

Award-Winning Coverage of Sustainable Construction, Products and Lifestyles

# GREEN BUILDER®

July/August 2016 / [www.greenbuildermedia.com](http://www.greenbuildermedia.com)

## COOLING THE CLIMATE

Can greener business practices and smarter living slow our global nose dive toward climate disaster? Our annual Eco-Leaders issue looks at companies and ideas addressing what may be the toughest challenge in human history.



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2017 Super Duty® preproduction models shown. Available fall 2016. Some vehicles shown with optional features and aftermarket equipment. \*Based on IHS Automotive, Polk 1985–2015 U.S. Class 1c-8 New Registrations, excluding SUVs.

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# EDITOR'S NOTE

The Inside Scoop

By Matt Power  
Editor-in-Chief

## Advice for Attention Seekers

We don't live in the information age anymore. The only commodity worth anything is your attention. A company that gives some of that back will earn our grateful loyalty.

MANAGING THE BUREAUCRACY of modern times sometimes feels like slow death by a thousand cuts. Assuming you're one of the 99 percent of people who manage your own affairs, you know what I mean. In your head (and smartphone), you carry around information about your:

contractor license renewal   excise taxes  
bank account status  
vehicle registration due date  
property taxes   permit status

quarterly federal and state taxes and annual filing

frequent flier miles   receipts for work expenses

inspection schedule   product warranties

And that's not even to mention your mother's birthday, to-do lists, grocery lists, appointments, deadlines, promises of correspondence and voicemails. You get the picture.

Is it any wonder people sometimes snap?

Occasionally, companies come along that promise to simplify your life. Often, however, that's fool's gold. Sign up for paperless billing, and you've committed to alerting that company if your email or any of your banking info changes. Forget, and your credit gets nuked.

I understand why builders sometimes rage out about regulations. Regulations often come along as sticks with no accompanying carrots. They are merely additional costs and hassles that the builder attempts to pass on to the homeowner. Sometimes I wonder why anyone stays in the shelter business.

Working on this year's selection of Eco-Leaders, I thought about the conversations I had with a couple dozen companies at PCBC last month. They all want basically the same thing: to capture and hold the attention of industry players.

When I step back and look at which ones are achieving this goal, they're companies that don't demand much attention from their customers. Instead, they offer *relief* from the attention rat race.



That may mean a product with a simple warranty, no-questions-asked replacement service, a 24-hour technical desk, or a high-tech product that is self-diagnosing and handled completely by the manufacturer.

Let's be honest, not all builders or contractors care about sustainability. That doesn't mean they can dodge the transition to high-performance housing. Rapid building code changes and "pull" from clients will continue to push the envelope. But manufacturers should take heed. The "Eco-Leader" brand a pro chooses will be the one that demands the *least* share of attention, now, and for the life of the installation. **GB**

**Simplify, simplify, simplify.**  
With all the information people must keep track of on a daily basis, it's no wonder people snap. Companies will succeed by simplifying products and processes.

**ATTENTION**  
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WITHOUT WARNING

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## EPA Accused of Fracking Cover-Up

Instrument that measures fracking methane emissions allegedly reports wrong information.

**A**N ENVIRONMENTAL WATCHDOG ALLEGES THE Environmental Protection Agency (EPA) has engaged in a years-long, systematic cover-up of the true data surrounding climate-warming methane emissions from fracking. That cover-up, the group says, was at the hands of at least one EPA researcher who accepted payments from the oil and gas industry.

The cover-up was discovered by NC WARN when it became aware that the inventor of the Bacharach *Hi-Flow* Sampler, an engineer named Touché Howard, had been attempting to blow the whistle for years on the crucial instrument's malfunctioning. The critical failure causes the instrument to under-report methane emissions "up to 100-fold," the organization wrote.

Studies have shown the EPA underestimated methane leaks from fracked gas production for years, and Howard's own research found the agency has been "hugely underestimating" methane emissions specifically as a result of the faulty instrument, according to Common Dreams.

NC WARN filed an incendiary federal complaint with the EPA's Inspector General, the agency's internal watchdog.



**Inaccurate reporting.** A crucial instrument used in the fracking process allegedly under-reports methane emissions.

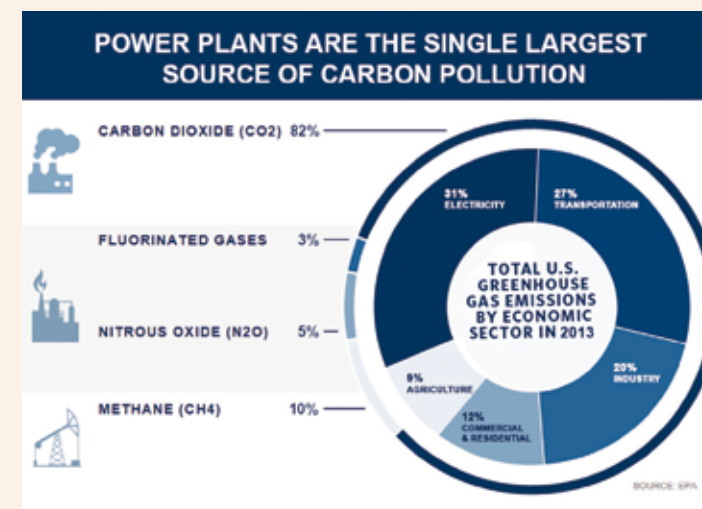
## Businesses Support Clean Power Plan

Many businesses praise the EPA's first rule limiting carbon pollution.

**T**HE ENVIRONMENTAL PROTECTION AGENCY recently finalized its Clean Power Plan. Under the plan, carbon emissions will be reduced 32 percent below 2005 levels by 2030. The Clean Power Plan marks the first official rule limiting carbon pollution. It specifically targets fossil fuel power plants, which are the top source of carbon pollution—resulting in one-third of U.S. emissions.

The plan allows states to meet that goal using any method that works for them, including helping power plants run more efficiently, using cleaner plants with renewable energy more often and offering market-based programs.

Many companies are getting behind the plan, including IKEA, Mars, Blue Cross Blue Shield MA, Adobe, Google, Apple, Amazon and Microsoft, as well as the Intervenor Advanced Energy



Economy, American Wind Energy Association and Solar Energy Industries Association.

## Carbon Emissions Surpass Critical Level

Carbon emissions and extreme weather lead to high CO<sub>2</sub> levels.



CREDIT: WIKIMEDIA

**C**ARBON EMISSIONS AND EXTREME WEATHER events are expected to permanently push CO<sub>2</sub> levels over maximum levels, according to a recent study published in the journal *Nature Climate Change*.

The current threshold is 400 ppm. CO<sub>2</sub> levels have passed that level before, but never permanently. At the current rate, CO<sub>2</sub> levels will not fall below that threshold again in our lifetimes.

The burning of fossil fuels has contributed to increased emissions during the past year. In addition, weather events such as El Niño, which is warming and drying tropical land areas, increases the risk of forest fires—and leading to increased emissions.

The generally accepted maximum level for carbon dioxide in the atmosphere is 350 ppm. Richard Betts, co-author of the study and UK Met Office scientist, estimates the level could rise to 450 ppm in 20 years.

## Toxic Legacy Haunts Dutch DuPont Plant

Long-term exposure to high levels of C-8 reported near former DuPont plant.

**D**UPONT IS UNDER SCRUTINY ONCE AGAIN, AS A recent report by Dutch regulatory agency RIVM confirmed C-8 contamination originating from DuPont's plant in Dordrecht, Holland. The contamination dates back decades.

The RIVM report states, "People living in the direct neighborhood of the DuPont/Chemours factory in Dordrecht have been exposed to perfluorooctanoic acid (PFOA) [also known as C-8] by air for many years. It is likely that they have been chronically exposed to higher values of PFOA than the limit value for chronic exposure derived by RIVM." The report continues, "At such a level of chronic exposure to PFOA, health effects, such as on the liver, cannot be excluded."

C-8 is a key ingredient in many common products, including non-stick *Teflon* pans, *GORE-TEX* jackets, ski wax and carpets, according to the Associated Press. Though it is now being phased out in the United States, remnants still remain in air and water sources. In fact, Centers for Disease Control and Prevention estimates 98 percent of Americans have traces of the chemical in their blood.



CREDIT: WIKIMEDIA

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(p.13)

ON THE COVER  
**COOLING THE CLIMATE**  
Artist: Kip Ayers

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2016  
ECO-LEADERS

# Visionary Thinking

**Efficiency and affordability.** The Arc House, shown here, is a 432-square-foot master-crafted design that is expected to sell for less than \$150,000, complete. Read more about it on page 48.

**We're entering a time in which Eco-Leaders, like the ones featured on subsequent pages, are more critical than ever. Can we work together to slow—or even reverse—the effects of runaway climate change?**

FROM COMPACT, REPLICABLE, turnkey homes like The Arc House (shown), to dishwashers that self-calibrate water usage to a bare minimum, to manufacturing processes that replace fossil fuels with natural products, to creating work spaces that mimic the environment, addressing climate change has become a front-and-center concern for some of the world's most environmentally progressive companies.

While technology and good intentions alone are just stepping stones in the transition to living more lightly on the planet, these "Eco-Leaders" play an important role: They raise the bar for industry, signalling an end to business as usual—when it comes to global warming.



# 2016 ECO-LEADERS

Green Builder Media

**Healthy buildings, healthy employees.** To create the healthiest possible indoor environments, Google created a program that screens and tracks the sustainability of all building products and materials.

CREDIT: GOOGLE

This year's Eco-Leaders find innovative solutions to reduce their impact on the environment and address the effects of climate change.

BY JESSICA PORTER

THERE'S NO MORE DENYING that climate change is happening, and its impact is hitting every corner of the globe. Just turn on the news, where you're likely to see the devastating effects of extreme weather such as wildfires, flooding and drought.

Greenhouse gasses (GHG) such as carbon dioxide (CO<sub>2</sub>) are major contributors to climate change. Unfortunately, we're largely to blame for releasing massive amounts of these gasses into the atmosphere by burning fossil fuels, deforestation, and many industrial and agricultural processes.

The construction industry is stepping up to the plate to do its part in reducing climate change, and this year's Eco-Leaders are leading the way. We've selected 11 companies that provide exceptional examples of creative solutions that help limit a company's environmental impact.

## MAKING A REAL IMPACT

This year's Eco-Leaders are inventing new ways to manufacture products using renewable energy like steam and solar; taking net-zero a step further by designing homes that also are net-zero for water and waste; reducing waste by finding new applications for it that benefit other industries; sourcing renewable energy from local solar farms; and creating products that use energy more efficiently—just to name a few methods.

Even more importantly, they are driving innovation by encouraging employees to get involved. Many Eco-Leaders hold competitions or encourage employee input on new processes that use less energy or create more efficient processes. Many also are spreading new knowledge around the world, giving back to their communities and encouraging global adoption of sustainable principles.

It's no longer enough to just embrace a sustainable method or two. To make a real impact, a company must change its entire culture to prioritize reducing its impact on the environment. This goes beyond just recycling or composting in the company breakroom. It means getting every employee on board and consistently creating new and healthier ways to manufacture products that are sustainable during their entire lifetime—from source to end-of-life.

GHG emissions are on the rise, and climate change is more threatening than ever. But with the help of innovative companies such as our 2016 Eco-Leaders working to develop more sustainable processes, we can all help to slow—or even reverse—this problem.



Putting it to work. This West Vancouver, Canada, home used Accoya as siding, railing, fencing and soffits.

## Accoya

### Careful selection of fast-growing trees avoids excessive deforestation.

**A**CCOYA, AN ALL-NATURAL wood created by Accsys Technologies PLC, is a 100 percent biodegradable, non-toxic product that produces extreme low greenhouse gas emissions during its entire lifespan.

"It's a sustainable product, class leading and competing with materials that we believe aren't sustainable materials," says Laura Ladd, head of marketing for Accsys. From its production, use and end of life, Accoya provides the builder a wood product that won't harm the environment.

#### PRODUCTION

Accoya is made from Radiata pine and alder trees that are abundant and fast growing from certified, sustainably managed forests and plantations. Using fast-growing trees from certified locations are important factors in avoiding deforestation.

#### USE

Just because Accoya is sustainable doesn't mean users sacrifice performance. It provides more thermal insulation than other wood products, resulting in lower heating costs and energy bills. It's also extremely durable with a Class 1 rating—the highest durability rating possible. In addition, Accoya provides high dimensional stability that requires less frequent coatings maintenance.

## COMPANY PROFILE

**Founded:** Accsys Technologies in 2005  
**Headquarters:** London  
**Leadership:** Paul Clegg, CEO  
**Products and Services:** Accoya Wood  
**Employees:** 121  
**Website:** www.accoya.com

#### END OF LIFE

No other chemicals or additives are inserted in Accoya during its production, so the product is completely natural and biodegradable. It can be reused, recycled, burned or even composted with no negative environmental consequences.

#### RECOGNITION

With programs such as LEED, Accsys could predict future demand for sustainable products. And Accoya meets that demand. For the past five years, it's held a Cradle to Cradle (C2C) overall rating and was awarded the Cradle to Cradle Products Innovator Award, which recognizes leaders that are designing for upcycling and making products with safe ingredients.

Accoya also earned C2C Platinum Standard certification in the Material Health category, as well as Gold Standard certification in C2C's other categories: Material Reutilization, Renewable Energy & Carbon Management, Water Stewardship and Social Fairness. In addition, it earned the highest score available in Portico, Google's Healthy Materials Program tool.

