Award-Winning Coverage of Sustainable Construction, Products and Lifestyles

GREEN HOME OF THE YEAR AWARDS

Art and science converge, as this year's winning projects raise the sustainability bar to new heights.

March/April 2018 / www.greenbuildermedia







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EDITOR'S NOTE The Inside Scoop

By Matt Power Editor-in-Chief

Building for the Owner You'll Never Know Award-winning homes begin with an attitude of service.

ACK IN ABOUT 1993, when I met my future friend and colleague Ron Jones, he was building one-off custom homes in Albuquerque for well-heeled clients. At the time, we didn't use terms such as Net Zero or Passive House. Guys like Ron just knew how to build superior, energy-efficient homes: You use the best available materials and install them with precision and care—always keeping the future well-being of your client and future homeowners in mind.

Ron and his subs didn't need to carry around the Code book and try to squeak by, doing the bare minimum. They considered the Code more of a safety net than a cookbook.

Stay with me. Before I talk about this year's Green Home of the Year Award winners, let me ask you something:

Have you ever had the experience of opening up a wall or ceiling





in an older home and finding a little "present" from the original builder? Maybe he penciled a date on the rafter or left a note about a renovation. He or she took pride in the work, and wanted to leave a legacy.

I've found these notes many times in my own renovation work. But there was also the OTHER kind of non-verbal messages: crisscrossed wires in a senseless tangle, missing insulation, poorly nailed rafters. The list of screw-ups is almost endless. The impression you get is that these contractors weren't thinking about the future owners of this home. On the contrary, they were thinking about finishing up early, loading up the truck and downing a few beers at the local sports bar.

In other words, great homebuilding and renovation is a mental exercise, above all.

Twenty years ago, I gave a speech comparing custom builders and production builders to Greeks and Spartans. The former group focused on a long-lasting "legacy" project—delivers a superior house, energy efficient and beautiful. The latter—narrowly focused and creatively stifled—delivers a "just enough" home.

I should add that today, that comparison is no longer really fair. Many production companies have raised the bar to Net Zero and are building homes a citizen of ancient Greece could be proud of.

Which brings us to the award-winning sustainable homes featured in this issue. These are forward-looking projects, built to please the second, third and fourth owners, not just the immediate occupant. Beautifully designed and sited, they minimize the use of energy and water, yet also address the factors that cause the built environment to deteriorate and lose value: moisture infiltration, wear and tear, and poor indoor air control.

From a long-term perspective, what's really encouraging is that every one of this year's winners is built "beyond code," whether or not it's certified under a green building program. The principles applied in these stellar projects transfer without translation to every type of residential structure, from tiny homes to multi-story, multi-family apartments.

We're proud once more to present: the Green Home of the Year Awards. **GB**





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Green Building NEWS

The Latest on Sustainability and Renewable Energy

Trump's 'Fake News' Claims Led to More Green TV in 2017

The President's doubts about Climate Change may have actually raised public concerns about the issue.

RESIDENT DONALD TRUMP'S skepticism about Climate Change and other ecological matters is becoming a good thing for environmentalists. According to research firm Media Matters for America (MMA), the more the President downplayed or disputed global warming in 2017, the more network television news stations increased their coverage of the subject.

The Washington, D.C.-based news analysts found that 79 percent of Climate Change coverage on the major corporate broadcast TV networks—ABC, CBS, NBC, Fox and PBS—focused on statements or actions by the Trump Administration, with heavy attention given to the President's decision to withdraw from the Paris Agreement, and to whether he accepts that human-caused Climate Change is a scientific reality.

As a result, the number of Americans saying they are worried about the effects of carbon emissions is at a 30-year high, according to a climate perspectives study by environmental advisor group ecoAmerica.

There were 260 total minutes of climate-related coverage from the TV networks in 2017, up from 146 in 2015, when MMA last conducted such a survey.

But all of that additional attention is not perfect: Eighty-five

Business as usual? The effects of global warming, such as the growing crack along Antarctica's Larsen C ice shelf, aren't happening, according to the President. But people heard even more about it in 2017.



percent of news coverage came in response to Trump's actions or statements-the decision to pull out of the Paris Agreement topped the list-while only about 13 percent went toward more-urgent topics such as extreme weather, public health, economy and national security. "They largely overlooked crucial stories like the ongoing rollback of the Clean Power Plan and the role of Climate Change in a year of record-setting weather disasters," says Lisa Hymas, MMA's director of climate and energy programs.

Not surprisingly, PBS had the most complete, balanced TV news coverage, offering twice as much airtime than that of the other corporate TV news networks combined. Climate Change denial was routinely featured on news segments, with media often not challenging the statements, MMA notes.

Still, uneven news can be good news in the long run. "Any segment devoted to Climate Change, as well as any substantial mention about climate change, impacts our actions," Hymas says.

UL Environment, Carpet and Rug Institute Hit the SPOT More than 600 certified green products are being added to ULE's sustainability database.

UL Environment (ULE) has added the Carpet and Rug Institute (CRI)'s Green Label Plus (GLP) certified carpet, cushion and adhesive products line to its online sustainability database. SPOT. According to ULE Vice President and General Manager Alberto Uggetti, the addition of CRI's products will provide SPOT users with access to more than 600 additional flooring products that have low chemical emissions, enhancing their ability to identify healthier, more sustainable flooring that meets their project needs.

SPOT features more than 50.000 credible green products and facilitates their selection for the design community, professional purchasers and others seeking sustainable products.

Uggetti calls GLP's inclusion "an important step in the evolution of SPOT to be the industry's most credible resource for finding healthier, more sustainable products they trust."

GLP products will also be part of UL's new AutoDesk Revit add-in, which allows users to access product data from SPOT and assign it

directly to their projects.

CRI President Joe Yarbrough considers GLP and SPOT a perfect match. "Our manufacturers [will] have more exposure for their products on a trusted product platform," he says. "And [it] helps architects, designers and specifiers access this information during the [Building Information Modeling] process."

More information on SPOT may be found at https:// spot.ulprospector.com/en/na/BuiltEnvironment.

Totally Tubular? A new type of tiny home offers a sustainable way to meet one of humanity's most basic needs.

N ONE HAND, there is a critical affordable housing shortage in many cities. In the other, a surplus of eight-foot-wide concrete pipes. Architect James Law found a way to solve both problems: The OPod Tube House.

Offering 100 square feet to 200 square feet of living space. the microhome is large enough to house up to two people. The unit can include areas for sleeping, bathing and cooking. The glazed glass front door doubles as a window and can be opened with a smartphone. It also offers natural lighting that is supplemented with a retractable lamp.

The pipes can also be stacked up to four high, making them ideal for narrow gaps along a city block. And—most importantly—they cost only about \$15,000 to convert, and could be rented out for about \$400 a month, according to Law.



Pipe dream. A microhome made from converted concrete piping could put a dent in large cites' ongoing shortage of affordable housina.

That's a far cry from rental prices in cities like Hong Kong, where a one-room, 400-square-foot sub-studio goes for about \$2,100 USD—about five times what a typical resident can afford, according to Demographia's International Housing Affordability Survey.

"Every person deserves a home," Law says. "It's a basic human right. I dream to make homes that are warm and safe for all those on this planet who cannot afford live in one. I want to achieve this through invention, design, innovation and technology, for all these things are the greatest powers of humanity to create a better future."

A prototype has been built, and is currently on display in Hong Kong. Law hopes to have them mass produced and available for occupancy later this vear.



Hand-built reboot. Today's manufactured homes, with green elements such as Energy Star shingles, fiberglass and cellulose insulation, and low-flush toilets, are not the less-flattering pre-fabs of old—something FMHA is happy to reveal in its new marketing campaign.

All Hands on Deck, Roof and Walls

FMHA's 'Hand-Built Homes' campaign strives to showcase the effort and elegance of crafting a manufactured home.

F HAT DOES IT REALLY TAKE to build a manufactured home? The Florida Manufactured Housing Association (FMHA) wants people to find out. The group has launched its "Hand-Built Homes" campaign to emphasize the craftsmanship and passion that go into building a sustainable, stylish and high-quality dwelling.

According to Jim Ayotte, FMHA's executive director, Hand-Built Homes will educate consumers about the manufactured housemaking process by using web pages, brochures, online ads and four videos. The videos each feature people who design, build and sell manufactured houses in Florida.

Hand-Built Homes will illustrate the process by which manufactured homes are made, concentrating on the thoughtful design and exceptional construction, Ayotte says. "This intentional focus will help consumers understand that manufactured homes are built by people who are accomplished in their trade, whether they be cabinet makers, electricians or roofers," he notes. "Further, the campaign will champion the quality of hand-built homes by showcasing the regulated, efficient environment in which the houses are constructed."

More information about the Hand-Built Homes campaign can be found at www.fmha.org/hand-built-homes.



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TAILGATE	

HERE'S A SAMPLE OF WHAT'S INSIDE

"I really like that LEED is based on science. I have found over the years that a lot of the bad things in our industry are the result of an overemphasis on pure aesthetics." (p.48)

ON THE COVER MARTAK PASSIVE HOUSE

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THE FLEX HOUSE: SECOND COMING At CES, The Flex House became a fully functioning Smart Home 2.0, demonstrating technologies that save energy, water and other resources.

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To achieve Passive House status for Scranton House, builders went back to	o basics

The eco-friendly Dundonald Street home deserves kudos for its building science and unique design.



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10TH ANNUAL Green Home of the Year Awards

his year's Green Home of the Year award winners are about firsts (inaugural Passive House projects) and seconds (renovations and rebirths). From going way beyond net zero to literally going back to nature, these high-class projects honor eco-friendliness and innovation. **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 science employed. Here's our run-through of eight exemplary and imaginative green homes. Enjoy the ride!





years of experience in residential design, her awardwinning homes can be found throughout the Lake Norman, N.C., area and in multiple states.

She is a certified professional building designer and member of the American Institute of Building Design (AIBD). Pippin holds diplomas in classical architecture, green building and renewable energy technologies and is a certified green professional with the National Association of Home Builders. She is the current chair of the AIBD High Performance Homes Team Committee and a well-known speaker on green building and sustainable living practices.

She is the recipient of numerous design and business achievement honors, including the 2009 "50 Most Influential Women of the Year" award from the *Mecklenburg Times*; the 2008 Green For-Profit Business of the Year, Green Advocate of the Year and Green Residential Renovation Project of the Year awards from the Charlotte Business Journal; and the Special Project—Green Renovation Stars award from the NC Homebuilders Association.





Ari Rapport is responsible for developing and leading IBACOS strategic relationships with builders, manufacturers, state and federal governments, and other industry stakeholders to drive innovation in the housing industry. Rapport has more than

10 years of experience applying building science principles to improve the quality and performance of U.S. homes. He works with multiple stakeholders to manage in-depth programs and projects that will have short-term and long-term impacts on the housing industry.

Rapport holds a Master of Science degree in Sustainable Systems from Slippery Rock University in Pennsylvania, and is a certified Home Energy Rating System (HERS) rater with more than 10 years of experience performing home energy ratings per Residential Energy Services Network (RESNET) standards.



Kim Shanahan is executive officer of the Santa Fe Area Home Builders Association (SFAHBA). A former builder of affordable and green Santa Fe subdivisions with more than 30 years in the industry, Shanahan is well versed in the subjective and objective

nature of judging homes for excellence and accomplishment. He is also a past Green Builder HOTY participant builder.

