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GREEN BUILDER[®]

July/August 2024 / www.greenbuildermedia.com



HOW FAR CAN PRODUCT DESIGN GO?

In our annual Eco-Leaders issue, we look at companies leading the way in transparency with Environmental Product Declarations and other sophisticated metrics of sustainability.



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Let Them Eat Fake

Gilded Age housing fantasies worsen CO₂ pollution and lead homebuyers astray.

If you haven't watched "Citizen Kane" in a while, it's worth checking out. There's a free streaming version [here](#). In this classic film, the obscenely rich, friendless media magnate, Charles Kane, gains all the material wealth in the world, but loses his soul. He builds a giant mansion on a hill called Xanadu.

"Charlie," says his wife, "we're different, 'cause we live in a palace..."

Kane: "You said you wanted to live in a palace."

Wife: "A person could go crazy in this dump."

Living large remains an entrenched American conceit. We still believe, on the whole, that more is better. More glass. More garage space. Slap on another ton of air conditioning and the heat won't come for us. We'll be able to hunker down as an idle spectator, not a perpetrator or participant in the overheating world outside. What a mean-spirited illusion.

In fact, the latest climate trends suggest that no house, big or small, will offer a permanent safe haven from climate change. And the threats are global. If the heat doesn't get us, the floods might, or the rising seas, or the [AMOC collapse](#), or the tornadoes or the hurricanes. It's not hyperbolic to say that we're skirting the edge of self annihilation.

Will we be shaken off the Earth like so many fleas on a dog? Possibly. As the late comedian George Carlin aptly pointed out, "the planet doesn't need to be saved." Can we save ourselves from ourselves?

Not if we keep following the same patterns. For example, I just received the announcement for the 9,423-square-foot "New American Home" (TNAH) from the NAHB. Each year, this dreadful project offers a shocking and wasteful "up yours" from the building industry to everyone trying to build greener, improve products or live more sustainably.

The excuse is always the same: The house is "aspirational" or meant to "showcase products." Let's pause for a minute. Do we really want people aspiring to wine cellars and three-car garages? Shouldn't we instead be presenting creative multi-purpose rooms, ways to drive

HOW HOME SIZE AFFECTS THE BOTTOM LINE

EXPENSE CATEGORY	1,500-SQUARE-FOOT HOME	3,000-SQUARE-FOOT HOME
MORTGAGE PAYMENTS	\$309,120	\$618,240
PROPERTY TAXES	\$132,000	\$264,000
HOMEOWNERS INSURANCE	\$24,000	\$48,000
HOA FEES	\$36,000	\$36,000
MAINTENANCE COSTS	\$25,000	\$50,000
TOTAL	\$526,120	\$1,016,240

The weight of luxury. Encouraging people to build larger homes exacerbates CO₂ pollution, vastly increases the owners' costs of living, and puts them at greater economic risk.

less, or transition to electric vehicles, live smaller and CHANGE?

The people likely to buy a luxury home like the TNAH represent a big chunk of our pollution footprint. The top 10 percent of U.S. earners cause 40 percent of the country's CO₂ emissions.

As housing leaders, we need to start listening more to what's really going on in the country and stop pretending it's okay to build like it's 1990. Or 1910. Throwing up our hands and creating another monstrous Gilded Age fantasy is irresponsible and insulting. Impressions matter. Ideas matter.

Picture the millennial mom who's building a new home in Pennsylvania. She won't be pouring 9,000 feet of concrete. But she might see TNAH and decide she needs larger bedrooms, a workout space, a bigger garage, a wine cellar, and on and on. Extra resources used. Extra CO₂ pollution.

She's set up for unpleasant surprises: Her property taxes double or triple almost overnight. Her extra-large house needs to be painted and reroofed—an extra-large expense every few years. Along with hastening the pace of the climate disaster, she's soon drowning in monthly bills from the albatross of a home that now OWNS HER.

Can't green products mitigate the ecological damage from these bloated homes? Of course, even a Xanadu *could* be built for net zero performance. But the high CO₂ costs of construction will take many years to recoup. To be fair, some of the products in TNAH have strong sustainability stories. However, their messaging is lost. Even companies working hard to create environmental product declaration (EPD) reports and do the right thing get tainted by touching this thing.

My recommendation? Next year, companies serious about addressing the climate meltdown should boycott inclusion in The New American Home, unless the project is shrunk down to about 2,000 square feet or less. It's that simple to do the right thing. **GB**

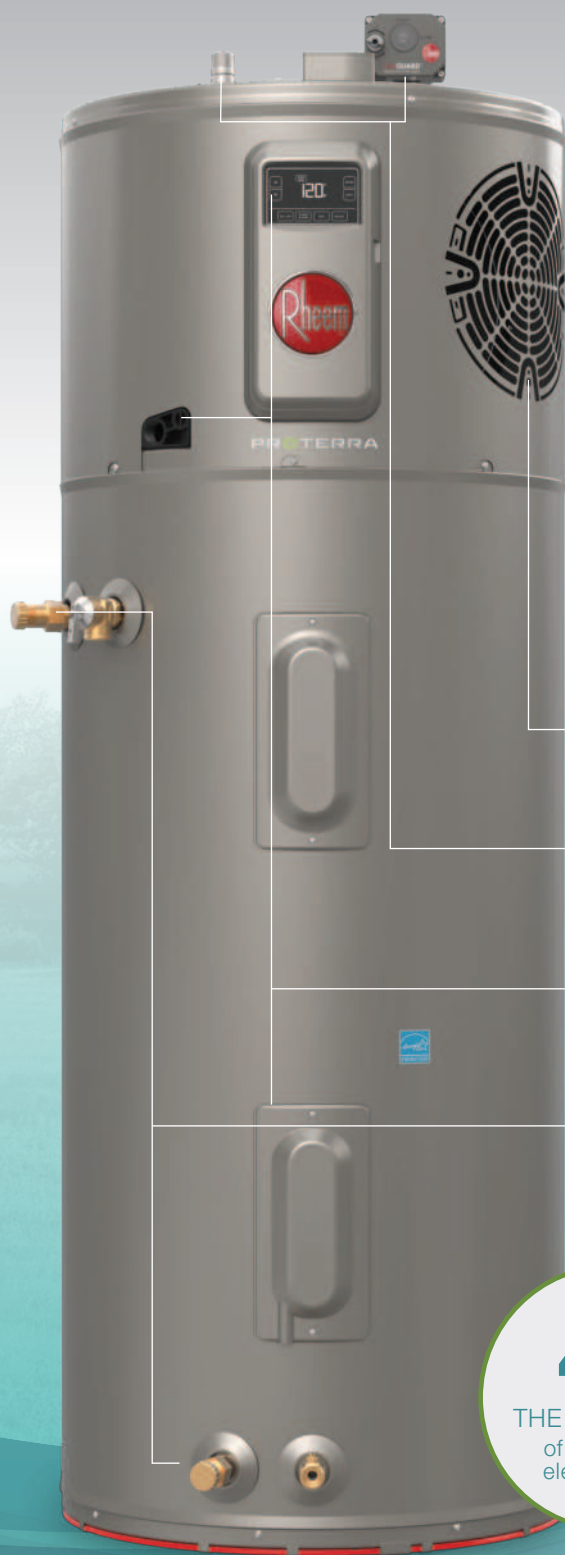


Matt Power
Editor-in-Chief

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2024 ECO-LEADER: JAMES HARDIE

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- **Minimizing waste:** zero manufacturing waste to landfill by 2035.



*Hardie® siding complies with ASTM E136 as a noncombustible cladding and is recognized by fire departments across the U.S. including Chicago IL, St. Paul MN, Flagstaff AZ and Wayne County, OH. Fiber cement fire resistance does not extend to applied paints or coatings, which may be damaged or char when exposed to flames.

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AI Energy Demands Raise Red Flag About Embracing It Too Quickly

A growing need for AI-dependent computing power could overload the nation's electrical grid by the mid-2040s.

Arising demand for data centers and computing power for artificial intelligence (AI), cloud storage and crypto assets could overload the U.S. power grid and lead to energy shortages within the next 20 years. A Conference Board report, "[Smart Power: Will AI Spike Electricity Demand or Reduce It Through Efficiencies?](#)," predicts that electricity demand will grow 4.7 percent through 2029—nearly double the previous five years' 2.6 percent growth.

Current-generation AI models use more than 500,000 kilowatt hours (kWh) per day to operate—compared to 29 kWh for the average U.S. household. AI's computational power is projected to double every



All eyes on AI. Artificial intelligence will consume a lot of power in future years. While that could be dangerous to the grid, gains in efficiency and productivity may help offset the problem. CREDIT: ISTOCK/IGOR BORISENKO

100 days, increasing global energy demand attributed to AI by 26 percent to 36 percent annually in the coming years, the report notes.

But implementing AI to manage electricity usage—for instance, by shifting the most taxing tasks to off-peak hours—can result in efficiency savings, reducing costs and enhancing the capacity of energy systems, the report notes. "If the added computational power of AI allows businesses to achieve greater efficiencies and utilities to operate more effectively when managing their own operations, then the increase in power demand due to AI could be lower than projected—as happened with the rise of smartphones and the internet in the 2000s and 2010s—and support climate goals." **GB**

Study: Construction Workers Really Enjoy Their Jobs

A happy work environment means better employee productivity and loyalty.

Seventy-five percent of construction workers are more likely to stay with an employer if they are satisfied with their company's organizational culture, according to a study by [TollFreeForwarding.com](#). The international telecommunications provider researched online review data for 200 companies across 10 industries and ranked them by culture and values, diversity and inclusion, work-life balance, compensation, career opportunities, and senior management satisfaction.

TollFreeForwarding.com scored each industry on a scale of 1 to 100 for each category, as well as an overall average. The research found the construction industry to have the most satisfied employees of any industry, earning an overall score of 72.20 out of 100. Factors contributing to construction's high scores include skyrocketing wages, which have seen a more than 20 percent increase since 2021, increasing job opportunities, greater job security, and the availability of diverse roles.



Ready to work. Construction and manufacturing employees are among the happiest in the nation if they agree with a company's workplace culture. CREDIT: ISTOCK/BUTSAYA

Accounting & Taxes, and Manufacturing finished second (71.92) and third (71.75), respectively, from among the study's other nine industries.

"It's clear that job satisfaction plays an important role in employee retention, and research shows that happy employees are more productive than those dissatisfied with their jobs," notes TollFreeForwarding.com Chief Operations Officer Jason O'Brien. "Businesses that want to retain their employees need to focus on all these factors, as the top-ranking industries scored highly across the board." **GB**

Fireproof Home Features ICF Walls and Operates At Net Zero

The PHNX Home project would be a safe housing option for wildfire-threatened areas.

San Diego-based homebuilder [PHNX Development](#) has developed the nation's first fully non-combustible single-family home. According to the company, the project provides a sustainable option for homeowners in wildfire-prone regions such as Northeastern and Southern California, which have experienced \$19 billion in property damage since 2019.

The project, *PHNX Home*, utilizes a proprietary wood-free roof system with insulated concrete forms (ICF) for exterior walls. The home is net zero and can be operated independently of the grid. *PHNX Home* also features a full-capacity solar array and battery backup storage system.

Laurie Fisher, president and CEO of PHNX Development, notes that these homes aren't just for wildfire-prone areas. "They are resistant to wind, water, earthquakes, and they're designed to be a smart choice for anyone



Hot topic. The *PHNX Home*, built in California's Santa Clarita Valley to replace a house destroyed in the 2019 Tick Fire, gives the homeowners greater peace of mind if such a wildfire should happen again. COURTESY OF PHNX DEVELOPMENT

seeking a sustainable, durable, and affordable living solution," Fisher says. "And, they can be built in about half the time of traditional construction, at a competitive cost."

PHNX Development specializes in residential construction through development of custom single-family homes, as well as franchise and master-planned community opportunities, Fisher adds. **GB**

Tax Credit Ahead for New Homebuilders?

A proposed amendment to the federal tax code would put \$2,000 in certain builders' pockets.

RESNET® and the Alliance for Water Efficiency have developed a policy proposal to create a \$2,000 federal tax credit for builders of WaterSense-certified homes. The credit would be available through 2032. According to a joint release, the federal government provides tax credits for ENERGY STAR new homes under Section 45L of the tax code to transform the new home market to greater levels of energy efficiency and to ensure affordable energy bills for future homeowners. This tax credit enables builders to increase the water efficiency of their homes.

"There is a growing need for new housing across the United States," the two organizations note. "At the same time, water resources are being stretched thinly, and utility bills have been increasing faster than inflation in most communities."

Currently, RESNET staff and the Alliance for Water Efficiency are socializing



People policy. WaterSense-labeled homes are popular because they enable families to use less water and energy, and spend less money on utility bills. Now, that certification could attract more builders to the cause. SOURCE: U.S. EPA

the concept to key stakeholders and will seek to recruit bipartisan sponsors of such legislation. A [paper supporting the proposed policy](#) can be found on RESNET's website. **GB**

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FEATURES

12

2024 ECO-LEADERS: BRAND TRANSPARENCY

As public demand for environmentally friendly products continues to grow, manufacturers want to know just how green theirs really are. Environmental Product Declarations (EPD) are the answer.

36

VISION HOUSE® AUSTIN: NATURAL AFFINITY

As VISION House® Austin takes shape, the design team reveals an “enlightened” perspective on the human-nature interface.

42

TODAY’S HOMEOWNER: THE PATH TO ZERO-CARBON LIVING

Provide the next generation of home buyers with the tools and knowledge to lower their carbon footprint, and you’ll win their business and their respect.

48

VISION HOUSE TRANSCEND: SYSTEMS AND INNOVATIONS

This high-performance, sustainable design offers a glimpse of homebuilding’s future.

54

THE ENVELOPE, PLEASE

Building America’s research yields retrofit solutions for existing homes, old and older.

HERE’S A SAMPLE OF WHAT’S INSIDE:

DEPARTMENTS

- 02 Editor’s Note
- 06 Green Building News
- 64 Tailgate

“The role of technology is continually changing the world at a pace that makes today’s novelty tomorrow’s obsolete afterthought.” PAGE 12

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2024
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Brand Transparency

BY GREEN BUILDER STAFF

Public demand for environmentally friendly products has been on an upward trajectory for years. People want to know if the stuff used to build or clean their homes is safe for themselves, their families and the planet.

But they're not the only ones. Manufacturers want to know where their raw materials are coming from and whether they are suitable to sell to a sustainably minded public. It also wouldn't hurt companies to find out what areas within their own operations need some green fine tuning. This is a hallmark trait of an Eco-Leader.

For these companies, an Environmental Product Declaration (EPD) is an indispensable tool. (For those not in the know, an EPD is a third-party verified report that quantifies the environmental impact of a building product.) According to the website Eco Platform, the number of EPDs issued globally has risen from a few hundred in 2011 to more than 23,000 in 2023. A report from the Dodge Construction Network shows a 2,000 percent increase in the U.S. alone from 2021 to 2022. Experts believe that type of demand isn't likely to slow down over the rest of the decade (although the upcoming Presidential election will be a major factor in what happens here with EPDs vs. abroad).

Earlier this year, Green Builder surveyed 30 leading players in the construction industry about their interest in EPDs. This list was pared down to 10 finalists. These companies, our 2024 Eco-Leaders, have their own stories to tell about why they use EPDs, how they obtained them, how effective they have been, and whether there are others in each company's future. [Here's what they had to say.](#)



Carrier Corporation

As word gets out about its EPD philosophy, Carrier customers are increasingly getting on board.

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48

EPDs made by Carrier and its brands

0

GHG emissions across value chain by 2050

BY ALAN NADITZ

Environmental Product Declarations (EPDs) have always been a major part of HVAC manufacturer Carrier Corporation's philosophy. But demand for EPDs from Carrier's customers has increased in recent years, leading to a series of steps designed to emphasize the company's commitment to the environment.

According to Korinti Recalde, Carrier's senior director of environmental, social and governance, the company's EPDs consider a product's environmental impacts such as global warming potential, acidification potential of soil and water, eutrophication potential, depletion of stratospheric ozone layer, depletion of non-renewable fossil fuels, and smog formation potential. "Our Product Environmental Profiles (PEPs) consider these environmental impacts and more," Recalde notes, "including water requirement, human toxicity and hazardous waste disposed of."