# Andersen Corporation

### Strides in innovation reduce fossil fuel production and increase efficiency.

**L**AST YEAR, ANDERSEN Corporation signed the Ceres Climate Declaration, which is a commitment to ensure the company doesn't contribute negatively to climate change. As part of that declaration, Andersen published its 2020 goals, which holds the company accountable for reducing waste, water and energy use by 20 percent per unit of product built by 2020.

"We were one of the first building product companies to sign on and spread their work and message about how we all need to contribute to minimize footprint," says Susan Roeder, director of corporate and community affairs.

#### SUSTAINABLE OFFICE OPERATIONS

One of the biggest investments in that goal is Andersen's new \$20 million energy plant, which reduces fossil fuels by injecting sawdust into a boiler to create steam that powers plant equipment.

The company is also working on sourcing energy from three nearby solar farms—from which the company will buy up to 19 MW of energy. That energy will power Andersen's headquarters and one of its manufacturing plants, with some energy left over.

#### SUSTAINABLE PRODUCTS

Andersen recently introduced VeriLock, which ties into a homeowner's existing smart home control or mobile device to determine whether doors and windows are locked. By ensuring all windows are locked, homeowners can save on energy bills.

#### SUSTAINABLE COMMUNITIES

Andersen also prioritizes giving back to its community. The company recently donated windows to 18 net-zero homes built by Habitat

for Humanity in River Falls, Wis. The community, Eco Village, works to make net-zero affordable using off-the-shelf technology.

"The residents are working families that don't have enough income for a traditional mortgage but have too much income for government help," Roeder says. "The discretionary in-

## COMPANY PROFILE

**Founded:** 1903 by Hans Andersen  
**Headquarters:** Bayport, Minn.  
**Leadership:** Jay Lund, Chairman and CEO  
**Products and Services:** Andersen Corporation and its subsidiaries manufacture and market window and door products under the Andersen, Renewal by Andersen, Silver Line and American Craftsman brands.  
**Employees:** 11,000  
**Website:** www.andersenwindows.com



Sustainable investments. Andersen's \$20 million energy plant injects sawdust into a boiler to create steam, which powers manufacturing equipment.



Sustainable communities. Andersen donated windows to 18 net-zero homes built by Habitat for Humanity.

come that comes from saving on energy bills is everything—it's eye glasses and band camp for their kids. We loved being a part of the project."

## Did You Know?

Locked windows are **three times more efficient** than unlocked windows.

A recent study by Andersen's research and development team tested 32 different windows and found locked windows to be significantly more energy efficient.

# Daikin

Developing smarter inverters and less environmentally damaging refrigerants.

DAIKIN IS A global HVAC and refrigeration manufacturer and developer that produces systems that often weigh close to a ton. Creating such massive systems requires Daikin to determine ways to minimize its environmental impact by creating efficient products and reducing waste and GHG emissions.

Daikin has stepped up to the plate, offering a number of innovative products produced sustainably to limit its impact on the environment.

## ENERGY-EFFICIENT INVERTER TECHNOLOGY

Daikin is pioneering an inverter-based compressor technology, which controls motor speeds to eliminate unnecessary operation. Air conditioners with compressors save 30 percent more energy than traditional air conditioners.

"They typically operate on an on-off scenario," says Marc Bellanger, director of marketing and communications for Daikin North America. "An inverter compressor operates at variable speeds or capacities, and in doing so it only delivers the amount of cooling or heating needed based on ambient condition or load in the space."

The compressor works using a permanent magnet with a natural magnetic force and an electromagnet. The north and south ends of the electromagnet are determined by the direction of the electric current. When the north and south ends of the magnets meet, they attract. When the north ends or south ends of the magnets meet, they repulse. Then, the inverter rotates the motor by switching the direction of the electromagnet's electric current.



**Inverter addition.** Daikin's inverter-based compressor technology controls motor speeds to eliminate unnecessary operation.

CREDIT: DAIKIN NORTH AMERICA LLC

## COMPANY PROFILE

**Founded:** 1924 by Akira Yamada

**Headquarters:** Osaka, Japan

**Leadership:** Noriyuki Inoue, Chairman, and Masanori Togawa, President and CEO

**Products and Services:** HVAC, refrigeration, filtration, chemicals including refrigerants, oil hydraulics, defense systems and electronics.

**Employee:** 59,000 globally

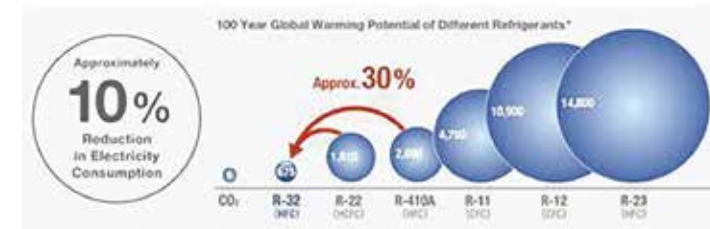
## NEW REFRIGERANT TO REDUCE ENERGY

Daikin also recently released the first residential-use air conditioner using R-32, a new refrigerant that can carry heat more efficiently to minimize damage to the environment. R-32's global warming potential is one-third lower than R-22 and R-410A, both commonly used refrigerants. It also reduces electricity consumption by 10 percent compared to R-22.



CREDIT: DAIKIN NORTH AMERICA LLC

**Environmental responsibility.** Many of Daikin's products are huge, weighing close to a ton, requiring the company to determine ways to minimize its environmental impact.



CREDIT: DAIKIN NORTH AMERICA LLC

**Safer products.** R-32 significantly reduces global warming potential.



CREDIT: GOOGLE

**Protecting employees.** Google created its Healthy Materials Program to ensure all buildings are constructed with the healthiest products and materials.

# Google

Opening new windows into building science by compiling data on chemicals and toxins in building materials.

TO ENSURE ALL Google buildings are constructed with the healthiest products and materials, Google created its Healthy Materials Program. The program screens and tracks products and materials using criteria in the Health Product Declaration, GreenScreen, and Cradle to Cradle. It's also aligned with the LEED version 4 rating system.

"Much like the scientific community, Google was eager to know what chemicals and toxins are in building materials and how they impact our employees' health and well-being," says Kate Brandt,



CREDIT: GOOGLE

**Optimal indoor spaces.** Google buildings follow Indoor Environmental Quality guidelines to enhance air quality, improve thermal comfort, mimic biophilia and improve acoustics and lighting.

## COMPANY PROFILE

**Founded:** 1998

**Headquarters:** Mountain View, CA

**Leadership:** Sundar Pichai, CEO

**Products and Services:** [www.google.com/about/products](http://www.google.com/about/products)

**Employees:** 60,000+

**Website:** [www.google.com](http://www.google.com)

lead for sustainability. "Our goal is to create the healthiest indoor environments and close the gap in transparency and material health information in building products."

The information is added to a database, which architects and contractors working on Google construction projects can use to find information about potential construction products and materials.

Google strives to achieve the optimal levels of air quality, temperature, lighting and more, which results in the most energy efficient use of interior systems. It also works to significantly reduce post-consumer landfill waste from daily operations—cutting waste by 85 percent in its campuses in the San Francisco Bay Area.

Google also focuses on its campuses' outdoor spaces with an ecology program that supports biodiversity and native habitats, plans for sea level rise and improves human health.

These efforts have paid off. Google has been carbon neutral since 2007 and recently signed contracts to purchase more than 2 GW of renewable energy. It also has invested more than \$2.5 billion in renewable projects around the world.

"Climate change continues to be one of the biggest, most challenging problems our planet faces, and we know that a sustained global effort is needed if we're going to have any hope of reversing its effects," Brandt says. "We believe global businesses should lead the transition to a more circular economy that improves people's lives while reducing dependence on primary materials and energy."



A team effort. Ingersoll Rand's green teams consist of volunteer employees who identify ways to improve the company's sustainability efforts.

# Ingersoll Rand

Engaged employees determine new ways to reduce waste and minimize GHG footprint.

**T**HIS YEAR MARKS the second year in a row that we've named Ingersoll Rand an Eco-Leader—and we're not the only ones acknowledging the company's commitment to the environment. It also recently made Corporate Responsibility Magazine's annual 100 Best Corporate Citizens List for the third consecutive year and earned an Outstanding Employee Engagement Practices & Green Teams Award from the Institute for Sustainable Enterprise (ISE).

The industrial energy market is projected to grow 44 percent in the next 10 to 20 years. As a major provider of compressed air solutions, electric and off-road recreation vehicles, commercial and residential HVAC and energy services, and transport refrigeration business, Ingersoll Rand's commitment to sustainability will make an impact on providing green solutions.

## EMPLOYEE ENGAGEMENT

Another reason Ingersoll Rand continues to win sustainability-related awards is due to its employee engagement policy.

"One of the reasons we won the ISE award was the way we took a systematic approach to engaging employees," says Scott Tew, executive director of the company's Center for Energy Efficiency and Sustainability. "The way to ensure you make lasting change is to fundamentally help employees understand that each person has

## COMPANY PROFILE

**Founded:** 1905 (formed by a merger of Ingersoll-Sergeant Drill Company and Rand Drill Company, both of which formed in 1871)

**Headquarters:** Davidson, N.C. (NA Headquarters and Corporate Center)

**Leadership:** Michael W. Lamach, Chairman and CEO

**Products and Services:** HVAC Equipment and services; complete compressed air systems, tools, pumps, material handling systems and comprehensive services; transport temperature control systems for a variety of mobile applications, including trailers, truck bodies, buses, shipboard containers and rail cars; and small-wheel, zero-emissions electric vehicles.

**Employees:** 40,000+

**Website:** [www.company.ingersollrand.com](http://www.company.ingersollrand.com)

a stake in the company's success."

Ingersoll Rand's Green Teams encourage employees to join a team, and each team identifies ways they can reduce the company's waste production, improve its GHG footprint and overall better the company.

"In aggregate, the impacts are huge from employee teams. When everyone takes a few small steps, it goes a long way. Some reduce waste to the landfill, install renewable energy sources, paint rooftops white instead of black," Tew says. "In aggregate, it really blows you away—all of these teams provide a big impact."

Employee engagement is a major reason the company has been successful in its Climate Commitment, which we highlighted last year (<http://bit.ly/28JuHHg>). The company celebrated one year of the commitment at the end of 2015.

"Once we made the calculations, we avoided 2 million metric tons of CO<sub>2</sub>, which is equivalent to the electric used in 270,000 homes for a year," Tew says.

# Interface

Going beyond net-zero.

INTERFACE IS ONLY FOUR YEARS AWAY from owning up to its 2020 commitment, but the company isn't worried about meeting the goals promised. It already reduced GHG emissions by 92 percent and water intake by 87 percent, sources 84 percent of its energy globally from renewable resources (96 percent in the United States), and increased the amount of recycled and bio-based products used by 50 percent.

## MIMICKING THE ENVIRONMENT

Now, the company is looking at how it can give back to the environment. It started a new initiative, Factories as Forest, which works to make factories perform more closely to healthy forests. Interface partnered with Biomimicry 3.8, a company of biologists and engineers that helps companies use natural ecosystems to solve challenges.

Interface piloted the program in an Australian factory. Biomimicry studied a high-performing ecosystem close to the factory to use as an example. They reported on the ecosystem's impact on many factors, including carbon filtration, nutrient filtration and pollination spaces. Then, Interface studied that list and implemented ways to mimic those systems inside its factory.

## CONTRIBUTING TO THE COMMUNITY

Interface also started Net-Works, which promotes using recycled materials while helping impoverished communities. The company realized carpets include the same nylon material used in fishing nets, which often pose environmental issues in impoverished communities that rely heavily on the water.

The nets are removed from the water and local residents turn them into yarn used in carpet. So far, the program has removed 177,223 pounds of fishing nets from water in the Philippines.

With initiatives like Factories as Forest and Net-Works, Interface is not just reducing its environmental footprints—it's actually helping to improve the environment. The company lives up to the idea that companies should aim for beyond net-zero.

Fifteen years ago, the goal for all factory locations was Mission Zero. Now we're transitioning, and the new goal is solutions to improve the environment.

Erin Meezan, vice president of sustainability

## COMPANY PROFILE

**Founded:** 1973 by Ray Anderson

**Headquarters:** Atlanta, Ga.

**Leadership:** Jay Gould, President and Chief Operating Officer

**Products and Services:** World's largest manufacturer of modular carpet.

**Employees:** 3,400+

**Website:** [www.interface.com/US/en-US/global](http://www.interface.com/US/en-US/global)

## By the Numbers

Interface's commitment to the environment has already resulted in:

- 92 percent less GHG emissions
- 87 percent less water intake
- 84 percent of global energy consumed from renewable sources
- 50 percent increase in use of recycled and bio-based products



Giving back. Interface's Net-Works program encourages residents of impoverished communities to collect fishing nets, which can be reused as yarn for carpet.

# JinkoSolar

## Sharing success by providing renewable energy access to local communities.

**T**HIS YEAR MARKS major growth for JinkoSolar. In the first quarter, the company shipped 1,600 MW of solar modules and reported net income of \$48.6 million, up 513 percent compared to the same time last year.

Jeanny Trang, marketing manager for JinkoSolar, equates this success to cautious growth during a time when many of its competitors were growing exponentially. “Two of our competitors were like the out-of-control kid with a credit card—costs were high and prices were low,” Trang says. “We’ve been much more responsible with better margins. We’re protecting our shareholders’ value the best of any company.”

