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May/June 2022 / www.greenbuildermedia.com

RESILIENCE & READINESS

It's time to analyze and strategize
the next steps in the battle
against climate change.



A background image showing two men in red and blue plaid shirts. They are holding and looking at a large set of architectural blueprints. The scene is brightly lit, suggesting an outdoor or well-lit indoor environment. The text is overlaid on the right side of the image.

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Investors, Taxes and the Housing Debacle

Does this lie ahead? A perfect storm of interest rates, inventory issues, property taxes and investor overreach say it might.

CREDIT: FEVERPITCHED/ISTOCK

Selling homes to investors who use housing as a cash register may seem like easy money. But a gathering storm is likely to leave everyone shipwrecked.

YOU MAY HAVE SEEN the recent “60 Minutes” piece about investors buying up single-family homes in the U.S. The risk to the middle class is real, but many other market shifts mean even these corporate gamblers may not walk away happy.

For example, property taxes in hot markets such as Austin, Texas, are skyrocketing. Homeowners have seen valuations rise 50 percent in one year. Existing owners have some legal protection. They get a Texas-wide 10 percent appraisal cap, so they don’t pay taxes on any part of a new appraisal that exceeds 10 percent of the home’s existing value. Most states have no such protective clause. And even in Texas, non-resident investors AND new homebuyers (for the first year) don’t qualify for this cap.

Put plainly, investors who bought a single-family home and plan to convert it to a rental will pay the full, reappraised taxes, and see their lowest rental margins in years (about 6.8 percent.)

New homeowners also inherit the current appraisal until they’ve lived in the home for a year. In Austin and other markets, it’s not uncommon to see a \$12,000 property tax bill on a house whose owners paid \$7,500 in tax in 2021. Ouch. That’s an extra \$375 per month on their mortgage, plus additional insurance costs, plus inflation. Will they sell? Face foreclosure? Tighten their belts?

There are reports that homeowners associations (HOAs) are creating new rules to protect neighborhoods from non-resident investors. I understand their resistance to absentee landlords, but as [Slate reports](#), these upscale homes may not be the types of housing that matter most to middle class wealth building. Instead, investors see easy money buying older, affordable homes, which they can pay off with only eight years of rental.

The defense offered by professional investors is that only a small percentage of homes are actually owned by them, and that they operate [only about 300,000 rentals nationwide](#). Let’s be real, though. In October of last year, 27 percent of all homes in the U.S. were sold to investors, not to people who actually need housing. And investor [purchase of homes in minority communities](#) may be the ultimate form of racial gentrification.

It’s likely to get much worse. As interest rates hit new highs, middle class buyers have access to less money. But big investors often borrow at rates 2 or 3 percent lower than consumers. They

might decide to double down and scoop up thousands of homes now, raising rent prices to cover their gamble. But how much more stress can the rental market bear? A little. According to Redfin, rental costs have gone up 15 percent since last February, while mortgages have risen 31 percent.

So far, investors have focused on destination cities such as Orlando, Austin and Atlanta. But what if they sell out and sell off, and target less popular, slower moving but more profitable destinations? They have deep pockets and a long game. First-time homebuyers don’t.

In the event that investors double down on their gamble, how do we save the last relatively safe method of wealth accumulation available to the middle class? Dallas, Texas, is considering a ban [similar to one about to be enacted in Canada](#), where they have forbidden the purchase of homes by non-Canadians for two years. That’s more symbolic than effective, however. Their real problem is in their backyard. According to a [Royal LePage survey](#), 21 percent of homeowners in Montreal and 42 percent of homeowners in Toronto and Vancouver own multiple homes.

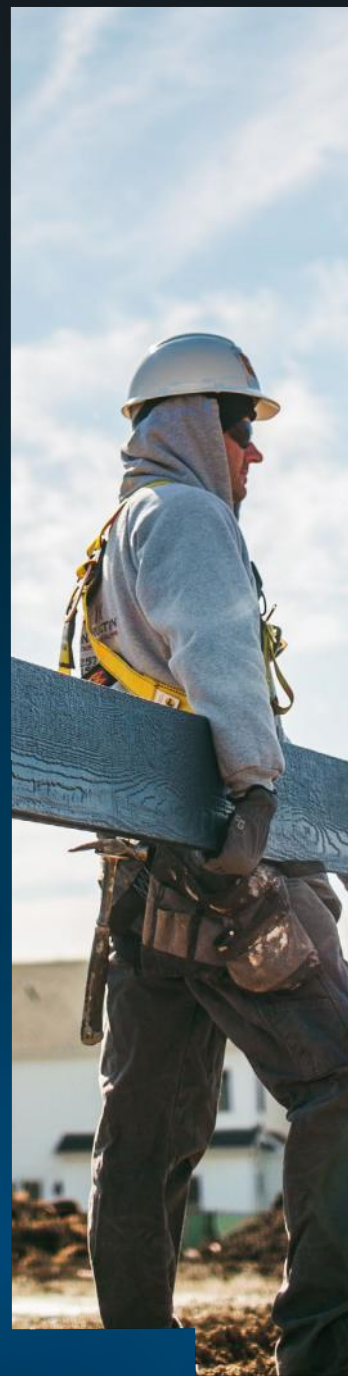
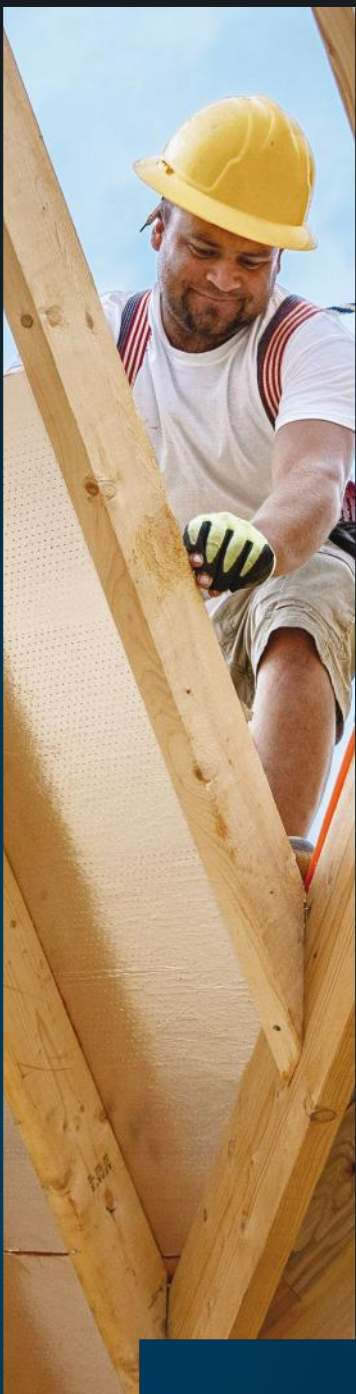
That’s nothing, however, compared to what’s coming. Core Development, a Toronto company, is reportedly [planning to buy \\$1 billion worth of single family homes](#) in the region. In the U.S., huge institutional investors such as BlackRock have made [similar moves](#).

Sadly, in all this housing chaos and anxiety, sustainability often gets pushed to the sidelines of the conversation. An enthusiastic capitalist will tell you that all of this drama will work itself out, and the market will ultimately right itself, and we can get back to talking about home performance. That’s probably true, but the new normal may not be to most peoples’ liking—in the same way that the post-Climate Emergency planet may not be hospitable to human beings. Let’s put our heads together and create a new plan that balances regulation and opportunity. Let’s help solve the property tax nightmare. American families need us. Let’s not become a low-paid human factory that builds boxes for number-crunching investors. **GB**



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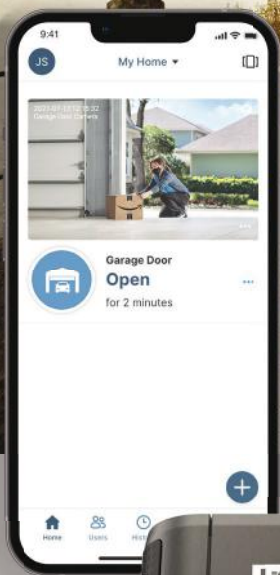


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Coal Use for Power to End in New Jersey

The Garden State plans to go all-clean with its energy by mid-century.



Black rock goodbye. There will be no more trips to the mines for workers in New Jersey. The state plans to shut down its last two coal-fired power plants as it continues to move toward all-fossil fuel-free energy. CREDIT: ADAM88XX/ISTOCK

New Jersey will bid goodbye to coal as a power source when it closes the state's last two coal-fired plants this summer, according to Gov. Phil Murphy. The closures are a "very good step" toward New Jersey's goal of being powered only by clean energy by 2050, and to curb total emissions in the state by 80 percent from 2006 levels, Murphy notes.

The closures will leave New Jersey with a "mix of energy sources" that includes natural gas, nuclear, wind and solar, Murphy says. The two sites will be used clean for clean energy projects such as battery storage.

Use of coal to generate electricity in the U.S. fell by half between 2005 and 2019, according to the U.S. Energy Information Administration (EPA). That mirrors actions by other countries, which have been abandoning coal over the last few decades because it is an "expensive and dirty" fossil fuel, the EPA notes.

Feds Juggle Water Resources as Short-Term Drought Solution

Drastic measures including moving vast amounts of water to save Lake Powell at the expense of Lake Mead.

To keep drought-stricken Lake Powell capable of generating hydroelectric power and supplying water to 40 million people across the West, the federal government is implementing an "it's there, but it isn't" accounting method. Lake Powell, the nation's second-largest man-made reservoir, has suffered from a 22-year drought and has now dropped to 24 percent of normal level, according to the U.S. Bureau of Reclamation.

To maintain the lake's current level, water from neighboring Flaming Gorge Reservoir will be transferred to Lake Powell. Meanwhile, about 480,000 acre-feet, or 156 billion gallons of water, will not be moved into cojoined Lake Mead from Lake Powell per a one-time agreement with seven Western states that have agreed to forego annual water allocations from Powell. This will drop Mead's water level drastically. Lake Mead feeds the Colorado River, the primary water source for Arizona and southeastern Nevada. Shrinking Lake Mead could trigger a Tier 2b shortage declaration, which, combined with an earlier Tier 1 implementation,



Water woes. A 22-year drought and increasing demand for water have dropped man-made Lake Powell to its lowest level on record. The pale white outline above the water's edge shows how much deeper the lake used to be at the start of the century. CREDIT: JAY HUANG/FLICKR

would prevent release of 580,000 acre-feet of water to Arizona cities—enough to supply 1.75 million homes for one year, the Bureau notes.

Here's the weird part: In exchange for the states' water allocation agreement, Reclamation will act as if allocated water actually did go into Lake Mead to prevent a Tier 2b decree. But this is a short term fix, officials note: The ongoing drought shows no immediate sign of ending, making more-restrictive water use edicts inevitable.

World's Energy Saving Efforts Fall Short

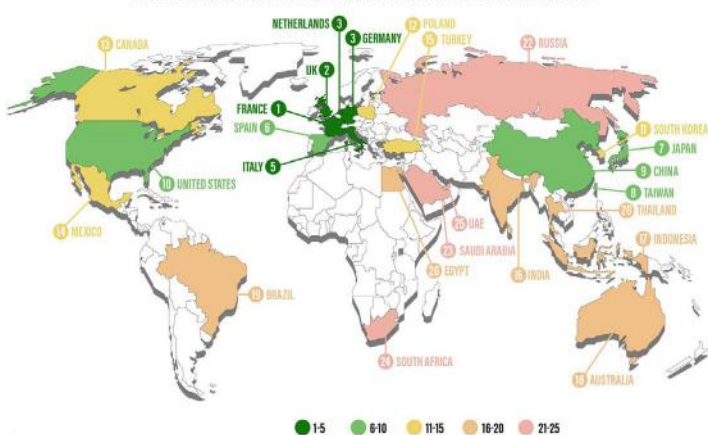
ACEEE's energy efficiency scorecard places the U.S. 10th out of 25 nations surveyed, while countries overall are conserving less power than in 2018.

Countries' limited energy saving efforts have cost them ground toward meeting climate goals over the past four years, and they must now ramp up their efforts if they have any hope of handling climate change as planned, according to the American Council for an Energy-Efficient Economy (ACEEE).

ACEEE's latest International Energy Efficiency Scorecard, which ranked 25 of the world's largest energy users on a scale of 1 to 100 against 36 efficiency metrics, shows that no nation scored higher than 74.5, with that honor going to France. The United Kingdom placed second at 72.5. The U.S., with a 54, finished in 10th place, largely due to the anti-conservation efforts of the Trump Administration. The average score for all 25 countries was 48.5, down from 51 on the previous scorecard in 2018.

"Top-scoring countries, though far from perfect, offer ideas for what other countries can do to increase their energy security, cut emissions, and save money," says Sagarika Subramanian, the report's lead author and ACEEE senior research analyst. Those ideas include incentives for electric vehicle purchase, and performance standards for reducing energy waste, she adds.

THE 2022 INTERNATIONAL ENERGY EFFICIENCY SCORECARD



Bright side. Overall, North America did better at working toward sustainability goals than most of the world, according to ACEEE's 2022 energy efficiency scorecard. SOURCE: AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY



Not ready for nature's worst. Lackluster building codes are enhancing property damage seen by coastal cities, such as New Orleans, the victim of weather-induced flooding several times over the past decade. SOURCE: CAN EUROPE/FICKR

FEMA: Most States Have Inadequate Building Codes

Almost 1 in 5 states receive a zero for their codes' effectiveness, while a similar number have top-of-the-line regulations.

Thirty-nine states have the least effective building codes when it comes to protecting people against wind- and flood-related disasters, according to a new analysis by the Federal Emergency Management Agency (FEMA). Nineteen states received scores of zero for having outdated regulations or minimal penalties to violators.

The states with zero ratings included disaster-prone states such as Louisiana, North Carolina and Pennsylvania. In contrast, 11 states—primarily ones with nation's toughest and most-ecofriendly construction policies, such as California, Florida, New Jersey and New York—received scores of 99 or highly from the agency.

The large number of low scores in FEMA's latest ratings reveals the pressure state officials face to not update building codes amid concern that stringent new standards could increase construction costs, says Leslie Chapman-Henderson, president of the Federal Alliance for Safe Homes. The pressure has gotten worse: In 2021, 28 states finished with FEMA's lowest possible score. Additional states saw scores drop this year because they did not adopt the latest building codes, which are updated every three years, FEMA notes. **GB**

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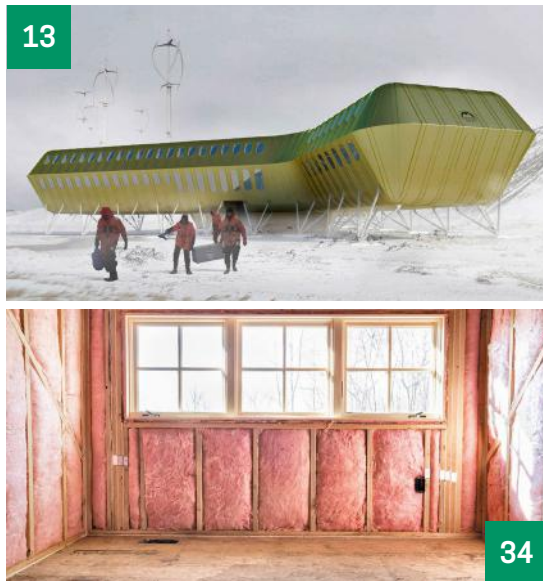
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“What matters when dealing in entirely new approaches to solving problems is understanding that there will be roadblocks, but there is always a way around a problem.” PAGE 14

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TO THE EXTREME

By Alan Naditz

The impact of climate change grows by the day, resulting in ultra-destructive wildfires, weather-induced catastrophes, eco-threatening drought and more. How do we survive? Here's what some people have done to take the lead, and show us the true meaning of resilience.



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TIME'S ALMOST UP

WITH CLIMATE CHANGE, THE WORLD IS APPROACHING SEVERAL TIPPING POINTS. EXPERTS SAY THERE'S STILL TIME TO PREVENT EXISTENTIAL COLLAPSE, BUT SOME DAMAGE IS ALREADY PERMANENT.

IF 2030 IS TRULY THE YEAR when some effects of the climate crisis become irreversible, the world is at T minus 8 and counting down. That's the dire word from the United Nations and its recent report on the world's "climate emergency," one of three reports the UN Intergovernmental Panel on Climate Change (IPCC) has been tasked with crafting before the end of 2022. Each looks to be more cautionary than its predecessor. "IPCC Sixth Assessment: Impacts, Adaptation and Vulnerability" lays it out in a no-BS manner: "Unless we act now, multiple crucial planetary systems are on the cusp of permanent damage."

For several decades, scientists have set a 1.5 degrees Celsius (2.7 degrees Fahrenheit) global temperature increase as the threshold at which the planet can survive, and perhaps repair any environmental damage. That increase originally was expected to be reached by 2100, but more-recent research reveals the process is happening faster and more severely than expected. Mid-century is now the likely point at which climate change can't be reversed, and some permanent negative effects could begin to appear in as little as eight years, under the world's current 1.1 degree C increase, IPCC notes.