An example is the *AquaEdge 19MV*, a water-cooled centrifugal chiller that utilizes a two-stage back-to-back compressor and an oil-free magnetic bearing system to deliver more operating range and consistent efficiency. The product's performance is measured against technical data such as energy usage, material composition, manufactured components, installation and transportation methods, and its service life.

Carrier and its brands have 48 products with EPDs. More would always be welcome, but suppliers currently are not required to provide them. "We work with them while developing our product EPDs to obtain the life cycle impact of the parts they have supplied," Recalde notes. "We prioritize the development of our EPDs based on customer requests and local regulations."

Acknowledging that there are quite a few EPD providers, Carrier tries to stand out with EPDs that align with the ISO 14025 standard and the relevant Product Category Rules (PCR)—which



Cooling time. Carrier's AquaEdge 19MV centrifugal chiller received an Environmental Product Declaration (EPD) due to its energy usage, material composition, manufactured components, installation and transportation methods, and its service life. COURTESY OF CARRIER CORPORATION



Solid strategy. Carrier Corporation plans to hit net zero in greenhouse gas emissions by 2050 by meeting several clean energy-friendly goals.

COURTESY OF CARRIER CORPORATION

1 gigaton

GHG emissions reduction planned by 2030

allow for review and comparison of different environmental product attributes among products in a defined category—for each of its EPDs. And, to get a more accurate operational energy use (B6) calculation, Carrier uses whole building simulation for the annual energy consumption of products with the largest environmental impact.

“Carrier also offers sustainable solutions that allow our customers to choose lower carbon footprint options,” Recalde notes. “For example, by offering lower global warming potential refrigerants such as R513A or R515B in our 19MV water-cooled chiller, we reduce the kilograms of CO₂ equivalent and go beyond the regulatory minimums.”

EPDs also help Carrier identify opportunities for material reduction and the selection of more sustainable alternatives by assessing factors like resource use, energy consumption and

“We see customers with ambitious sustainability targets looking to procure products that are not only more energy efficient, but that also have lower embodied carbon.”

— **Korinti Recalde, senior director of environmental, social and governance, Carrier Corporation**

emissions from extraction to disposal. This approach helps minimize waste and encourages the adoption of more sustainable materials, according to Recalde.

Leveraging these results, Carrier developed a “[Roadmap to Net Zero](#)” to align its emissions and those of its customers with the Paris Agreement, and operationalizes it to drive our technology investments. “EPDs allow Carrier to establish a baseline understanding of the environmental impacts of our products,” Recalde notes. “From there, we can implement the principles of design for sustainability to our development processes to identify opportunities for improvements.”

Carrier is now targeting net-zero GHG emissions across its value chain by 2050, complementing its existing goal of helping its customers avoid more than 1 gigaton of GHG emissions by 2030.





ClarkDietrich

A decade of pursuing EPD documentation for its cold-formed steel products has made ClarkDietrich a veteran in green manufacturing practices.

STATS

30

Percentage of reduction in embodied carbon vs. counterparts

100

Percentage of preconsumer steel waste recycled during production

BY VICTORIA MUHARSKY

As the largest cold-formed steel framing manufacturer in the U.S., ClarkDietrich has consistently been at the forefront, embracing Environmental Product Declarations (EPDs) early on to stay ahead of regulations and foster sustainability-driven innovation.

The company's journey with EPDs began in 2014 when several large architectural and engineering firms informed the company that its products would no longer be specified without EPD documentation. ClarkDietrich took immediate action, announcing its first-ever EPD the following year. Now, nearly a decade later, the company has rapidly expanded its EPD offerings to cover thousands of steel products.

According to Adam Shoemaker, director of corporate

sustainability at ClarkDietrich, the company's current motivation is no longer reactive but proactive. "We aim to reduce our company's impact on the environment, meet market demand and consumer expectations, stay ahead of regulatory compliance and industry standards, gain a competitive advantage by differentiating our products in the marketplace, and let sustainability drive continuous improvement and innovation," he says.

With such distinctions, it is no surprise that ClarkDietrich has established itself as a veteran in green manufacturing. Over the past decade, ClarkDietrich has refined its manufacturing process and supply chain impacts using insights gathered from previous EPDs to reduce the environmental impact of the company and its products. For instance, the company meticulously assesses the



Total agreement. One hundred percent of ClarkDietrich's in-house produced cold-formed steel framing products follow a low-embodied carbon Environmental Product Declaration (EPD). COURTESY OF CLARKDIETRICH



Bottom line. ClarkDietrich embraces the definition of sustainability known as the "3 Ps" or the "Triple Bottom Line" of Planet, People and Prosperity.

COURTESY OF CLARKDIETRICH

“The role of technology is continually changing the world at a pace that makes today’s novelty tomorrow’s obsolete afterthought. We embrace this challenge.”

—Jim Collins, president, ClarkDietrich

2015

The year of ClarkDietrich’s first EPD

sustainability attributes of its raw materials, Shoemaker notes.

ClarkDietrich has upheld that steadfast commitment to EPDs by certifying 100 percent of its in-house produced cold-formed steel framing products under a new low-embodied carbon EPD. Notably, ClarkDietrich distinguishes itself as one of only two manufacturers in the cold-formed steel framing industry that offers low-embodied carbon products eligible for General Services Administration (GSA) projects in the top 20 percent tier. It is also the sole national-level provider.

“We collaborated with our supply chain to gather primary data on steel coils produced in electric arc furnaces, [which are] known for their lower embodied carbon emissions compared to other furnaces,” Shoemaker explains. “This limited our supplier options, requiring us to navigate logistical challenges to ensure

nationwide availability of these products. Fortunately, our exceptional purchasing and operations teams successfully managed these complexities, ensuring that our customers have access to the eco-friendly building products they desire.”

ClarkDietrich has experienced a significant increase in demand for its low-embodied carbon steel products, driven largely by their low global warming potential (GWP) and supported by comprehensive EPD documentation that validate their environmental claims. Customers are more inclined to purchase EPD-backed products over traditional alternatives, as the verified sustainability attributes provide assurance that their purchase will benefit the planet. In a world where greenwashing is prevalent, customers appreciate the transparency that EPDs provide, Shoemaker adds.





Fiberon

With its highly recycled *Wildwood* cladding, this company puts its EPD on display.

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2,000

Plastic bags diverted from the landfill annually

5,300

Swimming pools filled with water diverted from the waste stream

BY ALAN NADITZ

Fiberon takes pride in being among the first to do anything. Issuing an Environmental Product Declaration (EPD) for its *Wildwood* composite cladding is a prime example.

The New London, N.C.-based company is one of the first composite manufacturers to release such an EPD, which offers a detailed look at the environmental impact of *Wildwood*, including raw material extraction, manufacturing and product disposal. The life cycle assessment confirmed that the wood-plastic cladding meets the environmental ISO standards required of products used in LEED v4-certified builds.

All seven of Fiberon's decking and cladding product lines now have EPDs, according to Fiberon Marketing Specialist Jacob Szyпка. "Our customers have a lot of great reasons to choose Fiberon composite decking over pressure-treated lumber," he

says. "When we decided to pursue an EPD, we didn't view it as an opportunity to raise our prices but to instead introduce our products to a broader market that was looking for an alternative to wood backed by a sustainability story [people] can feel good about."

Wildwood's manufacturing facility uses a closed-loop water system, which prevents enough water to fill 5,300 Olympic-size swimming pools from ending up in the waste stream. The composite boards are made with at least 94 percent recycled materials, including both wood and plastic. With this approach, Fiberon saves more than 1 million trees from being cut down each year and recycles an average of 100 million pounds of plastic annually, the company notes.

While traditional wood cladding is pressure-treated with chemicals and requires regular refinishing, *Wildwood* never needs to be sanded, stained or painted, which supports healthier air quality throughout its lifetime. The durable composite core of *Wildwood* ensures exceptional resistance to rotting, cracking, insects and decay.

Fiberon is one of the largest recyclers of polyethylene in the United States. The company has been open about how its products are manufactured and the environmental benefits of their creation. But there is no need to take only Fiberon's word for it. "While our story provides insight into our manufacturing process, we felt we had an obligation to be transparent with our customers by having that process reviewed by a third party," Szyпка notes.

That third party, SCS Global Services, is well known for its diligence when considering a company's product for an EPD. "We are striving to advance sustainable development goals through independent assessment, the application of sound science, and innovative solutions," the company notes. "Through these services, we are enabling decision-makers and purchasers to



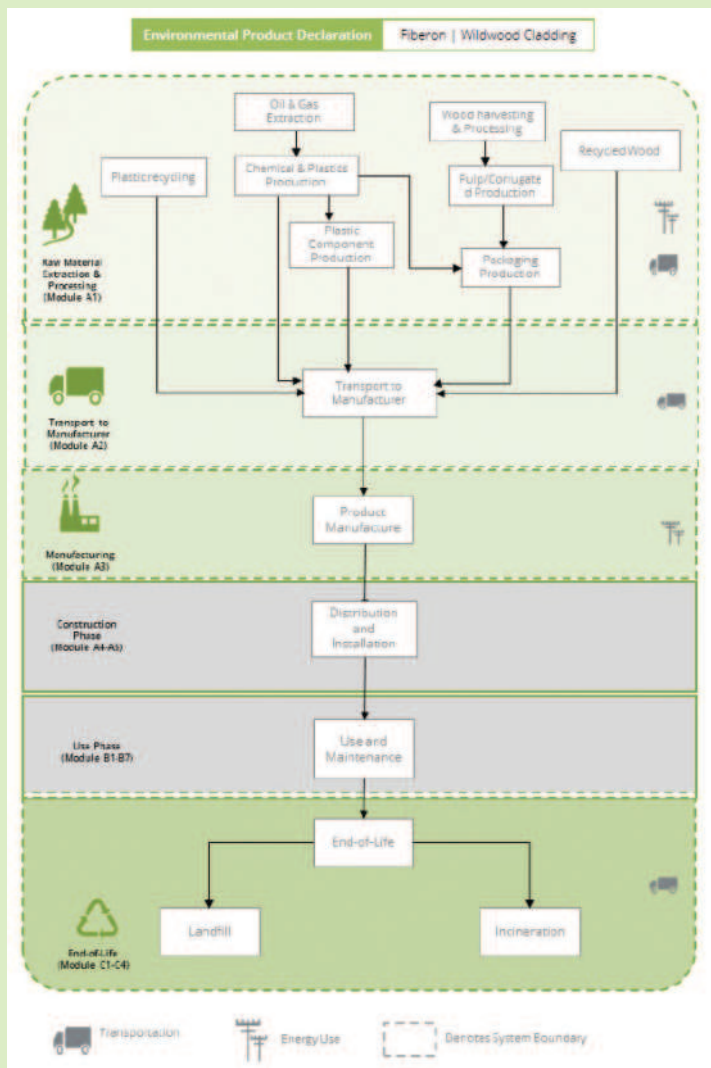
On board. Thanks to an Environmental Product Declaration (EPD), Fiberon's *Wildwood* composite cladding, shown here, has become a symbol of the company's commitment to sustainability. COURTESY OF FIBERON

94

Percent of recycled materials used for *Wildwood* cladding

“An EPD was an opportunity to introduce our products to a broader market that was looking for an alternative to wood, backed by a sustainability story they can feel good about.”

—Jacob Szyпка, marketing specialist,
Fiberon



Lifetime project. Fiberon’s EPD includes a depiction of the path followed during composite cladding’s production, from materials gathering to end-of-life disposal. COURTESY OF SCS GLOBAL SERVICES

make informed decisions, giving innovators a competitive edge, and helping to drive the development of leadership standards to create a framework for continuous improvement.”

According to Szyпка, an EPD has become a strong marketing tool. The company constantly receives viewing requests from domestic and international customers. Those requests are expected to increase as environmental impact becomes a greater focus within the construction industry.

But above all, obtaining an EPD was simply “the next logical step in becoming an eco-leader,” Szyпка notes. “Fiberon is focused on continuing to improve our process and offering a premium product our customers are proud to own.”

fiberon[®]
Composite Cladding



Greenfiber

Greenfiber leans into the power of third-party validated EPDs to highlight its dedication to transparency and sustainability.

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20%

Reduction in heating and cooling costs from *SANCTUARY* insulation

277,000

Tons of paper diverted from landfills annually by Greenfiber

BY VICTORIA MUHARSKY

Consumers are increasingly skeptical of environmental claims, especially given the numerous greenwashing lawsuits reported in the media. Companies with genuine sustainability initiatives must navigate through the noise to substantiate their claims. Many, like Greenfiber, are opting for Environmental Product Declarations (EPDs) to prove environmental integrity.

This commitment to transparency is particularly important in the insulation industry, where products are generally quite carbon intensive. Greenfiber has developed *Sanctuary*® Insulation, a unique cellulose-based insulation product made with 85 percent post-consumer paper. It stands out as one of the few carbon negative options available, boasting a low global warming potential (GWP) due to the carbon storage properties

of trees, and it maintains a low operational carbon profile by using low-energy manufacturing and short-haul transportation. Additionally, *Sanctuary* is ENERGY STAR certified, contributing to an average 20 percent reduction in heating and cooling costs.

With a comprehensive life cycle assessment (LCA) and corresponding EPD documentation, consumers gain valuable insights into the environmental impact of Greenfiber's *Sanctuary*, spanning from initial materials sourcing to end-of-life disposal. Consumers can see firsthand the monumental difference between *Sanctuary* and traditional, carbon-intensive insulation.

One key aspect highlighted in the EPD is the important role of sustainable material sourcing in reducing *Sanctuary*'s embodied carbon. Greenfiber diverts 277,000 tons of paper from landfills annually. It's estimated that outfitting every new home and under



Blasting away. Greenfiber's *Sanctuary* insulation, already known for its carbon emissions-reducing properties, gets a public awareness boost thanks to an Environmental Product Declaration (EPD). COURTESY OF GREENFIBER



Circular thinking. The Greenfiber EPD is built around a philosophy of Earth-friendly actions and recycling, carbon storage, and clean manufacturing techniques. COURTESY OF GREENFIBER

12.4 million

Tons of carbon to be removed from the air using *Sanctuary*

insulated home with *Sanctuary* could remove 12.4 million tons of carbon from the air.

In 2024 alone, Greenfiber is committed to removing 142,246 tons of carbon from the atmosphere, which is equivalent to the emissions from 14.5 million gallons of gasoline or the carbon stored by 369 million trees.

The EPD for *Sanctuary* provides significant reassurance to consumers that the product's environmental claims are genuine. Underlining its commitment to transparency, Greenfiber is pursuing EPDs for more of its products. This makes it a welcome choice for builders increasingly interested in purchasing sustainable, EPD-backed products to earn sustainability credits under green building programs such as Leadership in Energy and Environmental Design (LEED) and the Green Building

“We have the insulation product with the least embodied carbon out of all traditional insulation types. We wanted to substantiate that with concrete data.”

—Laura Woodford,
vice president of marketing,
Greenfiber

Initiative (GBI)'s Green Globes.

In its pursuit of EPDs, Greenfiber is working closely with Builders for Climate Action, the creators of the Building Emissions Accounting for Materials (BEAM) software, to understand the true impact of biogenic insulation. As it stands currently, the product category rules (PCR) for insulation in North America do not declare the product's carbon storage capability as a GWP-Bio or a Biogenic Carbon Removal from Product (BCRP).

This is problematic, as the PCR rules hinder builders at the specification stage from accurately determining the true impact of biogenic insulation. Greenfiber's commitment to changing this status quo is necessary and represents a step in the right direction for transparent and sustainable home building.





Guardian Glass

EPDs are an arrow in this company's quiver to fulfill its mission of stewardship.

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24%

Reduction in greenhouse gas emissions from 2018 to 2024

4

Number of products with an EPD in North America

BY VICTORIA MUHARSKY

Guardian Glass is dedicated to enhancing customer lives through sustainable product offerings and employs various strategies, including Environmental Product Declarations (EPDs), to fulfill its promise to customers and advance its environmental goals. Having EPDs boosts transparency and strengthens Guardian Glass' existing relationship with consumers.

