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GREEN BUILDER[®]

July/August 2022 / www.greenbuildermedia.com



CIRCULAR THINKING

This year's selection of sustainable-minded Eco-Leaders puts the Circular Economy at front and center. Can the right focus on EPDs, ESGs, Cradle-to-Cradle and other criteria raise the bar on building performance?

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Let's Feed^{the} Right Wolf

IF WE DO, THE TRANSITION WILL STILL BE TOUGH, BUT BETTER DAYS LIE BEYOND.

You might have heard the “Tale of the Two Wolves,” which is of Cherokee or Lenape origin. Put simply, the wolf you feed is the one that prevails. One represents despair and hate, the other optimism and love.

I had to turn off the news for a few days last week. I could feel the bad wolf rising. Isn't it enough that we've slogged through almost three years of COVID? Now we've been slammed with unthinkable public murder sprees, an ongoing coup to dismantle our democracy, and extreme weather that seems to be getting worse each month.

Seriously, where's the escape hatch? My friends call me, half in their cups, wrangling with depression. They ask me how I keep my head above water; what keeps me going. Do I have a “naïve” belief that things will all work out?

It's a fact that some people simply seem to have more optimism. But in my case (as I'm sure with yours), the reality is much more complex. Some of it comes from being American. I believe there is a deep core of fairness and courage in the American heart—despite our many failings. For 240-plus years, we have imperfectly shown that diverse people can live together, prosper, and share responsibility and power. There's a reason people from all over the world still want to live here.

The turmoil going on culturally, in my view, is a predictable and unfortunate phase in our evolution as a nation. It's also an artificial one, spurred on by a handful of ruthless opportunists: TV pundits, politicians, axe-grinding judges and shameless hoarders of wealth. They have identified certain “hot buttons,” such as fear of immigrants, that they try to use to put us at odds with our neighbors.

It's an old playbook, but its effects have a predictable arc. We're at the start of what I believe will be a 15- or 20-year period of struggle. In the end, as in past conflicts, the bad actors will be overcome, and we will emerge from it better, more whole and more appreciative of what we have.

Why do I believe this? I can give you many examples. Our staff and freelance network at Green Builder has never been more diverse. Right now, I'm testing one of the first-ever solar-powered heat pump systems, a 12,000 BTU, 22 SEER unit, from a company called Airspool. It runs directly from solar panels, with no need for batteries, charge controller or inverter. It's something I've been predicting for the last five years. It's also



something I've been told repeatedly by industry wonks was not possible.

Meanwhile, gas companies have doubled down on propaganda, this time aimed at minorities and Latinos, and suggesting that fossil fuels are key to our renewable future. Part of the story being told is that the grid won't handle the conversion to solar-powered electric homes.

But innovations like the solar heat pump put the lie to those arguments. That's going to happen again and again if we feed the wolf of innovation and optimism, and starve the wolf of lies and despair.

Will problems such as Climate Change solve themselves? Absolutely not. We must remain flexible, but also courageous. Our use of resources must shift to “full circle” models of efficiency. We must challenge our expectations of comfort, and look at what we lose by clinging to the past too tightly.

We have everything we need to craft a world of future abundance. The wolf lies within each of us, not “out there.” Let's make the right choice. **GB**



Matt Power
Editor-in-Chief

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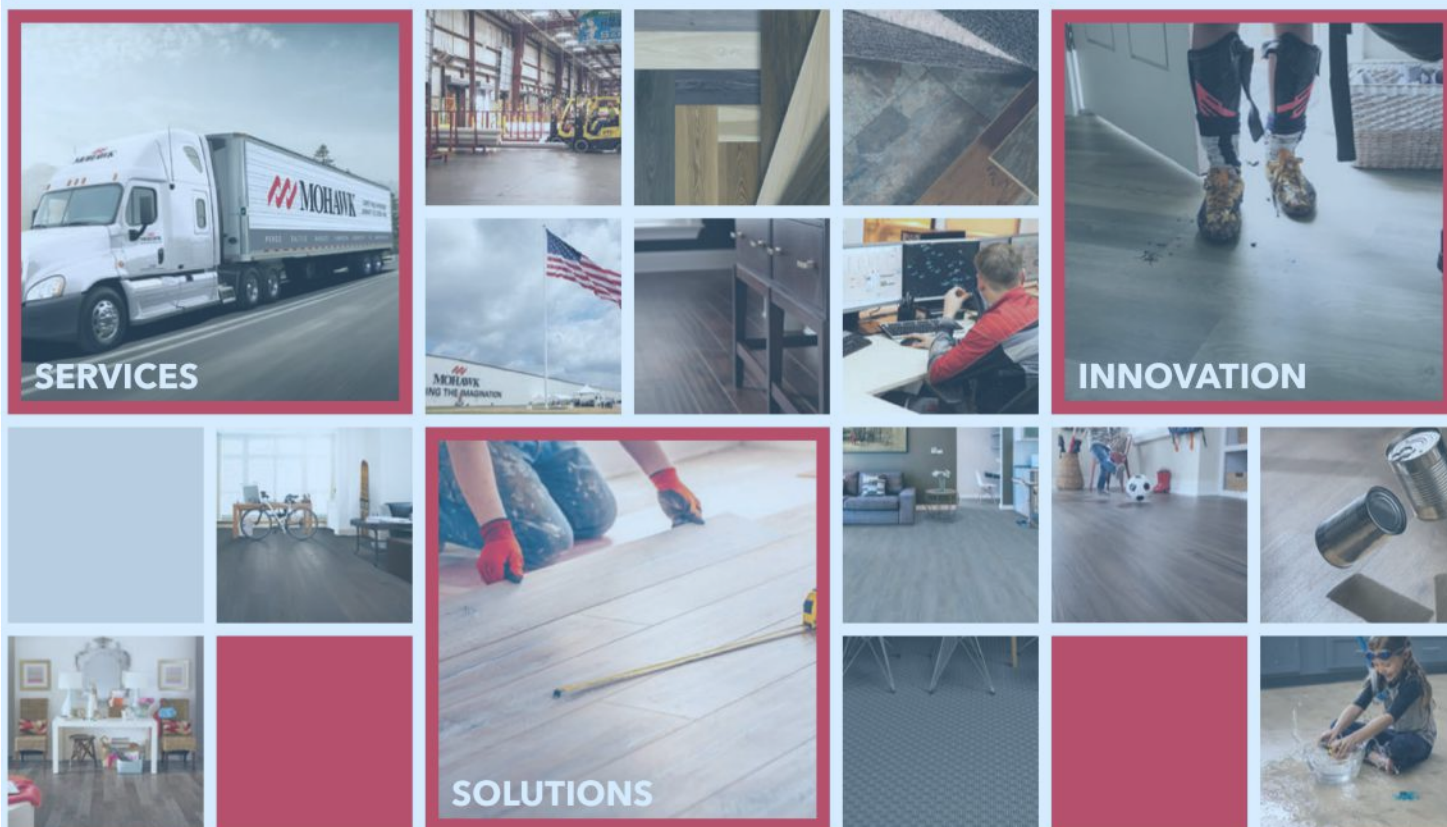


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California Cracks Down Hard on Plastics

A new, ultra-restrictive law sets mandatory reduction and recycling targets for manufacturers, starting in 2027.

California has authorized the nation's most restrictive law on plastics in an effort to curb emissions and reduce the impact of climate change. Senate Bill 54, signed in July, and set to fully take effect in 2027, establishes 2032 as a deadline year for several waste-related issues. That's when plastic producers must reduce by 25 percent the amount of plastic in packaging, such as in shampoo bottles, food wrappers, takeaway cups and bubble wrap; all single-use packaging, including paper and metals, must be recyclable or compostable; and the state must increase its overall plastics recycling rate to 65 percent. And, from 2027 to 2037, plastic manufacturers must pay \$5 billion into a fund to mitigate the effects of plastic pollution on the environment and human health.

According to the environmental nonprofit group Ocean Conservancy, by 2037, 23 million tons of plastic production will be eliminated. Any reduction in plastics creation will also reduce greenhouse gas emissions, and the amount of waste ending up in landfills. The 2027 start



Plastic surgery. Reduced production and increased recycling of plastics will be the new norm in California after a new law takes effect in five years.

CREDIT: JOSLYNLM/FLICKR

date for the new policy should give manufacturers plenty of time to prepare, the group notes.

It may have a ripple effect, according to Dylan de Thomas, vice president of external affairs at The Recycling Partnership, an environmental research firm in Washington, D.C. "Manufacturers don't make packaging for a single state," de Thomas told The New York Times. "They will make packaging recyclable elsewhere too, and you are going to have a stronger recycling system."

Are Widescale Blackouts in America's Future?

What happened in Texas last year could occur everywhere as the U.S. power grid ages.

As Texas residents once again deal with mandatory energy conservation to avoid rolling blackouts during a hot summer, those in other states may have similar problems coming, due to an aging national power grid network. According to the U.S. Department of Energy, 70 percent of transmission lines are more than 25 years old, and 60 percent of circuit breakers are more than 30 years old. Meanwhile, the total number of power outages since 2016 has doubled nationwide when compared with 2010 to 2015 totals, according to a Reuters report. Nearly half were caused by weather or natural disasters, a situation that will get worse as adverse climate situations continue.

Texans can relate. In February 2021, millions lost power when the State's independent power grid was hit by two major winter storms that led to the worst infrastructure failure in



Record blackout. Severe winter storms placed more than 10 million Texas residents in the dark for more than two weeks in 2021. At left is what Houston looked like from space before the outages on Feb. 7. At right is the city with the outages underway on Feb. 16. CREDIT: NASA

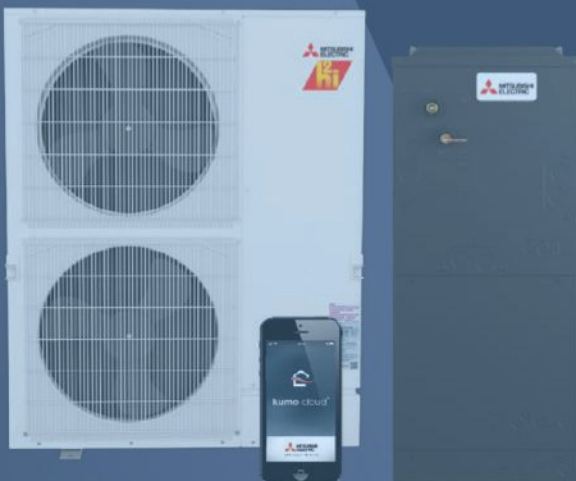
Texas history. Other states, notably Louisiana and Florida, with several massive hurricanes in the past few years, and California, with numerous major wildfires over the past half decade, have been forced to upgrade their grids. **GB**

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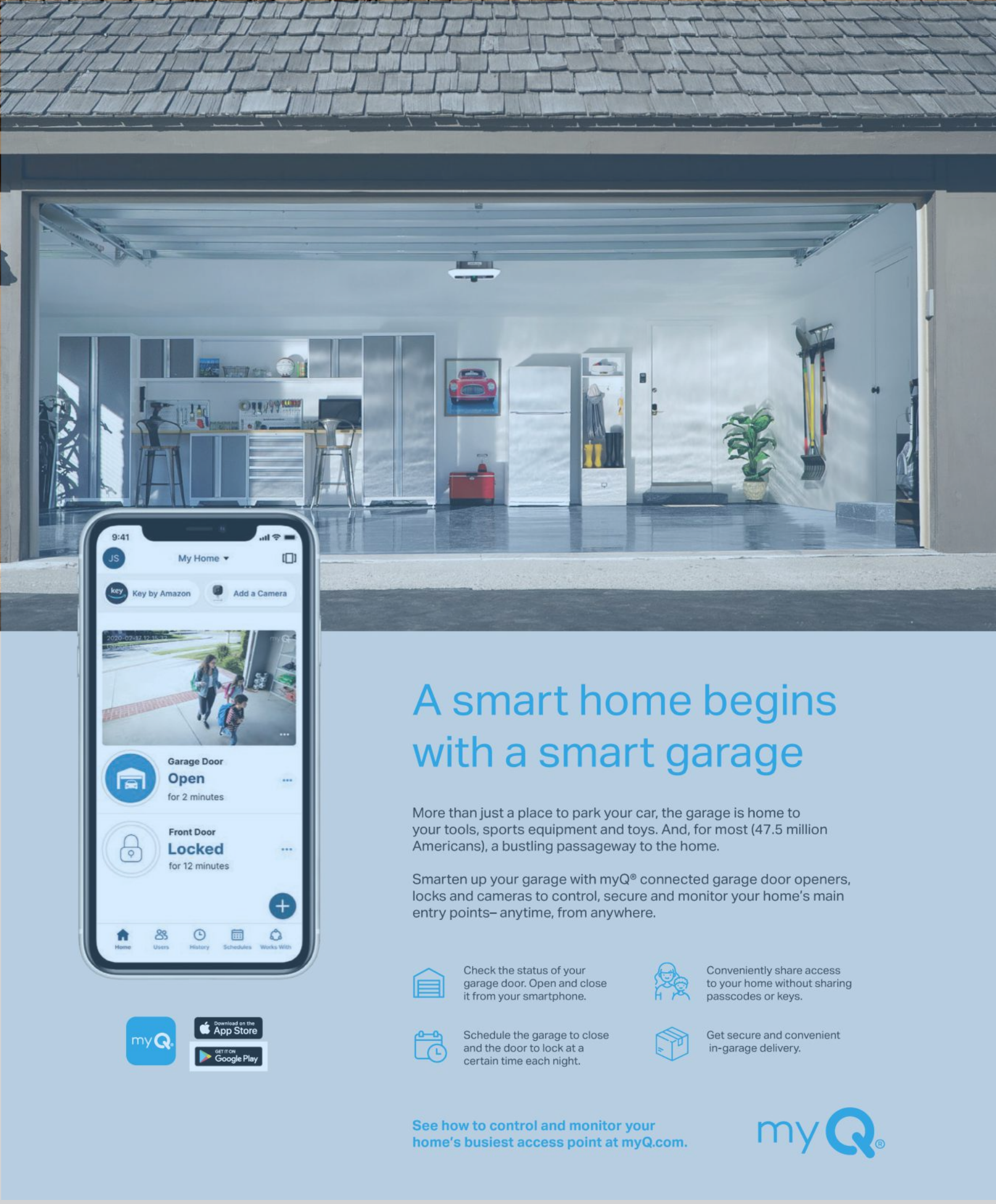
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HERE'S A SAMPLE OF WHAT'S INSIDE:

"These days, people don't come back for a second look, and they don't look at a second place. If it sounds like something close to what they want, people are taking it, sight unseen." PAGE 50

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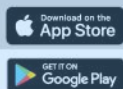
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One Step Forward

As the world's climate emergency continues, manufacturers are doing what they must: picking up the PACE.

BY ALAN NADITZ

This year's Eco-Leaders were chosen based on principles outlined by the Platform for Accelerating the Circular Economy (PACE), with its seven DISRUPT directives: "Design for the Future," "Incorporate Digital Technology," "Sustain and Preserve What's Already There," "Rethink the Business Model," "Use Waste as a Resource," "Prioritize Regenerative Resources," and "Team Up to Create Joint Value." All have stories to tell.



Carbon Cure

Greenhouse gasses are safely locked away inside everyday building blocks.

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77,000

CO₂ emissions, in metric tons, saved with CarbonCure technology in one year

500 million

The company's goal of embodied CO₂ emissions, in tons, to be reduced annually by 2030

Anyone in the construction industry has heard about how much of an environmental hazard cement is. It's the starting point to the most-abundant man-made material in the world, concrete. According to the International Energy Agency (IEA), cement—the key ingredient that gives concrete its strength—is responsible for up to 7 percent of the world's carbon dioxide (CO₂) emissions. Cement is also the world's second-largest source of industrial greenhouse gasses, IEA notes.

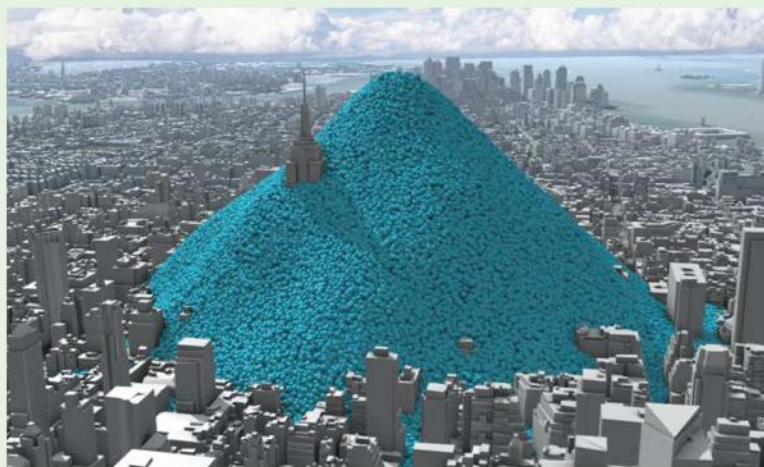
As the end product of cement, concrete gets to be the bad guy. In any given building, concrete can contribute a minimum of 50 percent of embodied carbon—the CO₂ emitted from the manufacturing of building materials and construction. Embodied carbon will also account for nearly 50 percent of carbon emissions from new construction over the next three decades, according to the agency. And, buildings currently generate almost 40 percent of the world's greenhouse gas emissions—and the planet's building stock is expected to double by 2060, equal to creating another New York City every month.

