) for homes and the National Green Building Certification Program.

“Buyers appreciate houses that are certified because it removes the fear of ‘green washing.’ Sellers are discovering the value of green improvements and look to certified ECO or GREEN Realtors to help them make wise improvements that will attract more buyers.”

— Mary Love, Love the Green
Keller Williams

ENERGY STAR homes focus just on energy efficiency while Green Built NC, LEED for Homes and National Green Building Certification Program also address water use, healthy indoor air quality, site impacts and resource conservation. Each program is third party inspected for quality assurance and designed to be a road map to help consumers and builders make ed-



Diagnostic airflow testing being performed at a final Green Built NC inspection for quality assurance. Home Energy Partners photo

ucated decisions while weighing the cost benefit of different green upgrades.

Green homes cost on average from 0 to 10 percent more depending on how green you go. Most often this increased mortgage cost is more than offset by the monthly utility savings. Add the reduced maintenance, healthy indoor air and comfort on top of that and it's a no-brainer.

According to Sean Sullivan of Living Stone Construction Inc., a local builder of Green Built NC and ENERGY STAR Homes and current president of North Carolina Home Builders Association, “There are many reasons why building ‘green’ is attractive to me: energy efficiency, using local suppliers and tradesmen, designing and building for passive solar, and water retention/collection among some of them. However, the most popular reason my clients choose to build ‘healthy’ is that the clean indoor

air quality is best for people moving here with allergies. The fresh air exchanges, media air filters and low VOC products are a ‘no brainer’ for anyone who struggles with seasonal allergies!”

If you are planning to build your dream home, the first place to start is with the site and design. Choosing a site that can take advantage of the sun’s free energy to heat the home can provide comfort and savings for the life of the home. Designing in green features from the early stages makes the process as seamless and affordable as possible.

Choosing a builder is probably the most critical step, though. An experienced general contractor with a passion for green building is easy to find in Western North Carolina, so don’t settle for less. But if you find a contractor that doesn’t know much about green

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Program Descriptions

ENERGY STAR is a household name for appliances, but what is an ENERGY STAR Home? Like the appliances, the standards are created by the National Environmental Protection Agency and inspected by a third party. But ENERGY STAR Homes include more than just efficient appliances.

Every ENERGY STAR Home is built to be at least 15 percent more energy efficient than the same home built to code.

This standard is reached through a combination of well-installed and efficient insulation, heating and cooling equipment, lighting, water heaters, and windows. Each home is computer modeled to determine its energy usage and then inspected by a nationally trained Home Energy Rater to make sure the home will perform as intended. ENERGY STAR

homes are more comfortable, durable, and energy efficient.

Green Built NC was created through collaboration between the N.C. State Energy Office, the N.C. Solar Center and building professionals throughout the state. This

program is administered locally by the WNC Green Building Council. Every Green Built NC Home is also required to be energy efficient, but the program goes above and beyond energy. Green Built NC Homes start with a menu of items which is divided into seven

sections: site (erosion control to native plants); water (low flow fixtures to rain gardens); building envelope (insulation and framing); comfort systems (heat pumps to geothermal systems); appliances, lighting and renewables (CFLS to solar hot water systems), indoor air quality (moisture resistance to non toxic paints) and materials (recycling to bamboo). Each home must attain a certain number of points in each of the sections to qualify for the certification. This way, builders are required to approach and improve all aspects of environmental friendly construction. These



homes are then inspected to make sure each of the items is actually achieved. Certified Homes span price range and style options from alternative to conventional, high end to affordable. LEED, Leadership in Energy and Environmental Design, is a green building rating system created by the U.S. Green Building Council. The LEED Rating System is a nationally recognized standard for green building but has primarily focused on commercial construction (categorized into New, Existing, and Interiors) until recently. LEED for Homes is a voluntary rating system, similar to Green Built NC. Like Green Built NC, energy efficiency is a pre-requisite and third party inspections are required.



Living Building Challenge certifies buildings that are net positive energy (meaning

they produce more than they use), net positive water, have locally sourced materials and zero red list chemicals. Hoping to inspire builders and designers to think beyond "less bad" buildings, the Living Building Challenge offers ideas and a path forward to truly sustainable living.

Home Energy Score with Green Gauge. The Home Energy Score, a program of the DOE is similar to a vehicle's miles-per-gallon rating. It helps homeowners and homebuyers understand how much energy a home is expected to use and provides suggestions for improving its energy efficiency. It also allows homeowners to compare the energy performance of their homes to other homes nationwide. The Home Energy Score includes: 1) the score itself, 2) facts about the home including data collected and energy use breakdown, and 3) recommendations to improve the score and the energy efficiency of the home. The process starts with a Home Energy Score Assessor collecting energy information during a brief home walk-through. Using the Home Energy Scoring Tool, developed by Lawrence Berkeley National Laboratory, the assessor scores the home on a scale of 1 to 10. A score of 10 indicates that the home has excellent energy performance. A score of 1 indicates the home needs extensive energy improvements. Coupled with Green Gauge, WNCGBC's new program for existing homes, the program also offers information about other green features including water efficiency, site, air quality and materials.



you answer these questions, at a low cost, before you buy to find out just how the home compares. According to Mary Love, "programs like Green Gauge help buyers and sellers determine important green features in existing homes, therefore making the selection process easier for the buyer while providing the seller a quicker sell."

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building, the WNC Green Building Council and the various certification programs can help provide the education and guidance necessary to provide you and your contractor with the tools necessary to green your dream home. An integrated team that meets regularly and works together is critical. If your framer and your HVAC contractor aren't working together, for instance, it can make it difficult to design the HVAC system to perform optimally, costing you more money in the long run.

If looking to buy a relatively new home, buyers can find certified green homes in affordable to high-end price ranges, in a variety of sizes, touting green features including everything from solar panels and reclaimed lumber to simple well-constructed, craftsman cottages that someone would be hard pressed to distinguish on the surface from a code-built, non-certified green home. When it comes to green homes, the devil is in the details. While there are many technologies and materials that are

constantly improving how our homes perform, the details and craftsmanship are the most important aspect to ensuring homes are comfortable, efficient and healthy. Details such as proper site drainage and air sealing don't cost more and you can't see them, but they do ensure that the home will save energy and last for years to come. What is greener than that?

When looking at a prospective home, it is impossible to tell that the builder was so conscientious during construction that he or she didn't even fill a single dumpster during the process by wasting little and recycling where possible. However, if the home is certified by Green Built NC or LEED-Homes, the Realtor or seller should be able to provide a buyer with a checklist of the green features of the home providing further guidance about what sets this home apart from the rest.

But what about an existing home? It is easy to do it right if you are starting from scratch, but isn't renovating an existing home the ultimate form of recycling? Yes! But where do you start? If you are

on the market for a home, the first step is to find an ECO or NAR GREEN certified real estate professional, someone who knows what questions to ask and what resources are available for evaluating just how much you would need to do to make an existing home "greener."

Consider getting a Home Energy Score with a Green Gauge Assessment before (or soon after) you buy. This process cost about the same as a home inspection, but you will receive valuable information that isn't included in a typical home inspection. How much will it cost to heat and cool the home? Is there any insulation? How old is the furnace? How can you improve the air quality? Is this a green home? These factors are very important when assessing the true cost of ownership.

If you find the perfect home that is within your budget, but it costs \$200 a month in electricity vs. \$50 a month for the home next door, that needs to be factored into your decision. Home Energy Score with Green Gauge is a locally available program that can help

you answer these questions, at a low cost, before you buy to find out just how the home compares. According to Mary Love, "programs like Green Gauge help buyers and sellers determine important green features in existing homes, therefore making the selection process easier for the buyer while providing the seller a quicker sell."

If you know a home needs work, and most do, the next step is your choice: you can hire a home performance contractor to do the work for you or you can do it yourself (if you are handy many of the most basic improvements are very simple and low-cost). Duke Energy Progress also offers incentives/rebates for making some energy retrofits if using an approved contractor. The WNC Green Building Council, a local educational non-profit organization also offers a free email or phone hotline to answer your burning green building questions and can help you get started.

Maggie Leslie is Director for the WNC Green Building Council. She can be reached at 828.254.1995 or Maggie@wncgbc.org, or visit our website for more information at www.wncgbc.org.



Advanced framing and blocking at Prospect Terrace, built by Mountain Housing Opportunities, the pilot project for NC Healthy Built Homes (now Green Built NC).

Green Built NC and ENERGY STAR receive an update

□ BY AMY MUSSER □

HVAC checklist splits into two – design checklist and the commissioning checklist

The design checklist will still be collected and reviewed, however the commissioning checklist, while still required, will be optional to collect. This should expedite certification because documenting this checklist often holds up certification. HVAC companies still have to pay to participate via an H-QUITO provider except for ductless HVAC or mini-splits.

Additional Changes to HVAC Requirements include oversizing limits expanded for multistage AC, testing and balancing is no longer required and expanded options for total duct leakage and rough-in duct testing (can't use with NC HERO though.)

Minor changes to builder requirements

Advanced framing (insulated corners, headers, t-walls, framing at windows/doors limited to 1 king/1 jack (or code) is still required unless exterior or insulated sheathing except a structural framing document can be used where solid framing structurally required. The HERS rater will have to collect this document. "Drill and fill" is now allowed. The Water Management Checklist is still required but the rater does not have to collect it.

Green Built Version 2 – Announcing a Net Zero and Net Zero Ready Certification!