Consumers are increasingly prioritizing products with lower carbon footprints, reduced water consumption, and increased recycled content, relying on EPDs as the gold standard to verify these attributes. Guardian Glass has embraced EPDs to reassure consumers that their preferences are understood. The company's commitment

to EPDs is particularly critical given the energy-intensive nature of the float glass sector. "By employing EPDs, Guardian Glass gains insights into 'hot spots' where inputs or outputs have the largest contribution to our cradle-to-gate embodied carbon value," explains Darlene Aldred, residential segment marketing director at Guardian Glass. "If there are discrepancies from one plant to another, we have the opportunity to understand them and evaluate what can be done to improve processes across plants."

Guardian Glass has enhanced its internal expertise in life cycle assessments (LCA) through the EPD documentation process. This has enabled the company to utilize more-detailed information for upstream raw materials and



Clearly focused. Guardian Glass products, with their lower embodied carbon totals, are a key component of the company's several Environmental Product Declarations (EPDs). COURTESY OF GUARDIAN GLASS

1970

Opening year of Guardian's first float glass plant

"Our vision is to help people improve their lives by providing products and services they value more highly than alternatives."

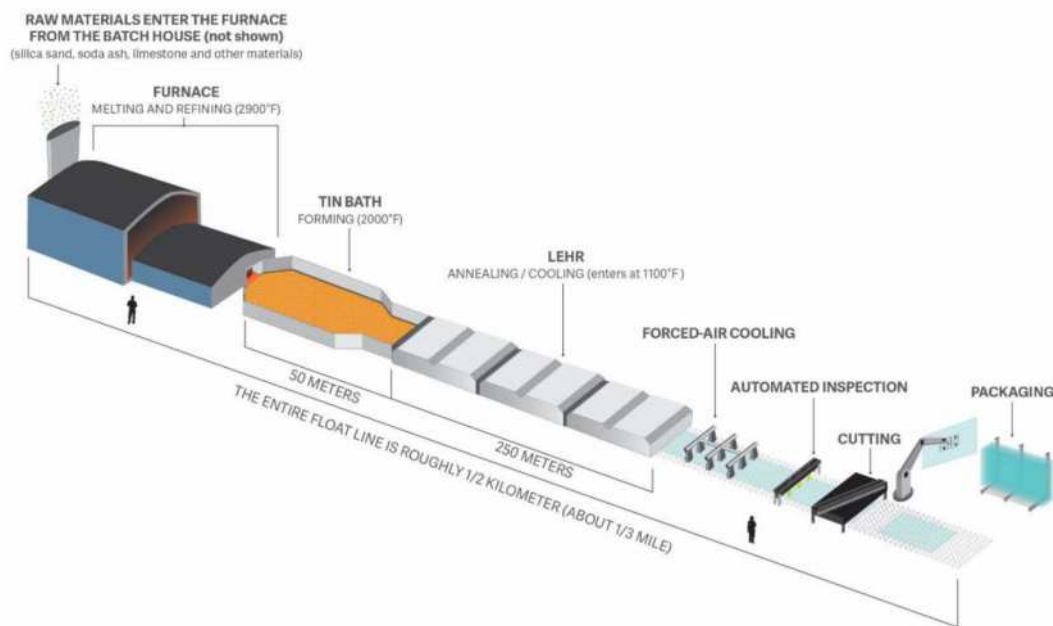
—Darlene Aldred, residential segment marketing director, Guardian Glass

integrate additional renewable energy sources into its operations. "We are constantly examining opportunities to further reduce the indirect and direct carbon emissions associated with the float glass production process, from selecting lower-carbon raw materials and increasing the use of glass cullet (broken or scrap glass)," Aldred says.

For example, recognizing that the energy efficiency of furnaces degrades over time, Guardian Glass implemented a cold tank repair (CTR) on half of its North American furnaces to improve their energy efficiency. With these manufacturing improvements, Guardian Glass was able to decrease the carbon footprint of its unprocessed flat glass by 24 percent from 2018 to 2024. This ensures that the product

meets the U.S. General Services Administration's (GSA) top 20 percent global warming potential (GWP) limits.

Guardian Glass further demonstrates its commitment to environmental stewardship and EPDs by providing life cycle data from seven of its North American float glass plants to help formulate the industry-wide EPD for float glass. This is in addition to the four product-specific EPDs covering its unprocessed flat glass and processed sputter-coated, wet-coated, and heat-treated glass. For customers having trouble navigating these EPDs and deciding which glass to use for their green building projects, Guardian Glass has Leadership in Energy and Environmental Design (LEED) Green Associates available to share their expertise.



EPD roadmap. An EPD requires data about a product's development, such as with Guardian Glass' heat-treated flat glass, developed in eight stages.

COURTESY OF GUARDIAN GLASS



James Hardie

With an EPD, this fiber cement maker's product quality goes hand-in-hand with transparency.

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94

Percentage of revenue derived from products with EPDs

50

Carbon reduction percentage goal by 2030

BY ALAN NADITZ

James Hardie Industries has no problem with its public image. On its website, the Dublin, Ireland-headquartered company proudly touts its position as “the world’s number one producer and marketer of high-performance fiber cement products.”

But when it came to demonstrating enviro-friendliness, James Hardie wanted the public and itself to have a clear view of exactly what it does to promote sustainability. So, enter the Environmental Product Declaration (EPD), a start-to-finish examination of how the company creates, markets and disposes of a product.

According to James Hardie Marketing Manager Will Shea, an EPD would help the company “understand the real environmental impact of our products, as compared with perception,” create a baseline to evaluate improvement in that environmental

impact over time, and create transparency with customers, homeowners, investors, and communities.

The company’s EPD for its fiber cement products, such as its *Hardie* lines, provides an opportunity to demonstrate a commitment to transparency, according to Shea. This includes communicating about the products’ full life cycle impact, such as the importance of recarbonation—a natural process where cement reacts with the air and reabsorbs carbon dioxide (CO₂) gradually over the life of the product.

Recarbonation is one place where James Hardie’s EPDs stand out from competitors’, Shea notes. Another is how the company opts to consider the environmental impact of a product during its entire lifetime—a.k.a., “Cradle-to-Grave”—versus the incomplete “Cradle-to-Gate” or “up until it’s ready for the consumer” approach taken by other manufacturers.



Impressive sight (and site). With an EPD, James Hardie is giving consumers a transparent look at its worldwide enviro-friendly efforts. COURTESY OF JAMES HARDIE INDUSTRIES



50

Life span, in years, of a James Hardie fiber cement product

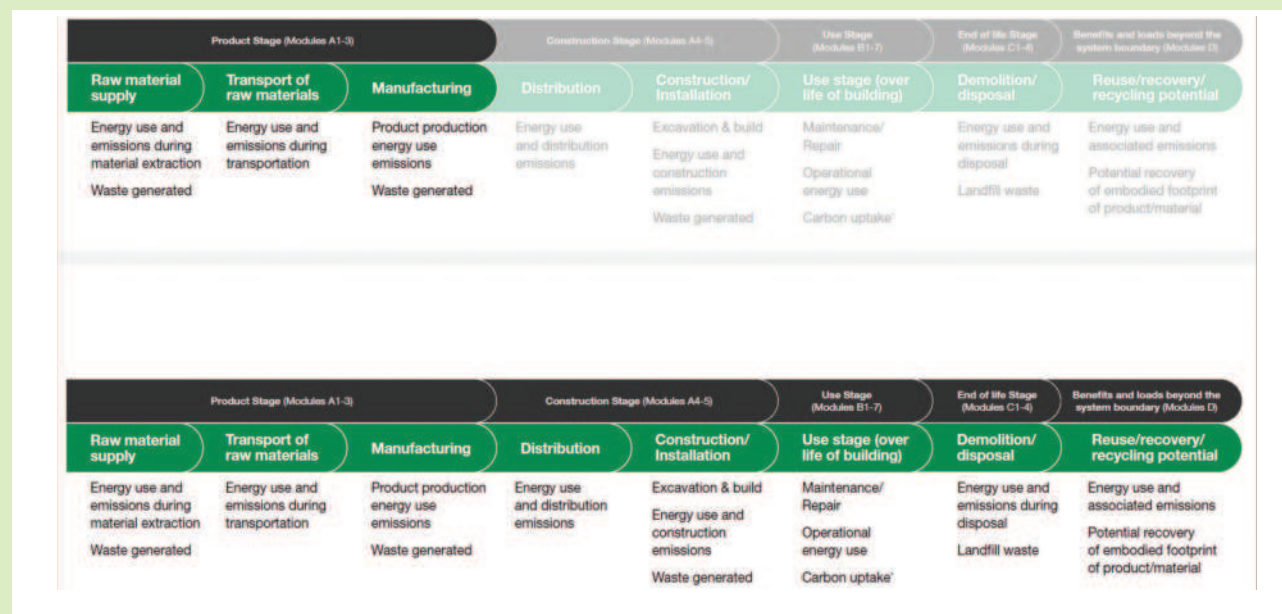
“Sustainability is not an endgame, it’s an evolution...a continuous journey that we call ‘A finish without end.’”

The EPD notes that "Cradle-to-Grave" is a more-complex, more-expensive life cycle assessment than "Cradle-to-Gate." But it's the best approach for evaluating a product's impact across its full life cycle. It's the most-efficient form of environmental information for making informed sustainability decisions, and it helps James Hardie customers contribute to environmental rating and certification schemes such as Leadership in Energy and Environmental Design (LEED). It's also a valuable marketing tool for the manufacturer and builders.

The results of the EPD led to the company's Low Carbon Cement Technology Roadmap, which was "developed and is being implemented as a result of understanding the full impact of our product, and the opportunity to drive that impact down," Shea notes.

Globally, the cement used to build dwellings such as a house or office building accounts for one-third of the structure's embodied carbon or greenhouse gas (GHG) emissions. James Hardie's roadmap charts the company's course to a 50 percent reduction in product-related CO₂ emissions by 2030 via development of a lower-carbon cement with better recarbonation, collaboration with other researchers, production trials, and extensive consumer education efforts, according to James Hardie's website. Thus far, the company is enroute to meeting a 15 percent reduction goal by fiscal year 2025.

"Our ultimate goal is to maintain leadership in the fiber cement industry and lead the future in a low carbon economy," the company notes. "We are committed to updating our roadmap as more data, insights and innovative technologies become available."



Production pathways. The "Cradle-to-Gate" form of an EPD includes only the first part of the "Cradle-to-Grave" variety, which covers the full spectrum of sustainable development. SOURCE: EPD INTERNATIONAL



LP Building Solutions

This leading building products maker leverages EPDs to validate carbon-negative claims and showcase its dedication to green solutions.

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Number of LP products with an EPD

10% more

What homeowners will pay for EPD-supported products

BY VICTORIA MUHARSKY

Everyone has to start somewhere, and that's especially true for monitoring progress on sustainability initiatives. LP Building Solutions has conducted a life cycle assessment (LCA) on eight of its products to evaluate their environmental impact and obtain Environmental Product Declarations (EPDs) that attest to the environmental footprint of these products.

Notably, LP recently completed EPDs for nearly all of its *Structural Solutions* products. These EPDs show carbon negativity for all five evaluated products, which together represented 92 percent of LP's *Structural Solutions* net sales in North America in 2023 (excluding *LP LongLength* and *LongLength XL OSB Sheathing*).

LCA and EPD, serving as a baseline metric, provide transparency into the environmental footprint of the products across their full manufacturing value chain, from raw materials to product end-of-life.

The company focused its efforts on selecting more sustainable raw materials, such as sourcing wood fibers certified by the Sustainable Forestry Initiative (SFI). This initiative minimizes manufacturing waste by ensuring that 99 percent of wood fibers are incorporated into products or used as an alternative thermal energy source to reduce fossil fuel consumption.

EPDs showcase the environmental footprint of LP's supply chain and manufacturing processes, ensuring the delivery of a sustainable, high-quality, and durable product that aligns with the company's "Building a Better World" initiative and helps it meet its ESG initiatives.



Positive negativity. EPDs for LP's *Structural Solutions* products show carbon negativity as of 2023. The product line represents 92 percent of LP's *Structural Solutions* net sales in North America. COURTESY OF LP BUILDING SOLUTIONS

80

Percentage of renewably sourced thermal energy used in product manufacturing

In 2022, LP was awarded the SFI President’s Award in recognition of its commitment to leading the forest community on important issues related to sustainability, education and collaboration.

LP extensively communicates the existence of its EPDs for their carbon-negative sheathing and siding products—one of the only product lines of its kind on the market—to showcase its commitment to sustainable innovation.

For example, over the lifetime of *LP SmartSide Trim & Siding*, it can store up to 10 times more carbon than fiber cement siding options.

Undergoing the rigorous third-party attestation process by ASTM International for EPD documentation—a lengthy and difficult process—set LP up for success by allowing the company

“Our ESG priorities align with our short- and long-term business strategies, enabling us to continue to innovate, lead and deliver on our purpose.”

—Brad Southern, CEO, LP Corp.

and others to assess and compare the environmental impact of LP products in line with internationally recognized standards, including ISO standards.

LP recently expanded its greenhouse gas (GHG) inventory for 2020-23 to include Scope 3 emissions in addition to Scope 1 and 2, data which will be released later this year.

Expanding to include Scope 3 emissions is monumental, as they typically account for about 75 percent of a company’s total emissions, enabling LP to more accurately assess its environmental footprint.

While EPDs may seem useful only at the product level to some, LP has shown that it can spark larger conversations about acquiring the necessary environmental data to develop robust strategies and continue optimizing the manufacturing process.

OUR CLIMATE RISK INTEGRATION ROADMAP				
	2021	2022	2023	
Strengthen board and management oversight of climate-related risks and opportunities.	✓	✓	➡	Completed
Continue to hold informational sessions with board to build on climate strategy and best practices.	✓	✓	➡	Completed
Define climate-related risks and opportunities across different scenarios.	✓			Completed
Identify the impact of climate-related risks and opportunities on the business.	✓	✓	➡	Completed
Develop strategies and processes to build resiliency and manage climate-related risks and opportunities.		⚙️	➡	Ongoing
Develop specific indicators to support investment in climate strategy actions.		⚙️	➡	Ongoing
Integrate climate-related risk into enterprise risk management framework and process.		⚙️	➡	Ongoing
Disclose Scope 1 and 2 GHG emissions.	✓	✓	➡	Completed
Disclose Scope 3 GHG emissions.	⚙️	⚙️	➡	Ongoing
Develop a GHG target and decarbonization plan.		⚙️	➡	Ongoing
Develop metrics and targets to manage climate-related risks and opportunities.			⚙️	Ongoing

Building resilience. LP is well underway with its Climate Risk Integration Roadmap, a series of actions designed to help the company respond to climate change. SOURCE: LP



Mohawk Industries

EPDs get a thumbs-up from this flooring giant. The best benefits for everyone are yet to come.

STATS

26

Number of Mohawk Industries products with an EPD

30%

Waste-to-landfill intensity reduction goal for 2025

BY ALAN NADITZ

While many companies are experiencing the highs and lows of implementing Environmental Product Declarations (EPDs), Mohawk Industries is in the “wait and see” mode. The Calhoun, Georgia-based flooring manufacturer has 26 active residential and commercial EPDs designed to provide transparency between supplier, manufacturer and customer in terms of how environmentally correct Mohawk products are.

“EPDs have been required by many of our commercial Architecture and Design clients for many years,” notes Matt Redding, Mohawk’s residential sustainability marketing manager. “We continue to see an increased desire for transparency among residential customers. The obvious choice for pursuing EPDs for these products was their ability to span both residential and commercial businesses.”

The benefits of EPDs are numerous. Redding notes that EPDs can drive positive changes in product development and company practices by promoting sustainability, enhancing competitiveness, optimizing supply chains, ensuring regulatory compliance, and fostering stakeholder engagement.

But there’s still a lot to learn. Thus far, Mohawk has uncovered ways to positively impact their products’ carbon footprints, and it recognizes a need to implement better end-of-life solutions for products.

Thanks to strong market messaging, customer knowledge of the EPD management process is solid. According to Redding, once a buyer has identified potential products or materials for purchase, they may request EPDs from suppliers or manufacturers as part of the procurement process. During the vetting



Wait and see. Mohawk Industries has more than two dozen Environmental Product Declarations (EPDs) in place that are performing well. Time will tell how much the company and its customers will benefit overall. COURTESY OF MOHAWK INDUSTRIES



More than aesthetics. Mohawk Group’s *ReWilded Refuge*, a carpet tile collection inspired by the restoration of ecosystems within urban environments, encourages people to think about sustainability—just like an EPD. COURTESY OF MOHAWK GROUP

90%-plus

The minimum amount of recycled material used in most tile, wood panel and flooring products

process, purchasers may compare EPDs from different suppliers or products to assess their environmental impacts and sustainability credentials. “This evaluation helps inform purchasing decisions, allowing buyers to select products that align with their sustainability goals and criteria,” he notes.