He has served on many local boards and committees, including Habitat for Humanity, YouthWorks, Affordable Housing Roundtable, Sustainable Santa Fe Commission, Capital Improvements Advisory Committee, Long Range Planning Committee, Planning Commission and the Mayor's Task Force to End Homelessness.

Shanahan has helped nurture a change in the local perception of Santa Fe's homebuilding and development community over the past decade. The public's acknowledgement of the inherently progressive nature of local builders and developers has been firmly established. As a national leader in the practice of green building science, for even the most affordable homes, SFAHBA plays a significant role in guaranteeing a healthy and sustainable local economy.

E CARACIERO E CONTRACTOR E CONT

This off-grid mountain retreat is designed to sip energy, resist wildfire and return to the forest at the end of its life.

HEN ANDREW MICHLER began designing his award-winning passive house, he knew he had a tough client: his family. The MARTaK Passive House, located near the one-stoplight town of Masonville, Colo.,

one-stoplight town of Masonville, Colo., was to serve as an off-grid family retreat. Consequently, it had to be flexible, accommodating

OF THE YEAD

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Vera

and architecturally interesting, as well as perform in a tough climate.

Serene spaces.

With an open floorplan and simple organic materials, the design draws from contemporary residential Japanese architecture.

Fortified envelope.

The super-insulated walls range from 16 inches to 24 inches, depending on their exposure.

Double duty.

High-performance windows from European manufacturer INTUS bring in daylight and solar heat gain in winter.

PANTRY

The nail-lam floor consists of FSC-certified dimensional lumber that is set on edge and fastened together.

Renewable

materials.

Less is more.

The home's **Passive House** envelope design and small size ensure it will require very little energy, even in a harsh mountain climate.

The 1,275-square-foot dwelling is built at an elevation of 6,700 feet, in a ponderosa pine forest increasingly at risk for wildfires. It's the first certified International Passive House in Colorado.

Michler took design inspiration from the Hogback Mountains, a spine-like ridge in western Colorado. The shed roof of the MARTaK House rises gradually from west to east, and the north wall cants back from the peak. The basic building form is simple—a necessary strategy for achieving Passive House standards—but the asymmetric ceiling and angled south wall help the structure transcend the rectangle, creating dynamic spaces inside.

"One of the tricks for small spaces is you have to think in three dimensions, and play with volume and scale," says Michler, who offers design, writing and consulting services under the umbrella of Baosol Design. The open floorplan includes flexible spaces which range from expansive to cozy. Other features that add flexibility and function include the multi-use stair with its series of nesting boxes and the "net-bed" in the loft, which ensures an exchange of natural light and provides the perfect retreat for kids. Except for the loft, the home is ADA accessible.

Old School but Effective Insulation

Michler thought carefully about the whole life cycle of the building and embodied energy of the materials. Wood, a renewable resource that also captures carbon, is used extensively in the structure and finish materials. Though many passive houses rely on spray foam insulation to achieve their superior energy performance, Michler decided to not use any foam in the MARTaK Passive House. The home is also built on a traditional crawlspace foundation insulated







Back to nature. Designer Andrew Michler envisioned a house that could be reabsorbed by the forest after the steel roof and windows are recycled.

with cellulose, rather than a concrete slab, greatly reducing the amount of concrete needed. The stem walls rise from an earth-andtire foundation that Michler salvaged from a previous shop building.

The walls consist of traditional 2-by-4 wood framing skinned with plywood; the cavities are filled with Rockwool mineral wool batts, and joints are taped with adhesive tape from pro clima. Larsen trusses—ladder-like, non-loadbearing frames—attach to the exterior, creating bays that are filled with blown-in cellulose insulation. Rockwool drain boards—a rigid mineral wool product—attach to the Larsen trusses, and the exterior walls are finished with a rainscreen and board-and-batten fiber cement siding. The walls vary in thickness from 16 inches to 24 inches, with the thicker walls on the north side. Triple-pane windows from INTUS complete the envelope.

Insulation values are high, even by passive house standards, with the thickest walls reaching R-120. In fact, modeling software showed the project performing at more than twice the certification level.

"We way overbuilt," says Michler. "It was my first passive house, so there was a lot of learning." Since then, Michler has designed a second passive house, and he recently traveled to Vancouver, B.C., to research high-performance buildings.

With Heating, Less Is More

Passive House design achieves a 90 percent reduction in heating demand. According to Michler, the MARTaK Passive House requires the equivalent of a stovetop burner for heating. The home is heated with a hydronic loop that relies on an efficient propane-fired tankless heater in combination with a heat recovery ventilator. The HRV supplies fresh air to the home and is supplemented with an earth tube for summer cooling.

Because it is an off-grid home in a fire-prone landscape, self-sufficiency and resilience were givens. Materials such as the mineral wool board, metal roof, cement board siding and triple-pane windows provide fire resistance; rain catchment

Project Stats

NAME: MARTaK Passive House ARCHITECT/DESIGNER: Andrew Michler, Baosol Design BUILDER: Baosol Design and Parr Construction PHOTOGRAPHER: Andrew Michler supplements water demand and is available for fire suppression. The home relies on a modest 2.3-kW solar array.

A visit to Baosol Design's website will surprise visitors expecting a tour of award-winning homes. Instead, the site features an eclectic mix of imaginative experiments, some of which qualify as art installations. Drawing on a background in the fine arts, Michler uses Baosol—a mashup of "tree" and "sun"—as a platform for exploring deep design.

"I try to do things that haven't been done before," he explains.

Michler has also founded Passive House Rocky Mountains, a chapter of the North American Passive House Network, which uses training and advocacy to help promote Passive House in the region.

The MARTaK Passive House should go a long way to furthering Michler's mission of demonstrating how we can build for today without compromising the future. **GB**

Key Components

ALTERNATIVE BUILDING SYSTEMS: Reused rammed earth tire foundation, foam-free passive house envelope

CABINETS, SHELVES, MILLWORK: Site-built FSCcertified plywood

CAULKS AND SEALANTS: Eco-Bond Adhesive Farm Safe Adhesive; SIGA Primur Roll adhesive compound; pro clima TESCON Vana adhesive tape DECKS: Reclaimed redwood

EXTERIOR FINISHES: Cedar picket, **James Hardie** fiber cement

FIRE PROTECTION: Class A fire assembly, tempered triple-pane windows

FLOORING: Slate, FSC-certified plywood

HVAC/DUCTS: Hydronic in wall and post heater on HRV

INSULATION: Applegate Cellulose, Rockwool mineral wool batts and *Drain Board* sheets

 $\textbf{LIGHTING: Cree}\, \text{LED}$

RENEWABLE ENERGY SYSTEMS (SOLAR, WIND, ETC.): 2.3-kW **Schott** solar PV array; **Iron Edison** nickel-iron batteries; **Outback** inverter and charge controller

ROOF: Galvalume Steel

SPECIALTY PRODUCTS: pro clima Intello highperformance vapor retarder

VENTILATION: Air Pohoda HRV

WATER HEATING: Noritz tankless water heater WATER MANAGEMENT (INDOOR/OUTDOOR): Toto 0.8-

gal toilet, low flow faucets, **Oxygenics** 1.0 gpm showerhead; rain catchment with **WISY** diversion filter

WINDOWS, SKYLIGHTS, PATIO DOORS: INTUS Eforte triple-pane windows (0.49 SHGC)

MORE INFO ON THIS PROJECT: www.greenbuildermedia.com/hoty

Big on design. An open floorplan and space-saving features such as this "multi-use stair" make the most of 1,275 square feet.



Net Zero **GREEN BUILDER** Victorian This classic Twin Cities home goes from 'remuddled' to sustainably remodeled. **BY ALAN NADITZ**



HEN STEWART AND LINDA HERMAN bought what would become known as the Minneapolis Net Zero Victorian, their goals were simple: Preserve and enhance the traditional character of the now 111-year-old home, and seamlessly reach net-zero-energy living in their retirement without sacrificing any modern conveniences.

According to SALA Architects Senior Associate Marc Sloot, the project's architect, the Hermans—a pair of retiring college professors wanted their passion for education and the environment to carry over to this massive rebuild. "Seeing the effects of global warming, and the huge number of aging houses that need improvement, [they] wanted to set an example for net-zero remodeling," Sloot says.

After spending their careers living in the Fargo region, the Hermans wanted a home in a dense residential Twin Cities neighborhood that would make for a challenging remodel. Finding that house was relatively easy: a bank foreclosure, built in 1907, on a tight 40-by-120 lot with a number of poorly designed additions by a previous owner.

Although the house was filled with what Sloot likes to call "remuddled" efforts, "it was a house that had some good bones and a real charm to it," he notes. "We could tell it had a really great potential."

The home had a south-facing roof, which ordinarily should have made it a match for one of the Hermans' top requirements: passive solar. But the project's tiny lot resulted in only a 15-foot wall-to-wall clearance from neighboring homes. Existing trees also ruled out highly efficient photovoltaic use. "We knew passive solar was out of



Light it up. Solar-powered lighting is a major part of the Net Zero Victorian, from the Mother Nature-produced form that streams through windows, to carefully situated LED lamps



Déjà new. Cambria quartz countertops, Marmoleum flooring, Energy Star-rated appliances and sustainably sourced wood cabinetry give the home an updated yet classic look.

the picture here," Sloot says. "So to get it to net zero, we had to try really hard to get as much as we could from the performance of the structure and the production."

The Case for 'Remuddling'

Structural difficulties started with the roof, which had been "remuddled" in 2005. The previous owners extended it by 15 feet, but not in a good way. "Instead of having the new roof seamlessly match the original roof, the pitch of it was off by about 15 degrees, and it was down a few inches," Sloot notes. "There was a few inches of transition between the old and new roof. Can you imagine putting shingles on a roof like that? They just rolled the shingles down over that edge."

The remuddling continued. The interior, which also held mold and moisture within the walls, simply wasn't engaging, Sloot says. "You've got the original house with its classic trim and windows, and the addition's got a big box store look—the cheapest stuff you could find. Things like that took away from the appearance and functionality of the house."

The floors were a basically a replay of the roof. "You go from the existing house on the first floor, to the floor where the addition comes on, and it steps down ³/₄ of an inch," Sloot describes. "Again, why would you do that?"

Ditto on the upper level, where "you go from the existing part to the new, and there's a six-inch step up, because they wanted to use different sized lumber that was probably cheaper," Sloot says.

"Some of those things we could easily fix. In some cases, we had to strip it down to the studs and start from scratch," Sloot says. "For other ones, we had to get creative in how we designed around them."

Aging in Place

An example is the insulation used for the foundation. The lot's narrow clearance from neighboring properties made using conventional installation equipment like a back hoe impossible.

Resilient paint.

The Sherwin-Williams exterior acrylic latex paint provides extra mold and moisture resistance, even in freezing weather, as well as an added layer of environmental temperature control.

Cool shingles.

CertainTeed roofing shingles offer solar reflection to lower energy costs.

Cocoon, Surgical Excavation and

EPS insulation systems combine to minimize the impact of severe weather upon the home's foundation.

Insulated foundation.

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Andersen triple-pane glass, which helps manage the amount of heat generated

by solar energy, is featured on windows

and doors throughout the home.

Glass act.

Solar plus.

A 54-panel photovoltaic array generates up to 150 percent of the home's overall energy use annually.

> FROM THE JUDGES "For buyers and designers that appreciate a period home with modern sustainable technologies, this home is a winner."