"The cumulative scientific evidence is unequivocal," says Maarten van Aalst, a climate scientist who heads the Red Cross Red Crescent Climate Centre in Enschede, the Netherlands, and a co-author of the report. "Any further delay in global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a livable and sustainable future for all."

FROM TOP

Ice waning. The Ross Ice Shelf, Antarctica's largest at 500 miles wide, 350 miles long, and 500 feet tall, is among those threatened by climate change.

CREDIT: MICHAEL VAN WOERT/NOAA

No clear answer.

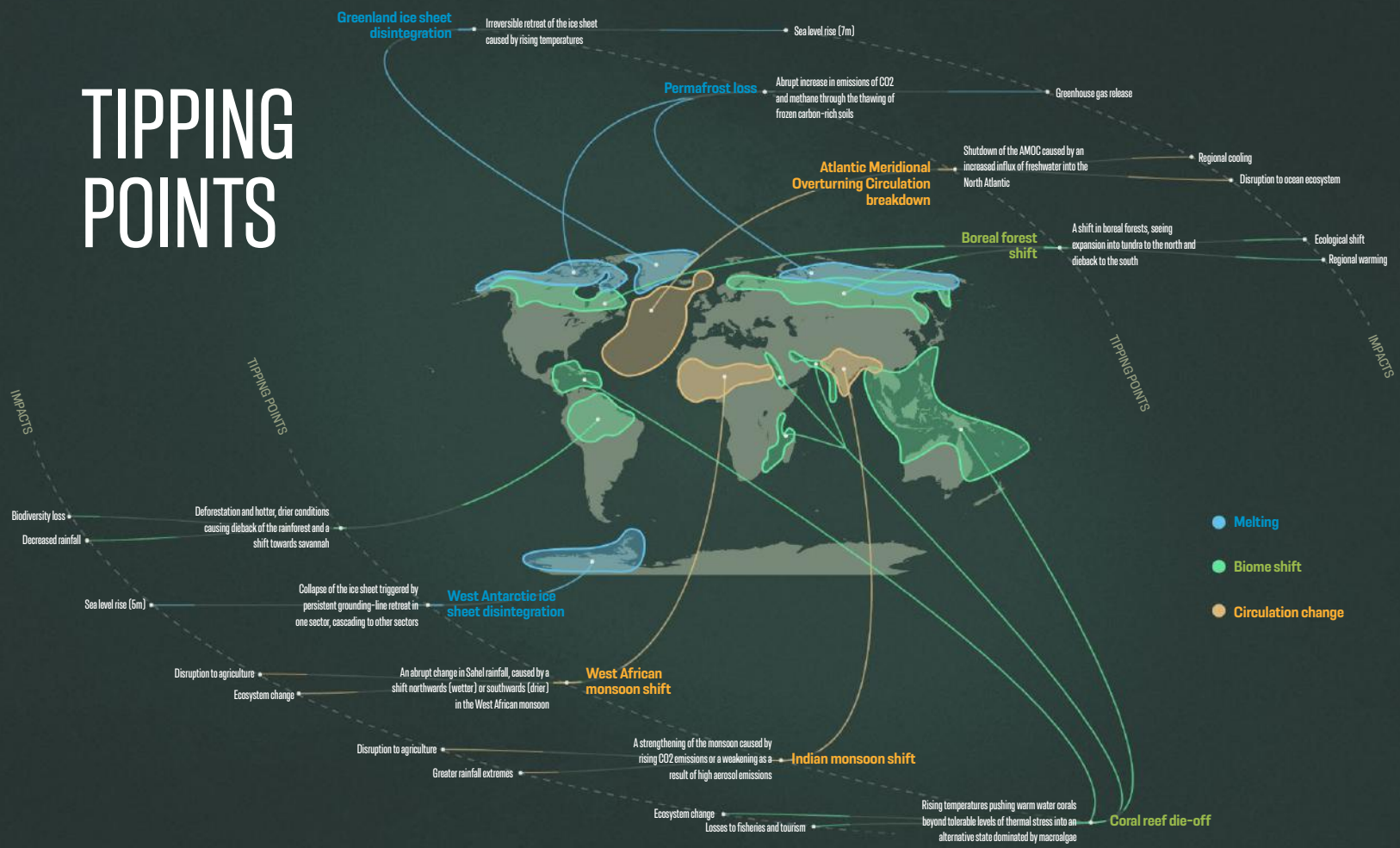
Deforestation has occurred in 20 percent of the Amazon rainforest—shown in the rectangular light green and brown regions—to the benefit of cattle ranchers and food farmers. Meanwhile, society could lose the planet's largest supplier of clean air by the century's end.

CREDIT: SENTINEL HUB/FLICKR

Vanishing act. Boreal forests, such as this one in Alaska, could be nearly extinct within 50 years, threatening the planet's ability to decarbonize 30 percent of its CO₂. CREDIT: KRISTINE SOWL/USFWS-YDNRW

Dead zone. Coral reefs, which protect coastlines from storms and erosion, are on the verge of starvation due to warming waters. CREDIT: PRILFISH/FLICKR

TIPPING POINTS



Point after point. There are nine essential systems in Earth's environment that are threatened by the climate crisis, the collapse of any of which could throw the planet into functional chaos. Several collapses in quick succession could be catastrophic.

SOURCE: CARBON BRIEF

Although the world's response window is quickly closing, there's still time to avoid the worst, according to the report's authors. A lot depends on whether the planet reaches a series of "tipping points" within the next few years. These sinister benchmarks include:

DEATH OF THE CORAL REEFS. Coral reefs protect coastlines from storms and erosion, are the source of new medicines, and provide food to millions of people. But they can survive only within a narrow temperature band, the report notes. The coral that build them get much of their food from algae living in their tissues. When the seawater is too warm, the coral expel algae, causing the coral to turn white or "bleach." If it lasts too long, the coral starve and a thriving ecosystem becomes a graveyard of dead shells. An unrelated 2021 IPCC report revealed that almost 15 percent of the planet's reefs have vanished since 2009, largely due to climate change.

MELTING OF THE ICE SHEETS. The Antarctic and Greenland ice sheets are melting quickly. Loss of the Antarctic sheet could result in up to an 11-foot rise in ocean level; loss of the Greenland sheet

could mean an increase of 23 feet. Though a total meltdown with that kind of damage is projected to take more than a century, it will still mean having to relocate coastal cities worldwide before then.

THE ATLANTIC OCEAN'S CIRCULATION STOPS. The Atlantic Thermohaline Circulation impacts global weather patterns dramatically. A complete collapse could result in a European and North American ice age, accompanied by higher sea level in coastal cities. A process known as the Atlantic Meridional Overturning Circulation (AMOC) keeps warmer tropical water flowing north along the coast of northern Europe to the Arctic, where it cools and sinks to the bottom of the ocean. That cooler water is then pulled back southward along the coast of North America. This circular cycle keeps northern Europe several degrees warmer than it would otherwise be. Some recent research indicates the AMOC system has gradually weakened over the past few decades, and it may soon be "critically unstable," collapsing in 50 to 250 years.

THE "SNOW FOREST" DISAPPEARS. Cold-weather boreal forests that run across the Western

United States, Canada and Alaska store more than 30 percent of all forest carbon on the planet. Without them—a distinct possibility over the next 50 years due to warmer temperatures, fire and insect-induced damage—huge amounts of greenhouse gasses would be released into the atmosphere, worsening global warming. Dead trees are also fire hazards, and would be replaced by grasslands, which are less-productive at CO₂ storage.

THE AMAZON RAINFOREST BECOMES A SAVANNA. Similar to the fate of the snow forest, the 2.5 million square mile Amazon rainforest—home to an estimated 30 percent of the world’s species, and capable of creating its own rainfall—is dying due to rising temperatures, drought, fires and clearcutting. Anything destroyed will be replaced by grasslands with few trees. A March 2022 report by British and German researchers estimates that 75 percent of the Amazon is headed toward its own tipping point, although no exact date of that status has been determined—yet.

Any of these collapses, even partial, would be disastrous for life on Earth, experts note. And, systems that become unstable will affect others, leading to more instability and potential collapse. “I’ve seen many scientific reports in my time, but nothing like this,” says UN secretary-general António Guterres. “It is a damning indictment of failed climate leadership.”

CALL TO ACTION

An estimated 3.6 billion people—more than 40 percent of the world’s population—are highly vulnerable to climate change, according to the study. From 2010 to 2020, 15 times more people died from floods, droughts and storms in very vulnerable regions, including parts of Africa, South Asia and Central and South America, than in other parts of the world.

“Any more delay in climate action is going to close off opportunities to head off the worst impacts of climate,” says report co-author Sarah Cooley, director of climate science at the Ocean Conservancy in Washington, D.C. “But the good news is, there are more details than ever about how the global community can meet the challenge effectively, despite our slow start.”

Adaptation is crucial. Feasible solutions already exist, but more support must reach vulnerable communities, the report notes. At least 170 countries’ climate policies now include adaptation, but many have yet to move beyond planning into implementation. The good news is that existing adaptation options can reduce climate risks if

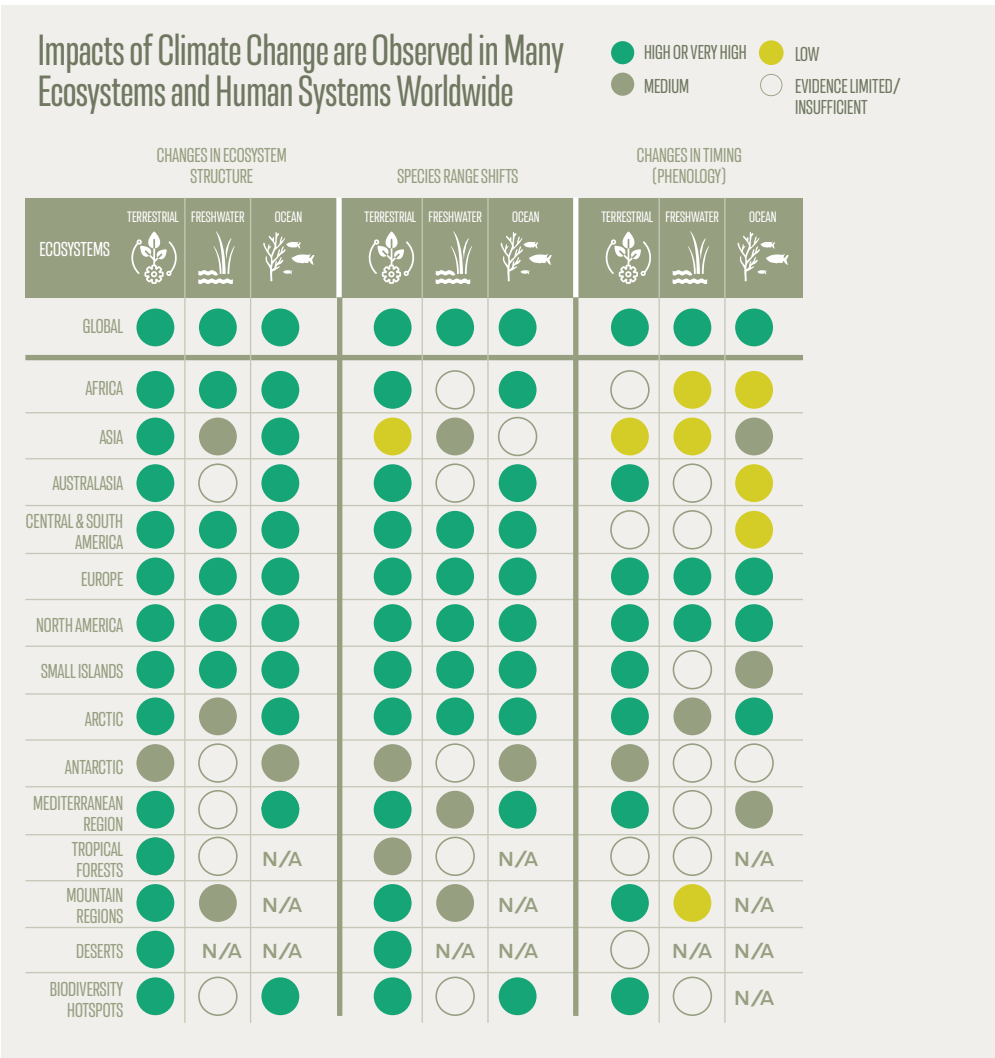
they are sufficiently funded and implemented with more speed and urgency.

These options include ecosystem-based adaptation, which includes the protection, restoration and sustainable management of ecosystems to more sustainable agricultural practices like integrating trees into farms, increasing crop diversity and planting trees in pastures. Ecosystem-based adaptation can reduce already-present climate risks—including droughts, extreme heat, floods and fires—while aiding biodiversity, livelihoods, health, food security and carbon sequestration.

New technologies are another factor. Combining nature-based solutions with engineered options such as flood control channels may help reduce water-related and coastal risks, particularly in cities, the report notes. Access to better technologies can also help strengthen resilience. Experts note that this is where upgraded methods of clean energy such as wind and solar, more-efficient use of building materials, and earth-friendlier structural design can boost resistance to a raging climate. They might even reduce and perhaps reverse the environmental damages that are expected to come. **GB**

Worldwide impact. Climate change poses a risk to life-supporting systems, from ecosystem structure to length of time between ecological events.

SOURCE: UN INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) “IPCC SIXTH ASSESSMENT: IMPACTS, ADAPTATION AND VULNERABILITY” REPORT



Here's How Buildings Must Change

AS CLIMATE
IMPACTS BECOME
EXISTENTIAL,
HOMES NEED TO
BE REDESIGNED

BY LAURIE SCHOEMAN

SINGLE-FAMILY AND MULTIFAMILY HOUSING used to be designed and built to consider natural weather conditions: Tall, operable windows brought in more natural light and air, color varieties improved residents' mental health, and local building materials were chosen for their durability and adaptive qualities. Since World War II, however, housing has largely been a cookie-cutter construct, reliant on an abundant supply of mechanized systems that regulate internal temperature, humidity, and ventilation. If we hope to meet the challenge of the climate crisis, we need a reboot of how we approach construction. Whether designing new single-family or multifamily housing, or retrofitting existing housing, here are eight things to consider when designing a climate-resilient home:

1. THE HOME SITE. Knowing the distance between the site and a flood plain, a historical fire zone, or a seismic area is critical in order to understand exposure to storm surges, extreme drainage, flood path, or fire. Whenever possible, homes should not be constructed in areas that are extremely prone to climate events. Enterprise has created a free tool, [Portfolio Protect](#), which can help developers and homeowners assess the risk to their properties from flooding, fires, earthquakes, and other climate hazards.

2. ABILITY TO REFLECT HEAT. Darker colors absorb heat and raise the temperature of the building, house, and site; lighter colors reflect and reduce heat. New home construction should utilize lighter colors across the site, from roof to pavement to paint, so that the heating footprint is reduced as much as possible.

3. ENERGIZING THE HOME. Overground and exposed electrical lines can severely limit power reliability during extreme weather events, as can off-site power generation. Buildings should install underground electrical lines and, when possible, should have the ability to produce power on site, through solar cells or other means.

4. CONSERVING AND PROMOTING WATER HEALTH. Most water systems in the United States are delivered via central treatment service in water districts through distribution lines. When these lines fail or get damaged, or if water is in short supply, as it is in the West, households can be left without potable water. Fortifying the building's septic system to prevent water supply contamination and collecting rainwater to reduce dependence on the wider water system can make a home more resilient in the face of climate crises.

5. SEALING THE ENVELOPE. In rain- and flood-heavy areas, the building envelope must be sealed securely and completely, as any leaks can allow water into the wall cavities, which can cause mold and structural damage, greatly impairing the safety of the home.

Developers must take steps to seal the foundation as well to prevent efflorescence, which can cause long-term structural issues.

The United States has nine distinct climate zones determined by regional variations in climate conditions. So, why do we find uniform housing stock across the country?

6. VENTILATING THE HOME. Passive ventilation, such as through operation windows and vents, is essential to creating a climate resistant home. Without these installed, buildings are forced to rely on mechanical cooling and heating products, which are not only more expensive but are also susceptible to failure in the event of power grid instability.

7. A STRONG STRUCTURE. It may sound obvious, but a strong building structure is an important step toward achieving climate resiliency. The continuous load path, a construction method that ties together the various parts of the house using timber, metal connectors and fasteners, and shear walls, must be free of defects and in good order. Enterprise's [Keep Safe Guide](#) offers strategies that can be used to strengthen housing against natural hazards like hurricanes and earthquakes that have the potential to cause catastrophic structural failure.

8. EFFICIENT SYSTEMS. During a weather emergency, power and water could be rationed. Constructing an energy- and water-efficient home reduces the amount of utilities consumed and increases resilience under extreme circumstances.