Other points, such as customer response, are less clear. “The EPDs are too new to determine, but we don’t expect an EPD will directly influence the buying decision of consumers,” Redding says. “The documents are far too extensive and technical for the average consumer and the benefits are lost. The impacts are more directly related to product development and continual improvement, which ultimately will result in better, more refined products that have a lower environmental impact.”

“EPDs can drive positive changes in product development and company practices by promoting sustainability, enhancing competitiveness, optimizing supply chains, ensuring regulatory compliance, and fostering stakeholder engagement.”

—Matt Redding, residential sustainability marketing manager, Mohawk Industries

But EPDs do have a direct impact on increased purchase intent for commercial products, he adds.

While Mohawk is generally satisfied with the value of EPDs within its organization, the company offers a caveat: Get more than one opinion or evaluation. “While EPDs are a fantastic tool to get a thorough look at a product’s environmental impact, there are elements of a product’s overall sustainability lacking,” Redding notes. “It is important to look at a diverse array of certifications for products to better give a holistic view of a product’s impact.”

In addition to EPDs, Mohawk uses Health Product Declarations, Declare Labels, Indoor Air Quality certifications and more. “These certifications often provide easier-to-read and easier-to-understand benefits for consumers,” Redding says.





Tarkett

For this flooring surfaces innovator, transparency is the name of the EPD game.

STATS

47%

Tarkett's global CO₂ emission reductions since 2019

30%

Minimum amount of recycled materials expected to be in Tarkett products by 2030

BY ALAN NADITZ

Ask sustainable flooring manufacturer Tarkett about the importance of Environmental Product Declarations (EPDs), and it offers a very straightforward answer: Everyone should be able to clearly see and understand exactly what goes into the products they choose and the impact such materials have.

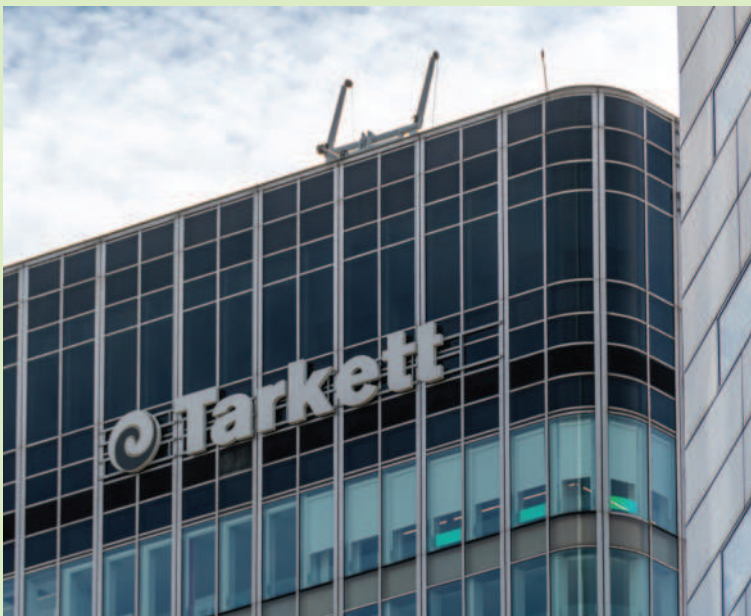
The company uses EPDs to accumulate data about the environmental impacts of its products. It then shares that data freely via all customer-facing media: its website, product brochures, and third-party specification sites such as Ecomedes, the Materials portal, and Material Bank.

Tarkett also promotes the existence of EPDs within its *Floorprint* documents. "Tarkett developed *Floorprint* to provide

a holistic view of each of our products," notes Roxane Spears, vice president of sustainability for Tarkett North America. "It shows how each flooring selection contributes to the health and well-being of people and the environment, while taking action to combat climate change."

Floorprint also lists each certification of a product and all transparency documents available—including EPDs. It also dedicates a page to illustrating the complete life cycle impacts of the product. "EPDs are dense, technical documents," Spears notes. "Clearly illustrating the lifecycle and carbon impacts at each stage of the product life makes it easy for our customers to find and comprehend the information."

It can also help clear up misperceptions that suppliers,



Warm up. Tarkett uses EPDs to gather important information on the environmental impact of its products, especially their embodied carbon potential. CREDIT: ISTOCK/HJBC

18%

Minimum amount of recycled materials in Tarkett products today

“We’re not ones to settle for ‘good enough’. We’re always on the lookout for ways to optimize our existing materials or switch them out for even better alternatives, because we believe we can always do better.”

manufacturers and customers have about EPDs. For manufacturers like Tarkett, who are investing in a holistic approach to reducing the carbon impacts of their products, an EPD can serve to spotlight areas within a particular product that could be contributing significantly to its carbon footprint. But EPDs were not intended to be a tool for comparison; they were meant to assist manufacturers in their efforts to isolate areas within the manufacturing process for optimization, according to Spears.

There is also confusion over a product’s end-of-life calculation. “The EPD metric is intended to give a view of the full life cycle of a product, but the end-of-life is assumed to be landfill or incineration,” Spears notes. “We hope that data regarding end-of-life solutions like recycling will be made more widely available so that it can be incorporated into the EPD. This would

capture and measure the positive carbon impacts that result when we keep materials in use, giving us a better representation of a product’s true impact.”

The industry is currently using EPDs primarily to identify the global warming potential (GWP) or embodied carbon of a product. “However, there’s so much more information to be mined from these documents,” she notes. “GWP is only scratching the surface.”

From a manufacturer’s perspective, “EPDs are a great starting point for determining which levers we can pull to reduce the impacts of our product,” Spears adds. “We can see what factors are having the most influence on the metrics, and prioritize our projects around those to reduce the impact of the particular product.”



Following the path. An Environmental Product Declaration (EPD) tracks a product’s life cycle, from materials extraction to waste disposal and, hopefully, reuse or recycling. SOURCE: TARKETT



GF Building Flow Solutions Americas (formerly Uponor)

The plumbing, heating and cooling giant aims to make EPDs the industry norm, ensuring consumers have access to valuable third-party validated documentation.

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90

Planned percentage of the product portfolio with EPDs by 2027

45

Number of EPDs published thus far

BY VICTORIA MUHARSKY

In an industry where Environmental Product Declarations (EPDs) are rare, GF Building Flow Solutions Americas (formerly Uponor) is boldly setting a new standard, striving to make them the norm. GF Building Flow Solutions Americas has committed to an ambitious goal: achieving EPD coverage for 90 percent of its product sales portfolio by 2027 and for its entire range by 2030. With an anticipated 60 percent of its global portfolio of sales covered by EPDs by the end of this year, the company has already made significant progress towards its goal.

As more forward-thinking construction companies require EPD documentation for mechanical, electrical and plumbing (MEP) products in order to meet environmental criteria for green building program credits, it becomes crucial for companies like

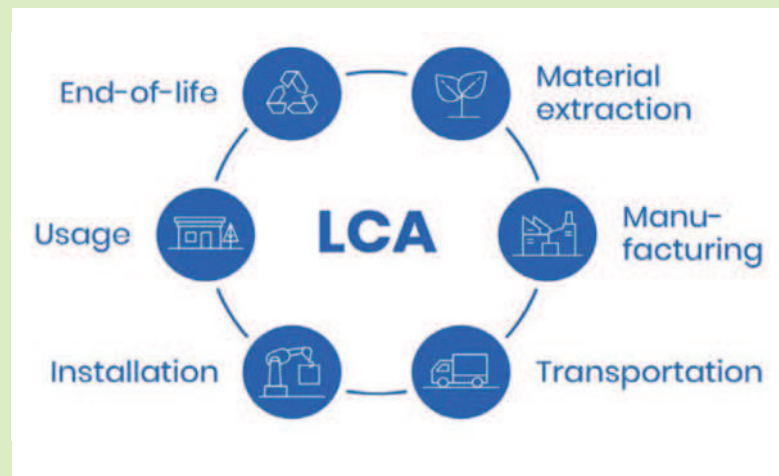
GF Building Flow Solutions Americas to enhance EPD coverage across its product range.

“The publication of EPDs is a critical component of our sustainability commitments, offering our customers data to unlock the capacity to not only make informed material choices, but also document and communicate their intentional impacts,” says Chrissie Walsh, sustainability manager at GF Building Flow Solutions Americas.

By offering a large selection of products with EPD coverage, GF Building Flow Solutions Americas provides customers with more flexibility to select the MEP product that best fits their project’s environmental needs. Customers can easily find EPD information on the company’s or One Click LCA’s website. In addition, GF Building Flow Solutions Americas offers in-person



Progressive partnership. The joining of Uponor with GF Building Flow Solutions Americas will mean more Environmental Product Declarations (EPDs) to help calculate the impacts of construction projects and reduce the CO₂ footprint of buildings. COURTESY OF GF BUILDING FLOW SOLUTIONS AMERICAS/UPONOR



Life cycle exam. The EPD uses life cycle assessment (LCA) to comprehensively evaluate a product’s environmental impact along its entire life cycle. COURTESY OF UPONOR

98%

How close the company is to using all-renewable energy for product manufacturing

presentations to clients to educate them about EPDs and their purpose.

Education is central to GF Building Flow Solutions Americas' strategy, ensuring customers and the wider industry understand EPDs to drive adoption and awareness. For instance, while many recognize the transparency and data benefits of EPDs, they may not fully grasp how EPDs contribute to a manufacturer's innovation process. This lack of understanding extends to external supply chain partners.

GF Building Flow Solutions Americas collaborates closely with external partners to help them understand their role in the EPD development process. This involves guiding them in identifying and implementing small yet impactful improvements, such as selecting sustainable materials and optimizing manufacturing

"We've had to develop a team-based mindset in tackling new challenges, including educating external partners in their role for EPD development and our own internal teams on why we're committed to the task."

—Chrissy Walsh, sustainability manager, GF Building Flow Solutions Americas

processes for greater energy efficiency. By doing so, GF Building Flow Solutions Americas helps move the industry forward in adopting sustainability best practices.

Internally, the company regularly hosts organization-wide meetings to ensure alignment on sustainability initiatives like EPD expansion and to help everyone understand the reasons behind the company's sustainability commitments. This approach embeds sustainability as a key decision-making factor across all levels of the organization, from hourly employees to C-suite executives.

By prioritizing sustainability through the expansion of EPDs, GF Building Flow Solutions Americas can pinpoint inefficiencies in the manufacturing process and make necessary adjustments. As a result, they are now 98 percent of the way to using 100 percent renewable energy, and 83 percent of the way to using recycled process waste—far ahead of its 2027 goals.

The logo for Uponor, featuring the word "uponor" in a bold, blue, lowercase sans-serif font.The logo for GF Building Flow Solutions, featuring a large blue "GF" with a plus sign on either side.

Honorable Mentions

These companies just missed the final cut, but still deserve applause for their eco-leadership actions.

LG Electronics

This company is actively pursuing Environmental Product Declarations (EPDs) to fast-track its Environmental, Social and Governance (ESG) strategy and achieve net-zero emissions across all scopes by 2030.

Having EPDs enables LG to optimize its manufacturing processes and deliver on the three tenets of its ESG strategy: carbon neutrality, circularity and clean technology. For example, LG has identified that the product use stage accounts for 80 percent of its total emissions. As a result, it has implemented highly efficient eco-friendly technologies to reduce those emissions.

Building on this approach, LG has already secured multiple EPDs for its refrigerator and air purifier product lines, with plans to further expand its EPD library. This focus on EPDs is part of a long-standing commitment, as the company has been conducting life cycle assessments (LCAs)—a key component of EPDs—on its products since 1995.



YKK AP America, Inc.

This is the first facade manufacturer to voluntarily provide third-party verified Environmental Product Declarations (EPDs) for all its products. With more than 75 EPD-backed products spanning seven product categories, YKK AP America's dedication to fostering EPD adoption and promoting transparency is undeniably impressive.

The company is committed to supporting suppliers on their EPD journey and collaborating with industry partners to increase EPD visibility. For example, YKK AP America partnered with cove.tool to upload its products, facilitating earlier engagement with design teams during the product selection process.

YKK AP America's adoption of EPDs aligns with its broader sustainability strategy, "Evolution 2030," which aims to optimize manufacturing processes to achieve zero waste and reduce carbon emissions, among other environmental initiatives. The company aims to reduce its Scope 1 and 2 carbon emissions by 80 percent by 2030 and 100 percent by 2040 while also making progress against Scope 3 emissions.

EPDs offer a natural path to achieve these ambitious goals by enabling YKK AP America to identify inefficiencies and make improvements. For example, the company procured lower-carbon aluminum as a direct result of insights provided by EPDs. **GB**

Oldcastle APG

As a major manufacturer in the outdoor construction products industry—specializing in mortar, concrete and grout—Oldcastle APG has a wide customer base, and those customers have a definite desire to know how those products are made. At the same time, the company likes to keep tabs on where and from whom its raw materials are coming. This makes EPDs almost second nature to the Atlanta-based company.

According to Jamie Douthit, Oldcastle's sustainability analyst, the company is updating EPDs across its footprint. Oldcastle has published 18 masonry and 2 dry mix EPDs, and has a tool that allows generation of masonry EPDs as needed.

"We have decided to pursue obtaining EPDs for our North American footprint because we value data transparency and believe that it is an important factor in helping to drive sustainability goals and initiatives—both internally and also for our customers," Douthit notes. "We aim to be a market leader with the top-quality products that we offer, and we understand that EPDs play a key part in that."

Having EPDs has helped Oldcastle select the best mix designs and raw materials for its products and find inefficiencies in its production facilities, Douthit adds.



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**Moving
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NATURAL AFFI

BY MICHELE LERNER

“To really understand a site, you need to listen,” notes Alan Barley, co-owner of Barley|Pfeiffer Architecture in Austin, Texas. He and Peter Pfeiffer are well-known for their decades-long commitment to sustainability and climate-resilient design. “We look for places where the land can work for us and where it could work against us,” Barley adds.

The idea of considering nature above all else stems from Age of Enlightenment philosophers such as Francis Bacon and Jean-Jacques Rousseau, who believed that humans should study nature to investigate it and harmonize with it. Rousseau promoted the virtues of a simpler life lived closer to nature. It’s no accident that Pfeiffer and team make a big deal about this “preconstruction” phase of our latest Green Builder VISION House partnership.

“When we approach a piece of property, we focus on listening to the site, to feel and see for ourselves the natural existing topography, where the sun comes up and sets, the views from different parts of the land, which way the breezes blow, the types of trees that thrive there and even the pattern of wildlife pathways through it.”

—Alan Barley, co-owner,
Barley|Pfeiffer Architecture

NITY

As the VISION House® Austin takes shape, the design team reveals an ‘enlightened’ perspective on the human-nature interface.



Construction guidelines. VISION House Austin is being designed relative to what parts of the home are being used when, to compensate for elements such as high summer temperature or cooling area breezes.

CREDIT: SERGIO FLORES

Today, architects and builders can take lessons from those 17th and 18th century philosophers about how understanding nature can inform design. Building a sustainable home that stands up to the increasingly extreme weather conditions in Austin—or anywhere else, for that matter—requires much more than a quick infusion of extra insulation and some energy efficient appliances. Studying the landscape provides a foundation for a design that can prevent solar heat gain, which in turn means less reliance on mechanical solutions to cope with high temperatures.

“Everything we do is site specific in terms of design, even when we build a spec home,” says Pfeiffer. “It’s fundamental to the way we design to respond to the site and to feel the breezes to decide things such as which way the windows should face and the placement of various rooms.”