Those are all dire figures. But what if, instead of contributing to embodied carbon emissions, concrete actually helped eliminate carbon from the built environment?

Enter **CarbonCure**, the Canadian concrete technology developer that has created a way to keep construction-produced carbon out of the atmosphere by preventing it from leaving the concrete.

CarbonCure's technology enables concrete producers to inject captured CO₂ into fresh concrete during mixing. When introduced, the carbon dioxide becomes chemically converted into a solid mineral, leaving it permanently trapped within the concrete. "In essence, CO₂ mineralization turns it back into limestone—the lowest thermodynamic state of CO₂," CarbonCure CEO Robert Niven notes. "This reduces embodied carbon in the built environment, and creates value for concrete producers."

Best of all, mineralization increases the concrete's strength, meaning builders can use less, saving them money and helping the environment, according to CarbonCure officials.



Burial ground. New York City added 56.5 million metric tons of CO₂ to the atmosphere in 2020, enough to bury the city several times over if the emissions were solid material. COURTESY OF REAL WORLD VISUALS/FICKR



Solid as a rock. CarbonCure technology enables users to inject captured CO₂ into fresh concrete during mixing, turning it into a solid mineral that is stronger than standard concrete. COURTESY OF CARBONCURE

100 million

Equivalent number of cars taken off the road by 2030 if the company's embodied emissions goal is met

One of the largest impacts the product had on the built environment occurred in 2017 at 725 Ponce in Atlanta, a 360,000-square-foot commercial building, and another 590,000 square feet of multi-use space. Completed in 2019, 725 Ponce is also the first project to be built entirely from CO₂ mineralized concrete—in this case, 48,000 cubic yards' worth. The CarbonCure technology enabled a 750-ton carbon footprint reduction, equivalent to 888 acres of forestland absorbing CO₂ for one year, or of 1 acre of forest sequestering carbon for 800 years.

Since its launch in 2015, CarbonCure technology has been used to reduce the carbon footprint of several notable developments, including MGM National Harbor in the Washington, D.C. area, and LinkedIn's headquarters in Mountain View, California. The technology has been used in more than 22 million cubic yards of concrete supplied to construction projects across North America, resulting in more than 180 million metric tons of CO₂ saved. More than 650 concrete

"CarbonCure's mission is to reduce the carbon footprint of the concrete industry and lead the global initiative to repurpose waste carbon dioxide into products that benefit society."

plants in the United States, Canada, Southeast Asia, Latin America, Europe and other parts of the globe now have CarbonCure roots—up from less than 100 in 2018. But with more than 5,500 such facilities available in the U.S. alone, the company sees the current implementation as a fraction of the technology's potential.

According to Niven, carbon utilization could become an \$800 billion to \$1 trillion industry by the year 2030. In the concrete sector alone, it represents an estimated \$400 billion market opportunity and has the potential to reduce up to 3 gigatons of annual CO₂ emissions by 2030. This would be equivalent to the current emissions of the entire digital industry, and more than Japan's annual emissions.

"Outside of the industry, few people give concrete a second thought," Niven notes. "Increasingly, however, it is coming under scrutiny for its significant climate impact. Carbon performance is the defining competitive issue for the foreseeable future."



Structurally sound. The 725 Ponce building in Atlanta, made entirely with carbon-mineralized concrete, is one of CarbonCure's top achievements.

COURTESY OF COUSINS PROPERTIES





Crossville Inc.

For this porcelain tile maker, what's old really does become new again.

S
T
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1.2 million

Total square footage of the John C. Kluczynski Federal Building

\$100 million

Cost of eco-friendly related building renovations

Look at the Chicago skyline and it's hard not to spot the John C. Kluczynski Federal Building. At a mere 42 stories, it's one of the smallest skyscrapers running along the shoreline of Lake Michigan (amplified by the fact that the strip includes four of the nation's tallest structures). But the Kluczynski building's dark black exterior makes it stand out.

As does its green history. Named in honor of longtime Illinois U.S. Congressman John C. Kluczynski, the building has been a central part of the city's Federal Center Plaza complex since 1974. But in 2014, after 40 years of occupancy, the building was starting to show its age, especially in its 78 bathrooms.

According to [CannonDesign](#), the architecture firm selected for the overall renovation, toilet room upgrades were needed to "incorporate high-level water efficiency and achieve ADA accessibility compliance." The aesthetic objective, the firm notes, was to "create a room design that

would harmoniously resonate with the original architecture while positioning the facility for its next 40 years."

The bathroom project went to tile manufacturer [Crossville Inc.](#), which had a then-unique idea of recycling its own previously fired porcelain tile. "A key focus for the renovation was sustainability," CannonDesign notes. "All retrofits and new installations would need to conserve energy and water, improve the indoor environment, and incorporate green materials. As part of the complete renovation, the building's bathrooms would all receive new porcelain fixtures, tile floors and walls."

Because Crossville was capable of "recycling its own tile scraps that had been through the kiln," it was conceivable that the same could be done with the Kluczynski building's pieces, CannonDesign architect David Kite notes. The Crossville team removed a toilet from the building and shipped it to its production facility in Tennessee to ensure the material was suitable for recycling. It was.



Federal facelift. After 40 years, the John C. Kluczynski Federal Building in downtown Chicago needed a sustainability upgrade, especially in its 78 bathrooms. COURTESY OF KEN LUND/FICKR



Washroom wonder. Crossville Inc. converted more than 57,000 square feet of old porcelain sanitary ware on bathroom walls and floors into modernized, energy-saving tile. COURTESY OF CROSSVILLE

114 million

Pounds of porcelain waste diverted from landfills since 2014

“In our practices, processes and products, we’re committed to improving the built environment and everyday experiences for employees, customers and partners.”

The building’s existing tile, toilets, sinks, urinals, and drinking fountains were then removed from the building and shipped to Crossville’s plant. There, approximately 200,000 pounds of harvested porcelain material was ground into a fine powder for feedstock and manufactured into more than 57,000 square feet of modern tile for installation on the bathroom walls and floors. The old porcelain sanitary ware that was shipped from Chicago later returned to the city transformed into 12-by-24-inch tile for the walls and 24-by-24-inch tile for the floors.

“While many other tiles were initially considered, once the concept of the potential repurposing of the porcelain material was confirmed and could be integrated in creating a new product, the selection was clear,” Kite says. “The result was a tile that represented the clean, minimalist aesthetic desired as well as translating a unique sustainable story for the project.”

The Kluczynski Federal Building’s success led to Crossville’s recycling partnership with plumbing products

manufacturer [TOTO USA](#), ensuring Crossville’s status as a net consumer of waste, according to Crossville media relations representative Irene Williams. Since 2014, more than 114 million pounds of fired porcelain waste has been diverted from landfills and has instead been recycled. Meanwhile, the company’s [Tile Take-Back Program](#), which allows previously installed tile from any manufacturer to be returned to Crossville for recycling, has also proven incredibly successful, Williams notes.

Crossville is the first U.S. tile manufacturer to produce large-format tile on site, manufacture tile with certified recycled content, earn the Tile Council of North America (TCNA)’s Green Squared certification for all of its U.S.-produced tile lines, distribute a complete line of large format gauged porcelain tile panels, and earn designation as a net consumer of waste—meaning it recycles more waste into new products than it generates through its manufacturing processes in the domestic tile industry, the company notes.



All fired up. At Crossville’s production facility, roughly 200,000 pounds of porcelain tile used in the John C. Kluczynski Federal Building was recycled and kept out of landfills. COURTESY OF CROSSVILLE





Greyter Water Systems

For this greywater treatment product maker, reused water is smart water.

STATS

1%

The amount of all water worldwide available for drinking, bathing, crops and cooling of power plants

6x

How much the demand for water grew during the 20th century

Flushing a toilet can kill the environment. That statement may seem far-fetched, but to [Greyter Water Systems](#), it makes perfect sense. Three percent of the nation's energy is used to pump and treat water, and the technology used for processing equipment translates into an 8 percent gain in carbon dioxide (CO₂) emissions annually, according to the U.S. Environmental Protection Agency (EPA).

Combine that with the amount of water lost from just a leaky toilet—about 200 gallons per day, resulting in about 100 kilograms of CO₂ emissions daily—and you have a definite environmental pollution problem, the EPA notes. "Conserve waste, and you conserve energy," the agency notes. "And that, in turn, reduces greenhouse gas pollution."

In steps Greyter Water Systems, which developed its *Greyter HOME Water Recycling System* to reduce the amount

of water wasted every day in the bathroom. Almost 50 percent of the home's water usage occurs here, more than half of which comes from toilet and shower usage. Overall, about 25 percent of all toilet water literally goes down the drain, as does nearly one-third of all household water—something that "makes absolutely no sense," because it all starts as drinkable, according to John Bell, Greyter's co-founder and vice president of business development.

The stackable washer and dryer-sized Greyter unit captures shower and bathtub runoff, including everyday items such as shampoo, conditioner, body wash, hair, lactic acid, toothpaste, bath cleaner and dust, then filters it to near-potable quality for use during toilet flushing. Roughly two showers per day supplies enough grey water to handle the daily flushing actions of a family of four. Overall household water consumption can be reduced by up to 25 percent, or about 9,000 gallons per year, Bell notes.



Certified clear. Builders such as Lennar have begun working with Greyter Water Systems to reduce the waste of water in their homes through use of the Greyter Home Water Recycling System.

COURTESY OF LENNAR

100 gallons

Average amount of water used each day in and around the home

“We designed the system so that it had a small footprint,” says Greyter Water Systems CEO and co-founder Mark Sales. “It’s affordable, energy efficient, water efficient, and meets the high quality of water standard that is demanded for the markets we are pursuing.”

That includes states like California, Colorado and Florida, which all require water reuse treatment systems to meet the stringent NSF/ANSI 350 standard, Sales adds. The company has also achieved ANSI/UL 1951 certification, which covers electric plumbing supplies.

The system has proven very popular with new home builders and municipalities, especially those that strive to create water-efficient communities. Its small size and completely self-contained structure—filtration, chlorination, pumps, controls and water storage are all inside the unit—make it a fast install for plumbers. Meanwhile, the water savings, and the resultant drop in the

“Our goal is to be a world leader providing water reuse solutions that help builders, developers and municipalities create water-efficient communities.”

monthly electric bill, resonates well with consumers.

The company has already worked with U.S. builders such as [K.B. Home](#), [Meritage Homes](#) and [Lennar](#), and Ontario, Canada’s [Mattamy Homes](#). Projects include homes, condominiums and apartments, along with commercial constructs such as hotels, colleges, office and retail space, military sites and government offices. Greyter Water Systems anticipates thousands of new units to be installed nationwide in the next few years.

Overall, the team at Greyter believes it all comes down to a basic philosophy: reused water is smart water. “Our mission is to work hand in hand with builders, developers, engineers and architects, along with municipal officials,” the company notes. “We want to provide out-of-the-box solutions that assist in the creation of water-efficient communities.”



Greyter™

Greyter knowledge. Greyter Water Systems CEO and co-founder Mark Sales says the small footprint and easy-to-install nature of the Greyter HOME Water Recycling System make it popular with homeowners and builders.

COURTESY OF GREYTER WATER SYSTEMS

www.greenbuildermedia.com



LG Electronics U.S.A.

When it comes to recycling, it's a case of waste not, want more.

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600,000

Metric tons of recycled plastic LG expects to reuse by 2030

56,000

Tons of e-waste collected worldwide in 2006

What's the best way to take out the trash? **LG Electronics U.S.A.** is well on its way to answering that question through an ever-evolving waste treatment process. The goal, according to LG officials, is for the company to recycle 95 percent of waste generated at production sites around the world by 2030.

To treat waste in an eco-friendly way and reuse it as a resource, LG manages the performance of each production site and of the company as a whole, then monitors the waste recycling process. "Through an increase in the use of renewable raw materials and designing for recyclability, the company has expanded its range of recyclable products while also minimizing the environmental impact of our products," notes John Taylor, LG's senior vice president of public affairs and communications.

LG strives to improve the efficiency of waste recycling processes by establishing a take-back and transportation system for waste generated at key production sites in South Korea, and by continuously researching recycling

technologies, Taylor notes. In addition, the company promotes a resource circulation program aimed at increasing the amount of collected e-waste, and reducing risks.

The company's waste management efforts have led to expanded use of recycled materials. It has also led to increased product stability and quality reliability tests aimed at improving the efficiency of resource use. As a result, recycled materials are currently included in various LG products, including selected washing machines, refrigerators, air conditioners, TVs and monitors.

Over four years, the recycled plastic that the company used exceeded 38,000 tons, Taylor notes. Moreover, LG is promoting development of alternative parts and technologies for all of its products. The company is expanding the field of application for recycled plastics for various product groups, and systematically managing performance in order to broaden the scope of the application of recycled plastics.

LG's packaging efforts utilize waste as a resource and



Good as new. LG Electronics' recycling plan calls for 95 percent of its post-production waste worldwide to be reenabled by 2030. COURTESY OF LG ELECTRONICS USA



Extraction effort. During e-waste recycling, harmful materials such as lead and mercury are separated from other elements suitable for reuse in consumer electronics products. COURTESY OF LG ELECTRONICS USA

3.1 million

Tons of cumulative e-waste collected worldwide between 2006 and 2020

“LG Electronics supports climate action by participating in the circular economy, reducing our carbon footprint, and developing products for a more sustainable and cleaner energy future.”

implement recycled materials. The company promotes the miniaturization and weight reduction of packaging materials, including the application of the eco-friendly variety, with a view to minimizing the number of resources used.

The company has established goals for each of its business units regarding the amount of packaging material used, the packaging volume and the reduction rate of packaging space, according to Taylor. LG monitors progress toward these goals twice a year. “Recent data shows the new development model reduced the amount of packaging material used and the packaging volume by 8.6 percent and 2.8 percent, respectively,” Taylor notes. “More-compact packaging contributes to greener logistics efforts.”

LG is also improving package design. For example, LG Soundbar products feature a durable inner casing constructed from recycled plastic. LG uses 1.5 million 500-millimeter polyethylene terephthalate (PET) bottles annually to create the chic fabric for its soundbars—a stylish

way to repurpose something often discarded, Taylor notes.

For packaging, LG uses molded pulp made with recycled paper and cardboard instead of Expanded Polystyrene (EPS) foam and plastic, which are difficult to break down and pollute the environment by off-gassing. This lowers the use of EPS foam by 250 tons annually and reduces plastic waste by 300 tons per year.

Meanwhile, to help sustain and preserve what is already in place, LG has an “upgradable” option for LG home appliances to enable them to deliver more benefits over time. For example, when a pet joins the family, users can improve the performance of the *LG PuriCare* air purifier by upgrading with a pet care filter to remove fur and dander more thoroughly from the air, Taylor notes. Similarly, upgradable LG dryers can be enhanced later on to handle different climates and fabrics, with new accessories and software downloadable from the Software Upgrade Center using the *LG ThinQ* app.



Remaining relevant. LG offers an upgradability option that allows consumers to upgrade their appliances, and pair them with other devices, to keep them in service longer. COURTESY OF LG ELECTRONICS USA





Niagara

Water conservation is top priority for this ultra-efficient toilet manufacturer.

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3,600

Gallons flushed per year in ultra-efficient 0.5 GPF toilets

19,200

Gallons flushed per year in ultra-inefficient 3.5 GPF toilets

Water products maker **Niagara** is at war with waste—a war it believes everyone can win. For more than a decade, the company's premiere *Stealth Technology* has been helping users conserve water by improving the operation of an every-household object: the toilet.

And now, with the world's population booming—the United Nations expects it to top 8 billion by the end of the year—and its drinkable water supply remaining at a flat 1 percent of the planet's 326 quintillion gallons, the need is greater than ever to use what's available in the smartest possible way, according to company officials.

"Water conservation has never been more crucial," the company notes on its website. "Scientists say that rising global temperatures and shifting precipitation patterns are leading to more frequent droughts and that the situation is likely to get worse."

Just as with showerheads during the company's launch in 1977, Niagara reengineered the toilet in 2009 with *Stealth Technology*, which applies a vacuum-assisted flush to highly efficient, no-waste toilets that saved more than 850 million gallons in 2021 alone.

"Prior to Niagara, toilets used the same crude technology that existed for more than 200 years," the company notes. "This traditional technology wastes water, and is prone to breaking, clogging, leaking, and partial flushes."

