

Award-Winning Coverage of Sustainable Construction, Products and Lifestyles

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GREEN HOME OF THE YEAR AWARDS

This year's top homes demonstrate the fearless creativity of the nation's best builders and architects. These eight stellar, innovative homes set the highest standards for energy efficiency and performance.



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EDITOR'S NOTE

The Inside Scoop

By Matt Power
Editor-in-Chief

At the Local Level, Sustainability Rules

Outside the D.C. bubble, politicians see green issues as common sense priorities.

BY MATT POWER

I'M ALWAYS EXCITED to introduce you, our readers, to some of the best green projects of the year. And yes, once more you're going to see some real showstoppers in our annual awards lineup. But before you get there, I want to mention what happened in Orlando in January, when we held our first Sustainability Symposium.

First, the event almost sold out. More importantly, we witnessed some remarkable moments: A Democrat and a Republican mayor on stage, having a conversation. No hostile exchanges. No finger pointing and insult hurling. Democrat Dr. Phillip Stoddard from South Miami and lifelong Republican James Brainard from Carmel, Ind., showed us how two different American towns are managed. On issues as diverse as affordable housing, traffic circles to reduce gridlock and creating resilience for worst-case climate scenarios, the two men found complete agreement. In fact, so harmonious were their responses that they occasionally finished each other's sentences.

If this is possible, why is such bitter, partisan conflict playing out at the federal level of government? I think the answer is simple: Mayors see themselves as public servants. Federal politicians see themselves as policy dictators.

At the local level, the mission is clear: Keep the water clean. Keep people safe and housed, address natural threats before they become



disasters, and make life better for the greatest percentage of the population.

At the state level, governors sometimes—but not always—follow the same game plan. A good example is Martin O'Malley, who just finished his term in Maryland. He broke new ground with many sustainability initiatives. "But not a single one of them," he told the crowd in Orlando, "involved any help from the executive branch of the government."

The closer you zoom in to any place in the U.S., the better things look, and the more you can see forward motion on sustainability. Solar jobs are booming, electric cars are selling like wildfire, and more homes than ever will be built to net-zero standards.

The reality is that nearly ALL of the economic opportunities of the future lie in green industries. The fact is that U.S. manufacturing now represents just 8 percent of total jobs nationally. For the populist dream of making things in America again to become reality, there's no better prospect than building solar cells, wind turbines and hydroelectric generators.

If you want proof that localism is where the action is, take a look at this year's Green Home of the Year winners. You'll find some beautifully designed homes that take energy efficiency very seriously. I'm especially intrigued by this year's grand winner, the Montana Ranch Residence. It's an "alternative" home with a green roof that's mostly underground. It includes geothermal HVAC as well, a technology that has really come of age in recent years.

Think of these eight homes as islands of hope in a sea of dystopian thinking. Sure, not every American can afford a custom, one-of-a-kind home, but these projects are full of good ideas that can be replicated in other floorplans or existing homes.

Let's not forget, as we go about our daily business of assembling sticks and bricks and SIPs and ICFs, that our industry plays a major part in climate change. Every time we raise the bar with a new or remodeled home that requires fewer resources to operate, we create a "conservation ripple" that may carry on for decades. It's the one legacy, other than educating the next generation, that's guaranteed to have lasting value. Thank you all for your beautiful work, your willingness to lead the industry and your willingness to share such high artistry with your peers. **GB**



Tiny champ. One of our award winners this year is the rEvolvE House, a "tiny home" built by undergraduate students at Santa Clara University in California.

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A GAME CHANGER FOR GREEN HOME CONSTRUCTION

An interview with Green Building Consultant Carl Seville of SK Collaborative on exterior continuous insulation

Q Let's start with SK Collaborative. Tell us about your firm.

A We are a green building consulting and certification company. We certify single and multifamily projects under all green building programs including LEED for Homes and Neighborhood Development, EarthCraft House, National Green Building Standard, ENERGY STAR, and Enterprise Green Communities. We also provide professional training, and curriculum and technical writing for the construction industry. We provide certification services throughout the eastern US in both the affordable and market rate sectors.

Q You're a leading authority on single- and multi-family green building. How do you work with homeowners, architects and manufacturers to create better buildings and products?

A Working with our clients from as early in the design process as possible, we recommend products and systems that will help our clients' building perform better while maintaining budget pressures. We provide energy modeling services to assist in determining the most appropriate products for each project, weighing building envelope and system efficiencies for highest performance.

Q Talk to us about the building science of managing condensation within walls, and why this is important for professionals or homeowners seeking to build an energy efficient home?

A The key to managing condensation is a combination of air sealing and vapor retarders where appropriate. Air leakage is the main cause of interstitial condensation – either from the exterior or the interior, depending on the climate. In most US climates, vapor retarders are not recommended in walls since walls tend to dry to both the interior and exterior, depending on the season. In extreme cold climates with limited or no air conditioning, vapor retarders can help avoid condensation in walls. In moderate climates, air sealing, particularly from the exterior using products such as ZIP System® sheathing and tape, helps keep airborne vapor out of structures.

Q How do prescriptive code changes in the 2015 IECC guidelines address the issue of thermal bridging which impacts energy efficiency?

A The 2015 IECC requires continuous insulation for thermal and moisture management in exterior wall cavities using the prescriptive path in climate Zones 6 and above. In Zones 3, 4 and 5, using continuous insulation with R-13 cavity insulation allows for a thinner wall than meeting the requirement of R-20 in a cavity. Using foam insulation helps keep the interior surface of the sheathing warm in cold weather, reducing the possibility of condensation on this surface, between the insulation and the sheathing. Cold sheathing without continuous insulation has a high risk of interstitial condensation of any vapor moving from the interior of a home through the exterior walls. In a typical wood framed wall without exterior continuous insulation, thermal bridging occurs at each stud, plate, and header, reducing the effective overall R value of the wall well below the rated value of the cavity insulation. By adding a layer of continuous insulation, the thermal bridging is eliminated improving the overall efficiency of the wall higher than the rated value of the cavity insulation.

Q How long have you used products from Huber Engineered Woods? How about ZIP System R-sheathing and tape, specifically?

A I have seen and worked with AdvanTech® sheathing for many years. My first experience with ZIP System sheathing and tape was during the renovation of my current house in 2013. I used it on the exterior walls and roof and was very pleased with the weather and air barrier properties. The house I am currently building will use ZIP System® R-sheathing with built-in R-3 insulation on the exterior walls, and ZIP System® sheathing on the roof and on the top of the second floor ceiling joists; this is a passive house style technique that will allow me to create a complete air seal on the exterior surface of the walls and ceiling, avoiding problems with ceiling penetrations, such as lights.



Carl Seville is a green building consultant with SK Collaborative in Decatur, GA.

Q What building methods did you use before you made the switch?

A The last house I built used OSB on corners where needed for structure and ½” XPS on all other exterior walls. Prior to this new home, I typically used or suggested my clients use spray foam on rooflines to create a well sealed building envelope. This project will be using ductless HVAC systems, eliminating the need for a conditioned attic. In this project, I will be using fiberglass insulation, limiting the use of spray foam to miscellaneous sealants.

Q How has using ZIP System® R-sheathing and tape changed your approach to designing and building the outer shell, or building envelope, of homes?

A ZIP System R-sheathing allows builders to create a tight building envelope prior to installation of drywall. With the appropriate design, it is possible to test for envelope leakage before any insulation or drywall is installed, identifying leaks before it is too late to seal them properly.

Q Why is a product like R-sheathing – that provides structure, thermal resistance, air leakage protection and moisture resistance – a “game changer” for green home construction?

A In any situation where continuous insulation is necessary or desired, the one step method using ZIP System R-sheathing is significantly simpler and less costly than installing multiple layers of OSB and foam to achieve the same results. In addition, eliminating the separate weather barrier further reduces installation cost.

Q Why did you choose this product for this particular house? (Or, what type of impact do you expect R-sheathing to have on the performance of this home?)

A LEED and ENERGY STAR certification require either advanced framing or continuous insulation. I will be incorporating both, however even the most advanced framing cannot eliminate all thermal bridging, so the use of continuous insulation will make a well-insulated a building envelope as is practical in my relatively mild Zone 3 climate. Traditionally, continuous insulation is installed on top of a home's structural sheathing in separate steps, requiring multiple trips for the crew around the building. One step to install the sheathing, another to install the rigid insulation, and another to install the weather barrier. Using ZIP System R-sheathing allows a crew to install the insulation, structural sheathing and weather barrier in a single step.

Q What are the benefits of using R-sheathing in a southern market compared to its insulation benefits in northern climates?

A In cold climates, installing continuous insulation such as R-sheathing can significantly reduce thermal bridging at framing members, significantly improving the overall thermal performance of exterior walls, particularly during periods of severe cold. The benefits of R-sheathing are not as significant in warmer climates, nor during moderate weather in cold climates, since the delta T (temperature differential) between the interior and exterior are relatively small. There are moderate benefits year round, and the combination of continuous insulation and comprehensive air sealing will help maintain indoor temperature during severe cold weather. R-sheathing provides a level of passive survivability should a home lose electricity during a severe cold snap.

Q Why did you decide to certify the house as LEED Version 4?

A The city I live in, Decatur GA, included a requirement for green certification for all new buildings and major renovations in a comprehensive development ordinance adopted recently. Options for homes include LEED, EarthCraft, and NGBS. Having done numerous projects in the second two programs, and several LEED V2009 projects, I decided it would be educational to certify under LEED V4, before we are asked to provide this service for our clients. Having been one of the main contributors to the LEED reference guide, it is interesting to now be using it to certify my own house. There are some significant improvements in the new program – obviously the USGBC learned from their experience with the earlier version. I will likely also certify under EarthCraft and NGBS as well.

**For more information on ZIP System R-sheathing, visit ZIPSystem.com/R-sheathing.
Learn more about SK Collaborative at SKCollaborative.com**



Batteries Planned for Gas Generator Raise the Energy Storage Bar

The giant battery banks will be some of the biggest ever built.

RENEWABLE ENERGY COMPANY AES Corporation plans to build the world's largest battery electric power storage plant in Long Beach, Calif., and have it fully functional by 2020. According to Stephen O'Kane, AES U.S. West's director of sustainability and regulatory compliance, the 300-megawatt plant could power 225,000 homes in San Diego County.

Plans call for the construction of three 50-foot buildings at the existing Alamos Generating Station (AGS). Each building would house arrays of lithium ion batteries and cooling equipment. Each building would also require a separate chiller plant and a fire-control system.

The facility would allow AES to store unused power generated during non-peak hours and instantly allocate it to the energy grid when demand rises. In contrast, a traditional gas-fired plant requires extra time to reach full capacity, according to



GREATER SOUTHWESTERN EXPLORATION COMPANY

Power brokers. AES Corp.'s longstanding power plant at Alamos could make way for a massive battery electric power center and more by 2020.

AES Southland President Jennifer Didlo.

The battery plant is one of three projects AES has planned for Alamos. The company also hopes to build a new, 1,040-megawatt natural gas-fueled power plant—the Alamos Energy Center (AEC)—to replace the 61-year-old generating station. The final project would be the shutdown and demolition of AGS, which would begin in 2020 once AEC goes online, Didlo said.

AES Corporation: <http://aes.com>

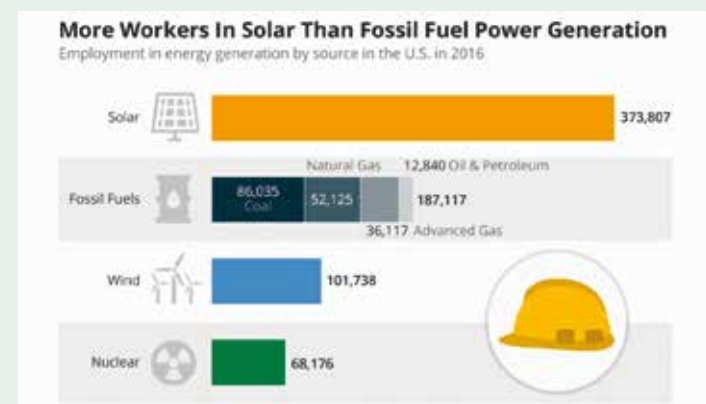
Solar Power Jobs Top Energy Industries

In 2016, more people held jobs in solar than in the top fossil fuel groups combined.

THE NUMBER OF people employed in solar power was nearly double the combined total working in the oil, coal and gas industries in 2016, according to a report from the U.S. Department of Energy. Solar power employed 43 percent of the Electric Power Generation sector's workforce, while fossil fuels combined made up 22 percent.

By numbers, about 374,000 people were employed in solar energy, while coal, gas and oil power generation combined for nearly 187,000. The study, *2017 U.S. Energy and Employment Report*, attributes growth in the nation's solar workforce to construction work related to expanding generation capacity.

In the past decade, solar power industry employment has grown by 5,000 percent, while natural gas jobs grew by 33 percent, and jobs in coal decreased 53 percent.



The second most popular non-fossil fuel energy source, wind, had 101,000 electricity-related jobs in 2016—more than any one of the traditional energy industries.

2017 U.S. Energy and Employment Report: <http://bit.ly/2jlj7Ae>

At the Workplace, a Green Scene Is Golden for Business

A Harvard study shows that sustainable offices make for healthier, more-productive employees.

CHALK UP ANOTHER benefit of being green: It apparently makes you smarter. A study by the Harvard T.H. Chan School of Public Health finds that employees in buildings that are certified green do 26.4 percent better on cognitive function tests than counterparts in non-green offices.



FILICKR/NORMA/TRELLER

Brain power. A certified green building can make employees healthier and more alert on the job, and possibly prevent moments like this.

The study, showed that a green building's natural light and improved temperature control tended to make occupants more productive, according to lead author Piers MacNaughton. A greener building also led to better sleep at night among workers, which kept them more alert and less likely to doze off during the day.

Researchers designed the study as a follow-up to other findings where work productivity was hindered by indoor air quality. In general, employees in non-green buildings suffered more illnesses, and were unable to focus on their jobs. Green buildings have fewer volatile organic compounds, allergens, nitrogen dioxide and other health-impacting compounds, MacNaughton noted.

Source: "The impact of working in a green certified building on cognitive function and health": <http://bit.ly/2iaRsUz>

Tesla, Panasonic Gear Up for Solar Roofing Venture

The companies' high-efficiency panel will be produced at NY factory starting in summer.

TESLA MOTORS AND PANASONIC CORP. will co-produce solar roofing modules in the second half of this year at their new facility in Buffalo, N.Y. In a joint statement, the companies said the effort marks a new direction in their ongoing partnership, which focuses primarily on electric cars and self-driving vehicles.

The collaboration will "accelerate production of high-efficiency, extremely reliable solar cells and modules at the best cost," Tesla co-founder and CTO J.B. Straubel said.

Panasonic said its new photovoltaic panel has a solar energy conversion efficiency of 25.6 percent, compared to the typical panel's 15 to 16 percent efficiency rating.

The production site is the \$900 million, 1 million-square-foot facility built by SolarCity, which Tesla acquired in November 2016. The factory's output is expected to reach 1 gigawatt by 2019. By that point, it will be North America's largest maker of solar cells, employing 1,400 workers, including 500 people in manufacturing, according to the joint release.