Green Built has gotten leaner and greener. Many items that our now standard construction practices have been removed, while opportunities to gain points for many new technologies have been added. The sections have been overhauled to be more streamlined and organized so it is easier to fill out. Major changes include:

New Prerequisites:

- Energy Efficiency- now only two pathways: ENERGY STAR or NC HERO
- Duct Testing- to Align better with ENERGY STAR: Test all air distribution systems to have no more than 4% leakage to the outside and no more than 8% total leakage
- Radon- For homes in Radon Zone 1, follow the EPA's guidelines for radon resistant construction and perform a passive test OR have an active radon test done by a Certified Radon Measurement Professional.
- Erosion Control Plan required
- No "Rank 1" Invasive Plants

Net Zero Certified Homes

- Net Zero = Green Built NC with a HERS of 15 or lower
Or
Net Zero Ready= HERS 55 or lower
- South roof area suitable for future photovoltaic collectors facing within 45° East or West of solar South and free of shade
- A minimum of 110 sq.ft. of roof area per 2000 sq.ft. of conditioned area
- Chase and conduit installed

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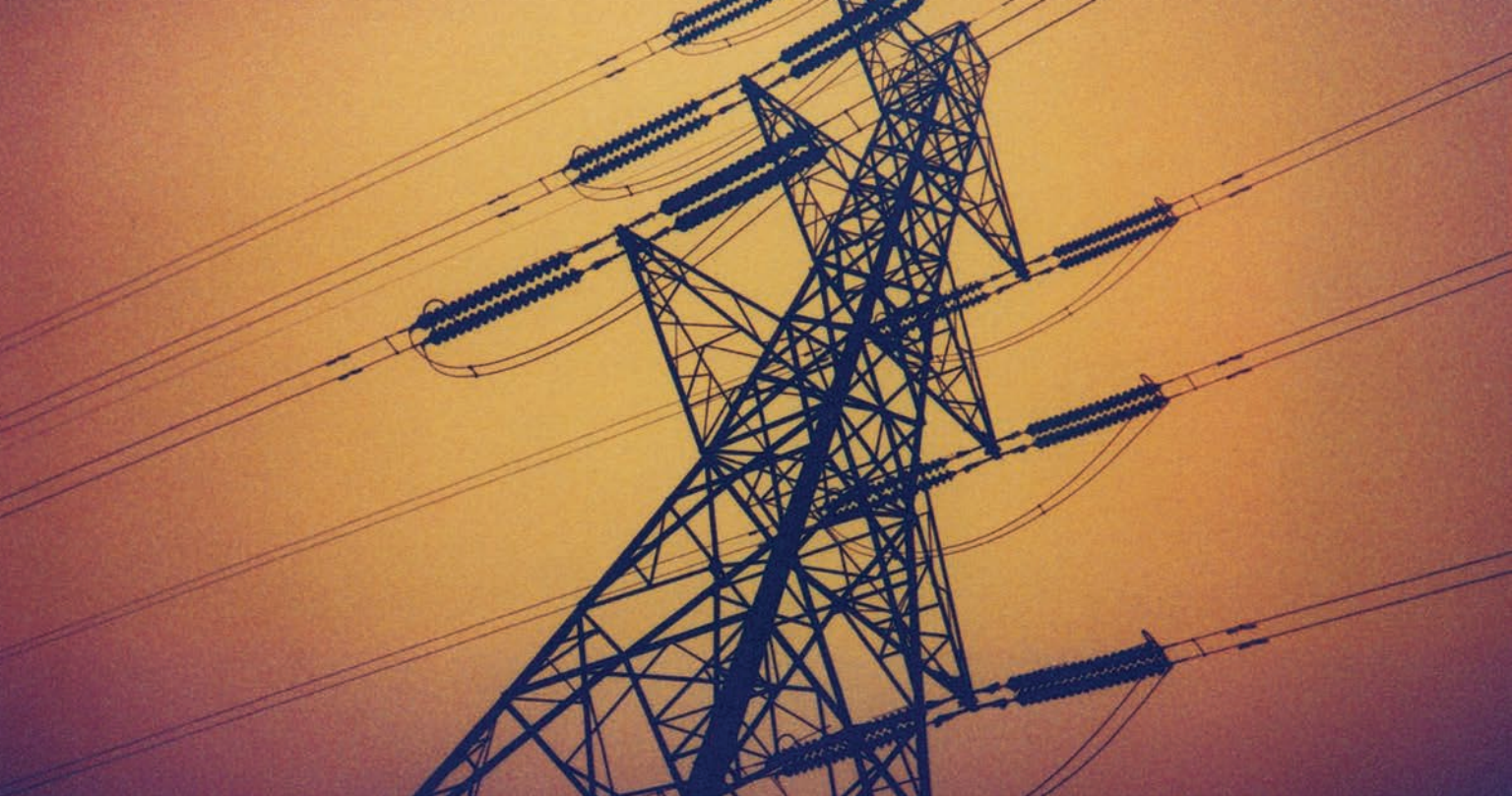
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Balancing nature and technology

Harmonizing electro and geopathic stress

▣ BY TIKA VALES CALDWELL ▣

The United States Green Building Council's vision as stated on their website is very inspiring: "Buildings and communities will regenerate and sustain the health and vitality of all life within a generation."

In the Council's Strategic Plan for 2013-2015, USGBC commits to "focusing on opportunities to improve the energy and environmental performance of existing buildings, including a more focused approach to human health." In addition, one of the Council's chosen guiding principles is to "reconcile humanity with nature: USGBC will endeavor to create and restore harmony between human activities and natural systems."

Perhaps we can be inspired by taking a look at the "green movement" in countries around the world who are now including the mitiga-

tion of Geopathic and Electro Stress in built environments to significantly raise vitality levels.

Geopathic Stress is not new. It's been known about at least since the 1920s when German scientists started documenting 'Krebshausen' – houses with an unusually high incidence of cancer cases that they discovered were situated over geological fault lines.

Geopathic Stress describes changes in the natural geomagnetic field of the earth caused by fault lines, mineral deposits, underground water flows, quarries, mine workings or other features.

In very basic terms, the entire earth is threaded with invisible geoelectro-magnetic field lines, appearing every 6 to 8 feet and forming a grid all over the planet. These rise up through the earth and can be compared to the meridian lines of a human body. These earth rays can

become positive power centers or they can have a significant negative effect on our health and well-being.

Many studies have been conducted in Europe. These studies indicate common signs of Geopathic Stress to include chronic fatigue, restless sleep, migraine, cancer, arthritis and rheumatism, miscarriage, nervous, emotional, and relationship problems, ADD, hyperactivity, sudden infant death syndrome, etc.

Technopathic Stress is a new term referring to a more recent phenomenon caused by our modern love affair with gadgets and wireless technology. Many symptoms are similar to those of Geopathic and Electromagnetic Stress and are considered by many to be part of the overall environmental picture throughout Europe. Electro Pollution has been called the silent killer of the modern age. Not only

do we have to deal with more electrical underground cables, overhead pylons and transformers to cope with our increased use of electricity, but our bodies and all other living systems have to endure increased Electro Magnetic Fields (EMF) from computers, broadband, mobile phones, cordless telephones, wireless laptops, microwave ovens, televisions, cell phone towers, vehicle navigation systems, etc.

In 2010 an article written by Michael Segell in Prevention Magazine documented health challenges students and teachers were experiencing in a new and technologically advanced "green" school building in La Quinta, California. In 1990, after the city of La Quinta, California, opened its doors of the new middle school, teachers started developing symptoms. By 2005, 16 staffers had been diag-

nosed with 18 cancers and about a dozen cancers were detected among former students, of which a couple of them died.

Sam Milham, MD, a widely traveled epidemiologist who had investigated hundreds of environmental and occupational illnesses, discovered that in some classrooms, he found surges of transient electro pollution exceeded his meter's ability to gauge them. The final analysis reported in the American Journal of Industrial Medicine stated, "Cumulative exposure to transients in the school increased the likelihood a teacher would develop cancer by 64 percent. A single year of working in the building raised the risk by 21 percent. The teachers' chances of developing melanoma, thyroid cancer, and uterine cancer were particularly high – as great as 13 times the average. The risks for young students were probably even greater.

In the UK, Sick Building Syndrome is considered to mainly be caused by Geopathic and Electro Stressed buildings. It is common knowledge that these misaligned electro-magnetic energies cause a high rate of absenteeism and in farm buildings, a higher death rate among animals. Also, throughout Europe, many medical doctors and therapists now confirm that any Geopathic or Electro Stress must be cleared before treatment can be 100 percent successful.

What can we do about it?

The traditional fix for Geopathic and Electro Stress that most European geo-biologists and dowzers adopt is to apply techniques of



Author Tika Vales Caldwell with Tok Tamang, the owner of Katmandu Restaurant in downtown Asheville. Living Design Consultants gave Tok lots of suggestions for interior design improvements and recently energy balanced the restaurant. Donated photo

earth acupuncture – using metal rods or other devices – at nodal points to rebalance the energetic matrix surrounding the property. High-tech proprietary devices for reducing or neutralizing Geopathic and Electro Stress can be purchased for installation inside homes and

offices. These products are not a substitute for optimal wiring in a building.

Many products, when applied, can be beneficial but not sufficient to neutralize or harmonize these imbalances. It is important to recognize that some products block,

some products absorb and some products transform. Products that block can send the problem somewhere else. Products that absorb can get saturated over time. Products that transform may or may not be permanent. Baseline testing is important. Electrical currents affect the Geopathic energy meridians and they end up forming one energy system just like tuning forks going into resonance with each other. In order to balance a building both need to be addressed.

After the environment is treated, follow-up testing is necessary to evaluate the immediate results. Annual testing is recommended because our environment is an open energy system and is ever-changing. Our planet is spinning through space and everything is in a constant state of reaching homeostasis. Raising the vitality level within our buildings by harmonizing Electro and Geopathic Stress is valid and a valuable asset to all living systems, from trees to bees to humans. This process is already being utilized around the world and is a great tool to add to our current green building checklist. Truly, the health of our buildings is determined by the quality of life existing within and around them.