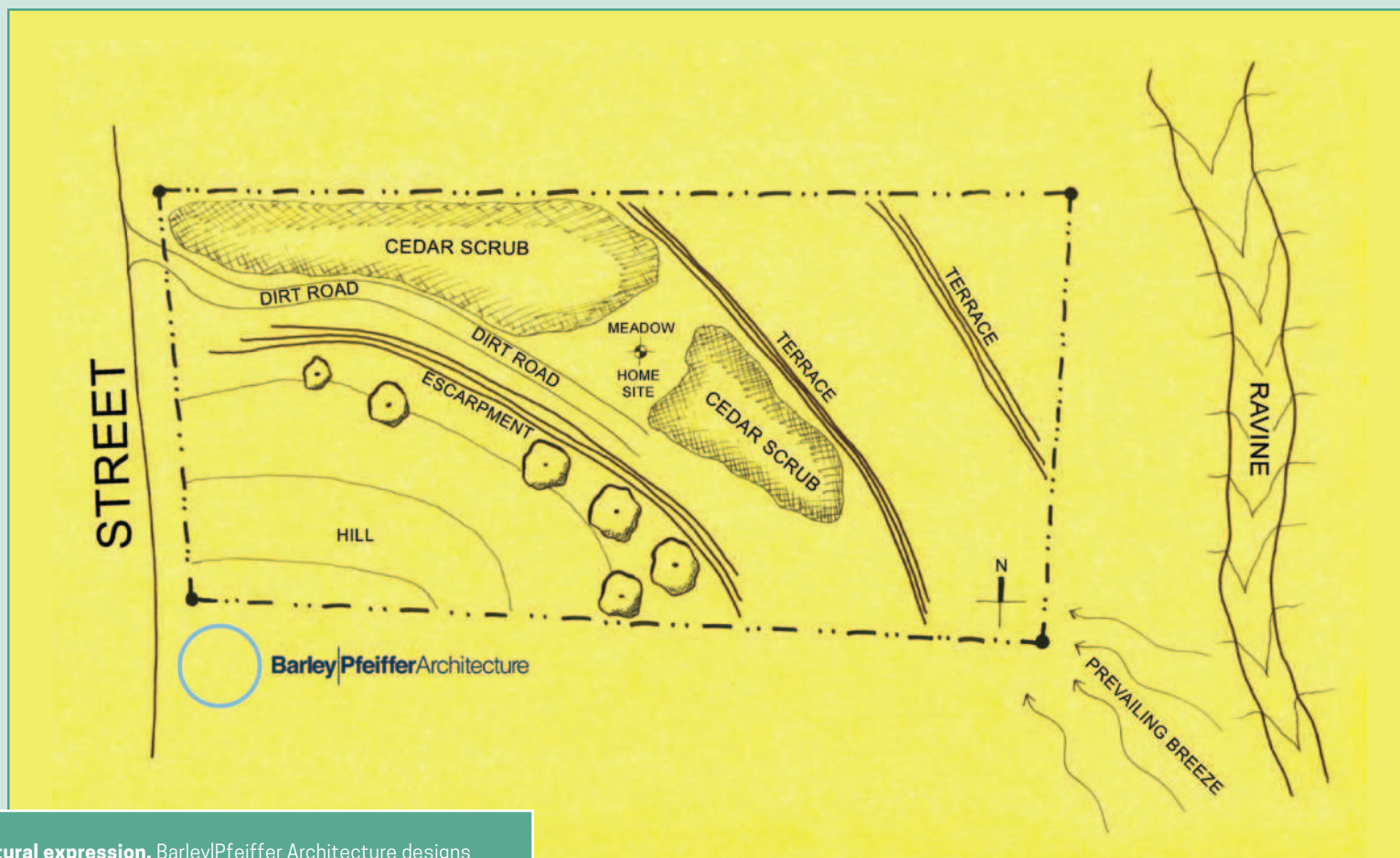
Pfeiffer and Barley take that philosophy to new levels at the VISION House Austin, built in partnership with Green Builder Media for homeowners Robert and Judi George. The Georges chose to build their

custom home on a two-acre site adjacent to their current home because of their deep appreciation for their Hill Country neighborhood outside Austin. “From this location we can see five or six miles of views of rolling hills,” says Robert. “The new site has an even better view because there are fewer trees obstructing the vista.”

The Georges’ goals for their house are to improve their ability to age in place with a low maintenance, highly resilient, net zero energy sustainable home. To achieve that goal, Barley and Pfeiffer started as they always do: by walking the empty land to listen to nature.

ARCHITECTURAL PHILOSOPHY LEADS TO RESILIENT DESIGN

For Enlightenment philosophers, the pursuit of empirical knowledge included the study of nature and the way flora and fauna adapt to their surroundings.



Natural expression. Barley|Pfeiffer Architecture designs homes environmentally tailored to each site, taking cues from the site and the region. MAP COURTESY OF BARLEY|PFEIFFER ARCHITECTURE

“When we approach a piece of property, we focus on listening to the site, to feel and see for ourselves the natural existing topography, where the sun comes up and sets, the views from different parts of the land, which way the breezes blow, the types of trees that thrive there and even the pattern of wildlife pathways through it,” Barley says.

Pfeiffer’s and Barley’s approach not only echoes Enlightenment empirical nature studies, but it also relies on the historical context of how people built sustainable, livable houses in the Texas heat long before electricity and air conditioning existed.

“We’re taking our cue from people who built their own houses when they moved into this region in the 1800s,” Barley says. “They knew how to site the house and they knew that they needed to have a windbreak from winds coming from the Northwest. They knew to separate their kitchen from the main house because they realized that cooking heated up the house.”

At that time, people built “dog run style” houses with the kitchen and living areas on either side of a breezeway to allow fresh air to flow, Barley says. They also needed to look for water because they grew their own food and kept animals on their property.

“Studying animals and their behavior on a site can be useful, because animals naturally gravitate to places that feel safe and comfortable,” Barley says. “Each site is a microcosm of habitats for all sorts of creatures, and you can learn from that.”

The architects’ goal is to solve problems for their clients and help them realize their vision, not the vision of Barley and Pfeiffer. “You have the needs of the site and the needs of the client,” Barley says. “You need to listen to the site – it will tell you where it wants to have a house put on it. We listen to what those two entities say and figure out the best way they can go together.”

Barley and Pfeiffer design homes organically for each site. “If the clients don’t have any particular ideas about design, then we begin to take cues from the site and the region,” Pfeiffer says. “We look for ideas that will give more connectivity and meaning to the site.”

For instance, on a flat rocky site, they might design a house that could hug closer to the ground and use materials related to the site such as limestone, Barley says.

“We concentrate on melding the clients’ dreams with the climate and the setting,” Pfeiffer says. “We place a priority on climate-responsive design.”

Combining climate-responsive and client-responsive design means, for example, listening when a client says they want to wake up to sunlight, Barley says. That means placing the primary bedroom on the east side of the house.

“When a client says they like to sit outside in the shade, that tells us where we need to think about placing outdoor living space,” he says. “This is how we figure out where each piece of the puzzle needs to be placed.”



New direction. Architects Peter L. Pfeiffer (left) and Alan K. Barley (right) discuss sustainability plans for a new house with owners Judi and Robert George (center). CREDIT: SERGIO FLORES

LISTENING TO THE VISION HOUSE AUSTIN SITE

At the VISION House Austin, Pfeiffer and Barley paid close attention to breezes and sun patterns that could passively cool the house.

“This was one of these sites that confused you because if you look at a map you would expect the breezes to be coming through from the Gulf of Mexico,” Pfeiffer says. “But because of the topography, the breezes came up the hill more. That’s responding to the microclimate—the specific factors of that specific site that might catch you by surprise.”

The breezes that flow along the south ridge of the Austin site helped Pfeiffer and Barley decide to design a screened-in porch on the southeast corner of the house.

“When we laid out the house, we responded to the fact that the afternoon sun is just a killer here—it was 100 degrees in May—so you need to think about shading that glass,” Pfeiffer says. “Before you do that, you need to think about what spaces you’ll occupy during the day. In this location, we wanted the common spaces that will be used most on the southeastern and eastern side of the house. It’s not just a matter of shading the glass, it’s also placing certain rooms in the house so they’re not being blasted by the hot sun.”

Rooms that are less likely to be used in the afternoon, such as the guest bedroom and bathroom, are on the opposite side of the house.

“We designed the house with the shorter sides on the east and west to limit the physical exposure on the west—the less exposure you have to the sun, the less the house gets heated by the western afternoon sun,” Barley says. “We maximized the northern exposure to reflect the sun and for less solar heat gain, then shaded the south side.”

The best views from this house are to the north, which also made it easier to orient rooms in that direction. In addition, functional rooms that don’t need a view, such as garages and carports, can be sited on the side of the house that doesn’t have a view.

“The thing that a lot of builders get wrong is that they focus on capturing a view, which sometimes ends up with a lot of western exposure,” Barley says. “Then they have to compensate for all that additional heat building up with larger air conditioning systems.”

As the Enlightenment philosophers knew, humans can learn a lot from nature through careful contemplation and thoughtful responses. **GB**



FIREWISE SITING TECHNIQUES

The combination of extremely long stretches of high heat and dry vegetation in Texas contributes to the danger that the volume and intensity of wildfires will continue to increase in Hill Country and elsewhere in the state.

“The first thing we noticed is the stray brush around the site, which we will get rid of because that’s ideal fuel for a wildfire,” Barley says. “We try to control grassy surfaces around the house and landscape it to be fire resistant. We also site the house for easy access for firefighters.”

A cut had already been made on the VISION House Austin site that can be used to connect to the main road for easier access for first responders.

In addition, construction materials can improve a home’s resilience to fire. The VISION House Austin will have a lightweight metal roof with a heat barrier underneath and cementitious siding that are fire resistant.

“One of the houses we designed in a nearby subdivision was one of the few that was still standing after a fire because it has a metal roof and a mostly corrugated metal exterior,” Barley says.

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CREDIT: MARTA SHER

THE PATH TO ZERO-CARBON LIVING

Provide the next generation of home buyers with the tools and knowledge to lower their carbon footprint, and you'll win their business and their respect.

BY MICHELE LERNER

Younger homebuyers tend to take their environmental impacts seriously. Our surveys and focus groups suggest that when people in their 20s, 30s or even 40s (the latter end of the Millennial generation) build or buy a home, they're especially open to choices that can reduce their CO₂ contribution.

To reach them, you'll need to understand their world view. Most of them are well aware that on a per capita basis, the U.S. has one of the world's highest rates of carbon emissions. Millennials perceive this pollution inequity as something they would like to change, given the tools to do so. Globally, the average carbon footprint per person is about 4 tons per year, according to the [Nature Conservancy](#), a global environmental organization headquartered in Arlington, Va. We're a huge part of that total: In the U.S., the average carbon footprint for an individual is 16 tons, the association notes.

The global consensus is that this level of CO₂ pollution is unsustainable. The latest extreme weather events worldwide reinforce this conclusion. According to the [Nature Conservancy](#), the average global carbon footprint for individuals needs to decrease to *less than two tons* by 2050 in order to avoid a 2 degree rise in global temperatures (80 percent of climate scientists, in a recent survey, believe we won't be able to avoid a 2.5 degree rise at this point). Achieving the less-than-2 ton output will require reducing per capita carbon pollution to one-eighth of its current rate. This shocking goalpost is daunting, even to younger homebuyers, but offering them housing that gets them much of the way there has instant appeal.

A PLACE TO START

An easy way to begin any net-zero conversation with a client is with a self diagnosis. Several carbon footprint calculators are available [online](#) to help clients conduct a carbon footprint "weight check"

first and estimate how much they contribute to greenhouse gas emissions. Options include the [Earth Hero](#) app, the [Klima](#) app and the [Commons](#) app.



CO₂ weight check. Online carbon footprint calculators, such as these from Earth Hero, Klima and Commons, can help clients estimate how much they contribute to greenhouse gas emissions.

Most of these apps and algorithms will offer suggestions of how to lower carbon emissions, such as riding a bike instead of driving, adjusting a home thermostat, or installing solar panels. (Note how building science and home life have a role in nearly all of the “big ticket” pollution sources.) Whether it’s a home’s location, siting, type of HVAC, or insulation level, it’s all going to affect the buyer’s long-term CO₂ trail.

FROM PRINCIPLES TO PRODUCTS

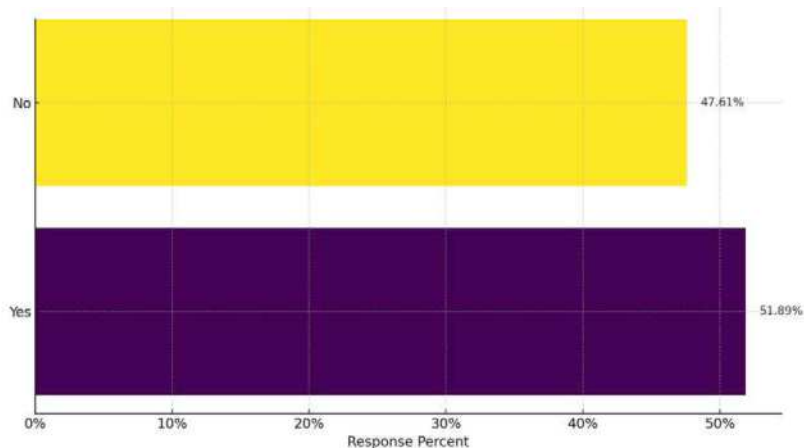
It’s sometimes best to approach emissions reduction in homes from a hands-on or “cause and effect” perspective. Rather than jump right in and suggest an upgrade to an 18 SEER HVAC system, for instance, talk about the impact of some specific behaviors at home that affect CO₂ emissions:

- **Present heating and cooling scenarios.** For example, explain how in most existing homes, lowering the temperature by 8 degrees in winter can save about 0.17 tons of carbon emissions annually. Increasing the temperature (to reduce cooling) by that same amount in summer can save about 0.21 tons of carbon emissions. Then, you can expand the conversations into how much larger that reduction can be with high efficiency heat pumps and better insulation.
- **Compare Old versus New tech.** Note, for instance, how ENERGY STAR refrigerators save about 0.5 tons of carbon emissions annually over old models, and the most modern ones are even better. [Whirlpool’s SlimTech Insulation Technology](#), for example, makes refrigerators up to 50 percent more energy efficient. The

vacuum-insulated structure technology is a step up from traditional polyurethane foam insulation because it reduces thermal conductivity. Temperature swings from door openings are less volatile, because the insulation allows for e-cooling that is up to 30 percent faster.

- **Connect CO₂ to real life.** As one example, a homeowner who does 100 loads of laundry per year can [save 500 pounds of carbon emissions annually by using cold water instead of heated water](#) (according to [ColdWaterSaves.org](#)). You can use facts like these to show how behavior matters, then segue into the fact that technology does, too. The combination of Energy Star dishwashers and clothes washers with low-flow faucets and shower heads results in a direct reduction in CO₂ pollution. Prospective buyers can take those savings even further if they opt for hybrid heat pump water heaters instead of conventional products.
- **Encourage alternative power.** Transferring electricity purchases to a 100 percent green energy provider can save 3.76 tons of carbon emissions annually for a 1,300-square-foot home (depending on average electricity usage). Solar panel installation, particularly on all-electric homes, cuts fossil fuels out of day-to-day energy for the house and shifts pollution away from any electric vehicles that are tapping inefficient grid energy.
- **Conscious waste management.** Most homes generate 0.5 cubic yards of waste each week. If the buyers can reduce that by half, they cut a full ton of CO₂ pollution from their portfolio. One way builders can assist this is to provide for food waste composting and recycling systems in the home. Of course, much of this waste depends on the buyer’s buy-in. They have to actively seek out lighter packaging and shop more carefully. Approximately 30 percent of food in the U.S. is wasted. But many new refrigerators include [better food storage](#) options, such as crisper drawers for fruits and vegetables that reduce food waste.

DO YOU CHOOSE APPLIANCES BASED ON ENERGY USE?



New awareness. Although they are just getting started, younger generations show a greater interest in whether appliances they buy are energy efficient. Thus far, more than half say “yes.” SOURCE: COGNITION SMART DATA

- **Zoom in on transportation.** No matter how well a home performs, commuting in a car or flying in airplanes can blow up the owner's efforts to cut back on emissions. Many new homeowners are well intentioned, but not fully informed. For example, in our research, "driving an EV" comes up very high on the list of actions young buyers are taking to reduce CO₂ pollution. They're aware that getting around is a big carbon creator. But they may not realize that electric vehicle (EV) travel comes with certain caveats. It's not an automatic CO₂ reducer.

An EV purchase is also probably not the most important behavior choice a buyer can make. Where they build, how they work and how frequently they venture out typically have the largest impacts.