Tesla: www.tesla.com; Panasonic: <http://shop.panasonic.com>



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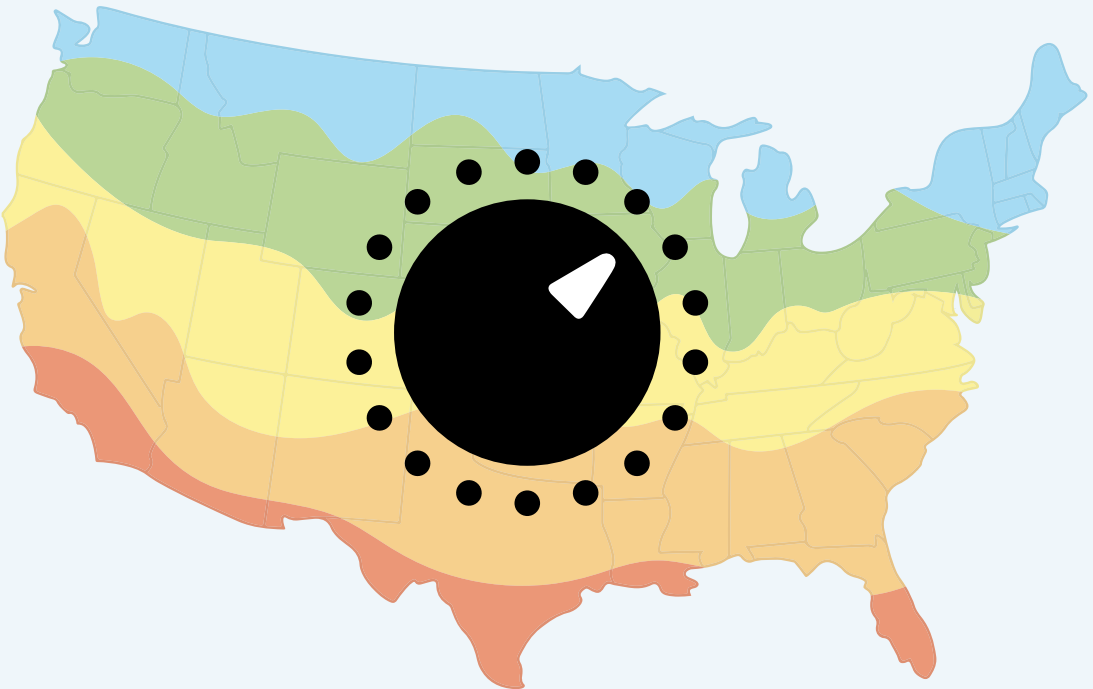
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*This product meets strict energy efficiency guidelines set by Natural Resources Canada and is ENERGY STAR® certified for the Canadian market only.



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“The home is nestled into the earth, which shelters the structure from the strong winds and cold temperatures.”

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ON THE COVER
OAK PARK RIGHT-SIZED HOME
Photographer: Eric Hausman

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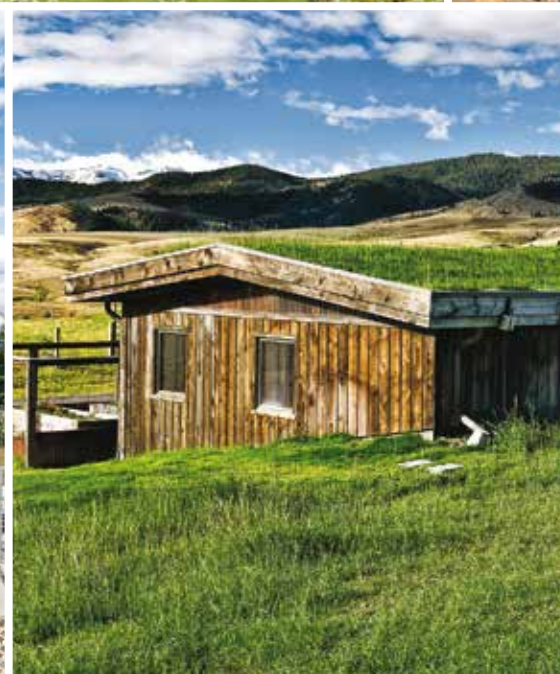
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This year's Green Home of the Year award winners aren't just projects that honor sustainability. Some of them are literally one with the environment. **OUR EXPERT PANEL OF JUDGES** evaluated projects in terms of overall sustainability, resilience, synergy with the environment and surrounding neighborhood, affordability, creativity and the depth of building science employed. We hope you enjoy this exemplary, unique array of green homes.



Green Home of the Year Awards 2016



Terry Beaubois has been engaged in research and the application of advancing technology to architecture

throughout his career. He has designed many single-family homes and has been involved in the architecture of hotel/resort buildings and medical facilities worldwide, and with many Silicon Valley high-tech facilities. Working extensively with building product manufacturers and partnering with publishers, he created some of the first websites and virtual reality projects in the building industry. As founding director of the Creative Research Lab at Montana State University, he was the MSU project director of the REHAU-Montana ecoSMART House Project. The project was awarded Montana USGBC Honor Award Project of the Year in January 2016, as well as a Green Builder Home of the Year Award. He is CEO of Internet startup BKS (Building Knowledge Systems LLC) and is an adjunct lecturer at Stanford University.

www.buildingknowledgeusa.com



Bob Kingery co-founded Southern Energy Management in 2001 with his wife Maria and served as its president for 16 years. With 28 years

of experience, contacts and expertise in sustainable energy, he is an industry veteran who understands what drives long-term success in this rapidly growing and constantly evolving field. He is also part of the founding team of Burt's Bees in North Carolina and was instrumental in turning the company from a \$1 million niche business into a \$60 million world-class natural cosmetics manufacturing company. He got his start in the solar energy industry working as an installer and designer for Solar Consultants, and later as a designer and fabricator for Astron Energy. He is a multi-term board member of the North Carolina Sustainable Energy Association and founding member of the DOC Home Builders Association's Green Building Initiative program.

<http://southern-energy.com>



Anthony Maschmedt, a principal of Dwell Development, has more than 13 years' experience building homes in the Greater

Seattle area. He is an advocate for sustainable design and green construction and continues to push the envelope with innovative construction methods that have positively influenced city building practices. As a lifelong Seattleite, he has a deep commitment to creating communities that bring together like-minded individuals who value sustainability and modern design. He has served as board chair of the Master Builder's Association of King and Snohomish Counties' Built Green Residential Building Program since 2014. He is a key member of the Columbia City Business Association and is sought after in the Seattle sustainable community to promote and share Dwell Development's green agenda.

www.dwelldevelopment.com



Colby Swanson is a serial entrepreneur determined to help the residential industry build smarter, faster and more equitably for

everyone. He authored long-term construction strategies for BASF and led many cross-divisional business development endeavors. As a director of Building Performance at Advanced Energy, he led a team that developed an educational platform helping homebuilders to better manage their construction risk with building science. He personally has conducted over 4,000 duct blasters and blower door tests, helped scale the Energy Star for Homes program nationally, and has performed hundreds of building forensics investigations. Additionally, his experience as a framer/builder has given him the opportunity to train thousands of builders and contractors. He is co-founder and current partner at Momentum Innovation Group, a construction consulting firm that helps clients accelerate innovation.

www.momentuminnovationgroup.com

Buried Treasure



For this Montana home, restriction was the mother of invention.

BY JULIET GRABLE

CLIENTS APPROACHED ARCHITECT Mike Wiseman and builder Rob Evans of Constructive Solutions Inc. with a simple task: Design and build a two-story home for their premium parcel near Gallatin Gateway, Mont. The property is on a “bench” overlooking the south end of the Gallatin Valley, with incredible views of nearby mountains and wilderness.

But a viewshed restriction made homebuilding difficult, if not impossible. The neighborhood below had created covenants, one of which stated that any development on the “bench” above must not be visible from their properties.

FROM THE JUDGES

“I love this project – the integration into the landscape, the use of natural materials, the design to withstand the weather of the Gallatin Gateway area. Well done!”

Earth sheltering.

The home is bermed into the hillside, protecting it from wind and weather. Temperatures, with wind chill, can drop to single digits from fall to early spring.

Advantageous siting.

The east-west orientation maximizes views and provides solar gain in winter.

Green roof.

Sod roof seeded with a mix of native plants helps the home blend into the landscape.

Weatherproof cladding.

Durable, rough-sawn fir siding does not require any oiling or maintenance.

Geothermal heating and cooling.

Unlike most heat pump scenarios, an exceptionally deep well allows the ClimateMaster unit to handle water supply and return.

Wiseman and Evans took a 20-foot section of PVC to the site, so they could test potential locations for visibility from below. They learned that anything over 10 feet high was out of the question.

“Well,” said Evans, half joking, “we could bury it.” To their surprise, the homeowners liked the idea. Wiseman began pulling together images of old homesteads and potato barns that were half buried in the ground, some with sod roofs.

The final design, with its heavy roof form and low lines, pays homage to those buildings. The home is nestled into the earth, which shelters the structure from the strong winds and cold temperatures typical of the region.

THE SUN AND THE (ENERGY) STAR

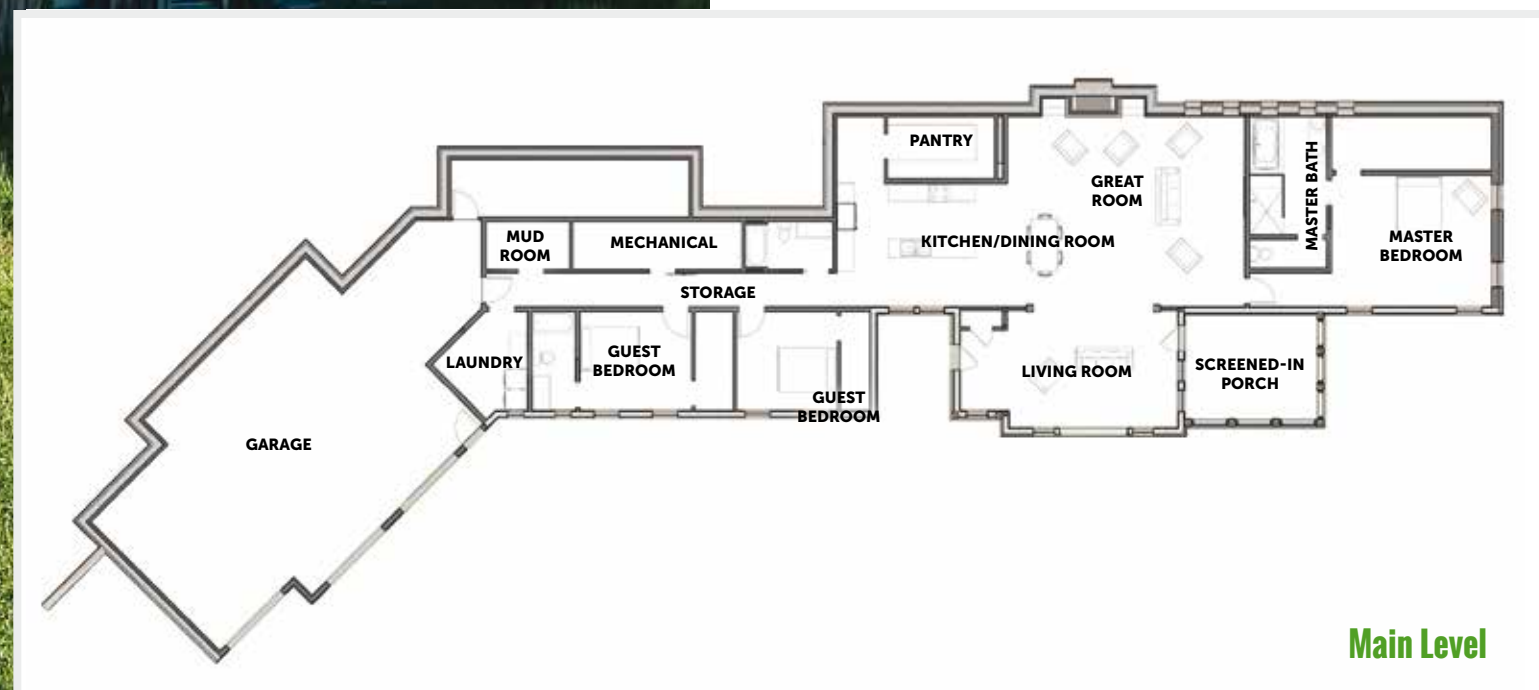
The 3,611-square-foot home is spread along the east-west axis. Though the home was oriented to maximize views of the Spanish Peaks, it turned out to be advantageous to solar orientation as well.

Gallatin Gateway’s home is Energy Star certified and achieves a HERS Index score of 48 without solar, thanks in part to an extremely energy-efficient envelope. The shell is constructed of four main components: buried concrete walls, exposed walls, green roof and thermally decoupled flooring.

The buried walls consist of 8-inch concrete with 3.5 inches of rigid insulation on the exterior (R-15), and a 2-by-4 furring wall filled in with R-13 batts on the interior. The exposed walls are constructed with 8-inch Structural Insulated Panels (SIPs) for an R-value of R-32. The green roof consists of 4-inch Polyiso insulation (R-24) under the membrane, combined with R-30 batts at the roof deck—a system that eliminates unconditioned spaces in the attic. Gaco Western spray foam is used to seal the truss heels and to glue the roof fiberglass batts in place.

Constructive Solutions has been dedicated to Energy Star and HERS for years, and the company owns blower door testing equipment.

“It’s standard for us to conduct two blower door tests,” says





Well protected. Wood trim, stained concrete floors and high ceilings create a warm interior in this bermed house, which is well insulated from the severe Montana weather.



Modern marvel. It may look like a traditional ranch-style Montana home on the outside. But on the inside, the Gallatin Gateway-based two-story is all 21st century.

Wiseman. The first test happens when the house is dried in. Although the ceiling is sheetrocked and taped, insulation has not been installed yet. This allows builders to identify air leaks at the exterior of the envelope, including wall plates and foundation connections that sometimes get hidden by drywall. Leaks are marked during the blower door test and sealed with caulk or acoustical mastic, depending on the location.

HOT STUFF

A 2-inch finished slab provides radiant heating. It is thermally decoupled from the structural slab and walls with 2.5-inch rigid insulation (R-10). This thinner slab is a bit more responsive than the typical hydronic slab, and provides thermal mass benefits.

An open-loop geothermal heat pump from ClimateMaster provides the home's heating and hot water. Most open-loop systems require two wells—one for supply, and a reinjection well for the return water. But the well for this home was so deep it could be used for supply and return. The casing is slightly wider and includes an outside baffle. The supply water flows from the inside; the return water flows down the outside of the baffle. A recirculation pump ensures water doesn't run while waiting for hot water, and a heat recovery ventilator (HRV) provides fresh air while re-capturing heat from the exhaust air.

The home's exterior is clad in rough-sawn fir, which is treated with ferrous sulfate powder to give it an instant patina. The fir planks, which are not stained or finished, are installed using furring strips made from pressure-treated plywood in a kind of "reverse board and batten." The resulting air gap between the fir and the sheathing means the system functions as a rainscreen. The unsealed wood dries evenly and needs no maintenance.

"This system holds up well in dry climates," says Wiseman. "As long as it can dry and dry evenly, it won't rot, cup or buckle." The durable siding holds up to punishing weather events such as hailstorms, and the organic finish complements the overall "homestead" aesthetic, he adds.

The green roof is planted with a mix of natives and is irrigated with a rotary head sprinkler system. It will be watered regularly until the plants are established, then in summer only to reduce the risk of fire, the builders note.

MANY HAPPY RETURNS (ON INVESTMENT)

The design and construction of this home was a welcome challenge for architect and builder. Evans founded Constructive Solutions Inc. in 1999. Wiseman had gone to school with Evans, and in 2008 hired him to build his own house. It turned out to be Montana's first LEED-certified home.

"My goal at that time was to see how economically we could build a LEED-certified home," Wiseman says. He hoped to limit the

cost increase to 5 percent and the return on investment (ROI) on upgrades to 15 years. The actual increase was 6 to 7 percent, with an ROI of 13 years. Wiseman joined the firm in 2010.

Though it may look like a classic ranchstead, the home is thoroughly modern. Smart Home Systems of Montana installed an Interlogix Concord security system that includes carbon monoxide and smoke detectors, low temperature and water leak sensors, a gas alarm and a driveway sensor. Alarm.com provides monitoring, including cameras that can be remote operated.

The interior is warm and spacious, with high ceilings, exposed wood timbers and wood trim. Stained concrete serves as the finished floor for all areas except for the dining room, which is finished with wire-brushed white oak. To increase natural lighting in the interior hallway, Solatube tubular daylighting devices with integral LEDs are housed in "chimneys" on the roof. These also provide collectors for plumbing and mechanical roof penetrations.