Tika Vales Caldwell is a nationally respected designer and environmental energy balancing specialist. Tika and her husband, Richard Spalding Caldwell, an award-winning commercial and residential architect, combine their professions of environmental energy balancing and architecture for well-being as Living Design Consultants. They are both Vesica Institute trained in Advanced Biogeometry, Creating a New Science of Earth Healing and Holistic Healthy Homes. LivingDesignConsultants.com

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The owner of a tiny home just outside of Asheville stands on his porch.

Off the grid

Appearance vs. reality

□ BY MARY PEMBLETON □

Off-grid. It's a term that's come to imply the absence of technology, a woody atmosphere; Chacos kicked up on a camp chair. Or perhaps it brings to mind the savvy survivalist, isolated and well-stocked with future food sources and ammunition; or a pursuit of the simplicity of homesteading; a nod to a time when life was about cultivating one's own livelihood.

Taken in its most literal definition, it means simply to live independently from the infrastructure that is our power grid. In reality the motivation for doing such varies widely, ranging from the doomsday "prepper" to those who simply aim to reduce their monthly expenses, or those who intend to build far away from the grid and financially it makes more sense go off-grid.

A power source certainly isn't

vital to survival, but for those who desire access to modern conveniences, it is a necessary addition. Solar power provides an excellent option for collecting and storing electricity, though not without some lifestyle adjustments for those used to having unlimited power accessible at the flip of a switch.

Grid-tied

That's not to mean that solar isn't also a viable option for households who want to live a modern lifestyle and maintain current electricity consumption. Grid-tied systems reduce or eliminate electric bills, providing a smart 10-year return on investment, on average.

With residential grid-tied systems, panels are mounted on the rooftop or the ground, depending on exposure to sunlight or the struc-

ture of the roof. The panels collect sunlight and produce direct current, or DC, power. An inverter is needed to convert the energy into alternating current, or AC, power. AC current is the type of electricity that our grid uses to maximize transmission efficiency, and most household appliances utilize AC current.

In most grid-tied residential solar situations in the state of North Carolina, a net meter is installed by the power company (some companies do not offer this option; Duke does) after the system is installed. This device keeps a record of how much energy your personal power plant is producing on a daily basis versus how much you are consuming, and shows up on your bill. If you don't use what you produce, it feeds the grid, and your neighbors can utilize it. You receive credit for any electricity you produce and don't use, and can bank what

you don't use. Currently, Duke offers an apples-to-apples exchange rate for the electricity you produce.

Off-grid

Off-grid systems utilize batteries to store the energy produced by solar panels that isn't immediately consumed; there is no connection to our community power grid whatsoever. There is great variation in off-grid systems in terms of the type of battery used, the number of panels, and the amount of power produced and stored.

Battery systems can be a great option when the cost of connecting to the grid (such as with a new, remote property on which its owners desire to build) equals or exceeds the cost of an off-grid solar system. The major benefits of an off-grid system is the ability to access pow-

er when there is an outage in the grid, along with the freedom from electric bills.

Depending on the amount of energy needed to fulfill the needs and wants of the consumer, off-grid systems that can power a standard household are typically quite a bit more expensive than grid-tied systems. Batteries are currently expensive and multiple batteries take up a good amount of space, and need to be replaced more often than other system components. That being said, technology is advancing quickly and industry-savvy folks are eagerly awaiting the next generation of batteries to hit the market.

Even with a large system, some lifestyle change is in order in order to live within the confines of energy produced by off-grid solar. Many people with this type of system operate on a schedule dictated by the time of day when energy production is highest, though with some perspectives on, one may view this is simply adhering to a daily cadence akin to nature's own rhythm.

Those with smaller systems may be required to sacrifice some convenience; to opt for sources other than electricity for cooking, to unplug anything not in use, to use a little elbow grease for daily tasks rather than electricity (like washing and drying laundry, grinding coffee beans, etc.)

From community...

Earthaven Ecovillage is an entire community dedicated to sustainable culture living off the grid in the Black Mountain/Old Fort area. Both micro-hydro and solar photovoltaics are used as power sources.

"We have about ten different residential neighborhoods, some quite densely populated and some with just a couple of folks. The densest neighborhood just created its own photo-voltaic micro grid. In other neighborhoods, where people live close together, photo-voltaic systems are often shared," says Arjuna da Silva, resident at Earthaven.

Da Silva utilizes 1000 kW battery system with four panels on the roof of her home at Earthaven.

"Everyone here learns quickly to shut it and/or shut it off – things our old dads told us when we were kids! Everyone learns to notice the weather, to read a power meter and understand their own system's potential. One becomes accustomed to regulating use according to weather reports!" da Silva says.

...to a tiny home in the woods.

Laura M. LaVoie is a freelance writer and blogger living with her partner in a tiny home nestled in the woods surrounding Asheville. Her home is 120 square feet, as reflected in her blog name, 120squarefeet.com. A two-panel off-grid solar system powers their dwelling.

"Our system is small but it runs everything we need including lights, laptops, and charging stations," says LaVoie.

The couple pursued a simple lifestyle in order to cultivate financial freedom. "By building a tiny, off-grid house not only did we eliminate our mortgage but we also eliminated our utility bills," LaVoie says.

A Happy Medium

It is possible to have the best of both worlds – a grid-tied system with battery backup. These systems are designed to function mainly as a conventional grid-tied system would, but offers emergency power in the event of an outage, delivered via battery. Net metering can be



employed in this application, and the system will function similarly to conventional grid-tied systems, while also allocating energy to charge the battery bank.

"When power outages have occurred the transition has been absolutely seamless, and usually I did not know there had been an outage," says Mary Erickson, who had a battery backup system installed in her home in the Asheville area because she worked from home and had her elderly mother residing with her.

According to solar companies local to Asheville, many customers opt for this kind of system as opposed to going completely off-grid because the conveniences of grid access are ample.

Mary Pembleton is co-owner of Asheville Solar Company. She can be reached at info@ashevillesolarcompany.com or 828.552.4851.

Zachery Adam became an independent mortgage lender after years working for big banks in the lending industry. Now the Branch Manager of Prime Mortgage Lending of West Asheville, Zack can find the perfect mortgage loan for his customers from a wide variety of products. A deeply committed family man, he follows his bliss: helping people buy their homes while doing what he can to enjoy, protect and preserve the environment.



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Building sustainably – it starts with the land

□ BY JENNIFER BAUER □

Meet Mr. and Mrs. Green (not their real names). They are a loving couple in their early 70s who bought their dream retirement home in the mountains of Western North Carolina a few years ago. They poured their savings into moving from the muggy summers of Florida into the crisp cool mountain air year-round. Their two-story home with a nice deck and mountain views sits atop a steep gravel driveway. They didn't want much landscaping maintenance, so were fine with having a steep slope as their front yard. Despite some unexpected health problems for Mr. Green, they were enjoying their retirement in WNC.

Then came the rains of 2013, the wettest year on record. Mrs. Green started noticing cracks in their driveway, which then became scarps, as the outer edge of the fill slope started dropping down. After every rain, more and more of the edge would slide down and away, preventing them from using the parking area near their garage. They even started noticing cracks in their basement garage and foundation (see photo, right).

Fortunately, one of their neighbors had an excavator and volunteered to help them repair the slope. As he dug down into the failing fill material, he found trash and actual car parts buried within the slope. The Greens had bought the place under the assumption that it had been constructed soundly. Unfortunately, they were wrong.

The right site

Many times, when people mention "sustainable building," what comes to mind are solar panels, energy efficiency, and recycled materials. What many don't realize is that sustainability starts with the suitability of the land on which the home is built. The Green's story is only one of many homes, driveways, and roads that have been con-

structed in a place and/or manner that doesn't take this into account.

One of the things that makes building in the mountains unique from building elsewhere is our need to consider the natural processes constantly reshaping our mountain landscape. Landslides have been a dominant force in the evolution of the Appalachian Mountains for millions of years, and will continue to be until there are no mountains left. As inhabitants of this naturally shifting landscape, we must make ourselves aware of these potential hazards and strive to live here safely and sustainably.

As in the case of the Greens, most of the landslides that happen in WNC are triggered by an abundance of water on the slope. Typically this is from long periods of wet weather causing high antecedent moisture conditions, followed by intense bursts of rain, similar to the rains in January, May, and July of 2013. Other times, it is back-to-back large storm systems that drop many inches of rain at a time. In September 2004, the remnants of Hurricanes Frances and Ivan passed over WNC, creating up to 22 inches of rain in a 10-day period, and triggering hundreds of landslides. Landslides can also be triggered from severe thunderstorms with extremely heavy rainfall. Other times, the water is from a human-caused situation, like a broken water line, or poor storm water management. In all cases, the soil or rock is oversaturated with water, and it slides or flows down the slope.

In North Carolina, we know of over 3,500 landslides that have happened since 1916 (from database inventories at Appalachian Landslide Consultants, PLLC (ALC), and the North Carolina Geological Survey (NCGS), as of July 2015). The majority of these (approximately 70 percent) started on natural slopes, or slopes that had not been modified by construction activities (see photo).

Over 2,000 of these happened in Watauga County in August 1940, when the remnants of an Atlantic



Cracks in the home foundation. Photo by Appalachian Landslide Consultants, PLLC

A home can have the highest LEED certification and be as green as possible, but if the house or its driveway slides off of the mountain all the painstaking efforts to reduce its environmental impact will be negated.



Left: Long Branch natural debris flow, Maggie Valley, Jan. 15-16, 2013. Above: Road embankment failure/debris flow, Maggie Valley, Jan. 15-16, 2013. Photos by Appalachian Landslide Consultants, PLLC

hurricane brought an average of 12 to 13 inches of rain to the area in a week. Watauga County is one of the four counties that was completed during the NCGS landslide hazard mapping program from 2005-2011. Had the surrounding counties also been mapped, the number of landslides would certainly be much higher.

Since the 1940 storms and the recent population growth in WNC, we have seen a shift from the majority of landslides starting on natural, unmodified slopes, to the majority of landslides (67 percent) starting on modified, constructed slopes. We are seeing that the amount of rainfall it takes to trigger landslides on marginally stable constructed slopes is less, sometimes much less, than the amount of rain it takes to trigger natural landslides.