Too often, these critical factors are rushed or overlooked altogether in the hurry to build or sell a home or apartment building. But the reality is that there is nowhere left to move that is safe from climate and weather events. Resilience in building design is no longer a luxury; it is a necessity. Lives, homes, and economies are depending on it.



Fire, Flood and Force

WHEN NATURE UNLEASHES ITS FURY, WHY DO SOME HOMES SURVIVE, WHILE OTHERS DISINTEGRATE?

Life in the Fire Zone

ON OCT. 9, 2017, as Santa Rosa, California residents waited for word about the impact of the Tubbs Fire upon their homes, Howard Booster received a video. It showed the entire neighborhood burned to the ground—except for Booster’s house. Somehow, the 35-year-old dwelling had survived, comparatively unscathed. Keeping the area clear of wild brush and maintaining a safety barrier around the home had apparently worked.

Fast-forward to the next day, when Booster arrived on scene. Instead of a standing structure, there was...nothing. His home looked like the other dozen in the area: a pile of ash. “The ground was entirely black,” Booster told *SFGate.com*. “If you

took charcoal and painted everything with it, that’s what it looked like.”

Had someone played a sick joke?

He should have been so lucky. According to fire officials, the Boosters’ house had burned from inside out. Hot embers had been blown into the soffit vents in the attic beneath the roof, eventually setting it on fire. So much for fire prevention.

NEW IDEAS ONLY, PLEASE

When Booster and his wife, Merritt, started to rebuild the home a couple years later, they had several ground rules: No attic or soffit vents. No wooden roof. Nothing from the old house, design-wise, to be used in the new one. Architect Brandon Kelly of Napa-based **Kelly + Morgan Architects** obliged, drawing up a plan for a structure that included a metal roof, prefabricated steel framing with noncombustible spray foam insulation, and thick, incredibly hard-to-burn engineered cedar for an exterior.

The 2,900-square-foot house, built by Santa Rosa local **Mikara Construction**, would also be an all-electric model running entirely on solar energy and at net zero efficiency. The framing, developed by Canadian homebuilder **BONE Structure**, is 90 percent more efficient at cooling and heating than a typical home. And, the house—completed in 2019—would be a bit ahead of its time, as California’s updated building code would require homes built from 2020 on to be net zero-capable.

There were other less-dramatic changes, such as developing an irrigated meadow near the house, instead of dry grass. Trees lost to the fire were replanted with native, less-flammable oaks. The design also included a small tower at one end of the house, which serves as a neighborhood lantern, a fire lookout, and even a place for grandkids hang out.

Overall, the new home serves as an example of what other homeowners can do after a fire, or even before one to prevent costly damage. More than 5,600 homes were lost to the Tubbs Fire, which burned more than 36,000 acres within four counties. It remains one of the most residentially destructive wildfires in California history, according to the California Department of Forestry.

Tragic as it was back in 2017, the loss of the original house has turned into a blessing, according to Booster. Always an optimist, Booster notes that 35 years of life in one area has given him great perspective: New is not always entirely new. “Who really gets to start from scratch?” he asked Kelly. “We still know where the wind, the sun and the rain comes from.”

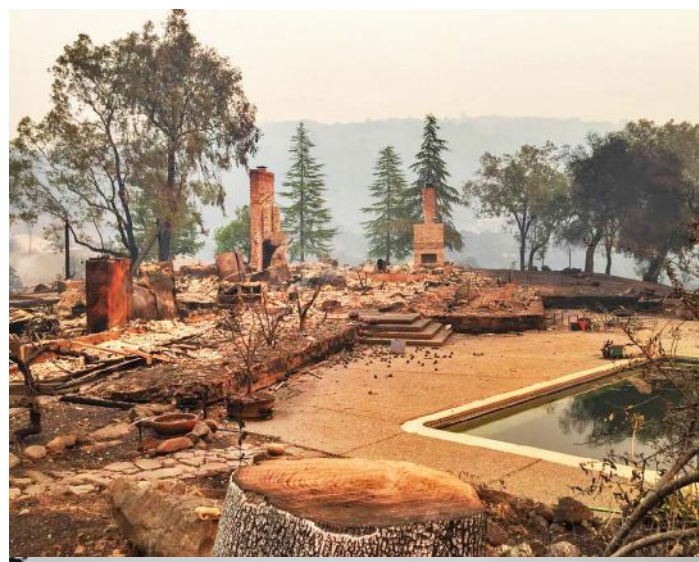
CLOCKWISE FROM TOP

Phoenix rising. More than 5,600 homes in and near Santa Rosa, California, were destroyed during the Tubbs Fire in 2017. But one owned by Howard and Merritt Booster came back better—and greener—than before, with an all-electric, all-solar, net zero format. CREDIT: COURTESY OF BONE STRUCTURE

Second effort. After the fire, Howard and Merritt Booster went to work replacing what had been in the family for 35 years. The effort ended in 2019 with an energy efficient, fire-resistant dwelling. CREDIT: COURTESY OF BONE STRUCTURE

Nature’s wasteland. The Tubbs Fire left little more than charred wreckage and stone throughout Santa Rosa, forcing homeowners like the Boosters to start over. CREDIT: CALIFORNIA NATIONAL GUARD/Flickr







Above and Beyond

WITH THE FEDERAL Emergency Management Agency (FEMA) projecting that nearly 15 million U.S. homes are currently in danger of flooding due to bad weather or rising coastal waters, wouldn't it be great if a homeowner could merely lift a house up and move it to a safe location?

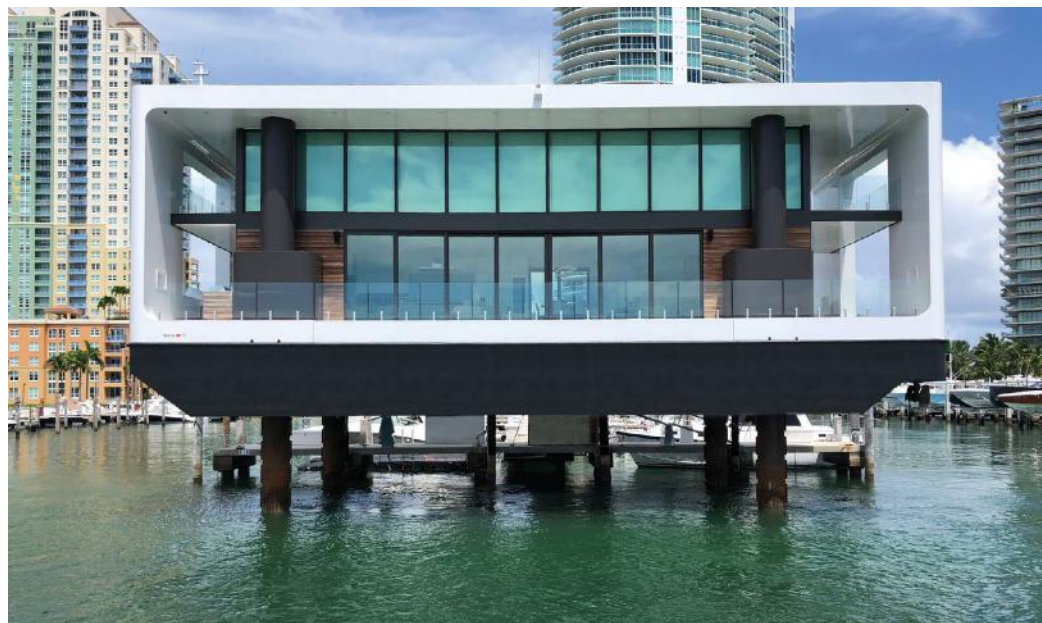
Dutch architectural firm [Waterstudio.NL](#) now provides such an option. The company has designed a mobile dwelling on stilts that can rest alongside a dock or shoreline, floating above the water. But, when desired—or necessary—the stilts can be retracted, lowering the home and allowing it to be taken out to open sea at up to 5 knots (5.75 mph).

Measuring up to 22 meters (75 feet) in length and equipped with two noise-free electric thrusters, the residence actually classifies as a yacht—which is exactly what Waterstudio.NL client [Arkup](#), a yacht manufacturer, wants. But the *Arkup 75*'s 2,700-square-foot rectangular shape, along with a two-story, four-bedroom, four-bathroom floorplan, also makes it resemble a residential home.

WATER, WATER EVERYWHERE

According to Waterstudio.NL founder Koen Olthius, the “livable yacht’s” design is based upon a flamingo’s one-legged stance, which enables the creature to balance its body over the water while resting one leg and touching the water’s bottom with the other. The craft’s four 12-meter (39 foot) steel spuds, which can extend to up to 7.6 meters (25 feet) below the surface and anchor the building in place, also make it impervious to Category 4 hurricane winds of up to 155 miles per hour (mph). “When [the house is] above the water, the waves only hit the stilts,” Olthius notes.

Meanwhile, a solar-powered electric system, a rain-harvesting unit and a purification system make the home capable of operating off-grid. A 36 kilowatt hour (kWh) solar array covers the entire roof to provide electricity for air conditioning,



appliances, lighting, propulsion and all other operating systems on board. In theory, it can stay in open water indefinitely as long as there is enough solar power to provide energy, according to Olthius.

“[The] livable yacht combines the best attributes of yachts, floating houses, and waterfront villas, with the added benefits of being self-sufficient, sustainable, and environmentally friendly,” Arkup notes. “[It’s] conceived to be ‘future-proof,’ from its ability to withstand or avoid extreme weather events, to its self-contained systems that allow fully off-the-grid living.”

There are similar elevated home projects geared toward traditional on-land dwellings. But Waterstudio.NL and Arkup believe that the home of the future will be on the water as sea levels rise due to climate change. “These buildings are portable and can react to known and unknown changes in the demands of near future society,” Olthius notes. And COVID-19, he adds, has raised the popularity of off-grid, off-shore independent living.

FROM TOP

Smooth operator. As a house, the *Arkup 75* uses retractable stilts for raising from and lowering to the water as needed, and makes the unit hurricane safe. As a yacht, a pair of electric engines can propel the dwelling to other destinations when desired. CREDIT: CRAIG DENIS/ARKUP

Double identity. Arkup’s “livable yacht” has the comforts of home, including bedrooms, bathrooms, a kitchen and dining area, a washer and dryer, and electric lights. But it also has a control room for lake and ocean voyages.

CREDIT: CRAIG DENIS/ARKUP



Soft Shell

FROM TOP

Under cover. Hurricane-resistant canvas installed in front of windows and in the terrace gives the Fuster + Architects project the ability to withstand winds of 75 miles per hour or more.

CREDIT: JAIME NAVARRO

Clearing the air. A series of “hot air chimneys” create a suctioning effect that continuously circulates air from the outside and through the inside of the house.

CREDIT: JAIME NAVARRO

AFTER BEING HIT DEAD-ON or sideswiped by eight hurricanes and tropical storms since 2017, Puerto Rico is not the place many people would want for their next home. The combined impact of the storms—which included Hurricane Irma and Hurricane Maria—topped \$92 billion, with more than 160,000 homes destroyed and more than 3,000 people killed, according to the nation’s climatic data center.

But in 2020, when a client approached San Juan-based architecture firm **Fuster + Architects** about building a new house within the hurricane zone of Puerto Rico’s southeastern coast, the architects knew they had to keep several things in mind.

First, the house had to be able to withstand winds of at least Tropical Storm strength—which hit up to 75 miles per hour (mph) and possibly

beyond—to at least mid-hurricane level of Category 3, for which winds top out at 130 mph.

They chose an unusual approach. A hurricane-resistant, canvas-like material was installed in front of windows and in part of the terrace. The material, which easily retracts like curtains, also allows light to enter the home. “Usually, hurricane shutters are an unwelcome accessory in many structures,” the company notes on its website. “This solution incorporates this element as an integral part of the main architectural expression.”

The home is also single story and sunken a half level, with eight “hot air chimneys” that are opened opposite to the prevailing wind direction to create a suctioning effect that continuously circulates air from the outside and through the house. The chimneys double as skylights, bringing in additional natural light—a key feature should power fail for several days due to a storm.

FURTHER BENEFITS

There are other weather-resisting and energy-saving features. The house is constructed in an insulated concrete system with a high R-value, which makes it extremely efficient in terms of cooling. “In Puerto Rico’s tropical environment, most concrete structures are not insulated and therefore allow the extreme heat to pass through,” the company notes.

The plaster on the house is a structural mortar with high compressive strength of 4,000 psi and a Type N for finishes that are resistant to sulfate and carbonate attacks. The plaster contains the continuous insulation found on the interior of the wall. And, the floor of the house is finished in polished exposed concrete. “It is the only structural element without insulation because it is not needed in this climate,” Fuster + Architects notes.



Cold Comfort

ANTARCTIC EXTREMES OFFER
LESSONS IN BUILDING SCIENCE
AND BEHAVIOR.

WHEN ARCHITECTURAL FIRM **Kuryłowicz & Associates** prepared to undertake its latest new home project, there were a few obstacles. The structure was in a very remote location and had to be completely off grid. The exterior needed to withstand an extremely harsh wind, and insulation had to be world-class, given the area's frequent sub-zero temperatures. The project was huge—about 5,000 square feet—and the construction window was only a few months, so the design needed to instigate an ultra-efficient building effort.

Those challenges may sound routine for experienced architects. But the “home” is in Antarctica, about 8,700 miles from the firm's headquarters in Warsaw, Poland. K&A's project is the Henry Arctowski Antarctic Station, a research facility on King George Island in the South Shetland Archipelago, about 75 miles from the Antarctic coast. When construction is complete in 2024, up to 29 scientists will call this place home for months as they (ironically) study the impacts of temperature-increasing carbon emissions and climate change upon the planet's coldest, driest continent.

Overall, the goal was to create a facility that “provides scientists with research space and a ‘home away from home’ atmosphere,” according to K&A's website.

HOW TO GET FROM HERE TO THERE?

One of K&A's first challenges was finding a way to handle the world-length mileage from Europe to Antarctica when it came to delivering construction components, which could take months. In an interview with *The Calvert Journal*, architect Bartosz Świniarski said any construction would have to occur during the annual “good weather window” of November to February, when temperatures can reach as high as 50 degrees Fahrenheit and wind is minimal. Product delivery and project development had to be quick. At other times of the year, construction crews could face average temperatures of minus 40 degrees F and near whiteout conditions, according to data from the Australian Antarctic Program.

“The decision was made to design it so that it could be prefabricated and tentatively assembled in Poland, and then disassembled and shipped to Antarctica in shipping containers to be assembled on the spot,” Świniarski noted. “This resulted in a modular construction philosophy reminiscent of IKEA furniture, with drawing packages that contain dimensions and instructions and a particular set of tools needed for assembly.” Assembly time, he added, would be less than three months.

COMFORT FACTOR

Then there were the extreme weather conditions. The facility had to hold up against wind gusts reaching almost 250 feet per second (about 170 miles per hour). The Antarctic Treaty of 1959 prohibits any building from being permanently fixed to the ground, so strong winds could literally cause it to fly away. Ultimately, the cross section of the building was designed as an inverted aircraft wing, about 10 feet off the ground, which causes the wind itself to keep the building firmly in place, Świniarski explained. The structure's elevation would also prevent formation of snow mounds and reduce impact on the environment.

A crucial aspect of the overall design was material for the building's outer skin, Świniarski noted. “The strong local winds carrying small rocks and salty water will cause accelerated wear to any material, so we were looking for a product that would be resistant to scratches and rusting,” he stated. “The choice was an alloy of copper and aluminum, which gives the building a distinctive, surprising golden color. The material will lose a bit of its initial shininess due to weathering but it

RIGHT

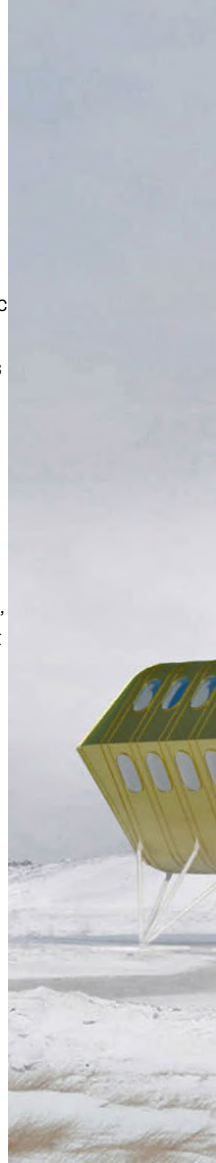
Good as gold. As a self-sustaining research facility, the Henry Arctowski Antarctic Station relies upon green energy, sustainable practices by residents, and carefully crafted living space.

CREDIT: COURTESY OF KURYŁOWICZ & ASSOCIATES

BELOW

Southern comfort. Station residents have private rooms, enabling them to feel more at home, instead of in isolation thousands of miles away.

CREDIT: COURTESY OF KURYŁOWICZ & ASSOCIATES





will not lose its tone, rust, or need maintenance.”