But growing smartly isn’t the only factor in the company’s success. Trang also says JinkoSolar’s success is due to its relationship-based customer service.

“A lot of companies do a good job selling, but they drop the ball on delivery, problems and customer service,” Trang says. “We’re different because every department in company is connected to the customer; it’s a relationship-based sale.”

JinkoSolar’s success is expected to continue. “If you look at the trend of U.S. electrical output garnered, it’s quite low. But by 2023, it will go up to about 5 to 6 percent,” Trang says. “We are on a strong growth trajectory. We expected double-digit gigawatt market installations.”



**Giving back.** JinkoSolar provided a 27-kW solar array to Wildlife Associates, cutting its energy bill by 90 percent.

A lot of companies do a good job selling, but they drop the ball on delivery, problems and customer service.

### GIVING BACK

The company is sharing its success with local communities. Last year, it worked with Everybody Solar and All Points North Foundation to provide a 27-kW solar array to Wildlife Associates. JinkoSolar donated 90 high-efficiency modules that will cut Wildlife Associates’ electric bill by 90 percent—generating more than \$175,000 worth of electricity over 20 years.

Earlier this year, it donated 57 kW of high-efficiency panels to GRID Alternatives, a non-profit organization that makes solar power and solar job training accessible to underserved communities.

GRID Alternatives will use the panels to provide 16 solar systems to low-income families in Washington, D.C. The panels will save the families \$533,000 in lifetime energy costs, provide 2,000 hours of hands-on solar job training opportunities and prevent 1,094 tons of greenhouse gas emissions.



**Responsible growth.** JinkoSolar’s success is partially due to cautious growth during a time when many of its competitors were growing exponentially.

CREDIT: JINKOSOLAR

CREDIT: JINKOSOLAR

# Masonite

## Innovating new uses for waste to improve material production and benefit local industries.

**C**OMING UP WITH sustainable solutions to production is a challenge for all building supply manufacturers. But Masonite found ways to create solutions that work on a local level and lead to meaningful results.

Every year, Masonite encourages its approximately 65 manufacturing plants around the world to enter its Environmental Excellence Awards competition. The competition recognizes plant initiatives that improve the environmental impact of Masonite’s products and manufacturing techniques.

Winning ideas often become best practices in the company, and have resulted in a number of ways to improve operations in its plants worldwide.

“It’s so much more effective than a top-down, corporate-directed initiative because every plant knows where its specific opportunities for waste minimization are,” says Jim Rabe, vice president of environmental health and safety. “It gives plants the flexibility to deliver meaningful results.”

Last year, one of Masonite’s North American plants won for



**Protecting rare wood.** AvantGuard entry doors are fiberglass, but made to look like exotic wood species.

CREDIT: MASONITE

**New processes.** Last year, a plant won one of Masonite’s Environmental Excellence Awards for developing a way to reuse scraps from door manufacturing.

## COMPANY PROFILE

**Founded:** 1924 by William H. Mason

**Headquarters:** Tampa, Fla.

**Leadership:** Frederick J. Lynch, President and CEO

**Products and Services:** Designer and manufacturer of interior and exterior doors for the residential new construction, residential repair, renovation and remodeling, and non-residential building construction markets.

**Employees:** 7,000 + worldwide

**Website:** www.masonite.com

developing a process to reuse scrap boards left over at the end of the production process, by grinding them up and adding them back into the feedstock into the process.

A few years ago, another winner found that residue resulting from a manufacturing process could be used by local farmers as a soil amendment. The residue is called AgRite, and Masonite plants in Wisconsin and Quebec, Canada, work with local farmers to reuse the product.

### MORE SUSTAINABLE PRODUCTS

Masonite also creates innovative products that are better for the environment, such as AvantGuard entry doors that are fiberglass but made to look like exotic wood species.

The fiberglass doors go through a large printer that applies an image of high-end wood species, including teak, Spanish cedar, cherry and black walnut. The image captures the wood’s unique graining and pattern to look exactly like real wood.

This process saves exotic or rare wood from being harvested and results in a cheaper product that can last longer, as fiberglass typically results in high insulation abilities, more water resistance and increased durability to climatic changes.



Recycle and reuse. Roxul's products contain up to 40 percent recycled materials that are reused after being melted and granulated.

# Roxul

## Embracing a culture of environmental responsibility from materials to final product.

ONE OF THE biggest culprits of energy consumption is heating a home. With insulation, that consumption can be greatly reduced. But it's not enough to just make sure your home is well insulated. Roxul takes this principle a step further by making sure its products are sustainable and manufactured in an environmentally responsible way.

"These qualities are built into the DNA of the company," says Peter



Natural materials. Roxul manufacturers stone wool insulation, which is made of of Basalt rock, a volcanic rock, and recycled slag, a by-product of the steel and copper industry.

### COMPANY PROFILE

**Founded:** H.J. Henriksen and V. Kähler in 1909  
**Headquarters:** Denmark  
**Leadership:** Jens Bigersson, CEO  
**Products and Services:** Stone wool insulation products and solutions servicing a wide variety of sectors, stone wool is a versatile material based on one of nature's most abundant resources—volcanic rock. It forms the basis of the ROCKWOOL Group businesses.  
**Number of Employees:** More than 11,000 operating in 28 factories in 35 countries.  
**Website:** [www.roxul.com](http://www.roxul.com)

Regenberg, vice president of operations for Roxul's Mississippi plant. "You can't say you're doing good things for the environment by selling products with solid environmental parameters, but have a production process that is not clean or following the same philosophy."

Roxul manufactures stone wool insulation, a byproduct of volcanic activity that can be used in all markets, from do-it-yourself projects to industrial applications. It's sound absorbent, fire resistant, repels water and has dimensional stability to maintain its form over time.

"It's a very natural product," Regenberg says. "It's virgin rock along with some waste and recycled products."

Roxul's products contain up to 40 percent recycled materials, reused by melting and granulating waste that's add to products further down the line. It also reduces water consumption by 50 percent by collecting storm water and water generated by the production process. Heat generated from material production is recovered and used to heat its factories and warehouses.

### COMPANY CULTURE

All employees are encouraged to bring anything that could affect safety, the environment or quality to leadership's attention right away. "Quality, the environment and safety are the most important," Regenberg says. "After that, we can talk about how efficiently we can produce a product, and how we can make more money. But we can't jeopardize those three things. Our policy is very black and white."

# Schneider Electric

## Challenging employees and community members to develop global climate change solutions.

FOR THE SECOND year in a row, Schneider Electric has been named an Eco-Leader for its serious commitment to the environment. Recently, the company made new commitments to advance its focus on sustainability. It's now measuring the carbon impact of every major client project, avoiding 120,000 tons of CO<sub>2</sub> by introducing end-of-life products in line with circular economy principles, as well as helping 50 million people access lighting and communications over the next 10 years through low-carbon solutions.

"Our commitment to driving innovation specifically for environmental issues like climate change, as well as leveraging these innovations in our own facilities, puts us ahead of many other companies of our size," says Aamir Paul, senior vice president of U.S.

Sustainability is a part of our DNA, and this focus is reflected in every one of our 160,000 employees.

### COMPANY PROFILE

**Founded:** 1836 by Adolphe and Eugene Schneider  
**Headquarters:** Rueil-Malmaison, France  
**Leadership:** Jean Pascal-Tricoire, Chairman and CEO  
**Products and Services:** Electricity distribution, automation management, service and components for energy management  
**Employees:** 160,000+  
**Website:** [www.schneider-electric.com](http://www.schneider-electric.com)

Operations. "Sustainability is a part of our DNA, and this focus is reflected in every one of our 160,000 employees."

Schneider Electric also is designing all new offerings using the Schneider ecoDesign Way, which works to ensure all materials and products are designed in an environmentally friendly way that is up to the company's specific standards.

### GIVING BACK

Schneider Electric doesn't just ensure sustainability on a company level; it also goes into the community to encourage others to develop sustainable solutions. For example, the company holds Go Green in the City each year, which challenges business and engineering students to create new innovations for energy management. The winning team earns a trip to two locations anywhere in the world to work with the company and learn more about creating energy-efficient and sustainable tools.

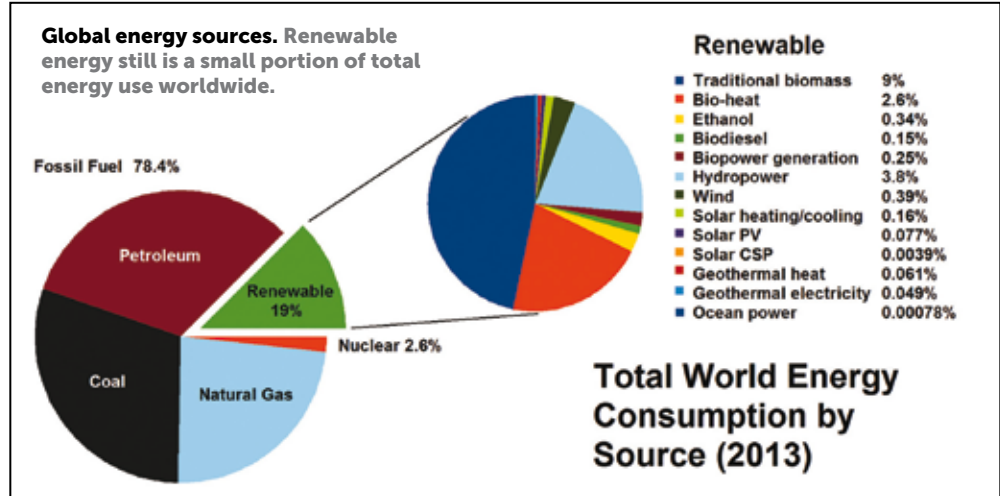
In 2013, Schneider Electric started a program to address energy poverty in mature economies by focusing on education, investment and technology. It recently expanded that program by partnering with the European Policy Centre and the King Baudouin Foundation to launch the Energy Poverty task force, which addresses energy poverty challenges specific to the European Union.

"Access to energy is an underreported issue that greatly impacts quality of life for as much as 20 percent of the population in mature economies," Paul says. "Low incomes, high electricity prices and poor building energy performance contribute to this issue."

### TAKING NOTICE

People have noticed Schneider Electric's commitment to the environment. The company recently ranked number 10 on the Newsweek Global Green Ranking 2016, which lists the most environmentally friendly corporations around the world.

In addition, Schneider Electric was named a 2016 ENERGY STAR Partner of the Year for the its efforts to increase energy efficiency and sustainability in commercial, manufacturing and public-sector buildings.



# Whirlpool Corporation

## Achieving net-zero water through rainwater collection, efficient appliances and graywater reuse.

**W**HIRLPOOL CORPORATION IS forging new paths on its ReNEWW House—a retrofit of a 1920s bungalow in West Lafayette, Ind., that aims for net-zero energy, water and waste. The project is a “living lab” for green innovations that consists of three phases.

Earlier this year, we covered the first phase that focused on net-zero energy (<http://bit.ly/295ouls>). Phase two focuses on water and was completed just a few months ago. During phase two, Whirlpool partnered with Kohler to achieve net-zero water using a three-pronged approach: rainwater collection, energy-efficient appliances and reusing graywater.

### RAINWATER COLLECTION

An underground rainwater collection system was installed with a carrying capacity of 3,000 gallons. The rainwater comes from gutter systems connected to the roofs. From there, the water goes through a filtration system and is purified with UV light.

The system includes an automatic bypass that switches to city water if anything goes wrong or if it's unable to collect enough rainwater to meet homeowner needs. In ReNEWW House, 90 percent of all water used is rainwater collected outside.

### ENERGY-EFFICIENT APPLIANCES

Whirlpool installed state-of-the-art energy-efficient appliances that use less water, including the dishwasher and clothes washer, as well



**Rainwater.** An underground rainwater collection system at the ReNEWW House in Indiana has a carrying capacity of 3,000 gallons.

as toilets and showers. These appliances are able to save up to 50 percent more water than traditional machines.

All of the appliances installed in ReNEWW House are available to the average consumer. And they work just as well as less efficient models of the same appliance.

### REUSING GRAYWATER

All water from the house's two showers goes into a graywater system to be purified using microbial and ozone treatments, and it's later reused in the toilet. But they aren't done thinking about more ways to save water with graywater.

“We're exploring ways to use graywater to do clothes washing,” says Ronald Voglewede, global sustainability director “Then, you could use it for toilet flushing and clothes washing. To me, that represents a huge advantage.”

Whirlpool's next phase focuses on net-zero waste, minimizing waste production and reusing waste that is produced on site. **GB**

## COMPANY PROFILE

**Founded:** 1911 by Lou Upton and his uncle, Emory, as the Upton Machine Company

**Headquarters:** Benton Harbor, Mich.

**Leadership:** Jeff M. Fettig, CEO

**Products and Services:** Whirlpool Corporation (NYSE: WHR) markets Whirlpool, KitchenAid, Maytag, Consul, Brastemp, Amana, Bauknecht, Jenn-Air, Indesit and other major brand names in nearly every country throughout the world.

**Employees:** 97,000 worldwide

**Website:** [www.whirlpoolcorp.com](http://www.whirlpoolcorp.com) and [www.insideadvantage.com](http://www.insideadvantage.com)

## Did You Know?

The average person uses 80 to 100 gallons of water per day. Here's how:

- **5 gallons** per minute in the shower
- **6-16 gallons** per dishwasher cycle
- **25-60 gallons** per clothes washer cycle
- **3 gallons** per toilet flush

Not to mention the water we use to drink, brush our teeth and wash our hands.