Of landslides from the 2013 rains, 133 out of 135 landslides that ALC mapped in were on modified slopes. Many were fill slopes or road embankments built on steep slopes near natural drainages. Often times these fill slope failures send debris directly into streams, filling them with sediment and impacting water quality (see photo,

above). A typical road embankment failure moves about 400 cubic yards of soil, or the equivalent of 20 dump truck loads.

These modified slope failures are the landslides that can be prevented with thorough evaluation of the property before development, proper design and construction of the slopes, and continued maintenance of stormwater drainage systems. In the past several years, some mountain counties have taken steps to help minimize or prevent modified slope failures with slope development ordinances which establish minimum requirements for designing and constructing on steep slopes. While these ordinances will help, they are not present in much of WNC and they only apply to new construction.

Check it out

WNC will continue to be a place where people want to live, and development will continue. We know that the potential for landslides exists in the mountains, and that they don't happen everywhere. An evaluation of property by a licensed

Learn more:

- The NCGS Landslide Hazard Maps are available for Macon, Watauga, Buncombe, and Henderson Counties on the NCGS's website www.portal.ncdenr.org/web/lr/landslides-information.
- You can view a web map version of the Buncombe County maps on the county's GIS site www.gis.buncombecounty.org/buncomap/Map_All.html.
- ALC has mapped sub-watersheds in Haywood and Jackson counties with grant funding from area non-profits. An online map viewer of these areas is available on ALC's website www.appalachianlandslide.com.

We have seen a shift from the majority of landslides starting on natural, unmodified slopes, to the majority of landslides (67 percent) starting on modified, constructed slopes.

geologist or other professional familiar with landslides in the mountains will help with siting new homes and roadways in places less likely to be impacted by natural landslides. These evaluations can also identify areas that are marginally stable in their natural condition and will need proper engineering design before construction to prevent a constructed slope failure. If purchasing an existing home in the mountains, it is wise to have it evaluated as well to ensure it was not built in harm's way and it is not showing signs of instability.

To help the public with identifying the areas with a higher potential for landslides, the NCGS (during the landslide mapping program) and ALC have created landslide susceptibility maps for some areas of WNC. These maps can be used to screen properties or pick out certain portions of a property that might be safer than others. If the property you wish to purchase is in a landslide prone area, which indicates the need for a site specific evaluation.

A home can have the highest LEED certification rating, and be as green as possible, but if the house or its driveway slides off of the mountain, all the painstaking efforts to reduce its environmental impact will be negated. It is in everyone's best interest to consider that sustainability starts with the suitability of the land. Mr. and Mrs. Green would agree with that.

Jennifer Bauer, L.G. is principal geologist and co-owner of Appalachian Landslide Consultants, PLLC in Asheville. She has been mapping and evaluating landslides since she started with the North Carolina Geological Survey's Landslide Hazard Mapping Program in 2005. She is passionate about helping protect lives and property of WNC citizens.

Aging in place

The Boomers green building priority

□ BY VICTORIA SCHOMER □

According to the U.S. Census Bureau, the elderly population will more than double between now and the year 2050, to 80 million. That means roughly one out of five adults in the U.S. will be over the age of 65.

And an AARP study found that the desire to continue to live in the same house increases with age: "83% of homeowners age 65 and over said they were "Very Likely" or "Somewhat Likely" to stay in their current homes for the rest of their lives, compared to 78% of those ages 55 to 64, and 69% of those ages 45-54."

That's a lot of feisty Baby Boomers not wanting to leave the places so painstakingly designed to perfectly fit domestic needs, to

surrender to a future in some homogenized old folks home. We Boomers want aesthetically beautiful, safe and stimulating places to live where we can continue to entertain and have our families visit. And we want to stay put.

The Boomer population has already been asking for more flexible home spaces that match our changing lifestyles, empty nesting, caring for an aging parent, and other future inevitable shifts and changes. As we age further, those requirements will surely include health issues and, just as likely, a fixed income and, now, suspected climate change impacts.

This same generation that originated and was weaned on Earth Day, solar panels and CFLs is also demanding that same level of en-



This bathroom allows for wheelchair access (left). A green designed kitchen is designed for disabled residents — open, inviting and barrier free (below). Dale Lang photos

vironmental integrity and balanced living in the homes we choose to live out our lives in.

Current Boomer housing requirements show continued demand for smaller and easier to maintain living spaces, single-story

homes, more livable houses featuring in-home accessibility, open floor plans, and indoor/outdoor living.

Many of these features sound very familiar to those of us in the green design and building field.



In addition to energy efficient and good indoor air quality, important tenants of green building include a smaller footprint, better connections to the outdoors, and a floor plan that is open and multi-purposed to maximize the use of every square foot of space.

New housing and renovations that are green for all – or “universally” green set up for aging in place – would include many of the following:

- Single story homes with a master bedroom and bath on the main floor.
- Low, 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 assessable fixtures.
- Kitchens that have storage that is easy to reach.
- Doors (cabinet and passage) that “disappear.”
- Easily navigable bathrooms with threshold-free showers.
- Energy-efficient heating and cooling for more sensitive bodies.

Green Built NC checklist points for accessibility

- All habitable rooms have 34” wide doors; all hallways are 42” clear, finished
- Accessible bathroom provided on the main floor with blocking for future accessory installations
- Cabinets and storage shelves between 18”- 48” from the floor (min. 50% by volume)
- Kitchen sink with knee space, and stove top with controls at the front and knee space underneath (or removable cabinet beside or below the stove top)
- Bedroom storage shelves 18”- 48” from the floor (min. 50% by area)
- Clothes closet with 32” clear opening (min.) and adjustable hanging rod
- 5’ turning radius around the bed
- Doors and faucets use lever handles; cabinet handles are ‘C’ or ‘D’ style
- Electrical panels, thermostats, breaker boxes, and any control panels are located on the main floor (max. 54” to top)



Victoria Schomer

- Better indoor air quality for weaker immune systems.
- Efficient and effective lighting for older eyes.

We know that a pro-active new-building and adaptive-reuse platform should take into account these needs for the aging, keeping what is working and redesign what is not. And 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 I have a home that my 94-year-old mom can safely visit, that my friends with limited mobility can come to, or that should I – knock on wood – break a leg!

One last thought: At an aging-in-place conference held a few years back at the University of Pennsylvania School of Design, the presenters challenged professionals to design spaces to accommodate a population that could potentially live – by 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 our better green building programs should be addressing equally, issues of energy efficiency and aging in place.

Since 1988 Victoria “Vicki” Schomer has been an activist and spokesperson for the green design and building profession. She is an award-winning ASID interior design, USGBC LEED Accredited Professional, REGREEN co-author, a designer and consultant for sustainable planning, remodeling, and green product specifying, and a Realtor specializing in identifying adaptable, and “green-able” properties.

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Rainwater catchment at Vandemusser Residence.
Photo by Jay Coble

Towards Net Zero Water

□ BY STEPHENS SMITH FARRELL □

“Know Water —
Know Life.
No Water —
No Life”

This flagrant plagiarism and adaptation of a signboard on a rural South Carolina church neatly sums up the need to understand the concept of Net Zero Water (NZW).

Those of you familiar with Net Zero Energy get ready – we’re in for some tough sledding; NZW poses an even more difficult challenge. There are, however, several examples of NZW in climates even more arid than our (normally) moist

region so it is doable.

For those of you unfamiliar with the unique language of green building design and construction these few lines will serve as an introduction to this critical subject. We’ll attempt to define NZW, why it’s important, what steps we can take towards this goal, and some of the more imposing obstacles.

The Living Futures Institute, the umbrella organization of the Living Building Challenge (LBC), defines NZW as a building or system that collects all of it’s water from on-site (rainwater) or from a closed loop and one that manages all of its water discharge (storm-water, grey water, and black water) on site.

The LBC invites us to consider a flower that manages to accomplish these tasks both elegantly

and efficiently. Like a building, the flower cannot move to obtain the resources it needs to survive. It gathers the water it needs without depleting its savings account (groundwater) or kicking the can down the road with respect to its byproducts (compare this to an expensive centralized sewage treatment system).

Why is NZW important?

Waste is not natural, it’s not sustainable, and it’s just not cool. Nothing as precious and essential to life as water should be wasted, no matter how seemingly abundant.

Following the flower as metaphor, observe that it does not even create waste! In fact, in a biologically balanced system there is no such thing as waste. The “by products”, if you will, of the flower are nutrients and oxygen.

Wasting water cost money, both yours and your community’s. Collecting, treating and distributing potable water, treating wastewater, and handling storm water are extravagantly expensive civil endeavors (think ever higher taxes).

Drilling wells costs big bucks;

running pumps uses electricity which cost money and, you guessed it, uses even more water in the production of centralized grid electricity. Apparently power plants are one of the largest consumers of clean water.

The flip side of this aspect is that if you’re already saving energy you’re saving water as well. Similarly with recycling; while it won’t help you reach NZW per se, it does save tremendous amounts of water in the avoidance of manufacturing raw materials such as glass, aluminum, paper, and plastic.

Putting city water on your plants or grass is subsidizing everyone else’s water use as you are paying for a sewer that you’re not using; remember, water supply (In) is metered, while sewage (Out) is not. Sewer bills are based on water usage, whether or not you use the sewer treatment.

Private sewers such as septic systems can be managed to last much longer if less water is introduced into them. Conserve water or achieve NZW and your system will thank you (although it’s not clear if a typical septic system qualifies as NZW on the discharge side).

Speaking of plants and other living things, rainwater is better for them as it does not contain fluoride and chlorine. By the way, do you recall authorizing the introduction of these chemicals into your drinking water?