A new purpose. Wood for flooring, railings and trim throughout the house consisted of reused or reclaimed birch and maple.

Key Components

ALTERNATIVE BUILDING SYSTEMS: Insulation and air sealing system

EXTERIOR INSULATION OF EXISTING FOUNDATION: Cocoon exterior foundation insulation system; Surgical Excavation hydro vacuum excavation system; EPS insulation; low expansion closed cell spray foam

EXTERIOR INSULATION FOR ABOVE GRADE WALLS: Pressure Equalized Rain Screen Insulated Structure Technique (PERSIST)

EXTERIOR INSULATION FOR EXISTING WALLS: 5%inch Gypsum board; self-adhesive **3M** Air and Vapor Barrier 3015; 7-5⁄4-inch thick **EPS** Insulation; 5⁄4-inch plywood sheathing; **Tyvek** Home Wrap; plywood furring strips for air space behind siding; **Louisiana Pacific** Smart Siding

EXTERIOR INSULATION SYSTEM FOR ROOF: PERSIST; self-adhesive roof membrane; new I-Joist; closed cell spray foam with low global warming potential

APPLIANCES: GE slide-in range with induction cooktop PHS920SFSS; Vent-A-Hood Exhaust Hood PRH9130SS; GE refrigerator GNE29GSHSS; KitchenAid dishwasher KDTE254ESS; Sharp undercounter drawer-type microwave SMD2470AS; LG clothes washer WM3570HVA; Whirlpool ventless clothes dryer with heat pump technology WED99HEDW

AUTOMOTIVE (ELECTRIC CAR CHARGING, ETC.): Schneider EV 2430WS 220-volt charger BUILDING ENVELOPE: Insulation and air sealing system CABINETS, SHELVES, MILLWORK: Cabinets and millwork from Accent Precision Wood Products; No Added Urea Formaldehyde (NAUF) material COUNTERTOPS: Cambria quartz

DECKS: Porch flooring is 1-by-4 Douglas fir tongue and groove; **Valhalla Wood Preservatives Ltd.** nontoxic wood treatment

DOORS AND HARDWARE: Andersen Hardware (exterior doors and windows); reused and salvaged knobs, lock sets and hinges (interior doors)

ELECTRICAL: LED lights used throughout EXTERIOR FINISHES: Andersen Windows

Maintenance Free Exterior Window and Door Trim; Louisiana Pacific Smart Siding and Trim; MiraTec trim; Boral trim; site-applied stucco on foundation with Dryvit top coat

FLOORING: Reused existing yellow birch on main level (front), new birch (rear); reclaimed maple on upper level; **Forbo** *Marmoleum* tile

FURNITURE: Reused from owners previous home **HVAC/DUCTS:** GeoComfort ground source heat pump with ducted forced air distribution system

INSULATION: Lapolla Foam Lok 2000-4G Closed Cell spray foam with low global warming potential (GWP): Rigid EPS with low GWP; **Roxul** mineral wool

with low GWP LANDSCAPING: Versa-Lok retaining walls; Bluestone

natural stone front sidewalk and retaining wall caps; Unilock Umbriano back patio and north sidewalk pavers; fencing is 1-by-4 Douglas fir tongue and groove; Valhalla Wood Preservatives Ltd. nontoxic wood treatment LIGHTING: Decorative lighting by Lampin Lighting WALLS SURFACE MATERIAL: CertainTeed AirRenew formaldehyde "eating" drywall

PAINTS AND STAINS: Sherwin-Williams PLUMBING/PLUMBING FIXTURES: Franke,

InSinkerator, Kingston Brass, Kohler, Mirabelle, Toto, Nantucket, Delta, Toto RENEWABLE ENERGY SYSTEMS (SOLAR, WIND,

ETC.): Photovoltaic array (54 PV panels, LG 315 watt each)

ROOF: CertainTeed Premium Designer Collection asphalt shingle

SPECIALTY PRODUCTS: Custom Cove ceilings STRUCTURAL COMPONENTS: New LVL ridge beam

with structural steel columns

VENTILATION: Broan Energy Recovery Ventilator (ERV)

WATER HEATING: A.O. Smith hybrid air source heat pump water heater

WATER MANAGEMENT (INDOOR/OUTDOOR): Indoor/ outdoor potable water usage; NDS Flow Well Dry Wells to retain 100 percent of storm water on site and absorb it into the ground

WINDOWS, SKYLIGHTS, PATIO DOORS: Anderson *A-Series* triple-pane glass

OTHER: Custom hand-turned columns and stair newels, Tuscan Doric design.



Instead, remodelers relied upon surgical excavation, in which a fiveinch trench is hydro-vacuumed next to the foundation. The trench is then refilled with about two inches of expanded polystyrene (EPS) insulation.

Builders also overcame the effect of a cold, wet Minnesota winter upon the usual self-adhesive membrane used with outdoor insulation. The team chose 3M's *Air and Vapor Barrier*, which proved pliable, thinner and workable in really cold weather. "We went into this expecting to use a more common form," Sloot says. "But the way the schedule played out, we were having to do a lot of the work during the winter. We had to find a product with a different membrane that would work."

Other upgrades reflected a philosophy of "conservation first." These included continuous air sealing and thick exterior insulation from footing to ridge utilizing Cocoon and Pressure Equalized Rain Screen Insulated Structure Technique (PERSIST) methods, triple-paned windows, a high-efficiency ground source heat pump heating and cooling system, a condensing clothes dryer and water heater with heat pump technology, and LED lighting throughout the home. For energy production, there is a 54-panel photovoltaic solar array on the house and garage.

MORE INFO ON THIS PROJECT: www.greenbuildermedia.com/hoty

The Minnesota Net Zero Victorian is a certified Zero Energy Building with the Living Futures Institute and performs at net positive energy, according to Sloot. In its first year of occupation, the house has produced 17,000 kWh while using only 12,000 kWh. Additional green building certifications are expected, including LEED Platinum, GreenStar Gold and MN Green Path Master Level. The home's HERS Index score is -9.

Since the project's completion in 2016, the Hermans have eagerly shared their experience through architectural tours. More than 1,600 people have visited the home for ideas on how they could move their residences closer to net zero. "People are able to monitor how the house performed," Sloot says. "It's one thing if it looks great on paper, but you need to see it work in real life." GB

Project Stats

NAME: Minneapolis Net Zero Victorian ARCHITEC T/DESIGNER: SALA Architects BUILDER: Sean Morrissey, Morrissey Builds PHOTOGRAPHER: Troy Thies Photography



This powerful 'his and hers' house is mostly HERS.

BY ALAN NADITZ AND GREEN BUILDER STAFF

O SAY THE APTLY NAMED Ohm Sweet Ohm saves energy is an understatement. The 2,400-square-foot single-family home in Roseville, Minn., has a HERS Index score of -49. The monthly energy savings alone could power up a 1,200-square-foot house. And, half of that energy goes toward charging two electric cars.

According to Mark Sloot, senior associate for SALA Architects in Minneapolis, that kind of energy efficiency is exactly what owners Mark and Kate Hanson were looking for. "They very much wanted to do something that would lessen their environmental footprint, and that they could show people and hopefully inspire others to do something green on their own," Sloot says. "Like many people, they equated energy efficiency with being green—because energy efficiency is a big part of our environmental footprint."

Sloot says he quickly introduced the Hansons to a concept beyond basic energy efficiency. "I suggested the broader notion of material efficiency and resources, environmental quality and water conservation," he says. "To their credit, they embraced that readily and quickly. They weren't aware of programs such as LEED or GreenStar, and when they did, they said, 'Yeah, let's do it right.""

FROM THE JUDGES

"This project is exemplary in its class, and represents a successful and beautiful expression of the owners' and designer's sustainability goals.'

Right angle.

Asymmetrical roof slopes enable solar panels to be at an optimal angle for maximum solar exposure

Tactical overhangs

Carefully sized roof overhangs promote passive solar heating in the winter and shading against overheating during summer.

and the

the groundwater.

Durable finishes.

Sherwin-Williams low-VOC paints on the home's interior and exterio are environmentally friendly and promote healthy air quality.

<u>**(eriscaping**</u>

Drought-tolerant plants se throughout the landscaping prevents the need for an irrigation system.

Properly Passive

"Doing it right" meant putting a number of passive and active principles into play. On the outside, carefully sized roof overhangs and a tuck-under lower level promote passive solar heating in the winter, and shading against overheating in the summer. Asymmetrical roof slopes enable the photovoltaic (PV) panels attached to the southfacing roofs to be at an optimal angle for Minnesota while lowering the ridge height, which maximizes the solar exposure of the garagemounted PV panels.

Runoff collection is a huge part of Ohm Sweet Ohm's efficiency

rating. More than 100 percent of storm water is absorbed on site into four rain gardens and by collecting additional storm water from the street via a cut curb, directing it to the property soil bed, where it can recharge the groundwater and aquifer. There are also four 50-gallon rain barrels installed to collect rainwater for incidental watering.

The storm water diversion offers another huge asset, according to Sloot.

"From an environmental standpoint, it's fabulous," Sloot says. "The reality of when it rains, especially if it's been a week or more since it's rained, is that a lot of debris collects in the drain line.

Project Stats

NAME: Ohm Sweet Ohm **ARCHITECT/DESIGNER:** SALA Architects BUILDER: Kerry Hage, Hage Homes PHOTOGRAPHER: Correy Gaffer Photography





A sustainable (work) flow. Material in the bathrooms, such as the Crossville Bluestone tile and the Neptune Nagano soaking tub, includes recycled content.

When it rains, the first flush of water that comes down the street sends that debris directly into the storm drain. So we're helping keep the drains that much cleaner, because we're always taking that debris away."

Potable water conservation is achieved through efficient plumbing design, water-efficient fixtures and drought-tolerant plants throughout the landscaping, which prevents the need for an irrigation system.

Inside, carefully placed Andersen A-Series triple-pane windows with a high Solar Heat Gain Coefficient (SHGC) boosted passive solar heating and passive cooling. All heating, cooling and hot water stems from a GeoComfort ground source heat pump system. Even the clothes dryer integrates heat pump technology.

All of the finish materials and coatings—such as the CertainTeed AirRenew drywall, which absorbs formaldehyde from the air, and Sherwin-Williams low-VOC paint-are environmentally friendly and promote healthy indoor air quality. And, there is LED lighting throughout. Storage space was emphasized throughout the home using built-in shelving and cabinetry. All are made of recycled wood sourced from the Midwest. All cabinetry and millwork also consist of No Added Urea Formaldehyde (NAUF) material.

Because of potential air leaks to the attic, there are no recessed





and most were made from post-consumer recycled polyester or

plastic. Most window and door frames are made of FSC-certified

All of the power-packed upgrades didn't come cheap. The house

cost about 10 percent more than a typical non-passive home of the

same size, and the couple estimates that it will take a decade before

that difference is recovered via energy savings. But that's all right

"They wanted what would be their forever home, a place where

they could stay and age gracefully," Sloot says. "With this, they more

lights in the ceiling. Instead, all recessed lights are in dropped soffits. All of these elements helped Ohm Sweet Ohm achieve certification with LEED for Homes v4 (Platinum), GreenStar (Gold) and Minnesota Green Path (Master Level). The home is also designated GreenStar Zero Energy Capable.