CREDIT: THE USGS WATER SCIENCE SCHOOL

“We have six 12-foot-wide by 6-foot-tall panel windows that are thermally sound and very energy efficient”

- Dean Papadopolous, homeowner



# Live Better

[westernwindowssystems.com](http://westernwindowssystems.com)



Affordable high-performance building does happen. What does it take? Smaller footprints, energy-efficient appliances and systems, sustainable building processes and motivation.



# PATHWAYS TO AFFORDABILITY

This showcase of award-winning homes demonstrates that super-efficient housing is not simply possible, but in easy reach—if performance is considered at every step.

BY GREEN BUILDER STAFF

IMAGES: DOE "TOUR OF ZERO"

SINCE 2013, the U.S. Department of Energy has held its Energy & Environmental Building Alliance (EEBA) awards, which celebrate the top home in the DOE's Zero Energy Ready Home program. We're highlighting the winning affordable homes, which serve as proof that high-performance houses can be built and occupied on a budget. Most people don't associate net-zero or energy-efficient homes with affordability. But, as you'll see in this roundup of some recent projects, affordable high-performance building does happen. What does it take? Smaller footprints, energy-efficient appliances and systems, sustainable building processes and motivation.

Innovations in building materials play a major role. Some builders are choosing structural insulated panels (SIPs), which provide an extremely airtight and well-insulated shell. Many efficient homes in hot and humid climates have optimized the use of concrete slabs, which allow heat to transfer into the ground. Some builders also finish the slab, creating interior while saving on flooring costs.

The homes featured in this article pay careful attention to orientation and siting. That means adding windows for solar gain and natural lighting, and using roofing material that diverts sunlight in hot climates.

Others use systems to bring the outside in, such as heat pumps that bring in clean, fresh air while pumping out stale air. Another includes a solar water heating system that uses energy generated from the sun to provide hot water. All of these systems must come together, if the goal is to build an affordably priced home with lower-than-average monthly utility costs.



**Energy efficiency.**  
This 1,594-square-foot, two-story home receives a HERS score of 26.

# The McKinley Project

IN GARLAND, TEXAS, a public-private partnership built a 1,594-square-foot, two-story home for a husband and wife, both of whom are military veterans, and their two young children. The home is a product of Carl Franklin Homes and the Green Extreme Homes Community Development Corporation, as well as a number of other local and national organizations.

Together, the team built the three-bedroom, two-bathroom home that receives a home energy rating system (HERS) score of 26 without photovoltaics (PV). These factors all contribute to the owner's \$97 average monthly energy bills.

## Working with Nature

The house achieves a low energy rating affordably for many reasons. It takes advantage of the site's natural elements, with the fewest number of windows facing west and south and shed roofs that divert sunlight after 10 a.m. during the summer. Windows provide



**SIP construction.** The SIP thermal blanket uses 8.25-inch-thick roof panels placed on the SIP walls.

natural lighting in the bedrooms, living areas and stairwells during the day, while compact fluorescent lamps are used in the evenings, which minimizes heat production and use less energy. In addition, the foundation is an engineered post-tensioned slab that's not insulated—allowing the ground to act as a heat sink.

## An Airtight Shell

The home was constructed using 4.5-inch-thick walls and an 8.35-inch-thick roof made of SIPs. SIPs reduce cost by being manufactured offsite and installed onsite, but result in a high-quality energy envelope. The SIP panels result in an airtight house, with less than 0.4/air changes per hour at 50 pascals pressure difference.

## Interior Systems

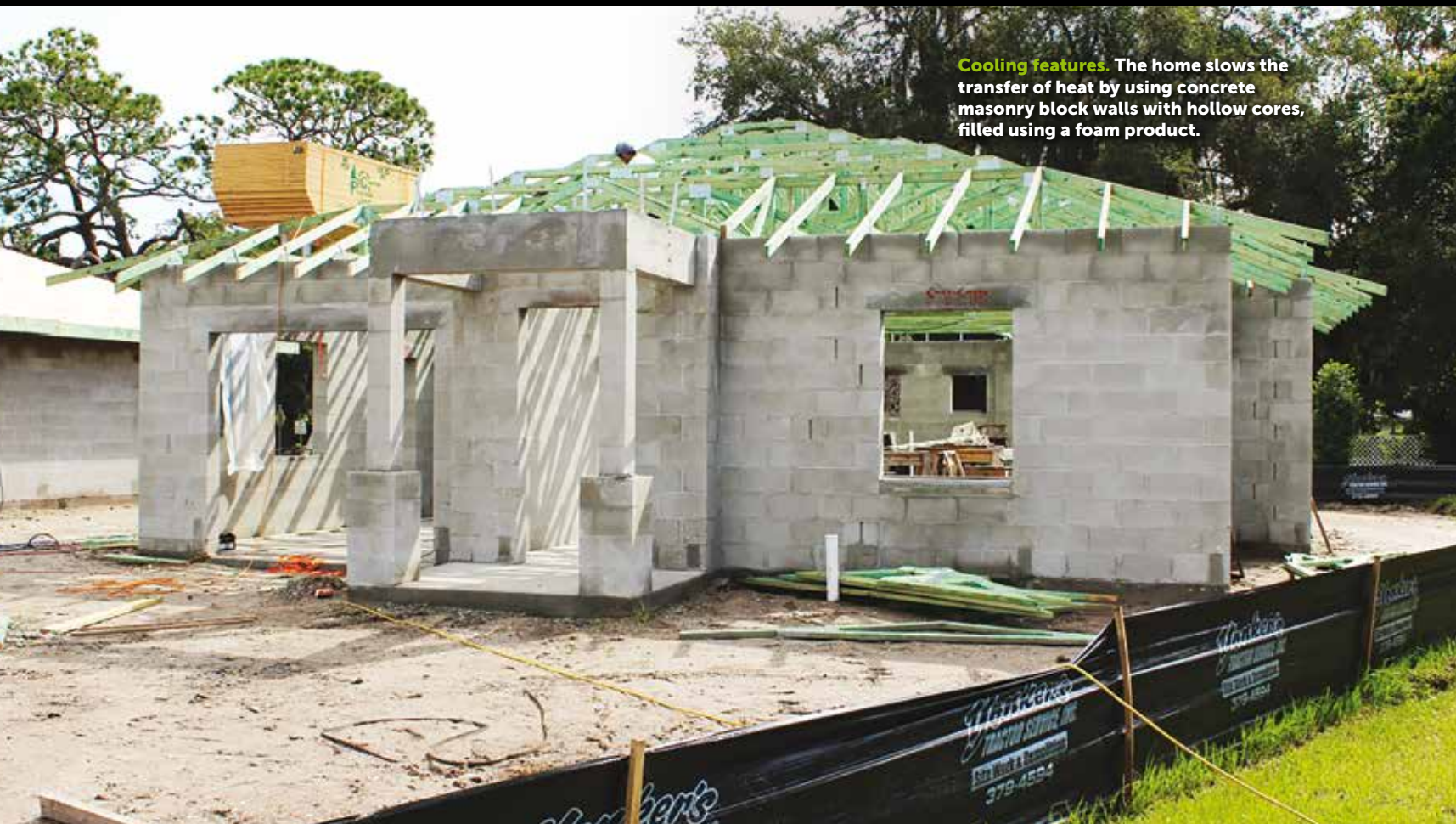
Highly efficient interior systems help result in the low monthly energy bills. The HVAC system is a ductless mini-split heat pump with a 15.5 SEER cooling efficiency that includes one outside compressor and five inside air handler units. An energy recovery ventilator brings in fresh air and exhausts stale air for ventilation and to keep out unwanted heat in the summer, retain heat in colder months and remove indoor humidity. The energy-efficient water heater results in an energy factor of 0.95.



**Saving with solar.** The home includes 3.5 kW of solar electric panels that provide \$1,905 in annual energy savings.



**SIPs and slabs.** The SIP wall panels sit on a bottom plate sealed against the post-tensioned slab foundation with a flexible foam sill gasket.



**Cooling features.** The home slows the transfer of heat by using concrete masonry block walls with hollow cores, filled using a foam product.

# Lauren Gardens #794

**H**ABITAT FOR HUMANITY is working to provide low-income families with energy-efficient housing. South Sarasota Habitat, its affiliate in Venice, Fla., is constructing all new homes according to specifications in the DOE's Zero Energy Ready Home program. By moving into an energy-efficient building, low-income residents can save on utility bills, improve their health and safety and see long-term affordability with lower maintenance costs, according to the DOE.

To date, Lauren Gardens #794 is just one of 15 energy-efficient homes constructed by the South Sarasota Habitat. It's 1,270 square feet and includes three bedrooms and two bathrooms on one level.

Its sustainable features will result in energy bills costing an average of \$72 per month, and its sustainable building materials and internal systems result in a HERS score of 51.

## Keeping Out Heat

Minimizing heat is a key factor in energy-efficient Florida houses. The home was constructed using concrete masonry block wall, and its hollow cores were filled with foam insulation, slowing the transfer of heat still further. The roof consists of ENERGY STAR-rated reflective shingles, and the roof



**Efficient and spacious.** The 1,270-square-foot home includes three bedrooms and two bathrooms on one level and achieves a HERS score of 51.

For a home to be considered affordable, rent and utilities cannot add up to more than **30 percent** of a household's income, according to the U.S. Department of Housing and Urban Development.

deck is coated with a 5.5-inch-thick layer of open-cell spray foam, which provides an R-20-insulation value.

The windows also minimize heat transfer by being dual-pane and thermally insulated with low-emissivity coatings. Those factors result in a U-factor of 0.32 and a solar heat gain coefficient of 0.22.

## According to the DOE, its Zero Energy Ready Home program requires homes to meet all of the:

- requirements of ENERGY STAR Certified Homes Version 3.0 program;
- requirements of the U.S. Environmental Protection Agency's (EPA) Indoor airPLUS program;
- hot water distribution requirements of the EPA's WaterSense program; and
- insulation requirements of the 2012 International Energy Conservation Code.

In addition, homes are required to have solar electric panels installed or have the conduit and electrical panel space in place for future installation.

## Unexpected Savings

When constructing efficient affordable housing, it's important to take total costs into consideration. This home includes a hip roof design, which is more resistant to uplift in high winds than a gable roof. Many insurance companies in Florida give homeowners with this design a discount.

The home uses many other moisture-resistant practices, including the concrete block and foam insulation, that can provide more moisture resistance than stud-framed walls, fibrous insulation, and carpet or wood floor coverings. It also includes slab-on-grade



**Moisture resistant.** Concrete block and foam insulation provide excellent r-values and resist unwanted moisture.

construction, borate-treated trusses and framing, and a secondary water barrier on the roof.

## Taking Advantage of Natural Elements.

To circulate fresh, clean air, an intake duct brings in air from a shaded spot near the home, which is run through the heat pump air handler where it goes through a filter. Every hour, the cycle runs for a few minutes.



**Unexpected savings.** The hip roof design is less likely to uplift in high winds than a gable roof, which can lead to insurance savings.



**Affordable efficiency.** This 1,104-square-foot home achieves a HERS score of 57.



**Reduce waste.** Because SIPs are manufactured in a factory and then shipped to the jobsite, they help reduce construction waste.



**Unique flooring.** The uninsulated monolithic concrete slab was stained and sealed to use as interior flooring.

# Bates Avenue

AS A LANDLORD LEASING affordable homes built in the 1970s and 1980s, Scott Willemsen of Sunroc Builders in Lakeland, Fla., watched his tenants pay hundreds of dollars each month on electric bills. He decided to take matters into his own hands, and build affordable, energy-efficient homes that were not available in his market.

He used SIPs on the 1,104-square-foot home on Bates Avenue, which has a HERS score of 57.

## Decreasing Heat Transfer

The house is built on an uninsulated monolithic concrete slab to allow heat to transfer to the ground. The slab was stained and sealed and is the interior flooring as well. The walls are made out of 6.5-inch SIPs with an insulation value of R-26. The roof consists of 8.25-inch SIPs and is topped with 30# felt and ENERGY STAR-rated asphalt shingles. A two-part expanding foam was inserted between each piece of SIP to reduce air leaks, which resulted in air tightness of 0.84 air changes per hour at 50 pascals pressure (ACH 50).

To minimize heat transfer, the windows are double-paned using glass with a low-emissivity clear metal coating and include argon gas between the panes to add insulation. The windows have an insulation value of U-0.30 and a solar heat gain coefficient of 0.22.

## Working with the Environment

The builder also used the house's orientation to determine where windows should be located. There's only one window on the sunny south side of the house, and it's located under a porch roof that provides shade.

## Awards Celebrate Innovation in Green Housing

Each year, the EEBA awards recognize the top projects on a path toward zero-energy-ready homes. In 2015, the awards were based on housing innovations in five categories:

- Custom
- Production
- Affordable
- Multifamily
- Legacy

This year, the event will be held Sept. 27-29 in Frisco, Texas. For more information, visit [www.eeba.org/conference](http://www.eeba.org/conference).

The home includes a fresh air ventilation system, ENERGY STAR-rated exhaust fans and a heat pump water heater with an energy factor of 2.75.



**Efficient renovation.** This renovated 1,436-square-foot 1970s ranch earns a HERS score of 40—lower than most new builds.