And finally, getting to NZW is important because to not do so suggest a lack of understanding of the interconnectedness of all these life sustaining elements. We save water because it connects to energy, to food security, to habitat, to social and environmental justice, and to one another. As the bumper sticker says, "We all live downstream".

What steps can we take towards NZW?

NZW is one of the toughest issues in an overstuffed basket of challenges facing the resilient community (by which I mean all of us). Don't get frustrated if you cannot solve all of the technical and legal obstacles between where we are and where we inevitably must arrive, but do take heart that there are some things we all can do to move in this direction.

- Educate yourself and your elected officials on NZW; a tangled thicket of uncoordinated laws, ordinances and regulations unnecessarily complicate this work. In most jurisdictions all water into a system must be of potable quality, no matter its intended use. Similarly, all water out must be treated as sewage no matter it's impacted quality.

- Build a cistern or other rainwater-harvesting device. Since we live in the mountains collecting water high and gravity feeding to gardens below is sometimes an option. Collecting rainwater for other uses usually involves pumping.

- Learn about different qualities of water and their corresponding uses (referred to as the quality/use cascade). Not every activity requires potable water, the highest quality generally available.

- Consider reusing grey water (water from showers, clothes and dishwashing, basically everything but sewage or black water) on gardens, lawns and other task not requiring the good stuff.

- Look into the technical and legal issues of composting toilets and other methods of dealing with the stuff which must not be named. This subject could take hundreds of pages as it involves public health but suffice it to say that this is the

critical disconnect in the loop that must be repaired but please, don't break the law! Author Joseph Jenkins has written an interesting book on this subject.

- Learn about bio-digesters and how they fit into the technical and legal realms. These are often the only way for a commercial building to achieve NZW.

- Include pre-plumbing for dedicated supply lines for the use of rainwater and for the separation of grey and black water (not commingling the two, such as it were) in new construction and remodeling.

- Create a rain garden to slow, cool, and reintroduce storm water into the ground. This has the added benefit of attracting native plants and animals (especially butterflies! What's not to like about a butterfly?)

- Remember that a roof or other impervious surface acts as a collection area that concentrates, warms, and accelerates storm water. This powerful force needs to be slowed down, cooled, and redistributed, preferably on site (for NZW) but at the very least before introduction into a creek or other natural body of water.

What should we stop doing?

- Planting non-native flora that are not evolutionarily adapted to our bio-tone and its rainwater quantities and frequencies.

- Leaving the water on as you brush your teeth.

- Washing partial loads of laundry or dishes.

- Letting storm water erode your property and carry sediment into our creeks, lakes, and streams (via streets, streams or directly).

- Over fertilizing lawns and gardens; preferably we should use organic fertilizers that do not cause as much trouble if they get washed into a storm sewer or creek/river. At the very least, be frugal with the use of fertilizers.

- Building in or otherwise negatively impacting natural storm-water recharge areas such as wetlands and floodways.

What are some of the obstacles to NZW?

As mentioned the biggest obstacle is regulatory. The good people of Building Inspections and DNER are our hard working friends

"Learn about different qualities of water and their corresponding uses. Not every activity requires potable water, the highest quality generally available."



Greywater plumbing. Georg Eifird, A-2-Z Plumbing photo

and neighbors and are only doing what they've been authorized to do. It's almost impossible to argue with, "I'm just doing my job."

Instead get policy makers to learn about the problems and opportunities of NZW. It has been remarked that our building codes and regulations are reactionary and need to be anticipatory. Presently the primary navigation tool of policy is the rear view mirror!

There are many technical challenges as well. Separating grey water from black, dealing with black water (or avoiding creating it altogether; again see Jenkins), rainwater capture and storage, stormwater capture and storage, etc. are among the many solvable technical challenges.

One small but significantly important obstacle is the inclusion of "algaeicides and mildewcides" in

composite asphalt roof shingles. While there are few studies one would be wise to consider the effects of these poisons, however minute, in the uses of water collected from such catchment areas.

Cleaning rainwater of other large debris is readily accomplished by so called first flush devices. Further on site filtration and treatment for various purposes is fairly well trodden ground and can be addressed by professionals with experience in this field. Water can be filtered to any level deemed appropriate for the intended use.

So the challenges are real but the fact remains - we have to figure this out!

Resilient cultures practice the Precautionary Principle, which states, among other things, that we shouldn't wait until we have a problem before we begin planning. We're not talking about a nicety here - we're talking water!

Let's learn from California. They never thought they'd run out of water and they were more or less unprepared when disaster struck (and is still painfully striking!). As if that weren't enough, satellite measurements indicate a dire depletion of California's aquifers from wells so they are depleting their savings accounts as well.

We're not immune to drought here at home either. Western North Carolina has been experienced more frequent and more severe droughts in the past decade than any other on record. As this article goes to publish the French Broad River is too low to float an inner-tube.

Net Zero Water represents the next plateau of resiliency planning and design. It is not an easy problem and it will not be solved overnight but with creativity, focus, and the requisite resources it is an imperative issue that can be resolved.

Steve is chief cook and bottle washer at Stephens Smith Farrell Architecture in Asheville. He is Architect of Record for the first LEED Certified Building in Western North Carolina and sits on the Western North Carolina Green Building Council Board of Directors. He is an Ambassador for the Living Building Challenge and is a member of the Asheville Living Building Challenge Collaborative. He lives and gardens in a net zero energy home in the Kenilworth neighborhood of Asheville. www.AshevilleArchitect.com.

Sources:

LBC • Natural Step • City of Seattle Study
Cascadia Study • WaterWise
Joseph Jenkins

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WNCGBC photos

Retrofit your home for energy efficiency

▣ 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 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 material, and how much it 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-\$.90 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.** 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 or Green Gauge Assessment. They can recommend improvements and provide contracting services, if you would prefer not to do the work yourself.

Heating and Cooling

Water heating, lights & appliances

NO COST

- 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.

- Energy-saving settings are used on dishwashers and washing machines and then 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

- 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.
- 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 to energy-saving compact fluorescents or LEDs.

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 they 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!).

- Appliances are plugged into a power strip that can easily be turned off to reduce ghost loads.
- A high-efficiency or a gas-tankless water heater 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.

LONG-TERM PAYBACK

- Windows are replaced with double-paned low-e windows with a U-value of less than .35
- Ceiling fans are installed.
- The Central heating and air system is replaced with a more efficient model.
- Wall insulation is installed.
- Exterior solar shade screens, awnings or removable trellises are installed where appropriate to shade from over-heating in the summer.

- Convert to solar water heating. *Note: Consider integrating it with space heating. The current tax credits available make it much more affordable than ever before.*
- Install a PV system to produce electricity.

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

Tree preservation

□ BY MARGARET CHANDLER □

A beautiful old tree is an asset to any home. Providing shade, wildlife habitat, and immense charm, it is worth the effort to retain these valuable natural resources on a construction site. Building around these trees is a collaborative process and requires cooperation of the builder, architect, structural engineer, and arborist, if needed.

A good rule of thumb in working around trees is the “drip-line” rule. Consider any roots below the drip-line, or outer circumference of the tree’s canopy, plus about 10 to 20 extra feet to be untouchable. This is your “root-protection zone,” or RPZ. Erecting a barrier around this zone is the best way to ensure that this crucial area remains undamaged. Vehicles should not park or drive here, it should not be used as a regular footpath, and materials or trash should never be stacked in the RPZ. The soil around a tree’s root system must remain porous, allowing air and water to percolate through the soil. Using the area beneath a tree for parking or material storage prevents water from reaching the root system.

A few new construction tips:

■ Establish root-protection zones before construction begins and ensure that these are respected

throughout the construction process. Simple fences provide a good visual barrier to prevent encroachment into the RPZ.

■ Place a four-to-six-inch protective layer of chip mulch within the barrier. It is likely that clearing the rest of the lot will provide the chip mulch material, with no purchase necessary.

■ If the RPZ must be breached, create a temporary driving path with plywood sheets laid out in tracks through the potentially impacted area.

■ If footings must be installed within the RPZ, maintain as much distance from the trunk as possible. Trenchers are never to be used within the RPZ - they rip the roots, exposing large portions of root to rot and decay. Any digging within this zone should be done by hand. This way, roots can be dug around or cleanly cut, if required. A clean-cut root is more likely to heal than a mangled one, increasing the nearby tree’s chance of survival.

If there are conflicts between existing root structures and footings that cannot be surmounted by thoughtful design, there are ways to work around these root structures. While not guaranteed to preserve the tree, they can at least increase the chances that the tree will survive construction. Some roots may be sacrificed in the process, but if conducted responsibly, the tree will live long enough to gen-



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The 6' diameter trunk is less than 5' from the kitchen window. Brooke Tate, Samsel Architects photo

erate other roots to make up for the lost structure.

Let's look at one home as an extreme case study. On a recently completed a renovation to an existing home from the 1920s, there was a massive white oak tree approximately 5 feet from the kitchen window, and the homeowners wanted more kitchen space. Aside from the home itself, the tree's presence was the site's main feature, with a canopy 100 feet in diameter and a trunk 6 feet at its widest. Sacrificing the tree was out of the question, but locating the kitchen expansion elsewhere was not financially feasible. As a compromise, a large portion of the house adjacent to the kitchen was demolished, and most of the kitchen function was expanded in this direction. Even with this design compromise, construction of new footings was required.

The next step was hiring a professional arborist to evaluate the tree and determine whether it was a viable candidate to be saved, or if any nearby construction would be detrimental to its long-term health. It was determined that this tree could withstand the stresses of nearby construction, but it did require stabilizing. The trunk naturally forked into two sections about 5 feet above the ground, and six cables were required to tie the two sides together and prevent the trunk from splitting in two.

Footing installation was the most critical part of the construction process. Footings were designed to be as small as structurally permissible. The engineer recommended hand-excavated pier footings with reinforced grade beams, rather


than slab-on-grade or crawl space, to minimize disturbance to the surrounding soil. After digging began and actual root locations were determined, this design was adapted to minimize root damage. Roots near footings were given a 4" minimum clearance, to allow for future root growth without disturbing the foundation.