Meanwhile, the interior is wood lined, covering layers of acoustic and thermal insulation. Large windows throughout the building help create a “familiar environment” for residents. That mood is accentuated by the inclusion of independent living quarters, a gym, sauna, library, kitchen, recreation area, and a greenhouse. The windows also maximize natural light and bring residents panoramic views of the area, another psychological plus. And there are, of course, the “business necessities,” done up in better-than-business casual fashion: laboratories, work spaces, lecture space, and storage.

SELF-SUSTAINING SYSTEMS

Energy availability is a challenge for research facilities throughout Antarctica. There are currently more than 70 research stations, representing 32 countries, scattered across the continent. All use diesel fuel for power to some extent, but many are supplementing energy needs in some green manner. Wind is the No. 1

choice, followed by solar, and Henry Arctowski Antarctic Station has both of these in play. Vertical wind turbines were incorporated into the design to lower the building’s carbon footprint. Solar photovoltaic panels were also added to maximize the renewable energy sources during the Antarctic summer.

In addition, the building’s electric heating system is decentralized, allowing wings of the building to be shut down in the winter months, when occupancy was low and the need for internal warmth is greatest.

Meanwhile, water used at the station will be supplied from an artificial reservoir filled by melting glacier water.

The station itself has a sustainable ending. “The modular assembly of the structure means that the building can also be easily disassembled at the end of its working life, which may be 50 years from now,” notes **Buro Happold**, the project’s structural engineering firm. “The timber superstructure also has the benefit of being easily reusable on the site for either further construction



CREDIT: RENÉ ROBERT/INTERNATIONAL POLAR FOUNDATION

South Pole Passive

THE PRINCIPLES OF PASSIVE BUILDING CAN EVEN BE APPLIED IN THE ANTARCTIC.

AS THE WORLD'S first zero emission polar research station—an honor bestowed upon it after the facility's construction by Belgium in 2008—Princess Elisabeth Antarctica, located about 125 miles inland, integrates passive building technologies, renewable wind and solar energy, water treatment facilities, continuously monitored power demand and a smart grid for maximizing energy efficiency.

Here are several passive and zero-emission aspects of the facility, according to antarcticstation.org.



PASSIVE SOLAR GAIN

Despite being in the coldest environment on Earth, no form of heating is needed to keep researchers warm.

The station maintains its internal temperatures using only incoming sunlight, and the heat produced by human beings and the station's electrical appliances.



INSULATION

Besides the need to shield its occupants from Antarctic cold, the facility also needs to be air- and water-tight to achieve optimal energy use and heat transfer. Princess Elisabeth Antarctica's insulation is nine layers thick, each of which has its own special function: stainless steel (exterior); closed-cell polystyrene foam; EPDM silicone sealant; lamellate wood (80 millimeter); low-density polystyrene charged with graphite; lamellate wood (60 mm); kraft paper; aluminum vapor barrier; and woolen felt.



VENTILATION AND HEAT EXCHANGE

The station's integrated heat exchange and ventilation systems extract vitiated or "stale" air (i.e., air without much oxygen, such as that which has been exhaled) and replace it with fresh air. Doing so prevents the station from turning into a sauna, as repurposed air is significantly warmer than incoming. It also spreads the collected heat over the building, with some areas such as the technical core needing more than others.



PHOTOVOLTAIC SOLAR PANELS

These are the traditional panels found on commercial buildings, capable of withstanding the harsh winds and subzero winter temperatures. They cover most of the station's surface and roofs, feeding the facility's smart grid with electricity. Any excess production is stored in lead-acid deep cycle batteries.



THERMAL SOLAR PANELS

Located on one side of the station roof, thermal solar panels are used to melt the snow and heat the water for the station's bathrooms and kitchen.



WIND TURBINES

Nine wind turbines complement the solar installations and are vital during the six-month-long winters spent in 24-hour darkness. Although each unit is designed to withstand some of the most vicious storms on Earth, the blades can close down if needed.



According to polarfoundation.org, many of the energy solutions perfected at Princess Elisabeth Antarctica have already been or will eventually be used in mainstream applications. These will "redefine energy use in our homes, offices and schools, and in every home, town and city across the world."



Heat Map

THE SUCCESS OF THIS ARAB CITY OFFERS HOPE FOR REGIONS FACING RISING TEMPERATURES WORLDWIDE.

WHEN ONE THINKS of Masdar City, a suburb of Abu Dhabi in the United Arab Emirates (UAE), one has to appreciate the irony: The world's greenest city may one day emerge from a place where little of anything green currently exists.

Work began in 2008 on what was envisioned as a \$22 billion, four-square-mile model of sustainability: An actual city built from scratch—one capable of housing 50,000 people and supporting nearly 2,000 businesses—powered entirely on clean energy. According to **Foster + Partners**, the architectural firm that designed the city, the goal was to “advance the development of renewable energy and clean-technology solutions for a life beyond oil.” It's a bold statement, considering that the UAE alone has 6 percent of the world's oil reserves (the U.S., by comparison, has 4 percent), and 95 percent of those are in Abu Dhabi, according to the “BP Statistical Review of World Energy 2020.”

But it's also a look at the future. According to the United Nations Department of Economic and Social Affairs, more than half of the world's population now lives in cities, and by 2050 this



number will increase to nearly 70 percent. Cities will soon account for 90 percent of global population growth as well as about 75 percent of global carbon dioxide (CO₂) emissions and 75 percent of energy consumption.

Water will be another struggle. Only 5 percent of the UAE land is suitable for growing crops—there is little potable water. Groundwater provides only about 51 percent of the UAE's water supply, with the rest covered by desalination (37 percent) and reclaimed water (12 percent) for irrigation.

Yet, with development comes increased water and energy demand. In the UAE, population

Green kingdom. When completed in approximately 2030, a carbon-neutral Masdar City will be home to up to 50,000 people and offer 40,000 jobs.

CREDIT: COURTESY OF FOSTER + PARTNERS



TOP RIGHT

Star power. Buildings throughout Masdar City are powered by solar energy from the city's own generating plant, and photovoltaic panels on all rooftops.

CREDIT: COURTESY OF FOSTER + PARTNERS



growth is expected to increase water need 30 percent by 2030.

This is why, according to Foster + Partners, the bar has been set pretty high for Masdar City.

Buildings in Masdar City are designed to be at least 40 percent more energy- and water-efficient than conventional buildings. Offices and homes are equipped with smart devices that reduce the water and electricity consumption of users. For example, there are no light switches or water taps within the city; instead, motion sensors are used. This technique is expected to save up to 50 percent of the energy and resources that would otherwise be exhausted by the inhabitants, according to a report at re-thinkingthefuture.com.

Electricity comes from the city's own 10 megawatt (MW) photovoltaic plant and a network of 1 MW solar panels on rooftops throughout the area. Combined, they produce approximately 17,500 megawatt hours (MWhs) of electricity

annually, displacing more than 7,000 tons of carbon emissions per year.

All water used in Masdar comes from desalination, rain and the treatment of wastewater. UAE has also begun research into use of hyper dehumidifiers that turn moisture in the air into drinking water for public consumption. According to a report in Daily Mail, 20 of the dehumidifiers can produce 6,700 liters of fresh water per day under the right weather conditions.

Buildings are constructed with low-carbon cement and 90 percent recycled aluminum, as well as other locally sourced and verified materials. Ninety percent of construction waste is reused or recycled.

EVERYTHING'S UNDER CONTROL

Fuel-burning cars are forbidden in Masdar City. To eliminate vehicular carbon emissions, a fleet



of driverless, electric-powered pod cars—similar to the 1993 Sylvester Stallone film “Demolition Man”—transports people within the development, although much of the travel can be done by walking due the city’s small size.

The geographic radius and design of the Personal Rapid Transit (PRT) system has changed over the years, largely due to continued advancement in technology and cost-cutting measures. But PRT has shuttled more than 2.5 million passengers since its launch in 2010, and displaced CO₂ emissions equivalent to running 70 cars for a whole year, according to Masdar, the UAE-government owned renewable energy company that serves neighboring Abu Dhabi. “This achievement stands as a true testament to our culture of innovation,” says Yousef Ahmed Baseilaib, Masdar’s executive director of strategy and corporate development. “The popularity of the PRT demonstrates how functional sustainable urban transport development is paving the way for cities of the future.”

Weather conditions have also been taken into account. Masdar City is in the middle of the Abu Dhabi Desert, where the temperature regularly tops 100 degrees Fahrenheit in summer. In addition to a perimeter wall designed to keep strong winds and sandstorms in check, its streets are narrow and oriented so as to take advantage of air currents, according to a report in *Tungsteno*. Public spaces can also be cooled naturally, by as much as 40 degrees. “The city has a 147-foot wind tower that redirects air from the top of buildings to pedestrian areas,” the report notes. “In this way, it channels fresh air currents along the city streets.”

Completion of Masdar City was expected by 2014, but the recession, pandemic and other factors have pushed that date to 2030. Only about 3,000 people live there now, but that total is expected to double by 2023, according to the company Masdar. The city has also attracted the attention of roughly 400 energy-related companies, including General Electric, Mitsubishi Heavy Industries, Schneider Electric and Siemens.

“Hard lessons have been learned, but despite coverage of difficulties in construction and development and slow growth in residency as the project evolved, the initiative kept going,” Masdar CEO Mohamed Jameel Al Ramahi told *Forbes* magazine. “What matters when dealing in entirely new approaches to solving problems is understanding that there will be roadblocks, but there is always a way around a problem.”





Desert Dream

THE U.S. WILL ONE DAY HAVE A CUSTOM-BUILT, SELF-SUSTAINING GREEN CITY OF ITS OWN, IF BILLIONAIRE MARC LORE HAS HIS WAY.

FROM TOP

Green giant? The city of Telosa, as currently planned, will be a built-from-scratch, self-supporting and eco-friendly metropolis that is home to 5 million people upon completion in the early 2060s.

CREDIT: COURTESY OF CITY OF TELOSA.COM

Path to greatness. Developers hope Telosa will become a blueprint and a source of encouragement for other carbon-neutral, renewable energy-driven cities in the U.S. and elsewhere.

CREDIT: COURTESY OF CITY OF TELOSA.COM

ALL-SUSTAINABLE—AND ALL-NEW—CITIES ARE going to be all the rage over the next 10 years. The United Arab Emirates (UAE) got the ball rolling with its Masdar City project in 2008, for which completion isn't expected until at least 2030. It also has the Sustainability City, Dubai Silicon Oasis, Desert Rose City and Neom projects underway, slated for grand openings within the next decade.

Not to be left out, billionaire investor **Marc Lore** and world-renowned architect Bjarke Ingels have announced a plan to build an all-green, all-smart city from scratch somewhere in the southeastern United States. The city, **Telosa**, will be constructed over a 40-year period on 150,000 very remote acres, possibly in Nevada, Utah, Idaho, Arizona, or Texas. When complete, Telosa—whose boundaries would make it about the size of Chicago—would have a population of 5 million.

Lore is known for launching 1800DIAPERS/Diapers.com and Jet.com in the past two decades. These were later acquired by Amazon and Walmart, respectively, in deals worth a combined \$4 billion. He also owns the NBA's Minnesota Timberwolves and WNBA's Minnesota Lynx basketball teams, and is now CEO of gourmet food delivery startup Wonder Group.

Ingels and his firm, **Bjarke Ingels Group (BIG)**, is known for numerous cutting-edge, sustainable and eye-popping projects worldwide, including Google's headquarters in Mountain View, California.

According to Robb Report, Telosa will feature "wide-open streets that prioritize pedestrians and cyclists but still offer room for autonomous public transportation. It will be replete with verdant public spaces that reflect the green ethos. There will also be facilities to recycle water and process renewable energy to promote long-term sustainability. And, at the center, will be a giant viewing tower called Equitism, which will act as a beacon for the city and a meeting place for its residents."

On Telosa's website, Lore says the vision is to "create a new city in America that sets a global standard for urban living, expands human potential and becomes a blueprint for future generations." He estimates that it will cost \$25 billion for the initial phase of 1,500 acres for 50,000 residents, and \$400 billion by buildout.

"Residents will come to Telosa for several reasons—good jobs, education, and a higher quality of life will play a large role," Lore says. "At the same time, we also believe that many will come to Telosa to take advantage of our new way of life. Some will come for the adventure and to live in a vibrant, exciting, sustainable city that is forging a blueprint for the future. Most importantly, the residents will have a part in creating something new, and with that comes the inherent pride to join the community."

But building an all-new city in a desert presents many challenges, especially if it is to be sustainable, said Zhihua Wang, an associate professor at Arizona State University's School of Sustainable Engineering and the Built Environment, in a report from Smart Cities Dive. "Desert is hot. Water is scarce," notes Wang, a Phoenix resident. "A new city definitely would face all the problems we are currently facing here in Phoenix."

The No. 1 problem, of course, is water. Las Vegas, the nation's most-high profile desert city, is, along with the rest of the Western United States, enduring a severe water shortage due to drought. If built in a similar location, Telosa would require 10 times as much water and electricity. Where does that come from?

That's why so many cities, historically, began near a water source, Wang notes. But he adds that building a city anywhere is not impossible if planned properly. "We have all the experience, all the things we can learn from building existing cities," he said. "If we start from scratch, there's a lot of information we can use. We can avoid a lot of things that went wrong historically."





The Good Earth(ship)

PEOPLE SAY MICHAEL REYNOLDS' OUTLANDISH HOME DESIGNS ARE PURE RUBBISH. THEY'RE ABSOLUTELY RIGHT.

WHAT DO OLD tires, aluminum cans and discarded bottles have in common? Yes, they're typical trash found in landfills. But they're also the key components of architect Michael Reynolds' "Earthship," a futuristic, custom-crafted and highly sustainable house dreamed up by Reynolds almost 50 years ago.

Reynolds' initial compound, the [Greater World Earthship Community](#), consists of 130 dome-shaped homesites—roughly 70 of which are currently developed—on 640 acres near Taos, New Mexico. About half of the land is part of a green belt that can never be developed upon. But any homes that are built have several requirements, according to Reynolds.

The house must be constructed from natural, indigenous and repurposed materials. Tires filled with packed soil are used to build the main support walls; aluminum cans, mortar, and glass bottles are used for interior walls. At least 40 percent of the structure must be recycled material, but "an owner can otherwise be as sustainable

or traditional as they want," Reynolds said in an interview with NBC News.

Earthships are heated and cooled by solar energy and thermal mass. Cooling is also enhanced with natural ventilation through buried cooling tubes and operable vent boxes.

To aid with thermal heating, the north side of the house is buried underground. Windows make up most of the south-facing wall, which acts as a heat collector and makes a room here into a perfect greenhouse, where food can be produced all year. A typical Earthship can produce 25 to 50 percent of the food its residents need.

Power is generated on site by photovoltaic solar panels and wind. The home's reliance on clean energy works well; an Earthship's electrical needs are only 25 percent of what's needed for a conventional home, according to Reynolds. Most residents can meet their energy needs with 1 kilowatt or less of energy production from solar panels. The wind power is actually a backup for overcast or stormy days. "The homes are meant to be completely off the grid," he notes.

Rainwater is collected, stored and filtered for residential use. Wastewater/greywater is treated on site and used for toilets and irrigation, including for crops.

In addition, the designs are intentionally uncomplicated and usually single story, to allow people with limited building knowledge to construct them. Stories abound about couples who build their own Earthships by themselves in two or three months, using only standard yard equipment and the printed plans.

A DIFFERENT BRICK AND MORTAR

Earthships, which remind people of Luke Skywalker's home on Tatooine in "Star Wars," are quite durable. The foundation is built by pounding gravel into used car tires. In effect, they become like thermal bricks, and they can reach up to 300 pounds. This creates a hurricane- and earthquake-resistant foundation for the home, according to [sluiceartfair.com](#).

The walls are then built up using cement or adobe, and more thermal bricks/tires, as well as recycled aluminum cans. The homes are then insulated with more compact trash. Adobe can also be used for floors, along with reclaimed wood and metal in other areas. Decorative internal or external walls can include recycled plastic or glass bottles to help provide natural light.

The construction ends up being almost totally

RIGHT

The total package. Designed for total self sufficiency, an Earthship covers all the bases: wind and solar for power, rainwater collection for water consumption and irrigation, a greenhouse for food production, and window placement for natural lighting and temperature control.

CREDIT: JENNY PARKINS/FICKR

BELOW

In the green(house). All Earthships, such as this one in Phoenix, must include a greenhouse for growing air-freshening plants, and ones that produce food.

CREDIT: KYLE GREENBERG/FICKR





fire resistant because none of the construction materials burn easily, if at all, as noted in “[Earthship Volume 1: How to Build Your Own](#),” the first part of Reynolds’ trilogy on the art of Earthship construction.