Water-saving toilets not only help the environment, but they can help save money on water bills, Niagara adds. The U.S. Environmental Protection Agency (EPA) estimates that water-conserving toilets can reduce water usage by up to 60 percent every year, saving more than 13,000 gallons of water annually and lowering monthly water costs—a key fact, given that water and sewer bills have increased 43 percent over the past decade, Niagara notes.



Quiet kings. Niagara's reengineered *Stealth Technology*-driven toilets use a vacuum-assisted flush to become models that saved more than 850 million gallons of water in 2021. COURTESY OF NIAGARA



Tool of success. Homeowners and businesses can see how much water they can save by switching out toilets and showerheads to Niagara products. COURTESY OF NIAGARA

November

The date when Earth's population is expected to hit 8 billion

"Niagara's mission is to continually save billions of gallons of our world's most precious resource, water, through technological innovation, efficient design, powerful performance, and education."

A multifamily property in Washington D.C., the [Girard Street Apartments](#), was able to realize a 78 percent reduction in consumption and a 77 percent decrease in water/sewer bill cost. By changing existing toilets to Niagara models at the end of May 2021, building owners saw a 375 percent return on investment (ROI) in about six months, or more than \$30,000 annually. The owners have since retrofitted several other properties and are seeing similar results.

Niagara also created an [online water saving calculator](#) to help homeowners and businesses see how much they can save simply by switching out toilets and showerheads to the company's products, and an online rebate locator to help homeowners save money when switching out products.

In 2021, Niagara launched a wholesale program designed to serve the needs of plumbing professionals by providing education about water efficient toilets and offering products that have advanced water efficient technology

while maintaining high performance standards. That year, Niagara also launched a dedicated pro website that provides detailed information on product lines and water efficiency.

As active members and sponsors of several organizations, such as the U.S. Green Building Council (USGBC), the American Society of Plumbing Engineers (ASPE), the American Institute of Architects (AIA), the American Supply Association (ASA), and the Alliance for Water Efficiency (A4WE), Niagara acts as a thought leader in the plumbing and plumbing engineering industries by sharing research, articles, and offering educational courses.

Niagara also consistently writes and submits articles on a wide variety of topics related to water conservation. The company had as many as 50 positive story placements in various industry publications in 2021, and nearly 15 so far in 2022.



Trading up. Owners of the Girard Street Apartments in Washington, D.C., saw a 375 percent ROI in about six months after replacing all toilets with *Stealth Technology* models. COURTESY OF HAMEL BUILDERS





Owens Corning

The insulation giant continues to ramp up efforts to chop down its carbon emissions.

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60%

The company's CO₂ emissions reduction since 2007

1.4 billion

Number of pounds of recycled glass used for products in 2021

When it comes to meeting environmental footprint goals over the next eight years, roofing and insulation products maker **Owens Corning** will rely on the “D” word: decarbonization.

According to the Toledo, Ohio-based company's recently released “**Building a Sustainable Future**” sustainability report, Owens Corning is well on its way to cutting its Scope 1 and Scope 2 greenhouse gas (GHG) emissions in half by 2030. Scope 1 emissions are those produced by the company's manufacturing operations. Scope 2 are indirect emissions from the generation of purchased energy. The 50 percent goal is based on the level of GHGs produced in 2010. As of the end of 2021, Owens Corning has cut emissions by 12 percent since the launch year of 2018.

Owens Corning also has a goal of cutting Scope 3 emissions by 30 percent by 2030. Scope 3 refers to other indirect emissions, such as those from a supply chain. The company's GHG reduction is currently at 8 percent.

Overall, Owens Corning has reduced its GHG emissions by 60 percent since its peak year of 2007, the report notes.

Recent dire reports by the **Intergovernmental Panel on Climate Change (IPCC)**, which assess the world's knowledge and progress toward handling climate change, emphasize how important it is for companies like Owens Corning to meet their emissions goals over the next decade. “The IPCC reports make clear the need to act decisively to reduce GHGs,” says Frank O'Brien-Bernini, Owens Corning's senior vice president and chief sustainability officer. “Our commitment to a decarbonized future is evident throughout our report, as we share our progress toward doubling our product handprint and cutting in half our environmental footprint.”

Emissions reductions have been driven by several efforts, including increased reliance on renewable electricity, switching to electrification-based technologies, energy efficiency improvements, product and technology



Emissions eliminator. Insulation manufacturer Owens Corning is working toward meeting a goal of cutting greenhouse gas (GHG) emissions by 50 percent by 2030. The company has reduced GHGs by 12 percent since 2018. COURTESY OF OWENS CORNING



Kinetic quality. Owens Corning produces numerous varieties of eco-friendly insulation, including its **PINK Next Gen Fiberglas** insulation, which is produced using 100 percent wind-powered electricity. COURTESY OF OWENS CORNING

51%

The amount of electricity generated globally from renewable sources (wind, hydro, solar and geothermal)

innovation, circular economy initiatives, and transportation sustainability, such as the gradual switch to all-electric shipping fleets.

A prime example of carbon emissions reduction planning is the company's *PINK Next Gen Fiberglas* insulation, which is produced using 100 percent wind-powered electricity. Within its first year of use, *PINK Next Gen Fiberglas* insulation saves 12 times the energy required to make it. And, the product can be installed up to 23 percent faster, which enables insulation of up to 161 more homes per year, according to Owens Corning.

Certified insulation products give architects and specifiers, builders, and homeowners the option of lower-carbon products to build energy efficient structures, the company notes.

"Corporate sustainability goals have evolved over the years, as companies like Owens Corning have expanded both the scope and ambition of their commitments," the

"This sustainable enterprise is embedded throughout the organization. It is the foundation of the company's strategy of building market leading businesses, global in scope and human in scale."

company notes. "Our first goals, set in 2002, focused primarily on environmental footprint reduction, and we did well in meeting them. Our second set of goals expanded to include product sustainability, the social aspects of safety and wellness, and our supply chain. Now, as we embark on our third set of long-term goals, we have broadened our perspective even more."

The company's 2030 aspirations are to double the positive impact of its products; cut in half the negative impact of its operations; eliminate injuries and improve the quality of life for employees and their families; advance inclusion and diversity; and act as a community leader.

"The increased scope and ambition of our 2030 sustainability goals will be met with rigor, and a focus on outcomes," the company notes. "It will require the engagement and ownership of our entire company to be successful."



Positively photovoltaic. More than half of Owens Corning's energy in 2021 came from renewable sources such as solar. The company plans an even greater reliance on green power by 2030. COURTESY OF OWENS CORNING





Rheem Manufacturing

The circular economy starts with resource management—within and outside the company.

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250,000

Plumbers, contractors and other key industry influencers to be trained in sustainable products and practices by 2025

12.8

Million metric tons of CO₂ emissions avoided by Rheem brands since 2019

When it comes to meeting the merits of a circular economy—one based on reduction and eventual elimination of waste and pollution, keeping products and materials in use, and regeneration of natural systems, HVACR and water heating global manufacturer [Rheem Manufacturing](#) has several ways to get the job done.

For example, teams across Rheem are involved from the start in making products that meet high sustainability standards. The company reports that at the beginning of the product development process, its research and development, sourcing, manufacturing and other teams conduct sustainability strategy sessions. The sessions consider 12 environmental and social factors to determine where the company's new products "will have the greatest positive impact throughout the course of their production, use and end of life."

Rheem also has a plan to use waste as a resource. All of Rheem's global manufacturing sites are focused on achieving "Zero Waste to Landfill" (ZWL) status by 2025. By that date, they will divert 97 percent or more of their non-hazardous solid waste from landfills or incinerators by redesigning, refusing, reducing, reusing, recycling, composting or converting that waste into energy.

Seven of the company's global sites have already achieved diversion rates of 97 percent or greater. Also, many sites are adopting creative processes to reach zero waste—such as eliminating single-use plastic and foam packaging, turning composted food scraps into thriving kitchen gardens, and finding innovative recycling outlets for hard-to-recycle materials.

The company has a strategy that calls for the addition of prioritizing reusable and non-toxic materials as part of its ZWL goal. Rheem's global manufacturing sites are



Business as planned. Rheem Manufacturing's circular economy actions start with research and development, sourcing and manufacturing sustainability strategy sessions. COURTESY OF RHEEM MANUFACTURING



Clean green effort. Rheem's manufacturing sites are using efforts such as recycling of boxes, eliminating single-use foam and utilizing renewable energy to reduce their environmental impact. COURTESY OF RHEEM MANUFACTURING

7

Factories with Zero Waste to Landfill status
(97+ percent safe solid waste diversion)

also exploring the use of renewable energy to reduce their environmental impact and help the company achieve its goal of cutting plant greenhouse gas emissions in half by 2025. Results are already being seen worldwide: Rheem's water heater manufacturing plant in Santiago, Chile now sources 100 percent of its electricity from renewable energy. Meanwhile, the Rydalmere, New South Wales, Australia, and Mexicali, Mexico plants have implemented onsite photovoltaic systems that together prevent nearly 500 metric tons of carbon dioxide-equivalent emissions per year.

"Rheem is proudly committed to closing the loop on materials used to create and package our products," the company notes. "In this spirit, we work with our suppliers to deliver product packaging with a high amount of recycled content to our customers."

For example, the company's partnership with fiber-based packaging provider, [Smurfit Kappa](#), ensures that the

"Rheem is leading sustainability transformation by developing intelligent products for decarbonization, dramatically reducing greenhouse gas emissions and waste in our manufacturing processes, and training the trade on environmental stewardship."

corrugated boxes that Rheem's products are sold in go on a circular journey: from the shelves of retailers, distribution centers, and customer homes, to recycling bins and sending them on to fiber collection centers, and then to the paper mills that transform this recycled fiber into new Rheem boxes.

Smurfit Kappa's Fort Smith, Arkansas, recycling center collects more than 375 tons of baled waste annually from the nearby Rheem air conditioning manufacturing plant. The resulting boxes are 100 percent recycled, with at least 90 percent post-consumer recycled certified content.

"Programs like these allow us to help to keep packaging out of landfills and in a closed loop," the company notes. "This ensures that we slow the flow of resources from the Earth and mine the urban forest instead of the real one for the materials we need to deliver our products safely."



Cooperative cardboard. Smurfit Kappa collects more than 375 tons of waste annually from a Rheem manufacturing plant, eventually resulting in boxes that are at least 90 percent post-consumer recycled certified content.

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SOLARCYCLE

When it's lights out for solar panels, here's a way to power things back up.

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10 million

Number of U.S. solar panels that will be decommissioned by 2030

720

Number of terawatt-hours of energy produced worldwide by solar panels in 2019

There's a solar e-waste glut coming. [SOLARCYCLE Inc.](#) plans to be ready. The Oakland, California-based solar panel recycling services provider has a recycling platform that can help offset the impact of nearly 80 million metric tons of solar panels worldwide that will reach end of life over the next three decades. The first wave, which the International Renewable Energy Agency estimates as a modest 250,000 metric tons from panels installed during the previous century, is creeping in. Most of those photovoltaic components end up in landfills because there really isn't anything else to do with them.

According to SOLARCYCLE co-founder and chief technology officer Pablo Dias, the company's proprietary technology allows recovery of more than 95 percent of a solar panel's energy conductive materials, such as silicon, silver, copper and aluminum. And, the technology can be

applied to about 95 percent of panels currently in use.

The product can also help overcome a huge obstacle to panel recycling: cost. Arizona State University solar researcher Meng Ta estimates that a person might get \$3 for recovering aluminum, copper and glass from a typical 60-cell silicon panel. But it might cost the person up to \$25 to actually do the job. The landfill, where it might cost about \$1 to dump the full-sized sheet, seems a better alternative.

Encouraging recycling and proper disposal of solar panels is a top priority for SOLARCYCLE, according to company co-founder and CEO Suvi Sharma. The planet, he notes, is at a critical juncture as it transitions from fossil fuels to renewable energy. Solar energy is a growing part of that effort, and will require a massive volume of solar panels and batteries.



Problem solver. Solar panels are the way of the future for clean energy, but they don't last forever—a situation SOLARCYCLE is trying to correct with its recycling technology.



Cleanup job. By 2050, almost 80 million metric tons of solar panels will have burned out and require proper disposal. But roughly 95 percent can be recycled and put back to use. COURTESY OF SOLARCYCLE

10%

The portion of solar panels currently being recycled in the U.S.

“In order to make this energy transition truly sustainable, it is imperative to create a circular economy for these materials and components now,” Sharma notes. “The more we can recycle and reuse the key materials in existing clean energy installations, the faster we can transition to a world without the need for massive new mining operations, without pollution, and without the looming threat of the climate crisis.”

SOLARCYCLE certainly has the expertise. Sharma co-founded solar panel makers [Solaria](#) and [Nextracker](#). Co-founder and chief commercial officer Jesse Simons was chief of staff and executive team director at [Sierra Club](#). Dias is a world-renowned researcher in photovoltaic module and e-waste recycling technologies, and has authored numerous seminal research papers and several book chapters on the topic. Vice president Ted Herhold served as general

“For solar to truly scale to its full potential, we need to create renewable supply chains and a vibrant secondary market for used panels and recycled materials.”

counsel at Solaria. And there are a half-dozen other highly knowledgeable people on the company’s board of directors or serving as advisors.

The company also has influential partners. Current and former executives from SolarCity, [SunPower](#), the [Urban Innovation Fund](#), and [Closed Loop Partners](#) are investing in the startup to help ensure it flies. Meanwhile, home solar, battery storage, and energy services company [Sunrun](#) has supplied second-life panels that SOLARCYCLE uses as test subjects as it fine-tunes the technology.

“We are backed by technology, solar and circular economy investors who have partnered with us on this imperative mission to make clean energy even more sustainable on a global scale,” the company notes. “Our vision is nothing short of making clean energy itself completely and forever renewable.”



Helping hand. Solar power giant Sunrun is helping SOLARCYCLE get its industry footing by providing old photovoltaic panels for testing and metal extraction. CREDIT: COURTESY OF SUNRUN





Honorable Mentions

These companies missed the final cut this year, but still deserve applause for their ongoing eco-leadership.

GAF

Asphalt shingles don't get high marks from the public where sustainability is concerned, but **GAF** wants to lessen the environmental impact of the popular roofing product by recycling it. The company's newly patented process allows 90 percent of waste shingle material, by weight, to be reclaimed and reused in the manufacture of new shingles. Ultimately every homeowner, when replacing a roof, could choose to do so with high-quality, affordable shingles made with recycled asphalt. This would eventually lead to 1 million tons of roofing materials being diverted annually from landfills as of 2030.



Ingersoll Rand

The **air compressor and power tools** giant continues its "Operate Sustainably" strategic imperative, as it moves closer to meeting goals for net-zero status. The company has set a 2030 deadline for marked reductions in water use, greenhouse gas (GHG) emissions, and amount of waste sent to landfill, and wants net-zero status by 2050. Ingersoll Rand delivers products and services that offer sustainability benefits such as efficiency, circularity and safety, and that serve high-growth, sustainable end markets, including renewable energy, water and wastewater, food and beverage, and life sciences.



Mitsubishi Electric Trane HVAC US

METUS has two primary environmental initiatives: to design for the future, and to sustain and preserve what's already here. In the former case, the company works toward upgrading current building stock by developing decarbonization- and sustainability-focused products. These exceed today's stringent energy codes and building mandates, and are designed for long-term use. Meanwhile, METUS' adaptive reuse effort includes producing all-electric, variable-capacity heat pumps, such as its *Heat2O* unit, which enables homeowners and commercial building owners to decarbonize existing dwellings and facilities, and move away from fossil fuel-burning appliances.



Uponor

Decarbonization is an ever-growing concern for **Uponor's** customers, and this plumbing products maker is making it clear where it stands. In addition to science-based targets, Uponor aims to operate 100 percent by renewable electricity by 2025. Already, all seven of the company's Nordic manufacturing facilities are green energy powered. Uponor also has GHG emissions reduction goals of 70 percent from its own operations and 20 percent from third-party sources, as well as 100 percent waste recycling and 15 percent less energy use companywide, all by 2027.



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breathe **well**

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Panasonic

Circular Thinking

Several tools now in play allow corporations to adjust their operations based on the “Cradle-to-Grave” life cycle of materials and products. Here’s how they’re being actualized.

BY JIM GUNSHINAN

IN UNVEILING ITS annual report, “[Climate Change 2022: Mitigation of Climate Change](#),” the International Panel on Climate Change (IPCC) plays it straight: “Without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5 degrees Celsius is beyond reach.” A circular economy can make the distance shorter, although the transformation of how we live and work is currently happening in fits and starts. With a circular economy, every product we use will live a whole life and then be transformed for another use. In adapting this framework, we can limit carbon emissions and slow climate warming.

Many businesses are taking their environmental obligations seriously by building circular economies. There are tools they can use. Environmental, Social and Governance (ESG) criteria are standards for companies that want to take care of their workers, the people they serve, and the environment. They provide transparency for companies that take seriously the ecological impacts of the products and services they provide to the public.

