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DIRECTORY 2017-18

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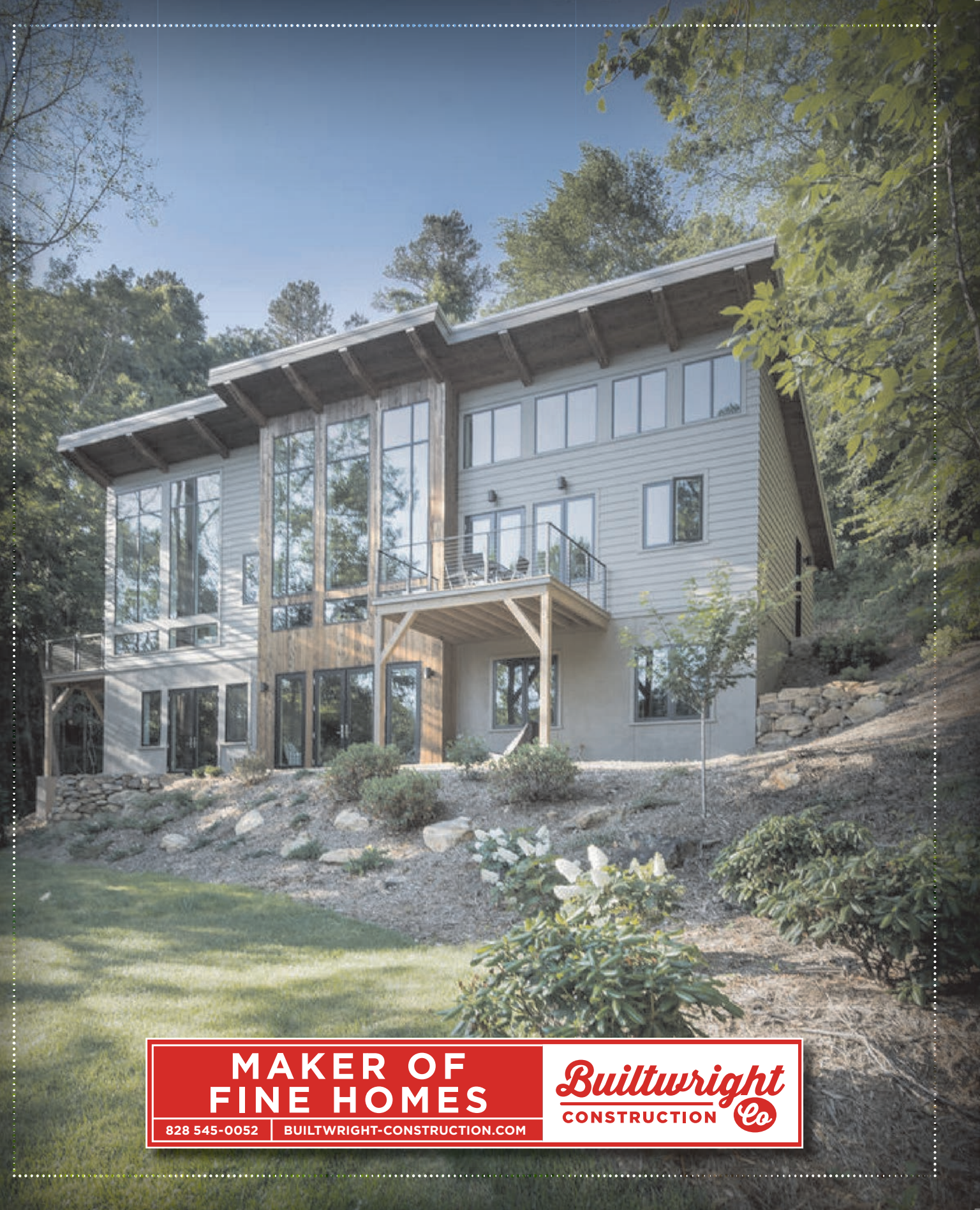
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Asheville Green Builder since 2003

Inside

On the cover

Solfarm Solar installs a 7.29 kW hybrid system on the Portwood residence, a modern solar-passive home in Weaverville. MARGARET HESTER PHOTO

Dedication

Maybe there is something in the water, or just love in the air.

Each of our three staff members had a baby born recently: Opal in May 2016, Pearl in January 2017, and Naia in May 2017. These beautiful babies bring us such happiness and instill a motivation to be of greater service to our community and this amazing planet.

And so we dedicate this edition of the directory to our daughters. May our words and daily actions reflect our wish for you to live in a healthy world where all people, places, plants and animals have the ability to survive and thrive.

From top left, Program Director Maggie Leslie, Executive Director Sam Ruark-Eastes and Community Engagement Director Cari Barcas. From bottom left, Maggie's younger daughter Opal, her older daughter Sophia holding Sam's daughter Naia, and Cari's daughter Pearl. PAT BARCAS PHOTO

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Welcome to the directory


MARGARET HESTER PHOTO

The 2017-18 Green Built Alliance Directory is offered to the community as a source of information and inspiration; a guide to highlight sustainability professionals and give insight on the technical know-how of green building; and a window into regional action on clean-energy issues.

We hope this 13th edition of the annual Green Built Directory will provide guidance on how to improve your home, get involved in clean energy efforts, and find a contractor, architect, or realtor. This year's directory and a dozen previous issues live as a permanent online resource at www.greenbuilt.org.

It is our intent that this Directory motivates our community to deepen its commitment to living in right relationship with each other, our neighborhoods, and these ancient mountains.

How to use this resource

Find the list of green building companies and professionals in the back of this directory. Contact them for support in designing, building, remodeling, or improving a new or existing home or commercial building, and let them know that you found them through our Directory.

The articles and case studies in this directory can provide you technical expertise, plug you into our regional clean-energy action, and hopefully inspire you to act to co-create the sustainable future we desire for our community and world.

Who is Green Built Alliance?

This directory marks a new chapter for our organization. With gratitude for the legacy of the WNC Green Building Council, we look ahead to the future with excitement as our nonprofit grows and rebrands as Green Built Alliance.

This new chapter finds us partnering on new projects and charting a collaborative path for a clean-energy future for our region, while remaining focused on advancing our home certification programs and serving our members well.

Because we have established good name recognition and a positive reputation in the community since our inception in 2001, some may ask why we are changing our name after 16 years.

In 2016, we worked with WNC Nonprofit Pathways to gain insight on ways to improve our organization. Their main suggestion was to change our name as part of a larger effort to improve our branding and marketing of who we are and what we do. Supported by a small grant from the Community Foundation of WNC and the expertise of consulting firm Design One, we received the recommendation to become Green Built Alliance.

GREENBUILT ALLIANCE

Advancing Sustainability in the Built Environment

After months of introspection, we brought this new name to a vote by our Board of Directors as well as our full membership in the spring of 2017, and both enthusiastically approved.

With its origin in the name of one of our core programs, we believe this new name reflects not only where we have been as an organization but also where we hope to go in the future, representing both the solid roots of our nonprofit as well as the potential for new growth and expansion moving ahead.

With a federal government hostile to the environment, it is more important than ever that we take action on the local and regional level to advance the sustainable path we all need. Through our alliance of connected members, businesses, local government and community nonprofits, we are helping shape the building practices and clean energy future of our region.

While our mission remains the same as Green Built Alliance, we are excited to explore new opportunities for collaboration with our valued members and connection with the broader community.

In conjunction with the rebranding, we are launching our new website at www.greenbuilt.org and renaming our flagship Green Built NC program "Green Built Homes."

As a membership-supported nonprofit organization, we are here to serve the community thanks to the continued support of our business and individual members. We hope you find this directory and all the services we offer to be a valuable contribution to our community.

Year in Review

- Certification has remained steady with us certifying 137 Green Built Homes and 132 LEED homes from August 2016 to July 2017. In Buncombe County, there are now 15 certified Net-Zero Energy homes producing just as much energy as they use. Green Built Homes is growing and we are reaching out to areas beyond Buncombe County to encourage building professionals to certify their homes through us.
- Our collaboration continues with the Land of Sky Association of Realtors and the Asheville Home Builders Association to deliver the Building Green Real Estate course, which is designed to share best practices with builders, Realtors® and general contractors. We host an average of two classes per year and educate 30 professionals each time. We are in the process of getting a continuing-education course for Realtors approved by the North Carolina Real Estate Commission.
- Through Appalachian Offsets, we are raising money to fund a solar system on Isaac Dickson Elementary School, which would make it one of the first Net-Zero Energy schools in the southeast. We have secured a matching grant to pay for half of the $220,000 fundraising effort. In April, we completed an energy-efficiency retrofit for Opportunity House that will save them approximately $10,000 per year. Please visit www.cutmycarbon.org to learn more and contribute.
- We received a Z. Smith Reynolds Grant to support our Green Gauge program and our work on the Energy Innovation Task Force.
- The 2016 CiderFest NC was a success, with more than 1,200 festivalgoers supporting the cause while enjoying tasty cider. The fifth annual CiderFest will be Oct. 7, 2017 at the Salvage Station. Visit www.ciderfestnc.com for information and tickets.
- Our nonprofit launched its first annual disc golf tournament as a success this spring. Be on the lookout for the next tournament in April 2018.
- Our annual membership party takes place September 14, 2017 at Highland Brewing.
- We continue to distribute 25,000 copies of the Directory annually.
- We gave presentations at the State Energy Conference, North Carolina High Performance Buildings Conference, Asheville Build and Remodel Expo, WNC Home Garden and Green Living Show, Buncombe County Board of Commissioners meeting, Energy Innovation Task Force meeting, City of Asheville's Sustainability Advisory Committee on Energy and the Environment, and Henderson County Home Builders Association.

The roof garden slows stormwater runoff, but more importantly provides a great spot to relax in the evening and keep an eye on Mount Pisgah.
KEVIN MEECHAN PHOTOS

Home for life

The complexity and compromise of building my second and last personal home

BY JAMIE SHELTON

In more than a decade as a green builder, I've built two homes for myself.

The first one was easy. The house was built on a fairly normal mountain lot on a fairly normal mountain road. It was a nice Green Built home I knew I could sell in the future when I wanted.

The second was much harder. My wife and I found a great deal on a large piece of property very close to town and decided to buy it with my parents. In all likelihood, this was going to be the last house I ever built for myself, so I really needed to get it right.

In the meantime, I had to keep up a very full work schedule, live out of a vintage camper, and, as I found out about halfway through the project, get the house done before my first child was born. Bringing him home to the camper was not considered an option.

I started with a list of what I liked about our old house (overall size, general layout, lots of south windows) and what I wanted to do differently (this time I wanted a modern exterior, a bigger great room, one more small bedroom). I also had some goals for the project: Green Built Homes certification, net-zero energy, green roof garden, and some cool metal work.

Decisions were really tough because I wanted to build this house in about a year instead of the two and a half years I took to build my last personal home, but I also knew I needed to be happy with the product for the rest of my life. There were compromises everywhere.

One of the first was losing the huge garage attic from the old house that was my storage and woodworking area. I enlarged the garage a little to make up for this but I still miss the attic.

Another area I compromised was on the stairway. I had always wanted to build an all-steel stairway that allowed for a visual connection between the three levels. I opted for a very nice metal railing and some thick maple treads.

One area where I did not have to compromise at all was on energy. Energy efficiency had come a long way since I built my original house in 2008.

First of all, LED bulbs have become available and affordable. Wow — why couldn't we have done that sooner? They come on bright immediately, the light color is great and they use so much less energy than the old CFLs.

Next was the photovoltaic array for solar power. I spent less on the materials for my new 8 kW array than I did for my previous 5 kW array. We currently produce about 2,000 kWh more than we use every year.

Today's heat pumps are also greatly improved. Both my geothermal heat pump and especially my heat pump water heater from 2008 were too loud for nearby conversation. Not so with the new ones. The first time I turned on the new air source heat pump, I thought it was broken. I heard the thermostat click to start the unit and then heard nothing. I opened my front door; still nothing. Finally I walked around the corner to look at the unit. The fan was spinning and once I was about 10 feet away, I finally heard it. Same thing for the air handler inside. The heat pump water heater is equally pleasing; it is faster, quieter and more efficient than I was used to.

Plumbing products have made some strides for energy efficiency as well. We always plumbed with copper until we found a PEX product we felt offered the same durability and the best warranty in the business. Once we switched over, we were thrilled we did. This product has made it so easy to run hot water "home runs" from every bathroom to the water heater. I was able to use about four feet of three-quarter inch hot water piping leaving the water heater, and then I switched to all half-inch runs. I didn't know how long I was waiting for hot water before. Between the half-inch home runs

Large south-facing windows in the great room are a trademark of passive solar design and give lots of winter light and warmth as well as a great view.

Finding a lot of cherry timber standing in the path of my driveway gave me the opportunity to do lots of custom-cut, live-edged trim details with my favorite wood.

and low-flow showerheads, we have dramatically reduced our water heating energy consumption and increased our comfort level.

One of the unexpected opportunities I encountered during the project was a nice stand of cherry trees right in the middle of my driveway. The trees were in a very overgrown area and I had never noticed them until I started clearing.

I was not planning on using any lumber from my site in my house because of the amount of work that requires and the very tight timing of getting trees down, milled, stacked, dried, dressed and finished by the end of drywall hanging, but cherry is one of my favorite woods and I couldn't pass up the opportunity.

It was a big push but I got the wood milled on site and then built a makeshift kiln around it. I dried it out using heaters, fans and dehumidifiers. It was not your textbook drying process, but it worked. In the end, I got to use a wood I love but would probably never buy in that quantity, and I got to leave a lot of live edges on the boards for window sills, headers and baseboard which makes a tremendous impact on the interior of the house.

I'm thrilled I went through the Green Built Homes program, even though I didn't do it as well as I should have. I was majorly stressed trying to get this project going and did not design the home catering to Green Built, but rather built the house and then evaluated it with the program. Fortunately, between my normal energy package and the net-zero-sized PV array, I just made it to the Platinum level of the Green Built Homes program. I had to make a few tweaks at the end of the project to get over this threshold and all were items I am glad I included. I was extremely proud when I received that certificate.

I completed the house in September of 2015, beating my son's arrival by about four months. I survived the process of working as hard as I could for a year straight. After a year and a half here, I've found a few things I wish I had done differently but I think I can live here for the next 50 years.

One of the things I love most about houses and building them is their humanity. Houses, like the rest of us, are never perfect. In the ideal scenario, a house is built using the best materials and technologies of its day, and with its future occupants and their interests in mind. I have no idea what the future holds, what new technologies will be available, and what the climate will be like. I can only hope in 50 years I will still feel like I live in a home built to stand the test of time.

Jamie Shelton is a partner at Blue Ridge Energy Systems, a design-build firm focusing on energy-efficient and durable home building. He lives in Asheville with his wife Rachel, son Arthur, and dog Iris.

Being green and saving green

Asheville Area Habitat for Humanity leads the way

Volunteers working on a habitat home, and one of the families served by Habitat at their house. ASHEVILLE AREA HABITAT FOR HUMANITY PHOTOS

BY GARRET K. WOODWARD

Since 1983, Asheville Area Habitat for Humanity has constructed around 300 homes that have provided shelter, as well as a brighter future, to hundreds of families in need of a new beginning.

"We try to provide a home that's affordable for our partner families," said Sumaya El-Attar, Asheville Area Habitat construction administrator. "That means a house where all the systems built into the home run efficiently."

Within all the opportunities they provide for area families, there's also been a long-time push for green-certified Asheville Area Habitat homes.

"Habitat for Humanity has made a commitment to green building and sustainable standards for all homes we construct around the country," said Paul Reeves, Asheville Area Habitat director of construction services.

Besides providing a house that is airtight and low in monthly energy costs (for example, a three-bedroom home has an estimated monthly heating/cooling bill around $29.30, give or take), Asheville Area Habitat made a commitment early on to get its homes certified through the Green Built Homes program.

Asheville Area Habitat certifies to Green Built Homes standards and participates in the North Carolina Housing Finance Agency's SystemVision program.

"Being in the SystemVision program allows us to guarantee heating and cooling costs for the family buying the house from us, and it's an important part of the financing package that we use to fund the

"What drives us is that a lot of this green technology is very expensive, so we have to be price-conscious on the front end."

— Paul Reeves, Asheville Area Habitat of Humanity director of construction services

Asheville Area Habitat for Humanity Construction Administrator Sumaya El-Attar (left) doing a walk-through with homeowner Cindy Hensley.

building of the home," Reeves said.

Knowing that Western North Carolina is an innovative, progressive region for the growth of green building techniques and community initiatives, Asheville Area Habitat approaches what it's doing as a two-way street with local contractors and organizations.

"We see what other contractors are doing and, in turn, we share our techniques and what we're doing to be cost-effective on top of being green certified," El-Attar said. "There's always another problem that needs to be solved. Habitat will always search for the solution to the next issue."

Asheville Area Habitat plays a unique and multifaceted role as it supports families through the process of becoming homeowners.

"We're the builder and the bank," Reeves said. "When we qualify families to partner with Habitat, we have to partner them with all of the qualification of the Dodd-Frank Act, on top of gathering the volunteer labor and donated materials."

When building homes, Asheville Area Habitat is careful to only incorporate technologies that partner families can afford, knowing that they may need to fix or replace things that break down in the future.

"We can't build technologies into the house that drives the price north of what a family at 70 percent of area median income can afford to buy from us," Reeves said.

As it tries to strike a balance between cost-effective approaches and green-building standards, Asheville Area Habitat has become viewed as a litmus test for other contractors in the region.

"Habitat is really a microcosm of the construction market here," Reeves said. "What drives us is that a lot of this green technology is very expensive, so we have to be price-conscious on the front end."

Reeves noted Asheville Area Habitat has certified more Green Built Homes in recent years than any other single builder in the state.

"This is a long-term commitment," Reeves said. "Our business is about building and preserving affordable housing in the community. For our partner families, these homes are the single biggest investment they'll make in their lives. It's about making those homes as livable as possible — homes that perform well and are affordable to maintain."

There's no place like home! (And yes, we'll be Ashevillianing up those outside walls.) JOHN SHORE PHOTOS

Kermit builds a home

Crafting the first and last house we'll ever own

BY JOHN SHORE

My wife Cat and I had five requirements for the first (and last because we ain't young) house we'd ever own, let alone build. The house needed to be:

1. Within walking distance of downtown. Because old, not dead.

2. As green as possible. Because earth.

3. As inexpensive as possible. Because money.

4. Face south. Because of plan to one day install photovoltaic panels we couldn't afford when built. Also because of garden sunny enough to grow our own food — particularly tomatoes, the first bushel of which, given the price of tomatoes at the grocery store, should save us approximately enough money to be able to afford PV's not just for our house, but for every house in Asheville. And Greensboro. And Charlotte.

5. Have a big porch. Because sitting in rocking chairs and waving at neighbors.

In short, we wanted a house that expressed our inner selves, which is essentially Kermit holding a fistful of coupons: green, cheap, friendly, artsy, and basically from the early '70s.

Achieving our dream home meant we'd need three people: an architect to catch our vision, a builder to realize that vision, and an educator to teach us everything we could learn about the science of green building before we fell to the floor clutching our heads and screaming, because if Albert Einstein himself had decided to master that particular field of disciplines, he would have surely ended up living in a hole in the ground dementedly worrying a chunk of foam insulation and muttering to himself about how he should have stuck to something simple, like theoretical physics.

We found our educator first, that being Green Built Alliance member Amy Musser, a Jedi Master of sustainable building whose blog is a boundless gift to anyone seeking wisdom in the ways of airtight building envelopes, whole-house ventilation, and hot water recirculation loops.

Next to join Team Kermit was Ashevillian architect and Green Built Alliance board member Steve Farrell. Steve's initial response to our telling him how much money we had to spend on our house made me think he must have misheard the number.

"That's for the whole house," I repeated.

"Gotcha," said Steve. "And I'm on board like an octopus wearin' deck shoes. A small, affordable green home? You two are singin' my song, right there. Let's do this!"

Last but hardly least, fate brought our way Asheville's Doug Keefer of SAGE Builders, also a member of the Green Built Alliance. "I love working with Doug," said Steve. "He's quieter than snow fallin' on a cotton bale, but his word is solid gold."

"Doug is one of my favorite builders," said Amy.

"Please build our home," we said to Doug. Fixing us with his Jack of the Wood stare, Doug nodded once, and we had ourselves a builder.

As I write this, we're about one month away from moving into our brand-new two-story, one-bed, one-and-a-half bath, 1,100-square-foot, massively-porched home.

Here are a few factoids about the house into which we're so itching to move that for about six months now we've basically been living on its porch, as all of our future neighbors will readily attest:

1. From ground to roof, it's made of precast concrete. This makes the structure airtight, super-insulated, low maintenance, durable, impervious to rot, and heavier than Mount Everest. It also makes people slow their cars way down so they can stare at it.

2. The windows are Low-E 366 glass. This means they block out 95 percent of the heat that would normally come pouring in with the sun's rays. No heat in or out? Lower heating and cooling costs. Watching these high-tech windows profoundly confuse cats? Priceless.