Finishing Touches

The owners added their own environment-friendly elements by selecting furniture with sustainable attributes in the actual product, from local companies with green production policies. Fabrics were deemed durable, passing high rubs on a Wyzenbeek abrasion test,

Key Components

ALTERNATIVE BUILDING SYSTEMS: See Building Envelope listing below

APPLIANCES: Jenn-Air 30-inch induction cooktop; Vent-A-Hood exhaust hood; Subzero 36-inch refrigerator; Fischer & Paykel two-drawer dishwasher; Wolf Speed Cook oven; Wolf wall oven; Samsung clothes washer; Whirlpool ventless condensing clothes dryer with heat pump technology

AUTOMOTIVE (ELECTRIC CAR CHARGING, ETC.): Tesla universal mobile electric car chargers (3)

BUILDING ENVELOPE BELOW-GRADE WALLS: 8-inch poured concrete with low-VOC fluid applied exterior water proofing; 2-inch mineral wool exterior insulation; waterproofing protection material; wood frame wall with closed cell spray foam; CertainTeed AirRenew drywall finished with low-VOC paint

ABOVE-GRADE WALLS: Double-stud wall with 2-by-4 framing space; **CertainTeed** MemBrain smart vapor retarder; CertainTeed AirRenew drywall; Tyvek Home Wrap with 3/8-inch Cor-A-Vent battan strips and James Hardie fiber cement lap siding and trim

BUILDING ENVELOPE, CEILING: CertainTeed AirRenew drywall finished with low-VOC paint; 2-inch closed cell spray foam skim coat on attic floor covered by loose fill cellulose

wood.

with them.

than have just that." GB

CABINETS. SHELVES. MILLWORK: Echo wood veneer. Weitzner Cumulus color and pattern

COUNTERTOPS: Cambria guartz; Element Surfaces recycled glass

DECKS: Trex composite decking

DOORS AND HARDWARE: ThermaTru Pulse

ELECTRICAL: LED lights throughout; **eGauge** electric circuit monitoring system; Tesla Power Wall wiring EXTERIOR FINISHES: James Hardie fiber cement siding; James Hardie fiber cement trim: Durock cement board with **Dryvit** finish; **Sherwin-Williams** Duration low-VOC exterior paint

FLOORING: Crossville Bluestone porcelain tile; Forbo Marmoleum tile

GARAGE DOORS: Custom Door Sales insulated doors HVAC/DUCTS: GeoComfort ground source heat pump

INSULATION: Dense pack cellulose (above-grade walls); Lapolla Foam Lok 2000-4G closed cell spray foam (below-grade walls and attic flash coat); Rigid Type 9 EPS (below slab); Roxul mineral wool with low GWP (exterior of foundation)

LANDSCAPING: Drought-tolerant plants and low-mow fescue turf grass installed; rain gardens (4); terracing created with locally sourced granite boulders for passive solar access to lower level

LIGHTING: LED lighting

PAINTS AND STAINS: Sherwin-Williams Emerald Interior Matte, K36-350 Series, Greenguard, Gold Certified **PAVERS:** Local stepping stone path; local crushed granite path

PLUMBING/PLUMBING FIXTURES: Revere Sink; Brizo, Kohler; MTI Baths Universal; Neptune Nagano soaking tub

RENEWABLE ENERGY SYSTEMS (SOLAR, WIND, ETC.): LG 310 watt photovoltaic panels (61)

ROOF: Galvalume Standing Seam with Una-Clad finish SPECIALTY PPRODUCTS: Forbo Coral Grip MD walk-off mat

VENTILATION: Broan energy recovery ventilator (ERV) WATER FILTRATION: Reo-Pure reverse osmosis system WATER HEATING: GeoComfort ground air source heat pump water heater

WINDOWS, SKYLIGHTS, PATIO DOORS: Andersen A-Series Triple Pane with Argon.

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Designed to accommodate generational living, this home sets the bar for market-rate sustainable homes. **BY JULIET GRABLE**

EATTLE-AREA DESIGN-BUILD FIRM TC LEGEND has hit on a winning formula for building market-rate, netzero-energy homes: Start with a rectangular volume + Use passive solar orientation + Build a well-insulated, airtight envelope using structural insulated panels (SIPs) and highperformance windows.

That strategy is on display in a home completed in 2017 in West Seattle. The 3,160-square-foot home on an urban infill lot is netpositive energy and was built at market rate.

"I still talk to people who don't even know it's possible to build a net-zero home for the same price as a conventional home," says Ted Clifton, designer, builder and owner at TC Legend.

When Clifton began building with SIPs 17 years ago, he had reservations about the material. But then his father, also a builder, asked if he'd like to take on a project in Seattle. The home, which cost \$124 per square foot to build, went on to capture a Housing Innovation Award from the Department of Energy and has earned Net Zero Energy certification under the Living Building Challenge.

The combination of cost and performance of the SIPs system won Clifton over, and today, he won't build with anything else. The energy shell for the West Seattle home arrived on a truck. The 6.5-inch SIPs panel walls were unloaded and installed by hand; a crane was used to set the 10.25-inch SIPs roof. Triple-pane windows from EuroClime complete the envelope.

Environmentally Attractive and Easy on the Eyes

TC Legend homes aren't just functional boxes; it's important that the homes are attractive, too. On the exterior, Allura fiber cement panels combine with FSC-certified redwood accents to create a durable yet attractive façade. Overhangs and awnings add interest while shading the home from the summer sun.

As a case in point, Clifton points to his Tesla *S* electric car. Yes, it's Not content to stop at net-zero energy, TC Legend also integrated a

environmentally responsible. "But it looks really cool, too," he says. rainwater harvesting system into the home—a first for the company. The system was designed by RainBank; TC Legend installed all of the components. The system consists of four 2,500-gallon cisterns located below the first-floor deck, for a total storage capacity of 10,000 gallons. The water moves through a series of physical filters before undergoing UV treatment. The system supplies all of the water used in the three-story home, including irrigation.

Sizing the rainwater collection system for the three-story house







presented a challenge. The limiting actor was the roof area. The cisterns were sized so that they can meet the demand of the occupants, which include a family of five plus guests who stay in the downstairs Airbnb apartment, without overflowing during the rainy season. The system is also connected to the municipal water system, so the cisterns will never run dry.

"This was kind of a first for Seattle, too," says Clifton, adding that the city's inspectors were eager to collaborate and get the system permitted. The captured rainwater and site strategies such as permeable pavers also keep stormwater out of Seattle's combined sewer system.

Low-Cost Luxury

TC Legend's goal is to build only net-zero- and net-positive-energy homes for between \$200 and \$250 per square foot in the Seattle area (less in nearby Bellingham). Cost-cutting strategies start with the site. The home is built into the slope, eliminating the need to import or export soil. The building is a 41.5-foot by 27-foot box,

oriented with the long side of the rectangle facing south. Strategically placed glazing maximizes daylighting and solar heat gain in the summer, while openings on the east and west facades are minimized, to prevent overheating.

The home's design reduces heat and cooling load significantly. A Chiltrix CX34 air-to-water heat pump supplies heating, cooling and domestic hot water. A hydronic loop runs through the ground floor, while ceiling-mounted fan-coil units provide heating and cooling for the second and third levels.

Though new to the U.S. market, Clifton says the Chiltrix units are relatively easy to install, not to mention five times as efficient as a conventional tank-style water heater. The whole house is ventilated by a Zehnder heat recovery ventilator (HRV) that scavenges 91 percent of the heat from the exhaust air.

Because of the link between natural gas and fracking, TC Legend doesn't run propane appliances in their homes anymore. "The compelling argument for gas is gone," says Clifton. Going all electric also eliminates an entire utility—another cost savings.

Other features that helped the home earn its Emerald Star certification through the Built Green program—the most stringent level—include two electric vehicle charging stations, zero-VOC finishes, FSC-certified lumber and no PVC.

Clifton builds four to five homes a year, but he would like to spread his winning formula more broadly, possibly by partnering with a Seattle-area production builder—one who builds hundreds or even thousands of homes a year.

"From a moral standpoint, it would be a shame to know how to build net-energy-positive homes and not do it," says Clifton. GB

Project Stats

NAME: Net Zero Home in West Seattle ARCHITECT/DESIGNER: TC Legend Homes BUILDER: TC Legend Homes PHOTOGRAPHER: Jake Evans





Requirements achieved. To achieve Emerald Star Built Green certification, this home had to meet stringent standards for Site and Water, Energy Efficiency, Indoor Air Quality and Materials Selection.

Key Components

AUTOMOTIVE (ELECTRIC CAR CHARGING, ETC.): 2 stations: 1 internal, 1 external; 50a 120/240v BUILDING ENVELOPE: SIPs, ICF formed stemwalls, triple glazing throughout, spravfoamed RIM WALLS AND ROOF: Premier SIPS platinum with Neopor GPS foam; 6.5-inch walls (R29), 10.25-inch roof (R49) ICF FORMS: NuDura ICFs CABINETS, SHELVES, MILLWORK: locally made, FSC; Blum hardware CAULKS AND SEALANTS: Zero VOC **COUNTERTOPS:** Quartz DECKS: Sustainable Northwest Wood—FSC cedar **DOORS AND HARDWARE:** FSC wood doors ELECTRICAL: 9.9 kW on roof PANELS: 33x itek 300-W solar panels, locally made (Bellingham, WA) **INVERTER: SMA** Sunny Boy 7.8 kW, US NURIO REMOTE MONITORING OF SOLAR ENERGY PRODUCTION FLOORING: Marmoleum (70 percent rapidly renewable content, 43 percent recycled content); Wicanders Cork (renewable); QuietWalk (95 percent postindustrial fibers); acoustic subfloor layer; FSC white oak, Salmon Bay concrete (machine grind finish) with 30 percent slag GARAGE DOORS: R-15 single-car door HVAC/DUCTS: Spiral metal HRV: Zehnder ComfoAir 250 HEAT PUMP: Chiltrix CX34 INSULATION: R-29 walls, R-49 roof, R-23.5 perimeter and R-20 slab LIGHTING: 100 percent | FD PAINTS AND STAINS: All zero VOC PLUMBING/PLUMBING FIXTURES: No PVC RENEWABLE ENERGY SYSTEMS (SOLAR, WIND, ETC.): Solar, rainwater catchment SPECIALTY PRODUCTS: Reclaimed internal glazing **TILE: Stonepeak** Zebrino and Palazzo (66 percent recycled content) **50-YEAR LIFESPAN FIBER-CEMENT SIDING PANELS** SUSTAINABLE NORTHWEST WOOD, FSC REDWOOD LUMBER SIDING SECTIONS STRUCTURAL COMPONENTS: SIPs envelope and all FSC structural and nonstructural lumber WATER MANAGEMENT (INDOOR/OUTDOOR): Permeable concrete hard surfaces; rainwater catchment (from metal roof) and purification as primary water source (10,000-gallon water storage on site)

WINDOW COVERINGS: Custom window shades



Illuminating strategy. All-LED lighting helps reduce

energy demand.

Bright and clean.

High-performance windows bring in an abundance of natural light.

High IAQ. A heat recovery ventilator and nontoxic finishes ensure superior indoor air quality.

Reclaimed finishes.

A distinctive blend of rustic and modern attributes, such as repurposed wood from old barns and dying trees, defines the home's style.

