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**GREEN BUILDING
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A LOCAL GUIDE TO BUSINESSES & RESOURCES



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case studies

Depot Street revival

Glen Rock project melds affordability and efficiency



We got the power: Sixty solar panels supply heat for the hot-water system at 372 Depot St.

BY TRACY ROSE

The rooftop at 372 Depot St. in Asheville boasts an impressive view — but for two very different reasons.

From this bird's-eye perch, you can spot trains chugging through the River Arts District and see the hills rising up on the west side of the French Broad River.

But from an environmental perspective, the roof itself tells a new story. Row upon row of solar panels (60 in all) feed the building's hot-water system — the largest of its kind in the state for a multifamily development. And the bright white rooftop reflects heat and lowers cooling costs.

That's just the beginning of the environmentally friendly features of the mixed-use building, part of the Glen Rock Depot project developed by Mountain Housing Opportunities, an Asheville nonprofit.

Completed in September 2010, the \$10 million structure likely will be one of the first LEED-certified multi-use buildings in Asheville (the certification process is under way). Glen Rock includes 9,000 square feet of commercial space on the ground level and 60 workforce apartments on its top three floors.

"There's an assumption that when you build affordable housing, you can't build a beautiful building, you can't build an energy-efficient building," says **Cindy Visnich Weeks**, MHO's manager of com-

munity investments. "We challenged a lot of assumptions in the marketplace with this project but made it a success."

Location, location, location

The Glen Rock Depot project was launched in 2006, when MHO purchased a 3-acre tract of land along Depot Street where the River Arts District meets the city's Southside neighborhoods.

The project was divided into three phases: renovating the 1925 Corner Market building (completed in 2007); constructing the new, multi-use building at 372 Depot St.; and renovating the historic Glen Rock Hotel for residential and commercial use (the latter is now in the fundraising stage).

The multi-use building's first, perhaps best-known commercial anchor tenant, The Magnetic Field, opened in December 2010 as a restaurant, bar and performance space. By fall 2011, the remaining commercial spaces had been fully leased.

Sixty apartments fill out the top three floors, with the residential space centered around a welcoming private courtyard that includes a train-themed playground structure. Ranging in size from one to three bedrooms, the units rent from \$350 to \$750 per month. At those affordable prices, the apartments were snapped up within two months of the building's completion.

One of the fundamental green features of 372 Depot St. is its location: It's within a three-mile radius

of the center of downtown — a "sweet spot" where nearly 50,000 people work, according to an MHO census tract study.

"We need to build near the jobs so that people don't have to travel so far," explains Weeks.

And, in fact, a number of Glen Rock Depot residents either walk or take public transportation to work, she says.

Apart from cutting down on greenhouse-gas emissions by providing homes close to where people work, the centralized location also makes good economic sense for residents. MHO calculates that an employee who commutes 20 miles a day spends more than \$2,500 annually in auto costs.

Let the sun shine

The building's solar-thermal system may offer the biggest wow factor of its environmentally friendly features.

With 60 solar panels (one per residential unit), the system produces 2,400 gallons of hot water daily and reduces tenants' hot-water electricity costs by 80 to 90 percent over conventional systems. By avoiding 29 tons of carbon-dioxide emissions annually, the system is equivalent to planting 8,500 trees and taking 13 cars off the road, MHO calculates.

While it may be true that going green has become fashionable, Weeks notes that MHO has a 23-year history of building energy-efficient buildings. "We've



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bill@villagebuildersinc.com



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greenopportunities.org
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The GO Energy Team provides residential energy audits, building performance contracting and general labor. We support a triple bottom line. People-Planet-Profits.



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HomeEnergyPartners.com
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Mills River, NC 28579
cleanstreakinc.net
horacejr@bellsouth.net

Shine Cleaning Co.

Suzanne Wuefling
828-582-6112
825C Merrimon Ave. #262 Ave.
Asheville, NC 28804
shinegreenclean.com
swuefling1@gmail.com

Consultants



Adryana Services

Adrianna Weir
828-275-2534 / Fax: 866-875-1634
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Asheville, NC 28814
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info@invirodesign.com

INviro offers turn-key energy savings and affordable project coordination for all building types in WNC. Our expert team uses an integrative approach to provide site-specific solutions.

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Cindy Meehan-Patton
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shelterecology.com
sheltereco@gmail.com

20 years of experience helping to create truly healthy homes through residential architectural-interior design and consultation. Learn more from reading Cindy's book: The Healthier Healthy Home.

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jcolemanwaterproofing.com
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Developers

Green Earth Developments, LLC

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Stuart Ryman, PG
828-281-3350 / Fax: 828-281-3351
231 Haywood Street St.
Asheville, NC 28801
altamontenvironmental.com
mail@altamontenvironmental.com
Altamont Environmental offers expertise in environmental due diligence, contaminated property redevelopment, ecological restoration, and innovative stormwater management.

Essential System Engineering, PA

Dale F. Reynolds
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Asheville, NC 28801
dfr@eseavl.com

Mike Anderson Engineering

Mike Anderson
828-252-4880
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Asheville, NC 28806
mandersoneng.com
mikea@mandersoneng.com

Civil engineering consultants specializing in sustainable site development, including low-impact development techniques for residential, commercial, and public improvements.

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137 Wendover Road
Asheville, NC 28806
russdavispe.com
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Sud Associates

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20 Battery Park Ave, Suite 706
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Vandemusser Design, PLLC

Amy Musser
828-348-4723 / Fax: 828-253-8347
26 Crabapple Lane
Asheville, NC 28804
vandemusser.com
info@vandemusser.com
Engineering design services include HVAC systems and rainwater cisterns for residential projects in North Carolina.

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Finishes: Interior



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Whole Log Lumber

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 Reclaiming Antique Wood since 1984: WNC's oldest supplier. Specializing in Artisan Floors, Mantels and other components of fine wood interiors-including WOCA Penetrating, Hardening Oil. (VOC-free)



Compass Solutions, LLC

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 compasswnc.com
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 Compass Solutions offers ENERGY STAR Certifications and NAHB Green Building Verification as well as HVAC Load Calculation and System Design (ACCA Manual J, S, & D).



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Green Opportunities

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Asheville Geothermal Inc.

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We specialize in determining the optimum insulation system for each home: one that is cost effective and high performing. We also offer machine-finished siding to enhance the durability of your home.



Home Energy Partners

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167 Haywood Road
Asheville, NC 28806
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Traci Kearns
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Asheville, NC 28801
alchemy-interiors.com
info@alchemy-interiors.com

Alchemy offers comprehensive interior design services for residential and commercial projects with a focus on modern and sustainable design.



Allard & Roberts Interior Design, Inc.

Sharon Allard & Talli Roberts, ASID
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84 W. Walnut #201 St.
Asheville, NC 28801
allardandroberts.com
info@allardandroberts.com

Allard & Roberts Interior Design, Inc. is located in Asheville, NC and provides interior design services for new construction and remodel projects, with an emphasis on sustainable design solutions.

Green Built Environments

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Asheville, NC 28803
greenbuilt-e.com
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Over 20 years in Green Design + Build: remodeling and new, interior planning, green products, healthy indoor air quality, green rentals, aging in place. Residential and small commercial. Classes CEUs.



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Land Planning



Jade Mountain Hardscapes

Hans Doellgast
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Fairview, NC 28730
Jademountainbuilders.com
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Jade Mountain Hardscapes is an ecologically minded foundation, grading, and hardscaping company. We specialize in stitching homes into challenging sites with boulders, timbers, and native plants.

Mike Anderson Engineering

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Civil engineering consultants specializing in sustainable site development, including low-impact development techniques for residential, commercial, and public improvements.



Otter & Arrow Land Planning

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Certified Green Roof Professional, Landscape design and installation, Land Planning, Erosion Control submittals, Stormwater Design, Masterplan Renderings, 3D visualizations.

Landscape Architects



Equinox Environmental Consultation & Design, Inc.

David Tuch
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Jerald A. Snow, Landscape Architect, ASLA, LEED Green Associate

Jerry Snow
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Mary Weber
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Landscapers



Appalachian Environments, Inc.

Matthew Martin
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Appalachian Environments, Inc. is a full service landscape design and installation company focusing on sustainable gardening.



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carolinatrailbuilders.com
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Weaverville, NC 28787
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Jade Mountain Hardscapes

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Jade Mountain Hardscapes is an ecologically minded foundation, grading, and hardscaping company. We specialize in stitching homes into challenging sites with boundaries, timbers, and native plants.



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Certified Green Roof Professional, Landscape design and installation, Land Planning, Erosion Control submittals, Stormwater Design, Masterplan Renderings, 3D visualizations.



Snow Creek Landscaping, LLC

Tim Boone
828-687-1677 / Fax: 828-687-1667
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Jackie Rocks Green-Dawn Wilson Realty

Jackie Tatelman
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NAR and Eco Certified, Jackie creates partnerships with buyers and sellers. An Eco-Positive Realtor, she is a resource for navigating the shades of GREEN. Residential and land- Asheville & WNC.



Jody Whitehurst, REALTOR, ECO, Town and Mountain Realty

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Keller Williams Green Division

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Mary Love is leading KW Green Division program that educates and encourages all homeowners to become more sustainable. Sellers must market Green improvements correctly in order to entice buyers.



Mosaic Community Lifestyle Realty

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mymosaicrealty.com
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Renewable Energy



Asheville Geothermal Inc.

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Atomic Solar, LLC

Ron Frazier

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atomicsolar.biz

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Atomic Solar provides its customers renewable energy solutions such as photovoltaic systems, solar hot water, radiant floors, rainwater harvesting, and micro hydro.

First Light Solar

First Light Solar

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always done that because we believe it's important to pass on energy cost savings to our clients," she says. "And saving the planet is great too."

Weeks points out another green feature: Instead of recycling bins (which can be hard to manage in apartment buildings), each floor has a central recycling chute. Residents can toss mixed recyclables down the chute; the recycling company sorts them after pickup.

"We've kind of cracked that nut on this one and it works very well," Weeks says.

The building also boasts low-flow fixtures, ENERGY STAR appliances, a high-efficiency HVAC system and low-VOC paints, carpets, sealants and other materials.

Plus, contractors were able to recycle 85 percent of the project's construction waste.

On the exterior, the developers took care to use water-efficient landscaping and native plants. There's even a small community garden, complete with raised beds.

The building's stormwater design system includes a cistern for watering plants on-site, along with a detention vault that gently releases water over several days.

In yet another environmentally friendly move, the courtyard and one of the building's parking lots uses

pervious paving, while stormwater runoff from the paved parking lot drains into a bioswale rain garden.

Building a community

Weeks and MHO Resource Development Manager **Lisa Keeter** get downright animated when talking about the building's aesthetics and how its design helps to foster a sense of community.

"What a beautiful place it is to live," Weeks declares.

Largely brick on the outside, interior hallways gleam with white vinyl tiles offset by varied pops of colored tile that match each apartment door (the better for small children to remember which door is theirs). Greeson & Fast Design (which has an office just up the block) helped with the interior design, while local artists crafted the door numbers, which add a personalized touch.

Large black-and-white historic photos of the Southside neighborhoods adorn the hallway walls and offer reminders of what the area looked like before the city's urban-renewal programs of the 1960s and '70s radically reshaped the nearby landscape.

The building, designed by Reinhardt Architecture of Charlotte, offers numerous opportunities for neighbors to get to know each other, Weeks adds. It boasts 6,000 square feet of community space, such as a courtyard, small fitness center, laundromat and

communal kitchen, where school-age kids can use computers to do their homework.

Each floor also has a sitting area, including a kid-friendly space equipped with foam blocks for creative play, and one with Internet connections. The upper floors also have shared porches that overlook the leafy courtyard.

Bumps in the road

Bringing the project to fruition was no mean feat. Financing the multi-million-dollar building's construction in late 2008 — when the country's financial system neared meltdown — turned into a nail biter that forced a building redesign.

The residential part of the project received some funding through several governmental and community resources, including the city of Asheville's Housing Trust Fund, HOME funds and grants from Buncombe County and Mission Health.

"The city and the county have been tremendously supportive of this project — both the new building and the hotel," Weeks notes. But just as MHO was approved to receive federal housing tax credits that were to finance 80 percent of the new building's residential construction, the banks that typically invest in tax credits began teetering. The market for tax credits plummeted, forcing MHO's financial contacts to scramble for new investors to purchase the credits at a better rate. ➤



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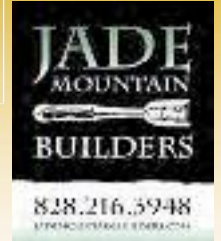
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The financial crisis also prompted MHO to cut costs. A redesign removed an underground parking garage in exchange for surface parking — saving \$2 million in construction costs. Meanwhile, the tanking economy created a more competitive construction environment, further reducing costs.

“That was kind of how we pulled it off in a crazy economy,” Weeks explains.

Meanwhile, the commercial part of the building was financed separately, including a New Markets tax-credit loan through the Self Help Credit Union.

Apart from the financing, the project had only one major surprise. Fortunately, from an environmental perspective, it offered a silver lining.

During site preparation, workers discovered that the soil was contaminated with oil, possibly from a leaking underground storage tank that had long ago been removed. Cleaning it up meant spending \$250,000 to haul away nearly 200 dump-truck loads of contaminated soil and replacing it with clean fill.

“We removed a huge environmental problem down there,” Weeks says. “It’s very clean. It’s much cleaner than it was before.”

The building took 18 months to complete, with Cox Schepp Construction of Charlotte serving as the general contractor, and Asheville’s Civil Design Concepts handling the civil engineering.

The result is a unique combination for the state. Weeks thinks 372 Depot St. is the only building in North Carolina that combines its particular financing strategy with a community solar-powered hot-water system and (imminent) LEED certification.

Two down, one to go

As a finishing touch, MHO plans to restore Town Branch, a stream located next to the building and once nicknamed Nasty Branch (perhaps due to one-time straight-piping into the stream). The nonprofit plans to remove the silt crowding the waterway and



People-friendly too: The interior courtyard at 372 Depot St. offers a relaxing respite; a dedicated chute on each floor makes recycling a breeze. (photos by Tracy Rose)

replace invasive plants with native ones, completing the property’s transformation.

A flowering of business has likewise crowned the commercial part of the mixed-use building. After the Magnetic Field opened in December 2010, West One Salon followed a month later. Vacancies remained through much of 2011, but by late fall, the remaining spaces had been leased to Desert Moon Designs Studios & Gallery, Integrative Family Medicine of Asheville, Magnificent Hair Salon and Partnership Property Management.

“The fact that we built it during an uncertain economic time and made it a complete success is a huge testament to our innovative and creative strategies on development,” Weeks says.

Only one major phase remains to complete the overall project: renovating Glen Rock Hotel, which was built in 1930 but has long been vacant. Once envisioned as commercial, retail and office space, the old hotel will incorporate commercial space on the first floor and 22 units of affordable apartments on the upper two floors.

If MHO’s track record can be used to predict the future, then the Glen Rock Hotel is destined to become the next green jewel of a building on Depot Street.

Tracy Rose is an Asheville freelance writer and editor.

Designer: Reinhardt Architecture
reinhardtarchitecture.com

Contractor: Cox Schepp Construction
coxschepp.com

Interior design: Local artists, and
Greeson & Fast Design
greesonandfast.com

Solar: FLS Energy
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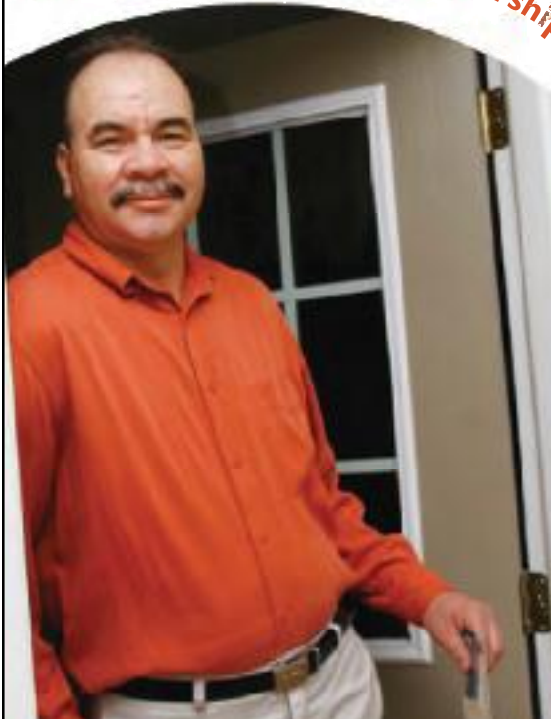


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Ground-breaking

The city of Asheville's newest community center takes the LEED

BY ANNE FITTEN GLENN

The new Dr. Wesley Grant Sr. Southside Center gets its LEED distinction from the ground up: The community center taps geothermal wells for its heating-and-cooling system. That's just one of several green-building features the city of Asheville applied to the center, located in south-central Asheville at 285 Livingston St.

Named for one of Asheville's Civil Rights-era leaders, designed by local firm Mathews Architecture and built by H&M Constructors, the center is on track to become the first city-owned-and-built structure to earn Platinum-level LEED certification. If it gets that designation, it will be one of just a few community and recreation centers to do so in the United States.

Architect **Jane Mathews**, whose firm designed the center, says she was excited about installing a geothermal HVAC system. "It's a no-brainer to use the earth to heat and cool buildings. And it was a great commitment from the city to let us do so."

Six geothermal wells were dug to supply the building with heat from the earth. While installation cost more on the front end than traditional HVAC, geothermal systems saves money and energy over time. In winter, the pump pulls heat from the wells into the building. During summer, the pump is reversed so it removes heat from the building and disperses it into the ground. (To learn more about how geothermal systems work, see the article "Go Geothermal" elsewhere in this guide.)

The building also has automatic fresh air sensors that let cool outside air into the building, especially when high occupancy causes the interior temperature to increase.

Mathews says one of her other favorite green features are the opaque skylights in the corridors. It's difficult to get daylight into hallways and corridors, but these skylights do the trick.

Other elements include a vegetative or living roof, stormwater management and natural day lighting. During construction, more than 75 percent of all construction waste was diverted from



A green community center: The new Dr. Wesley Grant Sr. Southside Center uses a geothermal HVAC system, skylights and a living roof (floor plan below).

PHOTO BY ANNE FITTEN GLENN; PLANS COURTESY OF MATHEWS ARCHITECTURE

the landfill and recycled. Building materials were sourced locally when possible, and all the wood used was Forest Stewardship Council-certified.

A culture of community

The center was designed with three phases in mind — cultural arts, physical activity and community. The first phase was completed in October 2011, after almost two years of design and construction.

Built near the site of the W.C. Reid Center it replaces, the 7,897-square-foot building features an auditorium, three classrooms, office space, storage and parking. The auditorium, for example, features curtains salvaged from the Reid Center and will soon sport that center's refurbished theater seats as well.

"That's one of the reuse parts of the center," Mathews says. "It's nice from an historical point of view to have some things from the old building in the new building."

SOUTHSIDE CENTER PHASE 1



The first community center built in the city since the Montford Center (1974), Southside's full name honors Wesley Grant Sr., who founded and was the minister of Asheville's Worldwide Missionary Baptist Tabernacle Church.

The center's name also recognizes the Southside community, a large geographic area that once surrounded the site and was a predominantly African American community of businesses, churches and neighborhoods, much of which was demolished during urban renewal.

"Having the center located in the historic Southside neighborhood and dedicated to the great Wesley Grant Sr. demonstrates a commitment to a

unified Asheville in which resources are equally allocated and where past inequities are remedied," says Asheville City Council member **Gordon Smith**. "The LEED Platinum center is now the crown jewel of our community centers, and I'll look forward to generations of neighborhood residents using it for the betterment of the entire city."

Anne Fitten Glenn is an Asheville-based freelance writer.

Design: Mathews Architecture
mathewsarchitecture.com

Builder: H&M Constructors
hmconstructors.com

Living roof: Living Roofs, Inc
livingroofs.com

LOOKING AHEAD

The city built the first Southside phase for \$1.8 million, Mathews mentions, saying, "It was a limited budget. There are no bells or whistles." She adds, "It's important that people know that a space doesn't have to be glitzy or overly expensive to quality for LEED."

For example, Mathews mentions that the designers decided not to put in solar hot water because there will be limited hot water usage in the building.

Mathews also touts the two vegetative roofs as having lots of positive environmental impacts. "They provide visual relief, extra insulation and [less] degradation of the roof, while needing little to no maintenance," she says.

The other roof lines are sloped to provide rainwater collection, and that water runs into two ponds that were added to property and filter the runoff from the building and parking lots into Town Branch.

The next construction phase will include a gymnasium, splash park, playground and a section of the Town Branch Greenway. The splash park will consist of multiple water features, such as spraying tunnels and separate areas for toddlers, teens and families. The water will be re-circulated.

The final piece of the project will include space for community-partner offices and meeting spaces.

These other two phases will be constructed as funding becomes available, according to the city.

To date, \$2.9 million has been funded by a number of contributors including the Eaton Charitable Fund, Glass Foundation, Janirve Foundation, Junior League of Asheville, the Raise the Roof at the Reid Community Campaign and the city of Asheville. — AFG

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Open space: The greening of this older home included gutting the interior to create an open floor plan and adding “farmhouse” features like a sliding panel that looks like a barn door.

PHOTOS BY RICH ORRIS



An 80-year-old home gets a green makeover BY MARI FOX

Not your grandmother's farmhouse

In early 2010, **Rich and Jen Orris** found a sweet property less than 10 minutes from Asheville that included just about everything they envisioned for their new life together — except a livable house. The 5-acre farm in Enka was a perfect location for commuting to their in-town jobs, yet suitable for the rural lifestyle they desired. Not to be deterred by the dilapidated condition of the farmhouse, the two launched plans that would require brute strength, sledgehammers and a strong will to take pride and ownership in the revitalization of their abode.

After purchasing the property and having the farmhouse inspected, the couple was assured that the shell of the house — basically the framing, floor and rafters — was in good shape; everything else had to go. The couple wanted a unique, sustainable and energy-efficient home, so after much research and interviewing, they hired local architects **Aaron and Calder Wilson** of Wilson Architects to redesign the original 900-square-foot, two-bedroom, one-bath floor plan into a more open, spacious area. The updated plans also included a 500-square-foot master-suite addition and a basement dug under the new portion of the house to accommodate plans for canning and storage.

When they began the intense process of choosing a builder, Rich and Jen clicked immediately with **Jim Demos** of Demos Builders Inc. “He is a standup guy and communicated in a way that worked for us,” Rich says. “We talked to a couple of people who had hired him for remodeling work, and they confirmed that he was a down-to-earth, good guy and talented builder.” Demos focuses on smaller, energy-efficient homes that are a little out of the box, with as much locally sourced material as possible — all important qualities for Rich and Jen.

The quaint, yet outdated farmhouse was built in the late 1930s, incorporating most of the offending toxic materials of the day, including asbestos shingles and lead paint. Before construction could begin, the entire home was gutted so the couple could start their journey into sustainable living with a fresh canvas.

The pair wanted to be actively involved in the reconstruction of their new home. So before the construction crew arrived, the couple completed about 90 percent of the demolition themselves. “The demolition gave me a new understanding of what goes into building a house ... by what came out!” says Rich. “We did all the demolition by hand over the winter (November – February) and it was *cold*. The professionals are so much faster.” The salvaged materials will be used in future projects — the original windows for a greenhouse and wooden boards for a chicken coop.

After demolition, all that was left were the original pine floors, framing, roof sheathing and an interior brick chimney discovered behind a wall. In April 2011, Demos and his crew took over the project, and within three months, the transformation was complete. “We took a nondescript farmhouse and turned it into a beautiful, solar-powered home,” Demos says. The upgrades in finishes and energy efficiency give it a modern, comfortable feel that had been missing for decades.

Some of the unique characteristics of this home come from blending old and new. The framing and floors were built to stand the test of time — and did. Simply refinishing the pine floors brought them back to their original beauty. Icynene spray-



foam insulation was installed between 80-year-old studs to create an airtight building envelope. The old chimney now forms a backdrop for the new, high-efficiency wood-burning stove. And Jen even had the original claw-foot tub in the bathroom refinished to its stunning former self.

The Galvalume steel roof was chosen for its durability and clean, environmentally friendly properties; the couple plans to harvest rainwater from it for an organic garden. Plus, a metal roof on a farmhouse just looks good.

Crowning the roof are 27 photovoltaic solar panels installed by Sundance Power Systems. The panel array was designed to supply all the electricity needs for the house, and so far, the 5.4-kilowatt net-metered system is just about hitting the mark. The homeowners can even go online and track real-time energy collection and find out how many kilowatts the panels collect in any given time frame.

Another major improvement to the home was sealing the existing crawlspace and installing an energy-recovery ventilator system to introduce fresh air into the home. “An ERV system is really important with the super-tight houses built today,” Demos explains. “In traditional, forced-air heating/cooling systems, the air continuously circulates through the ductwork (like an airplane), becoming old and stale. Older homes were leaky, so the fresh air came in regardless. An ERV system pulls in fresh air from the outside, which improves indoor air quality and provides a healthier living environment.”

Beefing up the insulation with Icynene was a no-brainer once the decision was made to remove the original plaster walls. It’s sprayed on in a thin layer, which fills quickly with air pockets that expand 100 times — creating an air-thermal-noise barrier hidden within the cavity of the wall. This protective layer keeps allergens, pollutants and noise from entering the home, thus improving indoor air quality and livability. ►

Before and almost after: Built in the 1930s, the Orris home incorporated many of the materials of the day, such as asbestos siding. The renovation plan called for replacing the exterior and insulating the walls with icynene spray foam. The Orris’ also made every attempt to reuse materials for other projects, such as using the old windows (center photo) for a greenhouse project instead of sending them to the landfill.

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Victoria Schomer

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Other notable features include double-paned, argon-filled windows and a mini-split heat pump in the master suite.

Rich reveals that his favorite part of the house is the kitchen-living-dining area. The gray quartz counters, farmhouse sink, new appliances and white bead-board create an invitingly warm space that's even cozier when he indulges in a favorite pastime: baking.

After the home was finished, the couple decided their farm needed a traditional pole barn. A friend obliged by sketching the initial design. "To get the structure approved by the city was an intense process," Rich says. "The design had to go through about five revisions before we could have it built." It had to be done, though; where else would Rich park the tractor or the old automobile he plans on buying and bringing back to life someday?

Rich and Jen plan to live in this home for the rest of their lives, as the family who originally built it did. In the fall, they harvested berries from their farm and used their new cellar to can and store food for the winter. A quarter acre is tilled and ready for spring planting.

What's next on the front-porch horizon? Perhaps finishing the fence and building a chicken coop, greenhouse and hop farm to supply local breweries. This story is one that will continue.

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

Design: Wilson Architecture
w2arch.com

Builder: Demos Builders Inc.
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Solar: Sundance Power Systems
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DR. WESLEY GRANT, SR. SOUTHSIDE CENTER

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Big benefits, little footprint

Smallest LEED home reaps huge paybacks

BY MARI FOX

In September 2010, **Ken Czarnomski**, department chair of Asheville-Buncombe Community College's Tech's Construction Sciences programs, asked his carpentry class a simple question: "Where would Henry David Thoreau live in the 21st century?" Their answer was a 280-square-foot LEED home — the smallest, as far as anyone knows — built to embody love of the environment, love of practical (yet fine) detail, and a love of simple living.

About 50 students from A-B Tech's Carpentry, Electrical, and Construction Management classes saw this project from beginning to end. "Everything about this house came from the students. They were the champions of the ideas," says Czarnomski. "They were the architects, engineers and designers of this project. The idea was to build something real — to show that building/construction is an evolving and developing field. There are new and improved sustainable methods in building technology that the students can now take with them as practical, employable skills."

Along the way and in less than a year, the class learned more than their respective trades.

And in true Thoreau fashion, they also learned about being resourceful and working in harmony with each other and with nature. (Happily, the call of nature is addressed in the home's indoor facilities — no outhouse required.) In a way, they are purveyors of a whole different way of living: small, affordable housing that rests lightly on the environment.

The first order of business was to take inventory of what materials were in stock and what materials they would need. The students decided that once the tiny abode was built, they would sell it and donate the proceeds to the college foundation's live project teaching fund, which helps A-B Tech instructors with projects that go beyond the classroom. They knew at the onset that the project would have to be totally fueled and funded by their resourcefulness and ingenuity.