3. Air circulation-wise, we'll be using three mini-splits and an ERV system. And if, as did I, you think that ERV stands for Excessive Re-

The cement box we'll call home is completed in one-and-a-half days.

action to Vampires, you are wrong. True, an excessive reaction to vampires would probably stir up the air, but it wouldn't do the job like an Energy Recovery Ventilator. And I can only hope, deeply, that cracking up at the term "mini-splits" is not a sure indication that one is too immature to own a home.

4. Our one-gutter metal roof design makes it easy to harvest rainwater. I have been singing to myself that song about "Slide down my rain barrel" for nearly 60 years, so to say I'm stoked about owning an actual rain barrel is an understatement. I've also recently learned that metal roofs contain no algaecides, as typical composite shingles apparently do. I assume that's good for algae. But is it good for the water barrel our algae will slide down into? I don't know. But I do know that song is now ruined for me forever. Thanks, science.

5. We added fiberglass insulation to the interior walls to bring them up to a respectable R-30. Technically speaking, that is one more than R-29. Our roof comes in at R-23. But we'll see if that number doesn't bump up once the roof is covered by all the algae that somehow resisted sliding down my rain barrel.

6. The trees we had to cut down in order to build our house were sent to a wood mill, where they were cut and kilned into gorgeous wood. We used in our house every inch of that wood that we could afford to buy back from the mill.

7. Our heat pump water heater will keep us in hot water and dehumidify our ground floor. Since the thing will be located not 15 feet from my office desk, I'm hoping it'll also dehumidify me a little. I sweat a lot.

8. Our home will be Energy Star and Green Built Homes certified. I'm not yet sure what I'll be wearing to the awards ceremonies that I assume these honorifics will occasion. But something green, obviously.

John Shore writes an advice column, "Ask John," for the Asheville Citizen-Times.

Framing done; insulation on ceiling.


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Craggy Park in West Asheville...not just a location; it's a lifestyle.

Going off-grid

The dollars and sense of living off the grid

BY NED RYAN DOYLE

The idea of off-grid living means different things to different people. Most presume, accurately, that it means not being connected to the power grid or a utility. Some imagine it's about living a primitive lifestyle with no electricity at all or, at the other end of the spectrum, expensive and complex energy systems only the rich can afford. In reality, going off-grid does not have to mean a primitive lifestyle nor have to be incredibly expensive and, in fact, it can be affordable and very comfortable.

The first step, before addressing any technical aspects, is to examine and consider your motivations and your circumstances. Why do you want to go off-grid? Some want to go off-grid for important environmental reasons, such as the grid's reliance on dirty fossil fuels and dangerous expensive nuclear power. Some want to go off-grid to save money. Some want to go off-grid for security and reliability reasons. Some find the cost of running a transmission line to a remote home site is more expensive than an off-grid system. There are many reasons to consider going off-grid.

As one who has been off-grid for over 20 years, my reasons were a combination of the environmental concerns, economics over time, desire for reliability and the cost of running a transmission line to the site. With my background in sustainable energy, it really was a no-brainer choice to make, even decades ago. But it's not often that simple for everyone.

If you live in a home that's already grid-connected, going fully off-grid for environmental reasons is tempting, however a grid-tied solar photovoltaic (PV) can meet your goals of clean energy with a balanced, net-zero energy system. The environmental challenges we face collectively with conventional grid-derived centralized energy are the result of power generated from non-renewable and dirty energy sources, not the distribution system itself.

(Above) Roof-mounted solar photovoltaic panels offer clean energy while saving space in your yard. For best output in most cases, solar PV panels should be within 20 degrees of true south. (Left) Battery banks are integral to off-grid systems, yet do not need much floor space. This 48-volt battery bank provides power to the adjacent inverter which produces conventional 120 volt AC for the home. SUNDANCE POWER SYSTEMS PHOTOS

The trajectory nationally and globally is towards a decentralized power grid system which means, in the simplest terms, transitioning from a central power generator that serves many tens of thousands to a distribution system that quite literally distributes power from many smaller sources onto the grid.

It's true that there are challenges in implementing, modernizing and upgrading the grid system, however there are no actual technological barriers today. The more people who produce their own clean energy and share it with the grid, the better off we all are environmentally.

If you live in a home that's grid-connected and are concerned about reliability issues, such as medical devices that need uninterrupted power, a basic battery-backup system charged by the grid can meet these needs in all but the most extreme weather events and outages. Whether a battery-backup system is charged by clean energy or the grid, there is emerging value for a decentralized grid in being able to both charge and withdraw energy (within parameters) to address peak demand and grid stabilization without needing to burn additional fossil fuels in a central power generator.

Interestingly, newer electric vehicles (EVs) can function as a battery-backup source in a power outage. In a best-of-both-worlds scenario, a home with battery backup, or an appropriate EV, and solar PV can support a decentralized grid while offering personal reliability in case the grid does fully

go down for an extended period.

Going off-grid just to save money is more complicated, however it comes down to understanding that going off-grid is a solid long-term investment, not a short-term quick-profit scheme.

If you're building a new home and taking on a mortgage that includes an off-grid infrastructure, the energy savings will cover additional costs in monthly payments for that system. To retrofit an existing home without financing, i.e. pay the cost upfront, there is still a payback in savings and tax advantages for now, typically in the range of seven to 10 years. In either case, financed or upfront, when the system has paid for itself in savings, you still have the capital investment in the home.

The charge controller (right) monitors and controls the flow of solar energy from the photovoltaic array to the battery bank. The inverter (left) is typically located as close as possible to the batteries to reduce low-voltage line loss, while its high-voltage output can run long distances into a home.

While an exceptionally better investment than buying a car, there are some parallels. Not everyone can afford a new car or high-quality used one out of pocket; nearly all cars are financed. Some folks can outright buy a Tesla; some folks take the transit bus.

If you have the money, or income to finance, it's a great long-term investment. If you're just getting by, it's much better to invest in energy-efficiency measures to reduce your power bill.

It's clear that investing in an energy system (off-grid or grid-connected) is far better than buying a car for the same price. At the end of 10 years, most cars have cost you thousands of dollars over the purchase price and are essentially worthless, or at best, worth a small fraction of the purchase price. On the other hand, at the end of ten years, you will have paid for an energy system which still has its value and will work for many more years.

One compelling economic reason to go off-grid is a remote location away from the existing power lines. The cost of having transmission lines run to a location varies, depending on terrain, distance and other factors, but can easily be $15,000 per mile or more. And then you get a monthly power bill! While my location is only about a quarter mile from the end of the power line, 20 years ago, the estimate was for between $5,000 and $6,000. A slam-dunk case for off-grid living!

If you've read this far and going off-grid makes sense for you to consider, great. Presuming you don't have unlimited money to spend, here are a few essential tips on a practical level for the design and building an off-grid energy system.

No. 1, top priority: energy efficiency matters!

Do a comprehensive energy audit to determine where you need the power. In a new building, incorporate as much green design as possible, such as natural day lighting, plenty of insulation, solar orientation and other features to reduce demand and increase comfort. Retrofitting an existing building can be more challenging, however the same principles apply.

Use LED lighting — now available in different ranges, such as soft white, warm, white and daylight — to dramatically reduce lighting energy demands.

It's virtually always less expensive to invest in high-efficiency appliances than to pay for extra solar panels, a larger wind turbine or more batteries to run cheaper, inefficient ones. This especially applies to refrigerators. Instead of a conventional electric water heater tank, consider solar thermal systems or gas on-demand water heaters. Instead of an electric stove, use a gas stove (generally propane for off-grid applications).

Design the battery bank for two to three days of power, rather than seven days. Rarely will it be cloudy, snowing or poor solar weather for more than a few days, and a small backup generator to charge the battery bank is far cheaper than designing for worst-case scenarios.

Perhaps most important, take an active role in understanding and interacting with your system. Unlike the "plug-and-pay" approach to being connected to the grid, your awareness of energy supply and consumption matters off-grid, not only for the costs but for a comfortable lifestyle.

It's not a chore; it's educational, informative and often interesting to have control over your own power. One of the joys I've found living off-grid (forgive me in advance) is when the winter blizzards hit, the grid goes down, and others face freezing pipes and cold homes, while I can follow it all on TV, perhaps choose a video to watch and relax comfortably until it passes.

Ned Ryan Doyle is a sustainable energy and environmental advocate with decades of experience and activism. Currently co-chair of the Energy Innovation Task Force's Technology Work Group, he works from a personally designed and owner-built fully off-grid workshop powered by solar energy. Contact Ned at nedryandoyle@earthlink.net.

This house smells

The dangers and opportunities IAQ presents in homebuilding

BY SEAN D. SULLIVAN

"This house smells ... different than the rest. Actually, it doesn't really have a smell?!" Mrs. Lee said as she walked into the Parade of Homes entry I was manning last year.

Mrs. Lee, like many other visitors in years past, noticed what most builders are missing across the country: the importance of indoor air quality (IAQ).

I had the privilege, two years ago, of sitting in a research lab think tank with seven other top builders from across the nation. The question was posed to us: "What is the greatest concern you have about the homes you are building today?"

Each builder at the table said they were concerned about building homes so tight they might be poisoning the people that move into them.

When they got to me, I was dumbfounded by their answers and had to ask my own question, "Are you using a rater?" As they all shook their heads no, it occurred to me that I was the only one at the table who was testing and certifying my homes.

Did they have reason to be concerned about the health of their customers? You bet. According to the EPA, we spend as much as 90 percent of our time indoors, and our indoor environment is two to five times more toxic than our outdoor environment. In fact, 80 percent of all cancers are attributed to environmental rather than genetic factors, including exposure to carcinogenic chemicals, many of which are found in household cleaning products.

Statistics show that people who live in green homes are happier, healthier, and more productive than those in non-green homes. Additionally, green homes sell faster, and for more money, than their non-green counterparts.

When I ask my prospective customers why green is important to them, they usually respond with an answer about being a good steward of the environment. Although green homes do give consideration to the external environment, builders have failed to recognize — and therefore educate people on — the fact that the indoor environment is equally important.

Green-certified checklists include categories for site, water, energy, materials and IAQ. There is an additional more stringent certification you can get within this checklist that focuses specifically on IAQ called "Indoor airPLUS."

According to the EPA, we spend as much as 90 percent of our time indoors, and our indoor environment is two to five times more toxic than our outdoor environment.

The checklists identify causes of indoor air pollution and offer points for remedying them. Sources of indoor air pollution include radon, tobacco smoke, mold, cooking and heating, household products and building materials.

Most people have heard of VOCs (volatile organic compounds) and formaldehyde, but few realize just how dangerous that they actually are to breathe.

We recognize these dangers and therefore have made it a standard to certify every home we build. We educate the client about the products that we are going to be using on their home like low-VOC adhesives, water-based finishes, shelving that is compliant with the California Air Resources Board (CARB) Phase 2 standards, and drywall that absorbs the remaining VOCs left in the home. We also make recommendations on products that they may select after moving in such as air fresheners, cleaning products, mothballs, furnishings and furniture.

Above: This master bedroom features cedar tongue-and-groove ceilings and maple floors, both with low-VOC stains, low-VOC paints, and LED bulbs. RAY MATA PHOTO Below: This kitchen features low-VOC paints and stains, low-VOC grouts, AirRenew drywall, low-VOC cabinets and a repurposed existing brick chimney chase. RYAN THEEDE PHOTO

Building a new home presents unique opportunities to get exactly what you want. Design, style, finish and energy conservation are usually the top reasons for building new. However, if you do your research, you may find that building a certified green home can present the greatest opportunity that you have to protect and preserve your health so that you can live a happier, healthier life.

Sean D. Sullivan is a leading green builder and a past president of the North Carolina Home Builders Association. In 2016, he was named the National Association of Home Builders' Certified Green Professional of the Year. In addition to building aging-in-place projects, his firm Living Stone Design+Build is dedicated to certifying all their new homes with Energy Star, Green Built North Carolina, and Indoor airPLUS certifications.

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Building health from the ground up

Minimizing the risk of mold in construction projects

BY AARON CAREY & JOEL KLOPP

The opportunities for moisture and water intrusion during the construction process are endless.

In the past, this posed fewer problems due to less "air-tight" construction. Today however, high levels of moisture can pose real issues to both builder and homeowner, especially in the green-building industry.

One common issue is the development of mold during the construction project. Prolonged exposure to mold can lead to structural as well as health-related problems, especially for mold-sensitive individuals who are more prone to developing allergic or asthmatic symptoms.

When mold is encountered at a job site, it is time to call a reputable mold-removal company with certified mold-remediation specialists to eliminate the mold quickly and efficiently. There are however, practical ways to prevent mold and eliminate it when it occurs.

Avoiding mold growth during construction requires constant attention to details, and certain best practices can help reduce the risk.

Allowing for and maintaining proper drainage of water away from the foundation throughout construction is of utmost importance.

During the framing phase of construction, high humidity levels or water intrusion into a construction project can create an ideal environment for mold contamination on framing members and insulation. Mold can grow quickly and appear within 24 to 48 hours after water intrusion. Water inside needs to cleaned up quickly and dried before progressing.

Mold can grow in many moisture-prone places in a home, including between the subfloor and the insulation. AARON CAREY & JOEL KLOPP PHOTOS

Frequently inspecting attics, ceilings, walls, window openings, doors, floors, and basement and crawlspace areas for water stains or standing water is necessary. A small water intrusion can develop into a big problem if not taken care of properly. As construction progresses, drywall is very susceptible to mold growth in high humidity situations. Thorough inspection of building materials before and after they are installed is important to avoid problems down the road. If a mold problem is found during a construction project, it is important to eliminate the mold before continuing. Covering contaminated building materials does not prevent further mold growth. Cleaning with bleach is not enough.

Applying mold-inhibiting products can be very effective when done properly and decrease chances of mold contamination. However, if it is not done correctly, or if there is prolonged exposure to moisture, these products may not be effective.

While building, watch for the following common pitfalls, which may create optimal growing conditions for mold.

Sealed crawlspaces that are not properly dehumidified before vapor barrier installation, causing mold contamination of joists and insulation.

Improper sealing of foundation walls, leading to water intrusion and mold infestation.

Improper flashing of windows and doors, allowing water penetration into building materials and structural damage.

Prolonged exposure of building materials to high humidity conditions, giving rise to mold growth.

Installation of hardwood flooring over high moisture content subflooring, resulting in mold contamination and cupping of hardwood flooring.

Undetected plumbing leaks in crawlspaces of homes under construction, bringing on illness after residents occupy the home.

A certified mold-remediation contractor uses a variety of tech-

Improperly sealed spaces around windows can lead to many problems.

niques and products to complete structural drying and mold-remediation projects.

Inspection and monitoring with thermal-imaging cameras and measuring moisture contents of building products are methods used to identify the source and extent of water intrusion and to monitor progress. A mold-remediation professional will use equipment including heated drying equipment, dehumidifiers, high-efficiency particulate air (HEPA) vacuums, and HEPA filtration to eliminate both the conditions conducive to mold growth and the mold itself.

It is important for the mold-remediation professional to work with both the builder and the homeowner to determine what antimicrobial product should be used so that any concerns about chemical sensitivities are taken into consideration. Today, there are many environmentally safe products and methods suitable for individuals with chemical sensitivities. Finally, recommendations can be made regarding any sealers or coatings that may be needed.

Staying vigilant and taking these recommendations into account will ensure not only a healthy living environment from the ground up, but also peace of mind for both builders and clients.

Aaron Carey is president of Precision Restoration Services and an ACAC-accredited Microbial Remediation Supervisor. He holds a bachelor of science degree in microbiology and a North Carolina general contractor's license, and brings more than two decades of experience in mold remediation.

Joel Klopp is project manager and estimator at Precision Restoration Services, as well as an IICRC-certified Applied Microbial Remediation Technician and Water Damage Restoration Technician. He has more than eight years of experience in mold remediation and mitigation, 15 years as a North Carolina licensed broker and 30 years working in construction-related fields.

What to look for in a mold remediator

It is vital for contractors to retain a reliable and certified firm to perform mold remediation. Look for the following qualifications when choosing a company to eliminate and avoid future mold problems.

Companies should carry adequate insurance coverage such as workers compensation, general liability and, most important, pollution liability coverage to protect builders and clients.

A mold-remediation company should have certifications recognized by the remediation industry, such as mold-remediation certification from the ACAC (American Council for Accredited Certification) and/or IICRC (Institute for Inspection, Cleaning and Restoration Certification).

It is beneficial for the remediation contractor to also be a North Carolina licensed general building contractor that knows and understands building science.

What are the odds?

A theoretical physicist and a professional poker player team up to build green

BY DON M. NICHOLSON & DONALD P. NICHOLSON

In 1998's "Armageddon" film, an asteroid was hurtling toward Earth at 22,000 mph, and NASA sent Harry Stamper (aka Bruce Willis) to blow it apart with an H-bomb. If only climate change was so easy.

Instead, every second, 7.76 x 1035 photons from space (sun as a blackbody at T=6000K and solar constant 1361W/m2) are hurtling toward Earth at 671 million mph. Most of them pass right through Earth's atmosphere to strike her surface. Earth battles back by reflecting 30 percent of them — this is why Earth is a beautiful blue ball.

The remainder of the photons from space are absorbed and their energy bounces around on the surface, in the ocean, and in the atmosphere until Earth returns fire —va volley of photons of power equal to that which it received.

The total energy of all the photons fired back by Earth must match the energy of the photons that strike it. If Earth fails to give back as good as it gets, then the photons from space win and Earth heats up.

The situation is scary; we are scared.

For 500 million years, plants have handled this battle by taking carbon dioxide out of the atmosphere, stripping off the oxygen and burying the carbon underground so carbon dioxide won't block the photons that Earth fires back.

Our green friends have done a great job, particularly for Asheville, Earth's best climate.

What is "green?" To us, green means supporting plants in their eons-long fight to keep carbon dioxide out of the air by burying carbon.

Americans burn buried carbon at an incredible rate, putting carbon dioxide back in the air. Buried carbon provides most of the energy for production and transportation, as well as to heat, cool, and light our homes. The average American puts about 90 pounds of carbon dioxide into the air every day.

Designed by Don Nicholson and C.M. Wilson, the monolithic Solar on South roof provides 5.3kW of electric power. DON M. AND DONALD P. NICHOLSON PHOTOS

The heat pump dryer in this West Asheville home helped it achieve Green Built Platinum and Net-Zero certification. Note the interior windows transferring light from passive solar clerestory, eliminating need for windows that penetrate the envelope, and the use of lumber milled from displaced trees from the site.

Green Built Alliance supports a spectrum of goals for the "built environment"; they are all wonderful goals. Do they define green?

For some, green refers to an architectural style or a color palate.

For us, green means always focusing on the approaching asteroid — that is, climate change.

We focus on innovation. We strive to build the best homes on the planet that are also the best homes for the planet by discovering cost-effective techniques that advance building science. Our approaches must be economically viable; only in this way can they spread to have a broad positive impact.

We are developing and using new building techniques. Our homes incorporate materials that generate less carbon dioxide during manufacture; they sequester carbon; and they use very little energy.

Our homes generate less carbon dioxide because we avoid the use of concrete. Five to 10 percent of global manmade carbon comes from the manufacturing of concrete. By not using concrete, we avoid putting about two tons of carbon dioxide into the air for each house. We build our foundations with foundation-grade treated wood that is supported, kept dry, and held in place by massive amounts of gravel.

Can it be good to cut down trees? Trees use the carbon dioxide they take out of the air, and turn the carbon portion into wood. Wood is basically solidified carbon held together by a sprinkling of hydrogen. If trees die and rot, or burn, then the carbon simply returns back into the air as carbon dioxide. Milled trees can be great carbon dioxide combatants! They capture the carbon as lumber and we store it long term in houses so it does not add carbon dioxide to the air. Trees are regrown and the process begins anew. We take special care not to waste wood and we sequester as much carbon, i.e. wood, as possible; for example, by using our scraps to build a "carbon wall."

Our homes use very little energy from burned carbon. Over the next few decades, electricity from the grid will come mainly from burning buried carbon. For now, we must maximize solar-photovoltaic rooftop capacity and minimize electric use.

Existing homes have the greatest potential for energy savings and present the greatest challenges. Often it is not viable to transform an existing home into a completely green home. For these circumstances, we invented a solution we call an "environmental safe room." The very efficient "safe room" is a family's refuge for harsh economic, weather, or utility-supply situations — particularly when paired with solar battery backup that supplies key circuits only.

The asteroid of climate change is coming; the building industry needs to innovate now to avoid Armageddon.

Don Nicholson's career went from carpentry to physics, attaining his doctorate in that field in 1982. He did materials research at Oak Ridge National Lab in Tennessee until 2014, when he teamed up with his son Donald, a professional poker player, to form their green-building company, Nicholson and Sun. Don and wife, Christina, live near UNC Asheville where he is a physics research professor. A member of the Tennessee Bar Association, Donald studied economics at Sewanee and received his juris doctor degree from the University of Memphis. Donald, Krystal, and their daughter, Maple, live in Asheville.