# Options for Community Living

WHEN MOST PEOPLE think efficiency, they think of newly built houses. In this case, the United Way of Long Island Housing Development Corporation completely renovated a 1,436-square-foot, three-bedroom 1970s ranch in Patchogue, N.Y., on Long Island. The home now earns a HERS score of 40—a lower score than most new builds.

## Training for Green

The United Way of Long Island Housing Development Corporation remodels or builds about 10 homes per year, though this was the first DOE Zero Energy Ready project. It uses the construction projects as learning opportunities for its job training programs, including YouthBuild, VetsBuild, Green Job Corps, Weatherization Boot Camp

and the Green Construction curriculum. Many of the finished homes go to the elderly, people with special needs, or are used for other special-purpose housing such as group homes.

## Using Original Components

The United Way of Long Island stripped the interior down to the studs to create a more efficient building. The existing 16-inch center walls were preserved, but filled with 3.5 inches of dense-packed cellulose, which resulted in an R-13 insulation value.

The builder removed the old roofing, but repaired the original half-inch plywood sheathing over the original roof rafters where needed. Then, it was topped with two layers of staggered 2-inch polyiso rigid foam board and plywood sheathing, followed by architectural fiberglass shingles. Inside the attic, the builders created a "hot" roof assembly by installing 6 inches of open-cell spray foam against the underside of the roof decking, which resulted in a total R-value of 48 for the unvented attic.

## Bringing the Outside In

A solar water heating system was installed that uses two roof-mounted, 30-tube evacuated tube panels, as well as a 120-gallon storage tank that includes a single-coil heating element for an electrical backup. Because United Way homes are used most often for group settings that result in heavy water consumption, the builder expects the solar water heater to pay for itself in seven years.

The home also includes a balanced ventilation system with an energy recovery ventilator that brings fresh air from outside into the home while expelling stale air. The system includes a heat exchanger to move heat from the warmer duct to the cooler duct to help retain heat in colder months and remove heat in summer months. **GB**



**Solar water heating.** The system includes two 30-tube evacuated tube panels and a 120-gallon storage tank with electric backup.

*This article contains excerpts from case studies from the DOE's EEBA awards. For more information, visit [www.eeba.org](http://www.eeba.org).*

# VISION House®



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# Top Sustainable Business Trends of 2016

**This is the year for companies to best position their business models to capitalize on sustainable growth opportunities.**



BY JOEL MAKOWER AND THE EDITORS OF GREENBIZ.COM

**T**HE NUMBER OF COMPANIES taking a more holistic, business-focused view of their environmental and social impacts by participating in natural capital initiatives is on the up: 611 had made public commitments as of 2015, up 71 percent from 357 in last year's State of Green Business, and up 217 percent from the 2014 report.

In addition, carbon is no longer seen as just an atmospheric pollutant, but a building block for a new generation of molecules to make concrete, plastics and fuels. Greenhouse gases are no longer unwanted byproducts of industrial agriculture; they are now a valuable input. Finding value in waste streams is no longer just an innovative idea; it is an expectation and competitive necessity. In other words: It is tomorrow's business as usual.

This year is shaping up to be yet another exciting year in the world of sustainable business. Here, in no particular order, are trends we'll be watching.



On the rise. Plastic consumption continues to rise, growing an average of 3 percent annually since the mid-2000s, according to ICIS.

## The Circular Economy Revs Up

**T**HE TERM HAS no official definition, but at its core, the circular economy is about keeping the molecules in play. In such a system, products are made primarily from benign and nontoxic ingredients—nutrients that can be returned safely to soil or water or, in the case of more durable components, placed back into service again and again. Toxic ingredients are not verboten; they can be used as needed in products or processes so long as they, too, are continuously cycled back into productive use and kept out of the waste stream. And, of course, as much of this as possible should be powered by renewable energy.

However, creating circular models for some materials won't be easy. Consider plastics, which undergird, coat or package so many of the things we buy. Besides being some of the global economy's most ubiquitous materials, they are also among the most environmentally irksome.

### CASE STUDIES

- **DOW CHEMICAL** is piloting an "energy bag" technology in which customers collect non-recyclable plastics, such as utensils and packaging, which Dow turns into synthetic crude oil.
- **CHINA'S** government has developed a national circular economy strategy, part of a 50-year plan to address sustainable growth objectives and challenges, and has made substantial investments in circular economy-oriented pilot projects, according to the Ellen MacArthur Foundation.

There's sound business rationale for all of these countries and companies to be jumping aboard the circular-economy bandwagon. According to modeling by the Ellen MacArthur Foundation, the circular economy represents a net materials cost savings opportunity of \$340 billion to \$630 billion annually just in the European Union. The biggest opportunities were found in the automotive sector, followed by machinery and equipment.

## Carbon Recycling's Growing Promise

**G**LOBAL EFFORTS TO address climate change have focused to date on reducing emissions of greenhouse gases through using energy more efficiently, switching to renewable power and electrifying vehicles.

But what if the carbon in waste gases could be captured and used to make things, thereby turning pollutants into products? A small but growing band of companies is trying to do just this through a group of technologies one could call "carbon recycling." They use the carbon in greenhouse gases, such as carbon dioxide (CO<sub>2</sub>) or methane, as a raw material to make products like plastic or cement.

### CASE STUDIES

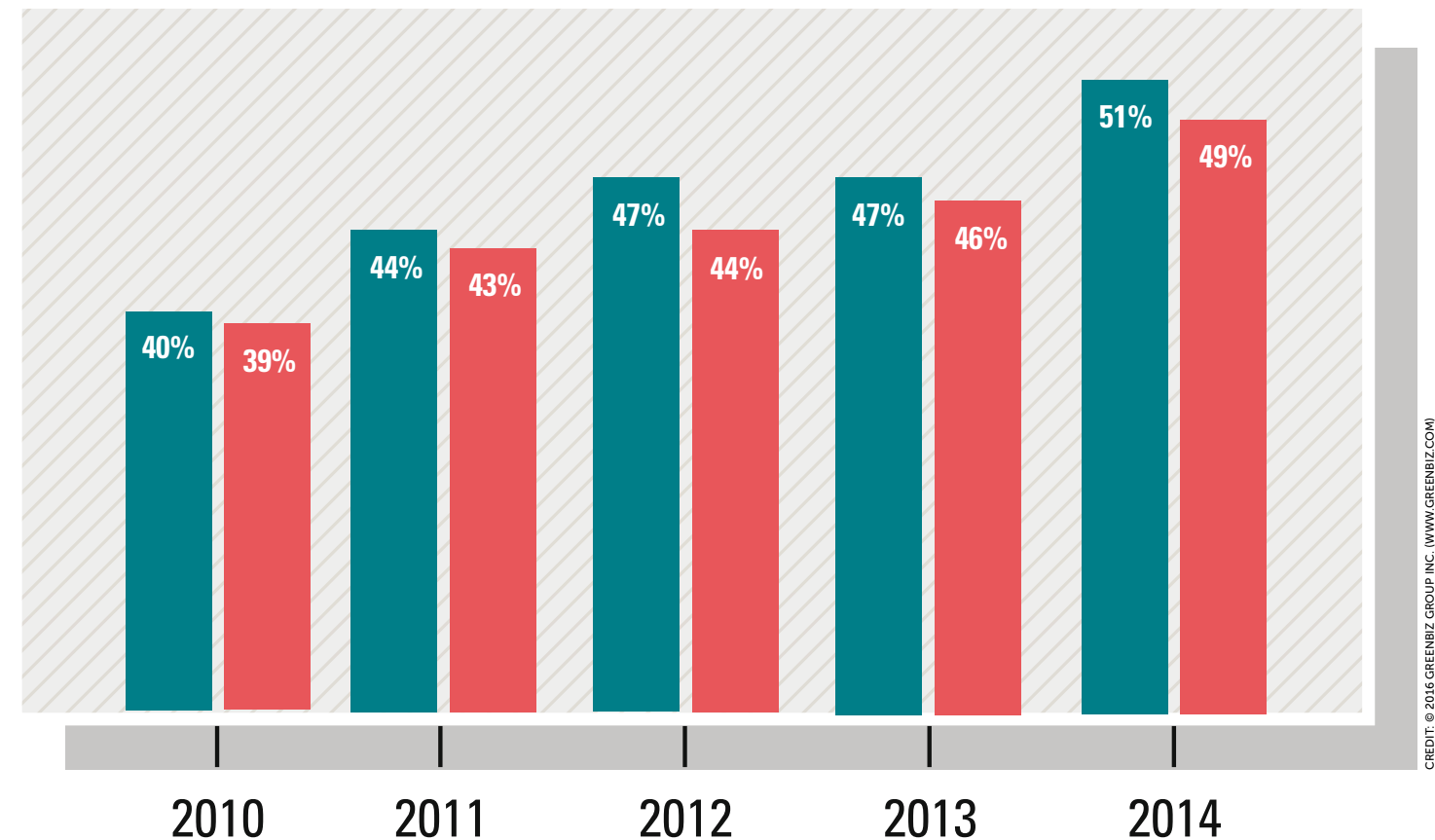
- **NEWLIGHT TECHNOLOGIES** developed, patented and commercialized the world's first carbon sequestration technology able to produce high-performance plastic that can match the performance and price of petroleum-based plastic.
- **SOLIDIA TECHNOLOGIES** developed a type of cement that is produced at lower temperatures and through a different chemical reaction that generates less CO<sub>2</sub> than conventional cement. The cement is hardened by injecting it with CO<sub>2</sub> from industrial sources.
- **NOVOMER** developed a way to transform waste CO<sub>2</sub> into high-performance, low-cost chemicals called polyols for use in applications such as coatings, adhesives, sealants, elastomers and foams.
- **LIQUID LIGHT** uses low-energy catalytic electrochemistry to convert CO<sub>2</sub> into chemicals, such as ethylene glycol, a raw material for plastic bottles.
- **SKYONIC CORPORATION** turns CO<sub>2</sub> emissions from power plants and industrial processes into products to manufacture baking soda.



## COMPANIES WITH GHG EMISSION REDUCTION TARGETS

Percent of companies disclosing reduction targets

US Global





CREDIT: BY ALYSON HURT FROM ALEXANDRIA, VA, USA

**Sustainable solutions.** Investing in green roofs is one way cities can handle stormwater runoff.

## Green Infrastructure Grows Like a Weed

**G**REEN INFRASTRUCTURE IS taking root. There were more than \$39 billion worth of green bonds issued in 2014, more than double the dollar amount of the previous year. Much of this money will be used to finance clean-energy projects. The annual value could reach \$1 trillion by 2020, according to a report by the Climate Bonds Initiative, UNEP and the World Bank.

### INVESTMENTS IN ALL SECTORS

Private-sector investments in low-carbon alternatives for energy, water, transportation and other critical infrastructure projects consist of billions, if not trillions, of dollars of committed money.

The Breakthrough Energy Coalition is a multibillion-dollar fund for clean-energy alternatives. The coalition aims to help get innovation out of the lab and into the marketplace faster. Its public-sector counterpart is Mission Innovation, a group of 20 countries—which

currently provide roughly 80 percent of all clean-energy R&D—that have pledged to double funding levels for these technologies over the next five years.

It's not just energy. Another group likely to shape the agenda is the Green Infrastructure Investment Coalition. Green infrastructure investments consider the impact on natural ecosystems far more carefully. The goal isn't just to minimize potential negative impacts, it's to maximize resilience by playing to the strengths of the natural world.

From the municipal point of view, the green infrastructure concept has gained more credibility thanks to projects in New Orleans, which rethought its coastal management system with an eye toward resilience after the devastation of Hurricane Katrina; and New York City, which started prioritizing bioswales, green roofs and other natural systems for handling stormwater runoff even before Superstorm Sandy exposed the city's vulnerabilities.

## Sustainability Becomes an Employee Perk

**I**F YOU'RE LOOKING for clues about whether a company really believes sustainable business practices are important, you should start with its mission statement or its declared core values.

Increasingly, the organizations that really care about sustainable business practices—and that want to attract millennial workers who care about how their employers treat the planet—are embedding the notion of environmental responsibility right into their central corporate belief systems.

Some companies are offering financial incentives or perks to encourage employees to act on them. But more organizations are building sustainable business principles into corporate training programs, or engaging employees across a variety of roles, from the front office to the manufacturing floor.

**"It is not appropriate to have a huge sustainability department," Caterpillar's global sustainability chief Tim Lindsey noted in a past interview. "More can be accomplished having a culture of sustainability. It's a lot like quality and safety, too. Everyone is responsible. I want to move sustainability forward to that point."**

### CASE STUDIES

- **CATERPILLAR** officially amended its code of conduct in 2015 to add a fifth core value to its existing four. It now urges employees to prioritize "integrity, excellence, teamwork, commitment and sustainability."
- **BANK OF AMERICA** supported a \$500 discount in 2015 for employees investing in a solar rooftop installation from SolarCity. It also offered a \$3,000 reimbursement incentive to workers buying a hybrid, compressed natural gas or "highway-capable" EV. As of the last update, more than 7,200 employees had taken advantage of that benefit.

## The Power of Microgrids Gets Unleashed

**M**ICROGRIDS ARE LOCALIZED systems that generate and deliver electricity to a defined geographic area, such as a building, campus or neighborhood. They are transforming remote economies in the developing world, as well as businesses, universities and municipalities in the industrialized world. Microgrids can serve as backup power sources to entities also connected to the grid or can be operated independently, allowing homes or businesses to operate off the grid.