Key Components

APPLIANCES: Thermador (all Energy Star certified) CABINETS, SHELVES, MILLWORK: Abodian CAULKS AND SEALANTS: Tremco Barrier Solutions Enviro-Dri liquid-applied WRB COUNTERTOPS AND/OR TILE: Statements, Inc., recycled content porcelain tile; Caesarstone countertops HVAC: Chiltrix CX34 air-to-water heat pump INSULATION: CertainTeed (fiberglass); Greenfiber (cellulose) LIGHTING: All-LED lighting from Seattle Lighting PLUMBING/PLUMBING FIXTURES: WaterSense-certified Grohe fixtures; 0.8 Flush Niagara toilet RENEWABLE ENERGY SYSTEMS: SolarWorld SW300 PV modules; SMA Sunny Boy 7.7-US inverter; Silk Road solar thermal water heater

ROOFING: TPO membrane

SPECIALTY PRODUCTS: Silk Road solar thermal hot water heater VENTILATION: Zehnder Comfoair 350 HRV

WINDOW: Prime triple-pane. tilt-and-turn

Completed in August 2017, the home has earned the very first Net Zero Energy and 5-Star Built Green certifications in the state of Washington. Taking on challenges is part of the firm's DNA, says Anthony Maschmedt, principal at Dwell Development. "We're on a continual search for the secret sauce."

High-Quality Inspiration

Genesee Park Net Zero is based on the Passive House model, with a super airtight shell fortified with high-quality windows. The threestory home features 12-inch-thick, double-stud 2-by-4 walls filled with blown-in cellulose insulation and triple-pane, tilt-and-turn windows from Prime. Externally applied Enviro-Dri fluid-applied air barrier seals the envelope and flashes doors and windows.

"We find that making the home airtight from the outside is a lot easier than trying to fill all the nooks and crannies from the inside," explains Maschmedt. Fiber cement panels and white oak siding are installed over a rainscreen.

First Lamp Architecture provided the design for the 3,700-squarefoot home. Rooms that flow from one to the next and indoor spaces that connect to sheltered outdoor rooms make for a fluid and dynamic floorplan. The flat TPO roof contributes to the home's aesthetic and also provides design flexibility for the PV array, and the southern exposure and absence of shading create ideal conditions for the solar modules. With the lowered demand, the solar thermal system and 9.0-kW solar PV array easily bring the four-bedroom, four-bath home to net zero. The home, which is also certified under the Department of Energy's Zero Energy Ready Home (ZERH) program, has earned a HERS Index score of o.

Repurposing Power

Genesee Park Net Zero exemplifies Dwell Development's "reclaimed modern" aesthetic, with ample wood, clean lines, abundant natural light and neutral finishes inside. The firm, which builds exclusively spec homes in the Seattle area, uses unique finishes to distinguish its homes. Design Project Manager Abbey Maschmedt has developed relationships with regional suppliers to obtain reclaimed materials, such as lumber from deconstructed barns in Oregon's Willamette Valley. The oak material used as exterior cladding was harvested from diseased and damaged trees in Montana. The oak was also used as exterior decking. Inside, it serves as flooring and is featured in the stairway, sliding barn doors and the chevron pattern on the kitchen island.

"We kind of went crazy with the oak," says Maschmedt. "It was awesome and very special." Contrasting with this warm texture are cool finishes, including Caesarstone countertops, neutrally colored walls and uncased openings.

Project Stats

NAME: Genesee Park Net Zero **ARCHITECT:** First Lamp Architecture BUILDER: Anthony Maschmedt, Dwell Development **DEVELOPER:** Dwell Development INTERIOR DESIGNER: Abbey Maschmedt, Dwell Development PHOTOGRAPHER: Tucker English

WATERPROOF DECK BEDROOM GUEST BEDROOM eeeeeeeeds----**FLOOR PLAN** 2 LEVEL MASTER MASTER BEDROOM BATHROOM BEDROOM 0

Five-Star Studded

Features that helped the home earn Five-Star certification from the holistic Built Green program include 100 percent LED lighting, 100 percent electric power, and water- and energy-saving appliances. The home also features two "firsts" for Dwell Development: a solar thermal system and a Chiltrix air-to-water heat pump.

The solar thermal system, provided by Silk Road Environmental, uses a "solar fluid" rather than water, which can withstand temperature extremes from -70°F to up to 700°F. Each of the two solar thermal modules is capable of producing 50 gallons of hot water per day.

"Even on a Seattle cloudy day, we can raise the temperature of water from 60 to 120 degrees," says Tadashi Shiga of Evergreen Certified, in a video produced by Dwell Development. "It's fantastic."

Supplementing the solar thermal system is a Chiltrix *CX*₃₄ air-towater heat pump, which also provides space heating and cooling for the entire home. Because the Chiltrix units aren't yet available in the Seattle area, one had to be shipped from the East Coast.

"As new systems and technologies become available, we adopt them into our repertoire," says Maschmedt.

There's an added risk that comes with being an early adopter, he admits, but Dwell Development will no doubt continue to push the sustainability bar ever higher. GB



Home made. The kitchen features locally made custom cabinets, LED lighting and Energy Star-certified Thermador appliances.



This custom home demonstrates health and resilience in a High Desert setting.

BY JULIET GRABLE

ABLES THAT SHOW off the unfinished, or "live" edge of a beautiful slab of wood are increasingly popular, and the graceful Live Edge home, north of Bend, Oregon, includes two distinctive

pieces of custom furniture with live edges: a walnut coffee table and a dining table made from reclaimed zapatero. But the home itself, nestled into a bluff above the Deschutes River, is also a kind of live edge. Architect Lydia Peters of Nathan Good Architects designed the home around the rocky outcroppings and sculptured juniper trees that distinguish the High Desert landscape.

"Like so many great projects, this one started with great clients," says Nathan Good, FAIA. "These clients wanted to build a home that had as little negative impact to the environment and to others as possible. Though they wish to remain anonymous, they are pleased to have their LEED Platinum-certified home serve as inspiration and a demonstration tool."

Storied Sources

Live Edge was built by Bend-based Leader Builders LLC. The distinctly modern home is characterized by an earth-toned palette and natural materials, inside and out. Materials were carefully selected to enhance the design and reflect environmental responsibility.

Some come with interesting stories. For example, the flooring is made from reclaimed shipping crates that arrive in the Port of Portland from Southeast Asia. Sourced from dense Asian hardwoods, the material has a striking grain and is extremely hard and durable.

Though based in Oregon, Nathan Good Architects has designed projects for clients in Hawaii, Alaska and Mexico-projects that share in common a responsiveness to a particular climate. Live Edge

MAIN FLOOR PLAN





FROM THE JUDGES "State of the art sustainable luxury."

Elevator, 36-inch door openings, and ergonomic door, cabinet hardware and shelving are just some of the features that make this home accessible.



includes baked-in resilience, starting with durable and fire-resistant exterior materials, such as the metal roofing and plaster. Inside, a sprinkler system protects the home and its occupants from fire.

Live Edge is served by a well, but it also includes a 1,800-gallon potable water cistern, and an attached greenhouse and frost-protected raised beds allow the homeowners to grow some of their own food.

A 22-kW solar array with a 15-kW *PowerWall* battery backup system from Tesla ensures the home will not consume more energy than it produces, and that vital functions can stay up and running during power outages.

Live Edge also includes a number of accessibility features, including zero-threshold showers, grab bars in every bathroom, 36-inch door openings, washlet toilets, an elevator, and ergonomic door and cabinet hardware, all of which enable the owners to remain in their home as they age.

Nature-Resistant Landscape

Landscape designer Chris Hart-Henderson of Heart Springs Landscape Design played a key role in integrating the dwelling with the surrounding landscape, keeping as much of the native vegetation as possible. New plantings, which are limited to the area immediately surrounding the home, require little irrigation and no pesticides or herbicides. Sand-set blue stone flagstone and mortared blue stone squares and rectangles enhance the plantings.

This is Nathan Good Architects' eighth LEED Platinum home. Live Edge has earned other accolades, including the Rethinking the Future 2017 Sustainability Award in the "Residence Built" category.

"We recognize the need to serve as champions for green homes in the luxury home market," says Good. "There are a lot of lessons learned in high-end market that we can apply to other projects."

Good cites the example of another effort, completed in Salem last year, which has earned LEED Platinum certification. The home is "near net zero"—the homeowners enjoyed five months with no electric bill—and cost \$180 per square foot to build. **GB**

Project Stats

NAME: Live Edge; Bend, Oregon ARCHITECT/DESIGNER: Lydia Peters, Nathan Good Architects BUILDER: Dennis Szigeti, Leader Builders LLC INTERIOR DESIGNER: Lydia Peters, Nathan Good Architects LANDSCAPE DESIGNER: Chris Hart-Henderson, Heart Springs Landscape Design PHOTOGRAPHER: Rick Keating, RK Productions

Key Components

APPLIANCES: Dacor range, Subzero refrigerator, Miele dishwasher, Dacor microwave drawer, Vent-a-Hood, Fire Magic (all Energy Star)

AUTOMOTIVE (ELECTRIC CAR CHARGING, ETC.): Tesla EV charging station

BUILDING ENVELOPE: Grace Ice & Water Shield HT self-adhered underlayment; Prosoco R-Guard WRB; Grace Preprufe 300R waterproofing membrane

CABINETS, SHELVES, MILLWORK: Bladt's Custom Woodworking

CENTRAL VAC: Vacuflo

COUNTERTOPS: Natural stone and **Cambria** *Devon* quartz

DOORS AND HARDWARE: Rogue Valley Door clear fir doors; **Baldwin** door hardware

ELECTRICAL: All-LED lighting with **Lutron** *RadioRA 2* system

EXTERIOR FINISHES: Stained cedar tongue-andgroove rainscreen; **Montana Moss** Stone

FIRE PROTECTION: Reliable concealed-head residential sprinkler system

FIREPLACE: Isokern wood-burning modular fireplace FLOORING: Viridian fish tail oak reclaimed engineered flooring

HOME CONTROLS: Lutron RadioRA 2

HVAC/DUCTS: Daikin Altherma air-to-water heat pump; Zehnder ComfoAir 550 and 160 HRV; Uponor USA Quik Trak hydronic floor heating system.

INSULATION: JM *Climate Pro* blow-in fiberglass; **Atlas** *ACFoam* polyisocyanurate roof insulation; **CertainTeed** *CertaSpray* closed-cell spray foam insulation.

LIGHTING: All-LED: Aculux, Juno, Tech Lighting, Pure Lighting, BK Lighting, WAC Lighting, StickBulb Lighting, Lighting Surfaces Inc., and Bega Lighting

PAINTS AND STAINS: Benjamin Moore Aura; Benjamin Moore Stays Clear; OSMO Polyx hard wax oil

PLUMBING/PLUMBING FIXTURES: Toto (toilets); Blanco and Elkay (sinks); Hansgrohe and Grohe (fixtures and fittings); Kohler, Kollista and Duravit (bathroom sinks); MTI tubs.

RENEWABLE ENERGY SYSTEMS (SOLAR, WIND, ETC.): Sunlight Solar Energy 18-kW PV array; Tesla PowerWall

ROOF: Taylor Metal Versa-Span standing seam TELECOMMUNICATIONS: Bend Broadband and Yellowknife Internet

VENTILATION: Zehnder ComfoAir 550 and 160 HRV WATER FILTRATION: Kinetico MACH 2060s WATER HEATING: Daikin Altherma hydrobox

WINDOW COVERINGS: Eclipse E-Zip exterior solar shades; Silent Gliss recessed curtain track

WINDOWS, SKYLIGHTS, PATIO DOORS: Unilux ModernLine. IsoStar and FineLine

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Powerful performance. The all-electric home generates 21,765 kWh and has achieved an Energy Performance Score of 0.