The tree roots that were exposed during footing excavation needed careful attention. The arborist was on-site all day during footing construction, ensuring that the correct measures were being taken. Before any concrete was poured, exposed roots were wrapped in a protective PVC sleeve with a few inches of extra space between pipe and root. This extra space was filled with topsoil, and the seams in the pipe were sealed with duct tape. Once these precautions were in place, rebar was carefully placed in the hole beneath the roots. The concrete footings were poured, and construction proceeded as normal.

While it does require significant effort, retaining existing trees on a construction site integrates the building with its environment. Tree protection practices can be effectively utilized on a standard construction site, and the owner will benefit from the results for years to come.

Margaret Chandler is a nearly-licensed intern architect with Samsel Architects. She has worked in sustainable design since earning her degrees at Clemson University, and briefly lived in a treehouse off the grid in Austin, TX. Margaret currently serves on the WNCGBC Board of Directors and the AIA AVL Executive Committee.

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Knowledge is power

How can home energy monitoring change your life?

By AMY MUSSER

What if I told you that you could use 30 percent less energy in your home without giving up anything at all? No five-minute military showers, you can keep using the AC, and you can watch all the TV you want. How is this possible?

About a third of the energy that a typical home uses is just pure waste. It's not being used for anything useful, and you wouldn't notice if you stopped using it. The only reason you are using it is that you don't know any better.

In this case, knowledge really is power. Or rather, the power to stop using so much power. And home energy and automation systems are going to allow you to take control.

You've probably heard of "phantom loads." These are appliances that use electricity whenever they're

plugged in, even if you're not using them. Computer equipment, AV components, and phone chargers are notorious offenders. But some of these things are worse than others.

Using a simple tool like the Kill-a-Watt monitor, we discovered that our office printer was using less than 10 watts in sleep mode, but we had a computer that was using nearly 100 watts. That told us what was most important to turn off, and ultimately we targeted that computer for replacement.

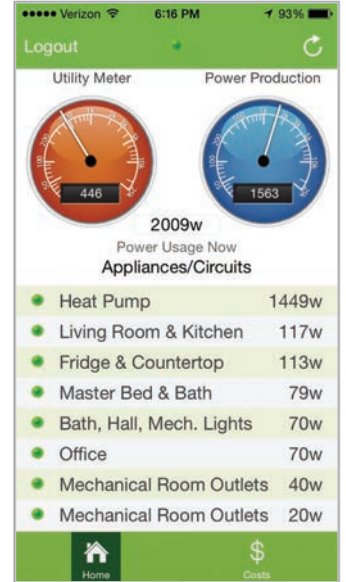
Phantom loads are pure waste. The electricity they use doesn't do anything useful, and it increases your air conditioning bill at the same time. Luckily, most phantom loads in homes can be easily found using handheld monitors (like the Kill-a-Watt) that you can buy at a hardware store for about \$20. This is a great project for kids that involves a little math and helps them

learn about energy conservation.

But this is all just the tip of the iceberg. With our expanding ability to gather and manage data and control things wirelessly, we are about to experience a revolution in how we use power. The revolution is actually here now, if you choose to participate. My husband and I have been using a whole-house monitoring system called SiteSage (available for \$500 to \$800) in our net-zero energy home for the past four years. These are great systems for finding both phantom loads and almost phantom loads.

Beyond phantom loads, Americans use a whole lot of power very inefficiently: the benefits we get from these things are very small in

Real-time energy use and production data via iPhone app. (right)
Handheld power monitor. (opposite)



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proportion to the power that they consume. But until you know what they are, we can't make smart decisions about what to do about them. You can read articles about what the typical offenders are, but there's nothing like using the power of the Internet to manage your own data.

Our monitor records power use on every circuit of our home, and the data is saved to an app that we can access via Internet and on our phones. It will email us if our dryer starts using more energy per load, reminding us to check the lint filter and vent. It also alerts us if we appear to have left the refrigerator door open. We can set it to notify us if a particular appliance starts using more energy than before, or if we are off-track for reaching our energy use goals for the month. It automatically analyzes our data and tells us how we compare to other homes in North Carolina and suggests circuits that may have phan-



tom loads.

Right now, you still have to log in and look at what's happening with your house, although the app does make it really easy for you by analyzing the data and suggesting where you may have a problem. And there are systems that will let you control your thermostat or turn off lights from inside the app. In the future, apps might be able to just turn off the power to phantom loads automatically, unless you tell them to specifically keep it on (no one wants to miss their DVR recordings).

It's also possible that the power company could pay you to cycle your air conditioning or water heater off when the power plant is peaking, allowing them to avoid building new plants or bringing inefficient backup systems online. The data is already there – we just need to decide how we want to use it.

Amy Musser is founder/principal of Vandemusser Design PLLC and Asheville-based home energy efficiency company. A licensed mechanical engineer, she provides design assistance, certification and audits to support high performance homes.

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— on Crooked Creek —

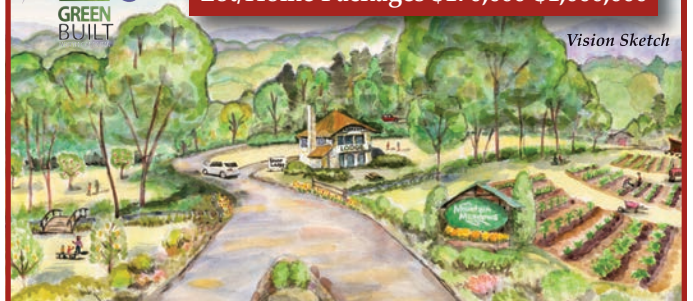
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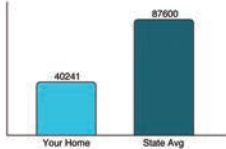
Homeowner Name
828-555-5555
4 bedrooms

2 Greenest dr, Asheville, NC 28811
Built in 2013
1899 square feet

Green Built Platinum, LEED Platinum, NGBS Emerald, ENERGY STAR v.3.0, NC HERO Code

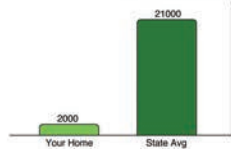
Water Use

Estimated Annual Indoor Water Use (in gallons)



Energy Use

Annual Energy Use (in kWh)



Green Building Materials

Roofing: Lifetime Warranty Asphalt & Green roof
Counters: Bamboo & Quartz, solid gold
Siding: Recycled/Reclaimed & Hardi
Decking: Locust
Cabinets: Made of old metal siding

Energy and Water Efficiency

Shower Heads: 1.25 GPM
Sink Faucet Aerators: 0.35 GPM
Toilets: 1.00 GPF
Washing machine is Energy Star labeled

Indoor Air Quality

CO Detector Present
ASHRAE Compliant Ventilation System: Erv / Hrv
Bath Fan Exhausts to Outside
Kitchen Rangehood Exhausts to the Outside
Radon System: Active
High efficiency air filter: Merv 8 or greater
Sealed crawlspace

Site & Outdoors

Turf Grass: None
Natives and Edibles: Over 50% of Landscape
Rain Catchment: +500 Gallons
Notable Features:
Fruit Trees, Permeable Driveways, Rain Garden, Vegetable Garden, Xeriscaping, Drought Resistant Ground Cover, Designed Permaculture, Wetland, Meadow/native Non-turf Grasses, Mature Trees Or Forest, South Facing Roof For Future Solar, Frog Pond

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Runoff - A sod swale

□ BY RAYMOND THOMPSON □

Welcome to Western North Carolina, home of ancient mountains and rainforest conditions. If you build here, be ready for tight building schedules, limited budgets, and small steep lots. Builders need to be ready to get creative, stay clean, and keep from going over budget while solving the inescapable difficulties of building in our mountain valleys and slopes.

This is a case study on a West Asheville residential infill project where 2.5 acres of street runoff drain through a steep lot.

The water runs down Logan Avenue into the storm drain, which discharges from a culvert into a swale, or a contoured drainage basin, and then off the rear of the property onto the adjacent neighbor's property.

On initial review of the proposed project, we expected to be able to build around the existing swale without disturbing it, but after some initial clearing by hand, it became evident that we were going to have to move the swale and seek professional guidance.

Russ Davis of RDA & Associates came up with a creative swale re-design, which utilizes sod as the swale liner. This is a nice design because it softens the swale by replacing the standard 6- to 12-inch rough granite of a standard swale design with soft green fescue. The grass effectively increases the limited yard area and reduces the overall cost of material and installation.

With the design established, execution was our next step. Silt fences

were installed along with some straw bales for redundant runoff protection. The grader, Mark McIntosh, removed some trees, filled and compacted the existing swale location, and dug the new swale path where it wouldn't interfere with the home. After the site work was completed, our hope was to have sod onsite immediately to prevent washing dirt onto the neighbors' property and into the stream.

Unfortunately, the sod farms weren't cutting due to rain. In order to keep the dirt dry, we purchased 6 mil plastic to line the swale. The crew rolled out the plastic and ballasted it with rocks. It promptly began raining, and rained for the next two weeks, which also meant no sod was being cut during that time.

At the first opportunity, sod was delivered and installation began at the bottom of the property. The sod was rolled out in a herringbone pattern with a 1- to 2-inch overlap similar to roof shingles. The sod was then pinned together with landscape fabric pins to ensure that the sod would stay put long enough for the roots to establish themselves in their new location.

It has now been 4 months from install, and we have an appealing swale with established sod that hasn't washed any soil from our site onto the neighbor's property or into the stream.

Raymond Thompson owns and works for Sure Foot Builders. He fell in love with green building when he built his first home out of maple bark and has been trying to do it better ever since.

Raymond Thompson photo





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Per square foot

How much does it cost to build a new green home?