Big impact steps to save big energy

Extreme sealing (0.5ACH at 50PA): Our unique approach places a continuous polyethylene sheet in a protected space between two exterior stud walls. This layer is essentially free of penetrations. In the early stages of framing, we do not cut window openings in the poly so we can use blower door equipment to check for perfect air sealing. As we install windows and doors, we periodically recheck for air tightness.

LEDs are awesome!

Insulate, insulate, insulate: Batts, if done perfectly, provide the highest resistance to heat flow per dollar. Perfect batt insulation requires what we call "perfect pockets." Perfect pockets are achieved by eliminating plumbing, electrical boxes and wires that encroach on the pockets formed by the studs in the two layers of exterior wall. Our doubled exterior walls are each built 24 inches on center with the studs staggered, meaning, the studs in the two walls don't line up. The staggering prevents heat flow, thermal bridging, through the thermally conductive wood studs. Using two walls gives more options for framing corners. The green standard is to use corners with reduced bridging and added insulation, "California corners". We use what we call "Nicholson corners" that have no thermal bridging and have more insulation.

The poly goes up. Note that balloon-framed outermost walls and staggered studs reduce thermal bridging.

Pump heat efficiently: We depend heavily on mini-split heat pumps to achieve our energy goals. We have found many scientists and engineers who are not familiar with the concept of pumping heat. So, we will explain.

Consider being in the ring with a 500-pound sumo wrestler on roller skates. Assume his belly is three feet above the ground. He has 3-by-500 or 1,500 units of energy with which to break your bones by falling on you. You can't lift him and he can't jump because it is very hard to increase his energy. However, it is very easy for him to skate around the ring or for you to push him. It takes very little energy to move his bone-crushing energy from one place to another.

Mini splits are like sumo wrestlers on roller skates. They come mainly from Japan (e.g. Mitsubishi and Fujitsu), and they move energy from place to place with little expenditure of energy. In the winter, they move, i.e. pump, heat from the cold outside to the inside. In summer, they move heat from the inside to the hot outside. How much energy is needed to move this heat? The Seasonal Energy Efficiency Ratio (SEER) and Heating Season Performance Factor (HSPF) tell us. There are systems with a SEER of 33 and a HSPF of 14.5. It requires only 1kWh to either remove 33,000BTU of heat from a house or to add 14,500BTU to a house.

To find the ratio of the energy pumped to the energy needed to pump it, divide by 3.43 (this strange factor goes back to stupid choices by scientists in the 19th century). What a bargain! The ratio is 10 for cooling and four for heat. Heat pump dryers and water heaters also get this fourfold energy multiplier.

Build beautiful solar: Because ugly solar is bad for green building.

Drought-resistant plants and techniques help conserve one of our most precious resources — water.

Staying hydrated

Drought-resistant landscaping in WNC

BY GARRET K. WOODWARD

After the wildfires that raged through Western North Carolina and greater Southern Appalachia last fall, the region is still not out of the woods when it comes to overcoming the drought conditions that have a become more of a norm than an exception in recent years.

"Last year was so dry," said Ruth Gonzalez. "It's surprising sometimes how people don't realize how dry it was, and still is. We went for months last year without rain. This year, we've been blessed with rain. But, with having a lot of rain, it can be misleading, because it becomes so dry for those couple of weeks in this middle of a hot summer when it doesn't rain."

For the last 14 years, Gonzalez has seen it all as part of Reems Creek Nursery, just off Interstate 26 in Weaverville. Though Western North Carolina has a unique scenario in which steep mountainsides and drought conditions can create a deadly combination for landscaping and prevention of erosion, Gonzalez sees the promise of drought-resistant plants and techniques as way to prevent wildfires and property damage, and also conserve the most precious of resources — water.

"Let's say you know you're planting an entire flower bed, you would amend that flower bed with 50 percent compost that's turned in with 50 percent native soil," Gonzalez said. "So, now there's a native affinity for the soil, and it also breaks up the edges so it's not like a hard clay surface, almost like a pot, so water won't absorb. On the other hand If you just put all potting soil in the planting hole, and then the edges of the hole become hard clay, the plant drowns."

Mixing the compost and the native soil creates spaces for air and water to collect and sit as storage for a hot, dry day.

"Although the clay has many beneficial qualities like a lot of minerals, the particles are so small there isn't a lot of room in there for air and water retention," Gonzalez noted. "When you amend your soil, you're making microscopic holes in there for air and water, and also water storage, where if you didn't do that, your clay would turn hard and affect the plant."

Nowadays, with local rainfall, the storms are either nonexistent or are violent and intense in nature when they do occur. With that, water doesn't get a chance to deeply penetrate the ground, it simply washes away down the mountain, into nearby rivers or storm drains. And by having a proper rain collection system, such as rain barrels draining into a cistern reservoir for storage, a homeowner can capture the precious, fleeting water and use it at a later time instead of dipping into city or well water.

"Having that cistern can make all the difference," Gonzalez said. "It takes very little time for a rain barrel to fill up. The amount of water that hits a roof and washes away just with a short rainstorm is astounding."

In terms of driveways and commercial lots, Gonzalez points out that one must make sure they are actually putting down permeable pavement, where hard gravel might not work as efficiently or effectively as open side concrete blocks or other materials.

"A hard gravel bed isn't really considered permeable pavement," Gonzalez said. "Concrete blocks work well, where water is allowed to go down into the ground and it isn't completely lost, whereas with regular pavement it acts like a roof and the water runs off."

When looking at a property, it's useful to pay attention to where the sun goes throughout the day. This will inform where to place plants that need more sunshine or more shade than others.

"You want to put the right plant in the right place. With the microclimate of your property, you'd be surprised how much the sun moves around into spots you might not realize," Gonzalez said. "As well, nothing is drought-tolerant until it's established. Even if you buy a drought-tolerant plant, you want to give it extra love and water that first year so it can establish itself."

Ruth Gonzalez

Gonzalez also suggests creating swales, which are indents made along the contours of the property that allow for water to collect (say on a hillside) and be dispersed throughout the property.

"You could install a swale that is almost imperceptible — a low, shallow ditch, so shallow you don't even notice it — but it has a big effect on your water retention," Gonzalez said. "Water is a huge resource, and anything we can do to protect not only the amount of water, but also the quality of the water, is important, especially for our region that's still in the midst of a drought."

Tips for drought-resistant landscaping

- Choose plants suited to the microclimates located throughout your landscape.
- Select species that are tolerant of difficult urban/suburban sites and the wide range of weather conditions your area receives.
- North Carolina natives may be suitable, but many equally beautiful non-native plants will work well and pose no threat to our native plant populations.
- Balance areas of turf and landscape plantings for practical water use and management.
- Remember that even drought-tolerant plant species need water during the establishment period.
- Year-round planting is possible with careful attention to irrigation needs. Ask your county extension agent for guidance in your area.
- Get your soil tested and amend where necessary for your plant selections.
- Till your planting areas and incorporate organic matter to improve drainage and provide nutrients.
- Minimize activities that may compact the soil. Compaction limits root growth, reduces water infiltration and plant growth and increases runoff.
- Aerify areas to improve water infiltration.
- Fertilize and water according to recommendations for your species.
- Match mower height to your turf species.
- Consult your turfgrass professional to assess quality year-round, particularly during a drought. For new installation and turf management tips, visit NC State's turfgrass program online at: www.turffiles.ncsu.edu
- Apply no more than 3 inches of mulch for woody landscape beds and individual trees.
- Apply no more than 2 inches for perennial and annual beds.
- Keep mulch away from trunks or crowns of plants.
- Use high quality mulch products.
- Group plants with similar water requirements.
- Install drip irrigation or use soaker hoses in landscape beds.
- For individual, newly planted trees apply water directly to roots and just beyond. Use hose-end on low flow, watering bags or five-gallon buckets with small holes.
- Use fertilizers, pesticides and herbicides at proper rates and follow directions to ensure they do not pollute the water supply.
- Apply water at dawn or dusk to minimize evaporation.
- Install rain sensors on automatic irrigation systems.
- Have an irrigation professional audit your system for irregular distribution, leaks, and overspray onto paved areas.
- Ask about "smart" controllers that apply water based on plant requirements and local weather.
- Properly installed rain barrels catch water for small scale watering needs. Cisterns can be installed for large scale uses.
- Plant rain gardens that capture and retain water, while filtering contaminants.
- A properly installed, healthy and well-maintained landscape absorbs and filters more water than an unhealthy site.

Tips provided by the North Carolina Green Industry Council. For more information, click on www.ncgreenindustrycouncil.com.

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- LEED Platinum, passive solar, SIPS construction Net-Zero home.
- Whimsical story-book home that inspires the imagination of children.
- Japalachian home that blends the feel of a Japanese Temple and an Appalachian barn.
- Reconstruction of a late 1800's salvaged timber frame barn as the bones for a new home.
- Locust log, and timber-frame home that is stitched into the mountainside.
- Hempcrete home and permaculture homestead.

- Reproduction of a an 1840's gristmill that feels like an art gallery on the inside.
- Multiple Historic reproductions in the Montford Historic District.
- Tiny passive solar home built using all the trees harvested off of the property.
- Timber-frame barn/recording studio for Grammy winning musician.
- Restoration/revitalization of an old church/commercial building in Montford.

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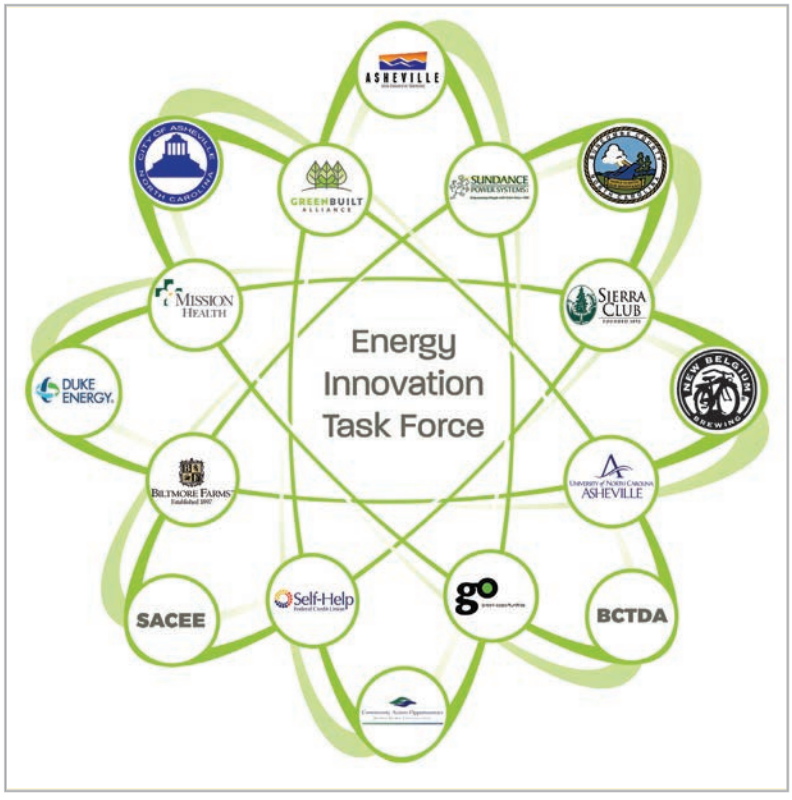
Energy Innovation Task Force

Empowering a clean-energy future

BY SAM RUARK-EASTES

In the year since our last directory reported on the formation and goals of the Energy Innovation Task Force (EITF), this energized group of local leaders has been making progress in developing an understanding of our region's current energy challenges and crafting strategies for our clean-energy future.

Comprised of leaders from the City of Asheville, Buncombe County, Duke Energy Progress, UNC Asheville, area businesses and nonprofits like Green Built Alliance, the EITF is charged with creating strategies to transition our region to a clean-energy future and gathers monthly to discuss the path to that goal.



What's at stake

As Duke Energy Progress plans to retire its coal plant in 2020 and build two new natural gas plants, we are at a crossroads.

Will we rise to the challenges of dramatically cutting our use of fossil fuel energy? Or will we stay a gluttonous group of Americans who use more than three times the amount of energy as the global average?

To rally toward a cleaner energy future, the EITF was formed with two main goals:

- To avert the need for an 186-megawatt natural gas peaker plant by 2023. This peaker plant would only be scheduled to be used a few times a year on the coldest winter mornings. Peaker plants are like big jet engines — powerful and inefficient.
- To transition Western North Carolina to a cleaner, smarter and more affordable energy future, rooted in community collaboration.

Now the hard part. How do we rise to this challenge and meet these goals?

What we've learned

The research completed in the past year has shed light on the challenge at hand. Our energy-use patterns show a winter peak driven by people's need to stay warm on the year's coldest days. That peak is exacerbated by the reality that many people live in leaky houses with very inefficient heating systems.

The base load — what is needed at all times — of our region is 550 megawatts, but during winter mornings when temperatures are below 20 degrees, demand doubles for a few hours per year to a peak of over 1125 megawatts.

What's emerging

The City of Asheville and Buncombe County are providing leadership by establishing programs to support energy-efficiency upgrades for nonprofits and low income families.

One innovative initiative is Buncombe County's creation of its Clean Energy Fund to help nonprofits pay for energy-efficiency upgrades. Buncombe County is also planning a 4- to 5-megawatt solar farm to sit atop an old landfill and is in installing LED lighting in its schools.

The City of Asheville is providing education for contractors, researching ways to incentivize energy efficiency through the

How you can help

- Switch all your lights to LEDs.
- Enroll in the Energy Wise Home program, which depending on your home's eligibility, could offer $75 off your electric bill each year. The program cycles certain appliances off for short periods of time during peak energy use, and most participants report they don't notice a difference.
- Enroll in Duke's Home Energy House Call, where they will send a professional to your home to install LED light bulbs, low-flow showerheads, and faucet aerators, as well as make recommendations on other energy-saving upgrades.
- Insulate and air-seal your attic.
- Have a professional inspect your HVAC duct system to ensure it is working properly.
- When buying a new heat source, consider mini-splits, cold climate heat pumps, and geothermal systems. If you choose an HVAC, make sure it is one designed for cold-weather climates.
- When replacing a hot water heater, upgrade to a solar hot water heater or heat pump water heater.
- Explore the directory listings at the back of this guide to find professionals who can help you with any of the above projects or other energy-efficiency improvements.
- Seek out Duke's available rebates when making home improvements. They offer rebates for upgrades related to HVACs, insulation, heat pump water heaters, duct repairs and more.

planning process and supporting efforts to upgrade the homes of low-income households.

In collaboration with the Atlanta-based Southface Energy Institute, the Asheville Area Chamber of Commerce, Buncombe County, City of Asheville, and Green Built Alliance are looking to bring the Better Buildings Challenge to town. This program invite local businesses to set energy-reduction goals (typically 20 percent), and then motivate and educate each other on what actions need to be taken to achieve those goals.

Upgrades to the grid are coming to the area in 2018. Advanced metering infrastructure, also known as AMI or smart meters, will be installed throughout Duke Energy Progress' territory. These meters will allow the utility to manage how much electricity is being delivered at a specific time, assist in restoring power during grid outages, and provide more information on how to more efficiently manage energy use.

Duke is also planning to install 15 megawatts of battery storage throughout Western North Carolina. These batteries will charge when there is excess electricity available and have energy available when it is needed.

Green Built Alliance has been participating along the way by leading the EITF's Programs Work Group, meeting with community leaders, supporting Duke in the evolution of its programs, and implementing projects such as those of Appalachian Offsets to directly mitigate carbon emissions. (For more information on Green Built Alliance's Appalachian Offsets program, see page 36.)

As of this writing in the summer of 2017, we are awaiting a community marketing campaign from the Shelton Group, the nation's leading marketing firm for energy efficiency and sustainability. We are also awaiting Duke's response to our recommendations for program improvements.

If you feel inspired to support this effort, start by making your home as energy-efficient as possible. There are many programs and technologies to help you do this, and conservation behaviors will help reduce the need for fossil fuels. Tell all of your friends and family how you are choosing a brighter and healthier future. Only through a community effort can we eliminate the need for this fossil fuel power plant and steer toward a clean-energy future.

Visit our website throughout the coming year for the latest updates on the EITF's progress and your opportunities to get involved.

Sam Ruark-Eastes is the executive director of Green Built Alliance and sits on the Energy Innovation Task Force. He has spent two decades working in the field of sustainability with local governments, small businesses and nonprofits. Get in touch with Sam at Sam@greenbuilt.org.

Young minds, big ideas

Issac Dickson Elementary goes green

BY GARRET K. WOODWARD

It's taken the better part of five years, but Isaac Dickson Elementary School Principal Brad Johnson is beginning to see the light at the end of tunnel.

"Currently, [we've completed] our first year at the new site. Overall, the process took about five years from the planning, to the demolition, to construction, and delays to our current reality inhabiting the school for a year," Johnson said in the summer of 2017. "We had teachers and students involved in every step of the way in the designing the new building. Each wing is different based upon the different needs of the students. We've been on our new campus for a full year now and are looking forward to the start of a new [school] year."

Johnson sees not only a new chapter for the school, but also new opportunities moving ahead, especially in the realm of green initiatives that are continually being added into the long-term design of the property, and also, most importantly, the curriculum.

"We're harvesting all the rainwater that falls on the hard surfaces, [and] we use that water to irrigate the landscape and flush toilets in our bathrooms. Daylighting is used extensively throughout our school. Research tells us that students perform better and are better able to pay attention with natural lighting," Johnson said. "Geothermal wells are also utilized to decrease fossil fuel energy consumption. Our school is [also] pre-wired for photovoltaic panels. There's a current effort underway to close a funding gap, which would provide our school with about an acre of PV which would make our school a net-zero school."

Green Built Alliance has been a key supporter of Isaac Dickson's efforts, primarily through its Appalachian Offsets program, which is fundraising for the school's solar system. Appalachian Offsets is a voluntary carbon offset program that offers businesses, organizations and individuals the option to easily reduce or offset their carbon footprint. (See article page 34).

Isaac Dickson is trying to provides its students with a lifelong well of academic knowledge that goes far beyond the usual classroom subjects, where a passion for agriculture and sustainable practices is learned early on, only to transition into a love for the outdoors that ensures an appreciation for Mother Nature.

"The ultimate vision is to have students continue to learn to become responsible stewards of our environment," Johnson said. "Our kids are immersed in an experiential education at Isaac Dickson each day, and by having our gardens, nature trail, chickens, greenhouse, and learning to care for our community and environment. We're preparing kids for their future."

In addition to the priceless learning experiences for the kids, Johnson also sees the interactions and lessons as a two-way street between the pupils and their teachers, where both sides come away from their time together with a better understanding of each other, and the natural world in general.

"For me, this has been an incredible experience. Our teachers and students were able to have a true voice in the design of the building so that it best met the needs of the children and staff," Johnson said. "Combined with that, we were able to construct a school that is outfitted with green technologies. Our students, staff, and parents have been incredibly supportive and involved in our school both before our new building and after."

Isaac Dickson also looks at itself as a template for other schools, perhaps even commercial spaces, considering these implemented green features, where the information and techniques can be shared between academic institutions, and the community as a whole.

"I think people are becoming more aware of issues that affect our climate and environment," Johnson said. "Here in Asheville, I think we have been ahead of the curve in terms of living responsibly. For many of our parents, our school and the strategies we use to save energy dovetail nicely with shared values."

A garden planted and nurtured by students and faculty helps teach lessons about being responsible stewards of the environment. MARGARET HESTER PHOTO

"The ultimate vision is to have students continue to learn to become responsible stewards of our environment."

— Brad Johnson, Isaac Dickson Elementary School Principal

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Energy surges for solar project

Appalachian Offsets fundraising for Isaac Dickson School solar system

BY CARI BARCAS

Green Built Alliance's Appalachian Offsets local carbon-offsetting program has begun work on its first community improvement projects since its relaunch last fall, including fundraising for a solar system for the new Isaac Dickson Elementary School and completing an energy-efficiency upgrade at Opportunity House.

Appalachian Offsets is a voluntary carbon offset program that offers businesses, organizations, and individuals the option to easily reduce or offset their carbon footprint. Supporters offset their emissions by paying into a community fund that helps make energy-efficiency improvements for local nonprofits, schools and low-income housing.

Appalachian Offsets' largest undertaking to date, the Isaac Dickson Elementary School project, will install a $1.1 million solar system on the roof. The LEED Platinum-certified school was designed as one of the state's first Net-Zero Energy schools and has been awaiting the integral solar system since building construction completed in 2016.

"Installing a rooftop solar system on the new Isaac Dickson Elementary will fulfill the architects' vision of using the school building itself as learning tool that can be used to facilitate discussions about our environment and conservation, as well as the impacts of fossil fuel consumption not just on our climate but also on our air and water quality," said Isaac Dickson Elementary PTO Co-President Matt Menne.