Bigger and brighter. Stonework, wood finishes, custom furniture and abundant natural light provide ample connections to nature.



Clear the air. A fluid-applied WRB, triple-pane windows (U=0.18) and exceptional craftsmanship create an air- and vapor-tight home.





To achieve Passive House status for Scranton House, builders went back to basics.

BY ALAN NADITZ

NCE UPON A TIME, there was a burned-out house on an abandoned hillside lot—an eyesore for residents of Scranton, Pa. You'd never know that today. The site is now where a two-story, 2,153-square-foot "state of green" house now rests. And the city, the home's owners and its developers couldn't be happier.

The home is Northeastern Pennsylvania's first residence designed and constructed to Passive House standards. It's also a triumph for architect Richard Pedranti and builder Rob Ciervo, both of whom have never developed a passive house before.

Passive houses, in general, are rare in the U.S. The Scranton Passive House is only the 112th Passive House Institute U.S. (PHIUS)-certified home in North America.

"There were a lot of first experiences in this project for everybody," Pedranti says. "But we had a great group; a great team. Everyone was really excited to do this."

Glass wise.

Intus triple-pane glass helps maintain a HERS score of 28 and an ACH50 score of 0.34.

Worthwhile walls.

Blown cellulose insulation made of newspaper helps prevent loss of temperaturetreated air.

Site specific.

siting give the home

excellent access to

free solar energy.

East and south

Stronger than stone. Replacing crushed

gravel with perlite increased the slab's R-value from 45 to 70.

Simple, Sensible Tastes

In 2014, when owners Declan Mulhall and Christie Karpiak professors at the nearby University of Scranton—approached Pedranti about replacing the destroyed Wheeler Avenue structure with an actual house, they had a straightforward request: Make a home that was ultra-energy efficient and practical in terms of living space. At the time, Mulhall was adamant that he did not want a "McMansion" full of "useless space," such as a formal dining area and sitting rooms.

"Christie and Declan were very much about sustainability," Pedranti recalls. "They were definitely looking to lower their carbon footprint—build something that didn't have a negative impact on the environment and the natural resources. Beyond that, they wanted a very simple home to raise their family in."

Pedranti had achieved LEED certification years before, but had yet to actually attempt anything in that venue. "[With this project, LEED] was a very positive way to take my business, and it was exciting," he says. "I really liked that it is based on science. I have found over the years that a lot of the bad things in our industry are the result of an overemphasis on pure aesthetics."

The design was kept simple: two stories, with three bedrooms, two-and-a-half baths, a den, a kitchen, and living, laundry, mechanical and mud rooms. The outside would feature a large porch—part of it screened—and an arbor. Plans also called for a neighboring garden shed.

Such a basic floorplan simplified what needed to be done to meet requirements for a certified passive house, according to Pedranti.

Trial and Air-or

Some energy goals were easier to attempt than others. The house faces south for maximum solar energy gain. The arbor provides shade during the summer to keep out unwanted heat. Solar panels on the shed northwest of the screened porch generate on-site energy that will help the home meet net-zero status.

A RenewAir *EV200* heat recovery ventilator was installed to draw fresh air from outside, and pre-heated or cooled air from indoors. Blown cellulose insulation, made primarily of shredded newspaper,

Project Stats

NAME: Scranton Passive House

ARCHITECT/DESIGNER: Richard Pedranti, Richard Pedranti Architect BUILDER: Rob Ciervo, Ciervo and Sons Renovations PHOTOGRAPHER: Rick Wright Photography



was installed in the ceiling (R-90) and walls (R-60) to prevent loss of that temperature-treated air during transfer. Pedranti says they went way above Passive House minimums during installation.

To stop heat loss through the concrete floor, Pedranti originally planned to use a typical 12-inch layer of expanded polystyrene and 8 inches of crushed gravel. But then a person familiar with PHIUS suggested replacing the gravel with perlite. "I never would have thought of it," he says. "It has an R-value of 3.5, it's environmentally safe, and it was being made in [nearby] Bethlehem [Pa]. It comes in 8-inch bags. We used it, and our slab went from R-40 to R-75 at very little cost. I never realized it could be that easy."

Not everything was as cut and dried. Knowing that achieving the Passive House designation depended on the home being airtight, Pedranti and Ciervo set out to make what amounted to an airtight box. "Everything had to be perfect, especially since we had an airtightness requirement of o.6 ACH50," Pedranti notes. "Your 'box' or envelope gives you a baseline. Then, every time you make a hole in the envelope—such as a window or door—you have an idea of the amount of leakage."

After accounting for the planned openings and sealing obvious escape areas, the team used a blower door and a fog machine to detect where any other leaks might be. Any leaks found were promptly patched up with foam and vinyl tape.

"The first time were tested, we were certain we were going to pass," Pedranti recalls. "When we failed, it was shocking. After all, it was a box!"

They never achieved better than 1.1 ACH50, far short of the minimum, he notes.

On a whim, the team put a piece of polyurethane over a portion of the Oriented Strand Board (OSB) sheathing in use, reversed the blower door and discovered that the problem was the OSB itself. "Sure enough, there was air leaking through the OSB," Pedranti says. "We were not happy. But we solved our problem by putting a membrane over the sheathing."

That reduced the home's airtightness score to 0.34 ACH50—well under Passive House standards. The home's overall HERS Index score is 28, a number that the homeowners are certain will improve as other energy-saving efforts come online.

"I knew when I got into Passive House, there was a hard learning



FROM THE JUDGES

"This simple, traditional PHIUS design offers a clear path to a solid, sustainable home."

curve, which has everything to do with the fact that you measure things. That's not the case with a typical, prescriptive code-built home," says Pedranti, who has since taken on other Passive projects. "With Passive, you build an energy model with a spreadsheet. It's very detailed; it's down to three digits. Every bit of material, the design, the orientation of the windows—all that stuff is either 'yes' or 'no' in terms of meeting the requirements. For me, it's well worth the extra effort." **GB**

Key Components

APPLIANCES: GE

BUILDING ENVELOPE: FPSF, TJI frame walls, raised heel engineered roof truss CABINETS, SHELVES, MILLWORK: Starmark green certified CAULKS AND SEALANTS: Siga tapes **COUNTERTOPS:** Green-certified granite DOORS AND HARDWARE: Solid core birch veneer and Schlage **EXTERIOR FINISHES:** Paine board and batten FLOORING: Bamboo and tile HVAC/DUCTS: Mitsubishi 9KBTU INSULATION: 12-inch EPS and 8-inch perlite under slab, dense pack cellulose in walls, loose fill cellulose in ceiling LANDSCAPING: N/A LIGHTING: LED PAINTS AND STAINS: Benjamin Moore Aura paint **PAVERS:** Locally sourced bluestone PLUMBING/PLUMBING FIXTURES: N/A RENEWABLE ENERGY SYSTEMS (SOLAR, WIND, ETC.): Wired for PV **ROOF:** Asphalt and metal SPECIALTY PRODUCTS: N/A STRUCTURAL COMPONENTS: TJI for walls and floors, raised heel engineered trusses for roof **TELECOMMUNICATIONS: N/A** VENTILATION: RenewAir EV200 heat recovery ventilator WATER FILTRATION: N/A WATER HEATING: GE GeoSpring hot water heat pump WATER MANAGEMENT (INDOOR/OUTDOOR): N/A WINDOW COVERINGS: N/A WINDOWS, SKYLIGHTS, PATIO DOORS: Intus triple-pane tilt/turn inswing



It didn't win a category this year, but this unique home deserves kudos for its building science and unique design. **BY GREEN BUILDER STAFF**

> HEN CONSTRUCTING THE Dundonald Street Environmental and Passive Solar House, developers had little thoughts—as in a creating a small home (1,281 square feet) that would have an even smaller impact on the area's ecological footprint.

Dundonald is a mere five minutes from central Whangarei, New Zealand, situated among established bush. Homeowners wanted a dwelling that could provide optimized view, sunlight, air flow and seasonal breezes, but keep the natural landscape intact. The design is a super-high clerestory roof reaching up to the sky, optimizing low-angled winter sunlight by bringing it directly into the center of the home, naturally warming the interior. Living areas are positioned at front with large north-facing windows for maximum heat in winter, and views over garden and bush. Bedrooms are on the south side of the home for cooling over summer.

These design strategies passively heat the house during winter, using 36-mm-thick heavy-duty particle board for radiant energy heat storage and black floor tiles with R-2.8 insulation under. During summer, large roof overhangs shade the house, and the clerestory roof design passively cools the interior, using a "stack effect"—a hot air rising principle—which exhausts warm air through the top light windows.

Due to the steep incline of the project site, the floor plan was oriented on a north-to-south axis, rather than the typical east-to-west axis used for Passive Solar houses. This significantly simplified the construction, and meant the design would rely on direct northern sunlight entering through the living areas and central clerestory roof. The house is designed for an annual electric use of 2,300 kWh, or an annual energy index of approximately 207.7 kWh per square foot. Excess power needs will eventually be offset by a 2.5-kW grid-connected solar panel system.

Green technologies and features incorporated into the house include partial off-site prefabrication; black tiles for thermal mass and heat storage; above-code insulation for floors, walls and ceilings; insulated glass; a hot water heat pump; nearly 5,3000 gallons of storm water mitigation; 5,300 gallons of rainwater harvesting; breathable bio-paints for interior finishes; long-lasting, low-maintenance metal cladding; pine fascia boards at roof and deck edges; seasonal vegetable gardens; energy-efficient appliances; and water-efficient bathroom and kitchen fixtures. **GB**





FROM THE JUDGES

"Passive cooling and heating were incorporated into this design. Excellent."

Key Components

ALTERNATIVE BUILDING SYSTEMS: Metra Panel, 36-mm-thick heavy duty particle board

APPLIANCES: New Zealand-made, Fisher & Paykel, or reused appliances from previous home

AUTOMOTIVE (ELECTRIC CAR CHARGING, ETC.): Nissan electric charging station

BUILDING ENVELOPE: Corrugated metal roofing; 12-mm Triclad textured plywood with natural brown stain

CABINETS, SHELVES, MILLWORK: All cabinets use off cuts from 36-mm **Metra Panel** board

CAULKS AND SEALANTS: James Hardie low-VOC sealants used throughout COUNTERTOPS: Locally made 20-mm particle board; formica

DECKS: New Zealand-grown H3.1 pine; Carter Holt Harvey paint finish DOORS AND HARDWARE: Phoenix Aluminum windows and doors

EXTERIOR FINISHES: New Zealand-grown H3.1 pine; **Carter Holt Harvey** paint finish

FLOORING: 6-mm black floor tiles, 10-mm grout, 6-mm cement board sheet HOME CONTROLS: Phoenix Aluminum, Interlock, Assa Abloy

INSULATION: Extruded ClimaFoam *Eco Insulation* R2.8, 75-mm thick (floors and walls); **Alsynite** *Polygold Pure* R3.6, 160 mm (roof)

LANDSCAPING: Native tree planting, composting and vegetable gardens LIGHTING: Lons LED recessed down light

PAINTS AND STAINS: Resene low-VOC paints and stains PAVERS: Local boulders used

RENEWABLE ENERGY SYSTEMS (SOLAR, WIND, ETC.): 2.5-kW grid connected solar panel system with **Mitsubishi Electric** panels and **Enphase** technical components

ROOF: New Zealand-made Plumdek metal roofing STRUCTURAL COMPONENTS: New Zealand-grown pine VENTILATION: Passive ventilation though specific design

WATER FILTRATION: Direct source from municipal provider

WATER HEATING: Econergy hot water heat pump

WATER MANAGEMENT (INDOOR/OUTDOOR): Devan 20,000-litre rainwater storage tanks

WINDOW COVERINGS: Weathermaster thermal honey cone Whisper Shades R 1.2

Project Stats

NAME: Dundonald Street Environmental and Passive Solar House ARCHITECT/DESIGNER: Solarei Limited BUILDER: N/A PHOTOGRAPHER: Sarah Marshall Photography

SECOND COMING

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HER./

Tyver

At CES, The Flex House became a fully functioning Smart Home 2.0, demonstrating technologies that save energy, water and other resources. **BY JULIET GRABLE**

A renewed effort. The Flex House's design combines numerous insulation techniques including spray foam, flashing products and waterproofing agents—to make it ultra energy efficient.