Microgrid deployment is a "global phenomenon," according to a 2015 Navigant Research report. It identified 1,437 microgrid projects worldwide representing 13 gigawatts of capacity either operating, proposed or under development. The market for microgrids will soar to \$40 billion by 2020, a fivefold increase over seven years, Navigant predicted.

### DRIVERS OF MICROGRID DEVELOPMENT

**BATTERY STORAGE:** Storage effectively eliminates a key barrier to renewable power generation: the intermittent nature of sunshine and wind. Batteries enable a microgrid to store energy tapped during sunny or windy times of the day and save it for use during times when those weather conditions don't exist.

**INTERNET OF THINGS (IOT):** IoT software means that exactly the right amount of energy from the cheapest source can be delivered via

microgrids or shifted in split-second response to changes in weather or demand, reacting just like the bigger grid does.

**LOWER COSTS:** The price of solar has fallen 82 percent per watt in the past six years, while wind power has dropped 61 percent during that time, according to Lazard's Levelized Cost of Energy Analysis. That makes them price-competitive with—or in some markets cheaper than—fossil-fuel power.

**RESILIENCE:** The perceived vulnerability of centralized electrical grids to extreme weather and other disruptive events are making microgrids an attractive option.

But microgrid deployment faces challenges. Local utilities sometimes create barriers to microgrids, both for safety reasons and to protect existing monopolies. But even entrenched utilities are seeing the benefits, and many are working with microgrid developers and regulatory bodies to overcome the challenges.

The U.S. microgrid market will benefit from legislation passed in 2015 that extended an investment tax credit for renewable and distributed energy resources. The tax credit's extension suggests 2016 will be a banner year for solar, wind and microgrid installations, which often happen together.



CREDIT: WIKIMEDIA



**Shared freight.** A new app connects truck drivers to freight that needs to be moved, creating new revenue opportunities, lowering shipment rates and resulting in less trucks on the road.

# The Sharing Economy Goes B-to-B

IF YOU GOOGLE the terms “Uber for X” or “Airbnb for X,” you’ll come up with thousands of entries referring to companies trying to be the next big thing in the so-called sharing economy. But all of that may be child’s play when compared to the fast-growing, business-to-business world of monetizing underutilized assets. Indeed, there are some who believe revenue from the B-to-B sharing (or collaborative) economy could soon eclipse the consumer version.

Companies are providing services to share unused office space, farm machinery, warehouse space, business equipment and services, retail spaces available for pop-up shops and idle heavy equipment. There’s even a sharing platform for cities and other public agencies to share heavy-duty equipment.

The environmental impacts of all this sharing and collaboration have yet to be measured, though they could be significant. It stands to reason that using stuff more efficiently minimizes manufacturing

costs, waste and emissions, as well as overall consumption. But so far, evidence is anecdotal.

For example, according to Joe Gebbia, chief product officer and co-founder of Airbnb, “In North America alone, Airbnb guests use 63 percent less energy than hotel guests.” That’s enough energy to power 19,000 homes for one year, he says.

## CASE STUDY

▪ **CARGOMATIC** connects shippers with licensed truckers using smartphone technology to connect truck drivers to freight that needs to be moved. For truck drivers, who often haul empty trucks for hundreds of miles en route to their next pickup, it creates new revenue opportunities. For shippers, it can mean lower rates on big shipments, particularly at the last minute. And then there are the environmental benefits of fewer empty trucks on the road.

# The Blue Economy Catches a Wave

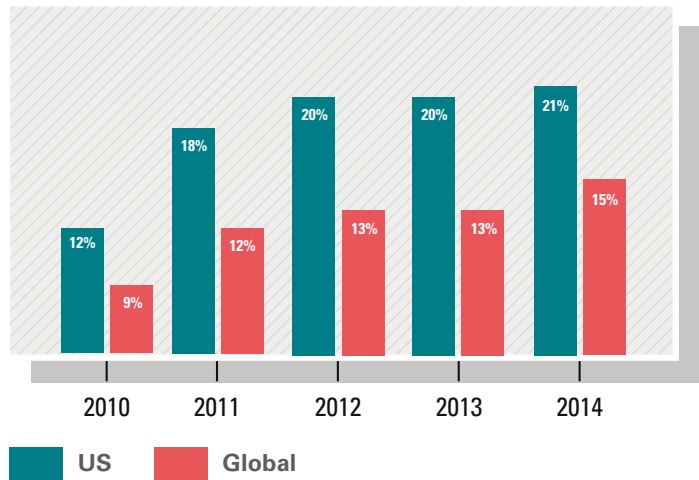
THE EMERGING “BLUE ECONOMY” movement applies sustainability to the vast marine environment, which encompasses shipping, transportation, tourism, recreation, and the harvesting of fish, seafood, oil, gas, minerals, energy and even water itself.

A truly blue economy should do more than prevent or diminish ecosystem harm. As visualization and protection efforts swell, so do new economic opportunities to monitor ocean health, store carbon, promote eco-tourism, prevent waste and protect marine habitats.

Change is taking place in some parts of the business world. A growing number of cargo companies are working to improve efficiency and reduce the emissions of their oceangoing fleets.

## COMPANIES WITH WATER-USE REDUCTION TARGETS

Percent of companies disclosing reduction targets



## CASE STUDIES

- **TRASH FREE SEAS ALLIANCE** is attacking the trillions of particles of plastic tainting the oceans.
- **OCEAN CONSERVANCY** is partnering with Dow and Coca-Cola to stanch the flow of plastic into waterways by 45 percent (in five choke points in Asia) in a decade.
- **METHOD** uses plastic collected from Hawaii beaches for soap bottles.
- **INTERFACE'S** Net-Works program makes new carpet tile from fishing nets, which the Patagonia-based startup Bureo also uses to create skateboards and sunglasses.
- **ADIDAS** partnered with Parley for the Oceans to create a new concept shoe made from recycled 3D-printed ocean plastic waste, including from gillnets used in commercial fishing.



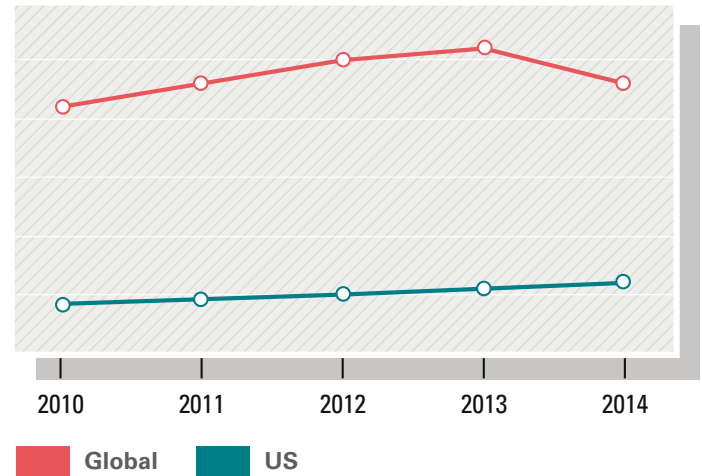
**Protecting the sea.** A growing number of companies are working to clean up the world’s oceans.

There’s more to be harvested from the seas. For example, biotech firms are concocting new painkillers, antibiotics and cancer treatments from ocean critters. Drugs made from sponges, fish, invertebrates, mollusks and fungi are projected to become an \$8.5 billion market by 2016, according to BCC Research.

But if a gold rush rises, companies will need to collaborate to prevent overharvesting ocean species. The same goes for protecting minerals and metals on the sea floor, where some ores may be 10 times more concentrated than on land.

## COST OF CORPORATE NATURAL CAPITAL IMPACTS

Total costs (trillion U.S. dollars)



**Using natural resources.** Natural capital is the limited stock of the Earth’s natural resources on which people and businesses depend for prosperity, security and well-being.



**Avoiding bad weather.** Suppliers seek ways to better respond to volatile weather resulting from climate change.

## Supply Chains Go High Tech

**T**HE FIRST THING to understand about the rise of connected supply chains is just how many companies are vying for a slice of the market. Some providers start with the basics, seeking new ways to vet individual suppliers, and putting that information online. Beyond that, there's the push to better verify and communicate supplier data through secure digital channels.

Others are more focused on better inventory management software, or using hardware to track products through the manufacturing process. At the end of the chain, a range of providers are honing new logistics offerings covering the last few miles of getting products to market.

### CONSIDERING CLIMATE CHANGE

One area of increased company interest is the capability to respond to weather patterns made more volatile by climate change. The threat of superstorms and the potential downtime in their aftermath is pushing companies to seek advanced analytics for expected crop outputs to gird their commodity supplies, or to assess multiple delivery options amid changing weather conditions and fuel prices.

Another area of focus is the more abstract idea of a "social license to operate," where a company's ability to operate in a given region is jeopardized by local resistance.

So, how does technology stand to help? Today's supply-chain cloud software and on-demand service providers aren't the first to recognize the need to modernize the field. Over the years, supplier surveys and radio-frequency identification (RFID) are two of the tools sold as ways to increase transparency and oversight.

But their success has been limited, at least in terms of engendering wholesale transparency. One reason is that countries regulate pollution and natural impacts very differently. Nagging challenges, like reducing the burning of Indonesian forests to clear land for palm oil plantations, demonstrate that a cause du jour among consumers and activists in the Western world doesn't always translate to immediate corrections upstream. International labor systems, meanwhile, vary widely in their ability to help the poorest secure better working conditions.

If it all pans out, technology will help reduce fuel costs, waste and related emissions while keeping the wheels of commerce moving in an ever-changing world.

## The Mining Industry Tries to Clean Up Its Act

**E**NVIRONMENTAL IMPACTS ARE business as usual in mining and other extractives. Yet amid an uptick in the demand for metals, minerals, fuels and rare earths that feed everything from cars to construction to clean energy technologies, the mining industry—squeezed by ever greater forces—is slowly shifting, and even cleaning up its act.

Coal is no longer king. The renewable energy economy is already larger than the coal economy: The U.S. solar installation sector employs 77 percent more people than the domestic coal mining industry, according to the Solar Foundation's 2015 National Solar Jobs Census. In the United States, President Obama's Clean Power Plan and rejection of the Keystone XL pipeline are signs of the times.

### RESPONSIBLE STANDARDS

There also are growing efforts to create standards for responsible drilling and mining. For example, Equitable Origin, an upstart company, is creating standards to clean up oil and gas exploration in developing

**The renewable energy economy is already larger than the coal economy: The U.S. solar installation sector employs 77 percent more people than the domestic coal mining industry.**

regions, and is seeking to do the same for wind and solar farms.

Mining requires vast amounts of energy, especially to tap harder-to-access ores. Energy makes up 20 to 40 percent of mining operating costs, and is set to grow by 36 percent by 2035 globally. Most mines are powered by diesel or the grid. As a result, renewable energy is an untapped opportunity for remote mines. Investment in renewables by mining companies could grow from \$2 billion in 2018 to \$3.9 billion by 2022, according to Navigant Research.



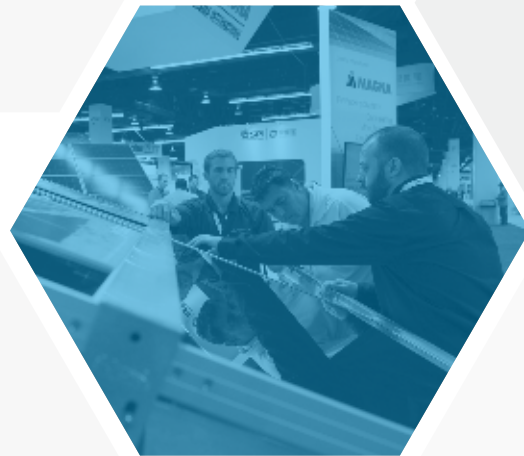
**Cleaner future.** Fueled by pressure from clean energy sources, the coal mining industry is starting to clean up its act.

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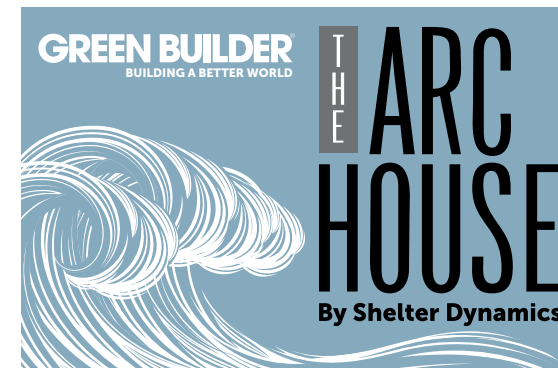


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# The Arc House

## SMART + SOLAR



**Green Builder Media has a decade-long history of identifying and investigating the most topical, cutting-edge issues of our time.**

Lately, we've been focusing on the evolution of the smart home, which converges smart home and solar technologies to provide homeowners with the ultimate control over their energy future.

To bring this concept to life, Green Builder Media has partnered with specialty modular builder Shelter Dynamics to showcase their prototype of next-generation living, The Arc House, a hand-crafted tiny home that is simultaneously net zero, resilient, intelligent, and sustainably designed. The Arc House offers ideas for independent, self-sufficient, and sustainable living.

**Visit the Arc House at Solar Power International in Las Vegas, September 12-15**

To learn more about The Arc House, visit [www.greenbuildermedia.com/vision-house-arc-house](http://www.greenbuildermedia.com/vision-house-arc-house) or contact Cati O'Keefe at [cati.okeefe@greenbuildermedia.com](mailto:cati.okeefe@greenbuildermedia.com)

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# Introducing The Arc House

Living large in 432 square feet of master-crafted comfort.