"Inside the structure it's dead silent, even when the wind is howling," says Wiseman.

The owners report that they are enjoying the most comfortable home they've ever owned, despite being located in one of the most demanding climates. **GB**

Key Components

ALTERNATIVE BUILDING SYSTEMS:

Big Sky Insulations Inc. (R-Control SIPs)

APPLIANCES: KitchenAid (kitchen appliances); Maytag (washer and dryer)

CABINETS, SHELVES, MILLWORK:

Showplace (cabinets; custom built-in shelves and trim)

CAULKS & SEALANTS:

Big Sky Insulations Inc. (R-Control SIP sealant);

OSI (acoustical mastic)

COUNTERTOPS:

Cambria

DOORS & HARDWARE: Emtex (hardware);

Simpson (doors); **Therma-Tru** (doors)

FIREPLACE: Heat & Glo (CERANA gas fireplace)

GARAGE DOORS: Raynor (ShowCase residential garage doors)

HOME CONTROLS: Alarm.com (monitoring);

Interlogix (Concord security system)

HVAC/DUCTS: ClimateMaster (geothermal heat pump)

INSULATION: Big Sky Insulations (EPS);

CertainTeed (OPTIMA loose-fill fiberglass insulation);

Gaco Western (Gaco 183M closed-cell spray foam)

PAINTS AND STAINS: Benjamin Moore (no-VOC paint);

Sherwin-Williams (low-VOC paint)

PLUMBING/PLUMBING FIXTURES:

Kohler (1.2-gpm faucets, 2.0-gpm showerheads and

1.6-gpf toilets); **Toto** (1.26-gpf toilet)

ROOF: GAF (TPO system)

VENTILATION: UltimateAir (heat recovery ventilator)

WATER HEATING: Geo-Stor (120-gallon indirect tank)

WINDOWS, SKYLIGHTS, PATIO DOORS:

Sierra Pacific (windows and patio doors);

Solatube (tubular daylighting devices with LED lighting)

Project Stats

NAME: Montana Ranch Residence, Gallatin Gateway, Mont.

BUILDER: Rob Evans, Constructive Solutions Inc., www.constructivesolutionsmt.com

ARCHITECT: Mike Wiseman, Constructive Solutions Inc., www.constructivesolutionsmt.com

PHOTOS: Mike Wiseman

Simply the Right Size



For this Chicago-area Passive House, energy performance, durability and health are interdependent.

BY JULIET GRABLE

WHEN ARCHITECT TOM Bassett-Dilley and Evolutionary Home Builders teamed up to replace an aging home in historic Oak Park, Ill., they wanted to pay homage to the region's early 20th-century architecture. They also wanted to design and build a high-performance Passive House. Oak Park, a large suburb west of Chicago, includes homes designed by Frank Lloyd Wright and E.E. Roberts.

FROM THE JUDGES

“Simple; functional; very well thought out. [This is a] strong project to share broadly as renovation becomes more prevalent.”

Non-toxic finishes.

Concrete treated with a zero-VOC finish serves as the finished flooring.

Feedback for occupants.

Energy and IAQ monitoring give owners more control over the health and energy performance of their home.

Certified glass.

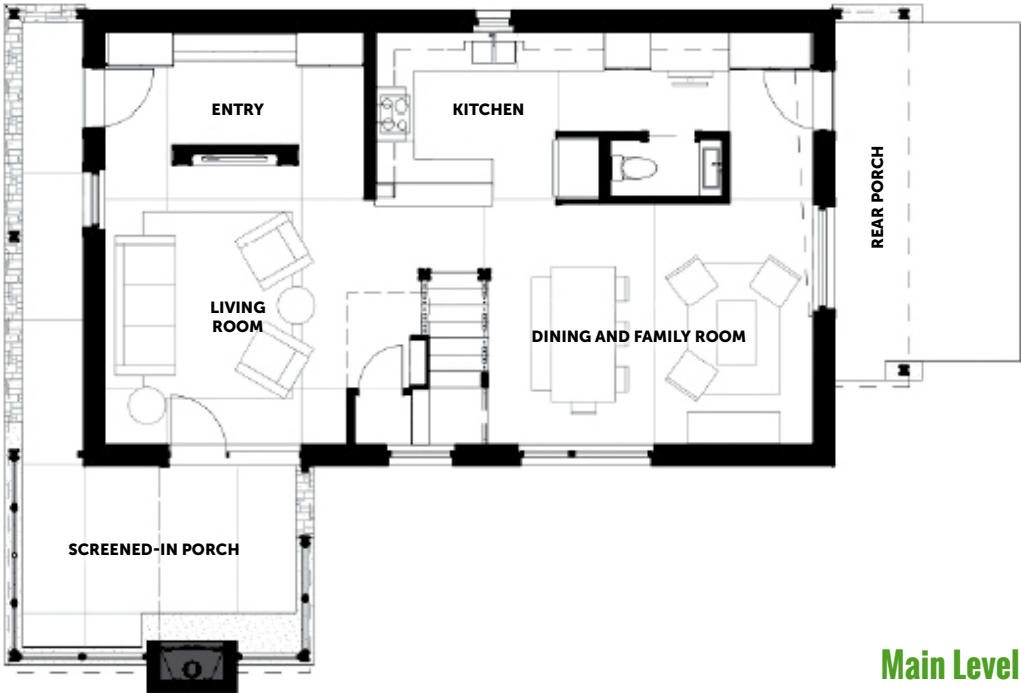
High-performance windows and doors from Zola help the building envelope achieve Passive House standards.



Water ways. If you’re looking for a way to instantly have whatever type of great-tasting water you desire — filtered, still or sparkling — whenever you want, Grohe’s Blue Chilled & Sparkling kitchen faucet does the job. Grohe’s products can be found throughout the Oak Park Right-Sized Home. www.grohe.com

“Simplicity is a common design philosophy for both Passive House and bungalow style homes, and it played a leading role in this project,” says Brandon Weiss, founder of Evolutionary Home Builders. “Pulling off that simplicity took a lot of study and creativity because of its influence on both performance and aesthetically fitting into the neighborhood.”

This “right-sized” Passive House is 1,800 square feet, and sits roughly within the footprint of the original dwelling. With its simple form, exposed knee braces and covered porch, the new house shares elements of the bungalow and Foursquare homes in the neighborhood. But other features, including a distinctive roofline,



Holistic IAQ strategy.

To ensure healthy air, even the furniture is vetted for VOCs and other toxins.



Bringing outside in. A screened porch, which includes a wood fireplace, enhances this passive house’s indoor-outdoor connection.

send a clear signal that this is a modern, 21st-century home.

The home is LEED Platinum and PHIUS+ certified. As such, it uses 90 percent less energy for heating and cooling than a conventional home. The envelope is airtight, superinsulated and free of thermal bridging. Because they were operating within a fairly tight budget, EHB performed a cost-benefit analysis, modeling various wall assemblies to determine the most cost-effective envelope for the specific site that would also yield high performance.

The resulting envelope consists of 2-by-8 wood-framed walls with Knauf *Jet Stream* insulation in the cavities. Liquid-applied Prosoco *R-Guard* seals all joints of the plywood sheathing and provide a continuous airtight membrane. Two layers (four inches) of Atlas Roofing *Polyiso* rigid foam are installed on the exterior. *Delta Vent*, a vapor permeable weather resistant barrier, is installed over the rigid foam, allowing moisture to escape while providing a wind and water barrier. Durable LP *SmartSide* lap siding is installed over a rainscreen, which allows moisture to escape. Zola *Thermo uPVC* triple-glazed windows (R-8) complete the envelope.

ENERGY EFFICIENCY THAT’S SET IN STONE

Unlike most homes in the area, which have basements to safeguard against frost heaving, the Oak Park home was constructed on a shallow, frost-protected concrete slab. This strategy, popular in northern Europe, sees the slab wrapped in foam insulation on all sides and

underneath. A frost skirt also extends outward from the slab.

The benefits of this home’s building shell go beyond energy efficiency. Because it controls moisture intrusion so well, the design ensures the building’s durability and health.

“We know moisture leads to 90 percent or more of building failure,” says Weiss. “Designing and building around these potentials is possible, and will lead to longer lasting, more durable buildings.”

LIKE A BREATH OF FRESH AIR

The interior of the two-story home is serene and airy. Salvaged and reclaimed materials ground the home in its neighborhood. Evolu-

Project Stats

NAME: Oak Park Right Sized Home, Oak Park, Ill.
BUILDER: Brandon Weiss, Evolutionary Home Builders, www.evolutionaryhomebuilders.com
ARCHITECT: Tom Bassett-Dilly, Tom Bassett Dilley Architect (TBDA), www.drawingonplace.com
LANDSCAPE ARCHITECT: Matt Fordham, Environments Studio, www.environmentsstudio.com
INTERIOR DESIGNER: Shawna George
PHOTOS: Eric Hausman

tionary Home Builders carefully deconstructed parts of the original dwelling, salvaging some materials for the new home and donating others. The open shelving in the kitchen, for example, was made from salvaged floor joists, and one of the salvaged sinks now serves as a vanity in the powder room. Overall, the project achieved 92 percent waste diversion.

Indoor air quality was a chief concern of the clients, a view shared by the architect’s and builder’s philosophies. Bassett-Dilley is a leader in high-performance and biophilic design, and Evolutionary Home Builders specializes in high-performance homes, with an emphasis on durability and wellness of occupants.

Some of the strategies that contribute to superior indoor air quality in the Oak Park home include specifying cabinetry and casework with no added urea-formaldehyde, and the use of low-VOC, toxin-free paints and finishes. There is no carpeting in the home.

The concrete slab, finished with *Consolideck* from Prosoco, serves as the finished flooring on the main level. Reclaimed hickory on the second floor is treated with Rubio *Monocoat* zero-VOC finish. There are no combustion appliances inside the building envelope.

A Mitsubishi Electric ductless mini-split heats and cools the home, while a Zehnder energy recovery ventilator ensures fresh air exchange by capturing and expelling heat as needed. Super-efficient bathroom fans from Panasonic help circulate air. The home’s interior design, with the three upstairs bedrooms arranged around a central hallway, also facilitates airflow.

UNDER A WATCHFUL EYE

According to Weiss, Evolutionary Home Builders researches all material that goes into its homes, using Declare Label, GREENGUARD and other third-party certifications for guidance. The firm even specifies and supplies products for its subcontractors. If subs bring in materials of their own, they have to sign a guarantee that these components won’t compromise the building’s health.

Weiss has started another company, Evolutionary Supply & Building Solutions, to distribute vetted materials and consulting to other builders and clients in the region. Inventory includes not just building supplies and products, but furniture, linens, bedding and household cleaning products.

Monitoring the home’s performance and IAQ has become standard service for every Evolutionary Home Builders project. Pre-occupancy testing is conducted over a 24-hour period, so indoor air is tested at different temperature, humidity and UV levels. In addition, Weiss contracts with a third party to provide post-occupancy energy and IAQ monitoring. This includes circuit-by-circuit energy monitoring as well as sensors that monitor temperature, humidity, VOCs and CO₂.

“The testing we’ve done over the years has reaffirmed our choices,” says Weiss. “We have data behind our statements.” Just as important, the monitoring provides real-time feedback for homeowners, so they can see the impact of their choices and change their behavior, if necessary.



Warmly modern. Reclaimed open shelving brings a warm and rustic touch to the kitchen, which features all Energy Star appliances.

Weiss believes that healthy buildings and high performance go hand in hand, and that designing and building a superior shell is the best strategy in terms of upfront costs, energy usage and lifetime carbon footprint. “If done right, the building envelope can last over 100 years without maintenance,” says Weiss.

There’s a health benefit as well. Since the home’s completion in 2015, the homeowners have reported fewer respiratory symptoms. **GB**

Key Components

ALTERNATIVE BUILDING SYSTEMS: Weyerhaeuser (*TJI* joists)
APPLIANCES: Bosch (dishwasher); Jenn-Air (oven and induction cooktop); Zephyr (range hood)
BUILDING ENVELOPE: Cosella-Dörken (*DELTA-VENT S*); Prosoco (*R-Guard* liquid-applied air barrier)
CABINETS, SHELVES, MILLWORK: Columbia Forest Products (*PureBond* no added urea-formaldehyde plywood)
CAULKS & SEALANTS: Prosoco (*R-Guard*); Eco Bond
DOORS & HARDWARE: Masonite (*Emerald Safe 'N Sound* interior doors)
EXTERIOR FINISHES: LP (*SmartSide*)
FLOORING: Prosoco (*Consolideck* concrete finish)
HOME CONTROLS: eMonitor; PowerWise (energy monitor and IAQ monitoring)
HVAC/DUCTS: Mitsubishi (mini-split)
INSULATION: Atlas Roofing (*Polyiso* rigid foam); Knauf (*Jets Stream Ultra Blowing Wool Insulation*)
LIGHTING: Restoration Hardware
PAINTS AND STAINS: AFM (*Safecoat*); Rubio (*Monocoat*)
PLUMBING/PLUMBING FIXTURES: Grohe (faucets); Kohler (faucets); Niagara (toilets)
VENTILATION: Zehnder (energy recovery ventilator)
WATER HEATING: GE (*Geospring* heat pump hot water heater)
WINDOWS, SKYLIGHTS, PATIO DOORS: Zola (*Thermo uPVC* Passive House-certified triple-glazed windows)

Natural Wonder



Committed clients help drive the sustainable design and construction of this lakeside home in Washington State.

BY JULIET GRABLE

WHILE ATTENDING CALIFORNIA Institute of Technology in Pasadena, Calif., Eric Hale used to help the team at Ewing Architects with their computers. Years later, after he moved to Washington State, Hale made good on a promise: He hired Douglas Ewing to design his house.

FROM THE JUDGES

“They made efforts in all areas of design and construction to support an energy-efficient project.”

Dark sky lighting.

Downward-facing exterior light fixtures minimize light pollution, which can disturb and disrupt migrating birds and other wildlife.

Durable materials.

Western red cedar siding and fiber cement panels installed with a rainscreen contribute to a long-lasting exterior.

Permeable parking.

Pavers are designed to allow stormwater to filter back into the ground.

Water conservation.