Meanwhile, Environmental Product Declarations (EPDs) certify the environmental performance of a company and its products. Life Cycle Analysis (LCA) and Product Category Rules (PCR) are components of EPD. LCA looks at a product’s life, from the extraction of raw materials to its manufacture, distribution, use, maintenance, and disposal or recycling. PCR sets out the rules for collecting data for different kinds of products.

PURPOSE FIRST, PROFIT SECOND

Here are some examples of companies that use the tools of circular thinking, in their efforts to become more sustainable.



Letter grade. From Hilti Head of Sustainability Peter Rupp’s point of view, accurate and thorough data can result in a building’s higher Leadership in Energy and Environmental Design (LEED) score, not the other way around.

COURTESY OF HILTI GROUP

HILTI

Like Hewlett Packard and Apple, [Hilti](#) had humble beginnings in a garage. The company was founded in 1941 to create construction products such as drilling equipment, fastening systems, and software, making construction tools more efficient and construction sites safer and healthier. Hilti is headquartered in Schaan, Lichtenstein, but has a global reach, with offices in more than 120 countries and more than 30,000 employees worldwide.

The company is committed to sustainable practices and products, including the EPDs, LCA, and circularity. Hilti’s product materials include steel, aluminum, electronics, and plastics. “We have been using EPDs for the products that remain in the building, such as passive fire protection products, for quite a while,” says Hilti Head of Sustainability Peter Rupp. “Customer requests very much drive this. We support the customer, general contractors, or building owners to reach a certain green building certification.”

Certifications come through the [U.S. Green Building Council \(USGBC\)](#) and its Leadership in Energy and Environmental Design (LEED) certification program, the [BREEAM](#) sustainability assessment method, the [German Sustainable Building Council \(DGNB\)](#), the [European Green Deal](#), and other national and international standards. “We conduct LCA—which is the foundation for EPDs—within our development process to compare alternative



Good ideas. Construction products maker Hilti promotes a “building a better future” philosophy, one that includes modernizing its corporate headquarters in Schaan, Liechtenstein with energy efficient buildings and a fleet of low emissions vehicles.

COURTESY OF PRESSE- UND INFORMATIONSAMT/VADUZ

product designs and materials, and develop a product with the environment and its CO₂ footprint in mind,” Rupp says.

As to the certification process, Rupp notes Hilti uses **UL Standards**—accredited in the United States and Canada—as well as European standards. “We have this mutual acceptance agreement,” he says. “If you develop it based on the standard in Europe, it’s accepted in the United States and vice versa.”

Data collection and analysis is crucial, Rupp adds. “A higher LEED score doesn’t mean that the building is more sustainable,” he notes. “We must digitize and integrate the data and sum it up for the whole building. Then, you can measure the carbon footprint of a building by square feet. And the data needs to be truthful, transparent, and reliable.”



Tools of the trade. Hilti specializes in products such as drilling equipment, fastening systems and software that make construction tools more efficient and construction sites safer and healthier. COURTESY OF HILTI GROUP

IRONROCK

Ironrock has been manufacturing bricks and tile in Canton, Ohio, for more than 150 years. Ironrock is a fifth-generation family-run business that has evolved from crafting fire bricks for the iron industry to paving stones and, more recently, durable and slip-resistant tiles and other construction products. It has committed to making its products environmentally wise, and sustainably sourced and produced.

“Working with transparency groups like **Cradle to Cradle** [a global standard for products that are safe, circular, and responsibly made] and publishing EPDs required us to dive deeper into what we put into our products in both materials and process inputs,” says Daniel Marvin, Ironrock’s senior vice president for operations. “We have worked steadily to increase our recycled and reworked material percentage and find beneficial uses for our waste streams. Through these efforts, we have created cost reductions and new sources of revenue that can be measured.”

At Ironrock, EPDs allow the company to offer customers choices that competing companies don’t, Marvin adds. “Certifications in and of themselves have no sustainable value; they are a net cost,” he notes. “The value they provide is to allow our customers

to make informed decisions about our products versus other manufacturers’ products.”

Data collection is always the primary challenge, Marvin adds. “If the data required for the certification is not routinely recorded or recorded in a different way than the certifier requests, it becomes time-consuming or impossible to provide it timely,” he says. “Deciding whether to provide Cradle to Cradle certification versus Declare! labels [for building products by the International Living Future Institute], versus HDPs [health product declaration] is not time or money well spent.”

Overall, Ironrock’s goals for certifications, according to Marvin, are “to provide the minimum number of them required to provide the maximum amount of value to our customers.”

Sustainability shift. Ironrock has evolved from crafting fire bricks for the iron industry to making household products that are environmentally less resource-intensive, and sustainably sourced and produced.

COURTESY OF IRONROCK



SHAW

Consumers have been walking on **Shaw** products in homes, schools and businesses since 1967. Those products include carpet, hardwood flooring, laminate, vinyl, and tile and stone flooring materials. With corporate offices in Dalton, Georgia, and offices and manufacturing facilities throughout the United States and internationally, Shaw is the world's largest carpet producer.

Architect and environmental pioneer **William McDonough** once called the carpet industry “the battlefield where the war for sustainability is being waged.” The carpeting footprint is significant, but not entirely in a good way. Too much of it is thrown out rather than being recycled. Carpeting has also been a substantial source of volatile organic compounds (VOCs) and other harmful chemicals.

In the last 20 years, motivated by government regulations, green building programs such as LEED, and customer demand, Shaw has made substantial efforts to create healthy flooring products. “It began with our introduction of EcoWorx in 1999, which was the industry’s first fully recyclable, PVC [polyvinyl chloride]-free carpet tile,” says Senior Product Sustainability Manager Candi Hampton. EcoWorx went on to become the first flooring product to be **Cradle to Cradle Certified**, and today almost 90 percent of the products Shaw manufactures carry that status.

This certification allows the company to be transparent with its customers as to how much energy is used and carbon emitted in the creation of its products, how to know the products are sourced sustainably and equitably, and how the products are reused or recycled. “[EPDs] begin to simplify that information for our customers and are being increasingly requested by commercial customers,” says Hampton.

“For Cradle to Cradle or most other certifications, it requires engagement with suppliers—and even their suppliers—to know very granular details about the ingredients in their products,” Hampton adds. “And depending on certification requirements, knowing the information around supplier energy or water use, and even their human rights policies may come into play.”

Environmental diligence is also a big deal with customers, Hampton notes. Research by the **Shelton Group** and others shows that more than 40 percent of consumers want to be seen as someone who buys eco-friendly products. About half of online shoppers prioritize and consider sustainability when making purchase decisions, and more than 30 percent of Millennials will always choose a sustainable alternative when available.



PVC-free pioneer. Shaw has made substantial efforts to create healthy flooring products, starting in 1999 with EcoWorx, the industry’s first fully recyclable, non-polyvinyl chloride (PVC) carpet tile.

INPRO

Inpro is an architectural products manufacturer based out of Muskego, Wisconsin. The company provides door and wall protection, cubicle curtains and privacy systems, commercial window treatments, expansion joint systems, signage, washroom systems, and elevator cab protection. The company has been in business serving commercial building customers since 1979 and sends its products all over the world.

“At Inpro, we use [EPDs] to communicate valuable sustainability information to our customers—namely, the effects our products have on the environment,” says Jessica Jenkins, environmental and technical project specialist at Inpro. “One of the main components we look at is the transportation footprint associated with delivering raw materials to our manufacturing locations. We do our best to work with local and regional suppliers.”



Goodbye to garbage. In an effort to become Net Zero by 2025, Inpro is examining its waste streams and actively looking for ways to reduce scrap generation in manufacturing to divert it from the landfill.

Play Nice

Most, but not all, eco executives are taking a positive approach toward meeting ESGs and EPDs.

Environmental, Social and Governance (ESG) standards are popular with corporations because they increase the value of a company's stock and provide good PR. Proponents say it's also the right thing for the company, its workers, the people it serves, and the environment in which everyone lives.

Environmental Product Declarations (EPDs) certify the environmental performance of a company and its products. The environmental issues include carbon emissions—specifically, how to keep them to a minimum—and the efficient use of energy required by the company and the products it creates, from processing raw materials to the product's operating point. The use of renewable resources and recycling are also included in the environmental category.

Inpro is presently examining our waste streams and actively looking for ways to reduce scrap generation in manufacturing. "In areas where scrap continues to be generated, we are investigating ways to reuse and recycle our scrap, thus diverting it from the landfill," Jenkins says. "Inpro aims to be Net Zero Waste by 2025."

When it comes to examining the environmental impacts of a product, there are a lot of moving parts," Jenkins notes. But the upside is a healthy return on investment. "We have a fantastic supply chain team that works with our local suppliers to create mutually beneficial relationships," she says. "They help us meet our sustainability goals without a huge cost impact on our organization." Additionally, examining the manufacturing process to reduce its environmental impacts has helped shed light on process inefficiencies. "Instead of spending money to reduce the manufacturing footprint," Jenkins says, "we can save money by being more efficient with our processes."

THE STATE OF THE ART

Companies involved in the building industry supply chain are acting sustainably and transparently. While completing the various certifications can be time-consuming and sometimes confusing, their efforts result in less waste, more satisfied customers, and a healthy bottom line. The drivers of corporate sustainability appear to be working—government regulation, third-party certification programs, and consumer demand.

But how widespread is the corporate sustainability movement? It's hard to find a precise answer. "In North America and international markets, we have recently seen an increase in sustainable initiatives being developed," says Justin Brown, senior technical reviewer of environmental products, at [NSF](#), a global public health and safety organization. "There has been a major impact on the behavior and interests of businesses, corporations, and manufacturers, to develop more and more EPDs for various industries. These initiatives have also impacted consumers' purchasing behavior." The demand for EPDs will continue. **GB**

Jim Gunshinan is a science writer covering energy and the environment. He was the managing editor of Home Energy Magazine, a science blogger for San Francisco-based media company KQED, and editor of "No-Regrets Remodeling, Second Edition." He lives in Walnut Creek, California.

For additional insight on the circular economy's role in decarbonization, [see the presentation by David McGinty](#), global director at the Platform for Accelerating the Circular Economy (PACE), during the recent [Green Builder Media 2022 Sustainability Symposium](#).

For an example of decarbonization in action at the community level, visit the microsite to the [Sonders Project in Fort Collins, Colorado](#).



Varied thinking. Environmental, Social and Governance (ESG) standards and Environmental Product Declarations (EPDs) are vanguards of a company's future sustainable practices. But some experts believe the green focus should be on current or long-running problems.

Social issues include the health of company employees and the people it serves, and equitable distribution of the energy and other benefits of the company and its products.

Governance covers responsible and transparent business practices, anti-corruption measures, corporate structure and culture, how employees are treated on the job, and fair compensation and benefits, including health care, retirement, vacation policy, and paid leave.

Not everyone thinks that ESG is a good business practice

In a recent opinion piece, Bloomberg opinion columnist [Matt Levine](#) wrote that "maximizing the long-term happiness and life satisfaction of our shareholders and their families" is probably a better goal than "we will maximize this year's profit." Still, it is "a more challenging goal to quantify, measure, and achieve."

In a recent Wall Street Journal article, columnist [James Mackintosh](#) notes that for sustainability practices to get people to pay a little more for a product, there is "no need to persuade the capitalists to exercise discretion. They'll do what you want if you make it profitable through customer demands or government intervention."

Mackintosh's big concern about ESG investing is that it distracts everyone from the work that needs to be done. "It is easier and more effective to tax, regulate and subsidize the things we as a society believe are bad," he notes, "rather than trying in vain to direct the flow of money to the right causes."

SUSTAINABLE SOLUTIONS THAT STAND OUT



Given that heating & cooling and water heating represent 65% of a home's energy usage, we're doing our part to help homeowners reduce their environmental impact. That's why we created the **Sustainability Standout™ seal**—to help customers easily identify our products that meet a stringent set of internally defined sustainability standards. Because planet-friendly solutions should be people-friendly, too.

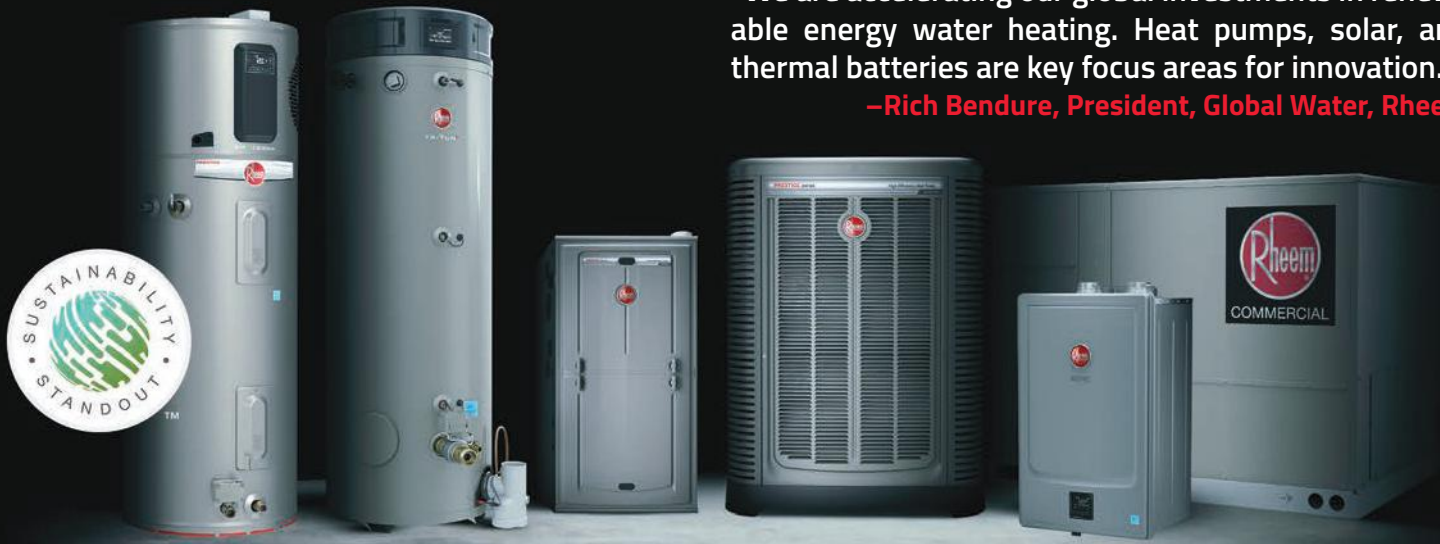


Learn more at [Rheem.com/ProductSustainability](https://www.Rheem.com/ProductSustainability)

The new degree of comfort.®

"We are accelerating our global investments in renewable energy water heating. Heat pumps, solar, and thermal batteries are key focus areas for innovation."

—Rich Bendure, President, Global Water, Rheem



RHEEM®, A LEADING GLOBAL MANUFACTURER OF AIR AND WATER COMFORT PRODUCTS, is known for developing new ways to deliver precise temperatures while supporting a more sustainable future. Since the company announced its global sustainability initiative, A Greater Degree of Good™, in 2019, Rheem's more than 11,000 employees around the world have made environmental responsibility central to how the nearly century-old brand designs, manufactures, delivers, and supports its products.

"At Rheem, we have a shared belief that a more sustainable future will be powered by innovation," said Rheem President and CEO Chris Peel. In that spirit, Rheem is leveraging innovation to transform the environmental impact of heating & cooling and water heating. The company boldly envisions a future with zero energy and water waste in the use of its products and zero material, energy, and water waste in its manufacturing, operations, and supply chain. In addition, it aims to empower members of the industry's global workforce to be good stewards of the environment, promoting high-efficiency, sustainable products and adopting eco-friendly work practices.

"Our people-powered sustainability program has made tremendous progress decarbonizing our products, training installers and influencers, and minimizing the environmental impact of our manufacturing." **—Mike Branson, President, Global Air, Rheem**

How Rheem's Products Make Homes More Sustainable

Given that heating & cooling and water heating represents 65% of a home's energy usage, installing high-efficiency HVAC and water heating products that provide greater control over energy and water consumption is one of the best ways for homeowners to reduce their environmental footprint. Rheem's goal is to make it easy for its customers to live more comfortably, while also living more responsibly.

Rheem is on the front lines of research and development of air and water heating products that use alternatives to fossil fuel to reduce greenhouse gas emissions. One technology—heat pumps—is par-

ticularly important to these efforts. With its current slate of heat pumps and new products in the pipeline, Rheem is poised to provide the best technologies to decarbonize the economy while continuing to meet consumers' needs.

To ensure that every new Rheem solution is designed with sustainability in mind from the start, the company hosts Sustainability Strategy Sessions at the beginning of the product development process. In these interactive strategy sessions, Rheem's extended teams consider how to improve a product's environmental impact at every stage of its life—from production, to use, to recycling and disposal.