- **Building close to things.** If your client has flexibility in where to build, the site location matters immensely in the CO₂ game. Talking about bike paths and mass transit is pointless if the location for the home has no bike-friendly infrastructure or bus routes. Keep the daily commute close to work, grocery stores, and other destinations and the CO₂ impact drops dramatically. If you can't convince them with an eco-conscious angle, talk about quality of life. It reduces CO₂ from travel, and it gives back precious time in their day.
- **Switching from a gas guzzler.** Driving an SUV 10,000 miles per year that gets 22 miles per gallon is an inefficient, polluting way to get around. Simply by switching to a sedan that gets 32 miles per gallon, the buyer will cut 2.19 tons of greenhouse gas emissions annually. In other words, even if a client is not ready to drive an EV, they can make simple changes in their vehicle type and achieve a major cutback on CO₂.



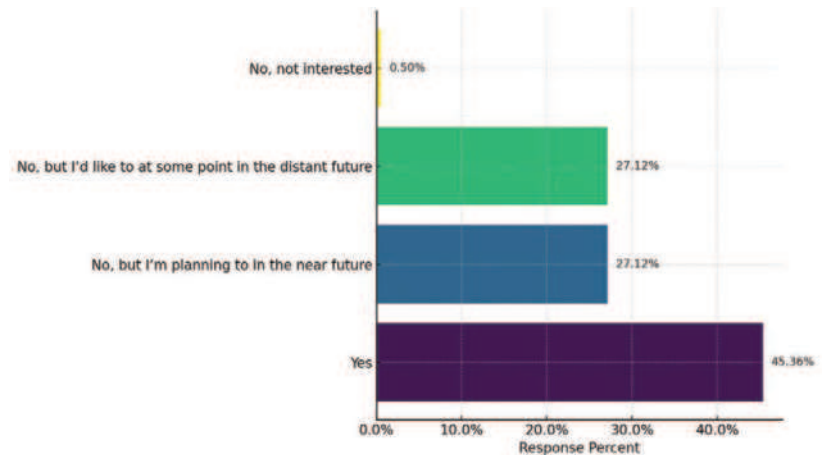
SUV vs. sedan. Switching to a more-efficient vehicle, even one powered by fossil fuels, results in major CO₂ reduction for most owners.

SOURCE: EVOX IMAGES

- **Buying an electric vehicle.** On the other hand, trading in that 22-mile-per-gallon SUV for an electric vehicle could save nearly 7 tons of greenhouse gas emissions annually. This halo effect is a bit overstated, however. Because there's so much pollution created in battery manufacturing for these vehicles, one [Harvard study](#) has suggested the cars may not achieve any CO₂ reduction until they have been driven 28,600 miles or more. Owners have to keep these cars for a long time to get a carbon emissions reduction. Also, the overall CO₂ impact of EVs depends on the electricity source and other details.

- **Charging smart.** Recharging an EV with "dirty" energy from a grid powered by a nearby coal-powered plant, for example, will reduce its CO₂ savings. Recharging it from solar panels on the roof or a solar field nearby offers a more-reliable cut in pollution.

DO YOU INTEND TO PURCHASE AN EV OR HYBRID VEHICLE?



Quantum shift? Interest in switching to electric vehicles continues to grow among the youngest homebuyers. SOURCE: COGNITION SMART DATA

- **Telecommuting is best.** You probably don't need to remind clients that telecommuting is the "greenest" option if it reduces road time. If they normally drive a combustion vehicle 40 miles roundtrip to work each day, they will save nearly 1 ton of carbon emissions annually by telecommuting four days per week.
- **Flying thoughtfully.** Flying typically generates the highest carbon emissions of various transit options, but again, the dirt is in the details. Flying solo is actually less polluting than driving solo. As you add people into the travel, however, the car becomes the less-intensive travel method. In other words, four people flying across the country will burn a lot more CO₂ than four people riding in one car.

Flying may not relate directly to new home construction, but many buyers site their homes with airport proximity in mind. Offer the clients a detailed CO₂ analysis based on how often and where they travel. Add in the costs of vehicle storage at the airport while traveling, assess nearby availability of trains and bus service. Provide a full picture of the pros and cons of air travel as it relates to their new home.



WITH NET ZERO, MAKE HIDDEN ASSETS VISIBLE

There are many ways to lead clients toward net zero living. Traditionally, certifications have led the way because they take into account the many products and systems of a home and provide an overall performance estimate.

The type of certification is probably less important to clients than the end result. How you get there is really a business choice. You may be familiar with long-term players such as Energy Star for Homes, Leadership in Energy and Environmental Design (LEED), and so on. But there are also new approaches that may better fit your work style.

For example, Casey Murphy, senior vice president of quality and standards at Pearl Certification, says his company brings the key element of education to clients along with certification. “Our tagline is ‘we make value visible,’” he says, “which means that we want to demonstrate what makes a high-performing home better in terms of comfort, indoor air quality, and your wallet.”

Pearl Certification doesn’t compete with other green certification programs such as National Green Building Standard (NGBS), LEED, HERS, Energy Star or Net Zero Ready, Murphy explains. “We often integrate those ratings and labels into our certification materials,” he says. “In that way, we can be seen as a ‘Carfax’ or a diary for the home. And when the home is sold, we are a Rosetta Stone, translating the home’s certified features into benefits that home buyers, agents, and appraisers can understand and use in their respective decision-making processes.” **GB**



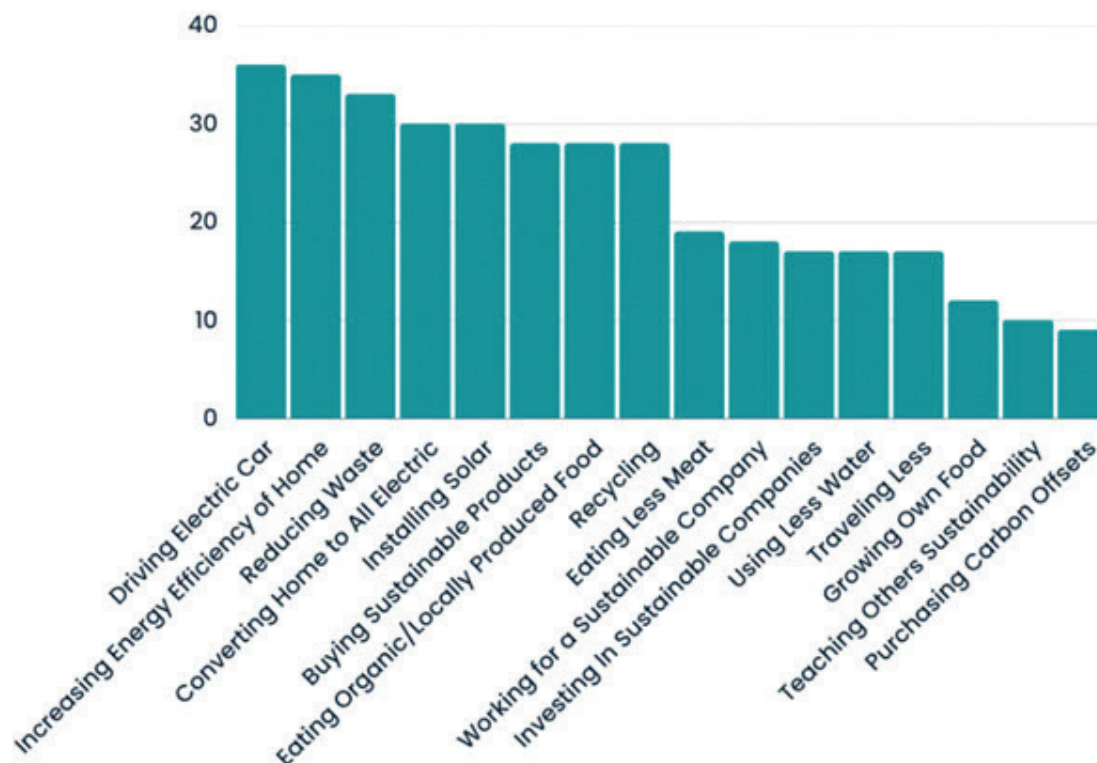
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DECARBONIZED LIFESTYLES



Pressure points. Four of the top five ways younger clients are reducing their CO2 footprint relate directly to home technology and location (transportation). SOURCE: COGNITION SMART DATA

When Green Builder Media recently surveyed consumers about the steps they're taking to lower their carbon footprint, the top five actions included:

- Driving an EV (36%).
- Increasing the energy efficiency of their home (32%).
- Having an all-electric home (31%).
- Reducing waste (30%).
- Installing solar power (29%).

In addition, approximately 8 percent of consumers said they purchase carbon offsets to reduce their carbon footprint. See the bar graph for other actions that made the list.



WHY CARBON OFFSETS (SHOULD) MATTER TO NEW HOME BUYERS

Sustainable building choices can only go so far in reducing net CO₂ to zero. High quality carbon offsets offer a way for well-intentioned clients to close the final gap.

BY SARA GUTTERMAN

Earlier this year, the European Union's Copernicus Climate Change Service reported that, for the first time ever, global warming exceeded 1.5 degrees Celsius across an entire year. Scientists claim that urgent action to cut carbon emissions can still slow warming, but they also assert that we're quickly reaching a critical tipping point wherein the threat multiplier of climate change will lead us into uncharted territory.

We can—and must—decarbonize our economy through the electrification of buildings and transportation, adoption of renewable energy, modification of manufacturing, and deployment of regenerative agricultural practices, but these things take time.

At a more micro level, the building industry can act as a conduit of information for the next generation of homeowners. Here's a brief primer on how to talk to a client about adding carbon offsets as part of their "getting to zero CO₂" strategy. In effect, they'll be engaging you, the builder, to play carbon broker for them, investing selectively in technologies with a track record of cutting carbon emissions.

WHAT ARE CARBON OFFSETS?

A carbon offset is a transaction that removes CO₂ or other greenhouse gases from the atmosphere to compensate for emissions made elsewhere.

The most common carbon offset projects today focus on emissions reductions (like landfill gas capture), forest management and conservation, biodiversity protection, renewable energy, biochar, and direct air capture.

Large corporations with high carbon emissions purchase carbon offsets. Smaller, less-polluting companies—as well as individuals—can purchase voluntary CO₂ offsets to counterbalance emissions from buildings, manufacturing, travel, energy use, and other polluting activities.

Carbon offsets are particularly important in the building industry, because the built environment is one of the most conspicuously consumptive sectors of our economy. The sourcing and

manufacturing of materials, construction process, and ongoing operations of homes and buildings require an immense amount of energy and emit a substantial amount of pollution.

While a sustainable built environment begins with climate responsive design, energy efficiency, electrification, renewable energy, water conservation, and ecosystem protection, the purchase of well-managed carbon offsets allows builders, developers, manufacturers, energy companies, homeowners, and other stakeholders to mitigate the emissions from and environmental impact of projects.

GREENWASHING CONCERNS

Some critics argue that carbon offsets enable companies to greenwash. That's certainly true in some cases. For example, if a highly polluting company purchases carbon offsets and claims that it is carbon neutral, that's greenwashing.

However, the responsible use of carbon offsets to help manufacturers, builders, and homeowners reach the "last mile" of their targets—after they have deployed other strategies to enhance the sustainability of their products, projects and homes—is prudent and essential. This is in light of the fact that there simply aren't enough carbon neutral products, transportation options, manufacturing innovations, or installation practices available to create structures that are net zero embodied carbon at this time.

CARBON OFFSETS QUALITY CONTROL

Unfortunately, the voluntary carbon offsets market is currently fractured and confusing, and not all carbon offsets are created equal.

Carbon offset projects vary in terms of efficacy. For example, projects such as tree planting are intended to remove carbon dioxide from the atmosphere through sequestration.

However, tree planting sequestration schemes can backfire in wildfires or invasive species incursions, or even destroy carbon-sequestering ecosystems such as peatlands if they are not planned carefully and placed appropriately. In addition, once these trees die, the sequestered

carbon is released back into the atmosphere, making these projects impermanent. On the flip side, gas capture projects are typically regarded as high quality, as they permanently dispose of emissions.

High-quality carbon offsets are developed, critiqued and managed in consultation with the expertise of third-party earth and climate scientists, address additionality, provide robust and timely data, eliminate double accounting, ensure permanent carbon removal, provide accurate reporting, and offer well-defined pricing, benefits and results.

CARBON OFFSETS FOR NEW HOMEOWNERS

In response to growing demand from stakeholders throughout the building industry, Green Builder Media has launched the COGNITION Carbon Offsets Marketplace to streamline access to carbon offsets.

Green Builder Media is only offering high-integrity carbon offsets from science-backed, verifiable projects. And, to avoid greenwashing, we're only working with building professionals, manufacturers and homeowners that have already taken steps to enhance the performance of their projects, products and homes.

With carbon credits purchased through the COGNITION Carbon Credit Marketplace, buyers can trust that their purchases have real impact. Diversified portfolio options built with multiple carbon projects across each of four Oxford categories of carbon removal and reduction ensure that purchasers are mitigating risk and maximizing their climate impact.

Builders can now purchase carbon offsets to mitigate the embodied CO₂ of projects up through the day those homes or buildings are sold, and they can also offer homebuyers ongoing operational offset packages to ensure that the homes remain carbon neutral for years to come.

To learn more and purchase offsets, check out the COGNITION Carbon Offsets Marketplace at <https://www.greenbuildermedia.com/cognition-carbon-offsets-marketplace>

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VISION HOUSE TRANSCEND'S **HIGH-PERFORMANCE, SUSTAINABLE DESIGN** OFFERS A GLIMPSE OF THE FUTURE OF HOMEBUILDING.

BY MICHELE LERNER

It's the quiet and comfort that you notice first when you enter the VISION House Transcend, nestled in the San Juan Mountains near Lake City, Colorado. Designed for resilience in any climate, this net-zero energy, sustainably built, all-electric, solar-powered and generally ultra-healthy house relies upon building science and various innovative products to support the physical and mental wellbeing of residents.

The Transcend Series of modular homes, developed through a

partnership between Green Builder Media and Dvele, a California-based prefab homebuilder, is configurable for the topography of any site, along with a homebuyer's lifestyle, climate zone, needs and preferences. Commitment to sustainability provides the foundation for every feature, fixture and design element of each Transcend modular home.

In Colorado, the VISION House Transcend rests on a serene site among pine and aspen trees with mountain and river views. Each

feature in this modular home fits the location and the mission to create an example of the future of housing.

FACTORY-BUILT FOR RESILIENCE AND EFFICIENCY

From its beginning in Dvele's California factory, the VISION House Transcend demonstrates that airtight, precision construction techniques result in a house that stands up to natural disasters and everyday impacts of climate change. Dvele uses light gauge steel framing and layers in materials and products that contribute to the home's resilience to wildfires, high winds, earthquakes and storm damage.

Dvele prefabricates recycled light-gauge steel panels in its factory, which reduces embodied energy by 20 percent (80 percent when compared to a code-built foundation). The foundation system utilizes magnesium oxide panels that absorb CO₂ in the curing process, making it a carbon-negative product. Magnesium oxide has the same sheer strength as plywood and is impervious to insects. The walls are mold and mildew resistant and waterproof.

The VISION House Transcend includes high-performance barriers from [PROSOCO](#) that make building envelopes waterproof and airtight, which increases energy efficiency and results in lower heating and cooling costs. Extreme weather-resistant materials such as [Prosoco Joint & Seam Filler](#), [FastFlash](#) and [AirDam](#) are durable, sustainable and comply with all VOC regulations.

[ROCKWOOL's Comfortboard 80](#) rigid thermal insulated sheathing is installed under the slab in the crawl space to provide thermal comfort and reduced energy consumption. The company's stone wool insulation, made from natural volcanic rock and recycled steel slag, is fire resistant, water repellent and vapor permeable for high drying potential, as well as sound absorbent for acoustic comfort. [AFB evo](#), a lightweight acoustical fire batt stone wool insulation, is installed in the interior wall cavity to reduce sound transmission and protect against fire.