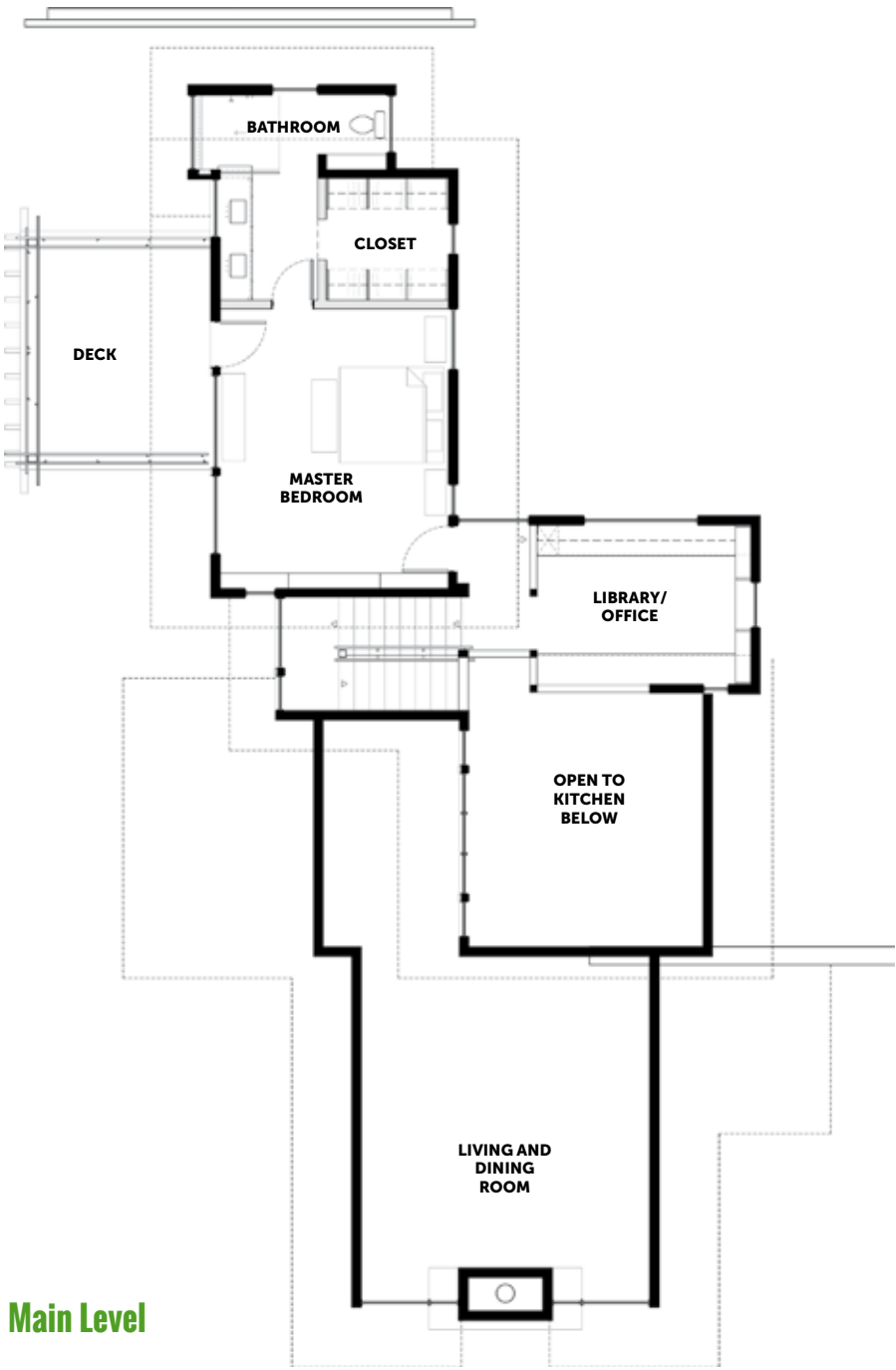
Rainwater collected from the reflective metal roof is stored in a 2,700-gallon underground tank and is used to irrigate landscaping and gardens.

Thoughtful sourcing.

Home components were carefully selected, such as USAP Cem-Clad fiber cement panels and plumbing fixtures from less than 150 miles away, only FSC-certified wood, and countertops made from reclaimed pallets, concrete and recycled glass.

The site is special. Located on Vancouver Lake in southern Washington, it includes mature trees, blackberry bushes and a natural meadow. It is also near an eagle preserve. Hale and his wife, Heather Carpenter, wanted to maximize the natural assets, including spectacular views of the lake. They also wanted to minimize the project’s impact on its surroundings, and to protect—maybe even restore—native habitat.

The couple drove much of the sustainability agenda, including commitments to superior indoor air quality, LED and Dark Sky-certified fixtures, by using only FSC-certified wood, and sourcing





Clean choices. The *Rumford 1000* fireplace, which has earned the EPA Clean Air Excellence award, produces 93 percent fewer emissions than a standard open fireplace.

materials as locally as possible. Though not LEED certified, the home is designed and built to align with LEED standards, and it exceeds all Washington State energy codes.

Ewing served as lead architect for the project. David Law, as project architect, worked with Ewing’s original design and interfaced with the owners and the general contractor, Corner Stone Construction Inc. Law made several trips to Washington during the process.

“It’s always nice to talk to local contractors and find out how things are done in that region,” says Law. “For example, we don’t see a lot of ICF [Insulated Concrete Form] buildings down here in So-Cal.”

ICFs were used for the below-grade walls, while the above-ground walls are wood framed. A good part of the framing is left exposed on the interior.

OUT AND ABOUT THE INSIDE

The exterior of this modern-style home is characterized by parapet walled boxes clad with fiber cement panels that are in dialogue with horizontal cedar siding and metal-clad pitched roofs. Large window

and door systems provide transparency and views on the lake side and privacy from the approach side. Large pitched overhangs protect windows and entries from the weather and solar gain in the summer.

USAP *Cem-Clad* fiber cement panels were purchased from a local warehouse less than 150 miles from the site. The design called out specific requirements for the panels—beveling the edges, for instance—and many different dimensions.

“The contractor did a fantastic job managing details, such as the spacing of joints and the locations and distances between exposed

Project Stats

NAME: Hale/Carpenter Residence, Vancouver, Wash.
BUILDER: Thomas McKone, Corner Stone Construction Inc.
ARCHITECT: Douglas Ewing, Ewing Architects Inc., www.ewingarchitects.com
PHOTOS: Jordan Sleeth, Jordan Sleeth Photography

fasteners,” says Law. “These little details don’t always get 100 percent follow-through, but in this case they did.”

The panels were installed with a rainscreen underneath. While rainscreens are not required in Washington State, they are recommended. The western red cedar was oiled with a natural finish.

The breathable envelope is insulated to more than 50 percent above code. Soy-based, closed-cell spray foam insulation from Demilec Inc. helps the building achieve strong R-values (R-53 ceiling, R-30 walls, R-59 floor over basement and R-32 slab).

A ground source heat pump provides radiant floor heating and domestic hot water, and a whole-house heat recovery ventilator, equipped with humidity and motion sensors, increases heat exchange as necessary. A 5.25-kW solar array powers much of the house, which also includes an electric car charging station.

The site is well oriented for solar and grand views, and every room in the house overlooks the lake. The many windows and linear floor plan allow for exceptional daylighting and foster an indoor-outdoor connection.

The design integrates high-efficiency LED and Dark Sky-compliant outdoor fixtures, which minimize light pollution. Only Energy Star appliances were used, including an efficient induction cooktop from Electrolux, which avoids the toxic combustion byproducts in natural gas. The great room utilizes an ultra-efficient Rumford-style wood fireplace, which has earned EPA Clean Air certification.

ECONOMY MINDED, ECOSYSTEM MENDING

Hale and Carpenter sourced many recycled and local materials to minimize the impact of transportation and help the local economy. The couple purchased used plumbing fixtures and sourced the rough-edged bar slab for the kitchen from a local woodworker. Countertops were made from reclaimed local alder, reclaimed pallets, concrete and recycled glass. Carpenter fabricated the dining table and other furniture from salvaged and recycled materials, and made light fixtures for the kitchen and living room using wood veneers.

Many points in the process illustrate the clients’ commitment to sustainability, according to Law. This includes the time they received a sample from the cabinet maker and learned it was old-growth mahogany from Mexico. “Instead of just letting it go, Eric stopped the whole project until we could find a better source,” says Law.

Many strategies were employed to ensure healthy indoor air. All of the plywood used in the project is formaldehyde-free. Flooring, which includes concrete, bamboo and tile, is finished with low-VOC products. The exterior siding is installed with an air gap; the enhanced breathability of the walls limits moisture build-up and mold growth. A heat recovery ventilator provides continuous ventilation, eliminating excess moisture and mold.

Water conservation was another of the project’s goals. All bathrooms include dual-flush toilets and low-flow fixtures; a hot water recirculation system helps minimize wasted energy. Rainwater collected from the reflective metal roof is stored in a 2,700-gallon underground tank and is used to irrigate landscaping and gardens.

The site design incorporates native and drought-tolerant landscaping to reduce maintenance and water demand. It also includes food gardens, fruit trees and berries, which provide a significant portion of the household’s food. Restoration of the adjacent riparian zone and removal of invasive species is also underway. **GB**



Good wood. Contrasting with the many warm wood elements, exposed posts and beams are coated with low VOC semi-transparent black stain. All wood used in the project is FSC certified.

Key Components

- ALTERNATIVE BUILDING SYSTEMS:**
Arxx (Logix ICF retaining wall system)
APPLIANCES: **Bosch** (dishwasher); **Electrolux** (induction cooktop and steam oven)
AUTOMOTIVE: **Tesla** (electric car charging station)
BUILDING ENVELOPE: **DuPont** (Tyvek breathable whole-house building envelope)
COUNTERTOPS: **Vetrazzo** (Cobalt Sky recycled concrete and glass)
EXTERIOR FINISHES: **Western red cedar** (FSC certified); **USAP** (Cem-Clad fiber cement panels)
FIREPLACE: **Renaissance fireplaces** (Rumford 1000)
FLOORING: **Plyboo** (PlybooPure FSC-certified strand bamboo)
HOME CONTROLS: **Lutron** (lighting controls); **Nest** (smart thermostat)
HVAC/DUCTS: **Carrier** (50YEW and 50YER ground source heat pumps)
INSULATION: **Demilec** (Heatlok Soy 200 closed-cell spray foam)
LIGHTING: **CREE** (High CRI LED)
PAINTS AND STAINS: **Benjamin Moore** (low-VOC paint); **Flood** (low-VOC stain)
PLUMBING/PLUMBING FIXTURES: **Toto** (Aquia dual-flush toilets); **Blanco** (faucets and sinks, purchased used)
RENEWABLE ENERGY SYSTEMS:
iTek Energy (275-W Solar PV modules)
ROOF: **Atlas** (Dutch Seam reflective metal roofing)
WINDOW COVERINGS: **Lutron** (control shades)
WINDOWS AND PATIO DOORS: **Sierra Pacific** (Green Globe and SFI-certified windows and doors)
MISCELLANEOUS/OTHER: **Georgia-Pacific** (DensArmor Plus gypsum board)

Extreme Measures



Sometimes, the most important accomplishment is simply proving something can be done.

BY GREEN BUILDER STAFF

CALL IT A ONE-OF-A-KIND SOLUTION for a one-of-a-kind scenario. The Home of Innovation Demonstration House is the first single-family home in the Middle East to earn Platinum certification under the U.S. Green Building Council (USGBC)'s LEED for Homes International Pilot program. It also is designed and built to achieve a net-zero energy balance.

What visitors find truly remarkable is that the house accomplishes those goals even though it was built in Riyadh, Kingdom of Saudi Arabia, one of the world's harshest climates. In that place, high-performance housing is the exception not the rule, according to Rich Binsacca, international communications program manager at IBACOS Inc., the project's innovation consulting firm in Pittsburgh, Pa.

FROM THE JUDGES

“Great integration of many complex systems. Loved the positive-pressurized house during sandstorm!”

Open air.

Air filtration, energy recovery ventilation and wide circulation cut the home’s overall energy use by 40 percent.

Light diffuser.

A Somfy window shading system and 3M window tinting reduce daily glare while keeping natural lighting useful.

Plumbing positives.

Bathrooms include water conservation tools such as a Geberit in-wall toilet tank and actuator, Kohler water-smart fixtures and faucets, and Thermaflex pipe insulation.

Clean floors.

Sandstorm monitoring equipment helps keep the air, furniture and floor clear of sand after a storm hits the area.

Binsacca says the home demonstrates the commitment that sponsor SABIC—a Riyadh-based chemical technologies corporation—has toward promoting green building. “This is meant to be a business to business program, and SABIC wanted something that building professionals locally and globally could relate to,” Binsacca says. “Everyone can relate to a house.”

The three-level, 8,600-square-foot home sits within a three-building complex serving the Home of Innovation, a collaborative regional business growth initiative with a focus on better building performance. Two buildings that make up a Collaboration Center the Home of Innovation have earned Gold certification from the USGBC’s LEED-NC rating system.

Built as a prototype, the fully furnished house showcases innovative yet commercially available products and systems integrated to achieve high levels of building performance and resource efficiencies. It is intended to steer the region’s construction industry toward more sustainable building practices and encourage



First Level



H2O aware. Water conservation matters more in Saudi Arabia than in many parts of the world. The Demonstration House features environmental aids such as an in-wall toilet tank, low-flow and water-saving plumbing fixtures, and bath fans.

local industry to manufacture advanced building products, according to Dennis Steigerwalt, managing director of international programs for IBACOS.

“In 2010, [SABIC] had this idea and what it wanted to accomplish,” Steigerwalt says. “But what we started with when they came to us turned into something much grander in scale.”

LEED NEEDS

To achieve LEED-Platinum and aspire to a net-zero energy balance, the home features a 28-kWh rooftop solar array, a bank of 88 lithium-ion solar batteries that stores surplus electricity for power outages. Saudi Arabia does not yet offer net-metering, but the house is ready when it does, according to Steigerwalt.

The project introduced insulated concrete forms (ICFs) for the home’s structural/thermal envelope. Combined with additional air sealing and high-performance fenestration, ICFs reduced the home’s overall energy load by at least 30 percent compared to conventional building practices and enabled the optimization—and further energy savings—of heating, ventilating, and air conditioning (HVAC) equipment and appliances.

Although a new and innovative technology for construction in Saudi Arabia, ICFs are a logical evolution from the prevailing use of concrete block, according to Binsacca.

SOMETHING—OR NOTHING—IN THE AIR

Other systems and products featured in the Demonstration House respond to the Kingdom’s desire to conserve energy and water resources, and enable healthful indoor air.

Chief among them is a specialized system that senses approaching

sandstorms—a common problem in the area—and automatically shuts down all fresh-air ventilation to the home. It then pressurizes the interior of the house to mitigate sand and dust infiltration, according to Binsacca. It’s a welcome home improvement tool. “You may not notice it when the storm hits. But the next day, you can see floors inside homes that are covered with thin layers of sand,” he says. “It’s not a problem we think about, because we don’t have that kind of air quality issue here.”

The home’s central and mini-split HVAC systems, including air filtration and energy recovery ventilation, contribute to a 40 percent overall reduction in energy use compared to conventional homes of the same size.

Energy efficiency abounds in the home’s long-lasting lighting fixtures, controls and sensors, low-flow and water-saving plumbing fixtures and appliances, and solar hot water.

Outdoors, there is drought-tolerant landscaping with a high-efficiency irrigation system and no-turf grass areas. These are served by an on-site graywater reclamation system that helps reduce potable water use by 50 percent.

Project Stats

NAME: Home of Innovation Demonstration House, Riyadh, Saudi Arabia

INNOVATION CONSULTANT: IBACOS, www.ibacos.com

BUILDER: Joannou & Paraskevaides, Ltd., jandp-group.com

ARCHITECT/DESIGNER: Zuhair Fayeز Partnership, www.zfp.com

INTERIOR DESIGNER: theOtherDada, <http://theotherdada.com>

PHOTOS: SABIC



Sun-sourced. Already open to a lot of natural lighting, the home’s overhead illumination carries further thanks to a 28-kWh rooftop solar array with 88 lithium-ion solar batteries, and skylight windows.

The home features a monitoring system that tracks the home’s water use, graywater reclamation, energy use, solar generation and various weather conditions.

Overall, about 92 percent of construction waste is diverted from landfills through recycling and reuse.

GOING PUBLIC

The Home of Innovation Demonstration House’s massive size makes it ideal for large tours and special exhibits designed to educate the masses about green building. In some cases, there’s a degree of redundancy to stress the different ways products can work in a given situation or environment.

To help show and tell visitors the story of high-performance housing, two of the home’s secondary bedrooms and a shared bath were converted into an interactive exhibit space. This “Performance Zone” features system mock-ups and animated videos, digital and printed content, and key products on display.

“The government and the local construction have always been on board with this project,” Binsacca says. “But the real score was the response visitors had to it. In Saudi Arabia, there tends to be a lot of ‘show me’ by the public when it comes to something like this. A project like this really means a lot to people.”

The extremely positive response to the prototype comes in spite of the fact that it functions more as a curiosity than a realistic living place for most of Saudi Arabia’s populace, according to Steigerwalt. Some of that is timing: The nation expects to need 3 million more homes by 2025, a 50 percent jump from the 6 million currently present.

Construction experts locally and globally have already inquired about buying the floorplans from SABIC. Others are taking notes of elements they can use in their own projects, or methods they can use to train contractors and workers.