The criteria set for the project was a totally sustainable eco-structure completely crafted with local materials and resources. Every detail, including structural elements and energy consumption, had to be well-thought out and designed with sustainability in mind. Considered paramount to the project's success was that the house be high-performance, energy efficient, affordable and aesthetically pleasing. The students also knew they wanted the finished structure to be LEED for Homes and NC HealthyBuilt certified, be ENERGY STAR rated, and meet the requirements for energy tax credits — a tall order,



The little house that could: The smallest known LEED home packs an impressive array of environmentally friendly features in its 280 square feet of space.

PHOTO BY MARI FOX

indeed, on such a tight budget. The house was independently audited throughout construction by engineers and green-building managers in conjunction with the Western North Carolina Green Building Council.

280 square feet of pure innovation

The structure itself is unique, incorporating custom-made features and innovative energy efficiencies. A lot of pride and practicality went into building this dwelling, which measures just 12 feet wide by 24 feet long. For starters, the post-and-beam red oak framing allows for easy modifications by the homeowners should they decide to expand up, down or sideways; it's completely adaptable, since none of the outside walls are load bearing. The exterior cladding consists of corrugated metal panels that extend from the ground two-thirds of the way up, at which point the cement board parapet takes off to the TPO white roof. The rainwater retention roof captures water with scuppers attached on the end to direct rainwater to a cistern.

Other notable features include:

- A screen extending out a few inches from the metal panels that will incorporate a living wall as a beautiful, yet functional cooling element.
- Passive solar design, the main energy source, is supplemented by a mini-split heating and cooling unit.

- Supports allow for future photovoltaic panels, which also could shade southern-facing windows in the summer.
- A mini-grant from Progress Energy helped insulate and weatherproof between the exterior and interior walls, making a high-performance thermal envelope that increases energy efficiency.
- Windows donated by Pella Corp. allow the home to meet stringent energy standards.
- All locally milled lumber adds to the home's sustainability.

High ceilings + open floor plan = a spacious feeling

Everything about the interior of this home is as well-conceived and precisely executed as the exterior. It has to be; there are only two rooms — an open space for the kitchen and sleeping area and a bathroom. The interior walls are 9-1/2-foot-high plywood panels, screws attached to the studs for easy access to plumbing and electrical. The panels were scavenged from a previous building project, as were the tongue-and-groove wood planks on the ceiling and 20-inch wide pine planks on the floor.

Superb student craftsmanship is evident in every direction. "This project was never about produc-

tion, but about pride; about doing it right,” says Czarnomski. The kitchen area contains 15 feet of beautifully polished 3-inch-thick concrete counters that line the south wall and sit atop custom-made birch cabinets. The counters act as thermal mass — part of the overall passive solar design that includes a handmade adobe Trombe wall.

The European bathroom is completely tiled and tightly sealed on the walls, ceiling and floor. Splash all you want with the hand-held shower: Everything in this room is water resistant and wipes down easily. The 4-foot wall-mounted sink offers a simple solution to counter space – something every master bath should have. Above the bathroom, there is a storage loft and a place to keep the towels dry.

Community counts for everything

Although the students were the main source of ingenuity and labor, it took a village to make this project happen. The local building community, building supply stores and corporate sponsors stepped up to the plate to lend a hand, a hammer or a head full of helpful tips.

Build it and they will come

Over 11 months, many people came to gaze at the tiny home under construction at a warehouse on the old American Enka manufacturing site. Among those visitors would be the eventual owner — the highest bid-

der in a sealed bid public auction. The new owner plans to move the house to his farmland near Warren Wilson College. With a crane to hoist the little home and an 18-wheeler to transport it all in one piece, it will be gently set upon a freshly poured foundation.

“This tiny LEED house and the spirit of the project aligns with our personal values and the vision for the farm,” said **Aaron Maret**, proud owner. “Once the house was brought to my attention, it seemed like a great way to start a new home for my brother-in-law and his family on the property. We will add some bedrooms and a mud room this spring so it will be move-in ready by summer.”

It’s a beautiful ending to this labor of love.

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

Designers/Builders: A-B Tech’s Carpentry, Electrical, and Construction Management students, faculty (abtech.edu)

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Sustainability

Ryan Lubbers' homestead in Hickory Nut Forest

BY SUSAN ANDREW

There was a time in these mountains — before tract housing and highways and the electrical grid — when folks made their living from the land and built houses using materials they found locally, dwelling in relative harmony with nature.

When **Ryan Lubbers** set out to build his dream home, he wanted to employ these same principles, while making use of modern building and energy technologies to achieve that broad goal.

His 1,750-square-foot home, shared with partner **Jane Vogelman**, is designed to coexist with nature — both by using green technology and by deliberately integrating elements of its natural surroundings, as did the homes of this area's early settlers.

The house is one of three built thus far in Hickory Nut Forest, a 200-acre eco-community in Gerton (near Chimney Rock State Park) where residents share a 10-acre organic garden and heirloom orchard, along with access to miles of trails through forest protected under a conservation easement.

It's hard to overstate this house's alignment with sustainable living, as practiced by Western North Carolina's early settlers. From its post-and-beam interiors to its clay stucco-and-shingle exterior, Lubbers sought to use materials harvested and processed on the site.

Consider the poplar bark he harvested for exterior siding. "That's been done for a long time," Lubbers acknowledges. "It's known to last up to 75 years; under the soffit, it should last indefinitely." Naturally rot-resistant, the bark can be peeled as soon as the tree starts to leaf out in April, he explains. "It'll be really slick underneath the cambium layer — it just peels off like a banana."

As the lead builder on the project, Lubbers worked closely with friend and fellow green builder **Nate Ballinger**, aka Bearwallow Construction. "We wanted to use everything from the site that we possibly could," Lubbers confirms. The house uses a surprising diversity of wood species, including white and chestnut oak, maple, cherry, silverbell, walnut, birch, sourwood and locust. "It's just amazing what you can do with the lumber" that other builders would regard as useless, Lubbers says, with obvious pride. "The trick is to use it for its best use."

For instance, some interior trim features boards still sporting the "live edge," the rough line where the bark meets the wood of a living tree. Raw laurel



Wood wonderful: Ryan Lubbers' dream home takes a few cues from the Hickory Nut Forest community center, shown here; the center features a variety of wood, including white and chestnut oak, cherry, silverbell, sourwood and birch.

PHOTO BY JONATHAN WELCH

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Systematic: A solar-thermal installation supplies the radiant-heat floor system, above, one of several features that help achieve net-zero energy use, says homeowner Ryan Lubbers.

PHOTOS BY BILL RHODES



Holistic thinking: This net-zero home is Lubbers' "best expression of a sustainable house."

stems were used as rails in an exterior porch railing. Stair risers and treads were made from available pieces of different hardwood species. "You can use any type of wood for something," Ballinger says.

It's a selective process, where a builder saves choice materials for certain applications. "With the cherry, we had just enough to do the kitchen cabinets" crafted by Weston Woodworks, Lubbers reports. He wanted to avoid the formaldehyde and volatile organic compounds used in many fabricated building components such as cabinets, so "Weston did the research and got soy-based glues, and low-VOC lacquers, and then used the wood we [got] from the site."

There's an element of luck involved in any successful building project. Forty big hemlocks on a neighbor's property had been killed by the woolly adelgid; those trees now provide the beautiful exposed timbers overhead in the home's main living area — "one of the top choices for timber framing, and we just got lucky," Lubbers says.

On the energy side, the house features both passive- and active-solar technologies. Radiant floor heating, embedded in the smooth cement floor, employs hot water provided by solar thermal panels on the roof. On cloudy days, backup is provided by a propane burner to boost the temperature of the hot water; a wood stove provides additional heat in the living room. "A week of pure clouds, and you're not getting solar to heat the water, so the propane will kick in," Lubbers explains.

As for electricity, "the 3.6 kilowatt photovoltaic system should make us a net-zero home, and hopefully energy positive," Lubbers reports. "The PV panels are producing well, with 14 kilowatt-hours produced on a sunny day, with only 9 kwh hours used on an average day. So we are currently making more electrical energy than we are consuming."

At the same time, Lubbers' home is carefully designed to maximize passive solar gain. The trick to passive solar heating is creating thermal mass to store and slowly release heat to the building's interior. Lubbers' home does this via the cement floor, which traps heat from the sun coming in the big south windows—but only in winter. His overhangs are designed with the sun's seasonal behavior in mind: "On the summer solstice, the sun is high in the sky, and doesn't come directly into the house. In the winter, it's low-angle sun, and it will come all the way in and light up the entire floor, soaking into that heat sink."

Continuing the passive solar features, a Trombe wall provides another heat sink for passive solar gain on the home's south side. Built from cement block, painted black and housed behind glass, the Trombe wall looks like a big window from the outside. Even so, "You don't want your whole house being blazed by the sun all the time — you want some solar-free rooms that provide a refuge" from the sun's light and heat. Lubbers provided these as bedrooms on the house's north side.

Brian Love and Earthaven Ecovillage helped with earthen plaster on the home's exterior. The clay component of

the plaster was dug on-site. "You have to do each coat in a single day," Lubbers points out, adding that this might have been the most difficult aspect of the project. "It has to be the right temperature outside, not too warm; we had about 20 people involved in a huge mud party, with ropes and scaffolding and trowels ... and beer," he says, grinning. "The best thing is, it's hydrophobic — it becomes a vapor barrier, a monolithic shell around the house," forming a nearly seamless building envelope.

Lubbers was thrilled when the project earned a platinum NC HealthyBuilt Home rating through the WNC Green Building Council, scoring 332 points. The point system ranks a home on everything from water and energy conservation measures to indoor air quality, materials and site treatments including landscaping.

Lubbers' ideas about landscaping are heavily influenced by permaculture concepts. "A permaculture garden gives you the tools to take care of yourself, right in your own backyard," he says, beginning with the most managed zones near the house to the least managed areas farther away.

How does the cost of building this house compare to conventional building per square foot? "We think, when it's all said and done, it will be very close to conventional building because of using so many resources from the site," says Lubbers. There's the up-front cost of purchasing solar thermal panels for hot water and photovoltaic panels for electricity, he says, but there are sub-

stantial tax incentives, and prices for solar panels have come down. "There's a clear return on the investment over time," he continues. "On sunny days, the [electric] meter flows backward as the panels provide electricity to the grid; at night, we can draw power from the grid."

As the project wraps up, what is Lubbers most proud of? "Thinking about it holistically, from top to bottom," he replies, "then working with local craftsmen and using the resources we had right here on-site to build my best expression of a sustainable house."

And while an intensive project like this could strain any friendship, he's still got Ballinger, Vogelman and a long list of helpers at his side. "At the end of it all, I feel really good about the community that formed around the project."

Susan Andrew is a science-and-environment writer who's working to green-retrofit an older home in Asheville's Kenilworth neighborhood with her husband, Mark.

Designer/builder:
Ryan Lubbers, with Bearwallow Construction
bearwallowconstruction.vpweb.com
Cabinetry: Weston Woodworks
woodworkartisan.com
Exterior plaster:
Earthaven Ecovillage
earthhaven.org

Caroteo

A home that's young at heart

BY MARI FOX

Kid-friendly meets green-building sensibilities at Caroteo — a playfully designed home that features both a firefighter's pole for the children and geothermal heating and cooling for energy efficiency.

Located north of Canton in Haywood County, the home is named for **Mark Bondurant's** children, **Caroline** and **Mateo**. Owner of Rare Earth Builders, Inc., Bondurant explains, "I really played with the design to incorporate lots of surprise elements that are secrets waiting to be discovered, such as small niches, intimate window seats, and recurring design motifs. My goal was to wed highly efficient bones with an organic, whimsical style to create a net-zero energy home that expressed who we were and what we value."

With the children in mind, Bondurant and designer Jack Devitt included such whimsical additions as a secret room and balconies in the children's bedrooms. Such touches make the house fun for the kids — and big kids, too, says Bondurant.

Add photovoltaic solar panels to produce electricity, a geothermal system to heat and cool the house, and a passive solar design, and the home incorporates sustainable energy with a family oriented flourish.

Bondurant says he aimed to create a living space that reflected his and his family's passion for environmental stewardship and a nature-inspired aesthetic.

For example, while many builders have gone to 2-by-6-inch framing studs to provide room for more insulation in the walls, Bondurant took it to another level. He wrapped the entire outside of the home with 2-inch extruded polystyrene foam board, starting under the slab on grade, continuing up the walls, and over the roof without interruption. Taped at the seams, the foam board keeps drafts out and keeps the bones, or framing of the house, warm and dry.

This tight-house approach is complemented by geothermal heating and cooling: Mike's Heating & Air will install a system that Bondurant configured so there will be minimal disruption to the property. The crew will lay 325 linear feet of PVC piping, set at a five-foot depth in horizontal loops instead of the typical vertical. "We are able to install horizontal loops because we have the room and the level land to make it easy, rather than having to drill a well, which is more expensive," says Bondurant. To further reduce the relatively high upfront cost of a geothermal system, Bondurant will do his own digging with his track hoe.



Triple threat: European triple-paneled windows help make the passive-solar design more efficient.

PHOTOS BY MARI FOX

To heat and cool the house, liquid refrigerant circulates through the loops, absorbing the ground temperature then passing it to a heat pump, he explains. There, the liquid is alternately compressed and condensed, squeezing the maximum amount of energy from the refrigerant before transferring to the air blown through the ductwork.

Since the ground temperature at five feet is a consistent 59 degrees, there is a smaller jump up to heating indoor air temps, such as 68 degrees in winter or 70 degrees in summer, compared to starting with outside air temperature, he continues. The walls, windows and the solar orientation of the home contribute to the overall energy efficiency. (To learn more about how such systems work, see "Go Geothermal" elsewhere in this guide.)

There's more ground work at play at Carateo: In preparation for pouring the concrete slab on grade, Bondurant first paid a visit to Haywood County's Recycling Center and collected brown, blue, green and clear glass bottles. Center staff crushed the colored bottles with a Bobcat, then Bondurant and his crew graded it with hardware cloth screen and washed it. After the slab was screeded flat, the glass was then seeded (sprinkled) in during the bullfloating process.

Once the house is dried in and the rough-ins are complete, a concrete polisher will grind the slab down to expose the colored glass, Bondurant notes. Concrete dyes add background color, resulting in a terrazzo-type floor with recycled colored glass rather than the usual colored stone.

When it comes to the home's overall design, wavy lines adorn just about every view, inside and out, with the intention of blurring the separation between inside and outside to create a natural, organic feel in every direction. Outside, a curvy-edged, cantilevered deck will blend naturally with the permaculture (including native plants, edibles, garden and a fish pond).

From the inside, the interior window features mimic fluid, organic lines found in nature. The window stools will be handmade from property-harvested hardwoods — interior trim will include bark or wane-edged wood rather than the traditional molded contour. A window seat in the living room, framed by a gothic arch, will have a sinuous hardwood seat that looks out over the pond and garden.

Says Bondurant, "This home expresses who we are and what we like ... Our sense of humor, our love of play, our curiosity and utter reverence for the natural world and its beauty."

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

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features

Getting to net **ZERO**



DON'T JUST USE ENERGY — CREATE IT

BY MATTHEW VANDE AND EMILY BOYD

Imagine living in a home that creates as much energy throughout the year as it uses. You could eliminate one of your largest sources of carbon emission and your power bill at the same time. The “net zero” movement is the pinnacle of the energy-efficiency movement, and a growing number of people in the Western North Carolina community are striving for it. We’re proud to be two of them.

When we say net zero we mean net-zero energy: a home that generates at least as much onsite renewable energy as it uses. Some people prefer to work toward net-zero carbon emission or net-zero energy cost. In most cases, the performance level is similar among these definitions, with the specifics of utility-rate structures and the mix of fuel sources used accounting for the differences. Regardless of the precise terms, net-zero homes are high-performance homes.

There are two ways to approach making a home net zero. The first is to think about strategies after a house has been designed and/or built. Usually this approach requires a much larger renewable-energy system and the cost and physical size of the system can be difficult to absorb. Energy efficiency is still generally less expensive than renewable energy. It really helps to start with a deep-energy retrofit. A small home, or a relatively efficient home, offers the best chance of success.

The more cost-effective way to approach net zero is to identify it as a goal early in the project and design the home to use as little energy as possible. This makes



Green, inside and out: A small home that incorporates passive-solar designs inside and out makes for an energy-efficient, comfortable abode.

PHOTOS BY JAY COBLE

the renewable-energy system required to achieve net zero much more manageable in terms of physical size and cost. We estimate that at least half of a typical new home’s energy use could be eliminated through energy-efficient design practices. The more a house takes advantage of these, the less renewable energy it will require.



Score one for sustainability: Workers install PV panels that will help make the home net zero.

PHOTO BY EMILY BOYD

Passive solar design is a great starting point for a net-zero building, and was used in at least half of the local net-zero homes that we know about. Why not take advantage of solar energy that you are already getting for free? If you are careful about how you orient the house, size the windows and south-facing overhangs (as well as the types of glass you use), and use thermal mass to store this free solar energy, you will be well on your way to achieving a net-zero home. (For more about passive solar technology, see "Here Comes the Sun," elsewhere in the directory.)

It's also important to keep this conditioned air inside the home. Insulation and air sealing are critical. A net-zero home should have wall, floor and roof insulation that exceed code. Too many windows can create a problem, since walls are much better insulated than glass. Sealing every crack in the building with caulk or foam is an important and cost-effective way to reduce air infiltration and humidity migration that can consume excessive energy. Ducts should be inside conditioned space to eliminate another potential route for unintended air exchange with the outdoors. It's crucial to have the home designed and inspected to make sure these goals are met.

Efficient heating and air-conditioning equipment also matters. Many local

net-zero homes use ultra-efficient geothermal (ground source) heat pumps which provide both heat and air conditioning. Others choose to use solar hot water radiant systems with a gas backup, and may install a very small air conditioning system. Some people choose not to install air conditioning, but it may be necessary for humidity control.

Water heaters are another area where efficiency is critical. The most efficient option is solar-water heating. For all electric buildings, heat pump water heaters are more efficient than regular electric tank water heaters. For buildings that use gas, tank-free gas water heaters are an efficient option. Geothermal heat pumps can often provide hot water as a byproduct of heating and cooling when the units are in operation. This preheated water can be used to supplement the primary hot water source. Also, low-flow faucets, showerheads and ENERGY STAR appliances all use less hot water, which saves water and energy.

Efficient lighting options are also plentiful. Compact fluorescent light bulbs are inexpensive and easy to find. LED technology can be competitive with CFL lighting when considering lifetime costs. Using occupancy sensors, dimmers and timers can also reduce the energy that lighting consumes. Other electric loads can be re-

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duced by purchasing ENERGY STAR appliances and electronics and installing power strips with master on/off switches for things like entertainment units and office areas to reduce phantom loads.

Once the building has been designed to be as efficient as possible, the remaining energy use must be offset with renewable energy sources (typically photovoltaic, wind or micro hydro systems). The renewable energy is usually tied to the local electric utility's "grid," allowing the homeowner to buy electricity when the home needs more than it produces and sell the excess when the home is producing more than is needed.

This approach has many advantages, including the elimination of costly batteries and contributing renewable energy to the grid during summer "peak power" times, when many utilities are generating its most costly and least efficient power. It will also make homeowners eligible for some utility rebates and/or the ability to sell the renewable energy credits for their installation.

Both the federal and North Carolina governments have excellent financial incentives for renewable energy systems. In-state residents are able to get up to 65 percent back on photovoltaic, solar thermal water heating, wind, micro-hydro and geothermal systems. The 35 percent N.C. state tax credit is available for passive solar material upgrades as well. Once these financial incentives are considered, the payback for each one can be quite short — often less than seven years.

Anyone setting out to build a net-zero home should enlist the help of experienced professionals early in the design phase because specific design elements will be different for every project. Wise decisions during the planning stage can save a lot of money later in both the construction of the home and the operating cost after it is completed.

Getting to net zero doesn't have to be difficult or prohibitively expensive. With the current incentives available, there has never been a better time to try.

As we're writing this article, we are sitting in the basement office of a passive-solar, net-zero home. The sun is shining in the south windows, the office desk lights aren't needed, it's a comfortable 72 degrees inside (even though it is 40 degrees outside), and the heating and cooling system hasn't been turned on in three months.

When we think of the fact that the only electricity being used in the office right now is the actual computer we are typing on, it just brings smiles to our face. Can't you picture yourself in such a home? It's easier (and less expensive) to create than you think.

Matthew Vande, an architect, and Emily Boyd, a general contractor, work for VandeMusser Design. VandeMusser Design provides technical consulting and certification services for green residential construction to builders, architects, developers, and homeowners in Western North Carolina. Both Matthew and Emily have recently completed their own passive solar, net-zero homes.

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The next seven generations

Eastern Band of Cherokee Indians takes sustainability to new levels

BY DAMON LAMBERT

While many communities are pursuing environmental sustainability, the Eastern Band of Cherokee Indians possesses assets that few other communities can claim. For one thing, the tribe has endeavored for many hundreds of years to be good stewards of the land, and to strike a balance between natural, cultural, spiritual and economic needs — now and for the next seven generations.

Another important advantage is that most of the development on tribal lands is managed by various tribal departments, which all report to a common management. That makes it much easier to implement a strategy on the Qualla Boundary, the homeland of the Eastern Band of Cherokee Indians, than in other locations.

For the past four years, there has been new impetus to achieve greater energy efficiency and develop local renewable-energy resources. It started when the Cherokee Preservation Foundation convened tribal members to set goals for being a green community. (The foundation was established by the tribe and the state of North Carolina in 2000 to encourage environmental preservation, cultural preservation and economic development.) The community then established the Generations Qualla initiative to help the tribe implement the Qualla Environmental Resources Initiative proclaimed by Principal Chief **Michell Hicks**.

Members of the Generations Qualla effort searched for a Cherokee symbol that would come close to the modern-day meaning of environmental sustainability. They consulted with elder **Walker Calhoun**, who showed them a Cherokee symbol that does not have a direct English translation, but could be interpreted to mean “endless.” The symbol is now used on recycling bags and other sustainability efforts on the Qualla Boundary.

Momentum began to build in 2008, when the tribe received a grant from the U.S. Department of Energy to complete a strategic energy plan and the Cherokee Preservation Foundation began funding energy audits of tribal and community buildings to identify ways to save energy and money.

Throughout the past three years, 40 energy audits have been conducted by Waste Reduction Partners, a program of the Land-of-Sky Regional Council. The

audits identified a range of energy improvements involving insulation, windows, roofs, HVAC efficiency, lighting, water-saving features in restrooms and office equipment that could be made to reduce energy usage significantly in existing buildings.

Tribal departments formed a Strategic Energy Committee to create a strategic plan to implement the

In early 2012, all three buildings will be retrofitted with new lighting, HVAC systems, waterless urinals, faucet aerators and dual-flush valves, and solar hot water systems will be installed in all three locations as well. Solar PV panels will be installed at the two kiosks to meet part of their electricity needs, and a small wind turbine will be installed at the downtown visitor kiosk for additional power generation.



Stewards of the next generation: Youth Council members wear the Cherokee symbol for “endless,” denoting an effort emphasizing sustainability on the Qualla Boundary.

PHOTO COURTESY OF THE CHEROKEE PRESERVATION FOUNDATION

recommendations from the audits and determine the best renewable-energy options available to the tribe. The committee also serves as the knowledge base and advocate for the plan. The Strategic Energy Committee is composed of representatives from the transportation, environment and natural resources, building construction, and planning and development departments, as well as the principal chief’s office.

The strategic energy plan targets at least a 30-percent energy reduction at seven tribal buildings. So far, \$1.5 million has been provided by the tribe, the federal government and the Cherokee Preservation Foundation for improvements. The foundation recently made a \$374,000 grant to the Strategic Energy Committee so it can create showcase projects in the tribe’s welcome center and two smaller visitor-information kiosks that will demonstrate renewable energy and energy-efficiency projects on the Qualla Boundary.

The Cherokee Preservation Foundation has installed its own solar PV panels as well, to set an example for the community and to help tribal members get used to the idea of seeing solar panels on rooftops and spur interest in taking similar action.

LED streetlights were recently installed throughout downtown Cherokee. They are expected to trim \$23,000 annually from the tribe’s utility bill.

Two fellows from the Environmental Defense Fund’s Climate Corps helped the Strategic Energy Committee accomplish a great deal over the summer of 2011. That included determining which sources of renewable energy hold the greatest potential for the tribe, prioritizing tribal buildings by their energy-efficiency potential if retrofits are installed, and developing a system that will enable

the tribe to track energy use now and after building retrofits have been completed. The system also will help in the development of green-building standards on the Qualla Boundary.

The Climate Corps fellows also recommended that the tribe create an energy program manager position to coordinate future projects on the Qualla Boundary, including fleet efficiency and establishing local availability of biodiesel fuel. A new grant from the Cherokee Preservation Foundation has helped the tribe fund the position. When the new manager is hired, the Generations Qualla initiative will spread its wings and take flight across the entire Qualla Boundary.

Damon Lambert, building construction manager for the Eastern Band of Cherokee Indians’ Building Construction Department, chairs the tribe’s Strategic Energy Committee. He can be reached at damolamb@nc-choerokee.com.

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A foot in the door

Effort targets women and people of color for green jobs

BY ERIN CONDO

A report prepared last February on the difficulties women and people of color face in finding green jobs in Western North Carolina has prompted local leaders to work on ways to improve their access to the green economy.

The YWCA and Green Opportunities, an Asheville community development organization, launched the initiative, which started with a research project to assess the status of women and people of color in Asheville and Buncombe County's green economy and identify barriers and best practices for creating a more inclusive green economy. The initiative was supported by the Z. Smith Reynolds Foundation and the Women for Women program at The Community Foundation of Western North Carolina.

In working toward a comprehensive understanding of these issues, multiple research methods targeted different population groups, including women and people of color looking for green jobs, green-jobs-training program administrators, and green business employers.

Findings and recommendations from the report formed the focus for ongoing planning discussions for a group of leaders from local businesses, government agencies and community-based organizations.

The report notes that the status of women and people of color in WNC's green economy is mixed. Specific findings include the following:

- Although local green businesses are struggling to provide a large number of jobs, the jobs they do provide are usually of high quality, offering a living wage and other benefits such as health care, flexible schedules, on-the-job training and upward mobility.

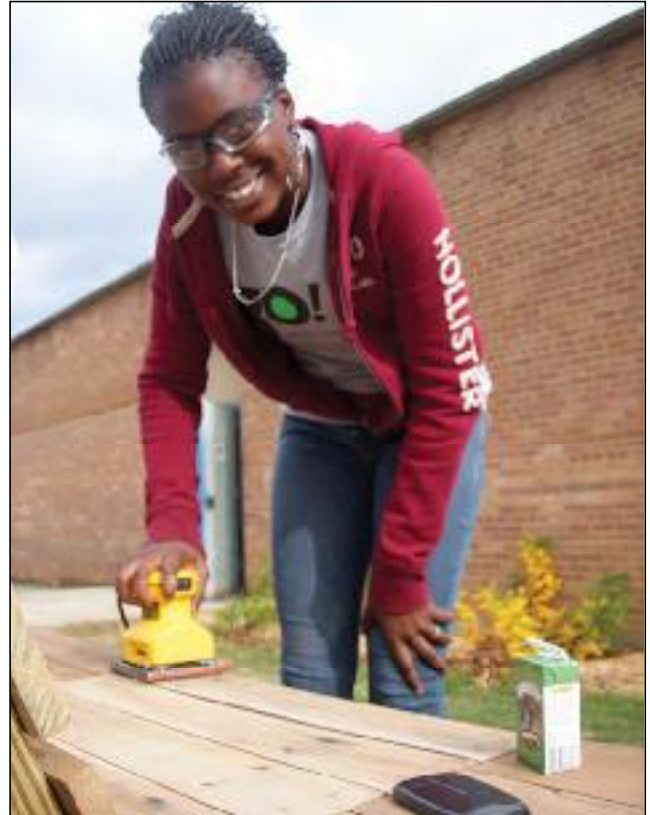
- However, competition for a limited number of available jobs means that people facing barriers to employment — including women and people of color — are often overlooked.

- Women are concentrated in administrative positions and at all levels of the business, including upper-level administration and ownership positions.