BY JULIET GRABLE

**G**REEN BUILDER MEDIA and Shelter Dynamics, in partnership with Kitcheneering and Align3D, have teamed up to introduce the Arc House, the latest in Green Builder Media's forward-thinking VISION House series. This innovative "tiny home" integrates many facets of sustainability into one compelling, compact package, taking the concept to the next level with its unique form, craftsmanship and functionality.

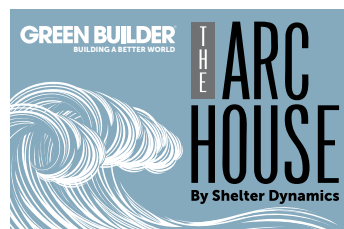
Jim Gregory, founder of Shelter Dynamics, used a sailboat as the inspiration for his solar-powered, net-zero energy prototype. He envisioned a small, factory-built dwelling that is functional but elegant, characterized by a high level of craft—a home that is efficient in its use of energy, water and space, but that doesn't sacrifice quality of life or comfort.

Like a cruising sailboat, the Arc House doesn't rely on a utility grid for power. An airtight shell, smart home technology, and a comprehensive solar PV array and battery system combine to make the home completely energy independent.

Gregory created the curving Arc House form with a framework of structural wood arches. Visible from the interior, these arches are an integral part of the Arc House's warm aesthetic. A wall of super-efficient windows combine with the ten-foot high ceilings to create a feeling of spaciousness inside.

The Arc House is just 432 square feet, but its well-designed interior—featuring comfortable living areas, clever storage, and even a walk-in closet—optimizes every square inch. Moorea Hoffman, principal designer at Kitcheneering, worked with Shelter Dynamics to create a versatile and functional kitchen.

Net-zero and intelligent, beautiful yet functional, the Arc House expands the market for tiny house living with its example of resilient, versatile housing. Following are some of the Arc House's most outstanding components.



## The Arc House—Products and Partners

Our sponsors are helping support The Arc House tour across the U.S., showcasing innovative products to thousands of visitors.

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### SMART + SOLAR

Smart home technology and solar technology share a common goal: to provide occupants with a greater level of control over their homes. Complementary benefits include reduced energy use, improved efficiency and greater comfort. The Arc House demonstrates how these technologies can fully integrate to create an intelligent, efficient home—one that automatically makes adjustments to optimize energy use and comfort, but also one that provides feedback to occupants and encourages them to change their behavior.

#### Smart + Solar Features:

- Responsive HVAC
- Smart Glass
- Interactive Lighting
- Smartphone-Enabled Security
- Weather Integration



### RESILIENT

The Arc House is factory built and easily transportable, giving it great flexibility in its ultimate destination. Its small footprint, independence from the grid and versatile design make it an ideal solution for a variety of living situations. Equally at home in a rural, urban or suburban setting, The Arc House can serve as a primary

residence for a single person or a couple. It can be used as a retreat, vacation home or “mother-in-law” unit. Clusters of Arc Houses can create small communities, based on the cooperative housing model, in which each household enjoys private space but also shares common areas such as courtyards and gardens.

#### Resilient Features:

- Wildfire Resistance
- Grid Independence (Solar PV, Inverter and Battery System)
- Rainwater Harvesting and Graywater Reuse Systems
- Water Conserving Fixtures
- Factory Built Construction and Mobility
- Repairable and Modular Components

### NET-ZERO ENERGY

The Arc House runs on the sun. At 432 square feet, The Arc House naturally has lower energy demand than a larger one, especially when it comes to space heating and cooling. An energy-efficient envelope, efficient appliances and smart home technology reduce The Arc House’s energy demand even further. Closed-cell spray foam insulation applied to the roof, floor and walls combine with rigid polyisocyanurate sheathing to create an R-40 envelope with superior air sealing. Super-efficient R-5 complete the envelope. A modest 1.5 kW solar PV array powers the Arc House during the day; at night, the home switches to battery power, all without sacrificing modern functionality and comfort. The Arc House includes a full suite of appliances and a state-of-the-art HVAC system.

#### Net-Zero Energy Features:

- Super-Insulated Shell
- Advanced Windows
- Efficient HVAC and Appliances
- Integrated Solar
- Passive Solar Design
- Energy Use Feedback

### SUSTAINABLE

The factory-built Arc House saves material that is typically wasted during site-built, “stick-frame” residential construction. In addition, materials and products for The Arc House were carefully selected for their durability, health, and responsible manufacturing. Exterior materials, such as fiber cement siding and an acrylic roof coating, protect the building from moisture, wind, fire and UV damage, helping ensure the building’s longevity. Inside, durable finishes, from quartz countertops and recycled glass tile to locally-made cabinets and oak flooring, complement the wood trim details. The beauty of The Arc House also contributes to its sustainability, inspiring occupants to value and care for it.



#### Sustainable Features:

- Efficient Factory Construction
- Small Footprint
- Protective Exterior Materials
- Recycled Content
- Durable and Healthy Interior Finishes
- Beauty

### SMALL BUT SPACIOUS

Tiny never felt so luxurious. Inspired by the elegant efficiency of a sailboat, The Arc House form is created with a series of curving wood arches that are both strong and aesthetically pleasing. Ten-foot ceilings create a feeling of volume and spaciousness. A wall of glazing heightens this feeling of spaciousness and also invites the



outdoors in. Thoughtful design creates distinct bedroom, living and kitchen areas—even a walk-in closet. Niches and built-ins, tailored for the dwelling’s curved form, optimize every square inch of interior space. Moorea Hoffman’s thoroughly-conceived kitchen is versatile enough to accommodate both simple meal preparations and gourmet feasts for a crowd. The window wall and deck encourage occupants to expand the living space to the outdoors.

#### Small but Spacious Features:

- High Ceilings
- Curving Window Wall
- Efficient Design with Distinct Zones
- Niches and Built-Ins
- Indoor/Outdoor Living
- Fully Conceived Kitchen

## The Arc House Features

**Small Footprint:** Efficient design makes the most out of 432 square feet, creating a space tailored for today’s smaller households.

**Hand-Crafted Details:** Extensive wood trim brings elegance and warmth to the functional features of the Arc House interior.

**Expansive Design:** A 10-foot high exposed arch ceiling creates the illusion of a much larger space.

**Optimized Interior:** Niches and built-ins optimize space and create separation in an otherwise open plan.

**Sustainable Materials:** Wood elements complement other durable materials to create an interior space that is elegant and warm.

**Good Glass:** A wall of glazing, featuring super-efficient R-5 windows, takes advantage of solar heat gain and brings the outside in.

**Net-Zero Living:** A tight envelope, extra insulation, efficient appliances, smart home technology and small footprint combine to reduce demand, which is completely met by a modest solar PV array and battery system.

**Durable Exterior:** Fiber cement siding and weather-tight acrylic roof coating protect the Arc House from moisture, wind, fire and UV damage.

**Functional Spaces:** Good design, including a fully conceived kitchen from Kitcheneering, creates functional zones within the living space.



## Protect Your Home During a Wildfire

The catastrophe in Canada has lead many homeowners to take fire resistance measures.

BY JESSICA PORTER

THE WILDFIRES THAT destroyed more than 2,400 buildings around Fort McMurray, Canada, continued to burn into June, prompting global help to fight the fires and aid displaced residents. As the world watched Mother Nature destroy so many houses so quickly, more people began paying attention to what can be done to minimize the risk of fire damage to their own homes.

“Sometimes, avoiding damage during a wildfire is a case of luck, and sometimes it’s a case of someone using good fire-safe techniques,” says Shayne Mintz, Canadian regional director of the National Fire Protection Association. Though completely protecting your home is impossible, there are a few ways people can reduce the risk of their home burning during a wildfire.

### BUILDING MATERIALS

Combustion-resistant building materials are important in wildfire-prone areas. Vinyl siding should be avoided, as it ignites easily. However, cement board siding is an option, as well as cement stucco, which provides 1.5 inches of non-combustible protection. Another alternative is full brick masonry, which provides 4 inches of protection, according to Wayne Finley, president of the Canadian Association of Home and Property Inspectors of Alberta and owner of Finley Home Inspections.

Finley also recommends adding an air space to the inner width and a full rainscreen to walls. In addition, the windows should be double glazed.

While walls are arguably the most important material for fire resistance, the roof also plays a key role. Using combustion-resistant roofing materials, such as metal or concrete shingles, can help deter combustion.

The deck material should also be taken into account. Homeowners

**Wildfire destruction.**  
The recent wildfires in Canada destroyed more than 2,400 buildings around Fort McMurray.



CREDIT: WIKIMEDIA

should avoid decking materials that are prone to combustion. Instead, try steel frame or aluminum decking. Some lumber can still be used, as long as it’s treated with a fire retardant.

### LANDSCAPING

Homeowners in wildfire-prone areas also should make sure combustible landscaping is not located against their houses. They should add a 30-foot perimeter around the home that’s free of mulch, leaves and tall grass.

“We call that 30-foot area the ‘home ignition zone,’ so make sure it’s cleared,” Mintz says. “That will provide a buffer for the home.”

### HOME MAINTENANCE

Proper home maintenance can help a home survive a wildfire. Mintz suggests homeowners clean debris out of eaves along the house. He

## Savage Irony: Alberta Wildfires in Tar Sands Town Tied to Global Warming

The wildfires call attention to dire environmental impacts possible if fossil fuel projects proceed as planned.

BY MATT POWER, EDITOR-IN-CHIEF

ENVIRONMENTALIST BILL MCKIBBEN, a vocal opponent of the proposed XL Pipeline—originating in the Tar Sands of Canada—has likened the extraction of dirty fuels to a death blow for the planet, and he’s not alone. The major concern with harvesting these fuels is the release of buried methane in the extraction process, but that’s just one straw on the climate change camel’s back. There’s also the burning of the extracted oil, the clearing and burning of forests and more.

You might not have caught this fact from the shallow coverage of the wildfires raging in Alberta, but Fort McMurray is ground zero for the fossil fuel industry’s tar sands operations. Last week, Scientific American released an analysis of the fires, noting that:

“The wildfire is the latest in a lengthening lineage of early wildfires in the northern reaches of the globe that are indicative of a changing climate. As the planet continues to warm, these types of fires will likely only become more common and intense as spring snowpack disappears and temperatures warm.”

Not to downplay the suffering of the tens of thousands of people affected by the fires, but all of the scientific evidence suggests continuing to develop the tar sands will have exponential negative effects in Canada and around the globe. For example, there’s a huge amount of flammable peat in the region, which could catch fire and add to the airborne pollutants, burning and smoldering for months. The analysis also stated:

As the planet continues to warm, these types of fires will likely only become more common and intense as spring snowpack disappears.

“Boreal forests contain nearly 30 percent of all the world’s carbon stored on land. As they light up, they send that carbon into the atmosphere where it warms the globe. Intense wildfires are already turning some forests into carbon polluters in certain years, creating a feedback cycle that drives temperatures higher and raises fire risks even further.”

### DIRE INDICATORS

New records for global temperature continue to be broken. Not only did we pass the 400 ppm threshold for CO<sub>2</sub> in the atmosphere this year, Mauna Loa Observatory recently measured the level at 409 ppm, the highest level in 15 million years. And it’s still rising.

In addition, Arctic Ice is melting at a rate that was not expected until about 2070. A recent article, ‘Arctic Sea Ice Ice is Falling off a Cliff and it May Not Survive The Summer,’ summarizes the findings from temperature readings and sea ice conditions in the Arctic region. It was recently published on Roberts Scribbler.

The article reads: “Back in the first decade of the 21st Century, the mainstream scientific view was that Arctic sea ice would be about in the range that it is today by around 2070 or 2080. And that we wouldn’t be contemplating the possibility of zero or near zero sea ice until the end of this century. But the amazing ability of an unconscionable fossil fuel emission to rapidly transform our world for the worst appears now to outweigh that cautious science...”

It’s time to wind down the fossil fuel industry, before it’s too late.

also recommends paying attention to small factors that could lead to big problems, such as storing firewood under a deck or near the house.

In addition, Mintz recommends making sure the soffit vents and vents into the foundation are properly size with a mesh no larger than 3 to 4 millimeters in size, which will prevent embers from entering a home.

### FUTURE IMPLICATIONS

Due to the extent of the damage, the wildfires will likely lead to changes in the building industry. For example, Finley expects insurance companies to begin giving rebates to clients using fire-

resistant building materials. Mintz expects it to lead to changes in building codes.

“We’re working on code developers, insurers and communities in fire-prone areas to improve code to make sure these kinds of events are minimized,” Mintz says. “But there’s no way to eliminate them all together.”

The Fort McMurray wildfires were huge, requiring an incredible amount of manpower to control, and resulting in significant damage to homes, the environment and the local economies. While there’s no sure solution to preventing destruction during a wildfire, there are ways homeowners and builders can reduce the risk of fire damage. **GB**

# ENERGY SOLUTIONS

## Sustainable Power From This Day Forward

# The Race Is On for Solar and Smart Home Technologies

The industries are merging quickly and attracting new players to the market.



**Remote control.** Companies are rushing to enter the home control market that blends home efficiency with intuitive and remote control.

BY SARA GUTTERMAN

THE GLOBAL SOLAR INDUSTRY, expected to reach \$345 billion by 2020, and the global smart home market, expected to reach \$59 billion by 2020, are two of the building industry's hottest growth sectors.