To make it easier for customers to find and select the most planet-friendly products, Rheem has introduced the Sustainability Standout™ seal, a designation for products that deliver the highest standard of sustainability across categories such as efficiency, packaging, performance, smart features, and recyclability.

Rheem assigns each sustainability attribute a point value based on a stringent set of internally defined sustainability standards, and products that earn enough points bear the seal. While many Rheem products have sustainable features, customers that select a Sustainability Standout can be confident they've chosen a product that stands out as a cut above.

Rheem's Sustainability Initiatives

Rheem's sustainability goals, to achieve by the brand's 100th anniversary in 2025, include launching a line of heating, cooling, and water heating products that boast a 50% reduction in greenhouse gas footprint; reducing greenhouse gas emissions by 50% and achieving Zero Waste to Landfill in its global manufacturing operations; and training 250,000 plumbers, contractors, and key influencers on sustainable products or sustainable installation and recycling best practices.

Proud to be named a Green Builder Eco-Leader for five consecutive years, Rheem sees its commitment to sustainability as a marathon, not a sprint. Adds Peel, "As we look ahead to 2025, there will be more aggressive goals to meet and our people at Rheem will power the innovations to get it done. As leaders in sustainability, we have no choice. Future generations are counting on us."



THE SONDERS PROJECT

POWER-PACKED INNOVATION



Serene existence. The homes at Sonders built by Thrive Home Builders will utilize a variety of energy-conserving strategies. COURTESY OF THRIVE HOME BUILDERS

Sonders Fort Collins achieves a radical level of neighborhood-wide sustainability through a multi-layered energy management approach.

BY ERIN ARRINGTON, GUEST EDITOR

Sonders Fort Collins, a new age-targeted community in Colorado, addresses the need for community-wide, responsible energy management with comprehensive, multi-layered solutions. The development utilizes strategies that address how energy is used in individual homes and entire neighborhoods, including production, demand-side energy management, and electricity-saving in-home appliances.

About half of the homes at Sonders will be built by Denver-based Thrive Home Builders. Thrive has made a name for itself constructing ultra-efficient homes throughout Colorado—the company currently builds the state's largest number of Leadership in Energy and Environmental Design (LEED)-certified homes under the U.S. Green Building Council (USGBC) LEED for Homes certification program. In 2020, Thrive achieved the nation's lowest average Home Energy Rating System (HERS) Index score in the country. And recently, it was recognized by the Residential Home Services Network (RESNET) for having the lowest HERS score for a U.S. home builder. Now, Thrive Home Builders is working with the developers of Sonders Fort Collins to create a community that sets a new standard in energy conservation.

ENERGY GENERATION OUTSIDE OF THE HOME

Although the community will be connected to the city's power grid, Sonders Fort Collins will function as a pseudo-microgrid, with a heavy emphasis on energy generation and storage within the community. The 220 homes built by Thrive will be outfitted with a Sunnova solar power system; Bill Rectanus, Thrive's chief operating officer, estimates that the units will produce 60 percent to 80 percent of a home's energy use. For any electricity not produced on



Photovoltaic appearance. When completed by mid-2025, The Sonders Project will feature up to 400 solar energy-driven single-family, courtyard, town homes, condominiums and custom homes that emphasize environmentally friendly living – from top-notch indoor air quality technology, to water-wise irrigation techniques. COURTESY OF SUNNOVA ENERGY

site, residents have the opportunity to purchase 100 percent renewable energy from the local utility company.

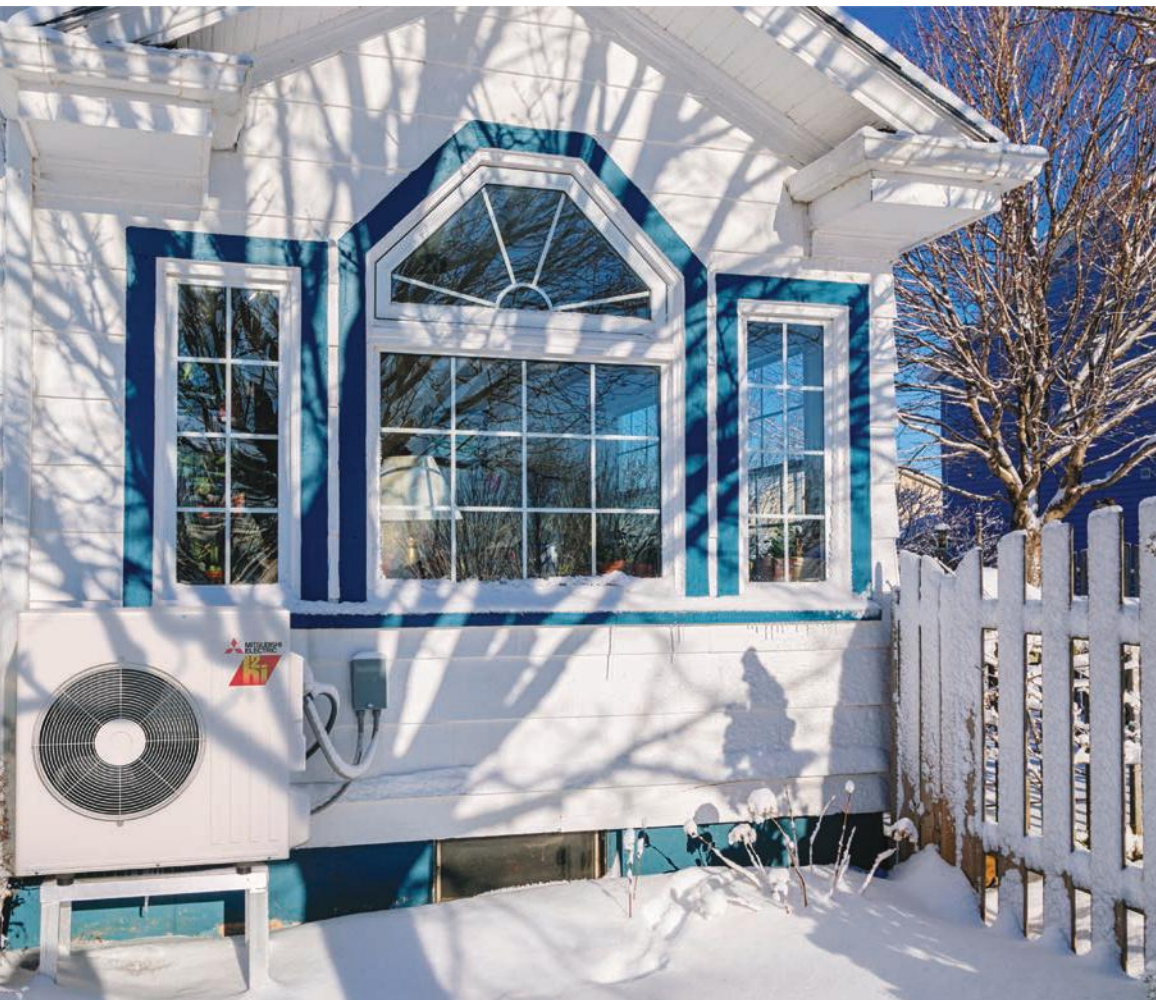
Homeowners will also have the option to have a battery storage system installed. The solar-powered batteries will allow Sonders residents to offset energy demand during off-peak hours and utilize it during peak hours. And since Fort Collins Power and Light employs time of use rates, limiting grid use during peak hours will also translate to lower energy costs for



Captured moment. Solar power will be like a best friend to homeowners at Sonders Fort Collins, providing an easy, low-cost and eco-friendly way to keep everything running.

residents. If a solar power system is overproducing at any given time—and not charging a

THE SONDERS PROJECT



Cold case. Mitsubishi Electric's newest variable capacity heat pumps are more resilient and efficient in cold temperatures.

home's battery storage system—the extra energy will go back onto the grid through net metering and be shared on the grid with the closest adjacent home.

According to Rectanus, another function of the battery system is to provide resiliency to the homes in the case of power outages. Thrive Home Builders has been collaborating with Mitsubishi

Electric to create units that have the ability to keep residents more comfortable for longer periods of time using stored energy alone.

“Batteries are typically installed through a backup panel where you have selected loads that it operates,” he explains. “Typically, that does not include a heat pump or heating and cooling system because it simply uses too much energy and

can drain the battery too rapidly.”

Instead, these backup panels will generally focus on keeping refrigerators, lights, internet connection, and other lower loads in the case of an outage, Rectanus notes.

“What we’re working with Mitsubishi on is a way to have resiliency on those typical loads... but also to include the heat pump,” Rectanus says. Unlike older models, Mitsubishi’s heating and cooling system has the ability to operate at 25 percent or 75 percent capacity. Thrive and Mitsubishi are developing a unit where, if the power goes out, the backup panel could signal the heating and cooling system to operate at a lower capacity, minimizing the draw on the battery and lengthening the time a home can stay at a comfortable temperature.

Rectanus says the aim for this system, which could set a new standard in resiliency for all-electric homes, is to “protect the home from damaged frozen pipes, protect the occupants from extreme cold, and be able to heat the home to 55 degrees for an extended period of time.”

According to Shawn LeMons, performance construction manager at Mitsubishi Electric, the company is “really focused on trying to raise the tide for all boats...we’re really trying to shift the market away from the status quo to help find the better new norm.”

ENERGY CONSERVATION INSIDE THE HOME

While Thrive Home Builders focuses on creating innovative systems for energy generation, it is also prioritizing energy retention in the home. “Obviously, conservation is the first and primary step in demand side management to make sure we’re using the least amount of energy as possible in the beginning,” Rectanus says.

Rectanus notes that conservation starts by building houses that act as a “good envelope,” which consists of “a well-insulated and airtight wall assembly. We want that assembly to conserve

“Our goal as a company really is to achieve higher efficiency in existing and new homes. By working with a company like Thrive Home Builders, we’re able to move beyond the status quo.”

**SHAWN LEMONS, PERFORMANCE CONSTRUCTION MANAGER,
MITSUBISHI ELECTRIC**

as much of the energy used to heat and cool the home as possible.” One way Thrive will accomplish this is by using DuPont’s *Great Stuff Pro* window and door insulating spray foam, which was recognized by the 2019 R&D 100 Awards for its reusability and precision, and for being less wasteful than competitors.

Every home will meet the requirements of a U.S. Department of Energy (DOE) Zero Energy Ready Home (ZERH), which are at least 40 percent to 50 percent more efficient than typical new homes. They will also be LEED certified and ENERGY STAR certified.

In planning, the builders also focused on selecting mechanical equipment and appliances for overall efficiency. According to the U.S. General Services Administration, a plug load—the energy used by products that are powered by means of an ordinary AC plug—as a share of overall building energy use, is higher in energy-efficient buildings. In minimally code-compliant office buildings, plug loads may account for up to 25 percent of total energy consumption.

But in high-efficiency buildings, plug loads may account for more than 50 percent of the total energy consumption. To reduce the plug



Park place. Sonders Fort Collins will function as a pseudo-microgrid, with a heavy emphasis on energy generation and storage within the community. COURTESY OF THRIVE HOME BUILDERS

A More-Versatile Air Source Heat Pump

MITSUBISHI ELECTRIC LEADS IN HIGH EFFICIENCY, VARIABLE CAPACITY HEAT PUMPS THAT WORK HARD IN ALL CLIMATES.

For those looking to build all-electric, highly efficient homes, air source heat pumps have long been considered the best HVAC option. In general, air source heat pumps reduce a household’s electricity use for heating by up to 50 percent. However, because of previous limitations in how these heat pumps fare in colder weather, they’re not always the first choice for new homes.

Now, after recent developments by Mitsubishi Electric and other manufacturers, air source heat pumps may become the most efficient and cost-effective option—no matter the weather. According to Shawn LeMons, performance construction manager at Mitsubishi Electric, variable capacity heat pumps act like pulleys. For every unit of energy a homeowner pays for, they can get two or three units of energy out of the system.

LeMons says that more builders are incorporating these variable capacity heat pumps into new builds. However, many builders and HVAC professionals are still coming to understand just how effective and versatile newer heat pumps are compared to their single-speed or two-speed predecessors.

“There are new developments all over the country that are moving forward just as Thrive Home Builders is with Sonders,” LeMons says. “Maybe not to the same level as Thrive...But there are builders, whether they’re working on custom homes, semi-custom homes or small communities around the country, that are applying these higher efficiency, variable capacity heat pumps.”



Playing it cool. Air source heat pumps can cut home heating costs by 50 percent, but they’re not the No. 1 choice for new dwellings. COURTESY OF MITSUBISHI ELECTRIC

The variable capacity heat pumps are one component of the energy generation and retention systems Thrive Home Builders will be installing in the homes at Sonders Fort Collins. Combined with Sunnova solar panels and battery storage units, the teams at Mitsubishi Electric and Thrive hope to make it so that homeowners can use their HVAC units even during a grid outage event.

“Our goal as a company really is to achieve higher efficiency in both existing and new homes,” LeMons says. “Working with a company like Thrive Home Builders, we’re able to move beyond the status quo.”

THE SONDERS PROJECT

TEAM LEADERS

PRIMARY BUILDER Thrive Home Builders

DEVELOPER Actual Communities Inc.

PEOPLE



GENE MYERS
Visionary of
Sonders Fort
Collins and
founder of Thrive
Home Builders



BILL RECTANUS
Chief operating
officer of Thrive
Home Builders



ERIC SUNG
Director of
design at Thrive
Home Builders



Electrical stewardship. Schneider Electric is contributing to Sonders Fort Collins with its *Wiser Energy* home energy monitors, which provide homeowners with detailed, real-time energy usage.

loads when possible, Thrive is working with manufacturers across the homebuilding industry that have shared goals for sustainability in the home.

To ensure the home is run efficiently in practice, not just in design, Thrive Home Builders partnered with Schneider Electric to include its *Wiser Energy* home energy monitors. The *Wiser Energy* system installs in a home's electrical panel and gives homeowners access to detailed, real-time energy

usage. It provides information on each individual device throughout the home and gives homeowners the tools to spot inefficiencies in their energy use.

Sonders homeowners will also have the ability to track their solar power generation, providing a full-picture view of their energy usage and habits. Over time, the aim is for homeowners to have a firm understanding of how energy is used in their home and learn how to reduce excess energy consumption. **GB**

BUILD FOR THE NEXT BILLION



As the leading provider of variable-capacity heat pumps, Mitsubishi Electric offers the widest variety of styles and capacities to meet current and future generation home buyer's efficiency and sustainability goals.

The **Mitsubishi Electric Performance Builder Team** is proud to partner with the building industry in developing connected, sustainable and attainable high-performance homes for all.



MitsubishiComfort.com/Performance



High priorities. With home renovations, preference sometimes needs to take a back seat to necessity. In the long run, ignoring mandatory fixes like a bad roof or damaged siding will cost more than not updating flooring or remodeling a kitchen. CREDIT: COURTESY OF RENNETT STOWE/Flickr

MILLENNIALS

ROADMAP TO RENOVATIONS

While new homeowners dream of renovating their home into a model of sustainability, they sometimes bump into the reality that fixing a leaky roof takes priority over installing solar panels and an EV charger.

BY MICHELE LERNER

The frenzied housing market of recent years led many buyers to make a split-second decision on a home that needed some work, often without an inspection. Among buyers who purchased a home in the past two years, 75 percent said they had at least one regret, according to a February 2022 [survey by Zillow](#). Among the biggest regrets: buying a fixer-upper that needed immediate and costly repairs. Renovation experts can help those unhappy homeowners work through projects in the smartest order while balancing their finances, aspirations, and sustainability.

“The homeowners’ intention for how long they will stay in the house drives all our advice,” says Michael Winn, owner of Winn Design + Build in McLean, Virginia. “For instance, some things like a [metal roof](#) are significantly more costly to build but have a longer life span and are more sustainable than an asphalt roof. But if someone plans to move in a few years, that investment may not make sense.”

Renovation experts can help homeowners understand the return on investment of sustainable choices for their home improvement projects, such as reduced utility bills, higher resale value, and resilience to the impact of climate change.

On the flip side, contractors and architects will need to remember that most homeowners, especially if they just purchased an older home, don’t have an unlimited budget and will need to make tradeoffs.

“Anything new you install will be an improvement on an older home and older systems,” says Jim Kitchin, owner of InterWorks, a home renovation and remodeling company in Portland, Oregon. “But once homeowners decide which upgrades are the most important, they often want to go a little above the standard level to achieve higher levels of efficiency.”

An important element of sustainability is smart planning. Failure to carefully consider all aspects of a job can be costly for the customer, which can mean definite dissatisfaction with the renovator, and a possible blow to their good reputation. It can also harm the environment.



Dream home. Many first-time homebuyers opt for existing houses which require upgrades or repairs. Renovation experts can help buyers tackle those projects in the smartest order by incorporating price, sustainability and return on investment (ROI).