"Our kids will bear a much greater burden of the consequences of climate change caused by carbon emissions than their parents, so we owe it to them to do whatever we can to ensure that these youngest members of society have the same opportunities to succeed in life that we have had," said Menne, who is also a climate scientist at the National Oceanic and Atmospheric Administration. "What better way to help than by reducing the carbon footprint of our schools, which provides the added benefit of saving money on energy costs for the district in the long run."

An aerial rendering of what Isaac Dickson Elementary School will look like with the addition of the solar system, which is expected to save 754.2 MWh or 754,200 kWh.

Over its 30-year life, the system is expected to save $3.5 million in energy costs for the school.

Private investors will cover the majority of up-front costs for the new solar system, and Appalachian

Isaac Dickson Elementary School.
MARGARET HESTER PHOTO

"Installing a rooftop solar system on the new Isaac Dickson Elementary will fulfill the architects' vision of using the school building itself as learning tool that can be used to facilitate discussions about our environment and conservation, as well as the impacts of fossil fuel consumption."

— Matt Menne, Isaac Dickson Elementary PTO Co-President

Offsets has taken on the challenge of raising the remaining $220,000. Thanks to the generosity of an anonymous donor, the project secured a matching grant of $110,000 in early summer of 2017, leaving a balance of $110,000 needed in community contributions to complete funding..

"If the community raises the $110,000, the school is essentially getting a million-dollar system for free that will deliver millions of dollars of benefits over its life," said Dave Hollister, president and CEO of Sundance Power Systems. "It's a win for the community, the school, the environment and the investors."

The system will be installed by Sundance, which won the bid from Isaac Dickson based in part on their unique proposal of this public-private partnership with investors helping to bring the plan to fruition.

"In my mind, there's a huge educational value too," Hollister said. "Isaac Dickson would be one of the first net-zero energy schools in the Southeast, and this would be a way for students to really see that solar works and their school is running on solar. That's a paradigm shift, which is really important from a developmental standpoint in creating a consciousness of sustainability."

Another Appalachian Offsets project, an energy-efficiency upgrade at the nonprofit Opportunity House in Hendersonville, was completed the first week of April. The LED lighting upgrade will save more than $10,000 per year in energy costs for the organization and reduce its carbon footprint by 47 metric tons annually. Also supported by incentives from Duke Energy's Small Business Energy Saver program, this $26,000 LED project has a 187-percent return on investment.

Initially launched in 2005, Appalachian Offsets completed numerous energy-efficiency retrofits for local nonprofits in the following two years. Interest in the program waned with the onset of the 2008 recession, as building projects were delayed or cancelled and businesses lacked the resources to offset their emissions. However, today, environmental stewardship and the economy are once again growing in Western North Carolina, and Appalachian Offsets was officially relaunched in fall of 2016 in response to community demand.

There is no shortage of future projects for Appalachian Offsets to undertake as funding becomes available based on community support of the program. Appalachian Offsets' program administrators are collaborating with organizations including The Land of Sky Regional Council Waste Reduction Partners and Lime Energy, which have identified numerous projects that are ready and waiting for Appalachian Offsets' support.

"Appalachian Offsets is the bridge that matches companies and individuals looking to offset their emissions with organizations who need support cutting energy cost and upgrading their facilities," said Green Built Alliance Executive Director Sam Ruark-Eastes. "The program encourages all of us to reduce our carbon emissions first, then pay into a fund that collectively helps others do the same."

Individuals and businesses interested in getting involved can visit www.cutmycarbon.org to calculate their carbon footprint and offset emissions, as well as learn more about the projects that will be supported by contributions to the community fund.

Cari Barcas is community engagement director at Green Built Alliance. She has more than a decade of experience in communications and nonprofit management, including time reporting on the green building scene in Chicago as a journalist covering residential and commercial real estate. Connect with Cari at Cari@greenbuilt.org.

Benefits of batteries

The emergence of energy storage

The Mount Holly Microgrid project located in Gaston County features a Saft 650kW lithium-ion battery and a 200kW Alevo lithium-ion battery. The battery storage system is integrated into a microgrid with more than 115kW of solar panels. In addition, residential energy storage systems from Tesla and Enphase are being tested and providing valuable insights into future benefits and operational realities of behind-the-meter energy storage. DUKE ENERGY PHOTO

BY NED RYAN DOYLE

Batteries are ubiquitous in our modern lives, in cell phones, computers, cars, clocks, toys, tools and many more applications. Yet the idea of a battery-powered home or business is likely to generate a quick laugh or a skeptical look.

Of course, there are hundreds of thousands, if not millions, of off-grid applications globally that employ batteries, but the idea of having a battery system in a conventional or even green building on the grid seems irrelevant to many. Fortunately, that perspective is changing as energy storage is being incorporated into a modern grid infrastructure, with benefits to homeowners, businesses and utilities.

The rapid pace of energy storage battery technology is getting lots of attention, from lithium ion to organic-based batteries, but instead of delving into details on how to store the energy, the focus here is why to store the energy.

There are four main benefits to having a residential or business battery system: increased reliability, addressing peak demand issues, grid stabilization and climate change.

Reliability of the power supply is very important to nearly all, and critical to some, for example those who rely on medical equipment. Power outages can last from a brief flicker of interruption to many days down. The average outage time, not counting major natural disasters, is generally only a few hours, thanks to the exceptional response of the utility line crews. Having a home battery backup system, much like a uninterruptible power supply for your computer, can avoid the disruptions of most of those outages.

If the home or business has a solar photovoltaic (PV) system, then a battery system can be recharged onsite by the sun during an extended outage. Many green builders already offer solar technology, and adding battery storage to the design enhances the options for additional, scalable backup power. Adding a new battery system to existing solar PV installations is another practical option.

On the utility scale, energy storage can increase reliability during peak demand times to avoid brown outs of localized power reductions. Energy storage options also allow a utility to flatten its daily generating output cycles and more efficiently utilize lower nighttime generating levels.

Peak power demand issues during the winter heating season are at the forefront in Western North Carolina. Duke Energy is closing its coal-fired power plant at Lake Julian and building two natural gas combined cycle turbines. Current Duke Energy peak demand projections suggest a need for yet a third natural gas turbine unless peak demand is reduced by approximately 17 MW each year for the next several years.

Since current utility planning for infrastructure revolves around the worst-case peak energy demand needs, shaving that winter peak demand saves money for ratepayers and for the utility. Among a range of promising opportunities, deploying battery storage in residential and business and utility applications can help directly to solve this challenge. Drawing power from a battery bank, rather than increasing generating output, can dramatically reduce peak demand.

Building weatherization, real-time demand response programs, load shifting, increased efficiency in heating systems, Advanced Meter Infrastructure (AMI) with two-way data exchange, solar thermal, and advanced heating and cooling systems like geothermal will also play a role. Notably, from a narrow economic perspective alone, it's

more cost effective to invest in these opportunities to reduce peak demand than in the capital cost to build a third natural gas turbine, even without including the operation and fuel requirements and costs.

Grid stabilization is a general term for the complex utility requirements to reliably maintain the voltage, current and frequency of the grid's power supply to customers. From the general public's perspective, it's likely the least compelling benefit, in large part because the grid is currently so successful at being stable.

Nearly a century of development and operation of a centralized power grid system has resulted in a conventional grid infrastructure that is overall very reliable and stable. Central power sources (whether large hydro, coal, gas or nuclear) that feed into thousands of miles of transmission lines carrying megawatts of one-way electricity to millions of end users are marvels of technology and engineering.

However, the rapid expansion of distributed energy sources, primarily solar and wind energy, changes the engineering equations and presents new challenges for energy distribution and voltage, current and frequency stabilization over the grid. The good news is that long-overdue new investments and upgrades to our aging grid infrastructure are underway, with Duke Energy alone committing billions to a wide range of grid-improvement projects.

Obviously the technical aspects are very complex, however, simply stated: the timing for modernizing the grid infrastructure is right on course to incorporate not only clean energy from solar and wind sources, but additionally a wide range of distributed energy services and customer resources to support a more responsive, reliable, clean and cost-effective grid system.

Climate change is the most important reason to take action regarding our energy and resource extraction policies. Transitioning to a much lower carbon footprint and reducing environmental impacts is essential for a myriad of reasons. Suffice to say, climate change is established science.

There is no single silver bullet to solve the problems of climate change; rather, the answers lie in a comprehensive approach that primarily includes electrical generation, transportation, building science and agricultural practices (not addressed here).

Energy storage is an essential factor for reliable, stable electrical generation from sustainable sources, in addition to the rapid emergence of electric vehicles (EVs) that operate from those clean sources. In fact, EVs already intersect with both utility planning and residential applications, such as home charging stations.

Green building science is another essential element, as it integrates many strategies from high efficiency providing demand reduction to true net-zero energy design.

Much like many unseen, yet incredibly effective, energy-efficiency measures (such as attic insulation), batteries don't have that "gee whiz techno" visual appeal of solar panels or wind turbines for most folks. However, just as efficiency measures are critical in reducing the demand for more generating capacity, energy storage is critical for managing and distributing our next generation of clean, sustainably generated power — because climate change matters.

Yes, there is an environmental and carbon footprint for battery systems. However, just like solar, the footprint and the economic costs are a small fraction compared to current non-renewable fossil fuel and nuclear impacts.

And just like the steep decline in the upfront costs for solar, cutting-edge battery and energy-storage costs are also beginning to see a decline. Interestingly, the traditional, time-tested flooded lead acid batteries are still the most cost effective in many energy applications, such as residential energy systems, and are virtually 100 percent recyclable.

Ongoing research and development of battery technology is crucial for higher efficiency and lighter weights and longer life cycles, however we already have the proven and emerging technologies to begin an energy-storage transition in support of clean energy generation — cost effectively and environmentally responsibly.

Ned Ryan Doyle is a sustainable energy and environmental advocate with decades of experience and activism. Currently co-chair of the Energy Innovation Task Force's Technology Work Group, he works from a personally designed and owner-built fully off-grid workshop powered by solar energy. Contact Ned at nedryandoyle@earthlink.net.

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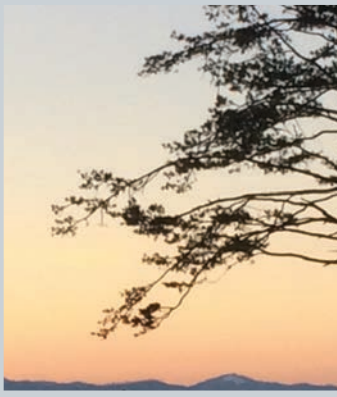

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It takes a vision to create a reality. DELTEC HOMES PHOTO

How to be a good customer

Tips for not going crazy while building your home

BY BRENTON FAIRCLOTH

Building your dream home is a unique experience.

It requires you to be honest with yourself about your family's current and future needs, and gives you to the chance to personalize everything to your taste. For most homeowners, this is a once-in-a-lifetime opportunity.

The building process shares parallels with creating a piece of art in that it will change and grow organically as it is created. Often, seemingly great ideas will fail and you will have to return to the drawing board. This can be frustrating, especially when adding elements like green building into the mix, but, at the end of the process, your home will be uniquely yours to enjoy.

The first day you walk into your new home will be the last day of a long design and construction process. How you feel at the end of that process will set the tone for how you and your family perceive the new house where you are preparing to spend years. Paying attention to a few basic mantras, tricks, and hard-learned lessons before beginning this process can make the experience of creating your dream home much more enjoyable.

Perfectionism vs. realism

The first tip is also the hardest to swallow: perfection is impossible in the reality in which we live.

Hard to hear, right? You are about to spend thousands of dollars on this project, and of course you expect the product to live up to your greatest expectations.

But, at the end of the day, it is critical for all parties involved in the building process to recognize that design and construction are bound by reality's limitations: budget, land, the laws of thermodynamics, and a pesky thing called gravity.

This is not to say you should back down from seeking quality and a design that meet your wants and needs. However, it can reduce stress to go in with the understanding that compromise will be necessary.

Because nothing will ever be perfect, don't get hung up on minute details while neglecting major design elements.

Your definition of green

Tip two: define what green building means to you. Write it down. Is it energy efficiency, locally sourced materials, low-embodied energy materials, net-zero, healthy indoor air quality or some combination of these or other values?

There are so many versions of green building out there. While this is wonderful, it complicates the process of building "green." You cannot tell your builder you want a green home and expect them to be thinking of the same elements as you.

The definition you create will act as your mission statement during the process. It will not only make it clear to everyone involved what the big picture goal is, but also will help you decide the design elements on which you refuse to compromise.

To get you started, I'll share my personal definition: "A green home is durable, energy-efficient, and healthy to live in. It has what my family and I need to live comfortably, and doesn't waste space or resources."

Certification determination

Creating your own definition of green building leads to another question for consideration: Is getting your home "green certified" important to you?

There are many great green-building certifications by both national and regional groups. Having one of these certifications can help validate your accomplishment of sustainability goals, and provide your builder guidance on how to achieve them.

However, when deciding to get a green certification, it is important to consider your personal green goals, and how they will mesh with the reality of your build.

How do the goals of a certification align with your definition of green? Does your builder have experience with any particular programs, or are they willing to invest the time into learning what each program entails? Are you willing to compromise on your other design or financial goals to meet the requirements of green certifications?

It is certainly possible to build a sustainable, and green home without getting a certification. Although, determining your own criteria for every green building aspect might prove to be a mountain of additional work. And you will miss out on having a third party rater verify that the house is being built as intended. At the end of the day, the choice is something you should consider with your builder.

Drawing the line on design

When making decisions in design and during the construction phases, remember that everything affects everything else. Every choice will have ramifications on other design elements, and trying to corral all of them simultaneously is impossible.

It is important to realize the level of interconnection, but do not become obsessed with trying to master it. Go back to your green definition, your lists of wants and needs.

Accept that something will probably get the short end of the stick by the end of the process, or else you might stay in the design cycle indefinitely. Plan on what these things will be, so you aren't dismayed when it happens.

Understand what the financial cost might end up being if you don't back down on a single thing or keep spinning through the design cycle.

Don't get caught in design loops.
PIXABAY.COM PHOTO

Trust your team

My next mantra for you is: If I try and do everything myself, I will become overwhelmed.

Trust your builder's experience; they make these building decisions every day and have seen the consequences of each.

Invest your time into researching the design elements and green building aspects most important to you, and then take your builder's advice in areas that you have not labeled "priority."

They are experts and you should feel comfortable using their consultation. If you try and take on the whole project by yourself and do not trust your team, you will quickly become burned out.

During the construction phase of the house, above all else, remain calm.

The majority of building projects will encounter some sort of delay, and it is natural.

It is also critical to remember that you are probably not an expert on everything. If you see something you don't understand or agree with, don't suddenly start confusing subcontractors by giving different instructions from your builder. Consult your builder immediately to get clarification on why something is being done the way it is and tell them your concerns.

If your builder understands your expectations and is on board with your goals, they will be your agent toward the subcontractors. Your builder will ultimately hold the subcontractors liable for the quality of work you expect.

Remember that every time you cause a delay in the work, you are costing yourself extra dollars.

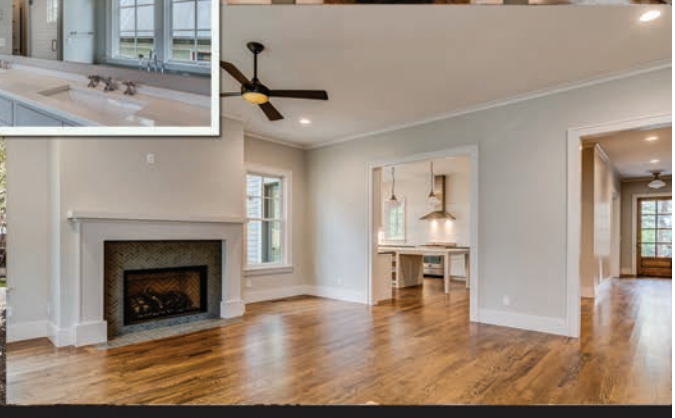
Realizing the green dream

These hints on building your green home are not intended to coerce you into giving up control, or accepting lower standards. They are merely suggestions on how not to create unnecessary stress during the process.

Turning your dream into a reality will mean accepting the rules of our reality. Stand strong on what goals are important to you, and don't lose sight of the bigger picture. This should be a unique, fun and educational process.

It is possible to get your green home and be happy the first day you walk into it. It just takes some simple rules, clear communication of expectations, and stress management to make it happen. Happy building!

A project coordinator at Deltec Building Co., Brenton Faircloth has worked to provide himself with a diverse background of experiences. His repertoire includes earning a master's degree in technology, being a pool-pump mechanic, serving as an assistant to a state congressman, and working for a builder. Above all, he has learned that "Applied Love" is the best science to master.



Approaching 2025

A manual for green, sustainable and healthy home development

BY RICK BAYLESS

If green and sustainable professionals hope to best serve the industry, now is the time to understand the home healthiness issues that need attention in the decades ahead.

Fast forward. The year is 2025, and the green and sustainable homes industry is well into the next stage of its evolutionary development. We've made great strides in energy efficiency, reducing our carbon footprint, and cultivating outdoor environmental sustainability. The planet is on the rebound.

In-house systems have become increasingly complicated. When we hand over the keys to the next generation of green and sustainable homes, a new set of needs will arise. The homes will need to be monitored to confirm that new methods, materials, and systems are performing the way we hoped. After all, homeowners will not have read an operator's manual on how to operate their new homes. They will need to learn how to recognize signs of developing trouble.

The top three things a homeowner in 2025 needs to learn in order to optimize their home's health — and their own — are:

1. How to address humidity and dampness intrusions into the building. Though bulk water intrusion gets a lot of attention, humidity offers an environment favorable to molds, mildew, must and damp rot.

2. Indoor environmental control systems, also known as the heating, ventilation, air and circulation (HVAC) system, need to dehumidify, offer balanced indoor-outdoor air exchange, include air filtration and cleaning.

3. As the home's occupants face health issues, professionals in the industry will feel compelled to learn how in-home systems contribute to human wellness. Understandings will emerge about ways occupants do or do not use — or misuse — the house and its systems.

In 2025, the discussions on green and sustainable homes continue to focus primarily on new construction. Let's estimate that as many as 10 percent of people live in one of these homes. That means the remaining 90 percent of us will continue to live in older, non-green homes, just as we did in the decade before.

As solar grows more affordable, more homes will become self-sustaining. PIXABAY PHOTO

Many of these homes already exhibit terrible performance and healthiness issues. To ensure that the vast majority of homeowners in the future can solve these issues, we need to step up our efforts today. We need ways to apply realistic, effective, and affordable green and sustainable measures toward resolving performance and healthiness issues in existing residential buildings.

Of course, homeowners will attempt to resolve the environmental issues of 2025 in their own ways.

One group will prefer the "back to nature" approach to living in their home. They'll ignore existing in-house systems, turn off the dehumidifier and air conditioner and opt to open the windows. These homeowners should anticipate high humidity and levels of dust, mold, pollen and dust mites — enough to cause respiratory irritation and allergies to flare. They will require guidance on allergy proofing their homes, removing mold-friendly items, clearing clutter, and adjusting their lifestyle preferences if and when their health demands they do so.

A second group of homeowners will retreat into the house, doors and windows closed, completely sealed in. These individuals and their families will rely exclusively on the home's environmental control systems. This option is a long way from sustainable. A simple power outage would disrupt the mechanisms they need to breathe in oxygen. Instruction on the proper use and maintenance of the home's systems will increase reliability. Eventually, they will need to upgrade and add to those systems.

When problems occur, both groups will need the guidance of home-healthiness professionals.

As Western North Carolina barrels toward the first quarter mark of the 21st century, we should bear two axioms in mind with respect and awareness to green and sustainable development:

Axiom 1: Nature will relentlessly and eventually undo the best of things man has constructed.

Axiom 2: If there's a way for humans to mess something up, we will!

Home healthiness in 2025 will result from the abilities of green and sustainable professionals to constantly explore, invent, and experiment to find common sense solutions to scientific problems.

Rick Bayless owns and operates A Healthier Home, LLC, Western North Carolina's leading environmental home health services provider. Learn more about maintaining a green and healthy home at www.ahealthierhomenc.com or address wellness concerns through systemic intervention with www.envirovention.com.

The first home is nearly complete in the new Shelburne Woods subdivision, where each home will meet Green Built Homes Platinum, Net-Zero Certification.

Finding a balance

Mountain Sun's Shelburne Woods

BY GARRET K. WOODWARD

Just a few blocks from the bustling Haywood Road in West Asheville, the folks at Mountain Sun Building and Design are hard at work putting the finishing touches on the first home of their Shelburne Woods development.

"It's definitely a community feeling we're trying to create here," said Jeb Boyd, co-owner of Mountain Sun. "We didn't try to overdevelop this property. We have a lot of community space created within the neighborhood."