- People of color, especially men, tend to be concentrated in entry-level, on-site labor positions. They are rarely found in administrative positions of any type or in positions with supervisory titles.

Access to green jobs for low-income women and people of color is limited by various difficulties, including the inability to meet basic needs, mental and physical health issues, lack of transportation and lack of adequate education and job skills. Women, regardless of their income, are generally not encouraged to enter trade careers such as those found in the local green economy.

At the institutional level, there seems to be a cycle of challenges to hiring and retaining women and people of color. First, there is simply a shortage of green jobs available locally. A limited number of women and people of color in existing green jobs translates into a lack of role models and mentors for those entering the job market. This lack of mentors provides



Opportunity: Asheville-based Green Opportunities gives disadvantaged youth and young adults like Jasmine Middleton a chance to learn the skills needed for green-building jobs.

PHOTO COURTESY OF GREEN OPPORTUNITIES

one reason why green employers report that women and people of color are not applying for jobs, and some green training programs reported difficulties in recruiting women and people of color. Still, most green businesses and green-jobs training programs lack targeted recruitment efforts aimed at these populations, adding to the multiple barriers they face to gaining green employment.

Training programs that specifically target people of

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color, such as Green Opportunities and Asheville-Buncombe Community Christian Ministries, are able to recruit plenty of trainees and applicants, but find that job placement and retention remain largely elusive unless employers are specifically seeking candidates who are women or people of color.

Based on these findings, the report made a number of recommendations to establish a more inclusive local green economy, including:

- Strengthening partnerships and collaborations.
- Increasing targeted recruitment and outreach to people facing barriers to employment.
- Standardizing green educational-and-training programming.
- Increasing access to wrap-around services, such as child care, transportation, mental-health counseling, job training and more.
- Participating in economic development and social enterprise, and developing strategies to create jobs for program trainees by finding unfilled local niches and opportunities.
- Creating mentoring, networking, and apprenticeship opportunities.
- Measuring and evaluating training programs and access to green jobs.

Since the release of the study, a group of local stakeholders made up of business owners, green-jobs-training program leaders and policymakers has come together to implement these recommendations.

Partnerships across green businesses and green-jobs training programs are becoming stronger and more streamlined, thanks in part to the stakeholders' work. By meeting regularly, stakeholders are networking and sharing opportunities such as job training, community projects and employment opportunities smoothly and efficiently.

Examples of these partnerships include Green Opportunities' work with the Asheville Housing Authority and the city of Asheville to secure a \$4 million grant to renovate the W.C. Reid Center, with the renovation itself serving as a green-jobs training program for women and people of color

from low-income neighborhoods. The Western North Carolina Green Building Council's NeighborSaves program is working to create insulation and crew-leader positions for GO graduates; the program was initially funded by the Community Foundation, with financing opportunities through Self Help Credit Union. And A-B Tech is working with the YWCA to create a Women in Technology and Engineering program, strengthening recruitment and training targeted specifically to women.

In terms of job creation, a number of graduates from green-jobs-training programs have secured jobs at local green companies such as FLS Energy, Sundance Power Systems and Blue Ridge Biofuels.

Perhaps most important, awareness about the benefits and importance of a local green economy is becoming more widespread. The stakeholders group is now embarking on a promotional campaign aimed at recruiting women and people of color into green jobs and raising awareness among local green employers. Local business leaders already report having greater consciousness about their own hiring practices simply by being part of the stakeholders group.

These efforts hold the promise of maintaining strong partnership networks, increasing awareness — and most important to the local economy — increasing opportunities for meaningful, quality green jobs for women and people of color.

To learn more about the Inclusive Green Economy Initiative, or to read the full report, visit greenopportunities.org.

Erin Condo is a freelance writer and researcher, a songwriter and novice natural builder. While living in Asheville, she undertook the Green Jobs study, working with the YWCA, Green Opportunities and the Western North Carolina Green Building Council. She currently lives in central Pennsylvania and owns Ecovents, a green event-planning company

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Down on the (solar) farm

Asheville church joins ranks of community-owned renewable-energy projects

BY BOONE GUYTON

There's a growing awareness of the need for cleaner alternatives to conventional energy sources across the country and the world. Climate change, energy security, a hedge against rising fuel costs and more local jobs are all reasons for the growth in solar, wind, geothermal and energy efficiency.

Community solar projects are one way to make solar energy more affordable and available to a greater number of people.

"A community solar farm or solar garden is a solar power installation that accepts capital from and provides credit for the output and tax benefits to individual and other investors," according to Wikipedia. "The power output of the farm is credited to the investors in proportion to their investment, with adjustments to reflect ongoing changes in capacity, technology, costs and electricity rates. Companies, cooperatives, governments or nonprofits operate the farms."

The advantages of establishing a community scale for renewable generation systems include: lower upfront costs due to economy of scale; availability of optimal solar-access sites; education and community building; support of local businesses and jobs; and opportunities for people who don't own homes or have solar access to own renewable energy installations.

Renewable energy development is heavily affected by federal and state tax incentives. In North Carolina, we are fortunate to have a good state tax incentive of 35 percent on top of the 30-percent federal renewable-energy tax incentive.

Asheville's first community solar project is on the roof of the First Congregational United Church of Christ. The Earth Team at the downtown church initiated it with help from **Richard Fireman**, the outreach coordinator for North Carolina Interfaith Power &



Thumbs up: Asheville's first community solar project resides on the roof of the First Congregational United Church of Christ.

PHOTO COURTESY OF APPALACHIAN INSTITUTE FOR RENEWABLE ENERGY

Light (a program of the N.C. Council of Churches). Fireman also works with the Appalachian Institute for Renewable Energy in Western North Carolina. Sundance Power Systems installed the 42-panel, 10-kilowatt system, which was financed for the most part by church members, who formed a limited liability company called First Church Solar. **Stan Corwin** and **Ron Martin-Adkins** manage First Church Solar,

which Corwin points out is appropriately named, as it's the first community solar system on a church in the state.

The investors in the company own the system and benefit from the tax credits, depreciation and revenue from selling the electricity and renewable energy credits. The expectation is that after about six years, the investors will have made their money back and then some, depending on each individual's tax situation. At that point, they will donate the system to the church.

Corwin says that the process went smoothly and that the congregants appreciate knowing that their solar system produces clean energy and reduces the amount of coal-fired power being used. Fireman reports that there were more interested people than could be accommodated by the installed system, since available space was limited on the church roof.

"In six years, once the church owns the system and depending on the price of electricity and other elements in the marketplace, the church may decide to net-meter and use the electricity itself," Fireman says. To date, the system has been producing more energy than estimates predicted.

At the dedication of the system, the Rev. **Joe Hoffman** said, "We know that human life on Earth, especially in the United States, has not been kind to Earth. We confess that we have used more than our share of Earth's resources and seek to live more in harmony with Earth's ways and with respect for all Earth's creatures and life systems."

The Appalachian Institute for Renewable Energy is talking with the city of Asheville about the possibility of installing other community solar projects on city-owned roof sites with good solar access. One of the main considerations is that any roof selected for a project of this nature must have a stable ownership over the 25-year expected lifespan of the project and

be in good enough condition to not have to be replaced during the 25- to 30-year life of the system. Churches, schools and government buildings are often good prospects in this regard. The institute has the expertise to help replicate this model throughout the region and provides counseling to prospective investors as they examine the probable return on their investments, according to their personal financial situations. AIRE provides feasibility studies of the sites, and for a fee based on the size of the system, will also handle the required legal paperwork.

Now that First Church Solar has shown that community solar projects are feasible and can perform as mod-

eled or better, the prospect of seeing more community solar projects in our area seems good. Our contribution to climate change needs to be addressed in as many ways as possible, and this promising new program for accelerating renewable energy production is one of them.

For a great slide show of the First Church Solar project, visit aire-nc.org. For more info about AIRE, contact Richard Fireman at Richard@aire-nc.org.

Boone Guyton is a partner with Claudia Cady in Cady and Guyton Construction. He is a longtime member and co-founder of the WNC Green Building Council.

COMMUNITY SOLAR PROJECTS

Several states have many community solar projects:

- **Colorado:** Clean Energy Collective and United Power's Sol Partners!
- **Florida:** Florida Keys Electric Cooperative Simple Solar program
- **Maryland:** University Park Solar
- **North Carolina:** AIRE Greenhouse Solar project
- **Oregon:** Solar Pioneer I and II
- **Utah:** St. George's SunSmart
- **Washington:** Ellensburg Community Solar Project and Solar for Sakai

Courtesy of Community Solar Power, a report from the New Rules Project (newrules.org).

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Aloft and alive

Done properly, living roofs yield years of benefits

BY KATE BLATT ANCAYA

A living roof: For many people, it may conjure up images of a character in a children's story — perhaps the roof equivalent of the marching brooms in Disney's *Fantasia*. In reality, a living roof, also known as a green roof, is a simple and accurate description of what is basically a vegetated covering for a roof, with growing medium and plants taking the place of metal, gravel ballast, asphalt shingles or tiles.

Many people are surprised to learn that this is not a new technology fostered by the growing demand for environmentally sound, sustainable solutions. In fact, turf and sod have topped an array of human dwellings for thousands of years, with “contemporary” green roofs probably rooted in Iceland, where sod roofs and walls have been common for hundreds of years, due to a lack of natural resources.

The green-roof industry is still relatively young in the United States but has gained momentum in recent years as more attention is being directed toward examining and utilizing approaches that deliver a positive environmental impact. Much more than simply an aesthetic element, a living roof offers a broad range of advantages for commercial, institutional and residential applications.

In its simplest form, a living roof usually consists of an initial layer of waterproof membrane on which additional layers are built up. A critical component of the initial design process is to assess the weight load the roof can handle and then develop a suitable approach. Careful consideration also is given to the anticipated runoff, which a living roof is ideally suited to control. Finally, the species, textures and colors of the plant material are studied, both to create the desired aesthetics and ensure the health and longevity of the roof.

An ideal example of a recent commercial application is the green roof on the recently completed Dr. Wesley Grant Sr. Southside Center in Asheville, which utilized a traditional built-up system. This project required a waterproof membrane topped with a root barrier, a loose-laid drainage mat, a water-retention mat and 4 inches of growing medium — which was custom mixed to support the selected plants and drain quickly, rather than washing away.

In this case, the plants include a dozen species of drought-tolerant sedums and succulents, involving approximately 10,000 plants. An irrigation system will support growth during the approximately one-year establishment period, after which it will be detached.

A living roof also can be retrofitted to a structure in many circumstances and offer numerous benefits.



Coming together: A green roof seamlessly integrates the living spaces of this home with the surrounding landscape.

PHOTO BY DANIEL LEVIN

LIVING ROOFS, WITH BENEFITS

- reduced energy costs, particularly by lessening thermal loading during warm months
- reductions in urban heat-island effects by cooling roof surfaces
- stormwater management by reducing impermeable surface area and retaining 65-100 percent of rainwater
- contribute to biodiversity by providing wildlife habitat for insects and birds
- increased longevity of roof membranes by blocking UV rays and preventing extreme surface temperature fluctuations
- added aesthetic quality and increased quality of life
- improved air quality, since living roofs gather and absorb pollutants

In addition, projects pursuing LEED certification can gain numerous credits by using green-roof solutions.

During its renovation, a federal building in Florence, S.C., received a new roof that features a sealed membrane and insulation, overlaid with soil housing more than 50,000 plants. Replacement of the existing tar-and-gravel roof with the green roof will substantially reduce heat intrusion into the building's upper floor by an estimated 60 to 90 percent, which lessens the load on the building's heating-and-cooling system. Stormwater runoff will be approximately 80 percent less per year due to the controlled absorption of the green roof, which covers roughly 22,000 of the 28,000 total square-foot area.

The new roof system also has a life expectancy of at least 50 years as compared to 20 to 25 years for a standard system, offering sizable replacement savings over time.

While commercial application remains the most common use, architects and homeowners also are electing to include living-roof elements in residential projects. A contemporary home outside Asheville features a number of green technologies, including a geothermal field for heating and cooling. A green roof is located off the main floor of the home on top of the lower guest wing and reaches out to surrounding mountain views (see photo). The green-roof system chosen was a semi-intensive built-up system planted with a variety of na-



Hurricane-ready: The green roof on the Ocean Conservation Center at Duke University's Marine Laboratory in Beaufort, N.C., survived a direct hit from Hurricane Irene.
PHOTO COURTESY OF DUKE UNIVERSITY

tive and ornamental perennials and grasses to unify it with the adjacent landscape.

The green roof is accessible to the owner and guests, allowing it to function as an aesthetic garden space.

While the multiple benefits and advantages of green-roof technology are becoming more and more recognized, it's also important to note that these solutions are not cost-prohibitive and are read-

ily adaptable to a variety of applications. What is required, however, is knowledge and experience to design a living roof that satisfies technological, building, aesthetic and legal requirements, while also implementing a well-conceived solution that ensures long-term sustainability and benefits. An initial feasibility study can determine the best approach, with many architects and engineers now utilizing green-roof experts as consultants in the planning stages of projects.

Proper installation is another critical factor in guaranteeing desired performance, with maintenance important particularly during the establishment stage to promote sustainability over the long term.

As a result, combining desirable aesthetic and lifestyle qualities with improved performance can make a living roof the ideal choice for a project committed to achieving positive environmental objectives.

Kate Blatt Ancaya is co-founder and principal of Living Roofs Inc., an Asheville-based firm. Living Roofs Inc. teams with landscape architects, architects, artists and structural engineers to provide high-quality green-roof systems for commercial, residential and institutional structures, including new construction, retrofits and ongoing maintenance services. More info: livingroofsinc.com.

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The three R's of greener schools

Reading, Riding and Retrofit aims for sustainability

BY ROBIN CAPE

"There's a tiny thing at the edge of the rudder called a trim tab. It's a miniature rudder. Just moving the little trim tab builds a low pressure that pulls the rudder around. Takes almost no effort at all" (to move the whole ship in a different direction). — Buckminster Fuller

Helping a community learn what sustainability is and how it can improve our mutual quality of life is a challenge shared by all who work in the green fields. Most people fear the unknown and may adopt erroneous ideas they hear from others, even if those ideas aren't fact-based but rooted in fear of change. It's easier to adopt ideas that you've seen in action.

Enter Reading, Riding and Retrofit, a program of the nonprofit Asheville-Buncombe Sustainable Community Initiatives, a collaborative effort with the public schools in North Carolina. We realized that if we could help the school leaders green their campuses,

operations and curriculum, they could not only have healthier and greener schools, they could also, in their role as community educators, teach us all how green and sustainable practices can lead to a brighter future.

Our public schools consist of two districts and three charter schools. As a group, the schools are a microcosm of the larger community, facing those same operational and infrastructure sectors that define our challenge. The 54 campuses and supportive facilities have many opportunities for energy efficiency and water conservation and little funding to pursue them. The population of 35,000 staff and students creates a rich venue of social, economic and cultural diversity and offers a living laboratory to present the value of green and sustainable projects. With the blessings of the superintendents, RRR sets out to encourage, support and strategize with our schools to save energy and money, and to stimulate the conversation of community sustainability. ➤



"R" is for rain barrels: The Reading, Riding and Retrofit program helps schools become more sustainable, by adding such features as a rain barrel.

PHOTO COURTESY OF EVERGREEN COMMUNITY CHARTER SCHOOL

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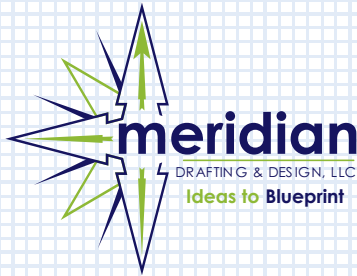
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feature

An early initiative involved convening the schools' facilities staff, the N.C. Energy Office, Progress Energy and Waste Reduction Partners (a team of highly experienced volunteer and retired engineers and scientists). Representatives from these public and private sectors came together to exchange ideas and explore the opportunities and challenges before them. Progress Energy shared information about its new program to rebate up to 50 percent of the cost of energy-efficiency upgrades. Waste Reduction Partners engineers offered energy audits and advice for efficiency upgrades.

The state Energy Office told of pending funding opportunities and the facilities staff shared their goals and challenges.

In fall 2009, the Environmental Protection Agency announced its Climate Showcase Communities grants. RRR, partnering with Land-of-Sky Regional Council, was one of 25 national projects to receive nearly \$500,000 to pursue energy- and carbon-emission reductions and mobilize green initiatives.

An exciting part of the EPA grant has been the opportunity to offer mini grants to teachers for green teams and energy projects in the classrooms. Partnering with A-B Tech's Global Institute for Sustainability Technologies brought additional funding and support into the classrooms. The teachers and students have created a variety of interesting projects with these funds. From energy and environmental edu-

SCHOOLS BENEFIT

Over the past two years, area schools have received energy-efficiency funding of \$1,090,000 from RRR, the state Energy Office and Progress Energy's Efficiency for Business program. Bottom-line results have been encouraging, with observed savings of between 30 and 70 percent energy-use reduction from the retrofits. These projects included:

Buncombe County Schools

- Retrofitted to T8 fluorescent lighting in 11 schools
- Retrofitted gymnasium lighting in 31 schools

Asheville City Schools

- Retrofitted to T8 fluorescent lighting and installed occupancy sensors in nine schools and the administrative office
- Replaced lighting in Asheville High School's "competition gym"
- Upgraded all schools to electronic Building Control Systems
- Installed solar hot-water system for the competition-gym shower rooms

ArtSpace Charter School

- Retrofitted to T8 fluorescent lighting

Evergreen Community Charter School

- Insulated middle-school attic
- Retrofitted to T8 fluorescent lighting

Francine Delany New School for Children Charter School

- Retrofitted to T8 fluorescent lighting
- Installed tankless water heaters

cation materials and tools, to gardens, composting and recycling programs, students' creativity and enthusiasm is contagious and has a positive impact on energy-conservation awareness and behaviors in classrooms, schools and homes.

Buncombe County Schools, meanwhile, built two LEED schools and initiated a "Green Schools Awards" program that recognized 12 schools last year. Evergreen Community Charter School created a student energy-audit team that had classrooms engaged in friendly competition to win the Green Cup for Energy Efficiency. Asheville City Schools created a District Green Team of teachers and staff who wrote a new Energy Management Plan and are looking at other policies and programs to support the continuous greening of their district.

According to audits by Waste Reduction Partners, these collective efforts have helped give our schools an average energy-performance rating that exceeds the state and national averages. To share this information with the public, RRR, the Land-of-Sky Regional Council and the N.C. Arboretum hosted the Sustainable Schools Series this fall, featuring some of the great strides of the past two years.

RRR team members have also participated in national conversations focused on the growing green-school movement. We presented at national conferences and received an invitation to the Center for Green Schools fellowship training. With much input from green-schools advocates, the U.S. Department of Education announced the Green Ribbon Awards this summer. This program will recog-

nize schools from around the country that excel in their sustainability efforts. To participate, each state needs a program that vets and nominates schools for the award. RRR is partnering with the N.C. Office of Environmental Education, The Pine Jog Environmental Education Center in Florida, Environmental Educators of North Carolina, the U.S. Green Building Council's North Carolina Green Schools affiliates, and others to develop the statewide RRR NC Green Schools Recognition Program. The intention is to have this program operating in spring 2012 to encourage more schools in North Carolina to go green.

Schools are natural partners in building a sustainable future. Sustainable educational systems not only yield more efficient public institutions but also foster a population that understands its relationship to the world that is our home. Helping schools reduce energy bills (and footprints) has proven to be a productive endeavor. Seeing the joy in the children's eyes as they engage in building a greener future reminds me again of Buckminster Fuller's trim tabs and the power of the individual to make the whole ship turn. We're lucky — our community has a lot of powerful little rudders!

For more info, see reading-riding-retrofit.org.

Robin Cape has lived off grid, owned an architectural salvage store, and served in local politics in her efforts to support a greener world. Her current trim tab is leading Reading, Riding and Retrofit, a program to encourage and support green schools in North Carolina.



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feature

Green, greener, greenest

Interior-wall finish alternatives for the home

BY MOLLIE CURRY

Almost every building project — whether it is new construction or a remodel/renovation — will use some kind of interior wall finish, often over drywall or already-painted surfaces. If you are thinking green, you'll want to know that your options have expanded way beyond big-box store lines of "low" or "zero" VOC (volatile organic compounds) paints to include several degrees of greener possibilities.

Though those mega-brand paints are certainly an improvement in terms of health and the environment over "regular" paint, even the zero-VOC designation refers only to the tintable base. Adding colorant increases the VOCs, sometimes significantly. And they are still petrochemical-based products. Not only that, but just being designated zero-VOC does not mean non-toxic. For instance, acetone is just one of many chemicals not regulated in paints under the VOC requirements.

I am by no means a chemist, and the world of paint chemistry — whether for conventional paint or more sustainable, eco-friendly, healthier paint — is very complex, so I am going to stick to the basics. Several companies now make paints that are similar to "regular" latex (and their reduced-VOC versions), but are significantly less toxic.

Toxic ingredients in conventional paint are the target of many of the alternative eco-paint companies — they have cut out the toxins for the benefit of human and planetary health. Alternatives have been on the market for more than 20 years that replace many petroleum-based ingredients with plant-based ingredients, such as soy or linseed oil.

In terms of how they look on the wall, these paints are close corollaries of the petrochemical paints they were designed to replace. Besides being healthier and better for the planet, they do have other differences, sometimes in coverage ability, ease in cutting in, washability and cost.

Milk paint, which uses milk protein (casein) as the binder, is another option. It is an old technique that produces a very durable and nontoxic paint that has a different look than most modern-day paints — it tends to be chalky or mottled. A couple of companies sell it or you can make it yourself. The chemistry is pretty easy.

Finishes made from clay and sand

Natural-building methods such as straw bale, adobe, cob and slip-straw also include remarkable wall finishes over conventional materials. These finishes look and feel different from the paints I've mentioned so far, and are some of the greenest alternatives possible: clay-based paints and plasters. ➤

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PRIMER: HOW LIME COMPARES TO CEMENT AND CLAY

You know those gleaming white buildings of Greece and the British Isles? They use lime in the form of plasters and paints. This special lime has been heated to produce a chemical change; it's used as a protective and decorative finish — inside and out. Lime-based plasters and paints (known as lime wash) have stood the test of time on many historic buildings. Mortar is also made with lime and sand. "Burning" limestone to make building lime is a very old technology, dating back at least to Roman times — the tagline for one of the lime suppliers is "Since 30 BC."

Making Portland cement is similar in that a high heat is needed, although the two products have important differences. Both produce plenty of greenhouse gasses during manufacture (from the burning of fossil fuels), which means they have a higher embodied energy than materials that do not use high heat in their production (like clay). Carbon dioxide is also driven off the limestone as a result of the chemical reaction that turns it into a reactive substance that can harden again when mixed with water. The difference is that the building lime slowly reabsorbs the carbon dioxide it lost and becomes limestone again, whereas the carbon dioxide that was driven off the Portland cement is not needed for it to become hard; it does not reabsorb it. So even more carbon dioxide enters the atmosphere from making Portland cement than from making building lime.

Lime-based plasters are softer than cement-based ones, but harder than clay-based ones. Since lime-based stuccoes are more vapor-permeable than cement stuccoes, they are less likely to trap water behind them and cause deterioration of the substrate. This is also true of clay-based plasters, which are almost as vapor-permeable as lime. Both lime and clay plasters resist mold, but lime is more resistant because of its high alkalinity.

When working with wet lime, the alkalinity is a danger to skin and eyes. You must wear protective gear or risk significant chemical burns. This is one way that earthen plasters and paints are easier to work with than lime and cement ones. Other factors are the "working time" and repairability. Earthen plasters are easier to deal with for both of those issues. Lime and cement are less forgiving of unskilled workers.

Clay-based products do not need to cure, just to dry, unlike both lime and cement products. Lime takes longer to cure and is more finicky about the level of moisture that needs to be maintained in order for it to cure well.

Lime wash and lime plasters do not need to remain white — pigments can be mixed in, as they can with earthen plasters and paints. Interestingly, brighter colors are possible with lime-based products, but the alkalinity is incompatible with some pigments, so only "lime-safe" pigments can be used.

On the "green-ness" scale, I see clay-based products as the greenest (lowest embodied energy, nontoxic), followed by lime-based, then cement-based. Resistance to impact and weather runs in the opposite order: cement, lime, clay. This matters less with interiors than exteriors, and buildings can be designed to use even the least weather-resistant coating (clay) effectively on the exterior. The greater vapor-permeability of the lime and clay are an advantage over the cement. If cracks occur and water gets in, it can evaporate out when the coatings are not cement. However, water trapped behind cement stucco has had disastrous effects on many buildings. Also, lime and clay tend to moderate odors and are less acoustically "hard" than cement. — M.C.



Hands-on training: People work the lumps out of native clay; students apply homemade clay-based paint over latex during a workshop.

PHOTOS BY MOLLIE CURRY

These products have unique texture and depth, which create a certain quality of light. They also are completely natural — no petroleum, no VOCs, nontoxic ingredients, potentially local and, often, a low embodied-energy impact. They can help balance humidity and are mold-resistant. On the down side, these finishes will not withstand kids with toy trucks banging into them and do not let go of stains easily. They are more labor-intensive, too.

Clay-based paints

Clay paint is relatively smooth (no sand) and has a matte finish. The manufacturer says it simulates the look of traditional plasters. It's also a very environmentally friendly product. But it's not your only choice for earthen paint: You can make your own or find a local artisan who knows how.

The main ingredients in homemade earthen paints (aka "alis" — meaning "to smooth") are powdered clay and fine sand or some other even finer aggregate like powdered chalk. Shiny flecks of mica occur in some sand sources naturally or can be added for a subtle or dramatic sheen. Mica on the wall is surprisingly attractive and does not come across as glitzy. Another fun addition is finely chopped and screened straw.

Wheat paste (like old-fashioned wallpaper paste) and powdered milk (for the casein) are modern additions to the traditional recipe — they increase durability. If you use nontoxic pigments, the paint is completely nontoxic. That said, you never want to breathe dust while you are mixing — mineral dust can cause serious disease.

Clay paints give a variety of beautiful textures to what would otherwise be a plain flat wall. Depending on ingredients and application techniques, the resulting finish can be quite smooth or with brush marks, sponge marks, finger marks, etc. It is pretty easy to create interesting textures without the final product being gritty or shedding. Burnishing with a sponge is a step that strengthens the surface and increases durability.



The personal touch: Steve Kemble burnished homemade clay-based plaster in this archway.

PHOTO BY MOLLIE CURRY

Earthen plasters are readily available

One of the main differences between earthen paints and earthen plasters is the way they are applied — plasters are usually put up with trowels, which is somewhat more labor-intensive than doing earthen paint. Troweling takes a bit more skill than painting or sponging, but is still within the realm of possibility for handy novices.

Though you can make your own earthen plaster, you can buy clay-based plaster in bags as well. You don't have to source and measure and experiment — just mix with water. There is lots of information on manufacturers' websites about how to do it and how to prepare various substrates. Earthen plasters come in many colors and textures. A very smooth surface can be created as well as a

more rustic one with many trowel marks and skips. A sponge finish requires less skill and leaves an interesting texture. Subtle mottling is common even when using only one color. Two or more colors can be artfully combined for even more amazing outcomes. The results are regularly stunning with both the manufactured product and homemade earthen plasters. You can see some of the possibilities at several local retail outlets.

The above-mentioned plasters are designed to go on conventional substrates, like drywall, in a very thin layer. However, there is also a wealth of possibilities in making your own bulkier, clay-based plasters from clay, sand and straw native to your area. Embarking on this adventure involves learning and experimenting — and way more work than buying it in a bag. But it is much cheaper, and through the process you become more connected to the world. (Mud therapy! Ultra-local and low-embodied energy!) This plaster can even be used to shape decorative borders around features such as windows, to build strong shelves and ledges or even to create bas relief sculpture.

So the next time you think about painting, consider some of these alternative wall finishes. They all aim for a more sustainable and healthy world. If you are overwhelmed with the choices, ask someone with experience with the various brands and methods to advise and offer recommendations for your project — this could be retailers, contractors or skilled tradespeople. Some local artisans and companies offer the less-common methods as part of their services. Look up books on natural plasters and paints — they have wonderfully inspiring photographs of various projects. Many people learn how to do their own natural paints and plasters through reading and hands-on classes — be sure to keep an eye out for these if you are interested.