"If you don't do something right the first time, you end up redoing it and the materials you used the first time end up in the dump," says Neil Bubel, president of Traver Construction, Inc. in Dallas. "Limiting rework is good for the environment and the pocketbook, so it pays to develop a master plan area by area, and system by system, even if it takes 10 years to complete."

WHAT HOMEOWNERS NEED

Most homeowners are tempted to start with projects they're passionate about, such as a kitchen remodel or a solar panel installation. But if they don't take care of immediately necessary updates and repairs, they expose themselves and their home to potential damage. Depending on the home, "must-do" projects may include:

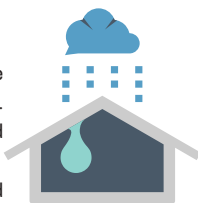
• NEW ROOF.

A leaky roof must be repaired or replaced before it causes more costly interior damage to a home. Replacing a section can be more cost effective and reduces materials going to a landfill, says Bubel.

Again, the financial element calls the shots, and renovators have to work with their clients as to what should—and can—be done first. "You have to balance the tradeoff between durability and money," says Kitchin. "We recommend concrete tiles or a metal roof because they last years longer than the standard composite roof, but those are more-expensive options."

• BETTER INSULATION.

American energy expert [Amory Lovins](#), chairman emeritus of the Rocky Mountain Institute, says improving energy efficiency is the most effective way to combat climate change. One of the most economical methods to improve efficiency is insulation. Closing penetrations to the house and adding more insulation on top of existing insulation in the attic can make a huge difference, especially in an older home, says Bubel. The payback is lower utility bills and a more comfortable home.



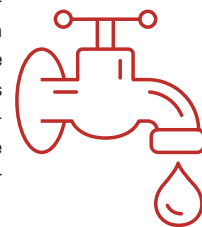
• NEW HVAC.

Replacing the HVAC system is a more expensive upgrade, but it will have a big impact, especially when you're replacing a system that relies on increasingly costly fossil fuels. "Homeowners concerned about minimizing their carbon footprint may be interested in going to an electric ductless mini-split system," says Kitchin.

Bubel suggests that repairing an already energy-efficient HVAC system may be a better option, as it helps avoid putting adequate equipment in a landfill. "The sweet spot for an HVAC system in terms of cost and value is [roughly] an 18-SEER system. This is likely to be more energy efficient than an older system, yet not as expensive as a 23-SEER system," says Bubel. "You also may want to consider adding a [zoned system](#) for greater efficiency."

• UPDATED PLUMBING.

First, inspect the house for leaks or other plumbing issues. Installing leak and water usage sensor systems such as [Phyn Plus](#), which automatically shuts off the water if a leak is detected, can save water and prevent damage to the home. Bubel also recommends replacing fixtures and faucets to save water. And, check the condition of existing copper or galvanized plumbing pipes. Because water tends to be chlorinated and sit longer in pipes, consider [CPVC](#) or PEX piping as replacement alternatives.



• SMART THERMOSTAT.

A smart thermostat is an inexpensive add-on to any existing system that provides the benefit of monitoring and managing energy use, says Bubel.

• VENTILATION SYSTEMS.

Tighter homes need bath fans and range hoods, preferably quiet ones that the homeowners actually use. An energy recovery ventilation (ERV) system may be considered to ensure fresh air is circulating in the house. But that can be an expensive option to retrofit, Bubel says.

- **HYBRID ELECTRIC HEAT PUMP WATER HEATER.**

These models are extremely efficient, says Winn, who is nudging his clients towards remodeling to an all-electric home. One caveat, says Bubel, is that they're typically taller and wider than traditional water heaters, which may make them more difficult to install.

- **UPDATED WIRING.**

Overhauling the wiring in a home can be a costly endeavor, but it's a safety and efficiency issue, says Kitchin. If the walls of the house are open for a remodel, that can also be an ideal time to update the wiring.

WHAT HOMEOWNERS WANT

Once the necessities have been addressed, homeowners can turn to their wish list for upgrading their home and make sustainable choices:

- **KITCHEN REMODEL.**

Discussing the benefits of an all-electric house is ideal at the beginning of a kitchen remodel, says Winn.

- **APPLIANCES.**

All-electric, ENERGY STAR appliances, including an induction cooktop, are recommended. "The annual cost of an all-electric home may be higher, and you may not get an immediate return on investment, but it's the right thing to do socially," says Winn.

- **COUNTERTOPS.**

Countertop options such as [Cambria](#), Caesarstone and Durat are sustainable choices to consider. Some brands use more recycled content than others, says Kitchin, so you want to be careful of which manufacturers you choose.

- **CABINETS.**

Most manufacturers now use low- or no-VOC adhesives and paint. A lot fewer use no-formaldehyde products. In fact, greenwashing—where a company spends more time marketing itself as environmentally friendly than on actually minimizing its environmental impact—is common in this category of green products. Companies with a reputation for green materials don't always live up to their hype. IKEA, for example, gets numerous complaints after the fact about the powerful odors from its particle board



Double duty. Hybrid electric heat pump water heaters use the surrounding warm air to heat water. They also offer premium features such as a user-friendly display, vacation mode, and Internet of Things (IoT) capabilities that allow unit monitoring and control from anywhere.

CREDIT: COURTESY OF AARON HEADLY/FICKR

Estimating a Renovation's ROI

While new homeowners may not be thinking about resale value, it should be part of the renovation calculation. The "best" return on investment (ROI) for renovation projects depends on the condition of the home, the location, the price range, and the homeowner's budget. [The Remodeling 2022 Cost vs. Value Report](#) offers insight into which projects are likely to have the highest return on investment based on the cost and estimated additional resale value.

For example, replacing vinyl windows costs an average of \$20,482, with an estimated ROI of 67 percent when the home is sold. Wood windows cost more at an average of \$24,388, with an ROI of 66 percent.



Peak performance. The return on investment (ROI) for renovation projects varies based on the home's condition, location, price, and the homeowner's budget. In this case, a homeowner opted for vinyl-framed windows because of their greater ROI vs. wood.

Installing a new asphalt shingle roof costs an average of \$31,535, with an ROI of 60 percent. Installing a steel roof, which costs an average of \$51,436, has an ROI of 55 percent. However, that doesn't take into account the longevity and durability of a steel roof.

Solar panels cost an estimated \$15,000 to \$25,000 before any tax incentives are applied, according to the [Center for Sustainable Energy](#). Homes with solar panels sell for an average of 4.1 percent more than similar homes without them, according to a 2019 [study by Zillow](#). The ROI for homeowners also depends on their savings on their utility bills while they own the home. So, for example, a \$300,000 home with [solar panels](#) might resell for \$12,000 more than one without, about enough to cover the price of installation. That's a 100 percent ROI. Keep in mind, however, that the homeowner has been "repaid" every month with lower utility bills. If the tenure of the occupants is long enough, the panels could have an ROI of 200 percent or more.



Start cooking. A homeowner's list of desired upgrades—after the mandatory improvements—includes kitchen elements such as an induction cooktop, reclaimed wood cabinets and granite countertops. Here, it took the owner four years, but he finally completed an "environmentally perfect" kitchen. CREDIT: COURTESY OF JUHAN SONIN/FICKR

type products. "It's important to think holistically about the lifecycle of a product—not just where it comes from, but how durable it is—and whether it can be recycled when it will be replaced," says Winn.

Winn suggests choosing locally sourced and fabricated cabinets for greater sustainability benefits. "If you're trying to save money on a lower-cost cabinet, you need to find out what it's made of and whether it's a low-VOC and low-formaldehyde product," says Kitchin.

• BATHROOM REMODEL.

The EPA's WaterSense label certifies that a fixture meets efficiency and performance standards. A bathroom remodel is also a good time to add water monitoring devices such as the *Phyn Plus* system that can learn your usage and help you save water, Winn suggests.

"Some of the digital products out there can reduce water waste and the power used to heat the water," says Winn. "For example, Kohler has a programmable thermostat to set the shower temperature with individual settings ahead of time."

Bubel recommends picking environmentally friendly tiles such as those made of porcelain, which contain fewer chemicals..

• FLOOR REPLACEMENT.

While luxury vinyl plank (LVP) and luxury vinyl tile (LVT) are durable and economical products, they're vinyl and often made overseas, making them among the least sustainable products, Kitchin says.

"The greenest flooring is still wood if it's sustainably harvested as close as possible to the house," says Winn. "FSC certified wood has an added cost, but it has a chain of custody report to prove its provenance."

WHAT HOMEOWNERS CARE ABOUT

After the practical and aesthetic renovations are complete, homeowners can plan their larger sustainability projects, such as:

• SOLAR PANELS.

Solar power requires a significant investment, particularly if homeowners want to add battery storage, says Kitchin.

"We're not at the breakeven point yet, but solar is definitely coming down in price," says Bubel. "**The new Ford F-150 electric** truck may change the formula because you're not using gas, and it has a backup power system so you can run your house with it."



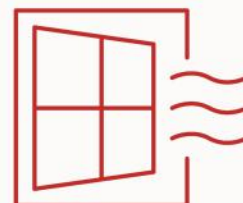
Continuous flow. Greywater collection units such as the Greyter HOME Water Recycling System provide an easy way to efficiently repurpose shower and bathtub runoff. CREDIT: COURTESY OF GREYTER WATER SYSTEMS

• ELECTRIC VEHICLES.

Installing the capability for an EV charger is a relatively small fix, but it requires the capacity for an outlet in the garage or driveway, Kitchin says.

• HIGH-PERFORMANCE WINDOWS.

Replacing every window with a high-performance window can be an expensive proposition, but some homeowners manage this by replacing them in phases. Installing the windows on one side of the house at a time over several years can be easier on the renovation budget.



New direction. Buying a car can help with home renovation efforts. The solar-charged battery in Ford's all-electric *F-150* truck can power a house if needed. This gives homeowners an easy and convenient backup plan in case of an outage.

COURTESY OF FORD MOTOR COMPANY

• GREYWATER SYSTEMS.

Some jurisdictions have rules about how greywater can be used and collected. Bubel says a **greywater system** can be an inexpensive way to save water and reuse it for gardening. But in the Pacific Northwest, collecting rainwater with barrels and installing rain gardens are more common practices than installing greywater systems, says Kitchin.



• SMART HOUSE FEATURES.

Systems such as **Panasonic's Swidget**, **Broan's Overture**, **Vivint** and **Orro** can manage everything in the household to work seamlessly, but they vary in terms of the complexity to install and troubleshoot, says Winn.

"We usually need to bring in a third-party integrator to set these up with the customer," Winn says.

"Fundamentally, homeowners need to decide what they want to change and then figure out their budget," says Kitchin. "It's a balancing act. If they can't afford perfect, we need to figure out what's worth doing and where to compromise." **GB**



Second choice. Solar power is one of the first things homeowners view as an upgrade, but its installation price can move it lower on the priority list.

CREDIT: COURTESY OF MICHAEL COGHILAN/FLICKR

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RESILIENCE FOCUS

Decarbonization

As rental inventory ramps up, environmental friendliness can dictate the place a renter chooses to call home.

BY ALAN NADITZ

The greener, the better. Demand for rental apartments, houses and condominiums is at an all-time high, but landlords still need to make theirs stand out to stay ahead of the competition.

As housing prices continue to climb, many prospective buyers are renting apartments until they can eventually own their own homes. This has created a major inventory shortage—NPR reports that things are so bad that there are even open houses and bidding wars for rental housing—and apartment rents are skyrocketing. But there's a flipside. While landlords can seemingly set any rental terms they want—rent prices nationwide increased 11.5 percent from August 2020 to August 2021, according to Realtor.com—there's growing competition to make sure their properties are the ones prospective customers visit first. "These days," notes the National Association of Realtors, "people don't come back for a second look, and they don't look at a second place. If it even sounds like something close to what they want, people are taking it, sight unseen."

A key way to stand out, according to commercial energy management service product provider Verdant—now a part of Emerson—is to emphasize the apartment's sustainable amenities. "More and more consumers are turning to sustainable alternatives to the products and services they consume on a daily basis," Verdant notes. "Unsurprisingly, this has sparked demand for more sustainable housing experiences. After all, housing is something that nearly everyone consumes 24 hours

a day, 7 days a week, 52 weeks a year."

Here are several vital sustainability elements that should be stressed when trying to draw renters to a specific rental unit, and also make things more profitable for property owners.

SMART THERMOSTATS

Unlike single-family residences, where consumer-grade smart thermostats are the norm, multifamily dwellings are best served with commercial-grade devices that can handle multiple units. In addition to monitoring the typical elements inside the home, commercial models integrate with occupancy sensors that monitor and automatically adjust to changes in occupancy inside the units and in common areas.

SMART LIGHTING SYSTEMS

Keeping an apartment building running is expensive due to high energy consumption and costs. Smart energy technology can help landlords monitor and manage power use by adjusting to changes in tenant occupancy patterns and time of day. Some lighting systems can also be linked to smart energy management models for a single-interface overview of lighting and HVAC energy use. Smart lighting also generates about 10 percent of the carbon emissions of standard incandescent and less than half of compact florescent bulbs, reducing the building's carbon footprint.



ABOVE

Rock solid. Cultured Stone's lines of stone veneer products offer a long-lasting, environmentally friendly way to dress up an existing building or home.

SOURCE: COURTESY OF CULTURED STONE

RIGHT

Under control. An under-the-floor heating system, such as *Smatrix Pulse* from Uponor, helps keep down the cost of managing a rental unit's indoor climate.

SOURCE: COURTESY OF UPONOR



ENERGY EFFICIENT APPLIANCES AND FIXTURES

Landlords can't control a tenant's appliance use, so they can't directly influence their utility bills. But installing more energy-efficient appliances such as refrigerators, stoves and dishwashers, as well as water-saving fixtures, can help the tenant cut costs (and the landlord's, if some of these, such as washers and dryers, are available on the premises). And, more-efficient appliances are another source of a building's reduced carbon footprint.

WATER LINE MAINTENANCE TOOLS

With drought becoming an increasing threat nationwide, the last thing a property owner wants is leaking plumbing. Enter predictive maintenance technology, which can help detect wasteful water consumption patterns and correct the issues before costs rise further and equipment failure occurs.

SOLAR ENERGY-DRIVEN DEVICES

Solar panels and power cells provide property owners with some control over how much they pay for their energy. Landlords can source their own energy and sell any surplus energy back into the grid. The technology doesn't work its best in all climate zones—particularly those that are less sunny—meaning it's not a perfect investment choice. But as solar technology improves, so does its potential toward elevating a building's sustainability status and as a selling point for renters. **GB**

SUPPLEMENTAL SUSTAINABILITY

While multifamily residences greatly benefit from the latest (and most effective) environmentally friendly appliances, lighting and energy products, they're not everything necessary to make a dwelling as renter-friendly as possible. There are numerous other items that promote safety and sustainability, including:

ProPEX lead-free (LF) brass fire sprinkler accessories. From adapters to mounting brackets, these items effectively meet state lead-level legislation and conform to NSF Annex G for lead-free plumbing requirements. Uponor's proven, cold-expansion ProPEX fitting system is also known for strong, durable and reliable connections without the need for torches, glues, solvents or gauges.

Minitec underfloor heating system. A low-profile, ultra-thin (15 millimeters) underfloor heating solution, this easy-to-install wet screed-based system runs close to the surface. The product operates at a much cooler temperature and still provides outputs that are ideal for heat pumps. It's suitable for new builds and renovation projects, and can be set up in as little as three days.

Smatrix Pulse room temperature control system. Designed for use with Uponor's underfloor heating systems—as well as all the typical above-floor locations—this easy-to-use room temperature control system offers maximum room comfort and compatibility with various smart home devices, such as Amazon Alexa Voice Control.

Stone veneer. Also known as faux stone, manufactured stone veneer is a manmade material designed to replicate the look of natural stone in a variety of architectural applications ranging from exterior façades to unique statement walls. It's a highly attractive choice when remodeling buildings. It also has a high sustainability quotient: Cultured Stone's product is at least 58 percent pre-consumer recycled content. Meanwhile, architects and builders can earn Leadership in Energy and Environmental Design (LEED) credits for indoor air quality and recycled content.

Textured watertable sills. An exterior trim designed to keep water runoff away from the stone veneer beneath it, textured watertable sills add dimension and depth to any project. The Culture Stone lines also complement all veneer colors and are extremely eye catching—a fact that can be the deciding factor in a prospective renter's choice of apartments.

Thermal conservation aid. Stone veneer serves as an excellent conduit for thermal gain, allowing for some degree of energy-free heating in the winter. It can easily last through a generational life span (or two, or even three) without the need for repair or replacement.

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THE BIOPHILIC IMPERATIVE

HERE'S HOW TO DESIGN WITH NATURE IN MIND.