“There’s nothing else like this over there that we know of,” Steigerwalt says. “There’s going to be a huge need for middle class housing in coming years. This demo obviously isn’t the type of home that will meet that need. It’s meant to be an idea generator. Hopefully, some of the local builders will come away with ones they can use to address that housing shortage.” **GB**



Performance zone. An educational, interactive exhibit space will feature system mock-ups, videos, digital and printed content, and key sustainable products.

Key Components

ALTERNATIVE BUILDING SYSTEMS: insulation, mini-split HVAC, ERV, fresh-air ventilation for sandstorms

APPLIANCES: Philips; Samsung; Miele

BUILDING ENVELOPE: ICF (low-E glazing)

CABINETS, SHELVES, MILLWORK: Group Harwal; J&P Ltd.

CENTRAL VAC: REHAU

CONNECTIONS: TE Connectivity (throughout)

ELECTRICAL: Badger Meter Europa (electronic water meters); Schneider Electric (electrical and data outlets, electric vehicle charging stations); Legrand (sockets and switches); Vimar Group (electrical controls)

ELEVATORS: Otis

FIRE PROTECTION: UTC

HOME CONTROLS: Philips-Saudi Lighting Co. (lighting controls); Honeywell (building controls and thermostats); Leviton (security system, lighting controls)

HVAC/DUCTS: Carrier (central split heat pump system, central air filter, central air-handling unit, whole-house humidifier); SAFID (air damper, pressurization fan, return air registers, sand filter)

INSULATION: FBS Thermomur (insulated concrete forms)

LIGHTING: Philips-Saudi Lighting Co.

PLUMBING/PLUMBING FIXTURES: Geberit (in-wall toilet tank and actuator); Kohler (fixtures and faucets); Thermaflex (pipe insulation); Neproplast (distribution and ventilation); REHAU (supply); Watts Water Technologies (back flow prevention); Wavin (low noise flow)

RENEWABLE ENERGY SYSTEMS: Saft (solar batteries); Schneider Electric (solar inverter, solar output meter); SunPower (photovoltaic panels); Watts Water Technologies (solar hot water expansion tank)

VENTILATION: KDK (local ventilation); Panasonic (energy recovery ventilators); SAFID (ventilation ducts)

WATER FILTRATION: Watts Water Technologies (water filtration system); Pentair (water treatment and chillers)

WATER HEATING: Grundfos (hot water recirculation pump)

WINDOW COVERINGS: Somfy (window shading systems); 3M (window tinting film)

WINDOWS, SKYLIGHTS, PATIO DOORS: REHAU; Group Harwal

Ultra Efficient



Touch the sky. Private rooftop decks offer views of downtown Seattle while encouraging the spending of time outdoors.

SolHaus homes are compact, ultra-green and one of a kind. And boy, are they popular.

BY ALAN NADITZ

IF GOOD THINGS COME IN SMALL PACKAGES, Seattle's tiny SolHaus community is a green giant. All 10 townhomes sold out before the complex had its grand opening in April 2016, and not just because they're in the centrally located Capitol Hill area.

The units' "ultra-green" reputation was also a bit of a selling point.

Designed and developed by renowned b9 architects and construction firm Cascade Built, each custom-designed townhouse—originally priced from \$700,000 to \$900,000—is an example of healthy, comfortable living, according to Cascade Built President Sloan Richie.

Sustainable elements include high-performance Passive House construction techniques to reduce energy usage, careful management of windows and garage doors to keep the units naturally well lit, and a common courtyard that creates a connected living experience among the residents.

"We wanted a shared project that everyone could benefit from," Richie says. "And we didn't want something that was cookie cutter. Every unit has its own, unique design."

ONE PRINCIPLE FOR ALL

According to b9 architects Principal and Founder Bradley Khouri, his company partnered with Cascade Built after realizing the green potential of two infill lots adjacent to Seattle's downtown business district. b9 had successfully completed a similar but smaller project in the area two years earlier, and other developers had steadily chipped away at properties on either side of the SolHaus location.

A key finding was that residents wanted both worlds: proximity to shopping, restaurants and nightlife, while still being able to drive their cars when they wanted. They also wanted to live somewhere with a lower carbon footprint for environmental and economic reasons. And they wanted homes that in some way stood apart from their neighbors'.

The lots' topography—12 to 14 feet of sloped earth—helped make individuality possible. The developers alternated duplexes and triplexes with street-facing homes lifted above the street. Units are two or three bedroom, with two bathrooms each, and are 1,382 to 1,737 square feet.

Many of the homes have large, transparent roll-up garage doors to encourage interaction, and indoor-outdoor connections.

The complex's shape also encourages socialization among residents. Cascade Built and b9 architects turned the two rectangular lots into twin "L" shapes, with a yin-yang setup that created a central courtyard. Two of the most popular areas in a multi-family complex—the mailboxes and on-site parking—lead directly to this one area as residents go to and from their apartments.

The "L" design and sloped location also helped address a major problem for any city dweller: parking. The lot shapes allowed for a single below-grade, shared parking structure. The garage includes electric car chargers for every space.

"It was important that we find a way to deal with parking," Richie says. "The experience of having a drive court in the middle of your project is not a great one. You have no communal space, and at times

FROM THE JUDGES

“Great community-based sustainability... need more of this!”

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Lofty currents.

Double-height spaces in all homes aid air circulation.

Triple-glazed glass.

European tilt and turn triple-glazed Passive House windows help preserve heat.

Clean air finishes.

Paint throughout the home is VOC-free.

Floor covering.

Dining area rug is made from recycled rubber and plastic.

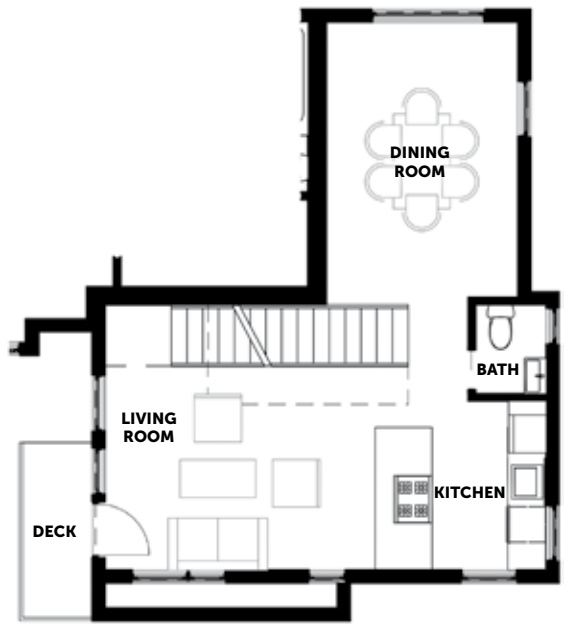
you can have problems getting your car out of the garage or even for you to go up the stairs. With the underground garage, people could just park their car and forget about it until they need it next.”

ALL FEATURES FOR ONE

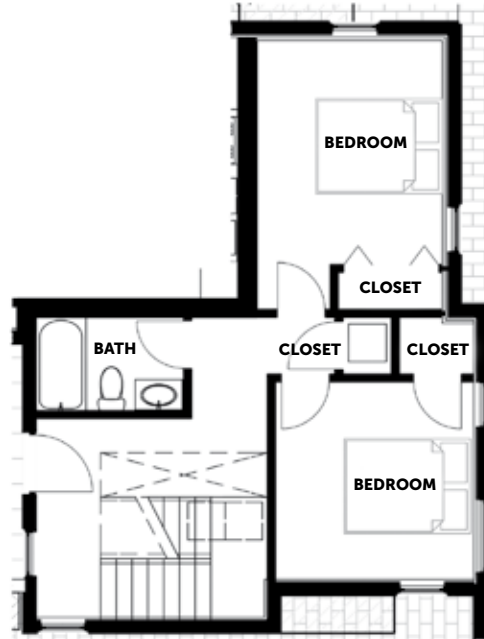
While every unit is custom, various elements are uniform throughout. All homes feature full LED lighting, Caesarstone quartz countertops, locally sourced cabinetry and Energy Star appliances. The latter



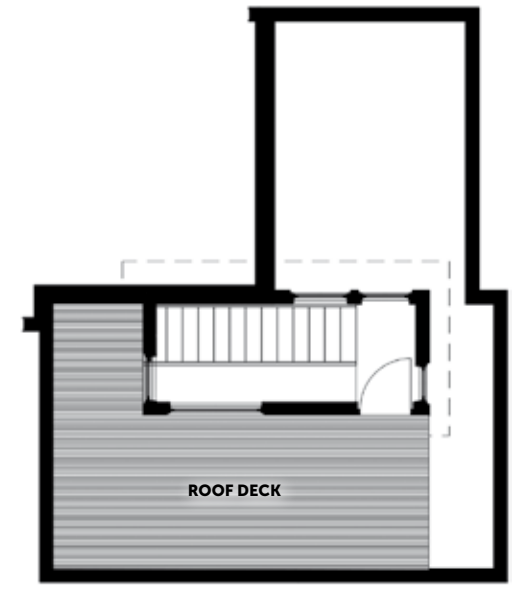
Second Floor



Third Floor



First Floor



Roof



Something old, something new. Appliances throughout the SolHaus townhomes are Energy Star compliant, while cabinetry and other products come from recycled materials.

includes induction cooktops—a rarity in new townhomes—Navien tankless gas water heaters, GE *Profile* ranges, and Bosch *500 Series* ventless dryers.

Airtight European tilt and turn triple-glazed Passive House windows help preserve heat. Zehnder high-efficiency HRV filtration systems provide continuous fresh air. The homes have dense-packed fiberglass insulation and additional exterior rigid-density *ROCKBOARD* insulation, and Mitsubishi mini-split heating/cooling pumps. The homes' structure includes a mix of reclaimed barn wood and modern materials. Exteriors are covered in zero-VOC Sherwin-Williams paints.

The central courtyard includes seating areas and native landscaping. Large windows from each unit oversee the outdoor common courtyard and provide expansive views of Seattle's skyline from individually designed private rooftop cedar decks.

Each unit is net-zero ready, having been built to Passive House standards. **GB**

Project Stats

NAME: SolHaus, Seattle, Wash.

BUILDER/DEVELOPER: Sloan Ritchie, Cascade Built, www.cascadebuilt.com

ARCHITECT/DESIGNER: Bradley Khouri, b9 architects, www.b9architects.com

LANDSCAPE ARCHITECT: Devin Peterson, Root of Design, www.rootofdesign.com

INTERIOR DESIGNER: Belinda Leppa, Macadam Floor and Design, www.macadamfloors.com

PHOTOS: William Wright



Breathe easy. Highly efficient ventilation keeps air throughout the house, including the bedroom, pollution- and mold-free.

Key Components

APPLIANCES: GE (*Profile Series* induction range); Bosch (*500 Series* ventless dryer)

BUILDING ENVELOPE: Roxul *ROCKBOARD* insulation (2-inch exterior rigid 8-lb density)

CABINETS, SHELVES, MILLWORK: Canyon Creek Cabinets

CAULKS & SEALANTS: Prosoco (*AirDam*)

COUNTERTOPS: Caesarstone

DECKS: Cedar

DOORS & HARDWARE: Schlage (touchscreen deadbolt)

ELECTRICAL: LED fixtures

EXTERIOR FINISHES: Hardie (panel); T&G (pre-finished cedar)

GARAGE DOORS: Northwest Doors (*Modern Classic* insulated anodized aluminum)

HVAC/DUCTS: Mitsubishi (mini-split heat pumps); Zehnder (*HRV CA350*, super-high-efficiency HRV)

INSULATION: Roxul *ROCKBOARD* insulation (2-inch exterior rigid 8-lb density)

LANDSCAPING: TrueScape Design

PAINTS AND STAINS: Sherwin-Williams (*Pro Mar 200 Zero VOC*)

PAVERS: Mutual Materials Bay

PLUMBING/PLUMBING FIXTURES: Bemis (toilet seat cover); Blanco (kitchen sink); Bootz (guest bathtub); Danze (kitchen faucet, lavatory faucet, master tub faucet, master shower valve, master shower head); InSinkErator (disposer, disposer switch); Kohler (lavatory); MAAX (master bathtub); Navien (condensing tankless gas water heater); Niagra (stealth toilets, 0.8GPF); Nuheat (master bathroom heater pad); Parma (guest bath shower faucet)

ROOF: TPO

SPECIALTY PRODUCTS: Nuheat (bath)

VENTILATION: Zehnder (*HRV CA350*)

WATER HEATING: Navien (*tankless NPE-240A*)

WATER MANAGEMENT (INDOOR/OUTDOOR): Green Roof

WINDOWS, SKYLIGHTS, PATIO DOORS: Intus (*Arcade series* triple-glazed Passive House windows)

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An Evolution Revolution



This student-built tiny house is packed with sustainable technologies and space-saving amenities. People are literally taking it for a spin.

BY ALAN NADITZ

IT'S NOT EASY FOR A DISABLED VETERAN and a new service dog to become fast friends. But 30 undergraduate students from Santa Clara University in Santa Clara, Calif., figured out how to make it happen, and did it by thinking small.

The group of mostly engineers, architects and builders spent almost a year designing and building the rEvolve House, a 238-square-foot trailer-mounted unit made primarily of repurposed materials and donated green goods. The 28-foot-long by 8.5-foot-wide home was constructed as an entry in the Sacramento Municipal Utility District (SMUD)'s Tiny House competition in fall 2016.

At first, the emphasis was on building a compact showcase of engineering marvels, according to product construction manager George Giannos. "We eventually shifted our focus onto what we wanted the legacy of the home to be," he says. "We wanted the home to feature more than just top-of-the-line sustainable technology—we wanted the house to have purpose."

A mutual friend and Solar Decathlon volunteer introduced rEvolve's builders to the San Martin, Calif., chapter of Operation Freedom Paws (OFP), which pairs service dogs with veterans returning from active duty who have physical limitations or suffer from illnesses such as Post Traumatic Stress Disorder. An on-site visit to witness the relationships between veterans and their dogs was all it took for the team to decide it would build, then donate the

tiny home to OFP.

"People come from a long way to get a service dog, and it can get quite expensive for everyone involved," Giannos says. "This home makes for a good, low-cost temporary living environment where veteran and dog can become acclimated with one another."

rEvolve was the overall winner of SMUD's competition and also placed first in two of four main categories: Energy and Communication—and first in six subcategories: Day Lighting, Integrated Lighting, Interior Design, Kitchen, Best Program and Best Tour.

"One of the requirements for the SMUD Tiny Home competition was that the project be totally off grid," Giannos says. "The key to that lay in our solar power system."

The home achieves net zero status largely due to eight 345-watt SolarWorld *Sunmodule* solar panels that fill four Aquion Energy salt-water batteries, which provide more than 2,700 watts of electricity. The batteries are the only ones on the market with the Innovation Institute's Cradle to Cradle Certified sustainability certification, according to Giannos. All biological and technical nutrients of the batteries can be 100 percent recycled or composted back into the environment.

rEvolve House gets its name from its attachment to Colossun's smart PV generator solar tracking system. The system literally follows the sun's position during the day, moving the entire house up

FROM THE JUDGES

"This is a great case study in small, efficient building systems."

SIP structure.

Walls and roof assemblies consist of interlocking structural insulated panels with an R-15 rating.

Sun-tracking solar.

LED lights, appliances, HVAC and more are powered by Colossun's smart PV generator, which follows the sun throughout the day for maximum solar efficiency.

Water wise.

Bathroom includes a dry-flush toilet and a graywater system that irrigates an outdoor vertical garden.

Salvage job.

Discarded maple hardwood flooring from Santa Clara University's basketball court was used for household cabinetry.

Recycled countertops.

Kitchen counters are made from PaperStone's stone-like, hyper-compressed recycled paper product and non-petroleum resin.