With nine homes planned for the 1.9-acre property, Shelburne Woods will encompass a natural, comfortable feeling for its inhabitants. All nine homes adhere to Mountain Sun's high standards for construction, and reflect an appreciation for preservation of the land. Each home is required to meet Green Built Homes Platinum, Net-Zero Certification, the highest standard a home can achieve in the Green Built Homes program.

Launched six years ago, Mountain Sun combines the building talents and passion for the natural world of Jeb and his wife, Emily. The duo saw a need for what they ultimately want to present and construct for their clients — innovative designs with functionality that truly aim to work with the landscape, and not against it.

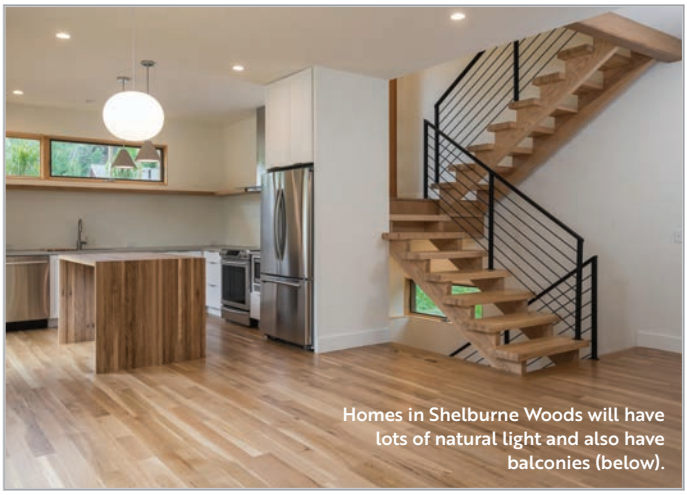
"There's edible landscaping, with blueberries and figs, and also trail space at the bottom of the property," Boyd said. "The sewer line actually runs primarily through land owned by a neighboring subdivision. They approached us about moving the sewer down to the path of the future Rhododendron Creek Greenway to save the trees on the hillside. At the same time, we recorded an easement through part of our property for the future greenway."

"A house has so many natural resources involved in building it, and the worst thing you can do is waste all those natural resources, especially in just the construction of it," Jeb said. "We build net-zero with a sensible design for the specific lot. We look for property that is south or southwest facing for the passive solar aspect—it's free energy, otherwise you'd be consuming coal or natural gas to heat your house."

"For us, we put our heads down and do what we feel is right, what's best for our company, and our passion for net-zero building practices."

— Jeb Boyd, Mountain Sun co-owner

Using all renewable energy, each home will be both passive and active solar. Shelburne Woods also features an electric-vehicle charging station for each home. The designs also incorporate as much natural lighting as possible, with emphasis on numerous south-facing energy-saving windows. Using 2x6 walls with advanced framing and spray foam insulation, the first home was able to achieve an air tightness of .58 ach50, which exceeds Passive House standards.



Homes in Shelburne Woods will have lots of natural light and also have balconies (below).

"Quality of light in the houses we build is very important, and we pay careful attention to window placement," Jeb said. "We look at each home as an art project, built to high quality net-zero standards, but also something comfortable, with a natural feel for the inhabitants. For us, we put our heads down and do what we feel is right, what's best for our company, and our passion for net-zero building practices."

A lifelong sufferer of asthma, Jeb is quick to praise the difference in air-quality between this Green Built Home and one built in the traditional sense, in terms of materials used and construction methods.

"There is no formaldehyde or harmful gases used in our designs and construction," he said. "I grew up with asthma, with daily inhaled steroids. After we constructed our personal Green Built house, I'm now off all my medications. It's a testament to the importance of paying attention to indoor air quality, especially with the toxicity of many conventional building materials."

Each of these homes will be all electric and will have no propane or natural gas, reducing risks associated with carbon monoxide. In addition, Mountain Sun used solid surface materials (reducing formaldehyde) wherever possible, zero-VOC paints and installed high-efficiency ventilation.

And as Shelburne Woods continues to break ground on the property, Mountain Sun is also pushing ahead with its personal and professional mission.

"We're trying to be stewards of the environment, and to lead by example for our kids. If we can't contribute on a large-scale capacity, at least we can do it one house at a time," Jeb said. "Being in Asheville for over 20 years, we're trying to bring something that's valuable to the community here, something that's long-lasting, something we can feel good about when go to bed at night."

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Climate adaptation real estate

What to watch for in Western North Carolina

BY DOUG BRUGGEMAN

Climate adaptation is the practice of lowering risks from the consequences of climate change. For Western North Carolina, these risks include more frequent wildfires caused by drought as well as increased flooding and erosion due to more common and severe storm events.

The local real estate market is strong thanks in large part to our abundant protected natural areas and the culture of healthy living they inspire.

At the same time, this love of nature also inspires homeowners to seek land for agriculture, a home with views of mountain ranges, or sites close to our abundant water features. Such an intermix of natural areas and development invariably creates a vulnerability to risks from drought, floods and wildfire.

However, if you are in the market for a traditional home that is well outside the flood zone, in an area with low wildfire risk, and not on an erodible slope, then climate adaptation is more a concern for your city or county. In such cases, homebuyers should ask the city or county that provides their public services whether it is anticipating and budgeting for climate change.

There is a real need within the real estate market to create awareness and include climate-change risk in the home-buying decision. Frankly, relying on insurance coverage may leave homeowners in a difficult position.

A Federal Emergency Management Agency (FEMA) review was reported to show that 80 percent of homeowners' claims in recent natural disasters were underpaid by their insurance companies, undoubtedly leaving some of those people homeless and with a mortgage.

The National Flood Insurance Program (NFIP) managed by FEMA, which pays insurance companies for claims, is $23 billion in debt, according to media reports. Meanwhile, the insurance companies that act as the middleman for the NFIP by collecting premiums and distributing payments are reportedly making a 30 percent profit on average. Effectively, it would seem that federal taxes are paying for flood-insurance coverage while the insurance companies profit as the middleman.

Enhanced by drought, wildfires have been increasing in frequency.

Young chorus frog.
STEVE ATKINS PHOTO

Thanks to advances in modern firefighting, these fires tend to be smaller and better contained than those observed in the past — though historically there were fewer homes built near national forests.

Fires in Western North Carolina affected 55,000 acres in 2016, causing thousands to evacuate their homes, according to Carolina Public Press. Simultaneously, just across the state border in Gatlinburg, Tennessee, fall wildfires caused the evacuation of 14,000 people and the destruction of roughly 1,700 homes and businesses, according to the Knoxville News Sentinel.

Given that climate change is a global threat, shouldn't our federal government be generating solutions? I personally remain hopeful, but the political process has been much slower than the rate of climate change. The United Nations Framework Convention on Climate Change in 2015 resulting in the Paris Climate Agreement was critical step in the right direction.

However, the reductions in greenhouse gases agreed to in Paris will still lead to an average warming of 3 degrees Celsius by 2100, according to some projections. To put this into perspective, the European Geosciences Union predicts that a shift from a 1.5 to 2.0 degrees Celsius will cause a 30 percent increase in severe weather events and a 30 percent increase in sea level rise. We broke the 1 degree Celsius mark in 2015 and are quickly approaching the 1.5 degree Celsius mark, according to the World Economic Forum.

With all that said, what can you do as a homebuyer? Energy-efficient green-built homes are an important solution. But it is also critical to think about where you buy or build within the landscape.

If you want to be close to forests, consider maintaining a 30-foot buffer of grass around the home to reduce wildfire risk. If you find a site outside the 100-year floodplain, within say the 250-year floodplain, consider getting flood insurance from a reputable insurance company. The FEMA floodplain designations do not consider changes in storm events due to climate change.

If part of the land is forested, then plan to budget to reduce fuels over time to lower wildfire risk. If part of the land is in the floodplain, then plan to install and maintain vegetated riparian buffers to reduce the impacts of floods and erosion. Many of these land-management activities will have the added bonus of increasing biodiversity.

Remember, adaptation is important for all species.

Doug Bruggeman received his doctorate from Michigan State University. He is adjunct faculty at Lenoir-Rhyne University, where he teaches a graduate course on the Economics of Sustainability. He has worked as an environmental consultant supporting brownfield redevelopment, and is a licensed realtor with Keller Williams Professionals.

The path to the future

An update on the French Broad River Greenway

David Tuch (left) and Steve Melton of Equinox Environmental look over a section of the greenway from the deck at New Belgium Brewing. EQUINOX ENVIRONMENTAL PHOTO

BY GARRET K. WOODWARD

In an effort to provide connectivity within Asheville, the French Broad River Greenway has become a welcome sight along the riverbanks in front of New Belgium Brewing, an ever-growing social hub in the city.

It's another piece of the puzzle of endless miles being laid out in a citywide push for the multi-million-dollar greenway project that Asheville has doggedly pursued for decades.

"Greenways are beginning to be viewed by the public as they should be — corridors that provide non-vehicular transportation options which limit the amount of interface with vehicles, creating a safer, more pleasant experience for the user," said Fred Grogan, land planner and landscape architect for Equinox, a consulting, planning and design firm for business sustainability in Asheville.

The French Broad River Greenway (FBRG) is a 2.83-mile multi-use path that connects the French Broad River Park, New Belgium Brewing, Carrier Park, and beyond. Grogan sees the FBRG as something of intrinsic and societal value for residents and visitors who find themselves on it.

"I was recently in a nearby city and visited a greenway that is experiencing firsthand the results that have been foretold for years," Grogan said. "[Which is] enhancement of a neglected natural area, implementation of a greenway within that enhancement area, and subsequent businesses/housing following immediately behind — and in some cases helping fund these efforts — which are reaping the benefits of utilizing and marketing the public greenway and open spaces as an amenity."

Designing the half-mile portion between New Belgium Brewing and the French Broad River, Equinox looked at "minimization and avoidance of impacts to natural systems" in its plan for the surrounding wetlands and nearby Penland Creek.

"The City of Asheville plans to connect the gap of a mile that would connect the existing French Broad Greenway," Grogan said. "Just the half-mile French Broad Greenway along New Belgium was under design for several years due to the complexity of the site as a brownfield and numerous utility considerations."

In terms of green and eco-friendly approaches, Grogan sees the FBRG as something that will ease housing issues within Asheville, as well as offer sustainable amenities and landscapes that provide more than just an access point for bordering neighborhoods and those simply looking to wander the metro-area on foot or bicycle.

"It is also a reality that greenways serve as economic-development drivers by providing tourists and residents accessibility to public spaces to recreate and commute," Grogan noted. "Greenways are essentially linear parks. Moreover, they protect open space, which has been proven to increase values of property as they are considered amenities. Combined with already rising cost of living, there is a responsibility to consider integrating affordable/workforce housing into greenway planning, and then ensuring that this land use maintains direct access to our public green space."

"Greenways are beginning to be viewed by the public as they should be — corridors that provide non-vehicular transportation options."

— Fred Grogan, land planner and landscape architect for Equinox

In terms of social impact amid the green initiatives, Grogan looks at the FBRG and other similar city projects as key components to aid in the sustainability and solution to long-time traffic concerns in Asheville and surrounding communities.

"Traffic reduction is a major consideration of why folks should care," Grogan emphasized. "Likely without need of explanation, increased visitation in the peak seasons around Western North Carolina leads to increased traffic volumes. When we begin to realize greenways provide means to relieving traffic congestion in our area, greenways — along with other means of alternative transportation — become an obligation."

For more information on the greenways in Asheville, visit www.ashevillenc.gov/departments/transport/greenways.htm. For more about Equinox, go to www.equinoxenvironmental.com.

Feel the warmth

Mini-split heat pumps for high-performance homes

BY LEIGHA DICKENS

In many new green homes, you might notice a little white box on the living-room wall. That box delivers heated or cooled air, and it's called a mini-split.

Once, mini-split heat pump and/or AC systems were rarely seen outside of small retrofit or addition projects. Increasingly, mini-splits can be a whole-home heating and cooling solution for new energy-efficient homes, especially those that follow the green-building practices of superior insulation and air-tightness.

Ductless — and not

Mini-split heat pumps are a specific type of air-source heat pump. As the name implies, they're "mini." The indoor air handler portion is anyway: replacing what in typical heat-pump systems is a sizable indoor air handler that delivers conditioned air to all the rooms in the house through a system of attached ducts, with the aforementioned ductless white box on the wall.

At least, that white box is a mini-split in its most iconic form, and I've often heard the phrases "ductless system" and "mini-split" used interchangeably.

The benefits of avoiding ductwork are easily appreciated in the green-building world. Ducts takes up space that must be (and often is not adequately) planned for, ducts are prone to poor installation with leaky connections and excess kinks and turns that choke off the airflow. For best results, you want to keep ducts out of unconditioned spaces like garages, vented attics, and crawl spaces.

While it's true that many of the indoor components of mini-splits are ductless, and that reducing ductwork is a piece of their energy-efficiency benefit, not all mini-split indoor air handlers are ductless.

In reality, mini-split indoor air handlers come in multiple "flavors." You can get air handlers that mount to the ceiling (looking kind of like a like a big ceiling mounted speaker), sit on the floor (looking kind of like a radiator), or even small "horizontal ducted" air handlers that — you guessed it — still use ducts. This air handler is much smaller than a traditional indoor air handler and is only designed for short duct runs, but can be useful for covering a cluster of smaller rooms.

(Above) Two "horizontal-ducted" mini-split air handlers fit nicely in the ceiling of a basement and serve two halves of this large super-insulated house (<4,000 square feet) in State College, PA. (Right) Mini-split outdoor compressors look a little different than traditional heat pump compressors too, and they're generally much quieter. LEIGHA DICKENS PHOTOS

The most practical balance of installation cost, efficiency and distribution is often achieved by combining ductless and ducted flavors in different parts of the house.

The technical case

Mini-splits are an energy-efficient choice for reasons beyond simply reducing ductwork.

The efficiency ratings alone are pretty impressive — up to 30 SEER (seasonal energy efficiency ratio) or 13 HSPF (heat seasonal performance factor) in some cases. This rating comes at a lower installed cost in many situations than other admirably efficient but often expensive choices, such as ground-source heat pumps or hydronic radiant floor heating.

Beyond SEER rating alone though is the fact that mini-splits often use variable-speed compressors, making them kind of like a bicycle with infinite gears, compared to the "single-speed bicycle" of a traditional heat pump. The variable-speed compressor can ramp heating or cooling output up or down based on the real-time needs of the home, running at lower speed when less energy is called for and only ramping up when truly needed. This reduces total energy use and can help alleviate some of the problems that come with the oversizing of AC units in particular. This feature also tends to make them quieter — a benefit that homeowners really appreciate.

Some mini-splits can come with a function called hyper-heat, which allows them to operate in cold temperatures previously unprecedented for air-source heat pumps. This makes them a particularly good application for the Western North Carolina area, which is on the northern edge of the climates where heat pumps can work and reliance on expensive backup heat can create high-energy bills. Hyper-heat mini-splits in this climate need no backup and are all electric, which pairs great with grid-tied solar and can reduce the need to run multiple types of fuel services to your home.

Design considerations

In very high-performing houses, it seems possible to meet the comfort needs of the homeowner with a single ductless mini-split indoor unit installed per level, using open doors or transfer grills and fans to get the conditioned air to rooms that don't have direct heating. Pilot super-efficient housing communities as far north as New

The iconic ductless mini-split indoor air handler.

England have experimented with this — though this design does pose some interesting questions about air distribution and is still the subject of ongoing research.

Homeowners and builders new to mini-splits sometimes erroneously assume they need the opposite extreme: a ductless mini-split head in every room in the house. While that may be necessary to use mini-splits in a particular leaky or un-insulated existing home, it's a costly way to go and very likely to be overkill in a new and energy efficient home.

Instead, the right number, location, and flavor of indoor unit will depend on the particular home design, climate, and specs of building envelope. Just like with any HVAC system, load calculation and equipment selection to match the calculated loads are essential. I have found that some floorplan designs work well with mini-splits, and some might be better served with another type of system.

New well-insulated homes with big open rooms — especially if the comparably smaller rooms are clustered together — can be great for mini-splits. Use a wall-mount unit for the open rooms, hide a horizontal-ducted unit in a small attic area or dropped ceiling to cover the bedrooms, so that you can use just two air handlers to cover the whole house. I've found that if you can keep the number of indoor air handlers to three or fewer, the costs for a mini-split heat pump system can be similar or even slightly better than that of a 16-SEER traditionally ducted system.

Designs that have bedrooms on either sides of a big open area (rather than clustering them), complex multi-level designs (especially those with basements that have just one or two conditioned rooms), or designs with one or two small rooms far apart from other rooms can introduce more challenges to mini-split design. Horizontal-ducted units are a great way to hit multiple rooms with one indoor unit and are small enough to be hid in ways that conventional air handlers can't be — but they still do take up some space, as do their ducts, and the length and number of those duct runs needs to be minimized. Designs that use of lots of different smaller rooms are perhaps the least amenable to mini-split systems, especially if vaulted ceilings, slab foundation, or other features limit space to hide and run short ductwork.

Thinking about how to fit mechanical systems into houses always reminds me of the green-building adage that the entire house is a system. Insulation, airtightness and space considerations for mechanical equipment, and the specs of that equipment, all affect one another.

Mini-split heat pumps are not the most efficient heating and cooling choice out there (as the geothermal people will be quick to remind you) and they don't make sense in every situation. But I do keep finding that around here, they're a strong contender.

Leigha Dickens is a HERS (Home Energy Rating System) Rater and the green building and sustainability manager for Deltec Homes. She works with clients across the country to specify their building envelope and HVAC systems for high-performance goals. She cautions that no one technology is a solution for all situations, but has observed that mini-splits are commonly a choice that makes a lot of sense.

Water heater workhorses

Homage to a couple of high-efficiency products

BY JACOB GOODMAN

As a plumber, I come across a wide variety of products and plumbing systems. I am definitely curious and interested in the new technology created by my industry, but very rarely am I impressed with a product. I mean, truly honest-to-goodness wowed.

Ultra high-efficiency water heater

One product that I am impressed with is the ultra high-efficiency water heater (aka, gas condensing water heater). These babies are real work horses.

In order to understand why I am so impressed, you need to know how a typical tank type gas water heater works.

Basically, it has what looks like an extra large stove burner located under a tank of water with a flue pipe for gas to travel through in the center of the tank. Inside this flue pipe is a wavy sheet of steel called the baffle. The baffle slows down the escaping hot gas just enough so heat can be transferred to the water.

This design is very inefficient. As it leaves the water heater, the gas still contains so much heat that we have to install double-walled metal flue pipe if it is close to anything combustible so it doesn't start a fire. That's not very impressive. Tons of energy and money is spent to slowly heat that water, and then most of the heat we have paid for is lost out the top, further heating our already stressed environment.

So what is the difference with an ultra high efficiency water heater? I mean, they look nearly identical to a regular water heater, except maybe a bit thinner, but these things might as well be from a different planet.

First off, the burner sits at the top of the water heater and the flame is less like a stove and more like a jet engine. A fan pushes heat down through a central pipe that spirals down through the inside of the tank, which allows time for the heat to transfer into the water. In fact, 96 percent of the heat from the flames transfers to the water — 96 percent! Cue the phrase "ultra high efficiency." (Not to be confused with what are sometimes labeled as "high-efficiency"

Ultra high-efficiency water heaters heat the water so quickly that it is almost like having a tankless, but without those limits. It's the best of both worlds really: virtually endless hot water, and as much of it as you want.

conventional types, which are only 8 percent more efficient than the older regular models.)

Do you remember the double-walled metal flue pipe the other water heater needed so it did not burn down your house? Well, this thing pulls out so much heat that the flue pipe is made of plastic. That's right, plastic, and it doesn't melt.

But wait! That's not all folks! When you fire this bad boy up, it will heat 50 gallons of cold water to a piping hot 120 degrees in about 15 minutes. So what is the big deal with that? Let me tell you.

Right now, there is a big movement to go to tankless (which, by the way, is a great invention and a huge improvement over conventional), but there are sometimes issues with tankless water heaters — unexpected issues that can require you to change your lifestyle in order to accommodate the tankless' gallons-per-minute limitation. With a tankless, you can have endless sequential hot water, but you can't have a large quantity at once. Ultra high-efficiency water heaters heat the water so quickly that it is almost like having a tankless, but without those limits. It's the best of both worlds really: virtually endless hot water, and as much of it as you want.

On top of that, the cash you save on energy bills is quite substantial compared to the cost of using a traditional tank. The savings over the lifetime of an ultra high efficiency water heater are estimated in the $2,550 range, which would help cover the extra cost of installing this amazing piece of equipment, while you reduce your carbon footprint at the same time.

Hybrid water heaters

Another energy efficient option for folks who don't have natural gas or propane is the hybrid water heater. Also known as a heat pump water heater, the hybrid water heater might just be the best water heater you've never heard of. Its relative obscurity is unfortunate though, because hybrid water heaters really out-perform their conventional electric counterparts.