Emotional rescue. Incorporating more natural light into a design can reduce stress levels, encourage healthier sleep patterns, reduce reliance on artificial light and aid in climate control. ALL IMAGES COURTESY OF WESTLAKE ROYAL STONE SOLUTIONS

BY SARA LOGRASSO

Stressful situations captivate our attention on a daily basis, and we spend many of our waking hours trying to minimize the many adverse effects of stress in our personal and professional lives. Thankfully, the principles of design can hold just as much sway over our anxiety levels as more significant lifestyle adjustments, including self-care activities such as yoga and meditation. To reap the stress-reducing benefits of design, we simply need to go back to our roots and embrace the application of nature-inspired solutions to create more relaxing, human-centric spaces in our homes and businesses.

WHAT IS BIOPHILIC DESIGN?

As technology continues to influence more of our daily activities, it's not surprising that we feel an increased desire to stay connected with the world outside our walls, windows and doors. This supports the biophilia hypothesis, which

suggests that humans possess an innate tendency to seek connections with nature. Numerous studies indicate that biophilic design solutions can even reduce stress, and lower heart rates and blood pressure while increasing creativity, productivity and well-being.

The landmark Terrapin Bright Green report, "[14 Patterns of Biophilic Design](#)," confirms this correlation, citing various empirical studies that verify a connection between humans' experiences of natural environments and "greater emotional restoration, with lower instances of tension, anxiety, anger, fatigue, confusion and total mood disturbance than urban environments with limited characteristics of nature."

Design features that showcase natural elements provide a primal, multi-sensory approach to reinforcing our connection to nature. From fire features and light wells, to stone statement walls and elaborate water features, these additions create memorable spaces and evoke a sense of tranquility in the places where we spend most of our time.



Earth friendly. Stone veneer incorporates unique, nature-inspired hues and textures, and allows for color and texture matching between historic or legacy stone and new applications.

Here are three fundamental strategies for incorporating these appealing touches into everyday experiences:

1. BRING THE OUTDOORS IN. First, we must embrace the use of natural elements within our homes and businesses, rather than anesthetizing and homogenizing our interior spaces. Luxury spas often incorporate stone and wood on their walls because of the calming effect of natural textures. This same philosophy can be translated into homes and offices with a variety of sustainably manufactured surfaces, from wood and stone veneer products, to wallpaper with botanical prints and even nature-inspired murals.

2. LIGHTEN UP. Natural light is key in any space, and research suggests that incorporating more sunlight can help with everything from reducing overall stress levels to encouraging healthier sleep patterns.

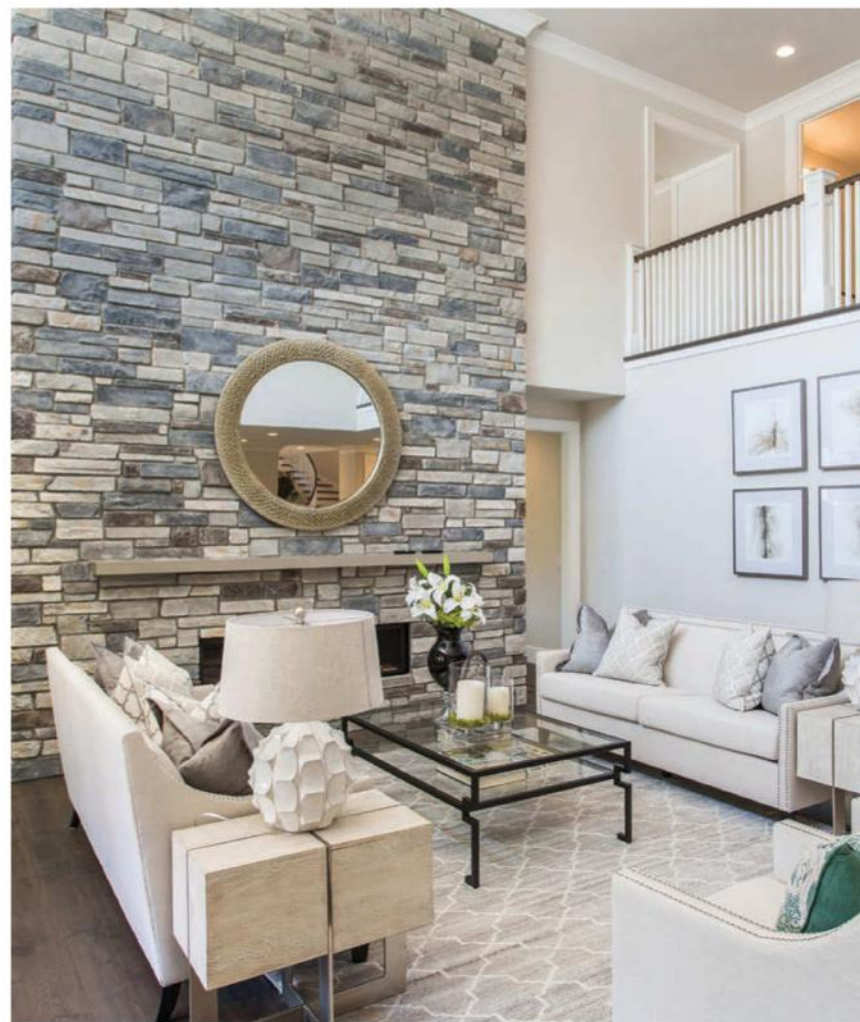
Windows let in views and breezes, and light wells reduce our reliance on artificial light. Blending indoor and outdoor spaces can be achieved with a variety of building products such as opening glass wall systems, which create spaces that integrate outdoor elements of natural light and views while ensuring the creature comforts of indoors, such as climate control.

As mentioned in a [2015 article from Fast Company](#), Google's alterations to make their offices more human-centric rendered huge benefits, causing employees to feel "deeper focus, more creative and more productive" due to having more access to natural light and other biophilic elements.

3. EMBRACE EARTHY ACCENTS. Incorporating natural colors and textures can provide direct and indirect connections with nature. Plants offer a pop of color and a breath of fresh air, often helping to filter the air and provide a greater feeling of calm simply by their natural aromas.

For the truly committed, entire living walls can be stunning in both appearance and effect. A stone veneer accent wall is another way to incorporate unique, nature-inspired hues and textures—evocative of the natural world, stone veneer products are lightweight and easy to install. Colors can be customized to fit a particular aesthetic as well, giving designers and other specifiers greater creative control and allowing for color and texture matching between historic or legacy stone and new applications many years later.

Biophilic design provides a versatile framework for understanding and addressing our common need for connection to the physical world around us and to one another. As nature-inspired design elements and solutions continue to grow, both in terms of volume and level of sophistication, the possibilities are endless when it comes to designing for the unique spaces where we live, work and entertain. **GB**



The great indoors. A selection of natural elements, such as wood and stone, along with a variety of sustainably manufactured surfaces, including stone veneer products and nature-inspired murals, can have a calming effect on those in the room.

Sarah Lograsso is the director of marketing and product design for Westlake Royal Stone Solutions brands (Cultured Stone, Eldorado Stone, Kindred Outdoors + Surrounds, Versetta Stone, Dutch Quality, StoneCraft and ProStone), where she manages all of the brands' marketing, advertising and promotional projects and objectives. She is well versed in manufactured stone and brick veneer, masonry techniques, biophilic design, fireplace surrounds, outdoor living, fire bowls, color and texture, and up-to-date industry and market trends.

This article has been reprinted courtesy of [Westlake Royal Stone Solutions](#) and [Cultured Stone](#). The original appears at <https://www.culturedstone.com/blog/the-biophilic-imperative-designing-with-nature-in-mind/>.



Fresh idea. Customers consider air filtration units and other clean air practices to be key reasons for visiting a business.

AN IAQ EMPHASIS

Better indoor air quality means greater customer satisfaction.

BY JOHN BOHLMANN

We breathe in approximately 2,000 gallons of air a day, and spend, on average, 90 percent of our time indoors. Given those two striking statistics, the quality of the air we breathe should be front and center when it comes to our health. A myriad of innovative solutions exists for improving indoor air quality (IAQ), however, and the federal government is squarely behind these new changes.

The impact of indoor air quality on our health went largely unnoticed until the pandemic brought it to light.

There is now heightened awareness of the role that air quality plays indoors—a genie that is not likely to go back in the bottle. With the U.S. Environmental Protection Agency (EPA) rolling out a new initiative, customers and staff will expect

more from businesses when it comes to indoor air quality, meaning HVAC upgrades are on the horizon.

A NEW-FOUND EMPHASIS ON INDOOR AIR QUALITY

In March, the EPA launched the Clean Air in Buildings Challenge, which “calls on all building owners and operators, schools, colleges and universities, and organizations of all kinds to adopt key strategies to improve indoor air quality in their buildings.” This roadmap has set the stage for a new approach and awareness of IAQ, beyond just tackling COVID-19.

The initiative promises to offer new and stricter guidance through a toolkit released by the EPA. This toolkit provides a detailed overview of steps and standards which should be adopted to ensure the optimal IAQ in public buildings. The higher standards and stricter measures

mean many businesses will have to enhance their air quality management practices if they want to meet the new recommendations and satisfy the public's demand for clean air.

WHAT GOOD INDOOR AIR QUALITY CAN DO FOR YOUR BUSINESS

There is a well-established link between IAQ and staff health. We spend a significant amount of our time in our place of work, which can leave us exposed to health risks. For builders, this is two fold, as they face the same threats in their workplaces and worksites. The same goes for their customers, the home owners. Without well-ventilated and filtered air, harmful particles can build up around us, including carbon monoxide, VOCs, airborne pathogens, and even excess moisture. Exposure to low air quality can lead to headaches, sore throats, tiredness, and more-serious long-term illnesses.

Meanwhile, staff illness or declining productivity can exact a burdensome cost on businesses, so it is also in the long-term economic interest of businesses to invest in air-improving solutions. Companies will reap the financial rewards of providing clean air by having more energetic and healthy staff.

As part of the [Clean Air in Buildings Challenge](#), the federal government seeks to implement a recognition scheme for buildings that achieve high air quality standards. It would most likely be modeled on the certification schemes used by the likes of LEED, wherein buildings can publicly display their certificates.

When deciding to visit, customers may factor in IAQ ratings, just as they would other types of certification around cleanliness.

TOP IMPROVEMENTS CUSTOMERS WANT TO SEE IN THE NEXT FIVE YEARS

When customers walk into your place of business, as well as into their own homes, they don't want to be met with an unpleasant smell, but rather an odorless space. Air filtration and other practices can help tackle foul



Clearing the air. The pandemic has moved indoor air quality front and center when it comes to personal health. COURTESY OF PRO-STOCK STUDIO/ISTOCK

www.greenbuildermedia.com



Sneeze guard. Well-ventilated and filtered air can prevent employee exposure to carbon monoxide, VOCs and airborne pathogens, protecting workers from common colds and more-serious long-term illnesses.

odors and give customers peace of mind. The market offers many effective options for businesses to tackle odors, such as carbon filters, which can slot in nicely with existing HVAC infrastructure.

With customers more aware than ever of the vital role that air quality plays in our health, businesses will have to step up to meet customer expectations.

Nowadays, people are more health-conscious and looking to recoup their bodies and minds. Customers are seeking out providers who offer a health-oriented experience. In response, contractors must incorporate a holistic approach to health and well-being, including IAQ. Nothing is more off-putting than walking into a stuffy hotel room or seeing particles floating in the air as the sunshine beams through a bedroom window. Surveys have shown that IAQ impacts how consumers design their dwellings, so it is essential that the construction sector reacts to these demands. Just as a five-star cleanliness rating can draw in customers, so will a five-star indoor air quality rating.

It's not always possible to see or smell poor air quality, so giving customers the option to see IAQ metrics is a great unique selling point for businesses. A recent survey found that 76 percent of respondents would like to see metrics displayed in public buildings. IAQ monitoring systems provide a sleek solution to ensuring optimal air quality and feeding information back to customers. These systems can display easy-to-read metrics on air quality through various devices. Businesses can display dashboards on televisions for customers to see or even provide QR codes that customers can scan to view air quality status. A company with nothing to hide will relish the opportunity to show off its top IAQ. **GB**

John Bohlmann is founder of [HawkenAQ](#), which conducts business strategy, growth, and full stack technical development for industry-shaping ideas. HawkenAQ combines real time monitoring and the latest standards to give confidence in the air quality of buildings.



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HOUSING 2.0

THE EFFICIENCY IMPERATIVE: NOT JUST FOR BUILDINGS

Government policies and programs must also aim for more-efficient, low-cost, and high-impact energy efficiency options.

BY SAM RASHKIN

This is Sam Rashkin's latest in a series of articles based on his second book, "Housing 2.0: A Disruption Survival Guide." It is intended as a roadmap for high-performance builders to become the most successful in the industry.

THIS ARTICLE IS BASED ON MORE THAN 25 YEARS of directing national housing programs that have led to more than 2.5 million certified homes, including extensive engagement with industry and government leaders. While this article is focused on a specific policy proposal for transforming the housing sector, the larger takeaway is that government policies and programs must be held accountable to far greater efficiency, just as we expect from buildings. This is because personal observations suggest that energy efficiency programs focus on high-

cost strategies that have historically yielded incremental results when substantially more efficient, low-cost, high-impact options are available.

Missing these program opportunities will not get the job done. The planetary imperative to deliver zero carbon buildings by 2030 can't wait for incremental. Virtually every part of our ecosystem is approaching or exceeding planetary boundary conditions that threaten its collapse: climate, biodiversity, nitrogen/phosphorus interference, stratospheric ozone, ocean acidification, global fresh-water supply, land use change, chemical pollution, and atmospheric aerosol loading. Think of it as the planetary canary in the coal mine revealing that the planet is at DEFCON level 1.

The only path aligned with this urgency employs policies and programs that mandate zero or zero ready buildings at transaction. This article will address one such policy option that has zero cost to the federal government, and would transform the housing sector to zero energy ready performance by 2030. The approximate bottom-line benefits include¹:

- \$1 trillion of homeowner utility savings
- \$0.27 trillion of annual construction revenue
- \$4.5 trillion of additional tax revenue to the U.S. treasury
- 360,000 persistent new jobs providing 9 million job-years of work that cannot be outsourced
- 8,400 million metric tons of carbon equivalent (MMTCe) reduced emissions
- Transformation to zero energy-ready housing stock by 2030²

A MORTGAGE INTEREST PROPOSAL

The mortgage interest deduction has long been a "sacred cow" entitlement attached to homeownership. In past years, it was considered for termination or restructuring in response to the historically unprecedented national debt crisis facing the country. This is because the mortgage interest deduction is the second highest government tax expenditure (\$104.5 billion), only exceeded by the exclusion of employer contributions for health care (\$177 billion).³

However, rather than looking at this tax policy as a liability, there is a unique opportunity to look at the mortgage interest deduction as a powerful asset that can be retooled to deliver the profound economic, employment, clean air, national security, and market transformation benefits cited above. Consider saving the planet a nice bonus.

All it entails is a simple policy that would change the mortgage interest deduction from an automatic entitlement when financing the purchase of



Sensible thinking. Energy efficiency programs have varying effectiveness, with high-cost strategies typically less efficient than low-cost versions.

savings easily exceed the incremental increase in the monthly mortgage payment to achieve the ZERH or HES threshold. Underwriters should be excited to provide these loans, since they provide lower risk financing homes with lower cost of ownership, less maintenance burden, and future-readiness that can increase appreciation.

SCALING OPPORTUNITY

Housing in the U.S. accounts for approximately 20 percent of total U.S. energy consumption. The ENERGY STAR Certified Home program has made significant inroads influencing mainstream home builders to construct homes at least 20 percent better than code. But, it still accounts for less than 10 percent of all new homes each year. ZERH accounts for less than one percent of all new homes. Market penetration is much worse for national programs supporting whole-house existing home upgrades.

Over the past two decades only 330,000 homes have been improved with whole-house energy retrofits through sponsors of the Home Performance with ENERGY STAR program.⁵ In addition, substantial stimulus funding was provided to 41 communities across the U.S. by DOE's Better Buildings Neighborhood Program to promulgate innovative home energy retrofit programs, but there is little evidence of any significant persistent impacts. This painfully slow incremental approach barely represents a ripple in more than 100 million units of existing housing stock. This suggests there is a tremendous opportunity to accelerate transformation of the housing sector much more efficiently.

INNOVATIVE CHALLENGES

Home builders are reluctant to construct homes that meet rigorous energy efficiency criteria because it entails a higher first cost, along with problematic recognition of this added value in the appraisal process. Even though new home construction represents less than one percent of the total housing stock, establishing innovations with them is an important first step. It is easier to scale in new construction with large projects, rather than upgrading existing homes one at a time. Moreover, once innovations are established in new homes, it is significantly easier to gain their acceptance in existing homes.

But transformation of the residential sector is not possible without motivating millions of existing homeowners to invest in whole-house energy efficiency

any home, to an earned benefit rewarding good behavior when purchasing a new home that is certified to the U.S. Department of Energy (DOE) Zero Energy Ready Home (ZERH) program or an existing home that achieves a DOE Home Energy Score (HES) of 7.5 or higher. This level of efficiency for existing homes provides a critical foundation for achieving zero energy ready performance.