By GREG MCGUFFEY

Over the 12 years that I have been building in Asheville, this has remained the most frequently asked question that I receive. It is always one of the very first things people inquire about in order to get an idea of what a new home will cost. With this being the case, I thought I would go ahead and answer the builder's most commonly asked question and a potential homeowner's number one concern.

First off, it is very important to understand that just as with many products, you will typically get what you pay for. In addition, when discussing cost with builders, take some time to read between the lines and make sure that you are comparing apples to apples. By this, I mean making sure that when a builder quotes cost per square foot (CPSF), you know exactly what that number includes.

It has always been quite simple for me. The CPSF should include everything that a finished home requires, excluding two things: land and design fees. Besides those two items, the CPSF should include all land improvements, utilities, labor, management fees, materials, fixtures and appliances for the home.

If someone tells you they can build you a home for \$100 PSF, then your home may not come with a stove or a sewer tap. Also, the CPSF should only include conditioned space. If you have 2,000 square feet of conditioned space on top of an 800-square-foot unfinished basement, then it's 2,000 square feet we are talking about.

So let's get to the magic number that everyone wants to know. In and around the Asheville area, its costs roughly between \$150 to 200 per square foot to build a new green home. This range will cover most homes ranging in size from 1,000 to 2,500 square feet

(anything smaller or larger than this falls outside of the norm, although in many cases these numbers will still apply).

The range of CPSF for a new home depends on a wide variety of factors. The overall design, land topography, location, finish selections, systems, and client-driven changes all play a role in the cost

formance. It might meet code, but that is not the standard that I suggest referring to.

Some folks will argue that a green home costs more. While this may be true in some instances, it's only true because you get what you pay for and a green home is typically a better built home. For the most part, a green home does

Earthtone Builders photo



of a finished product. Other factors include the builder's rates, company structure and efficiency. Any good builder should exhibit a competitive range of costs. I should also mention that this range of cost applies to most homes, although certainly not all. High-end custom homes can easily breach \$200 PSF because they are not designed with budget in mind. In that market \$200 PSF should be considered the baseline of what to expect.

On the contrary, I am sure that there are some who can build for under \$150 per square foot. I just don't know how. The new green homes being built today use high-quality materials, insulation, efficient HVAC systems and careful planning. To go under this price you will likely sacrifice the overall quality of the home and its per-

formance. It might meet code, but that is not the standard that I suggest referring to.

My best advice for getting the most bang for your buck is to do some research and connect with a reputable builder who is competitively priced. Once you choose a builder you will have the opportunity to get trusted guidance on how to build within your budget. He/she will be able to tell you where to cut back and where to spend in order to get the home you want at a price you can afford. If you do this, then you will be able to build within the range given above without any surprises.

Greg McGuffey is the founder and President of Earthtone Builders. He has been designing and building custom green homes in the Asheville area since 2003.

Using the appraisal addendum to increase the value of your CERTIFIED home

By CHUCK PERRY

I think you would all agree with me if I said communication bridges gaps, improves performance and, in general, good communication usually results in a more positive experience for all parties involved.

When I think of building a home I think of the many opportunities I am given to communicate with the client, the subcontractors,

the suppliers, the designers and the sales team. Each communication takes us one step closer to successfully building the homeowner a certified green home they will proud to live in. Imagine if we chose not to communicate enough. How would that experience be? We do not want to go down that road except to ask ourselves who else we could communicate with to

improve the experience. The answer is banks and appraisers.

Fortunately we now have a tool to help us communicate with banks and appraisers and speak their language, if you will. That tool is the Residential Green and Energy Efficient Addendum, created by the Appraisal Institute. This AI Form 820.04 is proof that industry is evolving and that valuing green and energy efficient homes is on the appraisal industries radar. It has long been believed that homebuilders and homebuyers have zero control over which appraiser arrives to value their home. Likewise, we have been told by the bank that they cannot communicate directly with appraisers. Let's dig a little deeper to see what is possible and identify steps to using this valuable tool in

our favor.

First, we need to understand how appraisers are selected and how to assure the right appraiser arrives at your certified home. The bank does not and cannot decide who appraises a home. This is done by a selection process that is out of their and your control. What they can do is request an appraiser who has experience evaluating green certified homes or who is "competent in the subject matter. This should be step one in our communication with the bank.

So, now that the bank knows we have a simple request the next step is to ensure the selected appraiser really is competent and knowledgeable about certified green homes. This step is real easy, interview the appraiser before the work begins. Trust me, appraisers want to be assigned jobs within their comfort zone and competency level. Once you have found an appraiser with the experience required it is now time to communicate fully with them.

This communication with the appraiser involves completing AI Form 820.04, the Residential Green and Energy Efficient Addendum, and providing a copy to the bank, appraiser and sales team. A few items to note when completing the form are:

It should be completed by a knowledgeable person. As the builder I will often complete parts of it but I send it to the third-party green verifier, home energy rater and/or the solar installer for specific details about energy savings, HERS scores, envelope tightness, azimuth of an array and other technical information requested in the form. I ask them to sign that they have completed the form. This lets the appraiser know that a licensed professional has performed the energy modeling and verification work.

For construction to perm projects or other pre-construction loans be sure to use the comments sections to note "Proposed New Construction" as the work will not be done yet. In this case it is best to provide an "as built" addendum at the end of the project.

Attach the Green Certification and/or the Energy Certification to the addendum.

Attach other forms provided the Home Energy Rater and/or

solar installer that share information about the HERS score and annual energy savings.

Use the comments section to identify costs for the appraiser. See an example in Figure 1 below.

The form is not limited to certified homes. It can be used to identify saving associated with solar arrays, solar thermal, water efficiency, etc.

To conclude I want to remind myself and you that this form is no magic potion for insuring we get the proper value assigned to our certified homes. It is, however, one great tool we can use to assist in the process. The Appraisal

Institute did a very thorough job in designing this document. The information requested is straightforward and is exactly

the kind of information we need to be getting to the appraiser.

Imagine if this form became a standard attachment to every build contract, every set of builder specification, and every home loan. If it was pretty soon bankers, underwriters, and appraisers would know more about green building, insulation types, ACH50, passive solar, HERS scores, energy saving, solar arrays, etc. Isn't this what we all want? Communication is the key to successfully building a great home and it will also be key in continuing to move the market for high performance homes forward. I encourage all high performance home professionals to look to this AI Form 820.04 as a step in the right direction and a valuable tool to helping not only their businesses but our industry.

AI Form 820.04, the Residential Green and Energy Efficient Addendum along with additional information to aid in completion of the form can be downloaded at: www.appraisalinstitute.org/education/education-resources/green-building-resources/

Chuck Perry is the director of the NC Energy Efficiency Alliance (NCEEA), is a North Carolina-licensed general contractor and a certified green builder. The NCEEA, operating out of Appalachian State University, works on topics such as energy codes, high performance building, appraiser and REALTOR training, greening the MLS and supporting energy efficiency in all facets of the construction industry. Chuck can be reached at 828.262.8331, perrycw@appstate.edu or visit www.ncenergystar.org for more information.



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Indoor air quality checklist

□ BY MAGGIE LESLIE □

Ensuring healthy indoor air quality in a home starts with the very foundation. Many simple building techniques, from radon resistant construction to drainage planes, can prevent unwanted air quality problems in the future. Additionally, to have a healthy home, it is very important to build a tight home to prevent unwanted moisture and contaminants from entering, but it is also important to provide ventilation to the home to provide fresh air exchange. Once the home has been constructed as healthy and durably as possible, consider the interior finishes and the chemicals used in glues, paints and stains. Below is a checklist of items to help ensure healthier indoor air, for more detailed information review the EPA's Indoor Air Plus requirements at www.epa.gov/indoorairplus.



Formaldehyde Free PureBond Plywood (Product of Columbia Forest Products, manufactured in Old Fort) uses soy based glues to replace conventional urea-formaldehyde glues in its decorative hardwood plywood.

Moisture Management

- Install a continuous drainage plane behind the exterior cladding.
- Install a capillary break between foundation and framing.
- Fully and properly flash windows, doors and roofing.
- Install a surface water management system. Final grade should be at least ½ inch per foot sloped away from the house. Gutters must be present and functional and must drain onto a finished grade at a minimum of five feet from the building foundation.
- Crawlspace flooring should have 100 percent coverage with sealed vapor barrier. Consider a sealed, non-vented crawlspace for added durability.

Ventilation

- The home needs to be as tight as possible, through proper air sealing. Then, mechanical air ventilation needs to be provided mechanically to the home (not too much and not too little). The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

requires 7.5 cubic feet of air per minute (cfm) per person (i.e., per bedroom) plus 7.5 cfm, plus an additional 1 percent of total floor area of fresh air ventilation. This isn't as complicated as it sounds. The two

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

- Install a properly sized and sealed HVAC unit (see "Heating and Cooling"). The home needs to maintain less than 60 percent relative humidity.

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

- Install MERV 8 or higher HVAC filters, but make sure the equipment is designed to accommodate pressure drop from the filter.

- Protect ducts from dirt and debris until construction is completed.

Combustion Safety

- Combustion equipment such as gas furnaces and water heaters must be either sealed combustion or installed outside the conditioned spaces. Do not install un-vented fireplaces.
- Install one hardwired carbon monoxide (CO) detector per 1,000 square feet of living space (minimum one per floor) in all houses where an attached garage or any combustion appliance is used in the structure.
- Common walls to the garage need to be properly air sealed, and doors to garages need to be weatherstripped.

Radon and Pest resistance

- Install a radon mitigation system

that depressurizes the slab and properly air seal any penetrations from the foundation to the home.

- Perform a radon test before moving in. For more information visit www.epa.gov/radon
- Consider non-toxic termite control system.
- Install termite flashings that provide a physical barrier between the foundation and the wood structure.

Materials

- Use Formaldehyde-free insulation and building materials wherever possible.
- Use low-VOC (volatile organic compound) paints.
- Use low-VOC stains and finishes on all wood work.
- Use solvent free adhesives and glues.
- Don't install carpet. If you do, use a low-VOC, CRI rated carpet.