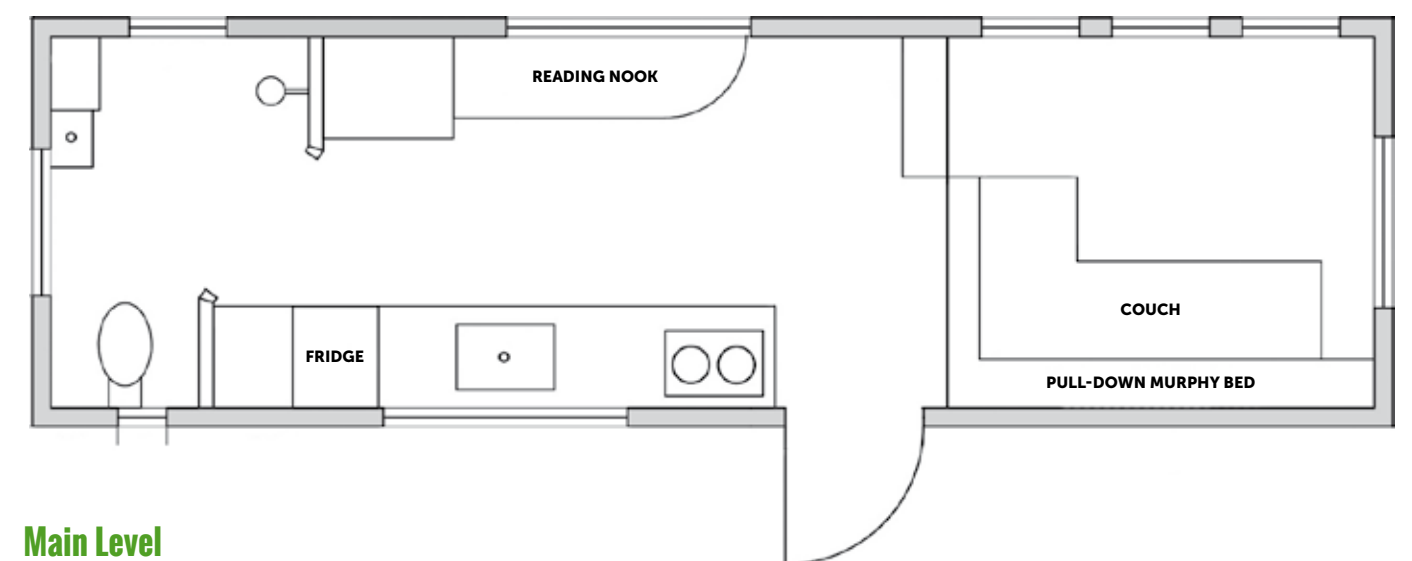
Elbow room and more. rEvolv's small rooms are still big enough for access by wheelchairs used by many of the home's occupants.

to 210 degrees to maintain maximum solar exposure. The result is a 35 percent boost to the photovoltaic system's efficiency, Giannos says.

The home's frame was constructed using Structural Insulated Panels (SIPs). The SIPs provide an R-value of R-15 and allow rEvolv's Mitsubishi HVAC system to operate effectively with minimal power input. A passive air vent brings in fresh air from outside, and can easily be opened and closed to adjust the temperature to a comfortable level without energy usage.

Even the insulation is green, consisting of denim from discarded jeans.

The interior is a lesson in recycling. Students salvaged maple hardwood that was destined for the dump, following the renovation of Santa Clara University's basketball court, and used it to create beautiful wood cabinetry.



Main Level



The great outdoors. Even rEvolv's roof is put to good use, serving as an outdoor, topside deck for relaxation.

Kitchen cabinetry is topped with a PaperStone countertop, a stone-like slab of hyper-compressed recycled paper products and non-petroleum resin. The countertop is sustainably manufactured and is certified recycled by the Rainforest Alliance to Forest Stewardship Council (FSC) standards and certified food safe by NSF International.

The home includes a 35-square-foot wet bathroom, but it uses a dry-flush toilet to eliminate use of a blackwater system. All graywater produced by the home drains through an organic bio filter and is pumped outside to irrigate a vertical flower garden.

Giannos estimates the entire project would have cost more than \$60,000, if not for generous donations by local builders, manufacturers and SCU alumni. "Everyone put a lot into this project, and we're very thankful for that," he says.

Despite the long hours and several technical difficulties, Giannos says he would happily do everything again if the end goal were the same. "We hoped that the home would not only exhibit sustainable technology that could change our world, but would also exhibit the importance of community and support organizations that do life-altering social work," he says. "Our relationship with Operation Freedom Paws was the perfect marriage between technical innovation and social change in our journey to turn lives around." **GB**

Project Stats

NAME: rEvolv House, Santa Clara University, Santa Clara, Calif.

DEVELOPER: Santa Clara University Engineering School, www.scu.edu/engineering

BUILDER: Santa Clara University Undergraduate Students, www.revolvehouse.com

ARCHITECT/DESIGNER: Samantha Morehead

INTERIOR DESIGNER: Samantha Morehead

PHOTOS: Joanne Lee, James LeClerc

Key Components

BUILDING ENVELOPE: Structural Insulated Panels (walls)

CAULKS & SEALANTS: Dynaflex

CENTRAL VAC: Dirt Devil

COUNTERTOPS: PaperStone

DECKS: Trex

ELECTRICAL: Philips Hue (LED)

EXTERIOR FINISHES: Cedar siding

FLOORING: Urban Surfaces (luxury vinyl)

HOME CONTROLS: Raspberry Pi

HVAC/DUCTS: Mitsubishi (mini-split AC unit)

INSULATION: Denim insulation/SIPs

LIGHTING: Philips Hue (LED)

PAINTS AND STAINS: Benjamin Moore (ARBORCOAT)

BATHROOM SINK FAUCET: Dawn (single-lever lavatory faucet)

KITCHEN FAUCET: Dawn (single-lever spray kitchen faucet)

SHOWER HEAD: Dawn (handshower with shower flexible hose and slide bar)

WATER HEATER: AO Smith (residential electric water heater)

RENEWABLE ENERGY SYSTEMS: Aquion (saltwater batteries); Schneider (electric inverter); SolarWorld (Sunmodule panels)

ROOF: Owens Corning (Oakridge shingles)

SPECIALTY PRODUCTS: Colossun (solar tracking ring)

STRUCTURAL COMPONENTS: Structural Insulated Panels

VENTILATION: Mitsubishi (exhaust fan)

WATER FILTRATION: Tetra Pond (ClearChoice BioFilter PF1)

WINDOW COVERINGS: Custom Size Now by Levolor (white faux wood)

WINDOWS, SKYLIGHTS, PATIO DOORS: Jeld-Wen

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Passive Power House



With the ultra-green Madrona Passive Home, what goes around comes around – again and again.

BY GREEN BUILDER STAFF

SPEND A LITTLE bit of time inside the Madrona Passive Home and you're likely to develop déjà vu—and that's a very good thing. It means the project's developers have succeeded in their goal of building a home where recycling feels as natural as the lake and mountain range it overlooks.

Natural beauty.

FSC rough-sawn tongue and groove siding grays naturally, and helps the home blend into its wooded surroundings.

Natural insulation.

A green roof above the garage acts as a living insulator to retain heat and cool air during appropriate seasons.

Two solar facings.

The Madrona Passive Home's L-shaped modular design ensures maximum solar heating.

Weather-tested windows.

Madrona's windows, patio doors and skylights utilize Zola's ThermoPlus Clad series for an air- and watertight seal in rainy climates.

Flow-through driveway.

Belgard Turfstone permeable pavers promote stormwater absorption into the soil.

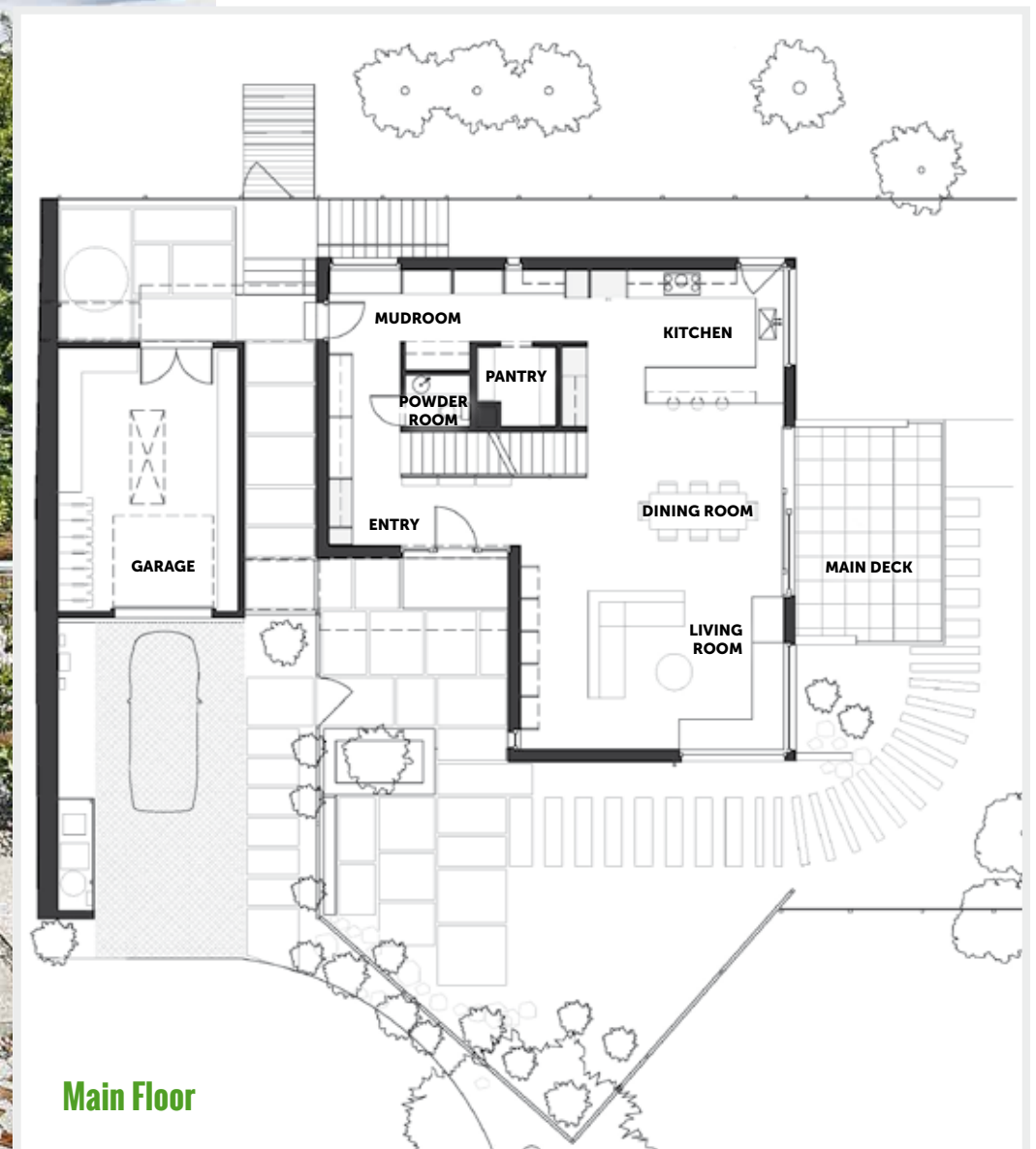
FROM THE JUDGES

"Hits almost all sustainability notes. Contemporary, yet understated."

This nearly 3,700-square-foot, single-family custom home in Seattle's Madrona neighborhood takes energy efficiency to a new high by keeping power needs low. Designed by Shed Architecture & Design and constructed by Hammer & Hand, the PHIUS+ Certified passive house is virtually net zero, according to H&H project supervisor Alex Daisley. Take away the home's electric charging station, and you have a residence where more energy is generated than needed in a typical year.

It's just the type of breakthrough Madrona Passive House's owner, former Microsoft program manager and renowned environmental advocate Jabe Blumenthal, envisioned when he commissioned the project, according to Daisley. "The client wanted a structure that was a highly efficient passive home, and could serve as an example for others who may want to invest in climate solutions," Daisley says. "He was very driven for the house to be cutting edge and comfortable, yet still in league, pricewise, with other homes in the area."

Blumenthal has stated that keeping the cost of a climate-friendly





Eco-surfaces. Lower-level rooms feature FSC-certified walnut EcoTimber flooring with polished concrete, built-in FSC walnut and European P-Lam casework, and FSC high-density cellulose insulation.

house down to about 10 or 20 percent above that of a traditional residence will make it more likely for others to at least consider building similar, environmentally positive homes. “It’s a little like *Leafs* or *Priuses*,” Blumenthal said in an H&H blog published in 2016. “You need to reach a certain critical mass before people really start to say, ‘Oh! There’s nothing weird about this.’”

CHARGING AHEAD

Madrona Passive Home relies primarily on three factors for its energy efficiency: a powerful solar array, high-performance construction and a contemporary design.

The home’s 9.8-kilowatt rooftop photovoltaic array—consisting of 30 327-watt SunPower modules—offsets the home’s energy consumption. The original plan called for a mere 6-kW array. “They were always going to put solar panels on the roof,” Daisley says. “But as we were looking at the modeling, and the performance of the home was being confirmed, there was an opportunity to take that 6 kW up nearer to 10. They were very eager to take advantage of that, to improve the chances of the home being net zero.”

A ballasted racking system was used to prevent a thermal break. Two 4.2-kW Power-One inverters complete the installation.

The low energy consumption stems in part from the home’s super-insulated building envelope, which includes a Zehnder *ComfoAir* heat recovery ventilator that supplies fresh air to the home’s interior while recovering 90 percent of thermal energy from exhaust air for reuse inside.

The home’s passive design elements continue with an exterior wall assembly that includes a blend of stained FSC-certified cedar, high-density cellulose insulation, Huber Engineered Woods *Zip System* sheathing, and Roxul mineral wool exterior insulation. The whole wall assembly carries a total R-value of 34.

Other exterior green features are cosmetic and practical. To manage stormwater, the project uses Belgard *Turfstone* permeable pavers for site hardscape. There is also a cistern to capture and control rainwater from the home’s roof and the green roof on the garage. And the home’s exterior mechanical shading system modulates solar gain through triple-pane windows.

The home is built in an ‘L’ shape—a somewhat fitting grid design, given that Blumenthal is a co-creator of Microsoft’s *Excel* software—

to provide a 180-degree view of nearby Lake Washington and the Cascade Mountains. FSC rough-sawn tongue and groove siding makes the home look like a giant, modular tree, blending it with its wooded surroundings. “It sits very well within the landscape,” Daisley says. “People can take real inspiration from a design that is basically a very nice custom, modular home.”

The house also has circuit-by-circuit energy monitoring with dashboard to provide homeowners with real-time consumption data over a 12-month period. This is expected to result in the Department of Energy’s Zero Energy Ready and Living Building Challenge’s Net Zero Energy Building certifications.

HAPPY ON THE INSIDE

The interior of the home provides Blumenthal’s family of four with a practical, gracious place to live. Shed designed the main interior and exterior spaces to optimize solar exposure to the south, while prioritizing an open connection to the expansive views to the east. Spaces requiring privacy and little natural light are arranged on the north side of the home, to reduce glazing area and heat loss.

According to Shed Principal Architect Prentiss Hale, the home’s modular shape, an extra four inches of exterior insulation, airtight seals where walls and ceilings meet, and strategically placed, triple-pane European tilt-turn windows combine for maximum thermal control and extremely reduced thermal bridging. “If it’s 68 degrees on one side of the house, it’s 68 degrees on the other side,” he says.

Window installation utilized a half-inch-thick spacing—about twice the norm—to enable easier insertion of expanded foam insulation and an easier, proper seal, Hale adds.

The home’s three distinct levels, connected by a central open



Let there be light. Strategically placed, triple-pane European Super windows maximize thermal control and natural lighting throughout the house.

stair, each have a specific purpose to meet the family of four’s ever-changing needs. The main level is shared living space, the upper level is a master suite and office, and the lower level is dedicated kids’ quarters that are pre-plumbed and wired for a kitchen. This last area can be converted into an 800-square-foot separate housing unit once Blumenthal’s children leave home.