This would effectively convert the huge federal government liability into a valuable asset that efficiently leverages existing federal government programs. Of course, it will be critical to ensure adequate lead time to develop the substantial design, construction, manufacturing, and verification infrastructure needed to serve the substantial growth in demand for peak performance new and existing

homes. That is because the mortgage interest tax deduction is a deal too good to refuse, providing more than \$6,000 per year in reduced tax payments or \$60,000 over the average 10-year term of homeownership. This value is based on an annual mortgage interest expense of \$12,000 that would provide a married couple in the 24 percent tax bracket a \$25,100 standard deduction in 2021.⁴

Note that this policy would also require working with the nation's key underwriters (Fannie Mae, Freddie Mac, FHA, VA) to reinstate or ensure availability of energy efficiency mortgages (EEMs) for new homes and energy improvement mortgages (EIMs) for existing homes.

EEMs would provide additional 30-year financing for the incremental cost required to achieve ZERH certification in new homes, and EIMs would provide the incremental funds held in escrow to upgrade existing homes to an HES score of 7.5 if not already at that performance level.

In both cases, no additional down payment or income qualifications are required, which prevents any extra financial burden for the borrower. And most importantly, these loans help ensure lower cost of homeownership for higher value homes where the monthly utility



Interest options. The mortgage interest deduction, the government's second largest expense, can be retooled to deliver numerous economic, employment, clean air, national security, and market transformation benefits.

upgrades, since the nation's existing housing stock is woefully inefficient. Scaling has proven elusive due to a lack of financing, supply infrastructure and awareness, along with competing interests for cosmetic improvements. In this context, a major initiative is needed that will effectively encourage our nation's home builders, contractors, manufacturers, suppliers, and homeowners to invest in energy efficiency.

WHY THIS INITIATIVE WILL WORK

Fear of loss is a powerful behavior change motivator, especially when the personal financial benefit is substantial. Such is the case with missing out on the mortgage interest deduction. As a result, this policy can be expected to succeed where past programs have failed. The compelling benefits include:

» ASSURED MARKET TRANSFORMATION.

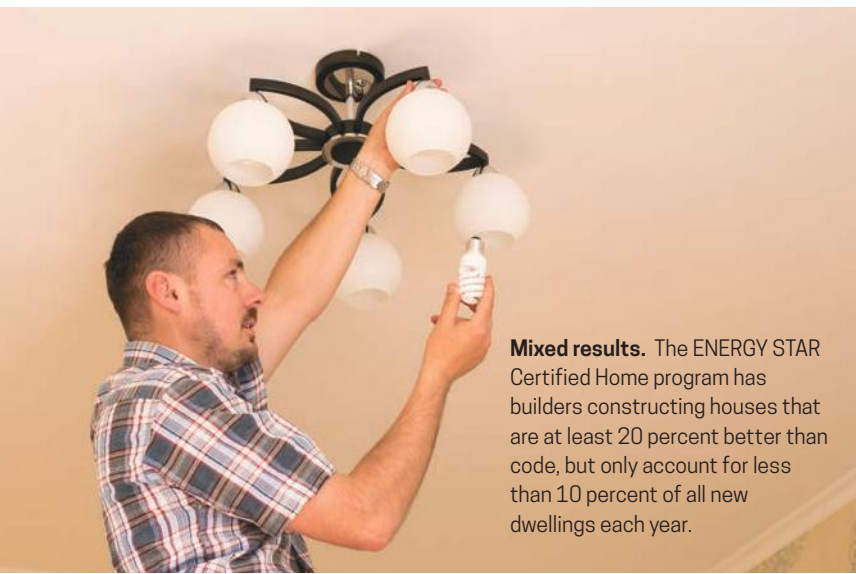
Meaningful tax benefits have proven effective at transforming markets when executed well, and failing when not. For instance, the mortgage interest tax deduction has been widely recognized as a major stimulus for home ownership and the solar electric tax credit has been a catalyst for the emergence of a nationwide solar electric industry.

In contrast, hundreds of millions of dollars were wasted on a solar domestic hot water tax credit that left the nation with no meaningful solar thermal industry when it abruptly ended without an effective transition strategy to a reduced- or no-tax subsidy. The significant value of the mortgage interest deduction will immediately drive consumer demand

to qualifying homes. In turn, it will motivate builders to provide peak performance new homes, homeowners to invest in upgrading the energy efficiency of their existing homes, and contractors to offer home performance upgrades.

» SUBSTANTIAL GREEN JOBS.

Unlike a rebate or short-term tax incentive that goes away in a few years, a new tax policy can create reliable long-term demand for high-performance new and existing homes. Energy efficient building product manufacturers, builders, contractors, and verifiers (e.g., HERS raters and certified HES professionals) can invest in their businesses knowing they have a compelling market opportunity that doesn't depend on temporary government or utility funding. This in turn will create jobs to manufacture products and provide services needed to ensure



Mixed results. The ENERGY STAR Certified Home program has builders constructing houses that are at least 20 percent better than code, but only account for less than 10 percent of all new dwellings each year.

high-performance. And the resulting "green" jobs cannot be outsourced overseas.

» PERSISTENCE.

Savings and benefits from homes constructed new or renovated to achieve exemplary levels of energy efficiency are reliable. Further, a national infrastructure for constructing and maintaining high-performance homes will be developed to help ensure qualified homes deliver expected savings.

» ENERGY SUPPLY RELIABILITY.

This initiative would have a profound impact on the total housing stock that would continually reduce total electricity demand and peak demand. This would result in much greater system reliability by removing a substantial burden from

the existing transmission and distribution infrastructure.

» GREATER HOUSING EQUITY.

The current mortgage interest deduction is income regressive, with more than 80 percent of the tax benefit going to households with earnings greater than \$100,000. Thus, a key recommendation would be to reallocate the billions of dollars spent each year on tax rebates, cash incentives and credits no longer needed with this policy change, to whole-house energy efficiency upgrade programs for low-income housing.

» REWARDING GOOD BEHAVIOR.

This tax initiative will provide an example of good government that substantially rewards good behavior rather than providing entitlements disproportionately to wealthy households. Typical incentives or rebates primarily reward consumers that "sat on the fence" and did not take prudent actions to improve the efficiency of their existing homes. This policy rewards those that took action before the policy change because their homes at resale will automatically qualify for the mortgage interest deduction.

» LEVERAGING EXISTING FEDERAL GOVERNMENT PROGRAMS.

DOE provides impressive but underutilized tools for the new home and home performance industries, including ZERH and HES. However, for the past decade, the U.S. Treasury has implemented the 45L energy efficiency tax credit pegged to its own metric: a home that reduced energy use 50 percent over code. This is incredibly inefficient. ZERH is readily available to deliver the same performance, along with critical assurances of moisture, comfort, and indoor air quality protection missing a narrow energy efficiency target.

Further, the qualifying methods to calculate the 50 percent threshold had huge loopholes that undermined the assurance-targeted program goals. Even if there were no loopholes, the IRS did not have the competency to ensure proper compliance, whereas rigorous oversight could have been leveraged at no cost by using ZERH and HES and the verification oversight provided by those programs. This is most egregious. For many years, 45L was approved too late in the year to influence builder decisions, and as a result, was just a free giveaway for homes that were already going to be built to the targeted performance.

» MOVING FORWARD.

This policy change requires a collective impact process to herd concomitant interests on a common agenda and action plan. The goal would be to educate government, industry, and the public about the impressive benefits of this no-cost retooling of the mortgage interest tax deduction policy, and coordinate a lobbying effort to motivate change. This includes the following actions:

- Develop a draft report on the opportunities to create millions of jobs, cleaner air, and improved national security with a retooled Mortgage Interest Deduction Policy.
- Vet the draft report with a broad stakeholder group including:
 - NGOs (e.g., ACEEE, ASE, NRDC, etc.)
 - Home Builder associations (e.g., NAHB, LBA)
 - Home builders
 - Manufacturer associations (e.g., NAIMA, PIMA, CIMA, Energy Efficient Windows Collaborative, ACCA, HARDI, AAMA, etc.)
 - Manufacturers of products for high-performance homes (e.g., insulation, windows, heating and cooling equipment, sealants, ventilation systems, lighting, appliances, etc.)
 - The building science community (e.g., consultants, EEBA, ACI, BETEC, NIST)
 - Financial institutions (e.g., Fannie-Mae, Freddie Mac, FHA, VA, MBA, etc.)
 - Federal Government Programs (e.g., EPA, HUD, GSA, etc.)
- Convene meetings to develop input for a final report.
- Complete the final report, disseminate it to the stakeholder group, and secure sign-off by all of them on the document.
- Use this report to facilitate a coordinated lobbying effort targeting legislation that instructs the Department of the Treasury to implement a new tax policy for the Mortgage Interest Deduction. The policy is pegged to a minimum HES score for existing homes and ZERH certification for new homes. It also requires underwriters to provide EEMs and EIMs for these homes.
- Initiate a coordination lobbying effort by all the stakeholders for this new policy, including

allocating U.S. Treasury savings from new and existing home energy efficiency rebates that are no longer needed, to programs providing whole-house energy efficiency upgrades for low-income homes.

A FINAL THOUGHT

Now that we have come full circle on a specific tax policy change proposal, I hope the elegance of its simplicity, impact, and cost savings are evident. That said, I'm not delusional. I know it takes an act of God to change institutional policy. But if the prize is virtually assured market transformation to a zero energy-ready residential sector at no cost to the U.S. Treasury, I say it's incumbent for all stakeholders to work together to solve the problem. There has to be a solution for a policy where every stakeholder's and the planet's self-interest are better served.

However, as the saying goes, "when you have a hammer, you see every problem as a nail." Too often we rely on policies and programs that keep hammering the same

nails that have not gotten the job done. I've had a front row seat watching this process for too long a career in federal government. Now our planet is at grave risk, and it is time to hold all institutions accountable to optimizing efficiency and minimizing waste. This includes the disproportionate government program priority of continually increasing budgets and staffing, assuming more can be accomplished with more resources.

Beware of too much of a good thing. Consider the massive inefficiency of the trillions of dollars spent on the great recession stimulus programs and COVID relief. This level of inefficiency and waste is not sustainable. The reputation and confidence in our governmental institutions is too important. They provide critical expertise and wisdom that can uniquely address our nation's greatest challenges. However, I continually observe too many missed opportunities to accomplish more with less resources. The efficiency imperative is not just for buildings. **GB**

¹ These results are based on a detailed spreadsheet model developed 10 years ago by an economic expert from McKinsey and Company supporting my work at the U.S. Department of Energy. Impacts would be much higher if calculated today based on higher costs of homes and upgrades. However, the scale of the high-impact opportunity at no cost to the government is much more important than the absolute precision of these numbers.

² A very conservative one-third of the nearly 7 million annual homebuyers (based on 2021 data) opting to qualify for the mortgage interest deduction results in over 20 million zero energy ready homes by 2030, exceeding the inflection point and locking in exponential growth.

³ Office of Management and Budget estimated effect on revenue for 2011.

⁴ "Calculating the Home mortgage Interest Deduction (HMID)," Lisa Smith, Investopedia, updated March 23, 2022

⁵ "Home Performance with ENERGY STAR," U.S. Department of Energy, <https://www.energy.gov/eere/buildings/downloads/home-performance-energy-star-0>

⁶ Data from the Joint Committee on Taxation, JCS03010, Political Calculations, 2011



Grand future. A new tax policy can create long-term demand for high-performance homes, and create jobs to manufacture products to ensure such high performance.

Sam Rashkin's two-decade career as a licensed architect includes serving on national steering committees for the U.S. Green Building Council (USGBC)'s LEED for Homes, Green Builder Media's Green Builder Guidelines, the Environmental Protection Agency (EPA)'s WaterSense label, and EPA's Indoor airPLUS label. He has partnered with Green Builder Media to develop the **Housing 2.0 program**, which empowers building professionals to design and construct higher-performance, healthier and more-sustainable homes at a fraction of the cost.

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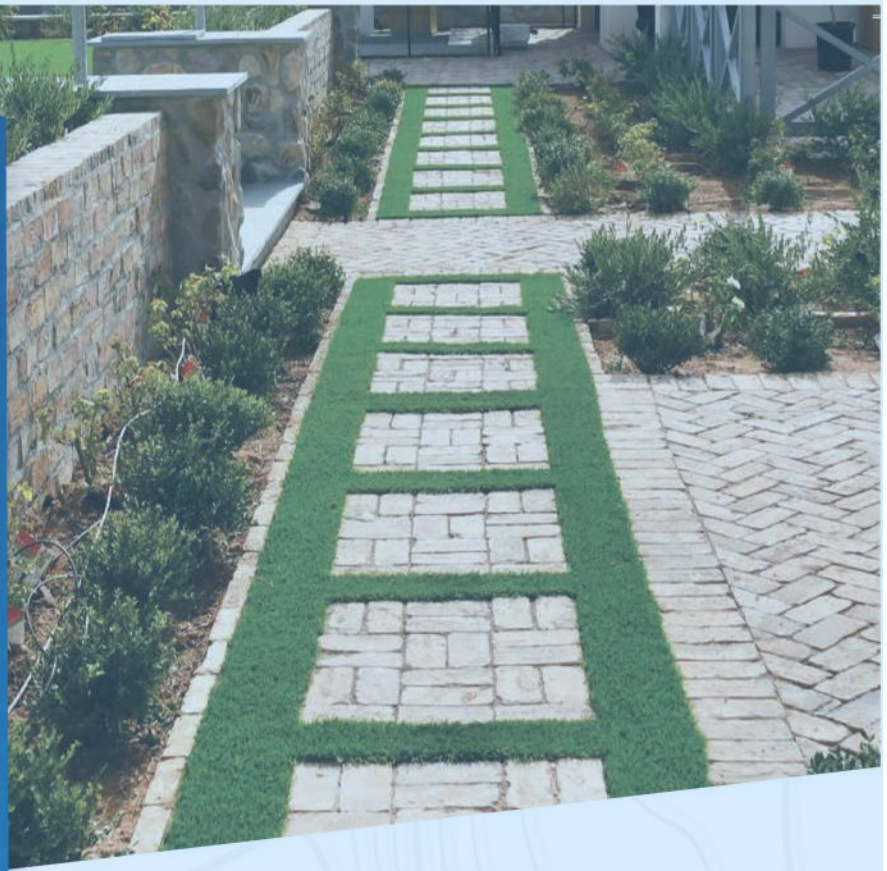
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Remember to Make a Clean Sweep



Ron Jones
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A S I WAS SWEEPING UP AT OUR PROJECT YESTERDAY, I found myself a little amused by that familiar activity. You see, I have always maintained that the first tool you learn to use in construction is a broom, and even though we largely take it for granted, it may possibly be the last thing you're allowed to operate at some point.

I'd also like to think that any good builder never lets the broom get too far away. A clean workplace can say a lot about the way you conduct your business. There's a saying that "you never get a second chance at a first impression." When a client, or prospective client, your banker or insurance agent, the local building official or one of your subcontractors, comments on how clean your jobsite is, you're being told that they have a favorable opinion of your work.

A tidy, well-maintained jobsite is undoubtedly safer for everyone, but I think it also sets the tone for better work. It serves as a reminder that it's important to clean up after ourselves, not only at our projects, but as we go through life. Some people prefer to do it all at once and others like to do it as they go, but everybody has to get it done sooner or later, one way or another.

Back when I was building for clients, I was fortunate enough to have a self-employed construction site cleanup man who would do the sweeping and haul away jobsite debris on a regular basis. He cleaned the jobsite with such pride that it made you feel as though you could spread out a blanket and serve a picnic when he finished.

He would also diligently separate the waste and recycle whenever possible. Doing so saved him a few dollars in tipping fees and made a few more for the materials that had monetary value, such as cardboard, wood scrap and metals. But he would have done it anyway, simply because it was the right thing to do. It served as a reminder that everyone's

work, no matter how humble, is important, and deserves to be respected.

Sometimes I wonder how we stack up as an industry when it comes to how we manage the things we're responsible for, and what we leave behind when we move on to the next project. The waste stream from construction is immense, and it's not just the onsite waste. We can't ignore the impacts our activities have on air and water, other natural resources, and our footprint on the land itself.

Building may well be the most conspicuously consumptive human activity. It's right out in the open for everybody to see. But the results are among the longest-lasting things produced by humans. Barring some kind of disaster, a well-built structure will far outlast the working life of the builder.

"When a client, or prospective client, your banker or insurance agent, the local building official or one of your subcontractors, comments on how clean your jobsite is, you're being told that they have a favorable opinion of your work."

It is an inescapable part of his legacy.

The same is true when it comes to evaluating how we leave things compared to how we found them. Keep the broom within easy reach. It's not just about where we get to, it's also about how we got there. **GB**



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