Lighter-weight yet durable, fire-resistant and mold-resistant [Sheetrock Brand EcoSmart panels](#) are installed for the walls and ceiling from the [USG](#) portfolio of products. The drywall is a light-weight gypsum board with the same performance and strength capabilities as standard [Sheetrock](#), but with a lower environmental impact and weight. The panels have up to 21 percent lower global warming potential and 22 percent less weight to reduce transportation fuel consumption by 20 percent. The gypsum core is encased with 100 percent recycled paper, and the product is low-VOC emitting. In addition, the panels are noncombustible and fire resistant for added safety.

The exterior of the house features [Delta Millworks Lunawood ThermoWood](#), which is grown and strengthened for nearly 80 years in the harsh climate of Scandinavia. The product is thermally modified using heat and steam with zero chemicals. [Lunawood](#) provides an attractive appearance and is dimensionally stable, weather resistant and durable.

Today's homebuyers want plenty of natural light and indoor-outdoor connectivity, which can come at the cost of energy efficiency without careful attention to glass installation. The VISION House Transcend includes triple pane large-expanse windows and doors from [Arq-Espacio](#). The tilt-and-turn windows have a double seal and a multiple point locking system for a tight seal to prevent energy loss. The sliding glass doors have a lift-and-slide

system that seals the perimeter of the sash against the framing for greater efficiency. Arq-Espacio also utilizes unplasticized polyvinyl chloride (UPVC), a recycled and recyclable material that contains additives and stabilizers that allow it to withstand ultraviolet radiation, temperature change and salinity that is also fire retardant.



Clear advantages. The VISION House Transcend includes Arq-Espacio triple-pane, large-expanse windows with a double seal and a multiple point locking system to prevent energy loss.

SELF-POWERED HOME

Dvele and Green Builder Media take a conservation-first approach to energy consumption to withstand heat waves and frigid temperatures. Transcend homes are designed to be 87 percent more energy efficient than the typical new home. The addition of solar power and storage results in a self-powered home that can withstand power outages and brownouts.

[JinkoSolar's](#) PV and storage system, with 26kw of battery storage, ensures carbon-free power production day and night to make this home resilient and self-sufficient. Their [Eagle](#) modules are certified to withstand humidity, rain, salt, wind, hail and snow – the thicker back sheet results in fewer failures and less damage. The [Eagle PV](#) panels minimize white space between cells for a boosted wattage. The [Eagle RS](#) DC-coupled battery storage system has off-gas detection, battery monitoring and an app for current and historical usage. The home is anticipated to produce 20 percent to 30 percent more power than it uses.



Resilient power. JinkoSolar's [Eagle PV](#) panels withstand extreme weather, minimize white space between cells for a boosted wattage, and may help the home produce 20 percent to 30 percent more power than it uses.

For increased energy efficiency, water conservation and safety, the Transcend home features Uponor [AquaPEX Plumbing](#) and [AquaSAFE Fire Sprinkler Systems](#), as well as its [Radiant Floor Heating and Cooling systems](#). Through *Uponor Logic*, the plumbing systems deliver water where it's needed quickly and efficiently to cut down on unnecessary pipe lengths and wasted water due to poor hot-water delivery times. [Grundfos](#), the world's largest manufacturer of pumps, supplied super-efficient pumps for the well, water systems and HVAC at VISION House Transcend.

The Uponor radiant heating and new radiant cooling systems are inherently efficient by using larger surfaces to distribute the energy needed. Lower supply water temperatures in heating and higher supply water temperatures for cooling optimize the efficiency of heat-pump technology. Radiant systems also contribute to a healthy home. Because radiant systems don't use fans or blowers, they cut down on dust and allergens circulating throughout the home.

Hot water is supplied via [Rheem's Proterra](#) electric water heater.

For water conservation and quality, Transcend includes [LIXIL's](#) water saving products and technologies. The [GROHE](#) water-saving dual flush system with [DXV](#) wall-mounted toilet, low-flow *Rain-shower* head and *SmartControl* shower thermostat, combined with [American Standard's](#) ADA-compliant sinks, elevate the bathroom experience. The *GROHE SmartControl Thermostatic Trim* in the shower automatically dials the temperature to the previously set target temperature to reduce the water and energy wasted when trying to find the right temperature. This shower also has a button to shut off or reduce water flow when lathering or shaving to save water. In the kitchen, the *GROHE Blue* sink and water system delivers filtered, still or sparkling water.



Waste not. The GROHE dual flush system, featuring the DXV wall-mounted toilet provides homeowners with exceptional water conservation and quality.



Sinking feeling. American Standard's ADA-compliant sinks compliment any bathroom design, save water, and ultimately cut the homeowner's monthly bill.

The local utility, [Gunnison County Electric Association](#) (GCEA) and its power supplier, [Tri-State Generation and Transmission Association](#), have made VISION House Transcend a case study of a high-performance, energy-efficient home. The associations are interested in data surrounding demand-side energy management, time of use pricing, and peak load shifting so they can fully understand the best path forward, including proper rebates and programs surrounding energy efficiency. According to GCEA, 46 percent of its wholesale power bill is generated in six hours each year (only 30 minutes each month), so the utility has increased the cost of energy during peak hours to limit energy use during times when electricity is in highest demand and most expensive.

The high-performance house provides wellness benefits in addition to reduced energy consumption.

HEALTHY LIVING

Healthy minds and bodies depend on fresh air, good sleep and a calm atmosphere, all of which are enhanced with products and systems in the VISION House Transcend. The *Dvele IQ* smart home system includes multiple sensors for indoor air quality (IAQ), leak detection, water management, and heating and air conditioning systems that can help homeowners manage their properties in normal circumstances and during extreme weather conditions.

[Broan-NuTone's Overture system](#) uses sensors and plugs that measure moisture, CO₂, Total volatile organic compounds (TVOCs) and temperature technology to monitor a home's air. Additionally, the home will have the [Broan AI Series ERV](#), which brings fresh, filtered air into the house while removing stale, polluted air. The ventilation system runs 24/7. The Broan ERV system functions as a heat exchange, which reduces the amount of energy needed to keep the home comfortable.

Meanwhile, filtered air is distributed to living and sleeping areas in the house, while air that has moisture, odors and possible toxins from inside the house is extracted from the kitchen, bathrooms, laundry room and garage. When the outdoor air quality is poor, such as when humidity levels are extremely high or when smoke is in the air from wildfires, the automated ERV system can stop importing air from outside.



Smart sensors. Broan-NuTone's *Overture* system uses sensors and plugs that measure moisture, CO₂, total volatile organic compounds and temperature technology to monitor a home's air quality.



Quiet ventilation. Broan-NuTone's efficient energy recovery ventilation (ERV) system keeps the home comfortable and healthy.

For better IAQ when cooking, the **Broan (RMP 17004) 30-inch Range Hood Insert**, a quiet system connected to the *Overture* system, clears away toxins and smoke.

Homeowners are more likely to use a quiet range hood, but sometimes homes need some "happy" noise. Studies show that music can bring families together, lift spirits and improve concentration. **Sonos** products at VISION House Transcend include soundbars, portable speakers and in-ceiling speakers connected by a Wi-Fi system, such as the **Sonos Amp**, an in-wall or in-ceiling speaker that when combined creates a surround sound experience. **Move** by Sonos will be mounted on an outside wall to bring music to all parts of the house. The products include **Ray** and **Beam** soundbars, the Sonos **One** and **Roam** portable speakers, and the **Arc** soundbar with a sub.

BELLS AND WHISTLES

The healthy, self-powered VISION House Transcend also showcases sustainable fixtures and finishes that enhance the home's comfort and beauty.

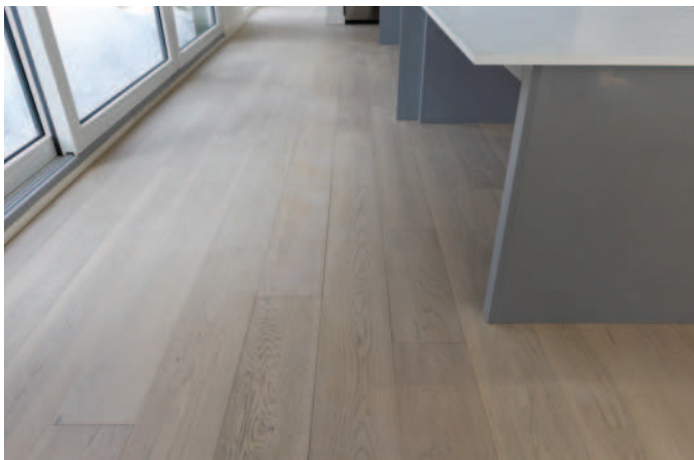
The house includes two doors from **TruStile's** collection of interior medium-density fiberboard (MDF) doors, which are third-party Scientific Certification Systems (SCS) certified to contain at least 69 percent pre-consumer recycled wood. Their no-added formaldehyde MDF material and low-VOC adhesives and primers contribute to better IAQ and a healthier home and environment. The **Tru Modern Infinite Rail TMR3001** has vertical and horizontal kerf cuts or inlays, drawing your eyes to the sleek door.

In addition, VISION House Transcend has a custom door with a stacked rail style with kerf cuts and glass inserts that allow light to flow through the door without compromising privacy.



Light touch. The VISION House Transcend has a custom door with glass inserts that allow light to flow through the door without compromising privacy.

The home will feature **Savona** handcrafted hickory floors by **CRAFT** in neutral light gray and beige tones that blend with the surrounding Aspen trees. The **CRAFT Elite Grade Hickory** used at VISION House Transcend is put through a multi-step, specialized color treatment process to create a light grey tone without changing the wood's natural beauty. **CRAFT** floors are made from North American wood and are chain-of-custody certified to be legal, responsible and traceable back to a sustainably managed forest. Additionally, all **CRAFT** floors have a Declare label and are rated Red List Free, certified to GREENGUARD Gold and covered by a Product-specific, Type III EPD.



Ground level. Savona handcrafted hickory floors by CRAFT undergo a multi-step, specialized color treatment process to create a light tone without changing the wood's natural beauty.

Pebble gray cabinets in the kitchen from **Norelco Cabinets** complement the neutral floors. The *Slab Melamine with AGT Soft Touch Matte* panels offer superior surface quality that protects against scratches, is anti-fingerprint and extremely durable. Micro scratches on the surface are easily repairable through an innovative at-home thermal process. Norelco Cabinets, based in Canada, uses premium quality material sourced from North America and Europe that improves global sustainability. The cabinets used throughout the project fulfill the requirements regarding formaldehyde emissions according to the EPA and California Air Resources Board Regulations. All AGT material is produced with a low emission value and a zero-waste policy.



Perfect panels. Pebble gray cabinets from Norelco Cabinets offer superior surface quality that protects against scratches, is anti-fingerprint and extremely durable.

Layalite, one of **Caesarstone's** new nature-inspired designs, is a biophilic design with pure white quartz counters with gray veining in a honed finish that adds light in the kitchen. The naturally occurring raw quartz has been transformed through Caesarstone's pioneering advanced technology. Since quartz countertops are the hardest stone surfaces, they are nonporous, hygienic and stain, heat and scratch resistant.



Brighter lifestyle. Caesarstone's Layalite is a biophilic design with pure white quartz that adds light in the kitchen.

Dacor manufactures energy and water efficient, high-performance products. Appliances include **Dacor's 24-inch Dishwasher Modernist Collection**, **36-inch Induction Cooktop**, **30-inch Combi Wall Oven Contemporary Style** and **36-inch Counter Depth French Door Fridge**. The Samsung energy-efficient laundry equipment includes its **2.2 cubic foot Capacity Front Load Washer with Super Speed** and the **4.0 cubic foot Capacity Heat Pump Dryer with Sensor Dry**.



Powerful benefits. The VISION House Transcend includes several Dacor appliances, such as a highly energy efficient, electric 36-inch *Induction Cooktop*.

The bathrooms feature *GROHE* and *American Standard* fixtures from LIXIL that offer water-saving technology.

Daltile's Uniform Concrete large-format 24-by-24-inch tile floors in white and 2-by-2-inch **Keystone Mosaics** porcelain tiles in Suede Gray are waterproof, slip resistant, stain proof, dent proof, fire resistant and easily cleanable. The selected styles also contain pre- and post-consumer recycled material and are free from VOCs, PVCs, formaldehyde and allergens.

Lee Industries' beds, chairs and couches at the VISION House Transcend are sustainable, healthy and handcrafted in the U.S.

Lee Industries works with local suppliers, which cuts down on transportation costs and CO₂ emissions, and requires all vendors to have a Code of Conduct. Lee manufactures upholstery that features soy-based cushions, fibers made from recycled plastic, organic fabrics for upholstery, and springs made from 80 percent recycled metal.

Now that the VISION House Transcend is installed on its mountain site, Dvele and Green Builder Media look forward to monitoring the home's performance and sharing the insights from the project with building professionals and consumers. **GB**

Product and support for Transcend is being provided by these partners.



THE ENVELOPE, PLEASE

Building America's research yields retrofit solutions for existing homes, old and older.

BY JULIET GRABLE



New homes have never been more energy efficient, thanks to stricter building codes and greater awareness of the link between energy efficiency and occupant comfort. But what about America's aging housing stock? According to the most recent [American Community Survey](#), more than half of all owner-occupied homes in this country were built before 1980. The percentage is even higher for multifamily buildings. Many of these older homes and units have 2-by-4 walls, leaky windows, minimal insulation and little to no air sealing.

There is tremendous opportunity in retrofitting existing homes, apartments and townhouses. Residential buildings account for

35 percent of total U.S. energy use; nearly half of that energy is used to heat and cool homes. In fact, adding insulation and retrofitting heating systems alone could achieve annual energy savings of up to \$5 billion in the U.S.

Upgrading existing building envelopes by adding insulation, air sealing, and/or replacing windows can significantly reduce heat loss and gain through a building. But envelope retrofits present distinct challenges. For owners, they can be disruptive and costly. Multifamily buildings with rental units present even more of a challenge, as many retrofits must be scheduled when tenants move out and the spaces are unoccupied. Utility programs often offer incentives, but too few



Like new again. Older, energy-inefficient homes can be restored to peak performance with a thorough retrofitting, which includes new, rigid insulation, aerosol sealant and upgraded windows. CREDIT: ANDREA ASTES/ISTOCK

people take advantage of them, and the number of homes that receive upgrades represents just a fraction of the total building stock.

For this reason, the U.S. Department of Energy (DOE), through its [Building America](#) program, has been supporting research to develop and validate envelope retrofit strategies that are affordable, easy to implement, and broadly applicable.

ENERGY SAVINGS ON THE SIDE

Every year, around 1 million U.S. homes are re-sided. “That’s a lot of houses, and yet the vast majority are not having their performance improved at all,” says Christine Liaukus, architect and principal

investigator for a series of Building America projects focused on “opportunistic retrofits.”

Such retrofits take advantage of an upgrade such as re-siding to add insulation or boost weather resistance. A team headed by Liaukus and the [New Jersey Institute of Technology](#) (NJIT) first tested this concept with a project called “[Re-side Tight](#),” in which contractors were trained to add a weather-resistive barrier to 15 homes that were being re-sided.

In 2020 and 2021, the team took the concept a step further with a Building America project called “[Re-side Right](#),” installing one inch of exterior rigid insulation and liquid flashing on 10 homes that were

being re-sided. This added R-5 and also served as a weather-resistive barrier and air barrier.

Though the drop in air infiltration wasn't huge, according to Liaukus. "Anecdotally, people felt the comfort difference and thought the house was quieter," she says.

To validate its work, the team conducted blower door tests and used infrared cameras to analyze thermal bridging. As the cameras showed, the opaque portions of the envelope were better insulated buttoned up, but the windows were still losing significant heat.

Window replacement is expensive, and it rarely pencils out for the homeowner when looking at it strictly from the perspective of energy savings. So with its latest Building America project, the NJIT team is developing an alternative to window replacement that still accomplishes significant energy savings. Called "[Renew-Wall](#)," the strategy involves adding two inches of exterior rigid insulation with an integrated air barrier to reduce air infiltration, and installing exterior secondary windows with a thermal barrier surround.

The project began with months of iterative design. Last fall, the team built two wall mock-ups on the NJIT campus. They include novel products from two companies. [Alpen Windows](#) agreed to modify an interior secondary window product so that it can be installed on the outside, and [BRINC Building Products](#), whose high-density foam-and-resin *ThermalBuck* eliminates thermal bridging around the edges of windows, agreed to modify its product so it can be used on existing homes.