Mollie Curry of MudStrawLove has 15 years of experience with natural finishes. She and her partner, Steve Kemble, can paint, plaster and bas relief up your house, but also can design and help build your house — especially if you want straw bale, cob, or earthbag walls. They also teach workshops on all these methods.



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Seasoned and strong

Reclaiming antique lumber as a resource

BY MICHELLE PRICE

Using reclaimed products is a great way to lessen our impact on the environment and support the local economy. Products made from antique lumber can add incredible warmth to every home and are part of our American heritage. Some of the barns, houses and mills being deconstructed these days are more than 100 years old. The timber used for their construction came from virgin forests that were several hundred years old, including heart pine and American chestnut, now virtually extinct.

American chestnut is only available through reclamation. This particular tree, which was the dominant species in the Appalachian region, died out sometime in the early 1930s due to the American chestnut blight. Efforts are being made to reintroduce it, but it will be decades or centuries before the chestnut tree is a viable part of our logging industry again.

Wood products stemming from reclamation efforts possess unique qualities. The density, stability and natural beauty of the wood in its original state, plus many years of seasoning, make this product valuable and in high demand. The richness and patina of the old-growth wood cannot be matched by trees that are being harvested today. Tens of thousands of trees are harvested every day by industrial mills and sold by retail giants. These manufacturers are continually using new material, while many small local businesses are reusing the old, which is of much higher quality.

Reclaimed lumber products are environmentally friendly because the reclamation process defers tons of demolition waste that's usually shipped to landfills, and reuses it. Much of the wood harvested is already cut and in plank form, so when it is reconditioned, there's considerably less fuel and electricity

required for processing. Buying reclaimed lumber takes advantage of the embodied energy already in the material.

The Recycling Business Assistance Center focuses on developing the construction-and-demolition recycling infrastructure in the state. "We need all kinds of recycling businesses to help grow the development of this sector," explains **Matt Todd**, market development specialist with the center. The RBAC supports reclaimed lumber companies because they fill an important salvage and reuse niche in North Carolina.

So before you build your next house or start your next renovation project — or if you just want to learn about local products and services — look at the resources in your area. Many local companies will be glad to answer your questions and help you decide if they are the best fit for your needs.

We spend a lot of time in our homes, so we should go the extra mile to be sure we install environmentally friendly products, including those that show off the history of the region we live in. Help our community achieve economic, social and environmental success. Together we can improve the triple bottom line.



Old is good: Reclaimed lumber defers tons of demolition waste that usually ends up in the landfill; much of the wood is already cut and planked, and can become a beautiful feature in a green home.

PHOTOS BY PHILLIP PRICE

Michelle Price owns Antique Reclaimed Lumber, a full-service local wood company that carefully deconstructs aged unused structures; processes the reclaimed material; offers custom-milled and handcrafted wood products; delivers; and installs. The company specializes in flooring, beams and barn wood. For more info, call (828) 659-9062 or visit pricelesswood.com.



From barn to floor:

The many old barns in the region can supply wood from old-growth forests — material that can't be matched by the trees harvested today.

Bright futures

ASU wins People's Choice Award at 2011 Solar Decathlon

BY SUSAN ANDREW

In just 14 ½ seconds, the sun provides as much energy to Earth as humanity uses in a day. Put another way, the solar energy hitting the Earth exceeds the total energy consumed by humanity by a factor of more than 20,000.

Clearly, there is enough solar energy available to fulfill your energy requirements now and, for all practical purposes, forever. The key is developing technologies that efficiently convert solar power into usable energy in a cost-effective manner.

This fundamental reality was a key motivation for Appalachian State University's entry into the Solar Decathlon, the U.S. Department of Energy's international competition to design and build cutting-edge solar dwellings.

Inspired by the days when isolated, self-sustaining homesteads dotted Western North Carolina, a team of ASU students and faculty designed a self-sufficient "zero-energy" dwelling that embraces the future. Last September, their creation went head-to-head with 18 other entries from across the globe, earning the People's Choice Award, a poll in which anyone can vote for a competition favorite.

The project got rolling in the fall of 2009, when eight graduate students developed the initial DOE proposal. That core team interviewed additional participants to help meet a wide range of needs: engineering and construction expertise, a detailed project manual, a marketing plan, a health-and-safety plan, a website and videos (required by the judges and also needed to create multimedia presentations used for fundraising and public outreach).

Recent ASU graduate and Asheville High alumna **Janelle Wienke** learned about the project when it was offered as a special course for credit; by that time, faculty advisers **Jamie Russell**, **Chad Everhart** and **Jason Miller** (all from the school's Department of Technology and Environmental Design) were enlisting student ingenuity and talent for their competition entry.

The ASU team designed a compact, 864-square-foot home; outbuildings like those found on old-time homesteads expand solar-collection possibilities and overall square footage. On an average day in Asheville, this home would harvest the sun's energy to produce 36.9 kilowatt-hours, more than enough to provide all of its electricity and heating its hot water.



Winning team: A host of Appalachian State University students and faculty worked on the school's entry project for the Solar Decathlon, held in Washington, D.C. The school's energy-efficient model home won the People's Choice Award.

PHOTOS COURTESY OF ASU

Dave Lee, a grad student in appropriate technology, headed up a team that raised more than \$700,000 from major donors. The N.C.-based home-supply retailer Lowe's kicked in \$350,000.

By the fall of 2010, the project's human capital swelled to include some 200 students and faculty from numerous disciplines. Small groups developed the home's unique, two-faced solar panels (which boost solar capture by 30 percent); reinvented the Trombe wall to store and slowly release heat to the interior; and built several required small-scale models of their homestead's final design. Sacrificing holidays and weekends, many core team members worked 100-hour weeks to meet project deadlines, Lee reports.

The U.S. Department Energy estimates that nearly half of the energy used in an average home goes to heating and cooling. The Solar Homestead's "building envelope" achieves an insulation value of R-40, augmented by R-5 rated windows and doors featuring triple-paned glass. A modern Trombe wall passively heats the house using a unique phase-change material: a wax composed of a plant oil mixture, which stores up to 50,000 BTUs as heat. In the evening, energy stored in this medium is released as the

wax solidifies and transfers its heat into the living areas. A sliding "barn door" can be operated over the Trombe wall, allowing the homeowner to adjust the amount of sunlight and heat that enters the home.

The house's floor plan is designed around a central "service core" that includes the kitchen, bathroom, laundry and mechanical room, allowing the main systems to reside in the space of a single trailer — a key feature for a house built to travel to Washington, D.C. for the competitive exhibition. Living and sleeping areas are placed on each side of this core. A solar thermal skylight over the central kitchen and bathroom supplies all domestic hot water; daylight filters through it, illuminating the rooms below.

The simple, rectangular floor plan facilitates flexible, modular connections to optional add-ons, including unconditioned spaces, such as a covered deck with outdoor kitchen, gardening shed or storage unit. Conditioned rooms provide additional sleeping or office quarters that can be shut down to save energy when not needed.

These add-ons connect to the main house via the "great porch," an outdoor living space inspired by Appalachian cabins of yore, but modernized using a

roof that incorporates a photovoltaic array or “solar canopy” that provides electricity along with some 900 square feet of outdoor seating, storage and shelter.

“A lot of solar panels are just sort of tacked onto a roof,” Wienke explains. “We didn’t think that was the most attractive way. The unique aspect of our panels is they are bifacial: They collect energy from both sides (that is, direct solar energy from above and reflected light from below) ... and they let this great light filter through.”

Such innovations give the university a tangible entrepreneurial boost. ASU already holds two patents for advanced technology, notes Lee. This project will enable the school to apply for four more, “so they’re tripling the intellectual property of the university.”

Aesthetics definitely influenced the home’s design. Flooring throughout the home was milled from recently felled 200-year-old white oaks donated by the Biltmore Estate. A vegetated “green roof” manages rainwater runoff, provides additional insulation and offers habitat for native plants and wildlife in a living assembly that extends the life of the roof by protecting it from the sun’s rays.

And while the house won the People’s Choice Award, what the public prefers overall may not fully align with pure solar-technology pragmatics. When the competition scores were tallied, this home’s final rank was 12th of 19 in the department’s judging. Lee believes that smaller houses with mini-fridges and other less-consumptive (but also less real-world) options had an advantage in the competition.

If they could have changed anything, Lee says they “would have had more sunshine” during the 10-day judging period (nine of which were cloudy days). “Normally, the house would produce about twice as much electricity as it needs, even with the full-size appliances, over the course of a year.” In view of the weather during the judging, the ASU team faced strategic decisions: “Do we dry clothes tonight, which uses 6 kwh,” says Lee, “or will those 6 kwh get us more points in the net-zero energy contest?”

“We shut down our heating and cooling, and we shut down our refrigerator for two days,” says Lee, “things that a regular homeowner would never need to do.” In addition, “We left our lights on for our VIP tours, because it looks a lot nicer, and used a little more of our energy to make sure the comfort zone was exactly where it needs to be.”

Winning the People’s Choice portion of the competition suggests their calculations paid off. The result is a flexible, attractive and marketable design. “The best part was hearing people’s conversations as they walked through, saying ‘I could live here, I love this part.’ ... A lot of the other houses didn’t use their space the same way, or didn’t have full-size appliances. We wanted to show that you can have the full-size fridge and still be net-zero.”

For a virtual tour of the ASU entry in the 2011 Solar Decathlon, go to thesolarhomestead.com. To learn more about the Department of Energy competition, visit solardecathlon.gov.

Susan Andrew is a science-and-environment writer who’s working to green-retrofit an older home in Asheville’s Kenilworth neighborhood with her husband, Mark.



Looks good from here: An ASU team member works on the living roof (top photo); North Carolina Gov. Bev Perdue tours the project (bottom photo).

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rethinking the box

Panelized wall systems increase efficiency, minimize waste

BY TOM OWENS

Builders who have been fortunate enough to stay busy over the past few years have had to rethink the way they run their day-to-day operations — to re-evaluate what they do and how they do it. Panelized wall systems, built within the controlled environment of a manufacturing facility, are a great first step in creating a more efficient, affordable and sustainable method of home building. The idea is to move redundant job-site tasks into a controlled environment to minimize waste, maximize efficiency, neutralize weather issues and make a quantifiable process of material recycling into a priority.

While our lives are influenced by technology in virtually every way, the home-building process is generally the same as it was 200 years ago. The home-building industry as a whole needs to look to the empirical data gathered through building science rather than relying upon tradition to move the industry toward a more sustainable and more efficient future.

Traditional building practices are full of unnecessary redundancies and conventional job-site construction is terribly inefficient and wasteful. On typical construction sites, up to 30 percent of raw building materials — including wood, metal, glass, rubber, petroleum-based materials, cardboard and paper — often end up in landfills. The industry lacks building-material recycling programs, suffers inefficient deployment of carpenters and subcontractors, and sees very poor quality control. Conventional construction workers seldom receive benefits, and workman's compensation insurance premiums are three times as high for site work as for shop work.



Panel by panel: Wall systems built off-site within the controlled environment of a manufacturing facility are a first step toward creating a more efficient, affordable and sustainable way to build homes.

IMAGE COURTESY OF TOM OWENS

Panelized wall systems take the layout, cutting and pre-assembly of site-built stick-framed walls and puts it in the controlled environment of a manufacturing facility.

Building wall systems in the “shop” allows for increased efficiency, minimal waste and working with more precision, all while keeping the materials (and workers) dry and not exposed to the elements. An artisan-driven manufacturing facility can produce full 2-by-6 walls, framed with advanced techniques in which windows and doors are installed in a fraction of the time it takes to do the same tasks onsite. This complete wall system can be delivered to the job site without insulation and fitted onto the foundation via crane, ready for the electrical and plumbing contractors to do their work the

way they are used to doing it.

The parallel methodology of panelized wall construction to traditional timber frame construction is interesting. Once the design of a timber frame home is finalized, the cutting of the entire frame, including all joinery, is done in-shop. The precision cutting necessary for proper fit and structural soundness requires a controlled, indoor environment where craftspeople can measure twice, cut once, and sharpen their tools as necessary in a day's work. Following the natural progression of timber frame production, a crew can plug into a panelized wall system of fabrication and produce all the walls necessary for the home in the controlled shop environment.

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This “value added” framing system marries perfectly with a Structural Insulated Panel Association-certified roof system to quickly and efficiently get a home dried in quickly and with much of the exterior work completed prior to delivery on site.

The fact is, reducing material waste and the costs associated with on-site labor will reduce the overall cost of building a home. It will reduce the builder’s tipping fees, reduce labor and fuel costs associated with hauling waste and employee commutes, and reduce insurance premiums. Centralizing wood cutting operations in the facility promotes wood reuse, which can reduce wood waste by 15 percent. The in-shop environment also protects materials from deterioration and exposure which helps mitigate any trapped moisture related issues that can occur when a site built homes framing and subfloor is exposed to the weather for any length of time. And it allows us to choose products with little or no packaging and use durable, locally produced, recycled content materials and finishes where available. A stable, in-shop environment helps ensure a correct amount of material is delivered at the appropriate time and integrated into the structure with precision and maximum efficiency.

It is a big step down the path toward affordable high performance housing. Panelized wall systems are the beginning of the transition phase of homebuilding. Encouraging their use supports an overall sustainable green building strategy.

Tom Owens is the owner and designer for High Country Timberframe, and the designer of the HCTF Shop Built Panelized Wall System. A timber-framer and fine woodworker since 1984, he has been a regular contributor to “Sukiya Living” regarding traditional Japanese carpentry. His furniture is featured in The Custom Furniture Source Book, A Guide to 125 Craftsmen, published by Taunton Press. He can be reached at tomo@highcountrytimberframe.com.



Pieces of the puzzle: Panelized homes are built quickly, which reduces on-site waste, protects materials from the elements and cuts labor costs.

PHOTO BY TOM OWENS

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Green your plate

Asheville restaurants strive for “greenest dining destination”

BY TIM BALLARD AND CARLY REESE

Food has long been a central element of social life. We all love to eat, whether it's apple pie at mom's house, a burger at a fast-food joint, Southern barbecue or farm-fresh vegetarian cuisine at an independent restaurant in the foodie heaven of Asheville. However, most people probably don't know that restaurants exact hefty demands on the environment. The choices a restaurant makes around energy, water and food consumption can have great environmental implications.

Of course, wherever there is a sizable environmental footprint, there is also room for improvement. The Asheville Independent Restaurant Association and the Blue Ridge Sustainability Institute have teamed up to help 18 local, independent restaurateurs to green their businesses and achieve Green Restaurant certification through the national Green Restaurant Association. By Earth Day 2012, they hope Asheville will be crowned the “greenest dining destination in the country” with the highest per-capita density of GRA-certified restaurants anywhere in the nation.

So what's the fuss all about?

To begin with, restaurants are the most energy intensive of all commercial buildings, consuming an average of 258,000 Btus per square foot, according to the U.S. Department of Energy. (A British thermal unit roughly equals the energy released by burning one kitchen match.) This is about two-and-a-half times more energy than the average commercial building. Some small Asheville restaurants use even more. One small, 2,400-square-foot Asheville independent restaurant consumes a shocking 2 billion Btus per year, which the Department of Energy equates to the energy consumed by about 19 homes of the same size. This adds up to an annual energy bill of \$30,000. To say the least, there are many opportunities for energy and dollar savings.

So where is all the energy going? About half fits into the familiar categories of lighting, HVAC and water heating, while the other half is consumed in food preparation.

Solutions for the first half are transferable to all sectors: Install efficient lighting, high-efficiency water heaters and properly sized high-efficiency HVAC units. Measures such as efficient lighting do present slight challenges for ambiance-conscious restaurants, but advances in technology are finally providing no-compromise solutions. If you need to see it to believe it, drop by Green Sage South with its



Green is good: Asheville is already known for its food scene, but local restaurants have also joined forces to find ways to be more sustainable, support local agriculture and apply environmentally friendly features, such as this concrete countertop at Laughing Seed.

PHOTO BY MAX COOPER

all-LED lighting. Other GRA-certified restaurants in town soon will follow suit with combinations of LED and compact-fluorescent lighting that will save hundreds of dollars per year. Solutions for food preparation are similar to those for the home kitchen: Purchase ENERGY STAR appliances, turn off appliances when not in use and put lids on pots.

Behavioral changes in the kitchen, as in most buildings, have an enormous impact and can reduce a restaurant's energy consumption by up to 7 percent, according to the Illinois Smart Energy Design Assistance Center.

Restaurants also consume enormous quantities of water — both hot and cold — in food preparation and dishwashing. Prior to the certification process, the average Asheville restaurant pursuing GRA certification used a staggering 500,000 gallons of water per year, with consumption at some locations topping 1 million gallons each year. Simple fixes to reduce water use — such as installing low-flow pre-rinse spray nozzles for washing dishes and low-flow faucet aerators — can have a large impact. A \$50 pre-rinse spray nozzle can save a restaurant \$1,000 annually in water, sewer and water-heating costs

with no loss in cleaning performance, according to the Food Service Technology Center.

Much of the water consumed in a restaurant is hot water for dishwashing, necessitating heavy energy inputs. Upgrading an old gas water heater in a typical restaurant to a 95-percent efficient gas condensing unit can save \$1,000 per year. If natural gas is not an option, heat-pump water heaters now offer a more environmentally friendly and cost-effective electric solution. Other effective options that can save thousands on water-heating costs include solar-thermal installations — soon to be visible on eight AIR restaurants — and refrigeration heat-reclamation systems that also help to lower air conditioning costs.

Restaurants are prime examples of the business case for pursuing environmental and efficiency upgrades. Restaurants typically operate on very small profit margins, so any reduction in overhead can have a large impact. For instance, at a restaurant operating on a 5-percent profit margin, a \$2,000 reduction in operating costs is equivalent to a \$40,000 increase in sales.

While reducing energy and water consumption provide the most direct economic benefit, that's certain-



Sun team: Sundance Solar Systems helped the French Broad Chocolate Lounge and Posana Cafe get greener with these solar panels.
PHOTO COURTESY OF SUNDANCE SOLAR

ly not the whole environmental story. GRA certification requires restaurants to achieve points in seven categories: water, waste, sustainable furnishings and building materials, sustainable food, energy, disposables and pollution and chemical reduction. One hundred points are required for two-star GRA certification, 175 points for three stars and 300 points for four stars.

While many of the specific details of GRA certification and environmental improvements in restaurants do not apply to other business types, the overall lessons do. For any business large or small, reducing resource consumption is an easy way to lower operating costs, reduce environmental impacts, improve employee-retention rates and increase profitability. It's easy to start small with behavioral changes and low-cost improvements (faucet aerators, turning off unnecessary lights, etc.) and move on to large improvements. And if you need a little inspiration to get started on greening your business, just drop by one of Asheville's GRA-certified restaurants for lunch!

AIR member restaurants currently GRA certified or pursuing GRA certification include: Bouchon, Bouchon Street Food, Burgermeister's, Comer Kitchen,

Fiore's (downtown and south Asheville locations), Frankie Bones, French Broad Chocolate Lounge, The Green Sage Coffeehouse and Café (downtown and South Asheville locations), Home-Grown, Jack of the Wood, Laughing Seed Café, Luella's Bar-B-Que, Neo Cantina, Posana Café, Rosetta's Kitchen and Tupelo Honey Café (downtown and south Asheville locations).

For more information:
airasheville.org and dinegreen.com,
blueridgesustainability.org,

Carly Reese graduated from UNCA with a degree in environmental studies focused on pollution prevention. She heads up the green-certification process at both Fiore's locations and is working with the Green Restaurant Association to help other Asheville restaurants through the certification process with a new, streamlined assessment approach she developed.

Tim Ballard is the Green Restaurant Initiative project manager for the Blue Ridge Sustainability Institute and a former board member and project manager for the Ecological Design and General Efficiency Fund, one of the first student-run revolving loan funds in the United States implementing energy efficiency on a college campus.

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Sustainable interior design

It's not just the building but what you put in it

BY LOU STEWART

Bob and Joanne Turner were excited to move into their new energy-efficient solar home. As they progressed through the design process, they decided to consider furnishing choices as much as the many other building decisions. This led them to discover the value of sustainable furniture, bedding and finishes. Here is some of what I shared with them.

Natural beds, natural sleep

Since we spend about a third of our lives sleeping, it makes sense to choose the best bed and bedding available. There are some great all-natural bed choices out there now, using rubber latex, wool and organic cotton.

If you are ready to update your mattress, shop around. Experiment with different styles. Here's a guiding rule: Be sure to take your time and don't purchase on your first trip to the store. You need to lie on the bed for a while (at least 20 minutes). Forget that you're in a store and practice turning over, lying in different positions, especially the one you sleep in. Closing your eyes takes away the distractions of the store. This will help you form a clearer opinion of each bed.

If you aren't ready to replace your bed, consider a wool topper. These affordable wool pads wick moisture away from your body, keeping you cooler on warm nights. On cool nights, the air pockets between the wool fibers trap your body heat, keeping you warmer and cozier.

When choosing an all-natural bed, look for these materials:

- Organic cotton offers firm support with natural fibers.
- Wool is resilient and wicks away moisture to help maintain a comfortable body temperature. It is naturally flame retardant, mold resistant and doesn't harbor dust mites or bacteria.
- Organic hemp is extremely durable and mold and bacteria resistant.
- Natural latex resists mold, bacteria and dust mites, and provides efficient air circulation and moisture regulation.

What to put on your organic bed?

A lot of chemicals go into the cultivation and production of cotton fabric. Fortunately, many con-



Baby-friendly: A green home that includes environmentally friendly furnishings completes the package.

PHOTO BY BILL RHODES, COURTESY OF NEST ORGANICS

scious manufacturers are producing all-organic cotton fabric for the home, as well as other organic natural fiber bedding.

- Organic Egyptian cotton is durable, soft and sustainable.
- Bamboo provides superior ventilation and is soft, silky and antimicrobial.
- Organic linen, while extremely durable, gets softer with use.

- Organic silk is, simply put, soft and luxurious. Even though a natural-fiber sheet can wrinkle, it is a better choice than a "permanent press" sheet that use added chemicals to prevent those wrinkles.

Lay your head ... on the best pillow

Neck and shoulder comfort is crucial to a good night's sleep. The multitude of pillow choices can be overwhelming, so here are a few guidelines and options to help you in your decision. ►



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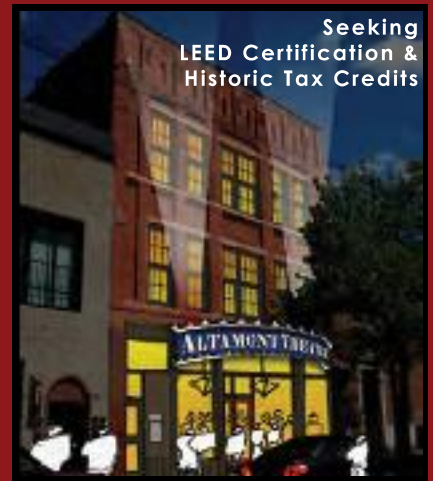
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	TOTAL \$88k	TOTAL \$125k
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Fluffy but green: From pillows to covers, choosing the right materials in your green home could lead to better sleep.

Determine which position you sleep in during the majority of the night. Then ask a sales person at a home store to show you the pillows recommended for your style of sleeping. And, most importantly, try them out at the store. Take your time; this is a big decision and you need to really feel each pillow. Be sure to close your eyes when doing this and get into your natural sleep position.

For natural pillows look for ones that are made with any of these materials:

- Natural latex: hypoallergenic, resilient, conforms to your contours.
- Wool, also hypoallergenic, is springy, cool and wicks away moisture.
- Organic cotton: hypoallergenic, cool breathable, will compact over time
- Buckwheat hulls: hypoallergenic, lightweight and conform to your contours.

Q. What to sit on? A. Eco furniture

Unfortunately over 90 percent of furniture is made with materials known to cause global warming, respiratory problems, breast cancer and even leukemia over extended periods of time. But times are changing. You can now get sofas and furniture with eco features. Here are a few materials and furniture choices that will keep your interior healthy and earth-friendly:

Antiques or vintage pieces are a natural choice as they have passed the sustainability test and can add warmth and elegance to a space.

- Reclaimed wood or recycled parts.
- FSC certified wood frames for sofas and chairs.
- Natural latex or soy foam cushions.
- Water-based finishes (low-VOC).
- Organic upholstery fabrics.
- Look for manufacturers who use “fair-trade” suppliers.
- Check for a “Greengaurd” certification that ensures furniture is low in toxicity.

As you can see, there are many ways to make your bedroom and home even more sustainable from the inside out. Getting sleepy yet?

When Lou is not sleeping on her fabulous organic latex and wool bed, she is designing sustainable interiors that look terrific and meet her clients' eco-conscious criteria. For more information visit LouStewart.com or call 450-1320.

SOME STARS ARE BORN, OTHERS ARE BUILT.



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North Carolina
Energy Efficiency Alliance



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Asheville Disclaimer

The Greenest Guide

Looking to dispose of your tires correctly? The Disclaimer Green page recommends the following:

- Set tires on fire and drop off at a blockaded intersection in the Middle East.
- Start a mosquito farm in the woods behind your neighbor's house.
- Form an artificial reef in the nearest body of water that's at least 12 inches deep.
- If you have a few spare minutes, pack the tires with dirt, cover with stucco and build a passive-solar, three-bedroom/two-bath earthship that's off the grid.
- Contact the city or county government. While they're distracted, your associate can dump the tires on city or county property.
- Fill the opening of the tire with cement to support a tetherball pole or a scary person's flagpole.
- Sell the tires as "used" to somebody who won't be driving on rain or around curves.
- Donate old tires to charity. The local chapter of the American Kidney Foundation is woefully short of bald tires left in its dumpster in the dead of night.
- Trade tires with a neighbor while they're out of town.



WITH A LITTLE IMAGINATION, GREEN LIFESTYLES CAN BEGIN AROUND THE HOUSE — NOT WITH RECYCLING, BUT WITH RE-USE.

HERE ARE A FEW IDEA-STARTERS TO COMPLIMENT YOUR OWN!

- Old coffee grounds can be reused for "guest coffee."
- Old mop buckets + nearly dead pens and markers = Door-to-door-salesperson-frightening masks.
- Used kitty litter = Facial exfoliating mud-mask.
- Water bottles can be crinkled to generate relaxing white noise.
- Plastic bag from dry cleaner = Child's head-fort.
- If you have pets, you can twist old towels in the winter time to "whip-snap" your pets when they try to come in from the cold.
- Reuse your old food scraps by composting them into your own pile of personal bear-bait.
- Unwanted gold? Recycle it into a vast personal fortune.
- Use old pillow stuffing and repurposed hot tar to coat 19th-century snake-oil salesmen before roughly escorting them from the premises.
- Reuse old toilet-paper rolls by making a giant pyramid that lets visitors know how clean your bottom is.
- Reuse old toothbrushes to clean hard-to-reach areas like your wisdom teeth.
- Drinking straws can be reused five different ways, four of which won't increase your heart rate.



Kid Cafe with Arnold

Arnold Capraquin is a Korean War veteran and member of the Woodfin Club's Club.

Dear Arnold,

I like being eco-friendly and I've heard there are bottle-warmers that harness solar energy to warm the milk. Do you know who sells them?

— Sally

Dear Deb,

Sure, and I've got a washing machine that harnesses angel farts and leprechaun wings. Bunch of hippie nonsense. The best thing you can do for our planet is to not squirt out another snot-nosed brat onto it.

The Asheville Disclaimer is parody/satire. editor@ashevilledisclaimer.com. Contributing writers: Michele Scheve, Joe Shelton, Cary Goff, Tom Scheve.

Fracking dangers?

Obviously, the future of fossil fuels is looking dimmer than a four-week-old CFL bulb blinking its last flicker. (Just kidding — buy CFL bulbs!). But seriously, it's looking dimmer than a house full of CFL bulbs.

One clean energy source — natural gas — is plentiful and abundant, though vigorously huffing that natural gas out of the earth may have unintended consequences. Besides sounding like a curse word made up by third graders, what is Fracking?

First, a mix of unknown and copyright-protected/none-of-your-damned-business secret chemicals are pumped into the solid aquifer, shattering a once-great shale into pieces — leaving it a shadow of its former self. Natural gas is

then briefly liberated only to have its hopes cruelly dashed as it is then captured, tamed, and bent to the will of man.