One of the main drivers for this meteoric growth is the unprecedented transition from a high-consumption and low-automation market to a low-consumption and high-automation market. This transition is fundamentally altering the performance of the built environment and the way that we interact with it.

As technologies in solar and smart home spaces become mainstream and cost effective, it's clear that these two categories will not remain stand-alone islands. Rather, they will sync together as a part of an integrated ecosystem that empowers consumers to optimize the performance of their homes.

Smart home technology and solar share the same ultimate goal: to

## Putting the Homeowner in Control

SMART HOME TECHNOLOGY gives homeowners control over their energy consumption using a home area network. According to Smartgrid.gov, a home area network connects smart appliances, thermostats and other electric devices that are connected to an energy management system inside the home. The system then adjusts the connected equipment's run schedules to reduce demand at critical times and lower energy bills. It also allows homeowners to personalize their temperature and light preferences to change throughout the day, as well as control systems from their smart devices.

## Best and Worst States for Net Metering

When homeowners who power with renewable energy produce more energy than they need, net metering allows them to deliver that energy to the grid for credit. All states allow for net metering, but some provide better incentives than others.

The top states for net metering allow customers to earn full credit with no subtractions. The worst states for net metering deter the practice. Following are lists of a few of the best and worst states for net metering.

### Best:

- Arizona
- California
- Colorado
- Vermont
- West Virginia

### Worst:

- Alabama
- Hawaii
- Nevada
- Tennessee
- Texas

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**Using renewable energy.** States that allow net metering enable homeowners to deliver extra renewable energy to the grid.

provide homeowners with a greater level of control. The integration of solar and smart home technologies transforms homeowners from passive consumers into active energy managers, offering the freedom to cut out the energy middleman (the utility), as well as the ability to intelligently plan and harmonize power generation with consumption patterns.

In essence, the convergence of smart technology and solar is the ultimate demand-side management strategy. It empowers homeowners (and their devices) to manage their own energy use, as well as to profit from it through net metering in some places. Only when these enabling technologies are bundled together will

The integration of solar and smart home technologies transforms homeowners from passive consumers into active energy managers.

homeowners be able to truly optimize their resource efficiency, cost savings and convenience.

While consumer demand has spurred the growth of residential solar and smart home technologies to date, utilities and the regulatory environment are now entering the picture. Factors such as rate restructuring, time-of-use pricing, fees on net metering and residential demand charges are shaping the landscape of the solar industry. Soon, the industry will cross over to impact smart home technology. With utilities concerned about grid reliability, resiliency and cost shifting, solar may soon be

## Behemoths Move In

GOOGLE ACQUIRED NEST LABS, which manufactures smart thermostats, for \$3.2 billion. Later, it released the *Nest*, an intuitive thermostat that lowers or raises temperatures based on residents' preferences that also can be controlled by a smart device.

Likewise, Amazon recently released the *Echo* as part of its *Alexa* voice assistant service. The *Echo* allows homeowners to control lights, switches and thermostats from a smart device.

required to connect with smart home technology as an effective load management strategy.

As solar and smart home technology converge, expect to see a rush of service providers offering personalized settings and customized energy packages that suit homeowners' lifestyles, preferences, and work and travel schedules.

Who will win this mad dash? Will it be the metadata goliaths Google and Amazon who disrupt yet another business sector with innovative, streamlined solutions? (Remember when Google was just a search engine and Amazon was just an online marketplace?) Or will the solution come from partnerships developed by the solar players and the smart home tech companies themselves?

While the solar and smart home tech companies will hopefully have the foresight to claim their fair share of the evolving market, I wouldn't discount the data behemoths when it comes making a play for the larger space of integrated enabling technologies. They certainly have proven time and again that they have the creative capability and business flexibility to transform the homeowner experience. **GB**

## Six Tips to Deal with Water Damage

Remove water properly to avoid mold and improve air quality.

BY CATHY RUST

**W**HETHER DUE TO a massive flood or just a leaky pipe, water in unwanted places can cause a lot of damage—and maybe more damage than you might think. Of course it can destroy items in a building; but it also can lead to mold growth and compromised air quality.

To get rid of mold, it's important to remove all water and dry out the affected area quickly and thoroughly. Then, disinfect the area and remove or clean all items that are conducive to mold growth.

Preventing mold is key to keeping a home's air clean and healthy. Whether a client's home is filled with two inches of water, or just has a few dark and damp areas, here are some tips to minimize water damage and improve air quality.

**1. Disconnect the power, unplug electronics, and remove electronics, furniture and all movable items immediately.** The faster those items are moved or elevated out of harm's way, the more likely they can be saved. If possible, turn off power leading into the affected area, especially if water rises above electrical outlets. Pull up all carpets (wall-to-wall and area rugs) and underpadding. It may be possible to save the carpet, as long as it is cleaned and disinfected. However, it's unlikely to save the underpadding, which acts like a sponge and



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**Compromised air quality.** Water damage can lead to mold and poor indoor air quality if not handled correctly and quickly.



CREDIT: DVIDSHUB

**Increased flooding.** Climate change is leading to an increase in devastating storms.

absorbs a lot of water.

**2. Get rid of the water.** Getting rid of all the water quickly, and drying out the area are the the most important things you can do to prevent mold growth. There are several ways to remove standing water. If the home doesn't have power, or if loose wires create a problem, the old-fashioned, manual way will work: Use old towels, buckets and mops. If nearby sewers aren't backed up, pour water down the drain. Otherwise, pour the water on the lawn or other permeable surface.

A wet/dry vacuum can be used, too (note: be very careful to plug it into outlets far away from water). Don't use an extension cord, as the connection could short out and shock the operator. A more extreme option, of course, is to rent a generator and a "dirty" sump pump and clear the water that way.

**3. Dry out the affected area.** It's important to dry the area out as soon as possible. Use fans and a dehumidifier. If the outdoor humidity is low, open windows and move air through the building.

If the area is a finished basement, and the drywall is affected, it likely will be necessary to cut away the areas that were touched by water, as the drywall will crumble—and the paper backing is a good source of food for mold. If the area has baseboard trim, remove it first. If the trim is made from wood, it might be salvageable; but if



CREDIT: CARLPENERGY

**After the storm.** Removing all moveable items quickly can save some household items after a flood, but carpets and drywall have to go.

it's made from pressboard, you most likely won't be able to save it.

**4. Disinfect.** After the area has dried out—including wood beams, insulation and drywall—use a disinfectant to get rid of any bacteria that might have come through sewers or toilets. Disinfect all areas affected by the flood waters, including walls, wood and

## Climate Change Leads to Increase in Storms

**I**N JUNE, WEST VIRGINIA was hit with destructive flooding that resulted in the death of many people and destruction of 1,200 homes. Just before the catastrophe in West Virginia, flooding struck Oklahoma and Texas—resulting in even more damage.

Climate change is largely to blame for these types of extreme weather events, as warmer air holds more moisture and results in heavier precipitation. According to the Union of Concerned Scientists, "very heavy precipitation events, defined as the heaviest one percent, now drop 67 percent more precipitation in the Northeast, 31 percent more in the Midwest and 15 percent more in the Great Plains, including the Dakotas, than they did 50 years ago."

If global warming continues to increase, those numbers are expected to increase by 40 percent by 2100. However, even if measures are taken to slow the effects of climate change, those numbers will still increase by 20 percent. The damage has already been done.

non-upholstered furniture. Avoid using bleach, which has harmful fumes and kills just about everything except mold spores. Instead, try EPA-registered mold and mildew disinfectants such as *Tough Guy* disinfectant spray or *Diversey* cleaner and disinfectant. Once the area is properly disinfected, it's important to stop the possibility of future mold growth.

**5. Prevent mold growth.** After the area has been disinfected and completely dried out, apply *Concrobium* throughout the affected area according to directions. *Concrobium* is a non-toxic product made with distilled water and inorganic salts that stops mold from growing. It can be used on furniture, walls and floors—basically anything that is susceptible to mold growth. Once a thin layer of *Concrobium* is applied, let it dry overnight. As *Concrobium* dries, it forms a thin layer over any mold that may be growing, which crushes the roots of the spores. Spraying it also prevents any mold from growing, and provides continued resistance to mold. If it's necessary to spray it on an entire room, consider renting a mister, which is easy to use and allows for quick application.

**6. Dispose of damaged items responsibly.** It may be tempting to throw everything into a dumpster and send it all away. But organizing damaged goods into piles and taking whatever possible to recycling centers will help alleviate pressure on your local landfill. Go to the management website for the city or town to find out where to recycle old paints, stains, adhesives and other toxic liquid, as well as damaged electronics, furniture and even drywall. **GB**

*Cathy Rust writes about green building materials, and where to find them in Toronto, Montreal and Ottawa. You can find her blog at [www.becgreen.ca](http://www.becgreen.ca).*

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## New Law Overturns Colorado Ban on Collecting Rainwater

BY MIKE COLLIGNON

COLORADO USED TO have the dubious distinction as the only state to outlaw rainwater harvesting. After a failed attempt to rectify that last year, the state legislature revisited the issue during the 2016 legislative session. HB 1005 received the support of the Senate Agriculture, Natural Resources and Energy Committee by a vote of 6 to 3. Then, it passed both chambers, before being signed into law by Governor Hickenlooper on May 12. When the bill goes into effect on Aug. 20, 2016, residents will be able to collect and store up to 110 gallons for exterior usage on their property.

Why did it take so long for such a widely accepted practice and common-sense conservation technique to gain legal approval? The delay had been due to “prior appropriation,” which is a form of water rights in the state that gives priority water rights to the first person to make a claim. Some thought the siphoning of water from roofs would negatively affect farmers and ranchers who depend on that water downstream. While the bill was supported by environmentalists and the Colorado Farm Bureau, it faced resistance from ranchers who were concerned they would receive less water under the State’s century-old water rights system.

### EXAMINING THE EFFECTS OF RAIN BARREL USE

Colorado State University (CSU) provided an unbiased analysis of the potential impacts of using rain barrels on surface runoff. The analysis simulated the amount of runoff that would occur from a typical residential lot in Denver with and without rain barrels, and found the difference was unmeasurable. This finding was key in



**New law. In August, Colorado residents will be allowed to collect and store up to 110 gallons of rainwater.**

refuting opponents’ claims of “injury” to their water rights. In such claims, the water rights holders must identify who is responsible for taking water out of appropriation and quantify the amount. The study concluded that any changes to the water cycle as a whole could not be accurately quantified.

The study was also a point of contention, as Sen. Jerry Sonnenberg (R-Sterling) called the CSU study “flawed,” and questioned the credibility of the educational institution—and it’s not often you see a state politician badmouth a university in his or her borders. Sonnenberg also suggested rain barrels be registered. This would allow the Office of the State Engineer, which handles water resources, to effectively curtail the use of rain barrels based on a determination of “injury.” The registration requirement did not make it into the final bill. **GB**

### 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](http://GreenBuilderCoalition.org)

For more information, contact Executive Director Mike Collignon at [mcollignon@greenbuildercoalition.org](mailto:mcollignon@greenbuildercoalition.org).

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# FROM THE TAILGATE

New Offerings for the Sustainable Minded

By Ron Jones

## New Codes, Old Problems

Creating codes for resilient buildings proves complicated, as usual.

**A**NOTHER BATTLEFRONT IS TAKING SHAPE ON the already-crowded fields of conflict that define the relationship between the regulatory sector and the homebuilding industry. However, I don't intend to suggest the ongoing battles around energy codes, proposed fire sprinkler mandates, stormwater management, wetlands designations, silica rules, endangered species, updated overtime compensation requirements and a host of others conflicts have been resolved—or even quieted significantly. The call for more resilient buildings is simply another brewing fight to add to the list.

Following a White House conference this spring on how to pass building codes that provide more resilience, the response from a National Association of Home Builders' representative echoed a familiar refrain: Codes essentially have been hijacked by the product manufacturers, so the poor, beleaguered homebuilder will be forced to purchase their latest products to comply.

Soon after, the organization's message to its members on the topic appeared benign enough, simply reporting the White House event had taken place, and predictably assuring members' interests would be looked after by vigilant monitoring of the situation.

### AN HISTORIC SITUATION

I am reminded of a project along the upper Rio Grande some years ago on the lands of one of the Native American pueblos, a few miles north of Albuquerque. The pueblo committed to build a new church, requiring it to be engineered and built to last "a minimum of five hundred years."

Sure, the pueblo's governing council was concerned about upfront costs, along with a vast number of aesthetic, structural, historic and cultural considerations. But their insistence on constructing a building that would endure for generations speaks volumes about their values as a society.

The coming battles over resilient houses and buildings are little more than reruns of the age-old struggles between those who search for ways to maximize short-term profits over choosing to deliver lasting value.

The homebuilding industry is quick to recognize and happy to benefit from the complexity of the resiliency issue, and this promises to be a long fight. This is especially true given the wide array of potential environmental disasters, from extreme weather events, seismic issues and wildfires to seasonal flooding, ground subsidence,



erosion and rising sea levels. These factors are already challenging enough without mixing in the myriad of stakeholders, public and private, and special interests that must find ways to address the growing need for more resilient building solutions. It is a safe bet that resolutions to these expensive and devastating events will be slow to emerge.

In the meantime, it will remain easier and more expedient to blame those devious product manufacturers, the White House, FEMA, the insurance industry, Mother Nature, Lady Luck or, heck, even the weatherman, rather than share the responsibility and try to be part of the solution. **GB**

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