Heat pump water heaters are not to be confused with heat pump heaters. These true water heaters are much more efficient than electric resistance (conventional) water heaters and most effective in warm climates with long hot or mild seasons, like that of Western North Carolina.

They work by transferring energy (heat) from the surrounding air to water in a storage tank. Instead of trying to heat water by applying direct heat, heat pumps use refrigerant to move the heat from one place (the air) to another (the water), the same way a refrigerator or an air conditioner works, but in reverse.

During times when the demand for hot water is great, heat pumps automatically switch over to using standard electric heat, hence why they are sometimes called hybrid electric hot water heaters.

Heat pump water heaters save money and save the environment. If all the residential electric water heaters in the U.S. were replaced with heat pump water heaters, the national energy cost savings would be $8.2 billion dollars each year, and 98 billion pounds of greenhouse gases would be eliminated from our atmosphere. That's the equivalent of removing 9 million vehicles from the road. What a big impact you can make just by choosing your water heater wisely!

Although hybrid water heaters can be more expensive to install than a conventional water heater, their energy savings over time can greatly offset that cost. A hybrid water heater in Asheville will typically pay for itself in just two years, saving 50 to 71 percent on energy use as compared to a standard electric resistance water heater. For a family of four, the lifetime savings can add up to about $3,510 in electricity bills you won't have to pay.

Installing these types of water heaters is something that makes us feel proud, knowing that we are helping to make a difference, one water heater at a time.

Jacob Goodman is a Master Plumber who completed his four-year plumber's apprenticeship in 2005 and became a licensed plumbing contractor in 2007. In addition to master plumbing skills, he also has professional accreditation in water purification and filtration, green plumbing, tankless, heat pump, high efficiency and solar thermal water heaters, and rainwater harvesting. Jacob's expertise is drawn from over 17 years of experience in the field, on projects ranging from public schools and colleges, to fire stations, storefronts, and custom homes. He is the owner and lead plumber at Asheville-based Goodman Plumbing, www.goodmanforthejob.com

With Nathan Bryant of Samsel Architects as architect and Traci Kearns of Alchemy Design as interior designer, this home was crafted to incorporate sustainable cabinetry. TODD CRAWFORD PHOTO

Is there soy in your cabinet?

Seeking sustainable casework and millwork

BY JOE ARCHIBALD

When it comes to choosing casework and millwork for a project, often the choice comes down solely to cost.

This can lead to casework with a limited lifespan, made of poor quality materials that off-gas formaldehyde and other chemicals.

Thankfully, there are many options for sustainably produced products and materials. To identify these products, often all that is required is to ask some simple questions of your casework or millwork supplier: What percentage of recycled content panel product do you use? What about water-based catalyzed lacquer? And how about your internal recycling program?

Let's consider a standard set of kitchen cabinets, exploring the design and materials to see where opportunities exist to make sustainable choices.

Construction style

There are two basic cabinet construction methods: traditional face frame and frameless or European.

In frameless cabinets, the wood face frame is eliminated and the edge of the cabinet box is banded with one of several different types of thin (0.5mm to 3mm) edgebanding material — either PVC (polyvinyl chloride), ABS (acrylonitrile butadiene styrene), solid wood or wood veneer. Any style of door and drawer front can be used, and most frameless cabinets look nothing like the sleek modern designs the name might imply.

This construction method maximizes the space within the actual cabinet box, making more with less, and eliminates several board feet of lumber required to make the face frame. Choosing frameless cabinet construction is a good start.

For the edgebanding itself, ABS is preferred over PVC in greenbuilding terms, however it is used less frequently and available in fewer colors than PVC. Ask your supplier to source ABS edgebanding if the option exists, as the major manufacturers of edgebanding are bringing more products to the market.

The wood or wood veneer option is the best choice, offering the ability to exactly match wood doors and drawer fronts or be painted to match the cabinet fronts if required.

Panel Products

Hardwood plywood panels are a superior choice for all casework projects. Typically using a birch or poplar core, hardwood plywood is available with many different wood species as the face (exposed) veneer surface. Prefinished panels are available with a UV (ultraviolet light-cured) coating that provides excellent durability and easy cleaning of the cabinet interiors while eliminating the hassle and potential off-gassing associated with other on-site or shop-based finishing methods. Hardwood plywood certified by the Forest Stewardship Council (FSC) can also be sourced, though wood species choices may be limited and cost can be 20 to 30 percent higher than non-FSC panels.

One hardwood plywood product worthy of direct mention is Columbia Forest Products PureBond, which uses a unique soy-based glue in the manufacturing process to eliminate off-gassing and provides great sustainability benefits due to its natural-based composition. Columbia has a local manufacturing plant in Old Fort, allowing for material sourced within a 100-mile radius. (Their UV-finished products come from Chatham, Virginia, though that is still within the generally accepted 500-mile radius for material sourcing.)

Hardwood plywood offers higher strength and greater longevity than other products, providing an improved life-cycle cost assessment.

Medium-density fiberboard, known simply as MDF, is a panel product composed of glue and wood fiber. MDF's low cost, stability (less likely to warp or twist), and smooth finishing ability make it a popular choice for painted casework and millwork as well as a substrate for laminates and veneer work. MDF can be sourced with non-UF (urea formaldehyde) glues and is also available with FSC-certification. Again costs are higher — approximately 15-25 percent more than standard MDF, depending on the panel manufacturer.

Alternatives are also available. Bamboo plywood is one that offers the ability to have a structural

panel and exposed face with a unique look all in one. It is frequently used for cabinet fronts and furniture. Though less readily available, there are also panels produced from wheat stalks and other agricultural byproducts.

Finishes

Gone are the days when you had to air out a project for days after the casework was installed. The long tradition of nitrocellulose lacquers and other hazardous and noxious finishes is evaporating like a can of lacquer thinner.

Water-based and other low-VOC (volatile organic compounds) finishes are making their way into every manufacturer's product catalog. These finishes offer equal durability to the traditional nitrocellulose products and are available in various sheens in both clear and tinted (solid color) versions, so matching that vintage avocado green range is easily accomplished.

Soy-based finishes are another option that a few specialty finish manufacturers offer. Durability may be an issue in high-use wet areas like bathroom vanities.

One product in this category that bears direct mention is Rubio Monocoat. Rubio is a hybrid wax and linseed oil all-natural based product that offers zero VOCs and a simple one-coat finishing process. It is typically used as a floor finish, though it works perfectly well for cabinets, furniture and other casework.

Veneer

Veneer-based construction has been around for hundreds of years, yet many people only associate it with cheap furniture from the 1950s.

What most people don't know is that the highly figured woodwork and casework they admire is veneer work. That gorgeous ribbon Sapele-lined elevator cab at the fancy hotel? Veneer. The antique dining table with the Walnut crotch-figured top and matching leaves from your grandmother? Veneer.

Veneer is thin (1/42" is typical), solid wood that has been sliced from whole logs. The amount of material generated from each log is maximized, making it an excellent sustainable choice.

Typically, the best and highest quality logs are culled out and sent to the veneer mills, providing some of the most exciting and sought-after figures and cuts—many that are unavailable in solid lumber. Specialty cuts, like quarter-sawn White Oak, are readily available in veneer for a more reasonable cost than in solid lumber.

Veneered panels can be used for cabinet doors and drawer fronts, millwork (including curved work), interior and exterior doors, furniture and any other built-in or freestanding casework that you can think of.

Veneer provides the beauty and organic benefits of solid wood with a reduced environmental impact.

Hardware

Think closely about the places where you actually interact with the casework.

Choosing high quality hardware — drawer slides, hinges, accessories and pulls or knobs — is always a better choice in the life-cycle assessment of a sustainable project, and higher quality typically means greater functionality.

Cabinet hardware that allows greater access to the interiors, especially blind corners and deep cabinets or closets, can maximize storage space, thereby making more room from less space — a true tenet of sustainable design.

In-house operations

Other simple questions to ask your supplier include:

- Do you recycle? What do you do with wood waste, scrap metal, shipping materials?
- How about your suppliers? Consider distance to them, shipping of materials and their sustainability measures.
- What about the distance to the project? Remember: "Love Local." If you as the contractor shop at Earth Fare, why would get your cabinets from Ikea?

Hopefully this brief look has given you some ideas and insight about what to consider when sourcing the casework and millwork for your next project. It can be as simple as asking, "Is there soy in your cabinet?"

Joe Archibald is an architect and contractor living in Asheville with more than 20 years experience in the residential construction industry. He operates Narwhal Design | Build, a craft-based design and construction firm with the intent to create a built environment that respects the natural condition, engages the people who use it and rewards those who participate in its construction.

Walk the environmental talk

Creating a sustainable action plan for your office

BY MARGARET CHANDLER

As design professionals, our focus is on providing clients the highest level of sustainable design and construction. The true test of practicing what we preach, however, comes from the internal operations of our businesses. Do we promote a sustainable ethos within our studios and offices? This is where a Sustainable Action Plan is helpful.

The LEED Existing Buildings Operations and Management (EBOM) and the Asheville Workplace Challenge provide an excellent framework for guidelines on drafting a Sustainable Action Plan tailored to individual organizations. LEED EBOM provides a more detailed checklist for sustainability, with acknowledgement of pest control, landscaping, sustainable products, green cleaning, and occupant comfort. More information can be found at www.usgbc.org/leed.

The Asheville Workplace Challenge is a regional sustainable operations plan promoted by the City of Asheville. It awards points for high levels of achievement in company internal policy, energy efficiency, water conservation, waste reduction, and transportation. Learn more about this initiative at www.asheville.municipalchallenge.com.

Another regional program that helps local organizations achieve environmental sustainability is Appalachian Offsets. This Green Built Alliance program gives organizations and individuals a way to offset their carbon emissions by paying into a community fund that makes energy-efficiency improvements within local nonprofits, schools, and low-income housing. Users can make contributions based on how much carbon they emit, calculating their share with a user-friendly application online at www.cutmycarbon.org.

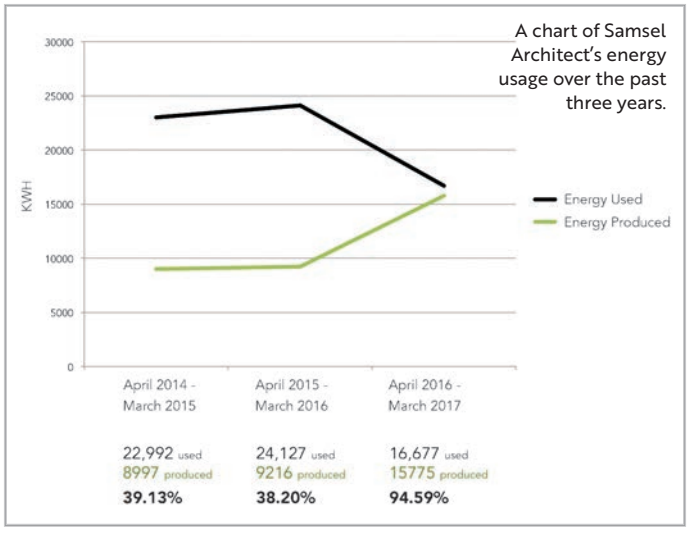
At our firm, we have synthesized the sustainable tenets of all three programs, creating a practical Sustainable Action Plan. Our sustainability policy includes an environmentally preferable office supply purchasing policy, a contract with a composting service, promoting energy efficiency internally by encouraging employees to maximize the use of natural light in our studio, and establishing a regular cleaning schedule for the 21kW solar array on the roof of our building.

In the past year and a half that these efforts have been in place, we have seen an almost 50 percent reduction in energy use, on average. The energy usage that remains has been offset by participation in Appalachian Offsets, officially making our office carbon-neutral. With the compost pickup service, our office landfill waste has easily been cut in half.

Defining commitment to environmental responsibility in quantifiable terms allows businesses to measure and improve their performance — an excellent way to ensure environmentally preferable practices internally as well as externally. A Sustainable Action Plan is a simple way to exemplify the sustainability tenets that we strive to promote in our community.

Margaret Chandler is an 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 as Treasurer on the AIA Asheville Executive Committee.

A 21 kW solar array is positioned on the roof of Samsel Architects' building. SAMSEL ARCHITECTS PHOTO



A chart of Samsel Architect's energy usage over the past three years.

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I lost 5,000 pounds in 8 weeks

Digging into the Low Carbon Diet program

BY AMY MUSSER

Learn how to implement the fastest-payback energy upgrade, with no sacrifice. AMY MUSSER PHOTOS

I lost 5,000 pounds in eight weeks. Actually, I shaved more than that off my carbon footprint. I was surprised by how easy it was, because my husband and I have lived in a net-zero energy house for the past six years. I thought I was doing all the "easy stuff": recycling, reducing miles driven, changing light bulbs, meatless Monday. And I was doing it, but it never hurts to dive in a little deeper.

A couple months ago, a friend showed me the "cool community" program and talked me into starting a local group. The idea is to gather a group of five to eight neighbors to do a carbon-reduction workbook called "Low-Carbon Diet."

We wanted to get it started in Asheville, so we got a group of eight committed environmentalists to try it out. Most of us thought we were doing pretty well — several of us even have solar on our houses. The program is pretty basic, so we didn't expect to get a lot out of it personally. It turns out we were wrong about that!

The program is really basic. You can do it even if you don't have much (or any) money to spend on energy upgrades. The most "handyman" thing the program asks you to consider doing is to change a showerhead.

Everything is a choice — there's nothing you have to do. But the program is also really powerful. It was developed by The Empowerment Institute, and they have found the average participant decreases their carbon footprint by 25 percent. Our group members all hit this target.

What surprised all of us was how fun the program was. We met four times over eight weeks at a different member's home each time. As we shared our successes and the ways we were getting hung up, we realized each of us was an expert at something: home energy, gardening, food production, internet research, canning, and even sewing. So now we each have our own "stable of experts" we can call when we want to do something that's new to us.

Are you using power strips the right way to eliminate vampire loads?

We also realized group brainstorming is really powerful — we came up with some good ideas I never would have dreamed up on my own. We really did develop a community.

What were some of our successes?

Showering was an area where a lot of us had been resistant to making a change. One person had even tried a low-flow showerhead and didn't like it. I was able to talk her through buying the right "high-performance/low-flow" showerhead. If you get a good one, it's actually a higher-pressure shower that feels great. She tried it again and loved it. Someone else in the group shared that she started timing her showers to two songs on the radio, a change that turned out to be really fun and helpful for those who wanted to try shorter showers.

One of the group members spent several hours researching the different types of power strips that could be used to reduce vampire loads. He explained to us which type worked best for cell phone chargers, computers, and AV equipment. He also bought a meter to measure the vampire power his home appliances were using, and let other members of the group borrow it.

I was reminded of the little everyday stuff that really adds up. Was I using my clothesline as much as possible? Was I combining trips when I could? Had we bought new appliances that needed to be checked for vampire power?

In the modern world, it's so easy to accidentally create wasteful carbon emissions that it helps to check in periodically to make sure you're still on track. It really helps to have the support and encouragement of friends.

Some of us also decided to offset carbon emissions, and we got local and creative about how to do that. Some of us volunteered with Energy Savers Network (ESN) and got offsets using sweat equity. ESN is an organization that provides free energy upgrades to low income families in our community, so you're helping real people while you're reducing carbon emissions. I chose to donate to Appalachian Offsets, which will be putting solar panels on the roof of Isaac Dickson Elementary School. Others bought green power through Arcadia.

We form new groups regularly, so if you are interested, contact us at cool.communities.avl@gmail.com. We will also provide an experienced facilitator for a group in your neighborhood if you have five to eight friends who want to participate.

If you're new to energy efficiency and haven't changed your light bulbs yet, this program was designed for you. If you've been in this game for decades, this program has a lot to give you too.

Amy Musser is a founder of Vandemusser Design, an Asheville area company that provides green certification and energy-efficiency consulting to contractors, architects, and homeowners. She and her husband and business partner, Matthew Vande, have lived in a net-zero energy house since 2011.

ORGANIC GROWERS SCHOOL PHOTOS

Get growing

Home-growers play a significant role in WNC's thriving food community

BY LEE WARREN

Western North Carolina is a mecca for those interested in sustainability and organic food production, yet we are a long way from where we want to be.

In our vision of a vibrant food and farming community in Western North Carolina and beyond, every person would be engaged in some form of food production. Home and community growers are central, dynamic and vital partners in the development of the sustainable food movement.

Developing the skills, confidence, and output of home-growers is a vitally important area of development for any region interested in food resiliency.

The Victory Garden program of the early-to-mid-1900s is a great example of a far-reaching and successful ongoing campaign to increase social understanding of the importance of reclaiming agriculture in daily life. At the height of the Victory Garden program in 1943 and 1944, it had 20 million gardens in the U.S. and grew 45 percent of the vegetables and fruit consumed nationally.

Imagine 20 million gardens in the U.S. today. Imagine 50 million lawns, parks and community gardens made productive. Imagine 40 to 50 percent of a region's food grown locally by the very people eating it.

It is possible. Yet the unmet needs are many, ranging from education, outreach, and public awareness to access to land, economic support, networks, and rebuilding community.

While the industrial revolution promised to liberate us from rural life and physical toil, it has created more problems than it has solved. Chemically-based methods and GMO foods are compromising our health and our environment, and the promise of mechanized agriculture to feed the world has fallen short.

According to the statistics on world hunger, 842 million people in the world are food insecure. Due to this rising rural poverty, world hunger, and environmental concerns, world leaders are encouraging a shift from industrial agriculture to diverse productions systems that improve soil, support farmers and feed communities.

We define the unmet needs in these social, environmental, political, and community contexts:

- **The Big-Picture Problem:** Big agriculture and globalization results in a loss of biodiversity, environmental crises, reduced food and community resilience, increased world hunger, and an over-reliance on industrial food systems.
- **The Community Problem:** Our food and farming heritage and culture are fragmented by the agribusiness agenda and our communities have little cohesion with regards to interdependence, skill-sharing, or celebration of food and growing.
- **The Family-Farms Problem:** The average age of farmers nationally is 58; traditional methods of farming and knowledge transfer have been lost; there is strong development pressure on North Carolina farmland; and there are many barriers to farming including access to land, capital, training, support, etc.
- **The Home-Grower Problem:** The industrialization of food and growing leaves the average person out of touch with the basics of food, kitchen, and garden literacy. The loss of ancestral knowledge and of a local food community leaves people disconnected, disempowered, and insecure.
- **The Healthy-Eater Problem:** Misinformation and manipulation by our current food system are leaving eaters sick and ill-informed.

The good news is that from all sectors, research is showing that sustainable agriculture — in the form of agroecology and resilient local food systems — offers promise for addressing our failed food systems.

Addressing the food crisis is going to take all of us, and we must start now. We must inspire, encourage, educate and support the average person to grow food in order to strengthen communities, reclaim food sovereignty (where the eaters make the decisions about the food life cycle), and prepare for global energy peaks and climate change.

The small-scale grower is the sustainable grower, which means planting a variety of crops, without chemicals, and eating fresh where the food is produced.

As the average person is inspired to re-engage with growing and to repopulate their daily lives with home-grown food, the following outcomes will be additional benefits:

1. Enhanced personal food security, self-reliance, and empowerment within each grower.

2. Expanded home-grower interests into food production, processing, storage, and sharing to increase regional food security and community resilience.

3. The development of regional interdependence, community resilience, and local food sovereignty by adding home gardeners as allies.

4. Increased environmental stewardship, nature and ecological awareness, best land use practices, attention to water and soil quality, focus on local food, conservation-mindedness, and overall appreciation for the web of life on the part of home growers.

5. The establishment of Western North Carolina as a region committed to regional food systems, small-scale sustainable agriculture, and a food- and growing-literate population.

Now is the time. We must end our over-reliance on industrialized food systems and create a region of inspired, educated and confident food growers.

The ultimate outcome is an empowered population successfully growing organically on a home- and community-garden scale, who are financially and nutritionally resourced, ready to take a seat at the political table and use their voice to advocate for more equitable, sustainable and accessible food systems and a vibrant, engaged community.

Lee Warren is the executive director of Organic Growers School, offering organic education to the Southern Appalachians since 1993. Organic Growers School provides practical and affordable organic education regionally, building a vibrant food and farming community by boosting the success of organic home growers and farmers. Their hands-on trainings, workshops, conferences and partnerships strengthen and celebrate each grower's move towards self-reliance.

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mikebosticbuilders@gmail.com

The Brigman Group
Tim Brigman
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828.273.1185
timbrigman@gmail.com
thebrigmangroup.com
The Brigman Group is a team of collective thinkers dedicated to high quality construction through custom, investment, and renovated home building in Western North Carolina.

Brock Builders, Inc.
Chris Brock
1854 Hendersonville Road #208
Asheville, NC 28803
828.243.6105
chris@brockbuildersinc.com
brockbuildersinc.com

Buchanan Construction, LLC
Rick Buchanan
44 Buck Shoals Road
Arden, NC 28704
828.650.6565
rick@buchananconstruction.com
buchananconstruction.com
A green home is healthier to live in and healthier for our planet. It is our mission to build green homes that bring together the features of an environmentally-friendly structure, while maintaining the function and design of a custom built, upscale home - our unique hybrid of green and luxury.