It has been widely reported that fracking has rendered drinking water "fracky-tasting." One man likened the taste to that of a bucket of water in which his beloved pet possum, Fracky Mc Fracker-son theThird, expired and began decaying a week before. Another claim has been that showering has been made unsafe by virtue of bathing water being "so fracking explosive that the slightest shower-friction could result in a fracked-out explosion resulting in personal bodily fracture, if you will."

Other experts aren't familiar with the term, so the scientific jury is still out.

Introducing Green Gauge

How does your home measure up?

BY MAGGIE LESLIE

The NC HealthyBuilt Homes and LEED for Homes programs have continued to grow even during the market downturn as builders and homeowners begin to recognize that these programs offer increased sales potential and that homes with these designations and features hold their value extremely well. Both programs are open to new homes and to gut remodels of existing homes.

However, the Western North Carolina Green Building Council recognizes an increasing demand for a program to assess green renovations, as well as new homes that didn't have the necessary inspections for the other certification programs. The WNCGBC is thrilled to finally have an answer. Green Gauge is a new program with three main functions: provide an assessment for sellers or buyers of existing homes; offer a low-cost, simplified way for people to learn about opportunities to green their existing homes; and serve as an assessment to meet the market need for a comparison tool for non-ENERGY STAR new homes. The program will include an affordable visual assessment with several levels of participation and reporting options.

For recently completed new homes that do not have a Home Energy Rating Score (HERS), or existing homes looking for detailed information about their energy efficiency, the program will align with the Energy Performance Score program (energy-performance-score.com). EPS is an energy-rating system

similar to the miles-per-gallon rating for the auto industry. Conceptualized by Earth Advantage Institute and supported by funding from the Energy Trust of Oregon, the EPS provides an estimate of actual home-energy consumption based on a detailed analysis of the home as well as related carbon



emissions. It shows homeowners where they rank in energy use on a regional and national scale.

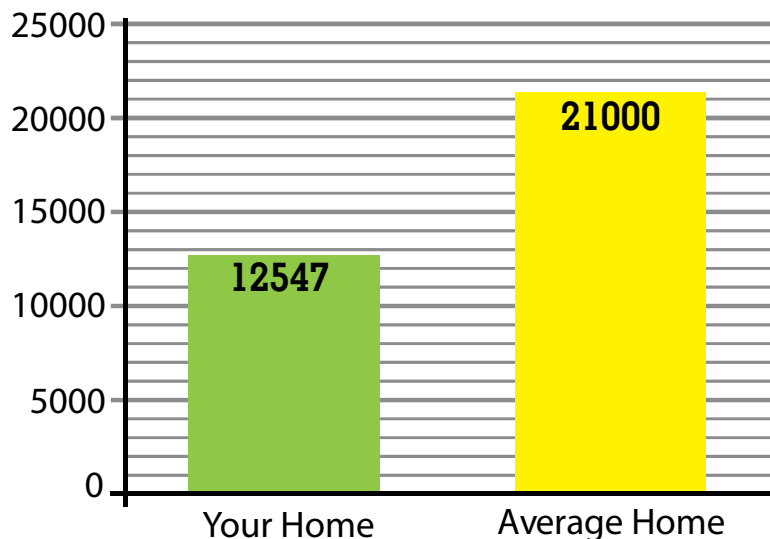
For those looking to retrofit or remodel, the Green Gauge Report, in conjunction with EPS reporting, will provide valuable information and suggestions about how to green the home, along with easy access to qualified contractors, incentives and potential financing opportunities.

For existing homeowners looking for a snapshot assessment to use in marketing their home for sale, there's Green Gauge Lite. Instead of a full EPS evaluation, this lowest-cost option includes a short visual assessment by WNCGBC staff, as well as review of 12 months of utility data (unless the homeowner has had a HERS). In turn, participants will receive a one-page "gauge" highlighting the green features of the home and illustrating how the energy and indoor water use of the home compare to average homes in the region. The information can provide a marketing advantage to those wishing to sell an efficient home, or it can be requested by a buyer who wants to make an informed decision about the true cost, which includes the operating cost, of the home.

All information will be tracked in a secure database that allows homeowners to access and update information over time so that no matter who owns the home, the data is always available. Since the goal of the program is to encourage improvements to homes, for a small fee, a home's Green Gauge can be updated to reflect green upgrades. Long term, a goal of Green Gauge is to catalog detailed information about the performance of homes in our area so that energy and water-use performance of homes can be compared based on square footage, ZIP code and number of bedrooms.

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

ANNUAL ENERGY USE (Kwh)



WHAT FEATURES WILL GREEN GAUGE ASSESS?

- Energy use
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- Environmentally preferable materials
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feature

Upward goes the neighborhood

Green homes equal market advantage



Certified: Even in a down market, demand for environmentally friendly homes has risen in recent years. This Waynesville, N.C., residence, built by Hanson Builders, is NC HealthyBuilt Home certified.

PHOTO BY BETH BROWN PHOTOGRAPHY

BY MARY LOVE

In today's market, a house has to be in good condition and priced right just to get noticed. There also has to be "special" factor to get it sold. Certified Green Homes have that factor.

In a study of existing and new houses sold from May 2010 through April 2011, the Earth Advantage Institute in Portland, Ore., found that newly constructed homes with third-party certifications for sustainability and energy efficiency sold for 8 percent more on average than non-certified homes in the six-county Portland metropolitan area. Existing houses with certifications sold for 30 percent more.

The raw sales data in the study was provided by the Portland Regional Multiple Listing Service. "Certified" houses were defined as those carrying ENERGY STAR or LEED for Homes designations or Earth Advantage home certifications (an Oregon-based

program). The latest study was the fourth in an annual series conducted by the Earth Advantage Institute, each of which has shown clear price premiums for certified houses. Homes marketed with energy-efficiency certifications appear to sell faster on average than those without.

In Atlanta, another study of green-certified home sales prices found more mixed results. Although certified homes sold for lower prices on average, they did sell faster and closer to asking price, according to the Atlanta Green Home Sales Report from local Realtor Carson Matthews. In 2010, certified homes spent an average of 97 days on the market, compared with 123 for traditionally built homes. The homes were certified by EarthCraft House, LEED for Homes and ENERGY STAR.

In WNC, a study of certified ENERGY STAR and HealthyBuilt homes also showed mixed results. Certified

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homes did not sell for more than non-certified homes of similar size and number of bedrooms. However, these houses did sell faster and closer to list price than similar non-certified homes.

In a recent Raleigh-Durham-area study, done by the North Carolina Energy Efficiency Alliance, 100 out of 400 homes were ENERGY STAR certified. The average selling price of the certified homes was \$3-per-square-foot higher than non-certified ones, and the homes sold an average of 89 days faster.

Studies from the National Association of Home Builders and the National Association of Realtors have indicated that a major request for new homes construction is energy efficiency. Homeowners are willing to have less cosmetic upgrades and landscaping features in order to obtain ENERGY STAR certified homes. The Appraisal Institute is responding with its recent

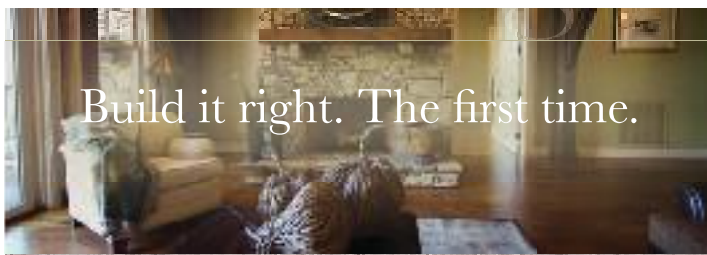
creation of the Residential Green and Energy Efficient Addendum for appraisers, so they can more easily assess value of green features.

Even with a down market, certified green homes are increasing in demand. Continual education for Realtors, lenders, appraisers and insurance companies is necessary in order for consumers to reap more financial advantages of green homes. Since consumers already understand that energy and water savings, along with improved indoor air quality, are value added features they are ultimately driving the market for certified green homes.

Mary Love is the Director for Keller Williams Green Division. She helped establish the NC HealthyBuilt Homes program and the Asheville Environmental Consultant designation. Love teaches NAR GREEN courses and combines her sustainability consultation skills with market knowledge.

ADVICE FOR RECEIVING AN ACCURATE APPRAISAL

- Make sure the designated appraiser understands new construction and green building values.
 - Develop a strong professional relationship with your appraiser.
 - Don't be afraid to provide all relevant information to appraisers, including comps, upgrades and area sales information, that you are aware of.
 - Try to understand the appraiser's challenges, particularly if there are no comps in the area.
 - Recognize this and talk to your appraiser about value.
 - Remind lenders that according to the Appraisal Institute, for every \$1 in annual energy savings, a home goes up \$20 in value.
 - Ask your Home Energy Rating System rater to fill out a "Residential Energy Report" form, which is necessary when applying for an Energy Efficient Mortgage and an Energy Improvement Mortgage.
 - Supply the appraiser with a copy of the new "Residential Green and Energy Efficient Addendum" from the Appraisal Institute. Provide them the information to fill it out if necessary.
 - Keep a record of the data you give to the appraiser. If they don't use the information, find out from the lender why it was not used. — M.L.
- Sources: National Association of Home Builders and Porterworks



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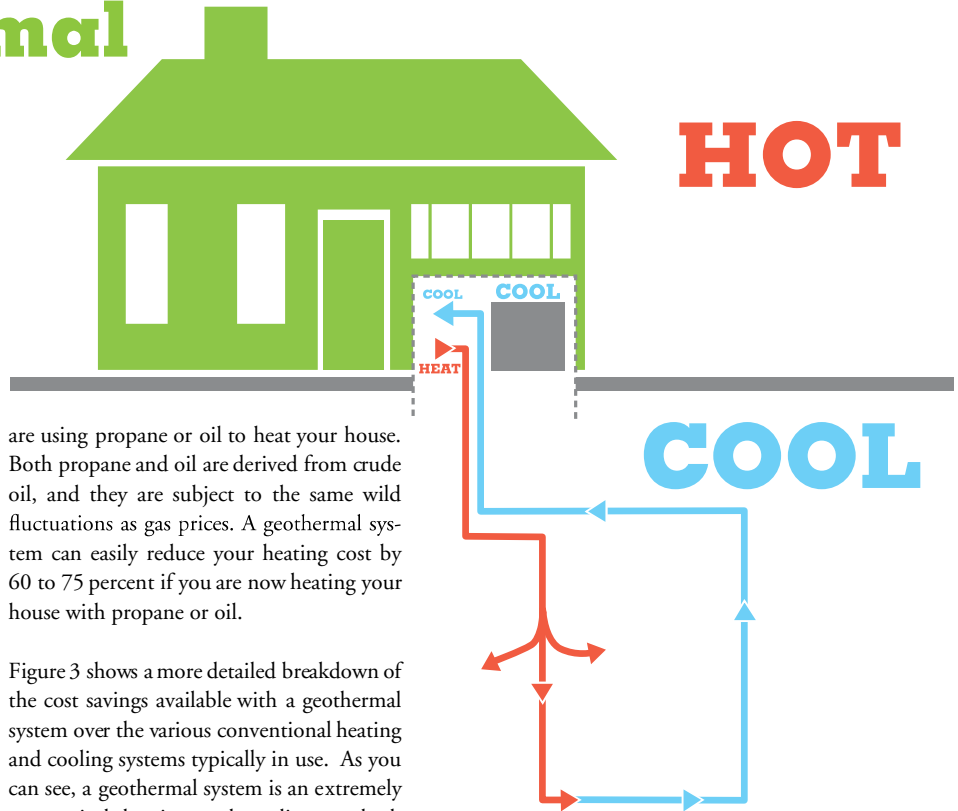
BY RICK CLEMENZI

A geothermal system is one of the most efficient heating and cooling systems available. It harnesses the stable temperature of the earth as an energy source. Figure 1 shows the basic relationship of the temperature of the earth and air in the summer. For example, when it's 90 degrees in Asheville, the ground temperature is 59 degrees. The opposite is true in the winter: When it's 20 degrees outside, it's still 59 degrees in the ground. A geothermal system can also provide much of a home's hot water for free.

The economic benefit of geothermal systems is significant. In essence, the system "mines" three to four units of heat from the earth for every one unit of electricity used to run the system. That is, you pay \$1 and get a total of \$4- to \$5-worth of heat. This is possible because the Earth is a vast solar collector, and a geothermal system uses your yard as its thermal-energy source.

Geothermal systems for heating and cooling are different from both the "high-temp geothermal" being used in the western United States, and the electricity-generating volcanic-heat collection under way in Iceland. Instead, we are simply mining solar energy stored in the upper layer of the earth. And, while these systems are heat pumps, they are also very different from the air-source heat pumps in current residential use that produce marginally warm air and cannot produce usable heat at all in the dead of winter. A geothermal system will produce toasty warm air all winter because it uses the stable 59 degree-Earth instead of the volatile, cold air.

Figure 2 shows the average economic savings that a geothermal system creates. These charts show the average savings, but it is even more dramatic if you



are using propane or oil to heat your house. Both propane and oil are derived from crude oil, and they are subject to the same wild fluctuations as gas prices. A geothermal system can easily reduce your heating cost by 60 to 75 percent if you are now heating your house with propane or oil.

Figure 3 shows a more detailed breakdown of the cost savings available with a geothermal system over the various conventional heating and cooling systems typically in use. As you can see, a geothermal system is an extremely economical heating and cooling method. Along with increased operational savings, geothermal also has a much lower carbon footprint than other heating and cooling options.

Geothermal systems also operate extremely quietly. There is no noisy outdoor equipment, and no equipment exposed to the environment. This also means that the system has a 50 percent longer life expectancy than conventional equipment, and the earth portion will have a life much longer than your home, making it an infrastructure investment in your property.

Figure 1 COURTESY IGSHPA

The challenge with a geothermal system is that they are more complicated to install than conventional heating and cooling systems, involving either digging trenches or drilling wells (called the loopfield). Figure 4 shows a vertical slinky trench in process and a completed loopfield. The trench was dug 7-feet deep and 6-inches wide, then the dirt was fully compacted back into it. After scattering some grass seed, the yard was restored. Other techniques for loopfields include drilling wells, digging large trenches or placing loops in lakes or large ponds.

GEOTHERMAL HVAC CUTS TOTAL HOME ENERGY CONSUMPTION IN HALF

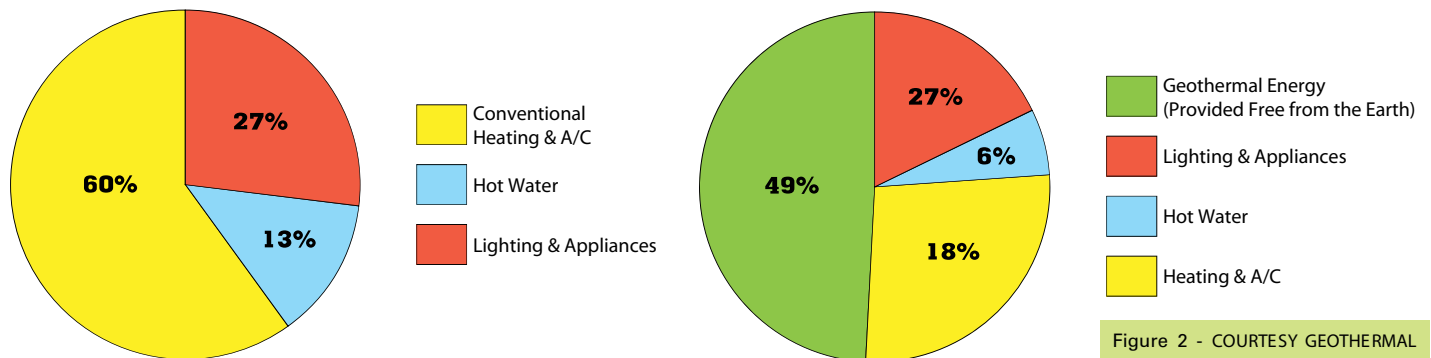


Figure 2 - COURTESY GEOTHERMAL EXCHANGE ORGANIZATION

The complexity of a geothermal system also makes it more expensive to install, but tax credits help make the net cost of a geothermal system about the same as a conventional high-efficiency air source heat pump. There is a 30 percent federal tax credit and a 35 percent N.C. tax credit with some limitations. Most homeowners can have between 55 percent and 65 percent of the cost of the system paid for through these tax credits.

Even with the tax credits, you still have to pay for the upfront cost of the system ranging from \$20,000 to \$30,000. After tax credits, typically, your net cost is about \$7,000 to \$12,000. And when you factor in the 50-percent-longer life expectancy of a geothermal system (even longer for the loopfield), the long-term cost relative to other heating and cooling systems is even better.

Geothermal systems are also more challenging to install than standard heating and cooling systems. Some firms ask the homeowner to subcontract a portion of the loopfield installation directly with excavators or well drillers, potentially leaving the homeowner at risk if something goes wrong. We have also seen systems undersized that have left the homeowner without enough heat for the coldest days of winter when it is most needed.

To ensure a successful geothermal system installation, here is a list of key points to consider: ➤

ANNUAL HVAC OPERATION COST COMPARISONS

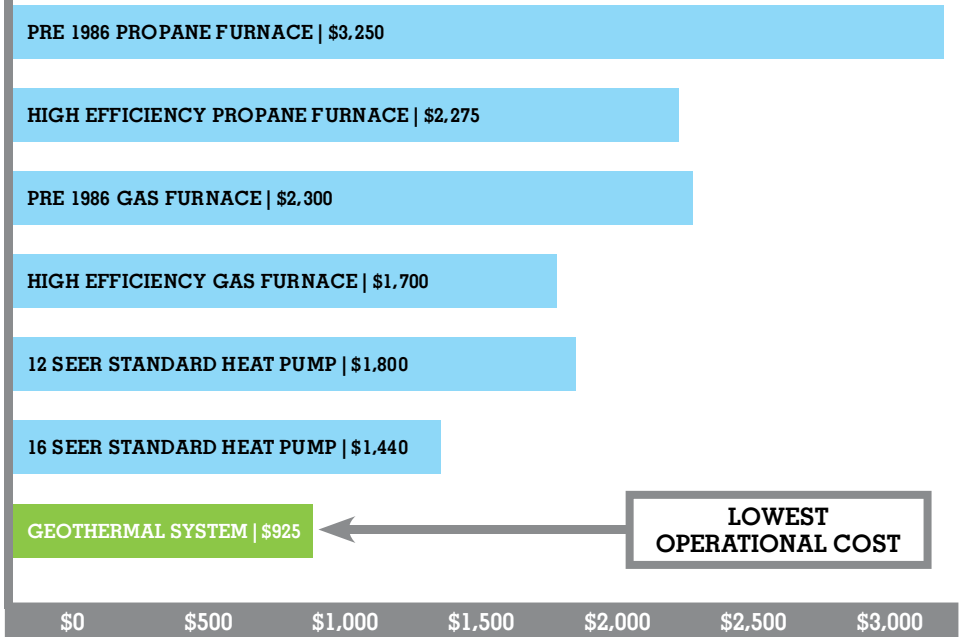


Figure 3

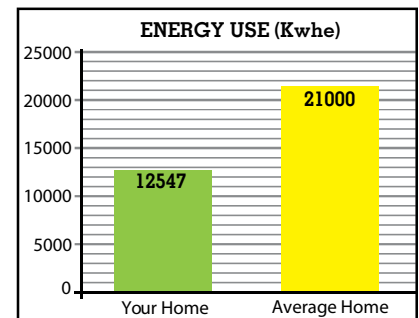
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feature



Figure 4: Piping laid out like a “vertical Slinky” is placed in trenches for this geothermal loopfield.

PHOTOS COURTESY OF ASHEVILLE GEOTHERMAL INC.

- The geothermal system must be engineered to match your home. The N.C. HVAC Licensing board requires all contractors to perform a formal heat and cooling load analysis on your house before installing any new heating and cooling system, known as a Manual J. Make sure you review this analysis with your contractor so you are confident the system’s capacity properly matches your home’s needs in the both the winter and summer.

- The loopfield must be sized for efficient operation in all seasons. The key here is that the geothermal system will typically “operate” even if the loopfield is undersized. However, the operational cost savings you are expecting will fly out the door if the loopfield is undersized. The contractor should be able to show you design documents predicting a minimal operational efficiency “co-efficient of performance” of 3.8 to 4.0 in the winter. If it is less, the system is not designed correctly. An undersized system might cost less to install, but it will cost you more every season to operate throughout its life.

- All indoor portions of the loopfield piping must be fully insulated. If

there is any gap in the insulation on these pipes, they will drip condensation, causing a mess and possibly a mold problem. Proper installation of geothermal and hydronic piping is essential.

- Know all the costs and risks, especially if you are expected to directly pay other subcontractors like excavators or well drillers.
- Expect the system to operate efficiently, quietly, and for many years to come.

Geothermal systems cost less to run than any other heating and cooling system, last 50 percent longer, have the lowest carbon footprint and give you a park-like environment outdoors year round. In all, a geothermal system is an excellent investment.

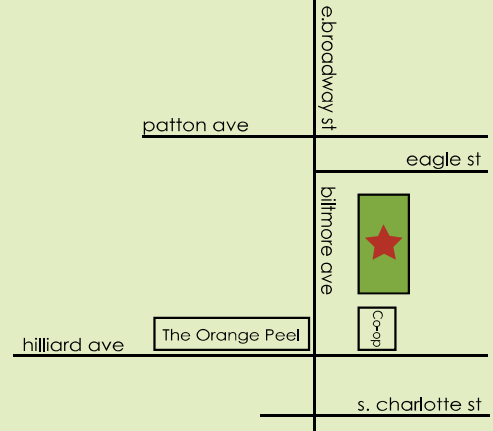
Rick Clemenzi is a licensed Geothermal HVAC contractor and part owner of Asheville Geothermal Inc. Rick is also involved in geothermal product development, maintaining a legislative and regulatory environment helpful to geothermal system installations, and he teaches CEU classes on geothermal systems for architects and engineers.

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feature

Small is renewable

Innovative energy projects on small farms



Space saver: Not all wind turbines feature large propeller blades. These vertical-axis turbines are quiet and bird-friendly.

PHOTOS BY ACCEM SCOTT

BY ACCEM SCOTT

As food prices continue to skyrocket, we need to begin looking at all of our options to keep food prices low. Decreasing the cost of running farms is a good place to start. Farmers can then pass their savings down to the customer.

Agriculture requires energy as an important input to production, in part because it uses energy directly: Machinery and equipment require fuel and electricity. Overall energy use in the U.S. from farms claims 3 percent of our total energy consumption.

In 2010, the N.C. Green Business Fund awarded Community Development Specialists and my company, Green Brothers Solar, a grant to install six small wind turbines and seven small solar thermal demonstration systems on local food-producing farms in 10 communities in Western North Carolina. The benefits to these farming operations vary from a 50 percent reduction in household electrical consumption to 100 percent reduction in electrical consumption for domestic hot water.

At Green Brothers Solar, we had the opportunity to select from a large variety of farms. There's the rice farm, apple farms, a goat dairy, chicken and cattle farms—all in WNC and all located in areas considered distressed by the Department of Commerce. It was these farms and those communities that would receive a free wind turbine or solar hot water system.

In many WNC rural communities, renewable technologies are considered very new. In fact, some didn't have any permitting process in place to handle solar, wind, water or geothermal projects. Going into this project, we agreed to teach a four-hour class that would cover all of the farmers' questions, inform permitting officials and teach local politicians and the community about this relatively new and growing industry. Our classes were eye-openers for most. Seeing and hearing what's going on throughout the state, the nation and around the world regarding energy independence really opens people's minds.

Joe Carswell, a rice farmer at Clyde Valley Farms in Morganton, was pleasantly surprised that his household domestic hot-water needs were covered with his newly installed solar system. Mr. Carswell had a broken thermostat on his conventional hot-water system. He toyed with the idea of fixing it before we came. He finally decided to see what would happen if he went completely without the conventional hot water system connected to the grid. He has enjoyed 100 percent off-the-grid solar hot water for more than five months.

For more information about the Green Business Fund, visit <http://avl.mx/prp5>

Acem Scott founded Green Brother Solar, which specializes in affordable options for solar installations.

For info: GreenBrotherSolar.com

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ABOUT THE TECHNOLOGY

Wind Turbine

The wind turbine technology we deployed has a vertical-axis design. Such turbines do not have a propeller like conventional horizontal axis wind turbines. They are totally silent, bird- and bat-friendly, and measure 30-feet tall. VAWTs generate usable power at much lower wind speeds than HAWTs, so there are many more potential wind sites. They can also be placed as close as 8-feet apart. This makes it possible to install multiple units on a relatively small parcel of land. Each VAWT can produce 2,000 kilowatt-hours of electricity on a site with an average wind speed of 11 miles an hour. They are designed to be maintenance-free for 20 years.

Solar hot-water system

Each participating farm received one evacuated tube array (20 tubes), a solar hot-water tank and a photovoltaic panel that provides electricity to a circulating pump. The panel and the pump then collect and circulate the heat throughout the entire system. We typically use the flat-plate solar arrays in our area, but chose the evacuated-tube systems because each farm preferred equipment that produces optimal levels of heat. With this option, space heating is a logical choice in the future.

These systems, on average, produce enough hot water to provide for a two- to four-person household. An energy-monitoring system was put in for each farm to monitor savings over a two-year period. The design of the system is such that it can easily be expanded upon easily. Typically, the payback on a system like this would be three to five years, but with



The right fit: Vertical-axis wind turbines work for tight spaces, like this Celo, N.C., farm.

government tax credits of 65 percent, it could be fully paid for two to three years.

Farming: at the frontier in green energy

As demand for green energy systems spreads throughout North Carolina through education, improved pricing, tax credits and local legislative support, farmers are becoming increasingly aware of how they can benefit. "The farmers we selected to receive wind turbines are very environmentally aware, and are excited to be playing a role in creating a more energy-efficient planet," says **Bob White**, owner of Community Development Specialists, Inc. "As we were doing the installs, neighbors would drop by to ask questions about what we were doing," White says. "They got it, and word travels fast in rural WNC. All they needed was assistance with financing their projects."

Funding for farmers

Farmers are eligible for renewable-energy-funding support from numerous sources. In 2011, grants were available specifically for farms from the USDA, the North Carolina Farm Bureau, the N.C. Rural Center and others. These funds are offered in addition to state and federal tax



credits, as well as incentives from utilities and local governments.

Jobs ... jobs ... jobs!

We were asked many times about the job outlook for this industry. I tell farmers this: "Look: You could be the one in your area to see the writing on the wall. Your farm could be a hub for renewable technology long before anyone else. Now is like it must have been right before the Internet took off, or personal computers, Windows, Macs, or iPhones. The hype is there before the jobs are, but they are coming. Get ready for it!"

Farmers are willing and able to support multiple technologies that reduce energy costs, and produce energy for farm use, while helping to grow our local economy. When you think green energy, think green-energy farming. — A.S.

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Thermosiphon Solar Water Heating

An affordable, reliable option

BY KEVIN WEI

Solar energy is clean, ubiquitous and inexorable. Solar thermal systems are the low-hanging fruits compared with photovoltaic systems. What's more, it is highly desirable to use solar energy to reduce or avoid the escalating costs of gas, oil or electricity, most of which is generated by coal-fired power plants. The cost of installing solar heating systems can often be recouped by utility savings within a few years, especially since federal and state governments offer strong financial incentives through tax credits. However, most homeowners or businesses have not gone solar yet. This may be due to the relatively high upfront costs of installing equipment compared with traditional heating systems (even though the total equipment and operating costs of traditional heating systems are far higher in the long run).

A solar water heater commonly consists of a solar collector; a controller and thermostat connected with temperature sensors installed at the solar collector and at the solar water tank; a pump assemblage; and a solar water tank with an internal heat exchanger. Such a system is generally difficult for most homeowners to comfortably and reliably install. Generally, the process requires two professional installers two or more days to set up the system, at a total cost of \$5,000 to \$7,000.

Furthermore, there are some vulnerable parts to the otherwise reliable solar heater. Controller electronics can be damaged by spikes in power supply or lightning, sensors and thermostats can malfunction because of bad contacts, and a pump can fail to start or burn out. When utility power is out, a traditional solar water heater will not work and may even be damaged. These problems usually account for 90 percent of service calls.