On the main floor, a palette of FSC-certified walnut EcoTimber-engineered flooring and polished concrete complement a natural green landscape visible through the large windows and an expressive floor-to-ceiling sliding door leading out to the deck. Built-in FSC walnut and European P-Lam casework and kitchen cabinets feature blue and green plastic laminate accents selected by the client for a fun splash of color, according to Daisley. Kitchen counters are Caesarstone quartz.

The upper level features natural oil finish Rubio Monocoat on the walnut floors, which travel through the master bathroom, bedroom, exercise room and office in a pattern that mimics the occupants’ daily routine.

The lower floor features two ensuited bedrooms divided by a large entertainment room emptying out to the hillside, with laundry and storage tucked behind the central stair.

Appliances are Energy Star certified, including a condensing dryer to avoid wall assembly penetration for venting, and a heat pump-powered, tank-style Sanden water heater. All LED fixtures are recessed, and lighting uses smart home controls by Lutron. The kitchen features an induction cooktop.

And, of course, there are the environmentally friendly electric car charging station and heat-storing sauna for recreational purposes.

Although this was not the first passive home built by Hammer & Hand, it was still a learning experience, Daisley says. “Every time we do one of these, we learn something different and the next home becomes even more efficient,” he notes. “I think it turned out really well. The end product is beautiful.”

But looks aren’t all it’s about, he adds. “It’s exciting to see a project that has a moral grounding,” Daisley says. “We’re not just building a custom home. We’re building something that shows the neighboring community that it’s possible to go large and still care for the environment.”

Hale agrees, noting that the number of affluent people in the Seattle area makes super-sized homes very common. “Many of the people building these massive new projects don’t align them with environmental priorities,” he says. “But if an owner is interested in a home like that, they may as well make it as environmentally friendly as possible. They can at least make up for their carbon footprint over time.” **GB**

Key Components

- ALTERNATIVE BUILDING SYSTEMS:** Roxul (mineral wool exterior insulation); Huber Engineered Woods (*Zip System* wall sheathing)
- APPLIANCES:** Energy Star
- AUTOMOTIVE:** Electric car charging station
- BUILDING ENVELOPE, ABOVE GRADE:** R-34; FSC (certified cedar); Gypsum (wall board); Johns-Manville *Spyder* (dense-pack fiberglass); Roxul (3.5-inch *ComfortBoard* IS, 1.5-inch vent channel); Huber Engineered Woods (7/16-inch *Zip System* sheathing)
- BELOW GRADE/AT FOUNDATION:** R-29.6; Gypsum (wall board); Johns-Manville *Spyder* (dense pack fiberglass, 3-inch Type II EPS, 8-inch reinforced concrete)
- CABINETS, SHELVES, MILLWORK:** FSC (walnut, European plastic laminate [P-Lam])
- CAULKS & SEALANTS:** Prosoco; R-Guard; FastFlash
- COUNTERTOPS:** Caesarstone quartz
- DECKS:** TPO (membrane roof); Vancouver Bay (architectural slab pavers)
- DOORS & HARDWARE:** Ducasse (custom solid core, pocket door hardware); Zola (exterior doors)
- ELECTRICAL:** LED (recessed fixtures); Sanden (heat pump-powered water heater)
- EXTERIOR FINISHES:** FSC (1-by-6 rough sawn T&G cedar); Galvalume metal flashings
- FLOORING:** EcoTimber (engineered flooring); FSC (orchard walnut); Polished concrete
- HOME CONTROLS:** Hella (exterior shades); Lutron (smart home controls for lighting)
- HVAC/DUCTS:** Zehnder (*ComfoAir 550 HRV*)
- INSULATION:** Rigid insulation; Blown-in insulation; Roxul (mineral wool)
- LIGHTING:** Lutron (home lighting and zoning control)
- PAINTS AND STAINS:** Benjamin Moore (semi-transparent stain); FSC (cedar exterior siding); Low-VOC interior paints
- PAVERS:** Mutual Materials (permeable pavers for site hardscape)
- RENEWABLE ENERGY SYSTEMS:** Rooftop solar photovoltaic array (9.8 kW); SunPower (solar photovoltaic panels)
- ROOF, MAIN:** R-75.5 (average); Gypsum (wall board); Johns-Manville *Spyder* (dense-pack fiberglass)
- TPO ROOFING AT DECKS:** R-54.2 (average); Gypsum (wall board); Johns-Manville *Spyder* (dense-pack fiberglass); TPO (roofing)
- SPECIALTY PRODUCTS:** Roxul (mineral wool insulation); Sanden (heat pump water heater); Zehnder (HRV)
- VENTILATION:** Zehnder (*ComfoAir 550*)
- WATER HEATING:** Sanden (CO₂ split heat pump water heater)
- WATER MANAGEMENT (INDOOR/OUTDOOR):** Mutual Materials; Belgard (*Turfstone* driveway)
- WINDOW COVERINGS:** Hella (shading system)
- WINDOWS, SKYLIGHTS, PATIO DOORS:** Zola (*ThermoPlus*-clad windows)
- OTHER:** Auger (cast piles)

Resilient and Ready



This custom home in the Hamptons was designed and built to withstand the next big storm.

BY JULIET GRABLE

SUPERSTORM SANDY SWEEPED through the Hamptons in late October 2012, destroying many homes in the area. Upon learning that their 1940s cottage was “substantially damaged,” the owners decided to start over. Viewing every decision through the lenses of resiliency, durability and sustainability, they built a 21st-century home they call the Sunset Green Home.

They hired architect Bill Heine and builder Chris Mensch of Coastal Management LLC, along with a sustainability team that included three LEED AP-accredited consultants. During the process of researching products and strategies for their new home, the homeowners attracted more than 70 sponsors. The project has achieved LEED Platinum certification and earned a HERS Index Score of 24.

FROM THE JUDGES

“A good example of how to build on the coast to deal with storm surges.”

High IAQ.

Mechanical ventilation combines with non-toxic finishes and furniture help ensure healthy indoor air.

Cool fans.

Ceiling fans in every bedroom help ensure comfort at higher temperature set points.

Sun shades.

A shading system prevents unwanted solar heat gain and provides privacy when deployed.

Good glass.

Marvin Integrity Wood-Ultrex windows combine a fiberglass exterior with a wood interior, providing a classic look with high-energy performance.



Out of sight, peace of mind. Sunset Green Home features two health-enhancing products from CertainTeed tucked away behind its walls: SMARTBATT™ with MoistureSense™ Technology, a fiberglass batt insulation that intelligently manages moisture to keep walls dry year round; and AirRenew® M2Tech® drywall, which actively removes formaldehyde and other contaminants from the air. Together they help prevent mold and improve indoor air quality.

“Every choice was made from a systems perspective,” says Kim Erle, who served as project manager.

The ruined structure was removed by a non-profit enterprise that provides green construction jobs to former inmates. This environmentally sensitive deconstruction diverted over 90 percent of the home’s building materials from the waste stream.

NEW AND IMPROVED

The new Sunset Green Home consists of a main house and separate pool house. The main house is just under 3,600 square feet, smaller than the other custom homes in the neighborhood. The pool house was designed to be completely shut down in the off season, so as not to consume energy needlessly.

Several resiliency measures were incorporated into the design. Building codes required the home to be elevated to 12 feet above sea level—four feet above the maximum storm surge level from Superstorm Sandy. Sunset Green is built on 130 pilings, 14 feet above sea level. Breakaway walls underneath enable flood waters to pass under the house and recede back without causing structural damage. Impact-resistant glass protects the home from wind-borne storm debris.

The owners consulted with building science experts from

Project Stats

NAME: Sunset Green Home, East Quogue, N.Y.

ARCHITECT: Bill Heine, William F. Heine Architect

BUILDER: Chris Mensch, Coastal Management, LLC, www.coastalmanagementllc.com

LANDSCAPE DESIGNER: Tim Rumph, Araiys Design, www.araiysdesign.com

SUSTAINABILITY TEAM LEADER: Kim Erle, LEED AP Homes, Sunset Green Home LLC, www.sunsetgreenhome.com

LEED GREEN RATER: Richard Manning (Energy Master LI)

LEED PROVIDER: Ian Johnson (Signature Sustainability)

PHOTOS: Photos courtesy Sunset Green Home LLC

CertainTeed, and the home incorporates several of the company's products and strategies. The home is stick framed. All structural framing surfaces were sprayed with CertainTeed's *FortiCel*, a topical application that inhibits the growth of mold and mildew, and Huber *ZIP System* structural sheathing and tape ensures an airtight assembly. Wall cavities are filled with CertainTeed's *SMARTBATT* with *MoistureSense* technology. This kraft-faced fiberglass batt insulation allows walls to breathe by adapting permeability to block moisture from entering when humidity is low, and allowing moisture to escape when sensing high humidity.

CertaSpray closed cell spray foam insulation was applied underneath the house, and *CertaSpray* open cell spray foam provides an insulating value of R-38 in the roof.

"Many decisions were made specifically to enhance indoor air quality," says Erle.

High-performance drywall products are used throughout the home, including CertainTeed *AirRenew Indoor Air Quality* drywall, which proactively absorbs formaldehyde from indoor air and converts it into safe, inert compounds that remain within the board. *SilentFX* sound-reducing drywall is installed in areas where acoustical control was important. Doors and decorative beadboard, which was installed throughout the house, were made with no added urea-formaldehyde MDF and finished with zero-VOC paint. A BEAM central vacuum system from Electrolux helps ensure ongoing IAQ.

POWER AND WATER MISER

In addition to the tight and well-insulated envelope, other strategies reduce energy demand. The home relies on an energy-efficient variable refrigerant flow HVAC system for heating and cooling; an energy recovery ventilator from Zehnder delivers filtered fresh air. All appliances are Energy Star certified. Energy-efficient Haiku ceiling fans from Big Ass Solutions installed in the living spaces and bedrooms allow cooling at higher air conditioning temperature set points.

Erle is especially pleased with the all-LED lighting, which utilizes Generation Brands (Feiss, Tech Lighting and Seagull) for indoor lighting, and B-K Lighting and Teka Illumination for outdoor lighting. All lighting is controlled by Lutron switches integrated into the *ELAN* home automation system. This unit also controls the home's HVAC, security and entertainment systems.

"It's a fun house, in addition to performing well," says Erle.

Water use is minimized by dual-flush high-efficiency toilets, and WaterSense faucets and showerheads. The home does include swimming pool, but careful choices ensure that it uses as little energy as possible. The Jandy *Hi-E2* pool heater has a 95 percent efficiency rating, and an automatic pool cover keeps heat from escaping and reduces evaporative water loss. In addition, the pool's primary sanitation is provided by an innovative system from Del Ozone, which combines ozone and UV sanitation.

ENVIRONMENTAL ISSUES

The elevated home and its nearly 3,000 square feet of deck provided the team with another challenge. Exotic hardwoods are one of the best alternatives to chemically treated and composite decking, but LEED requires that tropical hardwood be FSC certified—which can be very cost prohibitive. The homeowners sourced FSC-certified

cumaru through WalkGreen, which proved cost-competitive with uncertified ipe rain forest wood.

The home is close to tidal wetlands and the Shinnecock Bay, which includes sensitive oyster and eelgrass habitat. Landscape architect Tim Rumph created an environmentally sensitive landscaping plan, which incorporates a vegetated wetlands buffer reclaimed from what had previously been part of the home's lawn. Now home to birds, small mammals and native plants, the meadow enhances the view from water-facing rooms and provides a natural bulwark against future storm surges. Landscape architect Tim Rumph worked with the homeowners to create an environmentally sensitive landscaping plan, which incorporates a vegetated wetlands buffer reclaimed from what had previously been part of the home's lawn. A vegetable garden provides the family with produce from spring to late fall. **GB**

Key Components

APPLIANCES: **Bosch** (pool house refrigerator and dishwasher); **Samsung** (washer/dryer); **Thermador** (Energy Star freezer and refrigerator columns, Masterpiece series Freedom induction cooktop, and Steam & Convection oven)

CABINETS, SHELVES, MILLWORK: **Nantucket BeadBoard;** **Decospan**

COUNTERTOPS: **Caesarstone**

EXTERIOR FINISHES: **Boral** (TruExterior trim)

FLOORING: **Daltile**

HOME CONTROLS: **Core Brands** (ELAN home automation system); **Lutron** (lighting controls)

HVAC/DUCTS: **Mitsubishi** (Hyper-Heating VRF system)

INSULATION: **CertainTeed** (CertaSpray closed cell spray foam; CertaSpray open cell spray foam); **CertainTeed** (SMARTBATT with MoistureSense technology)

LANDSCAPING: **Hunter** (smart irrigation controls)

INDOOR LIGHTING: **Feiss;** **Tech Lighting;** **Seagull**

OUTDOOR LIGHTING: **B-K Lighting;** **Teka Illumination**
Lutron (controls)

PAINTS AND STAINS: **Sherwin-Williams** (Harmony)

PLUMBING/PLUMBING FIXTURES: **Axor;** **Hansgrohe**
(WaterSense fixtures)

RENEWABLE ENERGY SYSTEMS: **EmPower Solar/SunPower Solar** (PV modules)

ROOFING: **ATAS** (standing seam metal roofing)

STRUCTURAL COMPONENTS: **CertainTeed** (FortiCel mold prevention spray; AirRenew Essential indoor air quality (IAQ) drywall; M2Tech moisture and mold-resistant drywall; SilentFX sound-reducing drywall; GlasRoc Diamondback tile backer); **Huber** (ZIP System sheathing and tape); **Simpson** (Strong-Tie hurricane ties)

VENTILATION: **Big Ass Solutions** (Haiku ceiling fans); **Broan-Nutone** (bathroom fans and range hood); **Zehnder** (ERV)

WATER HEATING: **Rinnai** (tankless water heaters)

WINDOWS, SKYLIGHTS, PATIO DOORS: **Marvin** (Integrity)

OTHER: **BEAM** (Alliance central vacuum system); **Coverstar** (automatic pool cover); **Del Ozone** (Solar Eclipse ozone and UV sanitation system); **Jandy** (Hi-E2 gas swimming pool heater); **Uponor** (AquaPEX residential fire sprinkler system)

iNNOVATION UPDATE

Time for Tankless

Smarter, cheaper and more popular than ever, the tankless water heater is ready to give its old-school, storage tank cousin a lesson in energy efficiency.



CREDIT: BOSCH THERMOTECHNOLOGY CORP.

Getting into shape. Consumers like the *Greentherm 9000 Series'* compact, stylish design, which in turn has made life happier for retailers and installers.

BY GREEN BUILDER STAFF

IT HAS HAPPENED TO EVERYONE AT LEAST ONCE: that unexpected moment when there's no more hot water. Whether it's because there are multiple high-demand appliances running at once, or simply because someone was third in line for the shower and the tank is empty, being left in the cold is not a very cool thing. Tankless water heaters to the rescue.

Unlike their traditional, storage tank-based counterparts, tankless models are capable of providing virtually constant, uniform-temperature hot water on demand. Water passes through pipes over a heating element and goes directly into the house plumbing where needed.

In contrast, tank-style units heat dozens of gallons of water with a gas burner or electric heating element and then merely store that water until needed—all the while losing heat (aka "standby loss"). The unit then has to fire back up periodically to ensure hot water is always available, even at times when there is no demand (such as during sleeping hours, or when everyone is away from the house for a day or on vacation).

Not surprisingly, a lot of money is wasted with storage tank systems. Energy Star estimates that a household that uses up to 40 gallons of hot water daily can cut its bill by about 34 percent—about \$100 per year—by going tankless.

But consumers aren't the only ones to benefit from the shift to tankless. Retailers and installers are seeing positives, especially as the product has evolved. Bosch Thermotechnology Corp.'s newest line of gas condensing tankless water heaters—the *Greentherm 9000 Series*—takes the evolution further by solving some of the tankless industry's longstanding limitations.