FOLLOW US ON FACEBOOK:
facebook.com/greenbuiltorg

BuiltSmart by Bob
Bob Callahan
104 Lakeshore Drive
Asheville, NC 28804
828.620.9730
casegreenbob@gmail.com
builtsmartbybob.com
Green building with BuiltSmart means net-zero energy-ready homes with the best interior air quality for your family's health and comfort. Our custom construction utilizes building science techniques for low-impact and less future maintenance. Call BuiltSmart if you want reduced energy costs, better health and the greater free time you deserve.

Builtwright Construction, Co.
Andrew Gardner
301 Elk Park Drive
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828.545.0052
andy@builtwright-construction.com
builtwright-construction.com

Cady/Guyton Construction
Boone Guyton and Claudia Cady
85 Laughing Crow Road
Alexander, NC 28701
828.683.3688
boone.guyton@gmail.com

Cardinal Point Construction, Inc.
Dan Clere
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Asheville, NC 28806
828.712.5424
danielclere@gmail.com

Care Construction LLC
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careconstruction.net

Continuous Improvement Construction LLC
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ciclic.duane@gmail.com
cic-llc.squarespace.com

Corner Rock Building Co.
Zach Banks
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828.252.7787
zach@cornerrockbuilding.com
cornerrockbuilding.com

Crazy Hair Construction
Andrew Kucera
374 Old Toll Circle
Black Mountain, NC 28711
828.215.7618
hardsteelandiron@hotmail.com
We are small creative company. We are bringing life back to the speculative housing universe.

DeBord Enterprises, LLC
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Deltec Building Company
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dthompson@deltechomes.com
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Demos Builders, Inc.
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Dirt & Sticks Real Estate Development/Compact Cottages
Barry Bialik
PO Box 475
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828.254.5450
gimmeone@compactcottages.com
compactcottages.com

Duinkerken Homes, Inc.
Brandon Duinkerken
20 Adas Way
Weaverville, NC 28787
828.450.9395
duinkerkenhomes@gmail.com
duinkerkenhomes.com

Energy-saving Tip:
The quickest way to save energy on home cooling is to regularly clean and replace your cooling unit's filters.

Earthtone Builders
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Asheville, NC 28806
828.230.4469
earthtonebuilders@gmail.com
earthtonebuilders.com
We are a leading green building company committed to the highest standards in construction quality and sustainable, healthy living.

Equinox Woodworks
Todd Kindberg
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828.284.6552
todd@equinoxwoodworks.com
equinoxwoodworks.com

Evergreen Construct Inc.
Darren Henegar
12 Moonrise Ridge
Leicester, NC 28748
828.779.4077
evergreenconstructinc@gmail.com
Evergreen Construct specializes in custom built homes and renovations. We start with your inspiration and through a collaborative process we create mindfully crafted structures that are site specific to meet our clients needs. We build quality into everything we do.

Falcon Development of NC Inc.
David Ross
30 Hendersonville Road
Asheville, NC 28803
828.274.3055
tanya@falconbuilt.com
falconbuilt.com
Residential and Commercial construction services. 2012 Parade of Homes Best in Show winner. Specializing in quality green construction and design build of both new homes and remodels of existing.

Forward Construction Inc.
Jim Forward
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Asheville, NC 28803
828.298.9532
jtfbuilder@gmail.com
The Forward family provides each client with the attention to detail, caring, and enjoyment they deserve when building and remodeling.

Going Green Builders LLC
Raymond Jacques
222 Dogwood Hills Drive
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828.577.3472
goingreenbuilders@gmail.com
goinggreenbuilders.info
My goal is not only tohelp clients that canafford to go off the grid, but to help average homeowners redue the impact on the environment with affordable green building techniques

Goshen Timber Frames
Bonnie Pickartz
37 Phillips Street
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828.524.8662
bonnie@goshenframes.com
timberframemag.com
Since 1997, our family-owned and operated company has worked with clients nationwide to design and build the homes of their dreams. We listen, advise and share what we've learned from our diverse clientele. Our goal is to design and handcraft homes that are sustainable, energy efficient, structurally sound and beautiful.

Grammatico Signature Homes
Dan Grammatico
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Biltmore Lake, NC 28715
828.273.9877
grammaticohomes@gmail.com
grammaticohomes.com
Grammatico Signature Homes is an Asheville-based full-service building company offering complete home building, remodeling, consulting, and real estate.

Greencraft, Inc.
James and LeAnn Bound
PO Box 57
Fairview, NC 28730
828.713.2316
greencraft.lb@gmail.com
ashevillegreenbuilder.com
We are committed to serving Asheville as a sustainable builder. Our focus is super energy-efficient, high-quality and environmentally sound home-building.

Shut it down
Your computer may go to sleep, but it's still sucking up energy. Turn your computer off at the end of the day.

Green Earth Developments
James Boren
PO Box 17544
Asheville, NC 28816
386.690.0886
jamesnboren@yahoo.com
loveyournewgreenhome.com
Our business involves developing responsible homes on a site where the trees are considered very important assets to this planet. Love your new green home!

Green Light Home Builders, LLC
Jon Sloop
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jon@greenlightcustomhomes.com
greenlightcustomhomes.com

High Country Timberframe & Gallery Woodworking Co.
Tom Owens
PO Box 1858
Boone, NC 28607
828.264.8971
tomo@highcountrytimberframe.com
highcountrytimberframe.com
We've been a leader in traditional and contemporary timber frame and SIPS panel design and construction for more than 12 years, with many high-profile projects completed throughout the United States. We strive to ensure that the second life of the tree be as dignified as the first.

High Ridge Custom Homes, LLC
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Holbrook & Nichols Construction
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HomeSource Real Estate & Construction, Inc.
Tim Alexander
172 Charlotte Street
Asheville, NC 28801
828.252.1022
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homesourcebuilders.com
Fully licensed and insured custom home builder and remodeling contractor, providing expertise and commitment in construction. Offering turnkey service, including home design, kitchen and bath design, and product selection under one roof. Current and past projects include more than 100 custom homes and hundreds of remodels from large to small.

Jade Mountain Builders & Co.
Hans Doellgast
85 B&B Stables Drive
Fairview, NC 28730
828.216.3948
hans@jademountainbuilders.com
jademountainbuilders.com
Jade Mountain Builders is a team of 31 Craftsmen who pride themselves on taking an ecologically sensitive approach to building homes.

JAG & Associates Construction
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Asheville, NC 28805
828.216.0914
jody@jaggreen.com
jaggreen.com
JAG Construction is a small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, long-lasting houses more available to the general public. We're examining new ways to reduce the impact of construction on the environment around us and preparing for a future of alternative energy.

Jerry R. Brown Construction Co.
Jerry Brown
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JSS Homes, LLC
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16 Yorkshire Court
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arrowood197@bellsouth.net
jsshomesllc.com
JSS Homes is proud to offer homes with the planet's well being in mind. Quality, innovation and trend-setting designs are our promise.

KOR Construction LLC
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Lifestyle Homes of Distinction, Inc.
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Living Stone Construction
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Longview Builders
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longviewbuildersInc.com
We focus on a team approach with owner, designer and builder to deliver award-winning green homes on time and budget.

M.C. Kern Contracting, Inc.
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McHugh Designs
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rebaloo@bellsouth.net
mchugh-designs.com
We strive to make art that you live in. Custom woodwork, in-house design, and attention to detail sets us apart.

Meinch Construction Inc.
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Mike Eubank Construction, Inc.
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Mountain Construction
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Mountain Construction.com, Certified Green Professional residential builders of fine custom homes in northwestern NC and eastern TN. Hearthstone NC, representatives of Hearthstone Timber Frame, Log, SIP homes, barns, commercial structures, serving NC and beyond-HearthstoneNC.com

Mountain Realty Builders, LLC
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Mountain Sun Building & Design
Emily Boyd
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emily@mountainsunbuilding.com
mountainsunbuilding.com
As both a land developer and a Design/Build firm, MSB&D can help clients at any stage of the new home building process. We focus on site specific design and Zero Energy Homes, creating finely crafted, light filled interiors that capture the beauty of and connect to their natural surroundings.

Nemec Construction, LLC
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nemecconstruction.com

New Pointe Builders
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newpointebuilders.com

Nicholson and Sun LLC
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Weaverville, NC 28787
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Using a foundation of science, aptness for innovation, and passion for arresting climate change, we build unique true "green" homes.

Old North State Building Company
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Osada Construction
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osadaconstruction.com
NC General Contractor (unlimited license) Builders of Certified Green Built Homes. Custom Homes, new and remodels, commercial construction, full service contracting, construction management

Palladium Builders, Inc.
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jim@palladiumbuilders.com
palladiumbuilders.com

PebbleDash Builders
Brian Hutzler
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bhutzler@pebbledashbuilders.com
pebbledashbuilders.com

Pioneer Construction and Development Inc.
Duane Liming
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828.242.5101
duane@pioneerasheville.com
pioneerasheville.com
With over twenty years of experience, Pioneer consistently blends innovative ideas with time honored quality. We work until your project or new home is true to your vision. To learn more call us at 828.768.8771.

Preish Construction, Inc.
Mallory Fuller
1116 Burnside Drive
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828.776.4444
homes@preish.com
preish.com

Rare Earth Builders
Mark Bondurant
105 Creative Cove
Canton, NC 28716
828.492.0534
rareearthbldrs@bellsouth.net
rareearthbuilders.com
We build high-performing, exceptionally beautiful custom homes while minimizing negative environmental impacts with attention to construction details and client comfort.

RCJ Building Inc.
Robert Jacobelly
3 Von Ruck Terrace
Asheville, NC 28801
828.216.4433
rcjbuilding@yahoo.com
rcjbuilding.net
RCJ Building Inc.custom homebuilding professionals have the knowledge and expertise that you'll need when you have the opportunity to build the house you've always wanted. We understand what goes into the building process, and more importantly, what goes through the minds of future homeowners during the build. The RCJ Building difference is that we know how to make the process exciting, fun, and stress-free, from inception to completion.

Red Tree Builders, Inc.
Brandon Bryant
PO Box 8044
Asheville, NC 28814
828.712.1518
brandon@redtreebuilders.com
redtreebuilders.com

RS Motley Construction
Rob Motley
18 Alabama Ave
Asheville, NC 28806
828.776.7470
rmotley80@hotmail.com
robmotleybuilder.com
We distinguish ourselves through communication, honesty, transparency, attention to detail, and building each home as if it were our own.

Sage Builders
Doug Keefer
299 Morgan Branch Road
Leicester, NC 28748
828.713.7208
info@thesagebuilders.com
thesagebuilders.com
SAGE uses Sustainable, Appropriate, Green and Efficient building techniques to create beautifully hand-crafted homes with passive and active solar amenities

Schumacher Homes of North Carolina, Inc.
Steve Wallin
98 Dogwood Road
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828.490.4807
swallin@schumacherhomes.com
schumacherhomes.com

Sineath Construction
Allyson Sineath
PO Box 1603
Weaverville, NC 28787
828.645.8518
asineath@sineathconstruction.com
sineathconstruction.com
We're committed to offering you a place constructed with care; using quality, sustainable materials with enduring value and timeless appeal.

Solid Rock Builders
Travis Meinch
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828.712.3280
travis@solidrockbuilders.com
solidrockbuilders.com
We focus on providing our customers with a wonderful building experience, and a beautiful efficient custom home.

Standing Stone Builders, Inc.
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standingstonebuilders.com

Stewart Builders Inc.
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stewartbuilders.net

Sure Foot Builders Inc.
Raymond Thompson
11 Blanton Street
Asheville, NC 28801
828.242.0925
surefootbuilders@gmail.com
surefootbuilders.com
We are a speculative and custom home building company working in the greater Asheville area. It is our passion to build beautiful and creative homes that add value and comfort to the lives of our owners and community. In each home we strive to articulate modern green building practices.

The William Baxter Co.
William Baxter
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Thompson Properties, Inc.
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Timberframe Horizons, LLC
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We are a design build firm that specializes in creating energy-efficient custom artisan homes utilizing timber frame construction.

Timberline Custom Homes, LLC
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timberlinehomes@att.net
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Town Mountain Builders
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Tyner Construction
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Wheelhouse Builders
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Wright Family Custom Homes
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Cleaning

Clean Environments
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Shop and Clean 123
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Commercial Builders

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A green home is healthier to live in and healthier for our planet. It is our mission to build green homes that bring together the features of an environmentally-friendly structure, while maintaining the function and design of a custom built, upscale home - our unique hybrid of green and luxury.

Deltec Building Company
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GREENBUILT ALLIANCE

For info on events, educational opportunities and resources, visit www.greenbuilt.org

High Country Timberframe & Gallery Woodworking Co.
Tom Owens
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828.264.8971
tomo@highcountrytimberframe.com
highcountrytimberframe.com
We've been a leader in traditional and contemporary timber frame and SIPS panel design and construction for more than 12 years, with many high-profile projects completed throughout the Eastern United States. We strive to ensure that the second life of the tree be as dignified as the first.

Consultants

D & J Properties
David Walters
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828.631.1804
davewalt@bellsouth.net
balsamgreen.com
Need help with your green building project?We are a team of experienced consultants and designers acting as owner advocates throughout the design build process. Let us show you the many shades of green and explain our various services in our 5,000 sq ft LEED showroom.

Southeast Ecological Design
Kevin Ward
503 Old Farm Road
Marshall, NC 28753
828.768.6448
kevin@ecologicaldesign.net
ecologicaldesign.net
SEED is a green design and consultation firm. We are organized to approach land-use planning and custom building design, 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 and the earth.

Sustainability Consulting - Organic Growers School
Brandon Greenstein
PO Box 17804
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828.772.5846
home-grow@organicgrowersschool.org
organicgrowersschool.org/consulting-coaching

Crawlspace Sealing

Conservation Pros
Marcus Renner
53 Wellington Street
Asheville, NC 28806
828.713.3346
info@conservationpros.com
conservationpros.com
Conservation Pros is a building performance contracting firm providing solutions to energy efficiency, inadequate insulation, crawlspace mold and moisture, and indoor air quality in homes and business across WNC.

J. Coleman Waterproofing
Jan Coleman
505 Lafayette Ave
Asheville, NC 28805
828.299.8506
jan@jcolemanwaterproofing.com
jcolemanwaterproofing.com
Below grade waterproofing. Tuff-N-Dri R3,5,10 or any combo. Slab on grade to seal plus R5-10 Air Moisture Barriers EnvironDri, Encapsulated crawlspace. Interior Drains

Developers & Communities

Building for Life, LLC
Stuart Zitin
139 3rd Street
Asheville, NC 28803
828.230.1424
stuartzitin@charter.net
buildingforlifeasheville.com
We have completed many renovations, additions, and a few new homes in Asheville since 1996. Now we have begun developing 4 south-facing acres in Oakley, a mile from BiltmoreVillage. All homes will be Energy Star/Green Built Certified—some with breathtaking mountain views and some affordable, including a Cottage Development.

East West Capital
Brian Nelson
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828.490.1156
bnelson@eastwestcapitalgroup.com
eastwestcapitalgroup.com
East West Capital is a real-estate private-equity investment firm with a focus on acquiring, repositioning and managing value-add projects. We focus on driving successful residential and commercial projects in urban areas and in the path of development. Sources of capital include the principals and funding from Asia and the U.S.

Did you know?
Refrigerators and freezer units account for 1/6 of a home's energy use. Select energy-efficient models when buying replacements.

Energy saving tips: energy.gov/energysaver

Green Earth Developments
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PO Box 17544
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386.690.0886
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loveyournewgreenhome.com
Our Business involves developing responsible homes on a site where the trees are considered very important assets to this planet. Love your new green home!

Habitat Re-Imagined
Ron Czecholinski
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habitatreimagined.com

JAG & Associates Construction Inc.
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JAG Construction is a small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, long-lasting houses more available to the general public. We're 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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jsshomesllc.com
JSS Homes is proud to offer homes with the planet's well being in mind. Quality, innovation and trend-setting designs are our promise.

Mountain Meadows on Crooked Creek
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Mars Hill, NC 28754
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bernie@ashevillemountainlots.com
ashevillemountainmeadows.com

Did you know?

You can reduce air conditioning energy use by 20-50 percent by switching to high-efficiency air conditioners and taking other actions to lower your home cooling costs.

Space heating is the largest energy expense in your home, accounting for about 45 percent of your energy bills.

Mountain Sun Building & Design
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mountainsunbuilding.com
As both a land developer and a Design/Build firm, MSB&D can help clients at any stage of the new home building process. We focus on site specific design and Zero Energy Homes, creating finely crafted, light filled interiors that capture the beauty of and connect to their natural surroundings.

Pike Real Estate Development
Ken Condra
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Skyland, NC 28776
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Education

AB Tech
Heath Moody
340 Victoria Road
Asheville, NC 28801
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hmoody@abtech.edu
abtech.edu
Programs focus on live projects and hands-on activities to teach students energy efficiency, renewable energy technologies, and construction materials and methods associated with high-performance buildings. Students will learn advanced framing methods and other alternative building techniques associated with 'green building,' energy auditing techniques and software associated with building energy analysis.

Asheville Home Builders Association
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NC Sustainable Energy Association
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The leading nonprofit dedicated to creating clean energy jobs, economic opportunities and affordable energy to benefit all of North Carolina.

North Carolina Building Performance Association
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buildingnc.org
NCBPA is a 501(c)(6) nonprofit trade association dedicated to growing North Carolina's home and building performance industry through public education, workforce development, advocacy and much more.

Organic Growers School
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organicgrowersschool.org
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American Clay Earth plaster, Nat hydraulic lime, applicator services, clay workshops, Forno Bravo ovens, fireplace kits, complete installations. Sustainable flooring, Vermont Natural Coatings. Public showroom.

#DidYouKnow:
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Robbie provides clients with in-depth knowledge of Asheville, and works as listing agent for several of this city's green builders.

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Hannah Solar is a full-service solar integrator dedicated to providing the very best in engineering, products, installation and operations and maintenance of solar arrays, electric vehicle (EV) charging stations, Tesla® storage systems and Generac® backup generators.

Haynes Energy Solutions
Pam Parris
187 Deaverview Road
Asheville, NC 28816
828.254.6141
pparris@mbhaynes.com
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Save energy and slash power bills with solar panels, solar thermal, and geothermal heat pumps and hot water heaters. Financing, free analysis, and help with tax incentives.

Solar Dynamics Inc.
Ole Sorensen
40 Green Valley Road
Asheville, NC 28806
828.665.8507
ole@solardynamicsnc.com
solardynamicsnc.com

Solfarm - Renewable Energy & Efficiency
Mike Diethelm
66 McClain Street
Asheville, NC 28803
828.215.6007
mikediethelm@gmail.com
solfarm.com
A full-service solar energy company offering consultation, system design and installation for solar photovoltaic energy system. Devoted to providing a simple, streamlined solar experience to our customers.

Sugar Hollow Solar, Inc.
Phelps Clarke
6 Sugar Hollow Lane
Fairview, NC 28730
828.776.9161
info@sugarhollowsolar.com
sugarhollowsolar.com
We are a locally owned, full-service renewable energy company focused on great design, installation and service of solar arrays, electric vehicle (EV) charging stations, energy efficiency, battery backup and radiant heating systems. Our team has over 75 years of combined experience helping homeowners, business and government go solar.

Sundance Power Systems, Inc.
Dave Hollister
11 Salem Hill Road
Weaverville, NC 28787
828.645.2080
info@sundancepower.com
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 empower people to participate in the solution to our energy challenges.

The Solar Connection
William Boyle
400 Hickory Drive
Mars Hill, NC 28754
828.779.2165
boyleenterprises@gmail.com
boyleent.com

Renovators & Remodelers

A & B Construction and Development, Inc.
Jeremy Bonner
PO Box 15370
Asheville, NC 28813
828.258.2000
jeremybonner@a-b-construction.com
a-b-construction.com
Committed to quality since 1981, A&B builds with great care and efficient use of the resources needed. Your design or ours, residential or commercial, A&B is the right choice.

Burdett Building and Remodeling LLC
Bill Burdett
PO Box 381
Zirconia, NC 28790
828.693.6036
burdettbuilding@gmail.com

The Brigman Group
Tim Brigman
PO Box 683
Weaverville, NC 28787
828.273.1185
timbrigman@gmail.com
thebrigmangroup.com
The Brigman Group is a team of collective thinkers dedicated to high quality construction through custom, investment, and renovated home building in Western North Carolina.

Continuous Improvement Construction LLC
Duane Honeycutt
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Black Mountain, NC 28711
828.551.7573
cicllc.duane@gmail.com
cic-llc.squarespace.com

Earthtone Builders
Greg McGuffey
12 Rich Street
Asheville, NC 28806
828.230.4469
earthtonebuilders@gmail.com
earthtonebuilders.com
We are a leading green building company committed to the highest standards in construction quality and sustainable, healthy living.