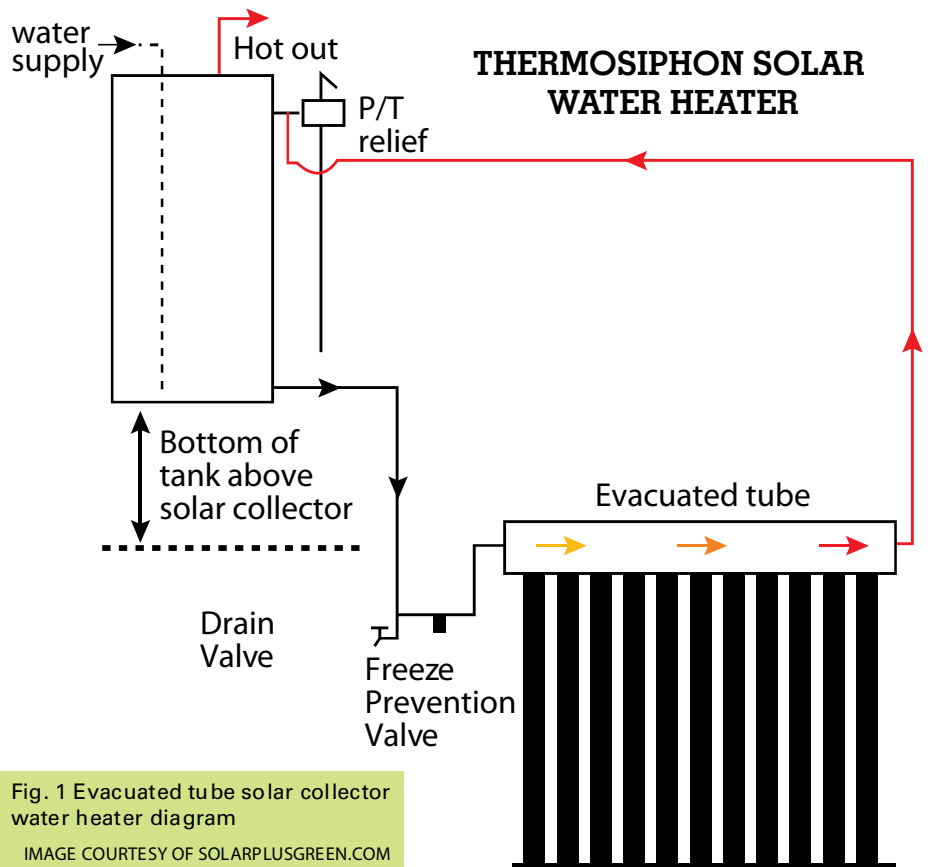


Fig. 1 Evacuated tube solar collector water heater diagram
IMAGE COURTESY OF SOLARPLUSGREEN.COM

However, there is a type of solar water heater that uses an evacuated-tube solar collector and eliminates the expensive and vulnerable hardware, reducing the equipment cost by half, and making installation simpler and the solar water heater much more reliable and durable (see Fig. 1). Many homeowners can even install the system themselves.

The specs are complicated, but worth knowing. An evacuated-tube solar collector is plumbed directly to a conventional electric water heater tank. The top of the solar collector should be positioned below the bottom of the tank. This means that the solar collector can be installed on the ground, on a slope below a building on the exterior walls, as window awnings or on a lower-level roof. The water tank costs less than half the

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price of a solar water heater tank with an internal heat exchanger. When the sun comes out, it heats the water in the solar collector. The heated water in the solar collector will rise, just as warmer air or any fluid will rise, because it is less dense. The warmer water will enter the water tank at the pressure- and temperature-relief valve level and rise to the top of the storage tank. At the same time, cooler water from the bottom of the tanks is drawn down to the solar collector through the pipe that connects to the bottom of the storage tank at the left end of the solar collector (see Fig. 1). This end has a "U" shaped pipe that prevents warmer water from rising from this end of the collector and entering the bottom of the storage tank. The clockwise water circulation in Fig. 1 continues as long as there is sunshine, gradually heating up the water in the tank, resulting in increasingly warmer or increasingly hotter water in the tank. This natural circulation is called thermosiphon. It requires no pump, and is the most reliable and durable operation.

Here's another option: A water heater can be installed or an existing water heater can be plumbed to the tank described above. This will increase water-storage capacity, and is a preferred setup especially for a retrofit project where there is already a water heater in place. In this case, the higher positioned tank that is plumbed

directly to the solar collector does not need an active back-up heat source, such as gas or electric. In terms of efficiency, the double tank system is only slightly better; there is also trade off because there are two tanks from which to lose heat. The single tank system does not store as much hot water as the double tank system, but the evacuated tube collector can heat the water significantly higher and thus can supply more hot water than a normal water heater.

Thermosiphon solar water heaters with flat plate collectors have been widely used in non-freezing climate areas, but they are not used in freezing climate regions: Flat-plate collectors don't have thermal insulation for the manifolds and riser tubes, which can freeze and break. The thermosiphon solar water heater with evacuated tube solar collector described above overcomes the freezing problem because the evacuated tube collector and the pipes have much better thermal insulation than pipes in unconditioned space in most homes. A double safety mechanism is added by installing a freeze-prevention valve, a relatively inexpensive, non-electric, thermally controlled valve. It contains a precise thermal actuator that opens the valve slightly to drip water when the temperature of the pipe approaches 350 degrees (with outside temperature much lower) and closes the valve when warmer water flows

to replace the near freezing water.

For places where it is not convenient or possible to install the solar collector below the water tank, natural thermosiphon circulation cannot be used. Otherwise, a PV-powered pump connected to a PV panel can be installed to provide forced circulation. This adds an extra cost of about \$300 compared with the thermosiphon-only water heater. When antifreeze is preferred to circulate through the solar collector and a heat exchanger is used to pass the heat from the heated antifreeze fluid to the water, a PV-powered pump connected to a PV panel is also highly recommended as this design is simpler, less costly and more reliable than the sensor-thermostat-controlled system design. Once there is hot water, it is relatively simple to circulate hot water to radiators, incorporate into existing forced air system to blow the heat through out a building or heat a building through radiant floor heating.

Kevin Wei, owner of SolarPlusGreen.com, holds a N.C. General Contractor/Home Builder License, National Association of Realtors' Green Designation, EarthLinked geothermal heat pump installer certificate and a North American Board of Certified Energy Practitioners' PV installer certificate.

Through local carbon offset donations to Appalachian Offsets WNCGBC has reduced over 3,000 tons of carbon from entering the atmosphere, increased energy security in our region and saved over \$500,000 in energy costs in WNC.



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- mass light bulb change-outs
- improvements to non-profit facilities
- leveraging funds to support weatherization for those who need it most
- incentives to encourage broad-based residential energy efficiency upgrades through the Green Gauge program.

REDUCE YOUR CARBON FOOTPRINT TODAY!



Neighbor Saves

Real energy solutions by real people

BY MATT SIEGEL

Energy efficiency has been a focus of those interested in American energy security and environmental preservation since the 1970s with a more recent concentration on global climate change. Energy efficiency is by far the most financially intelligent and simplest way to reduce dependence on fossil fuels. Yet, after 40 years of research, focus and education, Americans are using more energy per person than ever before. For the past three years, the federal government failed to pass legislation that would significantly encourage homeowners to make energy improvements. The WNCGBC decided to take the lead by launching the Neighbor Saves program, thanks to a grant from The Community Foundation of WNC.

The program goal is to eliminate the barriers to implementing the most basic, cost-effective, energy efficiency upgrades. With Neighbor Saves, we aim to take something that most people are intimidated by and make it fun and a results-oriented community-building activity similar to community gardening. To this end, WNCGBC created a music video, "Seal It Tight," which can be viewed on YouTube. The approach applies team-based sweat equity and



Teamwork: The Neighbor Saves program partners neighbors, co-workers, friends and experienced supervisors for cost-effective, energy-efficiency projects in participants' homes.

PHOTO BY MATT SIEGEL

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Contact Asheville Area Habitat For Humanity's Deconstruction Team at 828.777.4158 or visit www.ashevillehabitat.org

addresses three main barriers the average person faces. We worked to knock those down.

Barrier One: Knowing how to do the work

WNCGBC has spent years handing out brochures and writing articles with “top 10 things to do to increase energy efficiency in your home.” The problem is that telling someone “seal your ductwork” doesn’t do anything for most people, who have no idea what ductwork is, where to find it, what to seal it with and how to seal it.

It’s like telling me to adjust the carburetor on my car. Maybe it only takes a wrench to do, but I have no idea how.

Solution:

All participants take a two-hour training course to get oriented to building-science concepts and learn what they will be doing and looking for. In the next step, one supervisor visits the target home, identifying what improvements are needed and making a materials list. To ensure that the proper materials are on site and to take advantage of bulk buying, all materials are provided by the program.

Best of all, an experienced supervisor works with the team for the entire workday to make sure work is done correctly and safely.

Barrier Two: The cost of hiring a contractor

Many people receive quotes from contractors for energy retrofits and typically get estimate ranging from \$2,000 to \$5,000. While this may be justified, considering the nature of the work, many homeowners take those quotes and simply file them away. They end up doing nothing.

Solution:

Labor costs make up the bulk of most weatherization costs. The secret to Neighbor Saves’ success is strength in numbers and sweat equity, which both bring those costs down to nearly nothing. Participants can create their own teams of three or more house-



holds, or sign up individually and matched with a team. Team members work together to retrofit each other’s homes.

Barrier Three: Upfront cost of materials

Even though the upgrades may cost as little as \$400, many people lack the upfront cash or choose to do other more interesting things it, like go to Jamaica. Or when faced with deciding whether to paint the home’s exterior or crawl around to seal and insulate ductwork, we know what the choice usually is.

Solution:

We partnered with Self-Help Credit Union to create microloans that can be paid back in 12 to 18 months. For many, the result is monthly payments close to the amount saved in energy. After the loan is paid off, that payment becomes money in the participant’s pocket each month. Participants may also be eligible to receive rebates from utilities and federal tax credits.

Benefits: More than just financial and energy savings

While we expect participants to save between 20 and 30 percent on their energy bills after upgrading, there are also other, less measurable, benefits, such as improved comfort and indoor air quality — perhaps more important than the money saved. Turning a back room that is always hot in summer and cold in winter into a usable space can add valuable square footage to a home. Improving air quality by stopping air that seeps into the home from crawlspaces or attics can eliminate trips to the doctor.

And remember: Weatherization is just as important for the cooling seasons as it is in the heating season. Homes will be more comfortable and healthy year round!

Thanks to a start-up grant from The Community Foundation of WNC, we were able to work through the process of setting up the program, produce a fun-filled marketing video (“Seal It Tight”), make T-shirts for participants and provide a discount for the first 20 homes.

There have been six Neighbor Saves teams so far, and we have completed 20 homes. We have also been able to offer discount attic insulation to program participants.

To start saving today visit NeighborSaves.org. Please contact us if you are interested in having a presentation to your group.

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

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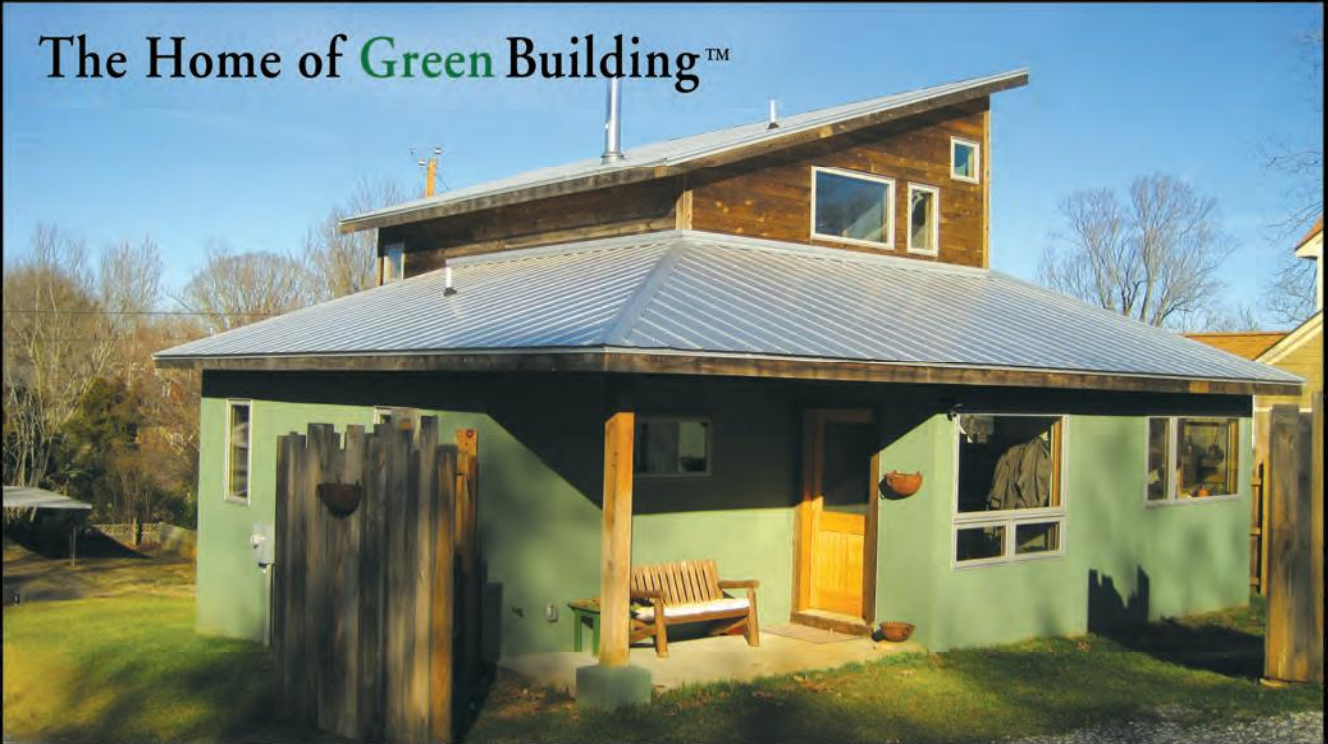
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feature

Go with the flow

The easy way to prevent hard water

BY EDWARD CORTRIGHT

It seems that not enough is said about water quality in relation to energy efficiency or performance. Heating domestic hot water is estimated to be 13 percent of household energy consumption, making water heaters the second highest energy consumers in the home, after heating and cooling equipment. And if water is used to heat the home, then the boiler or water-heating equipment contributes to a larger portion of the household energy demand.

Chemically speaking, water is a compound with many unique and amazing attributes. Industries and commercial buildings tap into water's energy-efficient promise every day when utilizing water cooling towers. The industrial sector recognizes that impurities in water waste energy and prove costly when present in water that is used in cooling towers for air conditioning, manufacturing and electric-power generation. Mineral-free water is efficient, cost-effective and essential to use in order to operate the equipment at the efficiency rating. Plus, mineral-free water prolongs the life of the equipment.

Water is never just water, and it is not the same, even among neighbors. Invisible hard-water minerals precipitate out of the water when heated and deposit in pipes and on heating elements proportional to their concentration in the water.

The problem of high mineral content in water

Water that contains calcium, magnesium and silicate minerals make up what is referred to as hard water. These are some of the same minerals that get promoted as "good minerals" to have in our drinking water by various disciplines. However, minerals create operational problems for water-heating equipment. The warranties for an on-demand water heater or tankless hot-water heater can be voided when the water hardness is above 3.5 grains per gallon. Hard water is mostly measured by grains per gallon and is commonly expressed this way in water analysis reports. It is also expressed as parts per million with one grain equal to 17.1 ppm.

WATER HARDNESS

The U.S. Department of the Interior quantifies hard water in the following way:

Soft	Less than 1.0 gpg, less than 17.1 ppm
Slightly Hard	1 to 3.5 gpg, 17.1 to 60 ppm
Moderately Hard	3.5 to 7.0 gpg, 60 to 120 ppm
Hard	7.0 to 10.5 gpg, 120 to 180 ppm
Very Hard	0.5 and over gpg, 180 and over ppm

GPG: Grains Per Gallon | PPM: Parts Per Million

Recognizing the problem

The Battelle Memorial Institute tested the effect of softened water and hard water as it relates to the energy efficiency of hot-water heaters and appliances in the household, and formulated a differential for estimating the carbon footprint of homes using softened water versus hard water.

The study introduces controllable amounts of hard water and soft water to the following units:

- 10 gas water heaters, 40-gallon, 38,000 BTU/h burners
- 10 electric water heaters, 40-gallon, 45,000-watt heating elements
- 10 tankless gas water heaters, 199,000 BTU/h burners.

In general, the study found the electric and gas storage water heaters and the on-demand gas water heaters using softened water performed well throughout the entire testing period. Each unit maintained the factory-estimated efficiency throughout the testing period and did not require any de-liming of heating elements or pipes throughout the testing period.

Quite the reverse for the electric and gas storage water heaters and on-demand gas water heaters using hard water: None lasted through the entire testing period. At some point in the testing period, all of the water heaters using un-softened water were removed from the test due to inadequate flow caused by mineral deposit buildup in the pipes.

The on-demand gas water heaters operating on hard water had an 80 percent factory energy-efficient rating. These units were allowed to operate down to a 72 percent energy efficiency before they were shut down for maintenance. Maintenance required de-scaling of piping before being put back in use. Once de-limed, the units only recovered a 77 percent efficiency rating. The equivalent of 26 gpg of water hardness would require the on-demand water heater to be de-scaled every 1.6 years to maintain operation. On-demand gas hot water heaters will lose their energy efficiency rating within the first year of operation proportional to the amount of hard water minerals present in the water. A conservative estimate would be 10 percent efficiency lost in the first two years of operation with hard water, according to a 2010 article by David H. Martin in the *Water Conditioning and Purification Journal*.

ELECTRIC WATER HEATER



Electric Storage Water Heater After 90 Days Using Softened Water



Electric Storage Water Heater After 90 Days Using Unsoftened Water



GAS WATER HEATER



Gas Storage Water Heater After 90 Days Using Softened Water

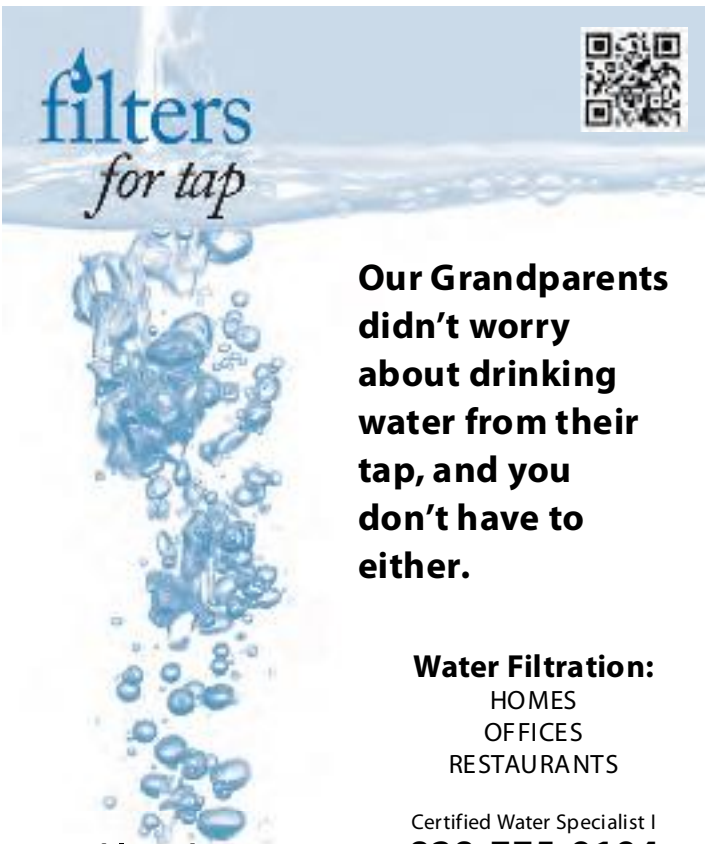


Gas Storage Water Heater After 90 Days Using Unsoftened Water

The gas storage water heaters operating on the hard water had a 70.4 percent factory energy-efficient rating. These units were allowed to operate down to a 67.4 percent energy-efficiency performance level before they were shut down for maintenance. The units required descaling of piping before being put back in use. The maintenance schedule was estimated to re-

quire the field equivalent of service every two years of operating on 26 gpg of water hardness.

The electric storage water heaters operating on hard water had a 93 percent factory energy-efficient rating. These units did not lose energy efficiency in heating the water during the course of the test. Since the



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feature

heating elements are completely submerged in water, all heat is transferred from the elements to the water in the tank. The maintenance schedule was estimated to require the field equivalent of service every 1.25 years in operation on 26 gpg of water hardness in order to maintain the water flow. A shorter life span of the heating element was projected over a 15-year service life. Scale buildup still occurs; it just does not impede the energy efficiency of heating the water, only the flow.

Solutions

To solve the problems caused by hard water, consider the following:

- If you are on a well, get a water analysis to understand what, if any, problems your water might present in consuming and using.
- Weigh the advantages of water conditioning if a water analysis indicate 3 gpg of water hardness or greater present in your water and you are operating or planning to use an on-demand hot-water heater.

- Consider an electric hot-water storage heater for use when hard-water minerals are present in your water to retain the energy efficiency.
- Explore alternative means for dealing with hard-water minerals to see if their operational parameters are appropriate for the impurities and quantities present in your water.

For a view of the executive summary of the Battelle study or for more information about water quality, visit Filtersfortap.com or e-mail ed@filtersfortap.com.

Edward Cortright is a certified water specialist, a member of the Water Quality Association and WNCGBC, and owner of Filters for Tap, a company specializing in water filtration. He has 30 years of experience in the residential building industry.

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NEW HOME – TIMBER FRAMING – SIPS – ADDITIONS – REMODELS

ONE BIN DOES IT ALL

Household recycling in Asheville gets an upgrade

BY DUNCAN MCPHERSON



Zero Waste AVL is the City's new waste reduction program. Here are some quick facts about the program and the materials that will be collected:

QUICK FACTS ABOUT THE NEW PROGRAM

Recent changes in city recycling practices make it easier for residents to keep more items out of the landfill:

- Larger, 95-gallon roll-cart.
- More materials now accepted, including additional plastics, gable top and aseptic containers (see below).
- No sorting: All recyclables can go in a single container.
- Citywide program implementation begins Spring 2012 and includes all city residents who currently have curbside recycling collection.

What is now recyclable?

- All No. 1 through No. 7 plastic bottles, jugs and containers (e.g., yogurt containers).
- Not accepted: No. 6 plastic PS or black plastic microwavable.
- Other materials include: gable-topped containers (e.g., juice and milk cartons) and aseptic containers (e.g., juice boxes and soy milk containers).

RESOURCES

City of Asheville Sanitation Services
 Wendy Simmons, solid waste manager
 Public Works Building, 161 S. Charlotte St.
 P. O. Box 7148, Asheville, NC 28802
 259-5857 or wsimmons@ashevillenc.gov

Asheville Sanitation Department's website is the most up-to-date listing of the sanitation services offered by the city: avl.mx/7a or 259-5857.

Curbside Management provides additional recycling info: avl.mx/7b or 252-2532.

Construction Debris and Hazardous Material Disposal:
 Buncombe County Solid Waste
avl.mx/7c or 250-5462

CURBSIDE MANAGEMENT STILL COLLECTS THE FOLLOWING

- Aluminum pie plates and trays
- Aluminum, tin, steel cans
- Plastic bottles
- Empty aerosol cans
- Mixed glass containers
- Soda and beer cartons
- Egg cartons
- Toilet paper and paper towel rolls
- Box board (e.g., cereal boxes, pasta boxes and frozen vegetable containers)
- Corrugated cardboard
- Mixed paper (brown paper bags, catalogues, construction paper, junk mail, office paper, paperback books, Post-it notes, shredded paper, magazines, manila folders, envelopes, wrapping paper, newspaper & paper envelopes w/plastic windows)

THE FOLLOWING MATERIALS CANNOT BE RECYCLED

- Aluminum foil
- Dog food bags
- Paint cans
- Plastic bags (most local grocery stores recycle these)
- Antifreeze, motor oil or pesticide bottles
- Styrofoam
- Plastic wrap
- Dishes or cookware
- Drinking glasses or mugs
- Light bulbs
- Window or mirror glass
- Plant trays or pots
- Plastic furniture and toys
- Hardcover books
- Paper contaminated by food
- Paper towels, tissue or napkins
- Photographs
- Waxed paper
- Carbon copy paper
- Black microwavable trays

Duncan McPherson, AIA, LEED AP is a co-founder of the WNC Green Building Council and principal at Samsel Architects. He can be reached at duncan@samselarchitects.com or 253-1124.

Steady with the plow

When it comes to a new home, it all rests on excavation

BY FRANK VOGLER

Green building is all the rage in WNC. But a basic, less glamorous component of the construction process remains virtually unchanged and unnoticed: excavation. The process goes by many names, including grading, dirt work, site prep and earth moving. Essentially, it is the practice of altering the natural shape of the land to suit human desires.

By its nature, excavation is destructive, and its impacts, including erosion and sedimentation, are severe and lasting, especially when it comes to soil fertility, waterways and wetlands. Excavation of a kind has also unleashed the plague of invasive flora, rapidly naturalizing in the Appalachian Mountains. So common is the damage that many now assume muddy rivers, giant swaths of bare subsoil and banks of kudzu, mimosa and micanthas grass are normal.

In 1973, in response to concerns about environmental degradation caused by land-disturbing activities, the North Carolina Sedimentation Pollution Control Act was created.

The basics of the law are:

- For areas larger than one acre an erosion and sediment control plan must be approved before any grading can occur.
- Construction site surfaces must be stabilized.
- Sediment must be retained on-site.

Despite these longstanding rules and many amendments, such as the N.C. Wetlands Standards, the situation is bleak. Development activity has increased markedly in the last three decades. Some once-rural counties have transformed almost entirely into metropolitan areas. Enforcement is lacking, perhaps due to funding. Moreover, many contractors and excavators have not received specific training for the installation and maintenance of erosion or sediment control measures. And then, of course, there is climate change, with its attendant weather extremes, which places a greater burden upon excavators to improve both their skills and protocols.

Urban flight, rural plight

With such a large migration of folks moving from urban areas to our rural mountains, public education on such matters is now imperative. Most urban denizens are “housecentric” — they think less about their land than their dwelling. Consequently they often under-budget and under-plan for excavation-related activities, such as driveways, retaining structures, drainage features and general landscaping.



The all-clear: Forestry-mulching equipment was used to strategically clear this gladed landscape of underbrush and dead trees, leaving the good stuff behind.

PHOTO BY FRANK VOGLER

Builders, adhering to market demand, follow suit. The costs borne by the inhabitants of our region, from brook trout to native orchids, as well as to taxpayers, are enormous.

The cost of maintaining or repairing a poorly installed driveway — one that is too steep, lacks visibility, appropriate drainage, surfacing, compaction or other necessity — may rival the initial construction cost. A poorly placed or poorly constructed driveway becomes a constant equity and resale issue for the homeowner or developer as well as the county and state (by virtue of economic and environmental impacts).

Homeowners, developers and builders need to think clearly about access when siting homes and subdividing acreage. Lots are typically divided and sold according to proximity to viewsapes and waterways, often with little thought of how to get there. According to one professional I spoke with, half of all stream sedimentation in WNC is caused by badly sited or installed residential driveways. He maintained that large commercial developers, due to big budgets, better engineering and greater public scrutiny, cause less impact than small residential contractors.

So what can be done? First, homeowners need to understand the financial and environmental im-

pacts excavation will have, and take greater interest. Avoiding lots and acreage with physical-access problems is one approach that has direct market influence. Homeowners and developers must learn more about excavation, beginning with hydrology, or the science of how water moves. If you don't have a clear account of where all the water will go after you excavate, you have not completed your homework.

Water smarts

Hydrology-related issues in very wet 2009, including dozens of road and bank collapses, were shocking. Our company alone evaluated sites where mitigation procedures totaled between \$20,000 to \$100,000.

Another essential component of grading is re-vegetation. There are numerous ways to re-vegetate, including hydro-seeding, sodding and good old-fashioned hand labor. Upon the completion of any grading activities, those areas must be stabilized through re-vegetation.

It also pays to know something about soil complexes and compaction. Soil maps are available at no charge through NRCS. Some soils are highly erodible and unfit for excavation. In general, foundations and roadbeds must lie on virgin subsoil layers or clean compacted fill materials, according to engineer-

ing specifications. Valuable top soils, those richer in organic matter, should be saved and reincorporated in finish-grading procedures such as landscaping, not discarded or mixed with fill materials.