With the natural insulation, indoor temperatures remain very stable, although the exact comfort level can depend on the local climate. Typically, they hover around 70 degrees Fahrenheit year round. Critics say Earthships are better suited to drier, warmer locations, such as at Reynolds’ home base in Taos. Reynolds says the units can be effective in other locales, including colder regions such as Canada or the Northeastern U.S. Thus far, 35 states and numerous other countries have begun their own Earthship projects, with the help of Reynolds and his teams of “Earthship Biotects.”

Jonah Reynolds, an Earthship Biotect like his father, notes that there has been a definite shift in what people think of Earthships. When his father first started building them in the 1970s, most of them sat empty. Now, thanks to concern over climate change, and a stay-at-home lifestyle brought on by the pandemic, “demand is



skyrocketing,” Reynolds notes. “We can’t build them fast enough.”

Certainly, no one is going to argue about the impact Earthships can have upon the world’s waste. “There’s no shortage of used tires,” Michael Reynolds notes. “At least 2.5 billion are currently stockpiled in the United States, with 2.5 million more discarded every year. The tires can actually be seen as a globally available natural resource.”

LEARNING LESSONS

A typical Earthship might contain 900 tires, 2,000 glass bottles, and 10,000 aluminum cans, all of which are pulled out of the landfill or prevented from getting there in the first place, according to theministryofarchitecture.com. That’s the type of information that Reynolds and others wanted to bring to the world. In response came the **Earthship Academy**, a four-week on-site course out of Taos that teaches participants about the water systems, solar and wind energy, and indoor farming while providing hands-on instruction. They also practice building elements of their own Earthships. There is also an online version for interested people who can’t make the trip to New Mexico.

The Greater World Earthship Community also features a free visitor’s center, open 365 days per year, that anyone may go to if they want to learn more about the history of the Earthship, and its benefits to the environment. Site tours are also

offered. Similar centers have been constructed at other project sites worldwide.

In 2007, Reynolds was the subject of a highly acclaimed independent film, “**Garbage Warrior**,” which showed another side of the Earthship construction process: the frustration of working with local, state and federal government for approval and public acceptance of his project. The movie is not kind to New Mexico lawmakers, who take away his architect’s license in the late 1990s for building structures that are “in breach of nearly every rule in the book.” Reynolds unsuccessfully tries to have a bill, “The Sustainable Development Testing Site Act,” approved by state lawmakers that would grant him land for development of sustainable buildings, and appears to be finished as an innovator. But ironically, a natural but tragic event by Mother Nature helps another version of the bill pass in 2007. Work begins on the Greater World Earthship Community soon after.

Reynolds says he has had his ups and downs during his career, but he’s survived everything because of one philosophy: Not being afraid to try new ideas, even if it’s possible to make serious mistakes. “Basically, if you’re screwing up while trying something, you’re turning over rocks for pearls,” he says in the film. “If you don’t get into the belief that you are always right, and if you don’t let people set you up for that, then you can’t fail.” **GB**

LEFT TO RIGHT

Natural wonder. Each house is constructed from natural, indigenous and repurposed materials such as tires filled with packed soil, aluminum cans, mortar, and glass bottles.

CREDIT: COURTESY OF EARTHSHIP BIOTECHTURE

Breaking new ground. Even after a half-century at the helm, Michael Reynolds, center, is still getting his hands dirty and working out his lower back on Earthship projects.

CREDIT: COURTESY OF EARTHSHIP BIOTECHTURE



Natural Order

THE EARTHSHIP AS WE KNOW IT MIGHT NOT BE HERE TODAY IF NOT FOR AN ANGRY MOMENT BY MOTHER NATURE.



Green guru. Michael Reynolds created the first Earthship in 1973 to demonstrate that it is possible to create an ultra-ecofriendly house that also keeps people independent from suburban resources.

CREDIT: COURTESY OF EARTHSHIP BIOTECHTURE

WHEN MICHAEL REYNOLDS lost his architect's license because local planners disagreed with the Earthship's radical concept—and ultimately, his ability to build more Earthships—he turned to state lawmakers for help. When that failed in 2003, it appeared the project was over. But then in 2004 comes a call for help that changes everything.

A community in the Andaman Islands in the eastern Indian Ocean, one of hundreds devastated by the Great Asian Tsunami of 2004, needed shelters for thousands of displaced persons, and they wanted them fast. Unlike the United States, where red tape drove Reynolds crazy (in "Garage Warrior," he called the process "long and treacherous," along with other more-colorful descriptors), regulations in the Andaman Islands are few. He and his team visited the community, introduced the Earthship concept and showed them how to build one. "They wholeheartedly jumped on the idea," he said in a report in *The Ecologist*. "There were no barriers. When there's an absolute breakdown of everything, new ideas are clutched like they could be lifesavers."

The success in the Andamans, along with Hurricane Katrina's pummeling of New Orleans in 2005, led U.S. lawmakers to reconsider Reynolds' concept. New Mexico state legislation allowing construction of Earthships passes in 2007, Reynolds gets his license back, and suddenly he's in demand domestically and abroad. He and his teams of "Earthship Biotects" have since been at work worldwide in response to hurricanes, earthquakes, tsunamis, typhoons, and a general need

for quick, low-cost sustainable structures in climate frontline nations.

A more-recent project in Puerto Rico, following the devastating one-two punches of hurricanes Maria and Irma in 2017, had workers from Reynolds' company, Earthship Biotechture, helping to construct a series of buildings that can be used as demonstration models and learning tools for residents. Pace of construction has depended upon public donations for funding.

Puerto Rico residents—some who are current homeowners, and some who once were—are also invited to the Earthship Biotechture offices in Taos, New Mexico. Others become students at Earthship Academy, to witness and learn how to build an Earthship, and bring that knowledge back home with them.

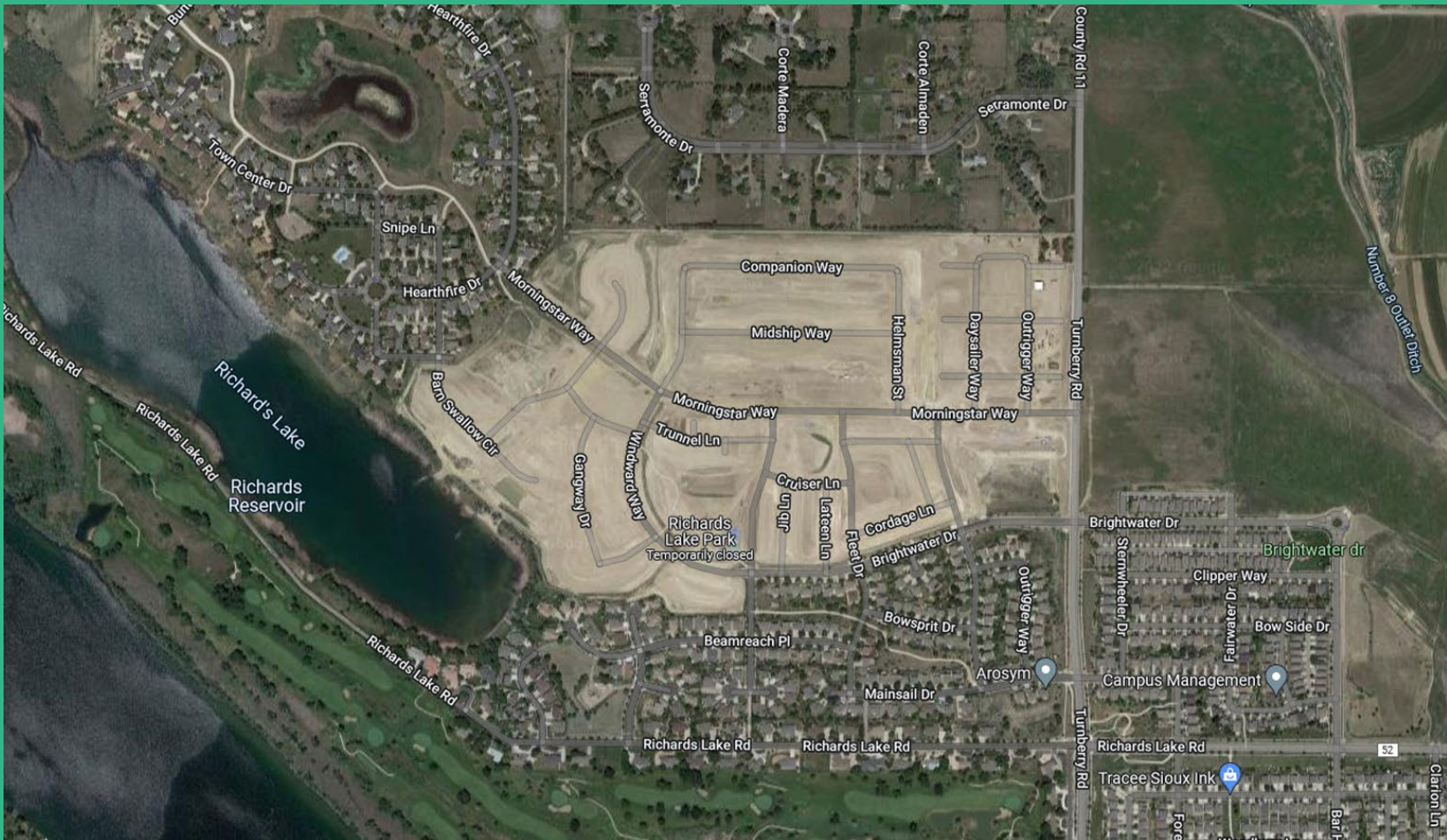
One couple, Lauralina Melendez and Mario Atunez, were instrumental in the construction of Puerto Rico's first Earthship and education center in 2019. But they had already taken interest in the concept two years before Maria hit, as they considered what type of home they wanted upon their move to the island from San Francisco. The idea of a home built out of natural and recycled materials, as well as being able to stand up to hurricanes and earthquakes, made perfect sense, Melendez said in a report to Al Jazeera. It was even more logical for Puerto Rico as a whole, she added.

"Tires come to the island, but they never leave," Melendez noted. "And, there is no system for recycling glass bottles...when the hurricane hit, we knew it was time. Everyone's life has changed."

THE Sonders PROJECT

A VISION House Community

DECARBONIZING AT THE COMMUNITY LEVEL



Coming soon. When completed by mid-2025, The Sonders Project will feature up to 400 solar energy-driven single-family, courtyard, town homes, condominiums and custom homes that emphasize environmentally friendly living – from top-notch indoor air quality technology, to water-wise irrigation techniques. CREDIT: GOOGLE MAPS

An upcoming development in Fort Collins, Colorado, reimagines sustainable living—neighborhood by neighborhood.

BY ERIN ARRINGTON, GUEST EDITOR

THE ROAD TO GREENER LIVING IS MARKED with guideposts on how individuals can lower their carbon footprint through lifestyle changes, as well as calls for nationwide and global regulations that aim to curb the world's trajectory toward an unlivable planet. What's often overlooked, however, is an approach that tackles decarbonization on a community level.

The Sonders Project, [an upcoming development in Fort Collins, Colorado](#), has its sights on becoming a template for how neighborhoods can reimagine and redefine their relationship with the resources they utilize. Located northeast of the city's center, the project is slated for ground breaking at the end of this summer. This age-targeted community, primarily (but not exclusively) for residents 55-plus, will be thoughtfully designed for healthy living – from the wholesome materials used for the homes, to the overall walkability of the community.

One of the primary builders of the development is Denver-based Thrive Home Builders. According to Gene Myers, Thrive's founder and chief sustainability officer, Coloradans have been shell-shocked by recent climate events such as this winter's Marshall Fire, which destroyed more than 1,000 structures and spread to more than 6,000 acres. Now, residents are prioritizing sustainability more than ever.

"That's a climate disaster, and I think it's really shaken our customers to the core," Myers says. "So we want to have an answer for that – that we can give our customers the peace of mind knowing they've done all they can for the health of their families and for the health of the planet."

The community will include roughly 400

homes – 220 of those built by Thrive Home Builders – as well as walking trails that weave throughout the community, a number of parks, and the Sonders Learning Center, a multi-building enrichment center that will promote continued pro-environmental learning with workshops, presentations and classes.

One priority of the development is to promote indoor/outdoor living for its residents. Most of the homes will face toward greenbelts throughout The Sonders Project, and the homes built by Thrive will include generous-sized porches. With the ample amount of intentionally placed green spaces throughout the community, the project will balance its priorities of creating nature-filled outdoor spaces and building higher-density, carbon-reducing neighborhoods.

There will be three house styles available from Thrive – two ranch-style detached homes and one townhome. One of the detached home styles will feature an optional studio suite above the garage that could be ideal for caretakers or family members. The development will also include two VISION House® projects – part of Green Builder Media's demonstration project series, specifically designed to educate homebuilders and consumers on how to design and build more sustainably.

A CITYWIDE MOVEMENT TOWARDS CLEANER ENERGY

The Sonders Project reflects the City of Fort Collins' efforts to reduce water and energy consumption across the board.

According to Fort Collins Utilities Interim Water Conservation Manager Abbye Neel, the city's efforts have

TEAM LEADERS

PRIMARY BUILDER Thrive Home Builders

DEVELOPER Actual Communities Inc.

PEOPLE



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



BILL RECTANUS
Chief operating
officer of Thrive
Home Builders



ERIC SUNG
Director of
design at Thrive
Home Builders

reduced water use from 248 gallons per capita per day in the 1980s to 139 gallons per capita per day in 2021. The 2010 Water Conservation Plan set a goal of 140 gallons per capita per day by the year 2020. The 2015 Water Efficiency Plan set a goal of 130 gallons per capita per day by 2030.

Neel described in an email that another large step taken by the city has been to incorporate conservation measures into its requirements for new developments like The Sonders Project. More recently, the updates to Utilities' Water Supply Requirements, adopted Jan. 1, 2022, "could be the largest driver toward promoting efficiency in new builds," Neel notes. Changes more closely tie the water supply requirement fees to a development's actual water use,

THE SONDERS PROJECT

A VISION House Community

she adds. For example, a higher water use development pays more, while a lower water use development pays less.

Thrive's homes at The Sonders Project will include water-saving equipment such as water leak detectors by Phyn and tankless water heaters with recirculating pumps. The community at large will also keep water usage low by maintaining lawns and parks with WaterWise open space irrigation systems.

FCU Energy Service Manager John Phelan says the goal is to run on 100 percent renewable electricity by 2030, as well as to pursue "a continuous and intensifying effort to transition from natural gas and petroleum [to] electrification of building heating and electric vehicles."

Likewise, future residents of The Sonders Project will have the option to choose homes that are all-electric, with a solar-powered backup battery that can jump in if any power outages were to occur. And regardless of the home chosen, residents will have the opportunity to purchase 100 percent renewable energy from the city. Solar will also be a main source of power for the community centers throughout the development, according to Phelan.

BUILDING HOMES THAT STAY HEALTHIER LONGER

In addition to providing residents with clean energy options, Thrive prioritizes design and insulation strategies to create ultra-efficient homes that require less energy to maintain in general.

Thrive is bringing to the project its commitment to healthy indoor air quality, with three focus areas: radon ventilation, mold management, and limiting formaldehyde and other toxic



Low on fuel. The many walking trails throughout The Sonders Project, as well as its proximity to amenities, will promote use of transportation other than gas-powered vehicles. CREDIT: WATERS' EDGE DEVELOPMENTS

"We want to have an answer for that—that we can give our customers the peace of mind of knowing they've done all they can for the health of their families and for the health of the planet."

GENE MYERS, FOUNDER, THRIVE HOME BUILDERS

chemicals used in building materials. Each home will be outfitted with a balanced ventilation system, which includes a paired Panasonic *WhisperGreen* exhaust fan with a Panasonic *WhisperFresh* supply fan. The homes will be equipped with building materials, including paints, insulation, and wood products, that keep levels of harsh chemicals low.

The company also recognizes that a major obstacle for home health is proper maintenance of the home's

systems. To combat this, Thrive Home Builders will gift each home buyer with Dwell Home Maintenance. This is a customized home maintenance management plan that includes an app that reminds homeowners when, for example, certain air filters need to be replaced and exactly which kind should be purchased.

"I'd like to be known as the builder that actually cares after we get the money from people," Myers says. "We actually care that the home is actually

BETTER PERFORMANCE

From Start to Finish

Thrive Home Builders is partnering with manufacturers who have demonstrated a commitment to efficiency and sustainability.

Choosing clean sources of energy goes hand in hand with building structures that require less energy to function in general. For The Sonders Project in Fort Collins, Colorado, Thrive Home Builders will feature materials and appliances that are at the forefront of efficiency and health. Here are a few of those products.



OWENS CORNING INSULATION

The insulation used for this project is formaldehyde-free, GREENGUARD Gold Certified, and made from 55 percent certified recycled content. The manufacturing process is driven by 100 percent wind-powered electricity. It's waste-diverting in its manufacturing, and healthier for homeowners.



WHIRLPOOL'S FREEFLEX 3RD RACK DISHWASHER

This dishwasher is ENERGY STAR Certified and exceeds government standards for energy efficiency, supporting sustainability and saving money on utility bills.