Evergreen Construct Inc.
Darren Henegar
12 Moonrise Ridge
Leicester, NC 28748
828.779.4077
evergreenconstructinc@gmail.com
Evergreen Construct specializes in custom built homes and renovations. We start with your inspiration and through a collaborative process we create mindfully crafted structures that are site specific to meet our clients needs. We build quality into everything we do.

Falcon Development of NC
David Ross
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Asheville, NC 28803
828.274.3055
tanya@falconbuilt.com
falconbuilt.com
Residential and Commercial construction services. 2012 Parade of Homes Best in Show winner. Specializing in quality green construction and design build of both new homes and remodels of existing.

Forward Construction Inc.
Jim Forward
24 Smokey Road
Asheville, NC 28803
828.298.9532
jtfbuilder@gmail.com
The Forward family provides each client with the attention to detail, caring, and enjoyment they deserve when building and remodeling.

Going Green Builders LLC
Raymond Jacques
222 Dogwood Hills Drive
Brevard, NC 28712
828.577.3472
goingreenbuilders@gmail.com
goinggreenbuilders.info
My goal is not only tohelp clients that canafford to go off the grid, but to help average homeowners redue the impact on the environment with affordable green building techniques

Green Built Environments
Victoria Schomer
25 Saint Dunstans Circle
Asheville, NC 28803
828.707.2919
vschomer@greenbuilt-e.com
greenbuilt-e.com
Interior and exterior renovation, focused on health, efficiency, aesthetics and sustainable living. Green Real Estate Broker too. LEED AP ASID.

Reduce and Recycle

The U.S. uses 100 billion plastic bags annually, consuming about 12 million barrels of oil. Less than 1% of plastic bags are ever recycled. Reusable bags can help reduce the number of plastic bags you use.

Hewn Inc.
Matt Parks
59 Gracelyn Road
Asheville , NC 28804
828.595.4396
office@hewn.co
hewn.co
Hewn Inc. is a full service residential and commercial renovation and construction company serving the Asheville area. We design and create homes that are comfortable, energy efficient, and aesthetically pleasing. We love working with recycled, local and re-purposed materials to create spaces that are unique, functional and more ecologically appropriate.

HomeSource Design Center
Tim Alexander
172 Charlotte Street
Asheville, NC 28801
828.252.1022
tim@the-homesource.com
the-homesource.com
One convenient location providing home improvement, new construction and remodeling products; kitchen and bath design; and all your construction needs. Specializing in cabinets, countertops, hardwood flooring, tile, closet systems, stone, cabinet and bath hardware, and window treatments. Visit our showroom to view samples, make selections or speak with a designer.

HomeSource Real Estate & Construction, Inc.
Tim Alexander
172 Charlotte Street
Asheville, NC 28801
828.252.1022
tim@homesourcebuilders.com
homesourcebuilders.com
Fully licensed and insured custom home builder and remodeling contractor, providing expertise and commitment in construction. Offering turnkey service, including home design, kitchen and bath design, and product selection under one roof. Current and past projects include more than 100 custom homes and hundreds of remodels from large to small.

Jade Mountain Builders & Co. Inc.
Hans Doellgast
85 B&B Stables Drive
Fairview, NC 28730
828.216.3948
hans@jademountainbuilders.com
jademountainbuilders.com
Jade Mountain Builders is a team of 31 Craftsmen who pride themselves on taking an ecologically sensitive approach to building homes.

JAG & Associates Construction Inc.
Jody Guokas
33 Mineral Springs Road
Asheville, NC 28805
828.216.0914
jody@jaggreen.com
jaggreen.com
JAG Construction is a small company specializing in in-town urban spec construction. Our goal is to make healthy, creative, long-lasting houses more available to the general public. We're examining new ways to reduce the impact of construction on the environment around us and preparing for a future of alternative energy.

Pioneer Construction and Development Inc.
Duane Liming
31 Post Rd
Asheville, NC 28806
828.242.5101
duane@pioneerasheville.com
pioneerasheville.com
With over twenty years of experience, Pioneer consistently blends innovative ideas with time honored quality. We work until your project or new home is true to your vision. To learn more call us at 828.768.8771.

Rare Earth Builders
Mark Bondurant
105 Creative Cove
Canton, NC 28716
828.492.0534
rareearthbldrs@bellsouth.net
rareearthbuilders.com
We build high-performing, exceptionally beautiful custom homes while minimizing negative environmental impacts with attention to construction details and client comfort.

RCJ Building Inc.
Robert Jacobelly
3 Von Ruck Terrace
Asheville, NC 28801
828.216.4433
rcjbuilding@yahoo.com
rcjbuilding.net
RCJ Building Inc.custom homebuilding professionals have the knowledge and expertise that you'll need when you have the opportunity to build the house you've always wanted. We understand what goes into the building process, and more importantly, what goes through the minds of future homeowners during the build. The RCJ Building difference is that we know how to make the process exciting, fun, and stress-free, from inception to completion.

River Birch Builders
Pierce Harmon and Griff Gamble
30 Stewart Street
Asheville, NC 28806
828.423.9813
riverbirchbuilders@gmail.com
riverbirchbuildersnc.com
We offer quality and craftsmanship in the building of green and energy-efficient homes. We offer design and build services for fully customized homes, and experience with a range of architectural styles and sizes. From start to finish, we'll work closely with you to make your dream home become a reality.

RockStar Marble & Granite
George Douglas
6 Fairview Road
Asheville, NC 28803
828.505.2137
matt@rockstarmarble.com
rockstarmarble.com
RockStar Marble and Granite is a leading counter top supplier of hand finished natural stone, quartz and recycled products. Opened in 2006, we have built our customer base by providing top quality products at a fair price and a reasonable time frame.

Sure Foot Builders Inc.
Raymond Thompson
11 Blanton Street
Asheville, NC 28801
828.242.0925
surefootbuilders@gmail.com
surefootbuilders.com
We are a speculative and custom home building company working in the greater Asheville area. It is our passion to build beautiful and creative homes that add value and comfort to the lives of our owners and community. In each home we strive to articulate modern green building practices.

Residential Designer

Earthtone Builders
Greg McGuffey
12 Rich Street
Asheville, NC 28806
828.230.4469
earthtonebuilders@gmail.com
earthtonebuilders.com
We are a leading green building company committed to the highest standards in construction quality and sustainable, healthy living.

HomeSource Real Estate & Construction, Inc.
Tim Alexander
172 Charlotte Street
Asheville, NC 28801
828.252.1022
tim@homesourcebuilders.com
homesourcebuilders.com
Fully licensed and insured custom home builder and remodeling contractor, providing expertise and commitment in construction. Offering turnkey service, including home design, kitchen and bath design, and product selection under one roof. Current and past projects include more than 100 custom homes and hundreds of remodels from large to small.

Mountain Sun Building & Design
Emily Boyd
48 Beaverdam Knoll Road
Asheville, NC 28804
828.713.0549
emily@mountainsunbuilding.com
mountainsunbuilding.com
As both a land developer and a Design/Build firm, MSB&D can help clients at any stage of the new home building process. We focus on site specific design and Zero Energy Homes, creating finely crafted, light filled interiors that capture the beauty of and connect to their natural surroundings.

SDM Design, Inc.
Stephen DerMargosian
460 Elk Mountain Scenic Hwy
Asheville, NC 28804
828.545.8693
stephen@sdmdesigninc.com
sdmdesigninc.com

Southeast Ecological Design
Kevin Ward
503 Old Farm Road
Marshall, NC 28753
828.768.6448
kevin@ecologicaldesign.net
ecologicaldesign.net
SEED is a green design and consultation firm. We are organized to approach land-use planning and custom building design, 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 and the earth.

Stan Jones
Stan Jones
PO Box 18935
Asheville, NC 28753
828.329.1641
sdj0011@gmail.com

Reuse Retail

Asheville Area Habitat for Humanity ReStore
Paul Reeves
31 Meadow Road
Asheville, NC 28803
828.254.6706
preeves@ashevillehabitat.org
ashevillehabitat.org
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 throughout their Deconstructions service.

Roofers

RCJ Building Inc.
Robert Jacobelly
3 Von Ruck Terrace
Asheville, NC 28801
828.216.4433
rcjbuilding@yahoo.com
rcjbuilding.net
RCJ Building Inc.custom homebuilding professionals have the knowledge and expertise that you'll need when you have the opportunity to build the house you've always wanted. We understand what goes into the building process, and more importantly, what goes through the minds of future homeowners during the build. The RCJ Building difference is that we know how to make the process exciting, fun, and stress-free, from inception to completion.

Salvage

Asheville Area Habitat for Humanity ReStore
Paul Reeves
31 Meadow Road
Asheville, NC 28803
828.254.6706
preeves@ashevillehabitat.org
ashevillehabitat.org
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 throughout their Deconstructions service.

Reduce and Recycle

The U.S. uses 100 billion plastic bags annually, consuming about 12 million barrels of oil. Less than 1% of plastic bags are ever recycled. Reusable bags can help reduce the number of plastic bags you use.

Whole Log Lumber
Loy Lauden-Stowell
195 Blueberry Farm Road
Zirconia, NC 28790
828.697.0357
info@wholeloglumber.com
wholeloglumber.com

Site Work

Carolina Ready Mix & Builders Supply, Inc.
Steve Brunelle
606 Old US Hwy 70
Swannanoa, NC 28778
828.686.3041
bjones@carolinareadymixinc.com
carolinareadymixinc.com
Carolina Ready Mix produces and delivers ready mixed concrete, colored concrete, retaining walls, aggregates, foundation and flat work supplies, rebar, verti-block retaining walls, masonry products, masonry sand and dump truck services.

Rare Earth Builders
Mark Bondurant
105 Creative Cove
Canton, NC 28716
828.492.0534
rareearthbldrs@bellsouth.net
rareearthbuilders.com
We build high-performing, exceptionally beautiful custom homes while minimizing negative environmental impacts with attention to construction details and client comfort.

V & V Land Management and Resource Recovery LLC
Carrie Vogler
PO Box 7
Del Rio, TN 37727
828.777.6637
carrie@voglerllc.com
voglerllc.com
Planning and execution of sustainable property improvements including forestry mulching, driveway building and repair, boulder walls and dry-stacked masonry, tree service, consulting and mapping.

SAVE ENERGY, SAVE MONEY:
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Structural Materials

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Steve Brunelle
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828.686.3041
bjones@carolinareadymixinc.com
carolinareadymixinc.com
Carolina Ready Mix produces and delivers ready mixed concrete, colored concrete, retaining walls, aggregates, foundation and flat work supplies, rebar, verti-block retaining walls, masonry products, masonry sand and dump truck services.

High Country Timberframe & Gallery Woodworking Co.
Tom Owens
PO Box 1858
Boone, NC 28607
828.264.8971
tomo@highcountrytimberframe.com
highcountrytimberframe.com
We've been a leader in traditional and contemporary timber frame and SIPS panel design and construction for more than 12 years, with many high-profile projects completed throughout the Eastern United States. We strive to ensure that the second life of the tree be as dignified as the first.

Supporting Members

Christmount
Rob Morris
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828.669.8977
rob@christmount.org
christmount.org

Duke Energy Progress
Renee Maxwell
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Fletcher, NC 28732
828.450.3082
renee.maxwell@duke-energy.com
duke-energy.com/newhomes
The Residential New Construction Program helps homebuyers find the best, most energy-efficient and comfortable new homes on the market. Homes are verified by independent, nationally accredited Home Energy Rating System Raters to meet stringent standards. Find participating builders at duke-energy.com/mynewhomewnc. For details on our builder program, visit duke-energy.com/newhomes.

Griffin Waste Services LLC
Chad Griffin
402 Old Leicester Hwy
Asheville, NC 28806
828.281.4549
chad@griffinwaste.com
griffinwaste.com

Integritive
Terri Morrin
120 Coxe Avenue, Suite 2A
Asheville, NC 28801
828.250.0970
terri@integritive.com
integritive.com
At Integritive, you can expect the proven results of a large firm with the flexibility of a small creative enterprise. You can expect the professionalism of seasoned experts with the fresh ideas of an avid entrepreneur. You can expect the technical muscle of talented programmers who understand your needs.

Rockbrook Camp for Girls
Jeff Carter
PO Box 792
Brevard, NC 28712
828.884.6145
jeff@rockbrookcamp.com
rockbrookcamp.com

Surveyors

Blackrock Surveying and Land Design PC
Jamie Brady
PO Box 8302
Asheville, NC 28814
828.225.4341
jbrady@blackrocksurveying.com
blackrocksurveying.com
Our services include topographic surveying, construction staking, boundary determination and relocation, subdivision designs, elevation certification and consultation on property use.

Kee Mapping & Surveying, PA
Brad Kee
88 Central Ave
Asheville, NC 28801
828.575.9021
brad@keemap.com
keemap.com

Get energy audit
A home energy audit should be your first step before making energy-saving home improvements, as well as before adding a renewable energy system to your home.

Sustainable Wood Products

84 Lumber
Judy Dinelle
75 Montgomery Street
Asheville, NC 28806
828.665.3815
jdinelle@bellsouth.net
84lumber.com
At GreenEdge Supply, 84 Lumber Company's green initiative, we can help you integrate energy, water and resource efficiency along with improved indoor air quality with our sustainable products.

Architectural Woodcraft Inc.
Craig Weis
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Asheville, NC 28806
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craig@architecturalwoodcraft.com
architecturalwoodcraft.com
Locally made cabinets, doors and energy star windows. Implementing green finishes and bamboo sustainable and reclaimed woods. Restoration specialists.

BuiltSmart by Bob
Bob Callahan
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Asheville, NC 28804
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Green building with BuiltSmart means net-zero energy-ready homes with the best interior air quality for your family's health and comfort. Our custom construction utilizes building science techniques for low-impact and less future maintenance. Call BuiltSmart if you want reduced energy costs, better health and the greater free time you deserve.

Columbia Forest Products
Richard Poindexter
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Greensboro, NC 27409
336.456.8657
rpoindexter@cfpwood.com
columbiaforestproducts.com
North America's largest manufacturer of decorative hardwood veneer and hardwood plywood (including plant in Old Fort, NC). Panels used for all types of interior casework (commercial and residential). FSC Certified. CARB & LEED Compliant. Innovator of soy-based formaldehyde free PureBond technology.

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Mike Stageman
134 Brevard Road
Asheville, NC 28806
828.216.9549
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hilltopbarnwoodshop.com

Smoky Mountain Log Homes
George Blackburn
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Whole Log Lumber
Loy Lauden-Stowell
195 Blueberry Farm Road
Zirconia, NC 28790
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wholeloglumber.com

System-Built Homes

Deltec Homes
Leigha Dickens
69 Bingham Road
Asheville, NC 28806
828.253.0483
ldickens@deltechomes.com
deltechomes.com
Deltec Homes is an award-winning prefabricated homebuilder. Offering round, traditional and modern styles, our homes are best known for energy efficiency, flexible floor plans and durability. We also offer a line of pre-designed net-zero homes. We pride ourselves on manufacturing homes sustainably in a facility powered with 100% renewable energy.

Mountain Brook Homes Inc.
J.D Wallace
31 College Place B-121
Asheville, NC 28801
828.250.0004
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mountainbrookhomesinc.com

Tiny and Small Homes

GreenSource Construction Management Inc.
Josh Scala
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Black Mountain, NC 28711
828.337.0284
greensourcebuilder@gmail.com
facebook.com/blackmountain-greenbuilder

Nanostead LLC
Jeramy Stauffer
448 Old Farm Road
Marshall, NC 28753
828.206.2526
jsstauff@gmail.com
nanostead.com

Wall System Installers

K-Wall Poured Walls/MonoKast Walls
Rich Kubica
140 Foundation Way
Fletcher, NC 28732
828.654.9255
rich@k-wall.com
k-wall.com

Superior Walls of NC
Bob Bauer
5045 Hendersonville Road
Fletcher, NC 28732
828.606.8371
bbauer@superiorwallsnc.com
superiorwallsnc.com

Waterproofing

J. Coleman Waterproofing
Jan Coleman
505 Lafayette Ave
Asheville, NC 28805
828.299.8506
jan@jcolemanwaterproofing.com
jcolemanwaterproofing.com
Below grade waterproofing. Tuff-N-Dri R3,5,10 or any combo. Slab on grade to seal plus R5-10 Air Moisture Barriers EnvironDri, Encapsulated crawlspace. Interior Drains

Windows, Doors & Awnings

All About Awnings
Thomas Prince
77 Reeds Way
Flat Rock, NC 28731
828.216.8118
info@allaboutawnings.com
allaboutawnings.com

Architectural Woodcraft Inc.
Craig Weis
199 Amboy Road
Asheville, NC 28806
828.258.9977
craig@architecturalwoodcraft.com
architecturalwoodcraft.com
Locally made cabinets, doors and energy star windows. Implementing green finishes and bamboo sustainable and reclaimed woods. Restoration specialists.

Builders FirstSource
Antonio Grion
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bldr.com

Morrison Millwork
Stacy H. Maye
51 Thompson Street, Suite F
Asheville, NC 28803
828.545.2194
stacy@morrisonmillwork.com
morrisonmillwork.com
Our focus on windows and doors provides unparalleled service, quality products and competitive pricing. In partnership with clients and vendors, we have established ourselves as a preeminent dealer for windows, doors, and hardware. We invite you to visit one of our showrooms and speak with our knowledgeable and professional staff.

Woodworkers & Cabinetry

Advance Cabinetry
Kip Driver
15 Design Ave
Fletcher, NC 28732
828.676.3550
kdriver@advancecabinetry.com
advancecabinetry.com

Architectural Woodcraft Inc.
Craig Weis
199 Amboy Road
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828.258.9977
craig@architecturalwoodcraft.com
architecturalwoodcraft.com
Locally made cabinets, doors and energy star windows. Implementing green finishes and bamboo sustainable and reclaimed woods. Restoration specialists.

BuiltSmart by Bob
Bob Callahan
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Asheville, NC 28804
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Green building with BuiltSmart means net-zero energy-ready homes with the best interior air quality for your family's health and comfort. Our custom construction utilizes building science techniques for low-impact and less future maintenance. Call BuiltSmart if you want reduced energy costs, better health and the greater free time you deserve.

Columbia Forest Products
Richard Poindexter
7900 Triad Center Drive
Greensboro, NC 27409
336.456.8657
rpoindexter@cfpwood.com
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North America's largest manufacturer of decorative hardwood veneer and hardwood plywood (including plant in Old Fort, NC). Panels used for all types of interior casework (commercial and residential). FSC Certified. CARB & LEED Compliant. Innovator of soy-based formaldehyde free PureBond technology.

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172 Charlotte Street
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tim@the-homesource.com
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One convenient location providing home improvement, new construction and remodeling products; kitchen and bath design; and all your construction needs. Specializing in cabinets, countertops, hardwood flooring, tile, closet systems, stone, cabinet and bath hardware, and window treatments. Visit our showroom to view samples, make selections or speak with a designer.

Controlling Moisture

Controlling moisture can make your home more energy-efficient, less costly to heat and cool, more comfortable, and prevent mold growth.

Ironwood Studios LLC
Thomas Gibson
329 Emma Road
Asheville, NC 28806
978.501.6954
tom@ironwoodstudios.org
ironwoodcustomcabinetry.com

Narwhal Design Build LLC
Joe Archibald
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Asheville, NC 28804
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narwhalbuilt.com

Sage Builders
Doug Keefer
299 Morgan Branch Road
Leicester, NC 28748
828.713.7208
info@thesagebuilders.com
thesagebuilders.com
SAGE uses Sustainable, Appropriate, Green and Efficient building techniques to create beautifully hand-crafted homes with passive and active solar amenities

DESIGN FOR EFFICIENCY

Reducing energy use in your home saves you money, increases our energy security, and reduces the pollution that is emitted from non-renewable sources of energy. There are many ways you can reduce electricity use in your home:

Appliances and electronics: Purchase energy-efficient products and operate them efficiently.

Lighting: Purchase energy-efficient products, operate them efficiently, and incorporate more daylighting into your home using energy-efficient windows and skylights.

Electric space heating and cooling: Purchase energy-efficient electric systems and operate them efficiently. Incorporate passive solar design concepts into your home, which include using energy-efficient windows. Properly insulate and air seal your home.

Electric water heating: Purchase an energy-efficient electric water heater and operate it efficiently. Or select an energyefficient water heater that doesn't use electricity.

Why Green-certified, energy efficient, and sensibly crafted?

Because living in healthy, safe, functional dwellings is important. Using the least amount of energy and resources while limiting the amount of collateral damage to the environment ensures that our local ecology continues to thrive as our community grows. By offering smart designs and smaller footprints, clients are protected from unexpected costs.

Our clients are happily raising families in our modern yet mindfully built craftsman-style homes, and we believe that contributes to a more sustainable future for us all.

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Visit us at BlueRidgeEnergySystems.com or call (828) 775-8665.

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