Sound complicated? It's really not. Once familiarity increases, facts begin to connect. One inexpensive tool for bringing information together is digital mapping. Mapping is to land planning what blue prints are to building. A good mapping procedure incorporates multiple layers of data, from property boundaries and topographical contours to timber profiles and soil conditions. Well-prepared mapping sequences allow developers, contractors and homeowners alike to site homes, plan roads, organize timber harvests and restore pastures and wetlands with less on-site data collection and guesswork.

Less is more

Another helpful strategy regarding excavation is to do less of it. This notion is analogous to Amory Lovins idea of "negawatts," or keeping track of energy not used as a benchmark. This means that home sites and plans are selected based on how little excavating is required. We should follow the example of Frank Lloyd Wright and integrate living space into existing land features. Before the advent of hydraulically driven equipment, this was largely how properties were developed. It now makes more sense than ever, both environmentally and financially, to return to this common-sense aesthetic.

Restrict grading activities to immediate building or road footprints. Grading outside these areas markedly increases environmental and financial costs, and works against many homeowners' desire to have lush, natural spaces. There are better options for creating recreational space and viewscapes, such as forestry mulching. Forestry mulching recycles unwanted biomass (i.e., trees, shrubs and vines) into mulch on site.

Mulching can be very specific, leaving desirable native trees and other flora undisturbed. It can create a portion of the finished landscaping even as construction is under way. Mulching vastly reduces erosion control costs,

burning and hauling charges, soil compaction and fertility issues, and furnishes clean, tractable footing for building activities.

Finally, and most importantly, discuss excavation with your contractor or developer before you build or buy. I guarantee site prep and driveway construction are no small portion of a new home's total cost. It has been my experience that while folks deliberate endlessly over paint colors and bathroom fixtures, they disregard major site preparation and access issues under the assumption that the contractor knows best. Unfortunately, many contractors are relying upon the skill of their subcontracted graders and engineers. If your builder is subcontracting the excavation, get references and photographs of the subcontractor's previous work and call those references, including older ones. Mistakes, especially cracking, shifting and slope collapses, take years to materialize. Visit your excavator's previous driveway jobs.

A few dos and don'ts

For those who want to build sustainably, extend your understanding and planning beyond building itself.

- Think first about the land you are looking to buy or build upon.
- Don't buy property with physical access issues.
- Take what is offered by your property in terms of contours, drainage, vegetation and soils.
- Consider digitally mapping your acreage if the terrain is not providing clear choices.
- Shrink your excavation footprint by employing forestry mulching for the creation of recreational space and viewscapes.

These are common-sense steps toward cost savings and good stewardship. Educate yourself about excavation practices. Sustainability is as much about following well-established protocols to avoid waste and damage as it is about innovation. Do it right, do it once.

Frank Vogler is vice president of V&V Land Management and Resource Recovery llc. He lives in Del Rio, Tenn., with his family, where they are restoring their 300-acre farm to productivity.



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spotlight

Green building 101

WNC colleges aim for LEED and beyond

BY ANNE FITTEN GLENN

Colleges and universities are natural locations for green building projects — both retrofits and new construction.

“It’s part of the culture,” says **Don Gordon**, director of design and construction at the University of North Carolina Asheville. “It makes sense to build this way here. We’re trying to be leaders.”

To wit, *The Princeton Review* publishes an annual guide to green colleges and universities in partnership with the United States Green Building Council. The recently released 2012 edition profiled 311 colleges; UNCA, Warren Wilson College and Western Carolina University have all made the list. And Mars Hill College has a chance next year, after taking on the Billion Dollar Green Challenge.

Here are some of these colleges’ green building projects.

UNC - ASHEVILLE

This Asheville college has been lauded for being one of the most sustainable universities in the North Carolina University system. A number of campus buildings employ green features such as geothermal heating and cooling, thermal windows, day lighting, vegetative roofs, solar panels and recycled building materials.

Since 2003, the following campus buildings have been built or renovated with green construction features: Highsmith University Union, New Hall, Sam Millar Facilities Management Complex, Zageir Hall renovation, Zeis Science and Multimedia Building, Pisgah House, Rhoades-Robinson renovation, Track Field House and The N.C. Center for Health and Wellness.

Currently, five UNCA residence halls in Governors Village are undergoing renovation (these buildings were planned to be demolished prior to this project) and one, New Residence Hall, is under construction.

“Not part of the New Residence Hall contract is a solar thermal installation we are planning that will provide domestic hot water for New Residence Hall and several other nearby residence halls,” notes Gordon.

“We are exploring the possibility of building a new building to the super rigorous standards of the Living Building Challenge by the International Living Futures Institute,” adds **Steve Farrell**, UNCA campus architect.

For more information, visit unca.edu.

MARS HILL COLLEGE

In October 2011, this private college joined 32 other universities in launching The Billion Dollar Green Challenge (greenbillion.org). The goal is investing a total of \$1 billion dollars in self-managed “green” funds that finance energy-efficiency upgrades on campus. MHC currently is the only institution in North Carolina to commit to The Challenge.

The college is undertaking major upgrades in more efficient lighting in existing building and adding solar hot water arrays.

For example, a \$60,000 Green Building Initiative grant from The Kresge Foundation will help fund design and planning costs for Day Hall, a 36,000-square multipurpose building that’s in the works. The college plans to seek LEED certification, but which level will depend on the final budget, according to **Granger Caudle**, MHC’s executive director of planning and auxiliary services.

For more information, visit mhc.edu.

WESTERN CAROLINA UNIVERSITY

WCU currently is making use of a \$5.6 million energy performance contract for several campus buildings that will introduce more energy-efficient heating and cooling, lighting and building envelope modifications, and renewable energy improvements.

WCU has one building under construction and one renovation underway, both of which will qualify for LEED certification.

The university recently started a \$15.5 million renovation of nearly 40-year-old Harrill Hall, a dorm that will feature enough energy-saving and sustainability features to qualify the building for LEED Silver, or possibly Gold certification. Some of the energy-saving components include geothermal heating and cooling, exterior wall insulation and canopies to control sunlight entering the building. Charging stations will be made available for electric vehicles, and a storm-water retention system will be used to control runoff from parking lots into the creek. A few of the proposed systems, including a rooftop rainwater collection system to provide water for flushing toilets and solar hot water panels, were removed from the project to bring it within budget.

When completed, Harrill Hall will be LEED certified at the Silver level. Some of its green features include a 20,000 square foot vegetative roof, a south-facing atrium for passive solar gain and day lights, straw-based particle board for interior casework, and a sand filtering system for the parking lot storm runoff.

For more information, visit wcu.edu.

WARREN WILSON COLLEGE

Only 16 colleges and universities nationwide make *The Princeton Review's* 2012 Green Rating Honor Roll, and Warren Wilson is on it. It's also the only private college in the Southeast on the top list, having received the Review's highest possible green rating of 99.

In addition to four LEED certified buildings on campus (listed below), the campus has one LEED certification in progress and several other WWC buildings that have been retrofitted with geothermal heating-and-cooling systems.

Warren Wilson's LEED certified buildings include:

EcoDorm

The crown jewel of Western North Carolina's green buildings, EcoDorm was completed in 2003 but later awarded LEED Platinum designation for an existing building. It was the first dormitory in the nation to be granted that certification. EcoDorm was featured in a 2009 *New York Times Magazine* article on green dorms.

The dorm uses about 70 percent less energy than a conventional building of the same size. There is no air conditioning, nor are there any mini-refrigerators, toaster ovens or hair dryers in EcoDorm. Residents are encouraged to forego television and synthetic rugs, and hang their clothes on outdoor drying lines. WWC students led the move to build a green dorm and worked with faculty, staff and architects to create a building that is both livable and follows the best sustainability practices.

Some of EcoDorm's more notable green features include:

- a 10,000 gallon salvaged train tanker car that collects rainwater from the roof before it is pumped into the dorm, pressurized; the water is used to flush toilets and irrigate the garden.
- a radiant hot-water floor heating system. The water is preheated with an array of solar thermal collectors, reducing the energy cost by half.



Earth warmed: While Warren Wilson College has earned national recognition for its green initiatives, other regional institutions have set to work too, such as this geothermal-well system under way at Western Carolina University.

PHOTO COURTESY OF WCU

- permaculture landscape. Most of the plantings are edible, and all are wild-life-friendly.
- wood siding harvested from trees prone to pine-beetle kill in the Warren Wilson forests.
- window awnings include photovoltaic panels that provide shading and power, with any excess energy fed onto the grid.
- cabinetry and wainscoting crafted by student crew from old farm fences on campus.
- a computer monitoring station that tracks the building's energy usage and savings.
- Composting toilets that create odorless, safe, organic matter for use in landscaping.

Orr Cottage

Named for **Doug Orr**, president emeritus of Warren Wilson College, and his wife, **Darcy Orr**, the cottage was one of the first buildings on a college or university campus to achieve LEED Gold certification for new construction. Built in 2006, Orr Cottage houses some of the college's

administration offices. More than 15 student crews did the work, making it the first completely "in house" building project at the college. Orr Cottage uses 50 percent less energy than a conventional building of the same size. The house was constructed with stone from nearby mountains and wood siding and trim from the college's forests.

Village Dorms

While the EcoDorm garnered the first LEED Platinum dorm certification in 2009, before that came the Village South residence hall — the first dormitory ever in North Carolina to win LEED certification (2006). The building got the Gold and offers extensive energy and water conservation features. Soon after, the adjacent Village North dorm also received a LEED Gold designation.

For more information, visit warren-wilson.edu.

Freelance reporter and columnist Anne Fitten Glenn lives in Asheville.

how to

Keep the water out

Proper drainage techniques

BY HANS DOELLGAST

If you are building a healthy home, the most important job is to keep the water out. If water intrusion becomes an issue, a house will be damaged — even if it's locally sourced, low-VOC and energy efficient. In the mountains, many building sites have natural drainage and justify a daylight basement. On potentially wet sites, call a professional waterproofing company to place drainage boards, install French drains and apply a waterproof coating. The warranties provided by these companies are worth their weight in gold.

The following methods are recommended to help passively move water away from homes where rainwater is the major concern.

- After a basement installation is complete, and the foundation walls are waterproofed, use a transit and a shovel to establish positive drainage around the perimeter of the foundation in the dirt where there will be a French drain. Establish low points at the two daylight corners of the basement, and a high point equidistant from both of the low points. The high point of the dirt should still be lower than the bottom of the basement slab by at least 8 inches.

- Next, roll out a 5-foot-wide roll of landscaping fabric around the foundation. Centered in the landscaping fabric, lay either flexible perforated pipe, or hard pipe with weep holes on the underside.

- Now comes the pea gravel. On top of the pipe and the landscape fabric, add 12 inches of pea gravel, which gives water a path to the pipe without placing hydraulic pressure on the foundation (the water makes it to the bottom of the foundation wall). Use the free edges of the landscaping fabric, folding them over each other to create a virtual burrito wrap around the pea gravel and the drainage pipe. The purpose of the landscape fabric wrap is to filter out any dirt that might clog up our drain pipe. One added option, but not in place of the French drain, is a J-drain that gives any water that may get next to the foundation a path away from the building.

- The next stage is back-filling the foundation, but wait to do that until the weight and framing of the house add rigidity to the foundation walls.

Here are a few rules that should be followed when planning out your foundation drainage:

- Never tie your downspouts and your foundation drains together. You don't want rainwater backing up against your foundation.



Almost done: Wait to back-fill until the weight and framing of the house add rigidity to the foundation walls (top photo).

Prep work: Establish positive drainage around the perimeter of the foundation in the dirt where there will be a French drain (right photo).

PHOTOS BY HANS DOELLGAST

- Daylight your foundation drains and gutter drains as far from your house as possible.

- Make sure that your final grade pitches a minimum of 5 feet away from your home.

- Always compact your back-fill in maximum 8-inch lifts. Non-compacted back-fill will settle when wet, negating all of your hard work getting positive drainage away from the home. (Not to mention, the settling will pull your gutter drain pipes away from their downspouts, additionally soaking the ground next to your foundation.)

- A hard rain will teach you volumes about where water wants to go on your job. A hard rain should have you racing toward your job, not away from it.



Last but not least: Whenever given the option, overdo it!

Hans Doellgast is the owner Jade Mountain Builders, an ecologically conscious construction company. Hans received his degree from Warren Wilson College in environmental education, and has been building healthy homes in Western North Carolina for 15 years.

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On the cover: The home, located in Mars Hill, is ENERGY STAR certified with a HealthyBuilt Homes Silver rating. **Builder:** Blue Ridge Energy Systems **Designer:** Samsel Architects. **Cover design by:** Carrie Lare. **Photo by:** Todd Crawford.

A Greener Bathroom Remodel

BY JAKE SADLER AND MAGGIE LESLIE





There are many things to consider when beginning a remodel. This guide provides a very basic overview of common choices, as well as greener alternatives for different components of a bathroom. All bathroom materials should be very durable and moisture resistant, but also beautiful. Be creative with such a small space — use as many locally made and artistic details as possible!



WALL TILE

Shower and tub surrounds need to be very durable, low maintenance and able to withstand significant moisture. Fiberglass and acrylic enclosures are easy to install and are low-cost but are not environmentally friendly to manufacture and not as durable as tile. If installing tile, use solvent-free





mastics or thinset mortars. To reduce maintenance, consider darker shades of grouts instead of white and choose tiles that can be set close together to reduce the amount of grout to clean. Use a water-based grout sealer, and latex-modified grouts.

MATERIAL	DESCRIPTION	BENEFITS AND DRAWBACKS	GREEN TIPS
Ceramic 	Ceramic tiles are made from many types of clays and fired at high temperatures. To prevent moisture penetration, seal and coat the grout.	Glazed ceramic is thought to require little to no protection and is extremely durable. If the tiles are imported from another country, research to make sure they are free from lead and other toxic heavy metals.	Look for regionally manufactured and recycled content tiles. Look for low-VOC, formaldehyde-free and nontoxic sealers and glazes.
Glass 	Glass tile is an excellent option that has a unique aesthetic in just about every color imaginable, from large tiles to small tiles for detailed mosaics.	Extremely durable; thousands of color and style choices: Glaze should be kiln dried; check mesh backs and make sure grout lines are even.	Look for 100 percent-recycled content and locally manufactured tiles. Choose nontoxic sealers.
Terrazzo 	Pre-manufactured tile (or poured in place for floors) that consists of marble or granite chips in a Portland cement or epoxy matrix.	Available in various sizes and thicknesses. Can fade over time and is difficult to refinish.	Look for terrazzo that contains recycled glass, stone and even reclaimed carpet fiber. Use a nontoxic sealer.
Stone 	Marble, granite, travertine, limestone, and slate are all examples of natural stones that can be used to provide a natural and earthy tone and texture.	Durable; natural: can add a nice aesthetic to your home. Can be expensive and must be sealed or glazed if used in the bathroom: may require more maintenance than other tiles. Difficult to assess the impact of various quarries.	Look for regional sources or even salvaged stone. Choose a stone that does not need to be sealed, or use a nontoxic sealer.

FLOORING

Bathroom floors must be very resistant to moisture and standing water, and they need to be easy to clean. Vinyl flooring is very popular, in part due to its low cost, but it is not environmentally friendly to manufacture or dispose of. If removing existing vinyl, be aware that floor-

ing manufactured before the mid-1980s may contain high levels of asbestos in its backing material. Depending on the product you choose to install, you may be able to avoid tearing out the old vinyl and instead place the new material over it, but check the manufacturer's specifications.

MATERIAL	DESCRIPTION	BENEFITS AND DRAWBACKS	GREEN TIPS
Tile 	Ceramic tile is made from clay and fired in a kiln at high temperatures. Tile requires a great deal of energy to extract and produce. It is durable.	Very durable; reusable; recycleable, recycled content available. Increased cleaning depending on amount of grout. Heavy to transport long distances.	Look locally for recycled-content, locally-sourced tile. To create beautiful mosaics for a special touch, consider using salvaged or small pieces.
Concrete 	Concrete is a mixture of rock, sand, or other fillers and Portland cement, which has a very high embodied energy.	Very durable; many finish styles. Eliminates need for additional finish materials. Prone to scratching; cracking is possible.	Use recycled content concrete and try to use nontoxic pigments to color it, rather than surface stains.
Natural Linoleum 	Made by combining linseed oil, wood flour, pine resin and plant fiber, natural linoleum is nontoxic and can last more than 40 years.	Made from all-natural materials; naturally antibacterial. Typically imported from Europe. Odor from natural linseed oil may irritate some people.	Some products are certified for individuals with asthma and other respiratory issues.
Laminates 	A type of floating floor (that is, it's not glued, nailed or stapled to the underlying surface), laminates usually consist of a thin layer of color or pattern over a tongue and groove, wood-product base.	Many different designs; easy to do your self. The padding system beneath the laminate must be installed properly; durability is questionable; not usually appropriate for wet areas such as bathrooms; glues used in laminate can be toxic. Most imported from abroad.	Look for laminate floors with a high recycled content and with a snap-in-place design that doesn't require toxic glues.

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COUNTERTOPS

Because it is typically such a small area, upgrading your countertops to a green, very durable and creative design may not have a significant impact on your budget!

MATERIAL	DESCRIPTION	BENEFITS AND DRAWBACKS	GREEN TIPS
<p>Concrete</p> 	<p>Concrete is a mixture of rock, sand, or other fillers and Portland Cement, which has a high embodied energy .</p>	<p>Durable; can be made locally with recycled materials; recycleable. Porous, requires water sealing; very heavy and can require cabinet reinforcement.</p>	<p>When sealing your counter look for a zero-VOC sealant. Concrete countertops are easily sourced and built by local craftsmen.</p>
<p>Engineered Stone</p> 	<p>Typically, engineered stone is a fabricated product made from ground quartz crystals, quartz dust, pigment and various binders.</p>	<p>Durable; does not require treatment (low toxicity); very difficult to damage, cut, or scorch. Typically made from non-renewable resources; heavy to transport.</p>	<p>To reduce unnecessary transportation, use the closest manufacturer.</p>
<p>Natural Stone</p> 	<p>Outside of quarrying the stone itself, natural stone adds little input in production costs. Transportation is expensive however. Salvaged stone can be found at many salvage yards and can be less expensive.</p>	<p>Tolerates hot surfaces well; durable; reusable. Porous; requires sealing; difficult to repair if broken; mining and quarrying is not always done in an environmentally friendly manner.</p>	<p>Use local stone, if possible, to reduce travel distance and get the most benefit from this countertop option.</p>
<p>Paper Resin</p> 	<p>Paper-resin counters are made from layers of paper bonded together under pressure to form a solid surface.</p>	<p>Hygienic; can be sanded to smooth out scratches. Prone to staining; can be scorched by hot surfaces.</p>	<p>Look for a high recycled content paper and low-VOC resins.</p>
<p>Tile</p> 	<p>Ceramic tile is made from clay and fired in a kiln at high temperatures. Tile requires a great deal of energy to extract and produce.</p>	<p>Recycleable; reusable; durable; can withstand hot surfaces. Scratch prone; cleaning grout properly can be tedious. Heavy to transport long distances.</p>	<p>Use recycled content tile, and use a local tile manufacturer when possible.</p>
<p>Solid Surface</p> 	<p>Solid surface counters are typically made from a combination of bauxite ore and fillers and resins, typically polyester or acrylic (both of which are derived from fossil fuels).</p>	<p>Durable; small scratches can be sanded; water resistant. Hot surfaces can scorch; bauxite mining is not sustainable.</p>	<p>Paper resin counters, concrete and recycled plastic are a great green alternatives to a solid surface countertop.</p>
<p>Terrazzo</p> 	<p>Terrazzo consists of crushed stone and glass set in cement or epoxy that is buffed smooth. Epoxy is petroleum-derived and can contain potentially harmful chemicals. Cement binders have high embodied energy.</p>	<p>Durable: low maintenance; high recycled content. Heavy to transport long distances.</p>	<p>Use local materials and products with a high recycled content.</p>

OTHER BATHROOM CHOICES

MATERIAL	DESCRIPTION	BENEFITS AND DRAWBACKS	GREEN TIPS
Tub 	Cast iron and stainless steel coated with a porcelain finish are the most durable tub choices. Acrylic and fiberglass tubs are lighter, however and come in a variety of shapes.	Acrylic and fiberglass tubs hold heat well but are prone to scratching and chipping and involve toxic chemical manufacturing. Cast iron and stainless steel can be refinished if the enamel is damaged.	If you have an existing cast iron tub or can find a used one, consider employing a professional to refinish it. However, be aware that the process requires toxic chemicals. A smaller tub will save water and energy if you are a frequent bather.
Sink 	Typical choices include enameled cast iron, porcelain, cultured marble, stainless steel and solid surface.	Many sinks come with a lifetime warranty. Cast iron and steel can be recycled.	Reuse or refinish a salvaged or vintage sink. Local artists can also create beautiful sinks that add a very special touch to your bathroom.

Resource: Images, text courtesy of Build It Naturally, Victoria Schomer and Bill Rhodes. City of Seattle Green Remodeling Guidelines <http://www.ci.seattle.wa.us/dpd/GreenBuilding/SingleFamilyResidential/Resources/RemodelingGuides/default.asp>



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OTHER BATHROOM CHOICES continued

MATERIAL	DESCRIPTION	BENEFITS AND DRAWBACKS	GREEN TIPS
Vanity 	Cabinet options include bamboo, compressed agricultural fibers, particle board, hardwood and plywood.	Urea formaldehyde is present in most particle board and plywood. Plywood is not often sustainable harvested. Consider reusing a salvaged vanity.	Look for FSC designation for wood products or use recycled-content or rapidly-renewable products. Use formaldehyde-free products. Transforming an antique dresser into a vanity adds character.
Toilet 	New toilets must meet the EPA's 1.6 GPF requirement, and low-flow toilet models can range from 1.0-1.28 GPF. Also, look for dual flush as an affordable option for water-saving toilets.	All toilets must be able to flush a specified amount of solid waste: Siphon draw toilets are more prone to clogging.	Low flow 1.28 GPF toilets are becoming standard and perform at least as well as higher-flow models. Look for the Water Sense label. Consider using rainwater or graywater for toilet flushing.
Faucet 	The bathroom faucet is one of the most heavily used water taps in the house and as such has certain requirements. What type of faucet you choose may influence the sink you need, or visa-versa.	Single-knob faucets are easier to use. Investing a little more for a quality faucet will save in maintenance long term.	The flow rate of the faucet is stamped on aerator where the water comes out — typically, 2.2 GPM. Aerators can easily be retrofitted to reduce the flow to as little as 0.5 GPM while maintaining pressure.
Shower Head 	There are a vast variety of showerheads with different styles and flow rates. Before buying one make sure you check the GPM rating and get one that uses the least amount appropriate.	Most low-GPM rated showerheads have good water pressure. Be sure to properly install showerheads to allow them to work properly.	EPA requires 2.5 GPM, but look for 1.5 or 1.75 GPM to meet the ENERGY STAR Water Sense criteria, which can save thousands of gallons of hot water a year.
Bath Fan 	One of the most important bathroom purchases, fans ventilate and remove moisture that could lead to mold and mildew. Run during — and at least 10 minutes after — a shower or bath.	Fans that exhaust at least 50 cfm are a necessity in any bathroom and help prevent mold and mildew. Not running your bath fan will dramatically reduce indoor air quality.	Consider installing a timer or a humidistat on your bath fan to ensure proper moisture removal.

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Here comes the sun

Getting the most from passive solar design



BY BRIAN KNIGHT

Passive solar design is one of the best techniques available for green building and energy-efficient construction. It can be done for zero to little extra upfront expense and is capable of reducing heating costs by 40 to 90 percent.

Other benefits include abundant daylighting, a stronger connection to nature, and passive survivability — meaning the home remains livable through winter power outages. Like the building envelope, these features are permanent and will last the life of the structure. There are no moving parts, and the only maintenance required is occasionally cleaning the windows.

The most important component of passive solar design is a building envelope that is airtight and minimizes thermal bridges. Free heat does little good if it quickly escapes through the building envelope. Obtaining great blower-door test results and using insulation details that minimize thermal bridging should be prioritized before passive solar design.



Bright solutions: A good passive-solar design takes into account such factors as which way the house faces, what kinds of windows are installed and what size overhangs are used.

PHOTOS BY BRIAN KNIGHT

Design details

Here are five ways to get the most out of passive solar design.

Calculate the area of south-facing glass as a percentage of the home's conditioned floor area

- 7 percent or less is considered "sun-tempered."
- 9 to 12 percent is the ideal range that most passive solar designs aim for.

More than 12 percent puts the house at risk of overheating unless the design includes extra thermal mass. Other concerns with higher glazing ratios include increased costs, glare and excessive thermal losses.

Specify high solar-gain glazing

For south-facing windows, the type of glass you choose is extremely important. The higher a window's solar-heat-gain coefficient, the better. Be aware of the difference between the glazing-only SHGC and the whole-window SHGC. A whole-window SHGC (the number on the NFRC label attached to the window) should be at least 0.40; a better target is 0.56.

Shape and orientation

Stretching a home's shape from east to west will create more room for southern windows and minimize the effects of intense sun angles striking the home's sides during the cooling season. This approach needs to be balanced with the fact that a squarer house loses less heat at night.

Facing within 20 degrees of true south is ideal. Many designers still incorporate passive-solar features up to 40 degrees off true south. Facing southeast is better than southwest due to less overheating. Currently in Asheville, true south is 6 degrees east of what a compass indicates due to magnetic declination.

Overhang design

Getting overhangs sized correctly seems to give designers a lot of trouble, especially on houses with multiple stories. Generally, overhangs should provide full shading on all southern windows on June 21 and full sunlight on Dec. 21 (the dates of the highest and lowest sun angle each year). A strict interpretation of this is not necessary but highly advised.

The rule of thumb that works for Asheville's 35-degree latitude is that overhangs should be 18 inches deep and 12 inches above the window. This is an easy variable to adjust depending on window size, orientation and design considerations.

Thermal mass

Thermal mass is the most controversial element

in passive solar design. Much evidence shows that thermal mass inside a home's conditioned space can decrease heating and cooling costs. The question is, how much more are you willing to spend in time, materials and labor to install additional thermal mass to achieve the benefits the mass provides? The question is debatable.

Uncarpeted concrete slabs are the most obvious mass to include since they are often needed anyway in typical construction. Stained and polished concrete floors are increasingly recognized as one of the most aesthetic, low-maintenance, high indoor-air-quality floor finishes available.

If you are building on a site that's ideal for a crawlspace, consider building stem walls filled with dirt or gravel and topped with a slab. A stem-wall foundation with a concrete slab is a common building practice that can cost less than a sealed crawlspace. Such a foundation has more thermal mass and less space to condition. A slab is also (arguably) healthier than a crawlspace.

For thermal mass to perform, it must be entirely within the conditioned space. This eliminates most of the thermal-mass benefits attributed to insulated concrete forms and autoclaved aerated concrete.

Keeping designs cost effective

By installing fewer windows on the non-south sides of the home, owners can balance costs and decrease year-round thermal losses while increasing needed solar gain.

Here are other tricks to save money and improve performance:

Increase the number of large fixed windows. If you specify as many fixed windows as possible, the cost per square foot of window drops dramatically. You'll also see an increase in energy performance because there is less thermal bridging and more solar gain. Fixed windows are easier and cheaper to equip with blinds and movable insulated curtains than operable windows. For the most part, fixed windows are easier to clean. However, there is a legitimate concern about the difficulty of cleaning fixed windows on upper levels. One good strategy is to place an operable casement nearby to facilitate cleaning from the inside. Be sure it opens the right way.

Decrease the number of operable windows. It's common to see designs with far too many operable windows. They are expensive, have more air infiltration, require maintenance, decrease solar gain, and increase thermal bridging. One operable

window per room is usually plenty for ventilation, especially if you are choosing casements.

A single bedroom egress window is already plenty big. Locating windows opposite doors helps with ventilation and makes rooms feel bigger.

Avoid extra engineering. Another good reason for keeping your glass ratio in the 9-to-12-percent range is that one can create large areas of wall that are uninterrupted by window openings, increasing shear resistance. This can eliminate the extra expenses of engineering, materials, labor and energy costs of needing structural members where your insulation should be. Solid wall area can help with interior furniture placement and is a good location for stairwells. This strategy also helps you avoid the use of pricier tempered glass.