SCHNEIDER ELECTRIC'S WISER ENERGY MONITOR

The Wiser Energy system provides homeowners with real time energy usage information and even allows users to set energy consumption goals for the household.

THE Sonders PROJECT

A VISION House Community



Fresh air reminder. One of Thrive Home Builders' priorities is to ensure superior indoor air quality through proper ventilation and interior design, as well as encouraging good maintenance habits. CREDIT: HOMESPOT HQ/FICKR

“We’re thrilled to have the opportunity to work with Thrive Home Builders on The Sonders Project to showcase how we should be approaching design and construction of next-generation decarbonized communities that feature sustainable homes, smart growth management strategies, clean mobility solutions, community greenspaces, and more.”

**SARA GUTTERMAN, CEO,
GREEN BUILDER MEDIA**

meeting the needs of the people that buy from us and keeping them healthier.”

All homes built by Thrive at The Sonders Project will be U.S. Department of Energy Zero Energy Ready, LEED v4 certified, and part of the EPA’s Indoor airPLUS program. In 2020, the builder achieved the nation’s lowest average Home Energy Rating System (HERS) Index score (26.9), and received the RESNET President’s Award for best home efficiency across North America.

Myers says Thrive Home Builders is looking toward the future as well. The company’s next big goal is to build only



Sustainable lifestyle. Thrive Home Builders’ upcoming Sonders Project combines the latest technology and sustainable, locally sourced products to deliver a green lifestyle for persons of all ages.

CREDIT: WATERS’ EDGE DEVELOPMENTS

carbon zero homes throughout and beyond Fort Collins in the near future. “I hope a thousand builders beat us to it,” Myers says. “It’s what the climate needs.” **GB**

Conservation Continues

The City of Fort Collins has a longstanding commitment to resource conservation efforts.

For decades, the City of Fort Collins has looked beyond individual responsibility and taken ownership of its citywide contributions to climate change and waste generation. Fort Collins has stayed ahead of its explosive growth (which has quadrupled since the mid-1980s) and prioritized responsible water management by setting ambitious goals for its per-capita water usage and conversion to cleaner energy sources. In roughly the same time period, its average per capita, per day water usage has decreased from 248 gallons to 139 gallons.

“Water conservation continues to be another tool in the toolkit to promote responsible water management while helping lower costs for ratepayers and avoiding the need to acquire additional costly supplies,” says Abbye Neel, Fort Collins Utilities’ interim water conservation manager. “To that aim, staff hopes to find new innovative ways to continue to promote water efficiency, whether that be through creating residential landscape and irrigation requirements, expanding programs and services, or finding new ways to better integrate equity, diversity and inclusion into our policies, programs and services.”

Platte River Power Authority (PRPA), the city’s wholesale energy provider, also has a 100 percent non-carbon-generating electricity target for 2030. The city’s Black Hollow solar project, expected to come online by 2024, will push PRPA’s non-carbon electricity use to more than 60 percent. A handful of other photovoltaic and wind projects, along with the retirement of the city’s coal production facilities, will help PRPA reach its target goal several years later.

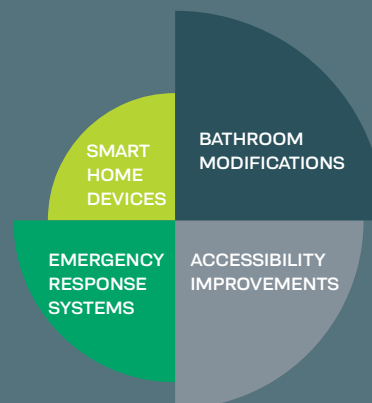
According to Neel, the city recognizes that real change happens on a community level. “It has developed guidelines, such as conservation plan requirements for new builds, and the 2016 Community Recycling Ordinance, that reflect this,” she notes. “Developments such as [The Sonders Project] that go above and beyond the call to action in responsible energy and water use, provide a template for what Fort Collins’ neighborhoods can look like moving forward.”



Long winded. Platte River Power Authority’s Roundhouse wind project, launched in 2020, is the electricity provider’s largest noncarbon resource. It produces energy for more than 100,000 homes annually. CREDIT: SHUTTERSTOCK

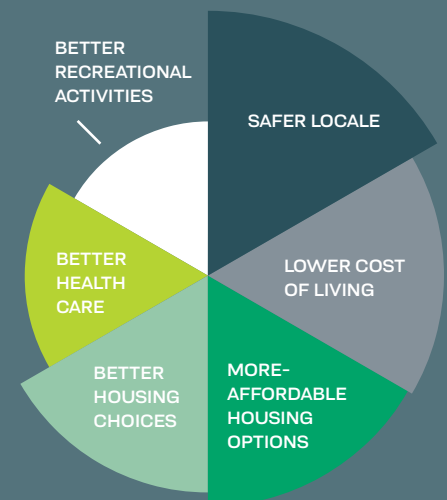
What makes a person stay in their home?

Two-thirds of all adults and 70 percent of those age 50-plus want their current residence to be their “forever home.” But there are also some upgrades that need to be made as they age, to enable them to stay:

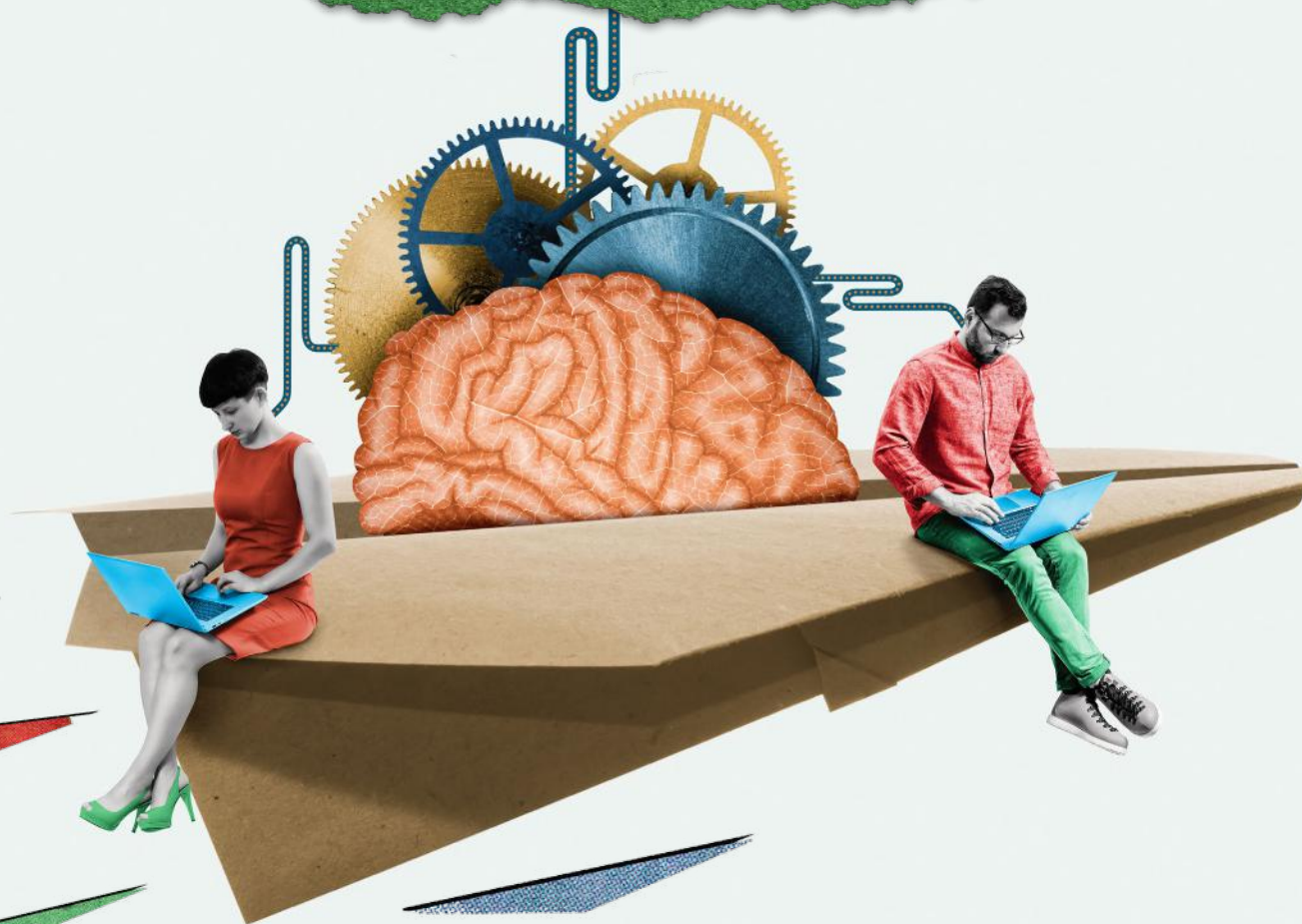
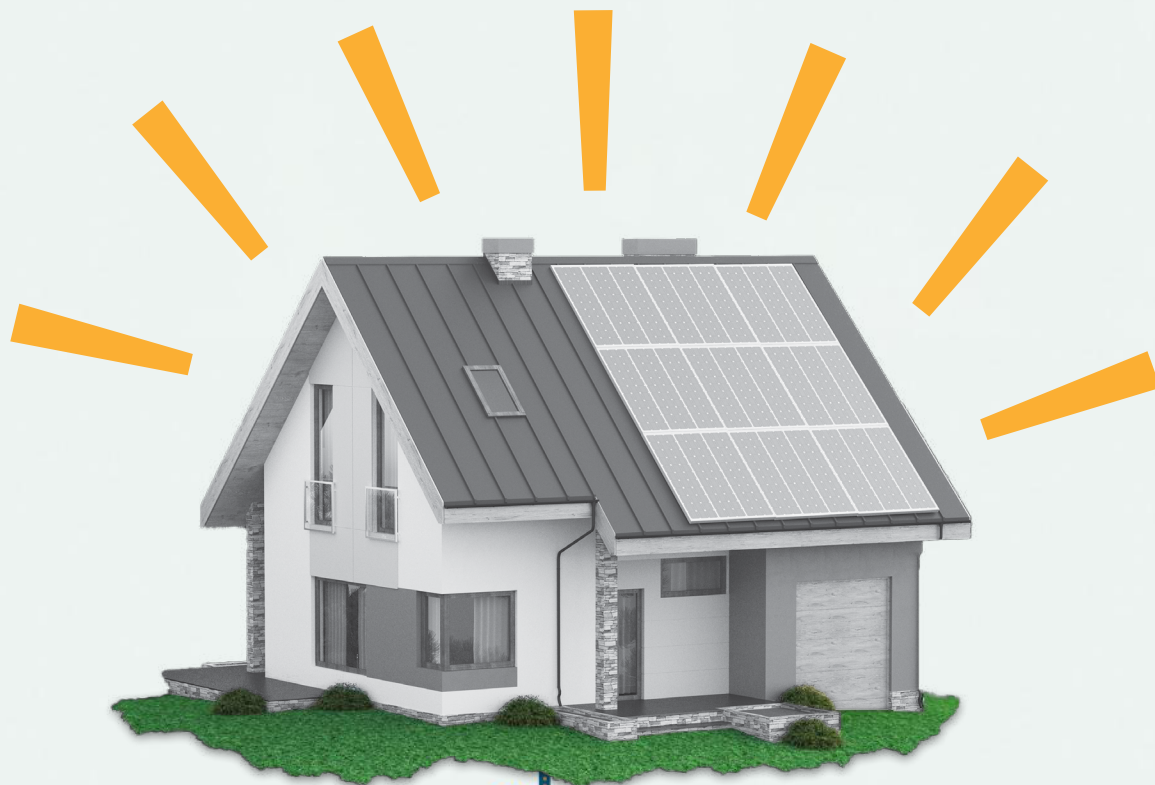


What encourages a person to move to a new community?

Regardless of age, many adults would consider leaving their current community if certain conditions were right. Here’s what would prompt them to pack up and leave for new frontiers:



SOURCE: AARP “TRENDS IN HOME AND COMMUNITY PREFERENCES, 2021”



MILLENNIALS THE DRIVING FORCE

COGNITION Smart Data market intelligence
shows what Millennials want—and what they will pay for—
in their homes.

BY SARA GUTTERMAN

OVER THE PAST TWO YEARS, Millennials (and older Gen-Zs) have seized the top influencer position in the housing market, spending more money on buying and remodeling homes than any other generation.

Some members of this audience segment, namely younger Millennials who haven't yet established a secure career and corresponding savings, remain saddled with student loans and credit card debt, and are therefore relegated to renting in a record-hot home buying market. However, their older and more affluent counterparts have become a major force in the housing sector.

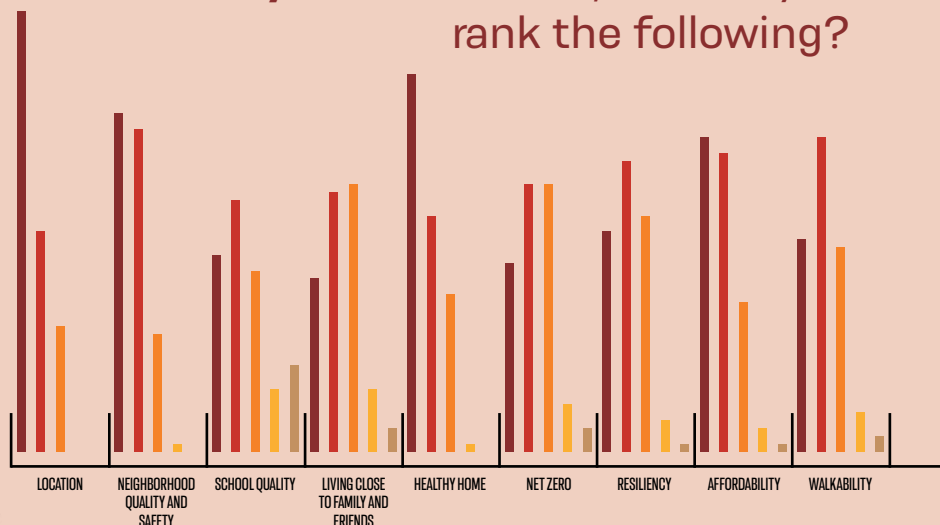
Millennials now have an estimated annual spending power of \$1.4 trillion—far more than any other generation. These individuals will comprise nearly 75 percent of the workforce by 2025, and they will also be on the receiving end of a massive wealth transfer of tens of trillions of dollars of inheritance from their parents and grandparents.

This savvy audience segment is bullish about buying homes, equating home ownership to economic security and a desirable lifestyle. Spurred by a growing desire for financial independence, Millennials recognize the value of investing in an appreciable asset that can create long-term financial wealth and stability.

As a result, Millennials are facilitating a tectonic shift in the way that homes are valued, away from the antiquated price-per-square foot metric to something different that incorporates factors like energy efficiency, resiliency, and indoor air quality—and more accurately reflects long-term homeowner value.



When making decisions about **where you want to live**, how do you rank the following?



SURVEY SAYS

When asked to prioritize values, millennials skew toward greener, more resilient lifestyles

BUYING BASED ON GREEN AMENITIES

Millennials, an audience segment that values and is mission-driven, have different expectations than previous generations, and this is placing new demands on building professionals and manufacturers. Granite countertops and large gas ranges, once considered mandatory elegance for boomers, are frowned upon by Millennials, who prefer more-sustainable options such as Quartz surfaces and induction cooktops.

In a notable shift over the past two years, Millennials now prioritize having a healthy home over location when making home buying decisions, according to COGNITION Smart Data, Green Builder Media's market intelligence division.

COGNITION Smart Data research shows that 96 percent of Millennials believe sustainability is important when making purchasing decisions. In fact, they report that corporate sustainability, including Environmental Social and Governance (ESG) strategies and Environmental Product Declarations (EPDs), is the top purchase driver when selecting products for their home—over quality, performance, price and warranty.

Seventy-seven percent of Millennials report that they are willing to pay more for environmentally sustainable products, and 79 percent of Millennials are concerned about the environmental impact of products they buy.

Perhaps sustainability is such an important purchase driver because the majority of this audience segment has grave concerns about climate change. Survey data reveals that a record 87 percent of Millennials are worried about climate change; 77 percent of Millennials consider the future to be frightening; and 56 percent think humanity is doomed.

SAVVY ABOUT BUILDING SCIENCE

The average profile of the Millennial home buyer is a dual-income, college-educated couple with an inherent ethic of sustainability.

Generally speaking, these couples are starting young families and want more room to move. Since many of them are able to work remotely, they're open to moving to suburban, secondary, tertiary and even rural markets to purchase a home that offers more bang for their buck.

Many of these home buyers had been living in smaller apartments, dense urban areas, or multi-family settings, and they're looking for single-family homes with more square footage (COGNITION data shows that the ideal home size for Millennials is 1,500-2,500 square feet) with yards, gardens and patios.