A better rebuild. The mock-ups consist of two inches of rigid insulation, liquid flashing, a thermally broken window surround, high-performance exterior storm windows, and new siding. CREDIT: COURTESY OF U.S. DEPARTMENT OF ENERGY

"Those companies are innovative and nimble enough to take on a new idea and try it out," says Liaukus. "They've been excellent partners."

Constructing the mock-ups allowed the team to work out details such as how long screws need to be and the sequence of steps. The goal is a replicable process that isn't too fussy and can be easily adapted by siding contractors and their crews in the field. Now that the mock-up has been validated, the team will test out the system on at least five actual homes in 2024.

The Renew-Wall assembly could achieve heating and cooling energy savings of 30 percent or more, and it could be an important step toward electrification.

RETROFITTING ROOF CAVITIES

In 2017, another Building America team led by Building Envelope Materials set out to answer a challenging question: How do you retrofit enclosed roof cavities without tearing down the ceiling?

Doug Lamm, CEO of [Building Envelope Materials](#), has been working on this problem since the Great Recession of 2008, when he obtained a grant to develop a minimally invasive process for adding additional insulation to wall cavities that were already filled with fiberglass batts. The technique, called *Pinole Insulation*®, involves injecting polyurethane spray foam insulation through tiny, quarter-inch holes through the drywall.

"We had developed *Pinole Insulation* for walls and had done big buildings already," says Lamm. "I said, 'how about if we develop a similar process for enclosed roof cavities?'"

The majority of existing homes have some type of enclosed roof cavity. This may include cathedral ceilings, dormers, or flat roofs. In the Northeast, where historic "triple decker" multifamily homes with flat roofs are common, the opportunity is especially ripe.

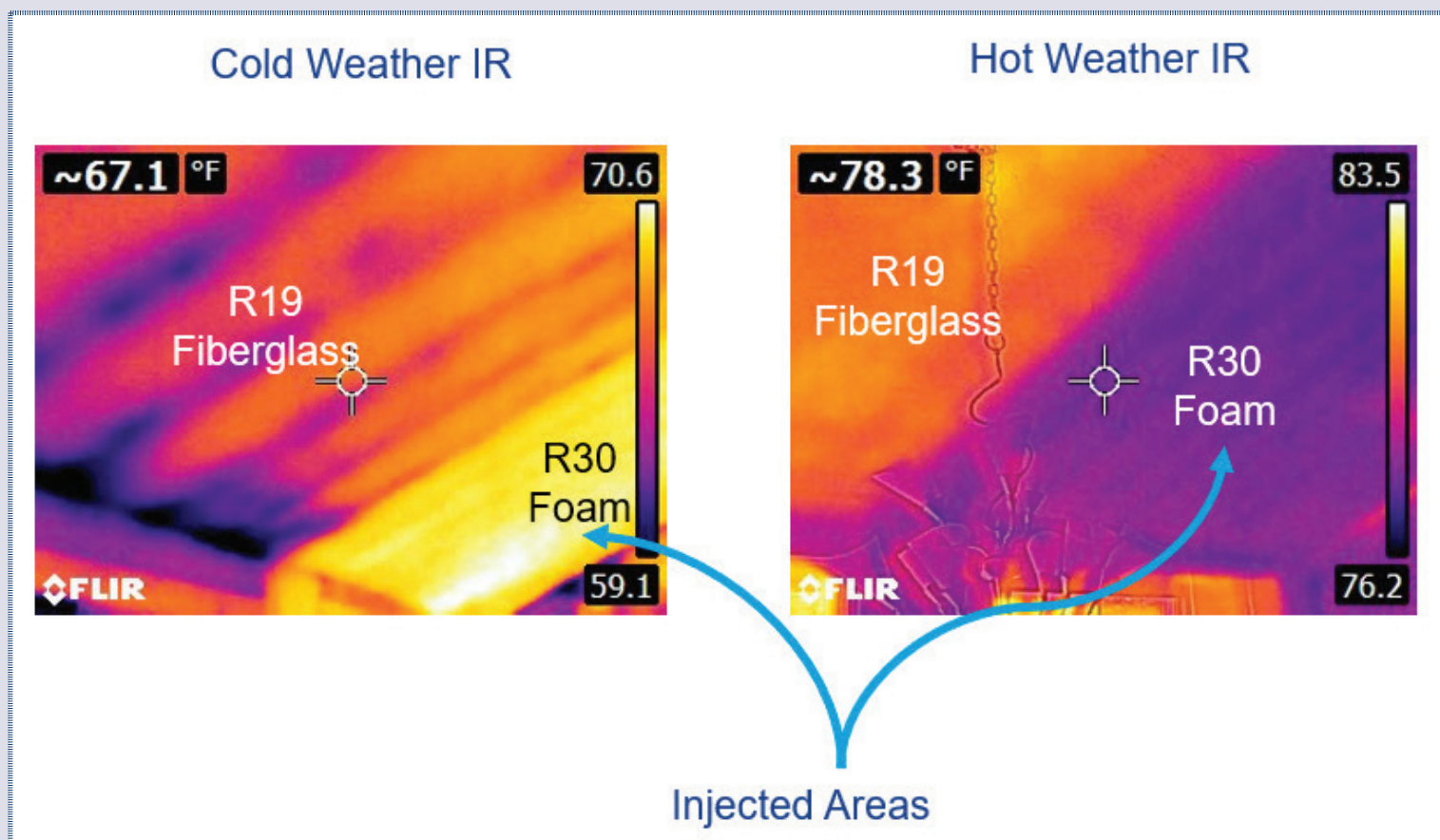
After developing systems in the lab, Building Envelope Materials tested them on pilot projects, including one where it treated half of a cathedral ceiling with existing R-19 fiberglass batts. After injecting closed-cell polyurethane foam insulation into the cavities through tiny holes in the ceiling, builders used an infrared camera to validate the quality of the installation.

Snow piled up on the side of the roof that had been retrofitted with injection foam but not on the side insulated only with R-19 batts. "The R-19 batts allowed so much warm air to escape from the interior that it completely melted the snow," says Lamm.

Pinole Insulation can be used in walls and ceilings. The most critical part is calibrating the "fill rate" so that cavities are filled completely—but not overfilled. "A lot of people have tried to do what we do and failed," says Lamm. "Blowing out walls is the number one reason."

To avoid this, Building Envelope Materials uses a proprietary smartphone app to calculate an exact shot time for every cavity. Because the foam heats up slightly as it is injected, installers can use an infrared camera to verify that cavities are filled completely. "We monitor every cavity we insulate and guarantee a complete fill and good quality foam that won't shrink or off-gas," says Lamm.

Lamm's company has treated hundreds of buildings, mostly in Massachusetts and other Northeastern states. On average, the process



Hidden truth. Infrared images reveal the difference between the side of the ceiling insulated with fiberglass batts and the side fortified with polyurethane foam. COURTESY OF U.S. DEPARTMENT OF ENERGY

increases insulation values in older, fiberglass-filled walls from R-10 to R-24, with a 22 percent to 26 percent reduction in thermal energy use. The material comes out “like shaving cream” and doesn’t emit formaldehyde or produce hazardous particulates.

“We’ve now injected 35,000 to 40,000 cavities,” says Lamm, who adds that they are exploring using the technique as an alternative to invasive “gut rehabs.” “We would not have been so successful had it not been for Building America’s help.”

LESS-INVASIVE AIR SEALING

As important as insulation is to a home’s comfort and energy performance, it’s only half the solution. The [U.S. Environmental Protection Agency](#) (EPA) estimates that homeowners can save an average of 15 percent on heating and cooling costs (or about 11 percent on total energy costs) by adding insulation plus air sealing—filling the cracks and holes in the building envelope where air can escape. Unfortunately, manually sealing these cracks is time consuming and often doesn’t yield the promised energy savings.

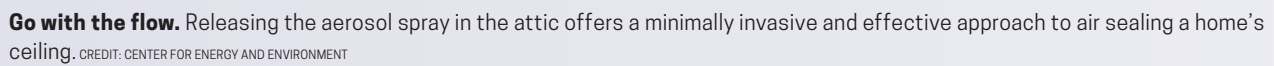
Building America has long supported the development of aerosol-based technology that can be used to effectively air seal homes. The

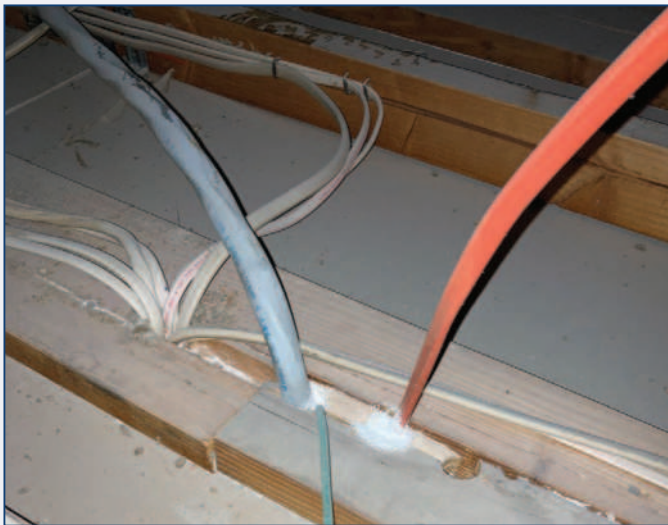
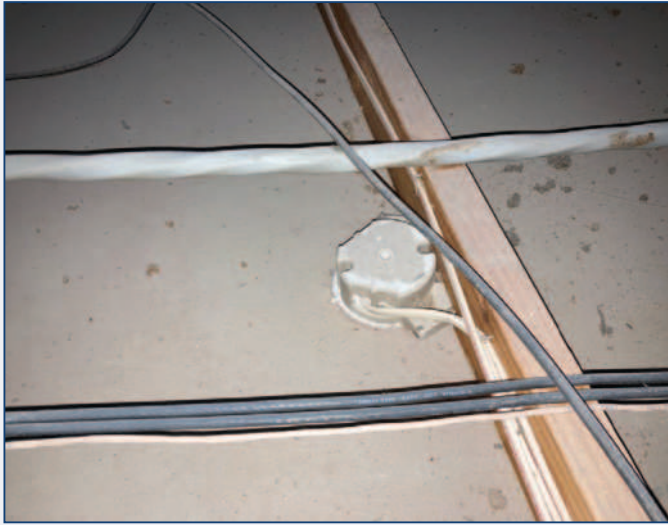
research has led to successful commercialization through a company called [Aeroseal, LLC](#).

This solution involves pressurizing an interior space and releasing an aerosol fog inside. As air escapes the building, sealant particles are carried to tiny cracks and holes in the envelope. The sealant particles make contact and stick to the edges of these leaks, eventually sealing them. The technique was initially used in new homes, but Building America has been supporting efforts to expand its application to existing homes and to adapt the process so it’s less invasive.

From March 2020 to January 2022, the [Center for Energy and Environment](#) (CEE) partnered with Aeroseal and the University of California, Davis’ [Western Cooling Efficiency Center](#) to test the technology on 34 existing residences in Minnesota and California. Furnishings were removed, and the residences were air sealed while they were vacant.

Aerosol sealing reduced leakage by an average of 47 percent, but the project also revealed a challenge particular to existing residences: how to protect horizontal finishes from aerosol particles while ensuring the aerosol fog reaches leaks. This was especially tricky where baseboards meet carpet or wood flooring—a common path for air leaks.





No leaks allowed. Aerosol sealant can be used to air seal common leaks in attics, including around ducts, fan housings, ceiling light boxes and wire penetrations. CREDIT: CURTIS HARRINGTON/UC DAVIS

“It’s not just protecting the surface and allowing airflow,” says Dave Bohac, senior director of research at CEE. “When you pull off the floor protection, you don’t want to pull off all the aerosol sealant with it.”

This got the team thinking: Was there a better way to aerosol seal existing residences like these? Curtis Harrington, senior engineer at UC Davis, tested an alternative approach at three townhouses. Instead of pressurizing the house and releasing the aerosol fog inside the occupied space, they depressurized the home and released the aerosol in the attic, sealing it from the outside in.

“For these three townhouses, we saw total leakage reductions of 54 to 55 percent overall, just by doing the attic,” says Bohac. “That led to, ‘wow, that’s a viable method; let’s pursue that.’”

In 2023, CEE won funding from the DOE’s BENEFIT program to develop an advanced aerosol sealing technology that can be used in attics, crawlspaces, unconditioned basements, and attached garages without having to disturb occupants or cover surfaces in living spaces. Aeroseal modified the sealing equipment for the project, and the team is currently

testing its methods in 40 townhouses and apartments in Minnesota, California, and two other climate zones.

The same team is working on a new testing method that will allow it to more accurately measure house-to-attic leakage so they can tell what proportion of leaks the aerosol sealing has addressed. “If we’re doing an attic, for example, we want to be able to measure both the overall leakage reduction and the reduction specific to that space,” explains Bohac. “With a lot of these residences, especially if we can do pre-sealing of larger leaks, we think we can see as much as a 90 percent reduction.”

MORE SOLUTIONS TO COME

In 2023, Building America named nine “Retrofit Solutions Teams.” These multidisciplinary expert teams, selected from around the country, will address hard-to-solve technical challenges of decarbonizing the U.S. housing stock. Teams will work closely with community-based organizations to identify technical integration issues and appropriate solutions for improving their existing housing stock. **GB**



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PAGES 4-5

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PAGE 60

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PAGE 11

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PAGE 3

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COVER 2

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PAGE 35

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PAGE 41

VISION House Las Vegas

Three demonstration homes in Cadence, a master-planned community in Henderson, Nevada.

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COVER 3

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COMING NEXT ISSUE**Building Science**

The U.S. Department of Energy shares its latest research on how to improve building performance and take on the challenges imposed by Mother Nature.



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From Zero to 60



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I first became familiar with the saying “hurry up and wait” when I was in uniform. Like many obscure fragments of the military lexicon, it represented a fairly benign commentary on the inefficiencies that ran rampant through the highly regimented, but totally disorganized, “organizational system.”

Later on, in private life, I began to experience many of the same frustrations when it came to building fine homes in an industry with so many variables and so much unpredictability. Anyone who has walked in those shoes can run down a long laundry list of fault lines that litter the playing field.

Let me share a case in point.

After delays of more than a year, we were finally able to have a submersible pump installed in our 300-foot-deep domestic well. The well produces a tremendous 35 gallons per minute. When the driller had finished his work and tested production for the well report, he was so excited, my wife said she thought he was going to “pass out cigars.”

We thought we had a clear path laid out in front of us, but it was not to be. Without the aforementioned pump to deliver water, we couldn’t move forward with the plumbing and mechanical. When at last we overcame that obstacle, we learned that our mechanical contractor had lost all his help, an all-too-common scenario in the trades, and that he was also experiencing some severe health issues.

Another year went by while we searched far and wide for a replacement. No matter how hard we tried, no one was willing to step in, especially on a project at a location as remote as ours. Then, like a bolt from the blue, our original plumber reached out and reported that he was between surgeries and would be able to put in three days on our project. We had four days of advance notice but we were thrilled.

Of course, that meant that now we had to scramble to try to line up our electrical contractor and the gas supplier, who had

Every year in this country, home building companies large and small are able to complete north of 1 million new houses and other dwelling types. It’s an incredible feat given all the potholes and speed bumps in the road.

been on hold, so that they could do their respective parts in getting the boilers up to operational status. With so little lead time, we would have to wait for each of them to have openings in their busy schedules. It reminds me of graphics depicting three-dimensional chess. Too many moving parts. Plus, there were the inevitable delays in scheduling the required inspections.

Building seems to represent a veritable “perfect storm” of hurry up and wait. It feels like a miracle is needed just to finish a project. The only saving grace in the situation is that it is our own in-house project and not that of a client. If it was, we would have been fired long ago.

Every year in this country, home building companies large and small are able to complete north of a million new houses and other dwelling types. It’s an incredible feat given all the potholes and speed bumps in the road. Any time I talk with a builder or any tradesman they all agree that getting and keeping help is getting harder and harder. Then they go on to talk about supply chain issues, material shortages, spiraling prices, tight lending and all the other issues that continually plague them.

Those who are successful need tremendous will and patience, along with the confidence that they are good enough to do the job, and they have to be able to master the art of going from zero to 60 and back to zero, as many times as it takes. **GB**

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