AS COMPANIES JOCKEY FOR POSITION in the burgeoning smart home market, questions about the true usefulness of smart home technology inevitably arise. Do we really need our toasters to be connected, or to talk to our refrigerators? How much is hype, and how much will smart home technology really be able to help the built environment become more sustainable and resilient? Green Builder CEO Sara Gutterman believes that the next wave of smart home technology—what she calls Smart Home 2.0—will help separate the hope from the hype. It's something The Flex House aptly demonstrated at the Consumer Electronics Show in Las Vegas.

"CES is truly an incred ible show, showcasing the most innovative advancements in everything from artificial intelligence to autonomous driving to virtual reality," says Gutterman. "But there were many products at CES that seem to exist simply for the cool factor and don't have much meaning. By bringing The Flex House to CES, we endeavored to showcase how technology designed with a purpose can play a role in reducing energy and water use, optimizing renewable energy generation and storage, and keeping our families healthy, safe and protected."



Here's a roundup of the technologies showcased in The Flex House at CES: **SMART HOME 2.0 TECHNOLOGY CAN...**

Save energy.

The Flex House optimizes energy use with an array of connected technologies: SYLVANIA LED lighting from LEDVANCE, smart appliances and HVAC from Bosch, a smart thermostat and a solar PV system with battery backup.

Smart thermostats continue to be among the most popular smart home devices, and for good reason: They're easy to use, they make homes more comfortable, and they save energy. In

Comfort within reach. Affordable and intuitive, the Sensi smart Wi-Fi programmable thermostat from Emerson is one of the most popular smart thermostats on the market. A 85*1 sen si HH 71 set 71 **\$**Fields CREDIT: EMERSON

The Flex House, the Sensi smart Wi-Fi programmable thermostat from Emerson works in tandem with the Bosch Climate 5000 ductless mini-split to provide energy-efficient comfort; users can also program customized daily schedules and control the thermostat remotely using a smartphone.

But Sensi steps ahead of good, solid Smart Home 1.0 technology with its geofencing capabilities. By tracking the user's smartphone location, the thermostat anticipates when the occupant is close to home, and can adjust the temperature accordingly.

Save water.

Water-conserving fixtures are a great strategy, but the intelligent fixtures and faucets from American Standard featured in The Flex House go a step further, by integrating features that maximize convenience-even as they minimize water use. These include the Spectra+ eTouch four-function showerhead with wall-mounted remote control and Serin deck-mount sensor-operated faucet.

There are also environmental novelties such as the Advanced *Clean AC 2.0 SpaLet* bidet seat. Features such as the heated seat and remote control may make the concept of a bidet more appealing to Americans. Popular just about everywhere but the United States, bidets save water directly and indirectly by foregoing the need for toilet paper, the manufacture of which is water and resource intensive. (According to bidet.com, an admittedly biased organization, toilet paper manufactures require 473 billion gallons of water annually to satisfy American demand.)

But water-conserving fixtures and faucets do no good if plumbing

or fixtures leak. The Flex House debuted the Phyn Plus water monitoring device, which not only can detect leaks—a significant source of residential water use-but can shut off the main water valve. This is where data-gathering capabilities of smart home technology really shine. Phyn *Plus* processes 240 data points per second to form an accurate picture of a home's water use. After learning a household's basic patterns, it can detect anomalies. Phyn will alert the user if the device detects a leak and will shut the main water valve off in the case of a major event, potentially preventing thousands of dollars in water damage. The company intends to build on its platform, providing detailed data on water use that will hopefully lead to changes in behavior.

The Flex House also showcased a Nexus eWater graywater recycling system, which can capture two of every three gallons of indoor water use, treating and storing it for use outdoors, and a smart irrigation controller from Rachio. The Rachio controller, which the



Selling points. On the WaterSense-qualified Spectra+ eTouch showerhead from American Standard, users can choose between four spray patterns by touching the outer ring of the showerhead or using a one-button remote.

company claims can reduce your water bill by up to 50 percent, is a prime example of how smart home technology outshines conventional devices. Smart controllers take into account actual conditions-soil moisture, temperature and humidity, for example-along with forecasted weather to continually adjust and optimize irrigation schedules, even canceling or delaying a watering if rain is predicted. This is why WaterSense-labeled controllers are by definition "weather-based"—i.e., they rely on weather data to modify irrigation schedules. It's better for plants and better for your water bills.

Help homes be more resilient.

Smart 'LED'er. A product like transportation" with the Toyota Prius Prime and Bosch EV Sylvania's RGBW charging station. In the near future, EV batteries will also bulb can make tie into the grid, becoming part of an intelligent back-up energy efficiency storage solution. cool in more ways Such "vehicle-to-grid" (V2G) technology will enable than one, from a Solar-powered homes are good; solar-powered homes with lower bill to a more battery storage and detailed energy monitoring are better. festive atmosphere The Flex House demonstrates a comprehensive approach around the house. to energy management with an efficient PV array from to the National Renewable Energy Laboratory (NREL), JinkoSolar and Eco-Intelligent Battery System from Tabuchi. When gridwhich is coordinating several research projects on V2G technology, tied, the battery can store and discharge energy from the solar array or V2G-capable EVs which can feed the grid via bidirectional charging stations will soon be commonplace. from the grid; it can also serve as emergency backup when the grid goes

SUN-SCAPING: A CLEAR ADVANTAGE

ARD MAINTENANCE IS a national obsession. We've decided a perfectly coiffed lawn is worth the noise and pollution, and people all over America start Saturday morning with back-wrenching pulls of the mower cord, interspersed with helpful cursing.

Greenworks tools, powered by lithium ion batteries, boast comparable power to their gas-powered counterparts, but without the noise, odors, pollution or wrenched backs.

"One of the biggest advantages is that they make a chore easier to manage," says Gray Abercrombie, director of global marketing for Greenworks. "There's no gas, no fumes and they're easy to start." The tools are also lightweight and take up less room in the garage.

Greenworks, with North American headquarters in Mooresville, N.C., offers 24-volt, 40-volt, 60-volt, 80-volt, and commercial grade 82volt battery-powered outdoor power equipment, a full line of corded equipment, and reel mowers. The 60-volt Greenworks Pro family of tools is ideal for everyday yard work and the occasional tough job. It includes a self-propelled mower, leaf blower, string trimmer, hedge trimmer and chain saw. A single battery is compatible with all of the tools of the same voltage.

Brushless DC motors ensure the tools can perform as well as gaspowered versions. As for battery capacity, a fully charged 60-V mower can take on up to half an acre; the chainsaw can make up to 90 cuts; and the leaf blower, string trimmer and hedge trimmer will operate for 40 to 60 minutes on a single charge.

The tools produce no onsite CO₂ emissions, and if charged with



down. This system was tested at CES, when condensation on a transformer triggered an hour-long blackout.

"Interestingly, while exhibitors at CES unveiled technologies that promise to tackle big problems ranging from urban congestion to cancer, there is one thing that those technologies couldn't do: keep the lights on," says Gutterman. "In contrast to the endless devices that were powered down and silenced, the solar-powered Flex House kept running like the Energizer bunny!"

The Flex House also demonstrated the concept of "clean

EV batteries to store excess energy from solar arrays or wind turbines generated during off-peak times and to feed the grid during periods of high demand. According



solar energy, they don't contribute to fossil fuels emissions at all-a concept Green Builder calls "sun-scaping."

According to the U.S. EPA, gas-powered lawn equipment is responsible for 5 percent of the country's air pollution. If everyone started sun-scaping, it could make a real difference. Neighborhoods would be a lot quieter on Saturday mornings, too. www.greenworks.com

Use comfort, convenience and "cool" to drive sustainability.

Statistics on smart home adoption consistently show that people are just as interested in security, entertainment and comfort as they are energy efficiency. Other reports track the growing popularity of smart home voice-control platforms such as Amazon Echo smart hub with Alexa voice control. User-friendly and, well, friendly, Alexa has provided just the sort of hand-holding that many people need when entering into the baffling world smart home technology. And, because female-voiced Alexa integrates with so many different devices, she makes possible the creation of scenes or routines customized to a user's home and lifestyle.

At CES, The Flex House demonstrated the appeal of such a strategy. Because Alexa pairs with SYLVANIA smart LED lighting from LEDVANCE, Lutron Serena shades and other smart home devices, users can create a routine with pre-programmed light and sound levels for, say, Movie Night, which activates with the

command, "Alexa, let's watch a movie!" But an Alexa routine can also be used to control the Sensi smart thermostat and the Emerson ceiling fans—a strategy that saves energy. For example, the fans can be programmed to keep rooms comfortable at slightly higher temperatures, reducing the demand for space cooling from the mini-split.

Lighting is a perfect example of a smart home technology which lures people in with its "cool factor" and turns them into unwitting energy misers. Connected smart bulbs such as the SLYVANIA RGBW products featured in The Flex House are capable of thousands of colors and variations of white from warm to cool (RGBW stands for "red, green, blue and white"). They can be controlled via a smartphone, and they also work with *Alexa* and the Wink smart hub—Who can't see the appeal of saying "Let's Party!" to instantly change a room's mood? But the bulbs are also extremely energy efficient, and they can be paired with other energy-saving devices such as occupancy and daylight sensors, optimizing lighting levels while reducing energy use.

MAKING GOOD ON LEAKED DATA

HYN PLUS, A SMART WATER LEAK DETECTION and shutoff, works by detecting tiny changes in water pressure. From these data, Phyn Plus can formulate a picture of the typical water use for each source, from faucets to washing machines to toilets. Launched at the Consumer Electronics Show in January 2018, Phyn Plus represents the culmination of a nearly a decade of careful research and refinement.

"Being able to detect leaks accurately is more complicated than it sounds," says Phyn CEO Ryan Kim. The company's methodical approach included a year-long pilot study involving more than 300 homes in 19 states from Alaska to Florida. Phyn devices were installed in the homes, which ranged from older to newer, and which had various plumbing systems and varying water pressures. The study collected data on over 11 million "water events," which enabled the company to perfect its algorithm so that Phyn Plus detects leaks with a high degree of accuracy and very few false alarms. But the study also revealed a prevalent issue: leaky toilet flappers.

In the homes where Phyn *Plus* detected a leak, 55 percent of those leaks were due to leaky toilet flappers. Based on the 300-plus homes in the pilot study, the average amount of water lost was 1,021 gallons per day per home.

"Half of the time people knew about the leak but just hadn't gotten around to fixing it," says Kim. Translating the number of gallons into dollars and cents proved motivating. Within three days, most of the flappers were fixed.