MONEY MATTERS AND MORE

Tank-style water heater advocates have long stressed how the price of a tankless unit—historically up to three times more than tank storage versions—offset any monetary savings. That argument is quieting a bit due to recent changes in industry regulation. In April 2015, the National Appliance Energy Conservation Act (NAECA) upped Energy Factor (EF) standards for gas-fueled tank storage heaters by 20 percent. New models require a minimum EF rating of 0.82, up from 0.62 for earlier units. This places tankless well ahead of traditional storage models, which saw EF score requirements improve to no more than 0.75, regardless of the tank's capacity.

This change had a double impact on tank-type products. Making the units more energy efficient often resulted in bulkier units, and their price increased by about 17 percent to 20 percent. The two types of water heaters are now closer in price, and tankless has effectively become a better buy due to its superior energy efficiency.

One of the tankless water heater's key selling points—its smaller, space-saving size—has become even more pronounced as tank-style units become larger and more cumbersome to transport, carry into homes, and install into tight spaces.

Tankless water heaters can also be easily integrated into smart home setups—another consumer desire—and may be controlled remotely or via mobile apps that also manage appliances, security systems and thermostats.

And, tankless water heaters are also further in line with tighter nitrogen oxide (NO_x) emission standards at federal and state levels, compared with storage water heaters.

These factors are expected to continue to boost popularity of the gas tankless condensing water heater market for several years. Navigant estimates that tankless unit sales in the U.S. will increase by nearly 75 percent—from \$399 million in 2015 to \$698 million by 2020.

GOING WITH GREENTHERM

The Bosch *Greentherm 9000 Series* offers nine gas-fueled models for high-efficiency, Energy Star-rated hot water generation in residential applications. These units were designed to surpass federal minimum energy-efficiency requirements and offer top-level performance, comfort and homeowner control.

Greentherm's EF of 0.99 is the industry's highest, as is its 100 percent Thermal Efficiency rating. A user will typically save up to 40 percent in annual energy costs versus using a tank-type water heater.

A general shortcoming of tankless-type units has been the ability of the unit to keep up with hot water demand when multiple devices—such as a washing machine, dishwasher and shower—are running at the same time. *Greentherm's* advanced technology solves the problem by seamlessly controlling output capacity. This optimizes comfort and efficiency by combining the burner's pulsating mode with the bypass valve to achieve the desired outlet temperature, even at low flow rates. Its wide operating range—between 9,000 and 199,000 Btu—saves energy when hot water demand is low by eliminating short cycling.

The new *Greentherm* units also offer integrated Wi-Fi control—an included feature on the *9000i SE* model and an option with the other models—allowing owners to control water heater functions via a free mobile phone app and receive live performance monitoring, real-time remote diagnostics and troubleshooting notifications.

An active bypass provides superior temperature stability and eliminates the need for a buffer tank, even with varying flow rates and supply-water temperatures. Water temperature is maintained at plus or minus two degrees Fahrenheit due to the active bypass function.

A standard built-in recirculation pump in the *9000i SE* model, which is optional on some other models, allows easy plug-and-play installation of a home recirculation system. This also provides faster delivery of hot water to outlets, and prevents up to 11,000 gallons of water per year from being wasted. Because no dedicated hot water recirculation return line is required, this model can be installed in virtually all existing homes.

Greentherm units are expected to last far longer than their tank-type counterparts. While a conventional water heater typically requires

replacement every 7 to 10 years, the tankless model could last up to 20 years with recommended annual maintenance. The lifespan is aided by a primary copper heat exchanger and a secondary stainless steel unit to minimize scale buildup.

IN AND OUT IN A FEW HOURS

Other features of the *Greentherm 9000 Series* makes life easier for installers—a primary goal during product development, according to Freddie Molina, tankless product manager at Bosch Thermotechnology Corp.

Typically, it takes up to three hours to install a tank-style heater and up to five hours for most other tankless units, according to Molina. But replacing a storage tank model with a *Greentherm* unit takes significantly less time, thanks to design improvements that make installation a plug-and-play affair.

Greentherm units are smaller, which makes them suitable for installation in numerous locations in any home. It also simplifies work for installers, who are not replacing a bulky water heater with an even bulkier one. The tank's *Roundagon DNA* design gives it a sleek, rounded-corner appearance that easily integrates into modern households.

Indoor *Greentherm 9000* units have top-mounted cold- and hot-water connections, similar in placement to those on tank-type heaters. Installers can use three-quarter-inch or half-inch gas lines (as designated by local and national codes).

Each model includes a manifold injector kit for quick conversion to LP gas if needed. A built-in touchscreen control speeds the conversion process and eliminates lengthy setups caused by complex dip switches found on other manufacturers' tankless units.



Power up. Top-mounted cold- and hot-water connections make the indoor *Greentherm 9000* unit easier to install when replacing a tank-style water heater.

The patented *Optiflow* combustion management system offers dynamic CO₂ control and automatically adjusts for various installation conditions, including flue length and altitude. This eliminates the need for a combustion analyzer in most typical installations.

Installation allows up to 60 feet of venting with two-inch pipe, or 280 feet of venting with three-inch pipe, using a wide range of venting material options.

Built-in drain ports, an anti-freeze kit and an atmospheric pressure sensor cut down on installation time and eliminate the need and extra cost to buy additional accessories.

There are dedicated models for indoor or outdoor installation. No outdoor vent kits need to be stocked or installed.

HERE'S LOOKING AT YOU

Although new to the market—the product was announced in January—*Greentherm* and Bosch have already received praise from the green products industry.

In December 2016, the *Greentherm 9900i SE* was named a CES 2017 Innovation Awards Honoree by the Consumer Technology Association. Such products “reflect innovative design and engineering in some of the most cutting-edge tech products and services coming to market,” according to CTA. The *Greentherm 9000* line was displayed at CES 2017 in January.

In March 2016, Bosch was named as the No. 1 preferred provider of tankless hot water systems in *Green Builder Magazine's* Readers' Choice Awards. The company also ranked No. 2 in environmental stewardship; third in greenest appliance products; and fourth for greenest heating, ventilation and air conditioning products. Bosch *Greentherm 9000* was selected by the GBM editorial team as a 2017 Hot 50 Product.

With all its innovations and crafted design, the Bosch *Greentherm 9000 Series* tankless water heaters are an advancement in hot water efficiency and comfort. **GB**



CREDIT: BOSCH THERMOTECHNOLOGY CORP.

At a Glance

Key elements of the Bosch *Greentherm 9000 Series* of tankless water heaters:

- Nine models for high-efficiency domestic hot water
- The tankless water heater industry's highest Energy Factor of 0.99, with a Thermal Efficiency of 100 percent
- Integrated Wi-Fi control that enables remote user-control of water heater via a free mobile app
- A built-in recirculation pump (available on certain models) that allows for easy plug-and-play installation of a home recirculation system
- An active bypass that provides unparalleled temperature stability and eliminates the need for a buffer tank, even with varying flow rates and supply-water temperatures
- Dedicated models for indoor or outdoor installation



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ISSUE

GREEN BUILDER®
The Hot 50

Green Builder's annual special edition will highlight 50 innovative products, hand-picked by our editors. We'll feature newcomers alongside upgraded, tried-and-true brands.



FROM THE TAILGATE

New Offerings for the Sustainable Minded

By Ron Jones

A Deeper Shade of Green

ENJOY READING AND learning about the amazing projects featured in this issue of *Green Builder*, highlighting our annual green home award winners, and perusing the lists of outstanding building materials, products and systems that these extraordinary builders and designers have employed in their entries. But I can't help but shake my head and privately chuckle in amusement, as well.

You see, for more than a decade we have delivered the highest-quality information to our readers about successful sustainable development and green building. Yet from time to time, we still turn over a rock and find folks in the industry who haven't gotten the message, or for some reason refuse to hear it.

While the vast majority of the building product manufacturers—and those who handle their marketing internally or through third-party agencies—have long understood the underlying *green* message and the benefits that come with it, there are still a few out there who leave us bewildered and asking ourselves where they have been for the past couple of decades.

When we approach these companies, they sometimes respond that they're "not promoting green" or that they "don't think they have a green message to tell," or that their "customers aren't asking for green." Others tell us that they are only trying to reach "mainstream" builders and designers, whatever that means.

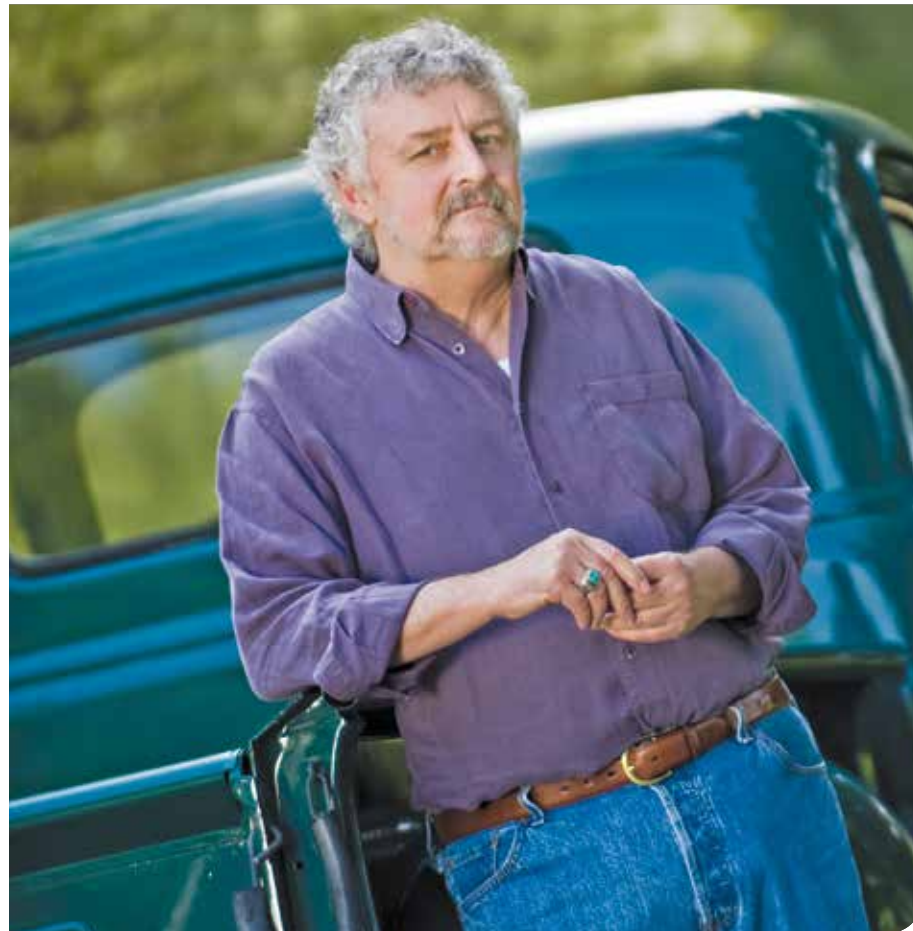
Sure, we are quite proud of the fact that *green* implies a sincere commitment to the natural environment, as well as an awareness and concern for social issues that are directly affected by the shelter industry. But there is so much more to the whole concept of *green*. So, in the context of the building and development sector, what does *green* really mean?

We believe it simply means **better**.

Green means not being satisfied with just meeting the minimum requirements. *Green* means being energy and resource efficient. *Green* means improved comfort and indoor environment quality.

Green means employing proven building science, third-party verification and performance testing.

Green means durability and resiliency, and it means caring about your projects and how they perform long after they have been completed.



In a nutshell, *green* means higher quality!

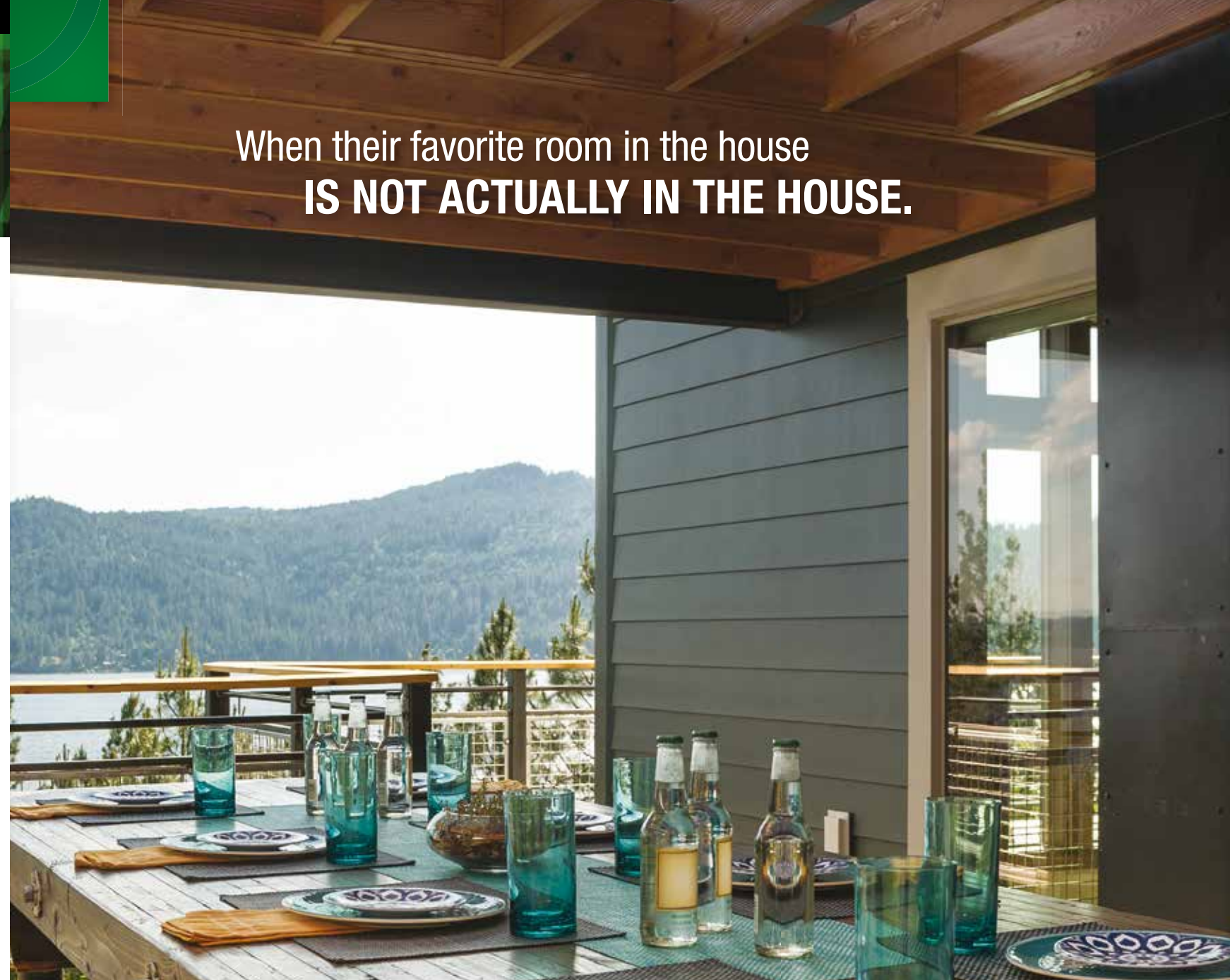
Take time to study the award-winning projects in this issue, and be sure to take a good look at the products and systems that are listed with each one. These are not exotic, crunchy, hard-to-find options that come from obscure sources, whether we're talking about the building envelope, surfaces, mechanical systems, finishes, appliances or whatever you care to name.

They are proven, respected, readily available components that really smart builders—those who deliberately and strategically differentiate themselves and their projects from the pack—specify in order to excel and succeed.

If you would like to offer your goods and services to the kind of builders and designers featured in this issue of *Green Builder*, you know where to find us. **GB**

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