Avoid muntins and dividers. They cost more, decrease solar gain, interrupt views from inside, and make it harder to clean the window if they aren't between the panes.

North Carolina's Passive Solar Tax Credit

North Carolina is one of the only states to offer a tax credit for passive solar design. It falls under NC-478: Investing in Renewable Energy Property. By following the advice above, it's possible to avoid any additional expenses associated with implementing passive solar. The credit allows one to offset several components of passive solar design, including additional southern windows, thermal mass and overhangs.

The credit covers 35 percent with a \$3,500 maximum for any improvements attributed to passive solar. Be sure to better research this credit. Tax policy and required details are subject to change at any time. Some of its notable requirements:

- Southern glass must have an SHGC of .70 or higher (glazing only).
- Orientation must be within 15 degrees of true south for new homes (20 degrees for existing homes).
- Overhang design must fully shade windows on June 21 and allow full sun on Dec. 21.

Brian Knight is the owner of Springtime Homes, a green builder specializing in energy efficiency and indoor air quality, serving Asheville and Western North Carolina.

The real crawlspaces of Buncombe County

Caring for your crawlspace

BY AMY MUSSER

The first rule of the crawlspace: Never go in without your cell phone. The latch is always on the outside, and you're one gust of wind away from being trapped inside. I've been in hundreds of crawlspaces and have seen only one with a string rigged to pull the latch open from inside. Most people don't give much thought to the short, dark, unconditioned area under their homes, but what happens down there matters.

The typical crawlspace is 3 feet tall with concrete block walls and plastic wall vents. The floor is dirt and the "ceiling" is a wood-frame floor with fiberglass insulation between the framing. That's typical, but in reality no two are alike. Crawlspaces can be short or tall, wet or dry, clean or dirty. I regularly find spider webs, empty beverage cans, lost tools, mouse poison and candy wrappers down there. My former sunglasses are lost in a crawlspace somewhere in New Orleans. And there are other, more disturbing things that should not be ignored.

Nobody likes to hear this, and I wish there were an alternative, but there isn't: If your house has a crawlspace, you have to go down there. You should go at least twice a year, including once in the summer and after any unusually heavy rains.

Once you're there, ask yourself: Does it feel humid? Do you see mold or mildew? Is there standing water? Are the ducts wet? Are there any animals of any kind? If yes, you need to call one of the professionals listed in this directory. While you're already dirty, verify that your downspouts are still attached to their underground connections. Watch the gutters during a steady rain to make sure they're draining into the downspout and that water flows at least 5 feet away from your house at the outlet end. This is cheaper, healthier and less scary than having a home inspector find mold when you're preparing to sell your house.

Water wars

Dampness is the biggest problem in crawlspaces. Once in a while, I discover a crawlspace that's been ignored for 60 years and is dry as a bone, but it's not common and I can't explain how it happens. The principles of building science cannot reliably explain how a vented crawlspace located in Western North Carolina would fail to develop moisture problems. If you live here, you know these two things: Summers are humid, and humidity will form condensation on a cool glass of sweet tea.

Crawlspaces are like caves, with temperatures in the mid-50s year-round. When humid air comes in



The good and the ugly: In the top photo, moisture has compromised the walls and subfloor. An improved crawlspace (lower photo) features a covered subfloor, insulation and other features.

PHOTOS COURTESY OF VANDEMUSSEER DESIGN

through the vents, it condenses on those cool surfaces just like it does on a cool glass. The tips of nails penetrating the floor above will rust. There could be condensation on top of the plastic groundcover, air conditioning ducts, pipes, block walls and wood

framing. If it stays there long enough, a fuzzy green layer of mold will start to grow.

There are other ways water can get in. If you live on a hill, your downspouts probably empty into under-

ground pipes that are supposed to carry water down the hill and away from your house. Maybe the downspout gets clogged, water backs up and the gutter overflows. Maybe the downspout disconnects from the underground pipe. Maybe the dirt around your house settles and rainwater from your yard drains toward the house. Either way, you've got standing water against your crawlspace walls.

The water bleeds through the walls leaving white mineral deposits on the inside that are visible even after it dries. Water can wick up through the concrete wall and into the wood framing that holds up your floor, wicking along the length of the wood toward the center of your house. Mold loves water and wood, so you'll start to see green and black spots. The wet fiberglass insulation will smell like ammonia. Now, you've really got a problem crawlspace.

Crawlspace or menagerie?

Animals and crawlspaces don't mix. I know a builder who accidentally shut a cat in a crawlspace overnight. The cat was unharmed, but the crawlspace was less fortunate. Imagine how inviting a warm, rain-free crawlspace must seem to wild animals. Wouldn't you want to climb in there and curl up against a nice warm floor with a thick, wooly blanket of insulation beneath you?

A missing crawlspace vent cover is a nine-alarm emergency — any animal smaller than a raccoon can climb right in. A friend of mine who works in crawlspaces once pulled back some insulation to see how thick it was and a 5 foot black snake fell down on top of him. Think about the smallest animal that you want living under your house, and then make sure that you air-seal all holes larger than that in your crawlspace. This is actually a great way to approach air sealing your entire home.

Seal the deal

There is a better alternative, and it's called a sealed crawlspace. Sealed crawlspaces are great options for new or existing homes but don't get too excited: You still have to go down there to check the dehumidifier and you still shouldn't use it for storage.

But your chances of a wildlife encounter or fungal situation are seriously reduced.

There are many ways to seal a crawlspace, but a few features are common: permanently and tightly closed vents, a continuous plastic liner covering the floor and extending up the wall, a drain or sump pump to remove water from the lowest point and a humidity-control mechanism. The North Carolina building code lists five approved humidity-control mechanisms, but a dehumidifier is my favorite. You can install the other ones too, but you should install a dehumidifier.

Some sealed crawlspaces have insulation on the walls instead of the floor above. This solves two problems: poor air sealing of the floor and fiberglass insulation falling down. If you move the insulation to the walls and you have air conditioning, you can supply conditioned air to the crawlspace (one of the five approved humidity control strategies). This is a great backup, but you should still install a dehumidifier because people in WNC don't run their air conditioning all year (and even if they do, it may not be enough). You want a system that senses humidity and reacts; you want a dehumidifier.

Sometimes it doesn't make sense to insulate the walls and condition it — if your crawlspace is 30-foot high, for instance. Instead, you can air seal the floor, insulate it and make a sealed unconditioned crawlspace. Obviously, you would not dump conditioned air outside the insulated boundary of your home, so you install a dehumidifier. Insulating the floor with spray-foam air seals the floor and is less likely to fall down, so it is a great option for insulating in a crawlspace.

Who wouldn't want to make a twice-yearly visit to check on these nice clean sealed crawlspaces? Some crawlspace experiences are wonderful. On a 15 degree day when the wind is howling up on Balsam Mountain, nothing beats warming your hands on the work light of a friendly duct installation crew in a balmy 50 degree crawlspace. I can promise you this: a crawlspace is never boring.

To learn more about high-performance crawlspaces, visit crawlspaces.org.

Amy Musser is a co-founder of Vandemusser Design, PLLC, an Asheville-area energy-efficiency consulting and home-energy-rating company. She is a licensed mechanical engineer, and can be reached at info@vandemusser.com or (828) 348-4723.

DOES YOUR CRAWLSPACE NEED PROFESSIONAL HELP?

Enlist the help a professional if your crawlspace has:

- visible mold or mildew
- a damp or mildewy odor
- standing water
- a wet floor, wood, ducts or pipes
- rusty nail tips poking through the floor above
- water marks on any wood framing
- elevated humidity levels
- animals or insects living inside

— A.M.

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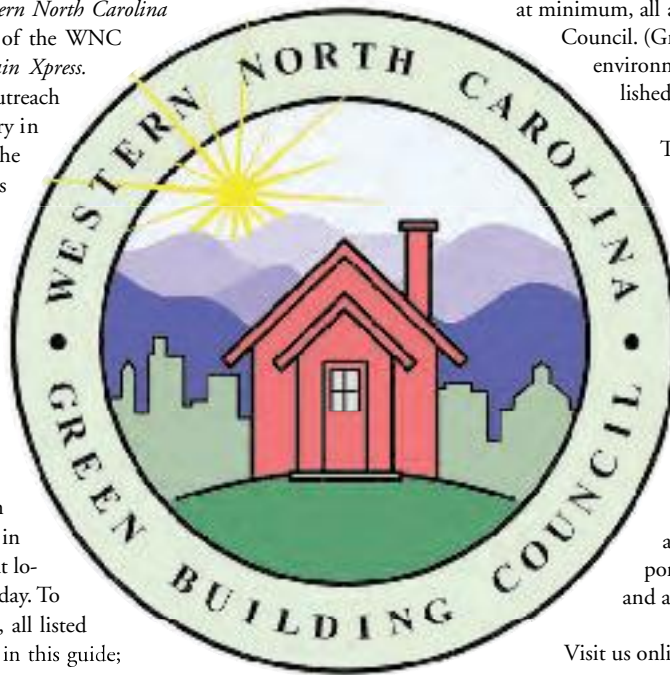
Building a legacy

And building green in WNC

BY MAGGIE LESLIE AND MATT SIEGEL

Welcome to the eighth edition of the *Western North Carolina Green Building Directory*, a co-production of the WNC Green Building Council and the *Mountain Xpress*. Consider this guide a tool for education, outreach and expansion of the green-building industry in WNC and a free, non-biased resource of the latest information for the general public as well as building professionals. Articles include technical fact sheets for professionals as well as case studies and green-building “basics” that help homeowners get started creating or renovating a home. Within these pages are the blueprints and maps to help make your green-building projects successful.

For those of you ready to take that next step and either build a new green home or green your existing home, the business listings in this guide connect you with the many great local companies that are greening WNC each day. To prevent green washing as much as possible, all listed businesses must meet specific criteria to be in this guide;



at minimum, all are members of the WNC Green Building Council. (Greenwashing describes businesses that claim environmental responsibility but fall short of established best practices.)

The WNC Green Building Council also offers a free hotline, online resources, and assistance through many programs. If you're building a new home, the WNC-GBC can help you through the process of certifying your home through NC HealthyBuilt or LEED-Homes. If you're renovating, consider the new Green Gauge Assessment or our Neighbor Saves team-based weatherization program. Look for profiles of these programs in this directory.

In the coming year, the WNCGBC will also be adding many online educational opportunities, including on-demand webinars and a video library.

Visit us online at WNCGBC.org.

THE 2012 WNC GREEN BUILDING DIRECTORY IS DEDICATED TO
Margie Meares



Margie was a long-time clean air and environmental quality advocate for this region. In recent years she worked for Mathis Consulting helping to educate the building community about energy efficiency and improve the energy code. From the Governor of NC to the thousands she taught, her efforts and accomplishments will be realized for years to come.

Thank you, Margie you will be missed.

“Margie was passionate and she had HUGE vision. But she also had the work ethic, follow-through and people skills needed to turn her visions into reality.”
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People breathe — houses should too

BY ISAAC SAVAGE

People need to breathe. And people perform best when the air they breathe is clean, high in oxygen and low in carbon dioxide. With the growing awareness of personal health and the role that air quality plays in this equation, combined with the rising interest in creating more efficient houses, what we breathe in our homes has never been more important than it is right now.

For years, building codes have required outside-air ventilation in commercial buildings for the benefit of those who occupy the given facility. To ensure this indoor air is “good,” one of the requirements involves diluting the indoor air with outside air, typically introduced through the heating and cooling systems. Thank goodness we’re all being looked after when we’re at the office, out shopping or visiting the doctor’s office.

Unfortunately, we go home to our poorly ventilated residences, where we breathe less-desirable air for the remainder of the day, and all night while we sleep. Residential ventilation systems are *not* required by building code. Therefore, few homes actually have any form of outside-air ventilation at all. The typical heating and cooling system simply recirculates the same air, over and over again. If people didn’t like to bring pollutants into their homes, this wouldn’t be that big of an issue. But most people introduce a variety of things into their homes that off-gas harmful pollutants: paint, carpet, stains, cleaning products, dry-cleaned clothes, fabrics, furniture and, the most telling of all, artificially scented “air-fresheners” used to cover up other pollutants.

Most residences rely on gaps and spaces in the walls, floors and ceilings to provide air-exchange. The problem with this scenario, beside the fact that the air is coming from places like attics and crawlspaces, is that sometimes the house doesn’t leak enough, and sometimes it leaks too much. Generally speaking, houses leak too much in the winter, when the extra ventilation creates high energy bills, and don’t leak enough in warmer weather, resulting in poor air quality for much of the year. The only way to have an efficient home that is also properly ventilated is to seal up the leaks you can’t control and install a ventilation system that maintains the right amount of air exchange all year long, regardless of the weather.

Emerging industry standards

Widely accepted and supported by organizations like the Department of Energy, as well as the EPA’s ENERGY STAR program, a residential ventilation standard is finally being embraced. The American Society of Heating, Refrigerating and Air-Conditioning Engineers has published the residential ventilation standard, ASHRAE 62.2. This standard addresses both “local,” or “spot” ventilation (exhaust fans located in

kitchens and bathrooms), as well as “whole building” ventilation systems, designed to dilute indoor air with air originating from the outside.

The standard covers a few main aspects of ventilation systems:

- Quantity of local ventilation
- Quantity of whole-building ventilation
- Sound-level thresholds of ventilation fans

This standard can be used for both new and existing buildings. The new construction requirements are relatively straightforward, while the existing home calculation methods are a little more complex.

Local ventilation

The purpose of local ventilation is to remove pollutants at the source. The two areas that ASHRAE 62.2 focuses on are kitchens and bathrooms that have a tub

or shower. Moisture is the pollutant in bathrooms, while both moisture and by-products of cooking are the main concern in kitchens. ASHRAE 62.2 allows for these pollutants to be managed using a continuously operating exhaust fan or an intermittent fan, used only when needed. The minimum airflow requirements for local ventilation are listed Figure 1.

Whole-building ventilation

Whole building ventilation should dilute interior pollutants by creating an air exchange within the home. This can be achieved by one or more of three basic methods:

- Exhaust-only: Exhaust fans remove air from the building. As a result of exhausting air, outside air is sucked into the home to replace the air that was just exhausted. Replacement air typically enters through the holes in the building nearest the location of the fan, which may result in poorly distributed ventila-

ASHRAE 62.2 LOCAL VENTILATION AIRFLOW REQUIREMENTS

	BATHS (FULL)	KITCHEN
Intermittent	50 cfm	100 cfm
Continuous	20 cfm	5 ACH

FIGURE 1

SONE LEVELS OF COMMON NOISES

SOUND LEVEL SITUATION	SONE LEVEL	HOW WE FEEL
Traffic Noise	8.0	Conversation with added noise
	7.0	
	6.0	
	5.0	
TV/ Radio	4.0	Normal Conversation
	3.0	
Calm Office	2.0	
	1.5	
Night In Suburbs	1.0	Comfortable Zone Free From Noise
Rustling Shrubs	0.5	

FIGURE 2

SONE RATING LIMITS OF 62.2

	LOCAL (SPOT) INTERMITTENT	LOCAL (SPOT) CONTINUOUS	WHOLE BUILDING
New Fans	3.0	1.0	1.0
Existing Fans	N/A	N/A	1.0

FIGURE 3

tion air. This method is also not recommended for moist climates, where pulling moisture through building assemblies is not desired.

- **Supply-only:** This method brings in outside air through mechanical means, generally connecting with the heating and cooling system's ductwork. This method creates a positive pressure in the home, which is ideal for moist climates, as it will not pull in moist air through the building envelope. The disadvantage is that the incoming air is not conditioned when the HVAC system is not running and thus may cause minor comfort problems.

- **Balanced:** This method generally utilizes a heat-recovery ventilator or energy-recovery ventilator. Both of these devices move air out of the home and into the home, creating an air exchange that is pressure-neutral. These devices also pre-condition the air by transferring heat (HRV) or heat and moisture (ERV) from one airflow pathway to the other. This can reduce loads on the building and reduce energy consumption during extreme weather.

To determine the amount of whole-building ventilation, ASHRAE 62.2 has provided a simple equation to determine the cubic feet per minute required:

CFM Ventilation = 7.5 cfm/person + 1 percent of the building's square footage.

To determine the number of people, count the number of bedrooms, then add one. For example, a three bedroom house would have four people, a four bedroom house would have 5 people, and so on.

For existing homes, ASHRAE 62.2 has a special section called the "Alternate Compliance" section. This section allows deficits in local ventilation to be compensated for by increasing the amount of whole-building ventilation. This can come in handy if you already have fans installed, but they are not meeting the 50/100 cfm local-ventilation requirements.

The Alternate Compliance section also allows you to decrease the amount of whole-building ventilation if your home's natural air leakage is greater than 2 cfm per 100 square feet of floor area. This air leakage must be measured using a blower door, a device that quantifies the leakiness of a home's building envelope.

Sound-level thresholds: ASHRAE 62.2 assumes that if fans are noisy, people won't use them as often. So, the goal is to have a quiet fan that moves the right amount of air. ASHRAE has specified the sound-level requirements in terms of Sone.

To put things into perspective, Figure 2 shows the Sone levels of common noises.

Figure 3 outlines the ASHRAE 62.2 sone limits for ventilation fans.

There are many possible ventilation-system designs that will satisfy the ASHRAE 62.2 requirements. Some cost more to install than others; some cost more to operate. There are exhaust fan controls on the market that cost as little as \$20, while ERV installations can easily cost \$2,000. The best advice

I can provide is that you work with a ventilation design specialist who can help determine a solution that fits your goals.

Every house is different. When it comes to ventilation, there is not a one-size-fits-all solution.

Isaac Savage is founder and principal of Home Energy Partners, an Asheville-based building performance contracting firm.



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Do it right, do it now

Insulating your existing home

BY MATT SIEGEL

Adding insulation to an existing home can be one of the absolute best investments toward energy savings. But before you tap the nearest insulation contractor, **read this first.** There are many things to consider to help make the most of your investment. There is also a variety of insulation options depending on the application, whether you want to do it yourself or hire a contractor, and the construction of your home.

The first question is simplest: Does your home need more insulation? Just because you have an old home doesn't mean it is lacking in insulation. (By the same token, just because you have a relatively new home doesn't mean you couldn't use more.) However, since North Carolina only adopted insulation requirements into its building codes in the mid-1970s, any home older than that is unlikely to have adequate levels. So, if your house was built before then, consider that range a good starting place.

There are three areas where a house should have insulation, and we'll address how to approach each location. The first universal rule to apply before adding insulation anywhere: Minimize air leakage into the building envelope. The effectiveness of additional insulation will be dramatically increased if you do so. Proper installation and using the right material are more important than the quantity of insulation.

Attic insulation

This is one of the most cost-effective and long-lasting energy upgrades you can make in a home. Since heat rises, it makes sense that the ceiling is where most heat is lost.

First step: Determine the "R-value" of your existing insulation. R-value is the amount of resistance to heat flow a particular material has. The higher the resistance, the better. To find the R-value, measure from the ceiling to the top of the insulation. If you have cellulose, aim for 10 inches; for fiberglass, try for 14 inches. If you have much less than that, it is worth adding more.

Again, make sure to air seal all the holes between the attic and the house *before* adding insulation. Common air-leakage sites include plumbing and electrical penetrations, around chimneys, can lights and dropped ceilings.



Out with the old: Held in place by little more than lengths of wire, most older fiberglass insulation sags over time. Spray-foam insulation is more effective — but can be more expensive.

FILE PHOTOS

There are a few different options for attic insulation: loose blown-in cellulose; blown-in fiberglass; fiberglass batts; and spray foam. For the DIYer, the first three are doable but demand more time and may only save a small amount of money compared to hiring a professional.

Whether you do it yourself or hire someone, it's important to make sure all areas of the attic are filled evenly and as fully as possible. While a level of R-38 is a target in our region, going beyond that is not a bad thing. The major cost and effort is in the preparation, and since this will likely only be done once every few decades, why not add a little extra?

Spray foaming the roof deck of a home is another option, making your attic a semi-conditioned space (this should be performed by a contractor). Spray foam is best if there is heating or cooling equipment and/or duct work in the attic.

Underfloor

One misconception about underfloor insulation is that floors won't feel cold once it's installed. It may

reduce the difference between your body temperature and the floor, but unless it's 100 degrees in your crawlspace, your floors will never feel warmer than your bare feet. That said, it is certainly beneficial to keep all the heat or coolness in your house that you can, and underfloor insulation can be relatively inexpensive.

First Step: Did I mention you should always air seal before you insulate? If you already have insulation, you can find common holes by following plumbing and electrical lines and looking for discolored insulation. If you already have insulation, make sure it is paper-side up to prevent moisture issues, and is securely touching the floor. Otherwise it is not nearly as effective.

Options: Fiberglass batt is the most common, though least effective underfloor insulation. It is inexpensive and relatively easy to install. But there is a downside, literally: It is almost impossible to install properly so that it is touching the underside of the floor completely and is not compressed. The other problem is gravity. I have never seen fiberglass batts

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how to



Headroom: Insulating your attic is one of the most cost-effective and long-lasting energy upgrades you can do in your home. A first step is measuring the depth of existing materials.

that are still completely touching the underside of a floor within five years of installation, since they are generally only help up with a thin wire. The best, though much more expensive alternative, is spray-foam insulation, which is sprayed under the floor and completely air seals as well as insulates.

dense-pack cellulose and fiberglass do not air seal, per se, as the foam and aircrete do, the density of the material does impede air flow in the cavities. All types of insulation achieve about the same R-value in existing walls. You must consider whether a high-pressure, dense-pack application will result in cracking of old plaster or nail pops in drywall. Make sure your installer has considered this, and ask for references for similar homes.

Walls

These are obviously the hardest places to add insulation once the house has been constructed. A wall is also the most difficult place to air seal. Therefore, it is usually the last place to get done. Unless you are tearing off the drywall or plaster, you are not going to be air sealing the wall cavities. Also, this is one area that a professional installer is absolutely necessary. Have a professional use a thermal-imaging camera to make sure insulation has filled all voids in the wall.

First Step: Check to see if there is insulation in your walls. Do this by drilling a 3/4-inch hole in a closet. I was pleasantly surprised when I discovered my 1927 home was insulated when the siding was replaced — which, by the way, is a perfect time to insulate walls.

Safety: If you are going to install insulation yourself, be well prepared and take every safety precaution. You won't be able to enjoy your increased comfort or energy savings if you're laying in the hospital. The first thing to look for, or have a licensed electrician look for, is faulty wiring. This includes aluminum or knob and tube wiring. Some older wiring may need to be replaced before you can insulate. To reduce the potential of creating a fire hazard, use a good quality respirator, gloves and coveralls when spending time around any insulation or in an attic or crawlspace.

Now you can contact one of the great insulation contractors in this directory, or go on your own insulation adventure to get the biggest bang for your buck, increase your health and comfort, and save energy and money.

Options: The variety of suitable materials include blown-in fiberglass, blown-in dense pack cellulose, "aircrete" and pour-in-place foam. In all applications, holes are drilled to access each wall cavity between studs. While

Matt Siegel is director of the WNC Green Building Council. He can be reached at matt@wncgbc.org.



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THE GREEN YOU KNOW: Building locally? Use local builders

BY SEAN SULLIVAN

For thousands of years, the “tailgate market” concept has been the way that small-scale contractors have done business. A local customer base is how we have survived through the generations. But the terms seem to be changing and the scale is shifting.

For example, a frustrated subcontractor contacted me recently about how he had been passed up for a large project in our area by an out-of-town contractor. He exemplifies a sobering trend: low-priced competition from anywhere and everywhere usurping local markets. While this has been common practice in commercial construction for years, the problem has become more frequent and severe. What good is it for our legislature to fight for projects, or to provide tax incentives, if our local construction industry doesn't get the work?

The impact is dramatic when you consider that the food chain of architecture carries to engineering firms, then to general contractors and subcontractors and finally to the vendors and the jobs

that are associated with each phase. Using that perspective, is “green” about soliciting the cheapest price from anywhere in the nation, or is it about providing jobs and using local resources — in other words, buying locally?

In residential construction, the problem becomes even more troubling. Our market has been flooded with every builder, subcontractor and handyman who has ever heard of Western North Carolina's promise. Building in the mountains is difficult. Experience is important. Too often, I hear about homeowners hiring builders (or subcontractors) based solely on price (or estimated price), regardless of their experience in the local market.

An example from a couple of years ago provides a cautionary tale. I was building a home near a creek. A builder from out-of-state was constructing a nearby home and hit a natural spring during excavation of the site. Neither he, nor his grader, knew what to do, so the builder drove over to my job and offered

to employ my grader. I see this all the time while estimating projects. Without enough experience in the market, builders cannot reliably price a project.

If you live in WNC, you probably enjoy its beauty and uniqueness. The region seems to inspire environmental stewardship. While the retail market may be competitive worldwide, residential construction should not be. An important aspect of building green means using local resources. For us, that means using experienced builders, trades and products from here and those that contribute to our own local economy. Any way you slice it, buying local is the original “green.”

Sean Sullivan is an Accredited Master Builder and past president of the Asheville HBA. He is currently the Region X VP of the NCHBA. His firm, Living Stone Construction, is mission-motivated and value-driven to meet the budget of any client. To learn more LSC, you can visit livingstoneconstruction.com.



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Choosing a green home

BY MIKE FIGURA

If you are in the market for a green home, you're in luck. Unlike many other regions in the country, you'll not only be able to find a green home in Western North Carolina, you'll have many options. The following checklist below can help you approach the purchase.

But first things first: Determine if you prefer a new or an existing home. Many people prefer new green homes because newer structures require little maintenance and were built energy-efficient from the start. Conversely, some prefer the charm of a historic home or cannot afford a new construction. While it is possible to buy an existing home and make it green, the following guidelines are for someone who is buying a new green home. If you want to buy an existing home and make it greener, consider hiring a building scientist to perform an energy audit of the home to give you ideas for how to make it more efficient.



Earth friendly: In West Asheville, the Gaia community features NC HealthyBuilt Homes like this one, done in the locally common Arts and Crafts style — with solar.

PHOTO BY MIKE FIGURA

NEW GREEN HOME CHECKLIST

Third party rating system

Green-home rating systems are the best way to ensure you are buying a home that has green elements. Locally, the most popular rating systems are ENERGY STAR, NC HealthyBuilt Homes and LEED for Homes (Leadership in Energy and Environmental Design). These rating systems are based on checklists of required and optional features. When purchasing a third-party-rated home, ask for a copy of the checklist specific to that home.

Indoor air quality

Look for homes that used paints and adhesives with no or low volatile organic compounds, as well as formaldehyde-free materials and low-VOC finishes. Give preference to homes that have fresh air introduction. A home with an energy-recovery ventilator will bring in fresh air without losing all of your heated or cooled air. If you have chemical sensitivities, consider hiring a specialist who can build a home that is safe for you.

Energy

Homes that are certified green built are energy efficient. Keep in mind, the lower the HERS Index (Home Energy Rating System), the better. The HERS Index measures how efficient a home is compared to today's building code, with a score of 100 being the baseline. A house with a HERS Index of 90 uses 10 percent less energy than a house built to the standard building code, and a house with a HERS Index of 40 uses 60 percent less energy. Also look for homes that incorporate passive solar design and renewable energy systems.

Water usage

Look for homes that have low-flow plumbing fixtures. Also look for homes that come with rain barrels or rainwater cisterns.

Materials

Green homes can be built with locally produced materials, recycled materials, low toxicity materials, rapidly renewable materials or conventional materials. Some materials last longer than others, making them "greener" because they will be replaced less. Ask the builder about the green elements of the materials that he or she used.

Location

Homes that are walkable to goods and services reduce your driving distances, allow you to walk/bike to places and make using public transit possible. Homes that are on large plots of land in the countryside help to protect our mountains from suburban sprawl.

Labor

Green homes can be built by laborers who are paid minimum wage or by skilled craftsmen who are paid a living wage. The adage "You get what you pay for" applies when buying a home. Homes that are built by well paid craftsmen are generally better constructed.

Mike Figura, owner and broker of Mosaic Community Lifestyle Realty, is an ECO Certified Realtor. Mike's commitment to sustainability extends to all of his transactions. When he helps someone purchase an existing home, he hires the Build Smart Alliance to perform an energy audit of the house as a gift.

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