Phyn Plus, which is backed by Belkin International and Uponor, manufacturer of flexible plumbing products, will be available in 30 metropolitan areas in spring of 2018. The devices will be supported by the Uponor Pro Squad, a national network of plumbers and water specialists. The device interface will include education about toilet flappers. www.phyn.com





Right at home. Belkin's smart power control products, such as [either the dimmer or Insight] such as the Wemo Dimmer, are perfect for the homeowner who wants to easily and inexpensively smart automate a home.

Change behavior...or not.

Anyone who's worn a Fitbit and grown obsessed with getting their "steps" understands what a powerful influence data can have on behavior. Therein lies one of the big promises of smart home technology: that providing fine-grained feedback on energy and water use (and the associated costs) will inspire people to shift energy usage to times of lower demand or fix that leaky toilet flapper (see Phyn sidebar).

As a case in point, Emerson has entered into partnerships with several utilities to engage customers in demand response programs facilitated by EnergyHub. Utility customers can use their Sensi smart thermostats to reduce or shift energy use from peak times, easing the burden on the grid and saving them up to 10 percent on their utility bills in the process.

Some smart home technologies, such as smart appliances and irrigation controllers, streamline resource use in the background without us even knowing. Others, such as the Belkin Wemo smart plugs featured in The Flex House, can be programmed to do so some of the hard work for us.

Here's how they work: Insert a Wemo Mini into a standard outlet, and whatever you plug into the Mini automatically becomes smarter. You can use Amazon Alexa voice commands to turn devices on and off or program them to do so automatically. (The plugs also work with Google Assistant.) This is the perfect application for someone like me, who intends but often forgets to do simple things to save energy, such as turning off power strips at night. (Anything plugged into a power strip will suck small amounts of energy throughout the night; hence the term, "vampire loads.")

Even better, you can use the *Wemo Insight* switch and *Wemo* app to track how much energy a specific outlet or room is using. The Flex House also featured Wemo switches and dimmers. None of the *Wemo* products requires a hub or subscription, so they represent an attractive option for those who want to dip their toes into the world of smart home automation without making a huge investment.

Save resources, including time.

With so many things to track, it's more important than ever to be able to do it all from one place and one device. That's what makes integration so important and helps explain the growing popularity of Amazon Alexa. Alexa can connect to over 1,000 smart home products, enabling hands-free control over music, lighting, security and just about every other smart home category.

Just as essential as integration is reliable, fast networking. The Flex House demonstrated this concept with a "command center" that included the Linkys Velop Wi-Fi system, various charging solutions from Belkin, and a writeable wall, made possible by Benjamin Moore's Notable paint.

The Linksys Velop Wi-Fi system uses mesh networking to consistently find the strongest Wi-Fi signal, ensuring fast speeds throughout the home. You can add "Nodes" to Velop, each of which increases the range by 2,000 square feet.

Belkin has developed *BOOST PUP* wireless charging pads for Apple (iPhone X, iPhone 8 Plus, and iPhone 8) and Samsung Qienabled smartphones that deliver fast charging and which charge through most lightweight covers. Among Belkin's many charging solutions are a line of Pocket Power portable chargers, a wall-mounted charger and a universal charger which will charge any device with a USB cable.

While it's obvious that smart home technology can save resources, including time, by allowing people to doing some things virtually, some of the applications are lesser known. For example, The Flex House showcased the TytoHome patient center, which people can use to monitor vital signs and share information with doctors.

Don't forget to have fun.

Saving resources is great, but can smart home technology really can help improve our lives? Absolutely, says Gutterman, pointing to the Awair indoor air quality monitoring device as an example. IAQ monitoring by itself is a good thing. But as part of a smart home ecosystem, Awair can trigger the Emerson ceiling fans to kick on when air quality dips below acceptable levels. When Amazon Alexa connects the home's smart devices with each other, Gutterman continues, possibilities open up. For example, the connected smoke detector can "tell" the Rachio irrigation controller to switch on if it senses a fire nearby or smoke inside the home, potentially preventing a fire from spreading.

"Smart home technology can help keep our indoor air healthy, help us eat better and be cognizant of our activity levels," says Gutterman. "And smart locks, cameras and doorbells can help keep our families safe and protected."

And, with responsive speakers and VR goggles to enhance the entertainment experience, it can help us have more fun, too. GB

CODE ARENA

The Latest Rules, Regulations and Codes Impacting Sustainable Construction

Water, Water Nowhereand Not a Drop to Drink

Efforts to preserve dwindling H_2O supplies are underway. But is it too late?

BY MIKE COLLIGNON

CAPE TOWN. SOUTH AFRICA

By now, you've probably heard about the dire water supply situation in Cape Town, South Africa. Unfortunately, the periodic updates have not been promising.

As of early March, the new projected "Day Zero" is now July 9, two months later than predicted in January. Government officials say they have received a reprieve due to conservation efforts by much of the populace. It's going to take a lot more effort, however, as well as a lot of help from Mother Nature, to keep a very restrictive water distribution/rationing plan from going into effect.

That plan calls for 200 distribution points around the city where residents can collect 25 liters (6.6 gallons) per person per day. (To put this in context, that daily amount of water is equal to a twominute shower using a 2.5-gpm showerhead and flushing a 1.6-gpf toilet once. That's it.)

People will also have the option to collect 100 liters for use over a four-day period. Each water collection point, which will have more than 50 supply taps, will be set up to accommodate roughly 20,000 people. Finally, Cape Town anticipates water restrictions to be in place for "at least 3-5 months, depending on how the situation unfolds." Hopefully, rationing won't need to last nearly that long.

For those who want to monitor the situation more closely, you can check the "Day Zero dashboard" here: www.capetown.gov.za/ dayzerodashboard.

WASHINGTON STATE

The State legislature recently passed a \$4 billion construction bill, but not before reaching an agreement on Senate Bill 6091. The legislation ensures that water is available to support development by calling on each building permit applicant to "provide evidence of an adequate water supply for the intended use of the building."1

It also calls for \$300 million to be spent over 15 years to restore and enhance watersheds through water conservation projects throughout the state. And, the legislation reduces the amount of water wells can draw in many areas of the state, with amounts



Tapped out? As taps threaten to run dry and "Day Zero" approaches in Cape Town, South Africa, residents face ever-tightening water conservation requirements.

ranging from 950 gallons per day (gpd) to 3,000 gpd.² Permit fees are now set at \$500.

Based on the passage of SB 6091, the Whatcom County Council voted 6-1 in favor of temporarily lifting its building permit moratorium. According to the Bellingham Herald, "that measure, and another one that would extend those temporary measures for six months...would allow the county to work on permanent landuse rules."³

U.S. CONGRESS

The Living Shorelines Act (H.R. 4525) was introduced in the House of Representatives in early December 2017. The goal of the legislation is to direct the National Oceanic and Atmospheric Administration (NOAA) to make grants to states and local governments, and NGOs to carry out large- and small-scale, climateresilient shoreline stabilization projects through the innovative use of natural materials.

Projects would need to "take into account historic flooding and projected flooding, climate change, erosion, the value of properties in the community and ecological benefits of a proposed project."4 The proposed legislation calls for \$20 million annually for six years, starting this year. Any grant funds issued would, at a maximum, be 50 percent matching funds. Any grant recipient would be required to publish the results by the end of 2022.

The American Society of Landscape Architects, The Nature Conservancy and Restore America's Estuaries, among others, support

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H.R. 4525. However, this bill may need more support, because it's been mired in the House Committee on Natural Resources' Subcommittee on Water, Power and Oceans for almost two months. This legislative effort was likely inspired by the prolific and devastating hurricane season of 2017, though its positive effect would be felt throughout the year. **GB**

Links:

1. http://bit.lv/2EJKWUA (SB 6091)

- 2. http://bit.ly/2EXdhGc ("Legislature passes \$4 billion construction budget, water rights bill." The Bellingham Herald)
- 3. http://bit.ly/2Flsj68 ("Following state measure, Whatcom lifts restrictions on building that relies on wells." The Bellingham Herald)
- 4. http://bit.ly/2BIDK8x (H.R. 4525)

Mike Collignon is the executive director and co-founder of the Green Builder[®] Coalition.

COURTESY OF The Green Builder[®] Coalition

The Green Builder® Coalition is a not-for-profit association dedicated to amplifying the voice of green builders and professionals, driving advocacy and education for more sustainable homebuilding practices. For more information, visit GreenBuilderCoalition.org

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The wet rated 54" Volta ceiling fan from Emerson features the best LED light available in a ceiling fan today. The dimmable LED light has an impressive 2,600 Lumens of light output. This sleek, modern fan with contoured blades is available in three finishes and comes with a stylish no-light plate and a 4-speed wall control. Bring a contemporary vibe to your indoor or outdoor living spaces with the Volta ceiling fan from Emerson. Learn more at emersonfans.com.

COMING NEXT ISSUE

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

Featured in the 2018 Flex House for Next-Generation Sustainable Living

EMERSON. CONSIDER IT SOLVED

FROM THE TAILGATE

New Offerings for the Sustainable Minded

The More Things Stay the Same, the More They Need to Change

HEN I TURNED THE PAGES of my calendar to 2018 a while back, I realized that this marks my 35th continuous year as a licensed general contractor. And although I don't build for clients anymore, preferring to work exclusively on our own demonstration projects instead, I still renew the license each time it comes due.

I don't really need it, at least not in any practical sense, but it has been such a core part of my life in the building industry that I can't bring myself to let it lapse and move on. I suppose it's the professional credential that I'm proud of, but it has also always been a badge of commitment-an important piece of the foundation that a lifetime of work is built on.

All this got me to thinking about how the industry looks today compared to 1983. I have to say, I'm not all that encouraged by the lack of progress that seems to define the business and differentiate our industry from so many others that profoundly affect our lives.

The old adage "The more things change, the more they stay the same" comes into play here. Sure, the trucks on the jobsite have become more beautiful and luxurious over the years, not to mention much more expensive, and the ubiquitous array of cordless power tools we all take for granted today have truly revolutionized many of the common tasks and made efficient use of our time more possible than we ever imagined in the "old days."

But I am not so certain about the core culture of the industry. We are still stubbornly clinging to 17th-century sources of power in our developments, 18th-century base structural materials in our buildings, 19th-century building practices and techniques in our production, and 20th-century financial and valuation models in conducting our businesses.

Meanwhile, the world around us is transforming at light speed, with breakthroughs in communications, medicine, transportation, energy production and a universe of technologies that we are only beginning to explore.

The most progressive among us have most certainly mastered the devices that almost magically allow us to download and demonstrate the approved installation procedures of a given product or system in real time, and multiple languages, to onsite crews, making antiquated training methods virtually obsolete. And the proliferation of components assembled offsite and delivered ready to install are

finally beginning to find paths into the mainstream thinking that has dragged like an anchor for so long.

But in spite of these and many other advances, the industry still wallows in attempts to solve outdated problems-namely labor and material shortages; the challenges of juggling a supply of buildable lots; and tilted financing strategies that have kept the lenders in control for as long as the business of building has existed, rather than seeking innovations that would render those issues obsolete. Builders keep trying to solve the same old problems with the same old responses and believing that somehow, the results will change.

Until we are willing to challenge the antiquated culture and customs of this industry, we will remain captives to the same set of challenges that have plagued us and limited our opportunities to integrate into the modern world-reflections not so much of how we build, but how we think about building. GB

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By Ron Jones

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