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Our newest initiative, **GREEN GAUGE** has launched this year to provide opportunities for existing homes to easily and affordably go green.

We also host a **Living Building Challenge Collaborative** which goes beyond green building towards truly sustainable, non-toxic, zero water and zero energy buildings.

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Equivalent Trees Planted
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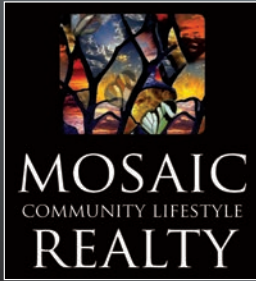
We have been live for three months now and we have not had to pay for any power used from Duke Energy. In fact, we have over \$45 in credits built up to use in the colder, less sunny, months.

Other than marrying my Wife Stephanie Sue & buying this killer house on the Tuckasegee River we call home, I'd have to say it's the third best investment I have ever made. Make your own transmission lines! Thanks Appalachian Energy Solutions! - A.J.

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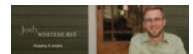
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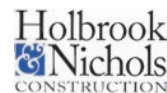


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westsidepainters@gmail.com

Land Planning

Altamont Environmental, Inc.
Stuart Ryman
828.281.3350
231 Haywood Street
Asheville, North Carolina 28801
www.altamontenvironmental.com
mail@altamontenvironmental.com
Altamont Environmental offers expertise in environmental due diligence, contaminated property redevelopment, ecological restoration, and innovative stormwater management.



Appalachian Landslide Consultants, PLLC
Jennifer Bauer
828.209.8642
PO Box 5516
Asheville, North Carolina 28813
www.appalachianlandslide.com
jennifer@appalachianlandslide.com
Protecting life, property, and our natural environment through site stability evaluations for home buyers and sellers, landslide characterization, and landslide susceptibility mapping. Helping our clients achieve sustainable development by identifying areas prone to slope failure for integration into smart development planning.



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David Tuch
828.253.6856
37 Haywood Street, Suite 100
Asheville, North Carolina 28801
www.equinoxenvironmental.com
David@equinoxenvironmental.com
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Ryan Houston
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PO Box 1551
Weaverville, North Carolina 28787
www.lawn-n-order.net
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Luther E. Smith & Assoc., PA
Luther E. Smith, RLA, ASLA, APA
828.697.2307
129 Third Ave West
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www.lsadesign.biz
les_lsa@bellsouth.net
Since 1976 LSA has earned a reputation for having a thorough understanding and respect for the Southern Appalachian terrain and environmental systems, we provide a full range of, land planning and landscape architecture services to landowners, developers, conservation organizations, communities and local municipalities.



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Kevin Tate
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730 Clubside Drive
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www.otterandarrow.com
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Southeast Ecological Design
Kevin Ward
828.768.6448
503 Old Farm Road
Marshall, North Carolina 28753
www.ecologicaldesign.net
kevin@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. Our focus on artistic and creative design, combined with a strong commitment to environmental and social sustainability is aimed at improving the quality of life for people and the earth.



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www.wncgbc.org



V & V Land Management and Resource Recovery LLC
 Carrie Vogler
 828.777.6637
 PO Box 7
 Del Rio, Tennessee 37727
www.voglerllc.com
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Landscape Architects



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JERALD A. SNOW
 LANDSCAPE ARCHITECT

Jerald A. Snow, Landscape Architect
 Jerald Snow
 828.712.0454
 30 Watauga Street
 Asheville, North Carolina 28801
www.jeraldasnowlandscapearchitect.com
geraldasnow@gmail.com

Practicing landscape architecture with an emphasis on environmentally sound site design and a preference for native plant material and sustainable products as a path to preserving our land and water resources.



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Since 1976 LSA has earned a reputation for having a thorough understanding and respect for the Southern Appalachian terrain and environmental systems, we provide a full range of, land planning and landscape architecture services to landowners, developers, conservation organizations, communities and local municipalities.



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Landscapers

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Carolina Native Landscapes
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carolinanativelandscapes.com
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 Weaverville, North Carolina 28787
www.ecomowofasheville.com
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 Asheville, North Carolina 28804
www.gardenology-asheville.com
adgarry@hotmail.com



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www.GreenestGrassInc.com
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PeterRocks
 Peter Pfister
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Snow Creek Landscaping, LLC
 Timothy Boone
 828.687.1677
 226 Clayton Road
 Arden, North Carolina 28704
www.snowcreekinc.com
info@snowcreekinc.com

Sprinkle Creek Landscaping
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 1130 Sprinkle Creek Road
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www.sprinklecreek.com
sprinklecreek@frontier.com

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www.mortgagematchmakers.com
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 10 Woodfin Street
 Asheville, North Carolina 28801
www.hometrustedbanking.com
marykate.rikard@hometrustedbanking.com

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 Asheville, North Carolina 28813
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Realtors

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 As an Eco-Certified Broker/Realtor I educate my clients on green and environmental issues when purchasing or selling a home.



Jody Whitehurst, REALTOR - Town and Mountain Realty
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 Buying or selling real estate in Western North Carolina can be a complex journey. Let me simplify your experience through hard work, thorough research, and thoughtful communication.

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Love The Green
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 Asheville, North Carolina 28801
www.lovethegreen.org
lovethegreeninfo@gmail.com

Love The Green Team is a full service real estate company for buyers and sellers. As full time Realtors we are committed to providing the absolute best professional services throughout the entire transaction. Our team approach allows us to help people in a more timely and efficient manner. Call today.



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At Mosaic Community Real Estate, we specialize in green real estate and in-town properties. Our approach to real estate is to advance the interests of our clients by being attentive to their needs and to negotiate aggressively on their behalf. Real estate is our job and passion. Call or email for a free consultation over coffee or tea.

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Robbie McLucas, Realtor - Town and Mountain Realty
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As a real estate broker at Town & Mountain Realty, Robbie focuses primarily on Asheville's core neighborhoods. He provides clients with specialized services and an in-depth knowledge of this city's vibrant communities. Additionally, Robbie works as the listing agent for several of Asheville's most successful green builders.



United Real Estate Asheville
 Mary Ellen Brown
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 Asheville, North Carolina 28803
www.unitedrealestateasheville.com/
[mebrowna.sheville@gmail.com](mailto:mebrown.asheville@realtor.com)
 Green Real Estate Solutions Mary Ellen Brown: knowledge of green elements, experience helping buyers and sellers, love of place and respect for the environment

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 The Asheville Habitat ReStore sells donated items to the general public, with proceeds supporting Habitat's building programs. Find building supplies, appliances, furniture and much more. The removal of usable materials from structures is available through their Deconstruction service.

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 Fairview, North Carolina 28730
www.sugarhollowsolar.com
info@sugarhollowsolar.com
 Sugar Hollow Solar is a full-service renewable energy and radiant heating company focused on design, installation, and service in Asheville, North Carolina and the surrounding WNC counties. Our team has over 45 years of combined experience helping residences, businesses, and government go solar.



Sundance Power Systems, Inc.
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www.sundancepower.com
info@sundancepower.com
 The Southeast's premier renewable energy company, serving residential and commercial clients since 1995. Our technical expertise includes design and installation of solar hot water and radiant floor heating systems, as well as solar, wind, and micro-hydroelectric power systems. We also serve our customers by providing information on tax credits for renewable energy systems, and help establish grid-tie partnerships with NC Green Power. With the energy of the sun, wind and water, we empower people to participate in the solution to our energy challenges.



Thermacraft Solar Solutions, Inc.
 Michael Pope
 828.285.8825
 PO Box 8833
 Asheville, North Carolina 28814
www.thermacraft.com
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Renovators & Remodelers



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 Asheville, North Carolina 28813
www.a-b-construction.com
jeremybonner@a-b-construction.com
 A&B has been in business for over 30 years doing new construction and renovation for both residential home owners and commercial clients within a 50 mile radius of Asheville NC.



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 Asheville, North Carolina 28804
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andy@builtwright-construction.com

Burdett Building and Remodeling LLC
 Bill Burdett
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Continuous Improvement Construction LLC
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 Black Mountain, North Carolina 28711
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cicld.duane@gmail.com



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 Gary Daniel
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www.goinggreenbuilders.info
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Green Built Environments
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 Custom home builder and remodeling contractor that is fully licensed and insured, providing you expertise and commitment in home construction. HomeSource Builders offers turnkey service, including home design, kitchen and bath design and product selection all under one roof. Current and past projects include over 100 custom homes and hundreds of remodel projects from large to small.

On average, landscaping techniques for shade, passive solar and windbreaks can save enough energy to pay for itself in less than 8 years



Jade Mountain Builders & Co. Inc.
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 828.216.0914
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 Asheville, North Carolina 28805
www.JAGGREEN.com
jody@jaggreen.com
 JAG Construction is small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, and long lasting houses more available to the general public. We are always examining new ways to reduce the impact of construction on the environment around us and preparing for a future of alternative energy.



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 Rare Earth Builders builds custom homes of high performance and exceptional beauty while minimizing negative environmental impacts - all with careful attention to the many construction details and client comfort.



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 503 Old Farm Road
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Residential Designer



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Living Stone Construction, Inc.

Sean Sullivan
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www.livingstoneconstruction.com
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Mountain Sun Building & Design

Emily Boyd
828.713.0549

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Asheville, North Carolina 28804
www.mountainsunbuilding.com
emily@mountainsunbuilding.com
MSBD focuses on creating bright, energy efficient, site-specific custom and spec homes. 2013 PoH Green Home award winner, we work with your plans or design/build a custom home on your land or ours.

SDM Design, Inc.

Stephen DerMargosian
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Reuse Retail



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Scott Stetson
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www.ashevillehabitat.org
sstetson@ashevillehabitat.org
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RCJ Building

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