And while they may shun hot tubs and other energy-sucking luxuries that were attractive to their parents, Millennials want the sustainability unicorn: They're looking for homes that are net zero, all electric, healthy, resilient, and solar powered, and provide the best value possible.

They understand that upfront investments in high performance, sustainable upgrades like energy-efficient appliances, windows and insulation, heat pump technology and induction cooktops will yield long-term benefits.

They value health and wellness, and are willing to spend their money on indoor air monitors, energy recovery ventilators (ERVs), ventilation fans, and air purification systems, as well as products like smart speakers and lighting that can add ambience to their spaces.

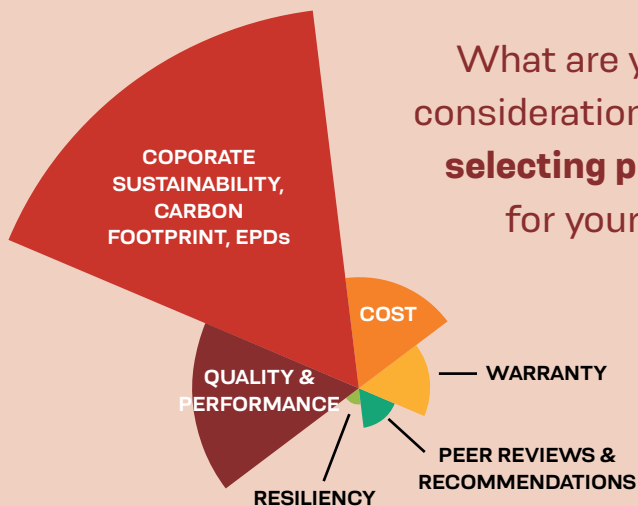
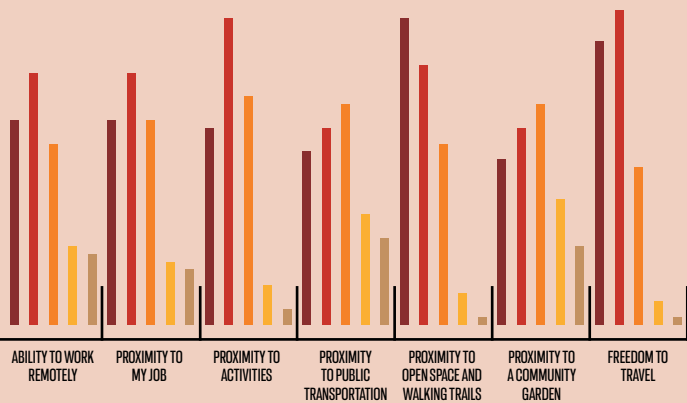
Millennials also are savvy enough to understand concepts such as demand side energy management, and will invest in smart home systems that enhance convenience and improve efficiency.

NEW USES FOR OLD SPACES

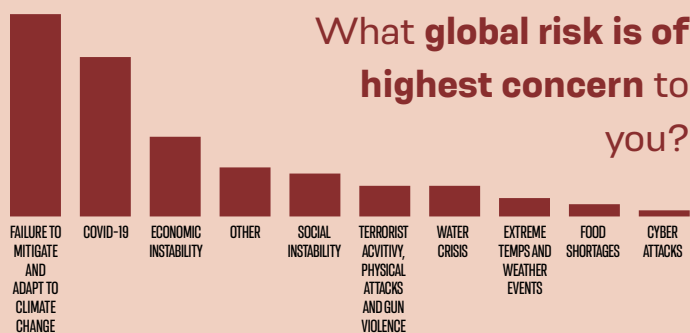
Millennials' housing desires often resemble that of their parents. For example, as they grow into families, they shift toward the suburbs. What's different, however, is how they intend to use the traditional family home.

For example, they want garages—not so much for vehicles, but rather to convert into home gyms, offices, or craft spaces. They really like the idea of outdoor living spaces that spill out of big kitchens into nature. These serve as central dining and entertaining areas for their family and friends. Some of this move to outdoor living is likely driven by years under the pandemic proximity shadow, but also their own cultural experiences with friends.

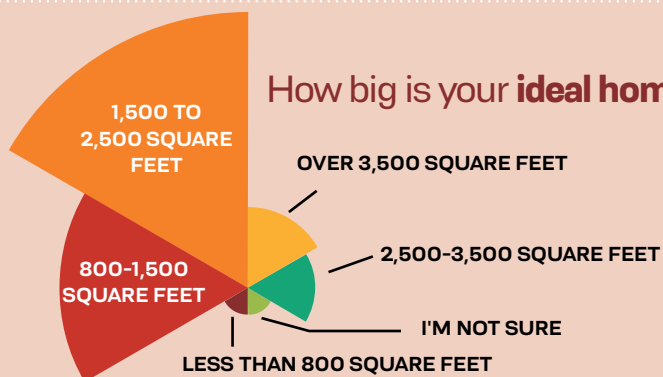
- EXTREMELY IMPORTANT
- VERY IMPORTANT
- IMPORTANT
- MARGINALLY IMPORTANT
- NOT IMPORTANT AT ALL



What are your top considerations when selecting products for your home?



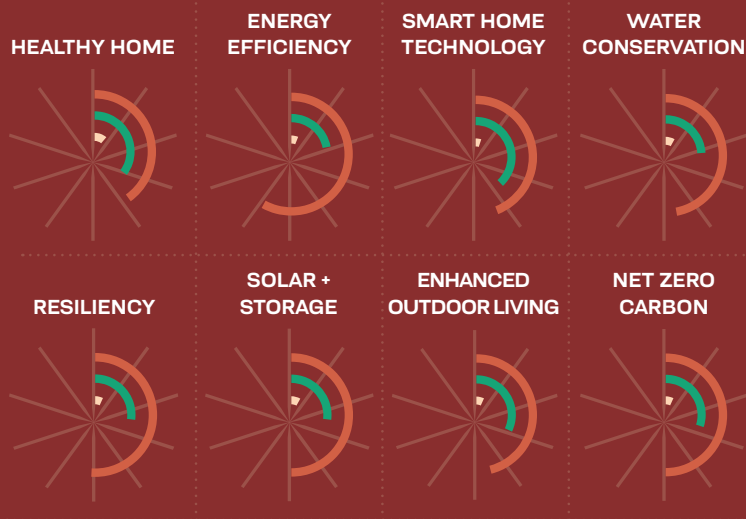
What global risk is of highest concern to you?



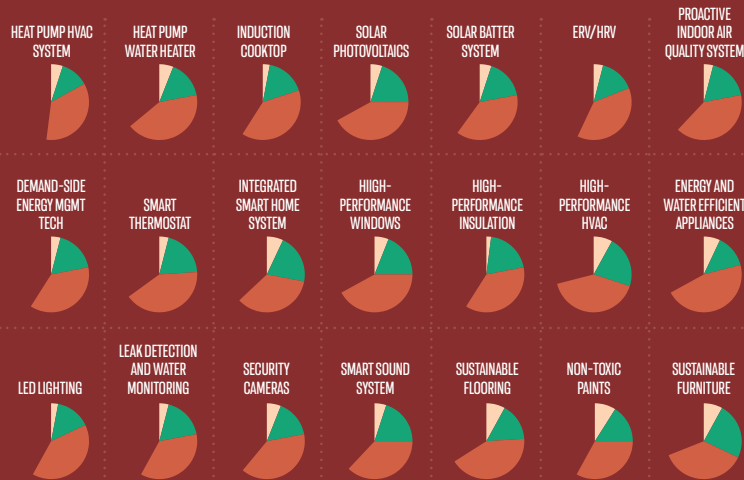
How big is your ideal home?

WHAT'S IT WORTH to you?

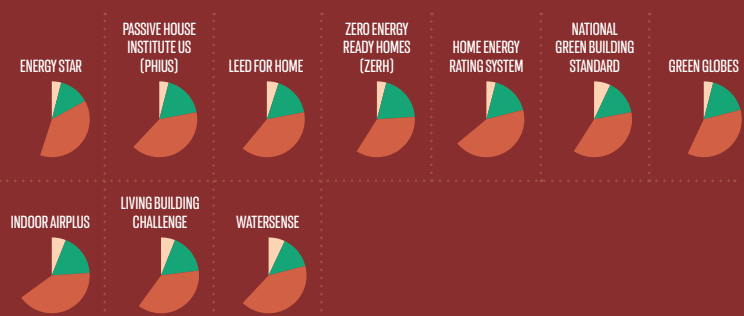
- MORE THAN \$10,000
- \$5,001-\$10,000
- \$1,001-\$5,000



Additionally, respondents indicated a WILLINGNESS TO PAY FOR UPGRADES such as high-performance HVAC systems, induction cooktops, solar panels and sustainable furniture.



Respondents indicated that they were MOST LIKELY TO PAY \$1,000 TO \$5,000 FOR A GREEN CERTIFICATION or rating for their home.



THE POWER OF Purpose

RIGHT NOW, IT'S A SELLER'S MARKET FOR THE BUILDING INDUSTRY. That's likely to change, as housing inventories and interest rates rise, causing the red-hot market to cool. Knowing where and how to meet Millennials on their own terms will be the long-range winning strategy for building professionals and manufacturers alike.

In challenging times, purpose is the antidote to emotional fatigue. Health concerns, economic constraints, and world events have compelled Millennials, more than previous generations, to link their values with product purchases and home investments.

To resonate with this savvy audience segment, it's important to create enduring relationships and a sense of meaning to help combat what seems like endless uncertainty and ambiguity with hope and positivity.

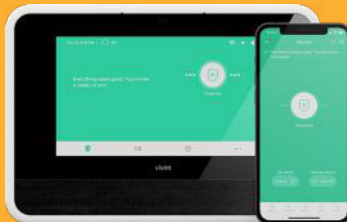


THE SHIFT FROM GAS TO ELECTRIC

According to Green Builder Media's **Next Generation Influencer Group**, comprised of influential Millennial and older Gen Z sustainability professionals, Millennials don't want to burn gas in their homes. They're shifting away from gas ranges to electric cooktops – like Whirlpool's 30-inch induction cooktop – and from gas-powered water heaters and HVAC systems to heat pump technology.

SCREEN NEW DEAL

Smart home platforms, like Vivint's *Smart Hub*, offer homeowners new levels of convenience, efficiency, comfort, independence, and security. These platforms allow homes to become intuitive, learn occupant behavior, upgrade themselves seamlessly, and take human error out of building performance to optimize comfort, cost-effectiveness and sustainability.



NEW CONVENIENCE

Millennials are looking for new conveniences like smart garage door opening systems, which enable them to provide temporary entry information to delivery drivers, or monitor their homes while they are away. Shown is a LiftMaster model, which is controlled with the *myQ* App.

NEW DAWN FOR SOLAR

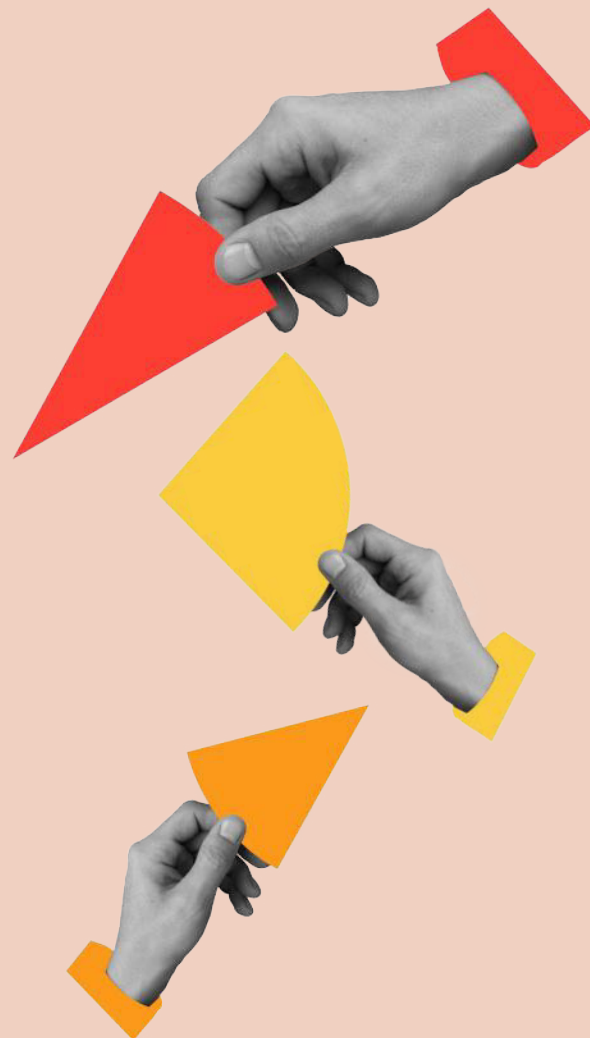
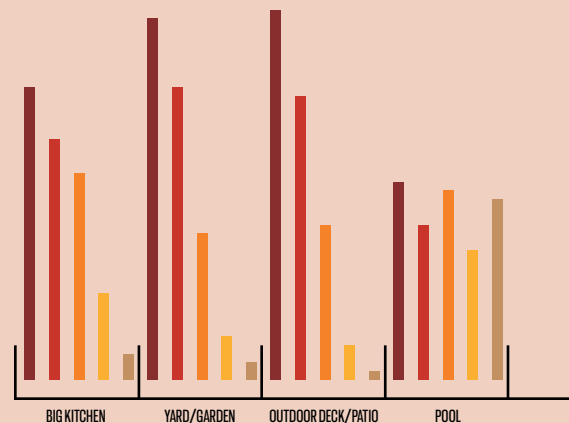
Nearly 70 percent of Millennial respondents in a recent Green Builder Media survey identified solar as a priority for their homes. They like the idea of saving money and having the resiliency and self-sufficiency that comes with producing and storing their own power. Companies like JinkoSolar are now offering integrated photovoltaics and battery storage systems with built-in software for optimized energy management.



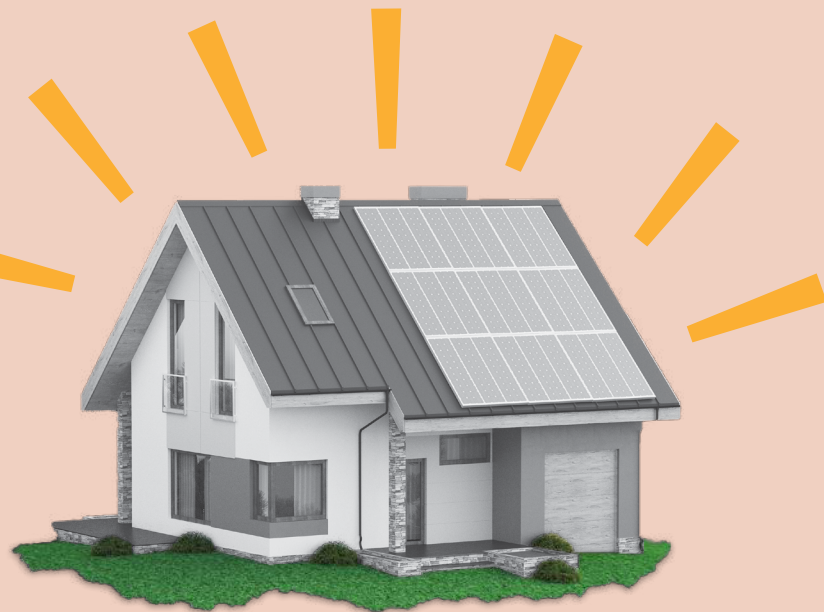
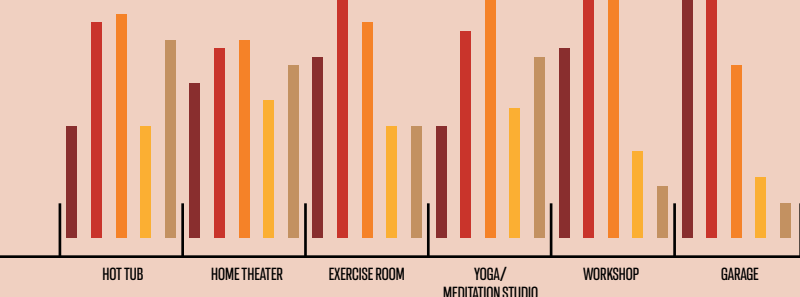
SOUND THERAPY

Healthy home is the top purchase driver for Millennials when making home buying decisions. The power of sound can bring stress-relief, peace, and harmony to indoor spaces. Portable Sonos speakers can turn any room into wellness retreat.

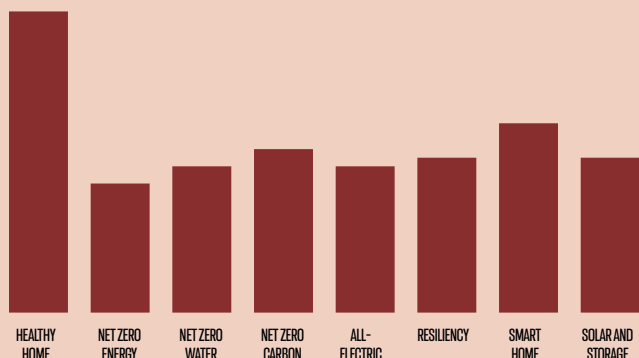
How **important** are the following **to you**?



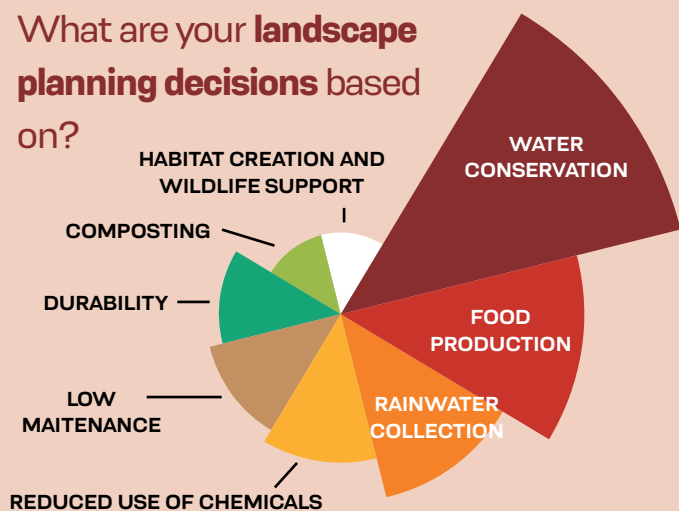
EXTREMELY INTERESTED
 VERY INTERESTED
 INTERESTED
 MARGINALLY INTERESTED
 NOT INTERESTED AT ALL



What are your top sustainability priorities for your home?



What are your landscape planning decisions based on?



THE HEALTHY HOME IMPERATIVE

Our recent COGNITION survey of nearly 700 millennials across the U.S. revealed an active interest in healthy living.

Of the respondents, 43 percent own a single-family home; 30 percent own a condo, townhouse, or apartment; 17 percent rent a single-family home; and 9 percent rent a condo, townhouse or apartment.

Respondents selected healthy homes as the top sustainability driver when making decisions about buying homes and/or products for their homes, followed by smart homes, and homes with a net zero carbon emissions total.

While healthy home attributes ranked as the No. 1 purchase driver across all age groups, resiliency was 17 percent more important to Millennials than to older generations. This likely reflects the former's concerns about climate change. In fact, 40 percent of Millennials indicated that they have been directly affected by hurricanes or tornadoes, 18 percent have been impacted by extreme temperatures, and 16 percent have felt the threat of wildfires in their region.

EDIBLE OUTDOOR LIVING?

Since the onset of COVID-19, connecting with nature has become increasingly important to homeowners. Nearly 53 percent of Millennial respondents indicated that they use their outdoor living spaces 4-6 times per week. But they may not be using them to barbecue hamburgers, like their parents. They're looking for spaces that can be part of their personal resilience plan. Edible plants and drought-tolerant xeriscaping are the most important landscaping elements to them.

Regarding the outside of their homes, Millennials indicated that water conservation is the most important factor when making landscape planning decisions, followed by food production and rainwater collection.

Given that they most often use their outdoor living spaces for entertaining, cooking, and relaxing, they selected decks/patios, kitchen entertainment areas, and gardens as the most important outdoor living area features.

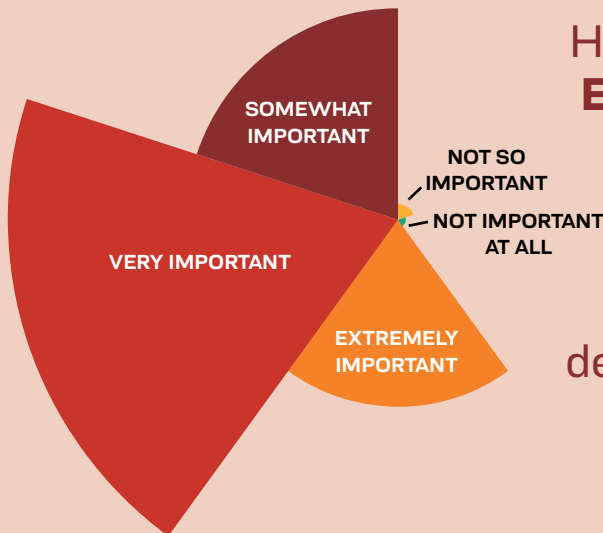
And the outdoor living renovation frenzy isn't over: 88 percent of respondents indicated that they have already upgraded their outdoor spaces in the last two years, 94 percent said that they plan to make more upgrades in 2022.

ESG IN THE SPOTLIGHT

Environmental, social, and governance (ESG) is a driving force for Millennials when making decisions about companies to buy from, work for, and engage with. According to **CNBC**, their passion for ESG investing has helped drive a tenfold sector-wide growth in just the past few years. "Millennials spurred the growth of sustainable investing throughout the 2010s – investors contributed \$51.1 billion to sustainable funds in 2020, compared with less than \$5 billion five years ago," the article claims.

Ninety-three percent of millennials we surveyed believe that companies should take a stand on environmental issues, and 95 percent say they want to use their financial capital for socially responsible investing. Fifty-seven percent report that they have sold stock when they think a company is not serving the best interest of society or the planet.

The COGNITION survey revealed that approximately 70 percent of Millennials consider ESG to be extremely important or very important when purchasing products, citing the "E," or environment-focused solutions like cutting carbon emissions, resource efficiency, and habitat restoration, as their top priority. **GB**



How much does **Environmental, Social and Governance (ESG)** factor into your decision making process when purchasing products?

For over 17 years, Green Builder Media has been considered the undisputed sustainability leader in the building industry.

Our team has unmatched experience, market intelligence, and technical expertise to provide clients with the information they need to proactively manage ESG risks and opportunities. Green Builder Media helps companies understand the ESG issues that are most relevant to their business. By analyzing existing business practices, policies, metrics, and engagements, we help clients objectively assess their strengths and weaknesses.



SPONSOR SPOTLIGHT



Whirlpool Corporation is committed to being the best global kitchen and laundry company, in constant pursuit of improving life at home. In an increasingly digital world, the company is driving purposeful innovation to meet the evolving needs of consumers through its iconic brand portfolio, including Whirlpool, KitchenAid, Maytag, Consul, Brastemp, Amana, Bauknecht, JennAir, Indesit and Yummly.



Vivint is a leading smart home company in North America, focused on redefining the home experience with technology and services that create a smarter, leaner, and safer home for customers. This includes an integrated smart home system with in-home consultation, professional installation and support, and 24/7 customer care and monitoring.



myQ-connected garage door openers, locks and cameras enable control, security and monitoring of a home's main entry points using a smartphone at anytime, from anywhere.



Renowned for incredible sound, ease of use, and commitment to innovation, Sonos wireless speakers bring every room and everyone together with incredible sound for music, TV and more. As the premier audio solution for builders, Sonos takes a smart home offering to the next level.



JinkoSolar is a leading photovoltaic module manufacturer and energy storage system integrator. EAGLE Storage brings together the best energy storage technology for turnkey hardware and energy storage services. Publicly vetted by trusted industry third-party laboratories and top financial institutions, EAGLE is a trusted choice for U.S. solar and storage projects.

Solar
JinkO



WEATHER ANY STORM WITH EAGLE RS



Back up your home with JinkoSolar's EAGLE RS energy storage system and have a few less things to worry about. When facing power disruptions caused by extreme weather, having a solar and storage system for your house provides peace of mind by ensuring that essentials such as lighting, HVAC, kitchen appliances, internet and home security continue to operate.

To back up your home now, visit:

www.jinkosolar.us/backup

SOLAR | STORAGE | WWW.JINKOSOLAR.US



From the Inside Out

As construction continues on ReVISION House Scottsdale, the focus shifts to what's going on behind the walls and above the ceilings.



Making progress. Material shortages and the pandemic have slowed construction of the ReVISION House Scottsdale over the past year. But as life starts to return to normal, hammers and shovels are back in play.

CREDIT: COURTESY OF STEVE EASLEY

BY STEVE EASLEY

REBUILDING A HOME in the middle of the Great Resignation, a housing boom and the COVID-19 pandemic has certainly been challenging, even for seasoned professionals like us. The biggest challenge by far has been supply chain issues with getting building materials. In addition, Phoenix has been the top city in the country for net migration for three years running.

“With the building boom, subcontractors have no problem walking away from work that requires them to do anything different from what they are used to...Fortunately, I was able to obtain subs that were willing to do most of what I wanted, but it added quite a bit of time to the project.”



STEVE EASLEY is an internationally recognized building science expert and founder of Steve Easley & Associates. He and his wife Susan Raterman, an experienced indoor air quality consultant, and founder and president of The Raterman Group, LLC, are remodeling The Forever House, their ReVISION House residence in Scottsdale, Arizona. Stay tuned for further updates as the remodel continues.

On average, 89,000 people per year—or 244 people per day—are moving to this area. This is not only pushing up home prices (35 percent in Scottsdale in 2021, according to Zillow), but also creating a huge labor shortage as most of the area’s 1970 vintage homes are being torn down or totally gutted and remodeled. The City of Scottsdale alone issued 9,600 building permits for 2021.

And then there’s the labor shortage. It’s hard to find subcontractors that are willing to even consider, much less apply, best practice building techniques. Many times, we have heard “we don’t do it that way” or “we only use materials that we are familiar with.” With the building boom, the subs have no problem walking away from work that requires them to do anything different from what they are used to. Because of the un-met demand for housing, I don’t see this issue going away anytime soon.

Fortunately, I was able to obtain subcontractors that were willing to do most of what I wanted, but it added quite a bit of time to the project. If you’re building homes, be sure to factor in the additional time it takes to find cooperative subs.

We had planned on saving 95 percent of the first floor of the home, but after demolition we quickly learned that 85

percent was not salvageable. Over-notched beams, studs, floor joists, and missing connectors required us to rebuild nearly all of the walls and the second-floor framing.

My motto has always been “look for opportunities, not obstacles.” This situation presented the opportunity to rebuild with 2-by-6 framing, allowing for more insulation. We considered structural insulated panels (SIPS) with exterior insulation, but that would have required re-engineering and restarting the permit process. We estimated that would delay the project another nine months.

Regardless of the obstacles, we are still committed to the same project goals: efficiency, resiliency and durability, health and wellness. Since the burning of fossil fuels like natural gas contributes a lot to climate change, we believe in electrification. Arizona Public Service has committed to having 45 percent of its electricity generated via renewable energy by 2030. By 2050, all of the utility’s electricity is expected to be 100 percent carbon free.

For our response, we are replacing all of our gas appliances: the furnace, water heater, stove with inverter-driven heat pumps and induction range, as well as a heat pump clothes dryer.

As we move towards completion of this project, here’s the progress we’ve made on various aspects of the home.

DESIGN

The south and west sides of the home have large porches to shield the house from direct, hot summer sun. The house is designed to have lots of flow-through ventilation for natural, passive cooling that will reduce the need for air conditioning.



CREDIT: COURTESY OF STEVE EASLEY

ROOFING

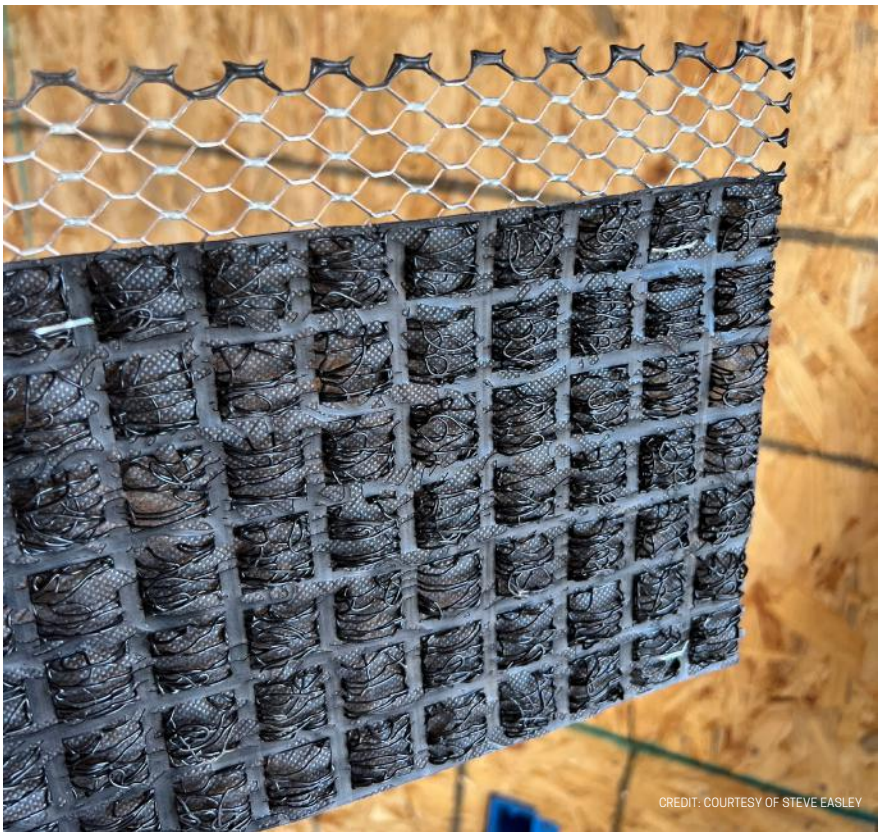
We have designed and installed a unique roofing system for waterproofing the flat roof areas. There is a Barrett *Black Pearl* cold fluid waterproofing system over oriented strand board (OSB). On top of that is Dupont *Styrofoam Deckmate Plus* R-20 XPS insulation board. About 1-3 inches of Henry Company *Permax 3.0* closed cell spray foam will be placed over the *Deckmate*, sprayed to slope rainwater to scuppers. The product has no chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) or hydrochlorofluorocarbons (HCFCs), and has a global warming potential (GWP) of a mere 1.4.

The final roof coating is Henry *AcryShield A550 93 percent reflective*, an acrylic elastomeric coating water final waterproofing. Open cell foam, R-20, will be applied under the OSB roof deck, for a total R-value of 54.

CREDIT: COURTESY OF STEVE EASLEY



CREDIT: COURTESY OF STEVE EASLEY



CREDIT: COURTESY OF STEVE EASLEY

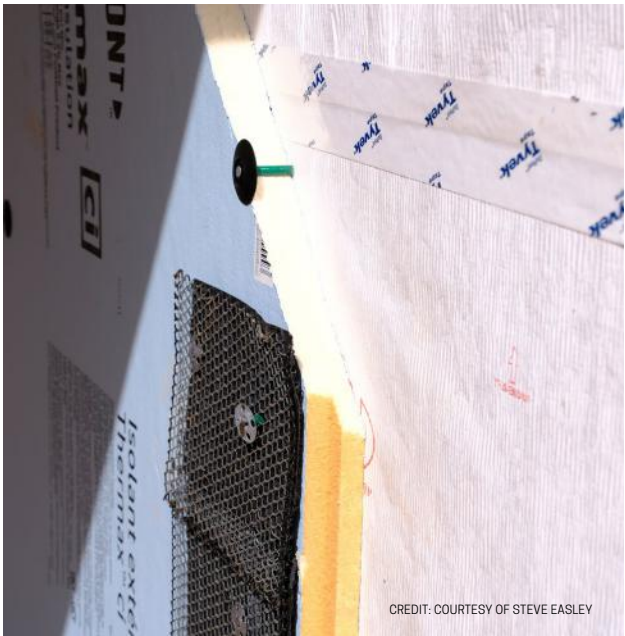
WALLS

The Revision House Scottsdale uses an R-37 wall system. The exterior wall cladding is half-inch thick synthetic stucco reinforced with Keene *Driwall LathNet* quarter-inch metal rainscreen lath for drainage and drying. The *LathNet* and *Thermax* will be attached with TRUFast Walls *Grip-Deck TubeSeal* self-sealing fasteners.

Behind the stucco and lath, we will install 1.5 inches of Dupont *Thermax* C.I. (continuous insulation) R-10. Then the house will be wrapped with DuPont Tyvek *StuccoWrap* weather barrier. Windows and penetrations will be flashed with DuPont *FlexWrap* and *Flashing Tape*.

Inside walls will feature half-inch OSB over 2-by-6 studs, with 2 inches of DuPont *Froth-Pack Low GWP* (R-12.2) closed cell foam applied to the inside surface of the OSB. Available in kits, *Froth-Pack* is an economical alternative for small jobs, versus the ones for large trucks and high-pressure foam.

The remaining 3.5-inch cavity will be filled with of blown fiberglass covered with 5/8-inch drywall. This provides a low-cost extra thermal mass, so we can pre-cool the house to help flywheel through peak energy times.



CREDIT: COURTESY OF STEVE EASLEY



CREDIT: COURTESY OF STEVE EASLEY



CREDIT: COURTESY OF DUPONT



CREDIT: COURTESY OF DUPONT



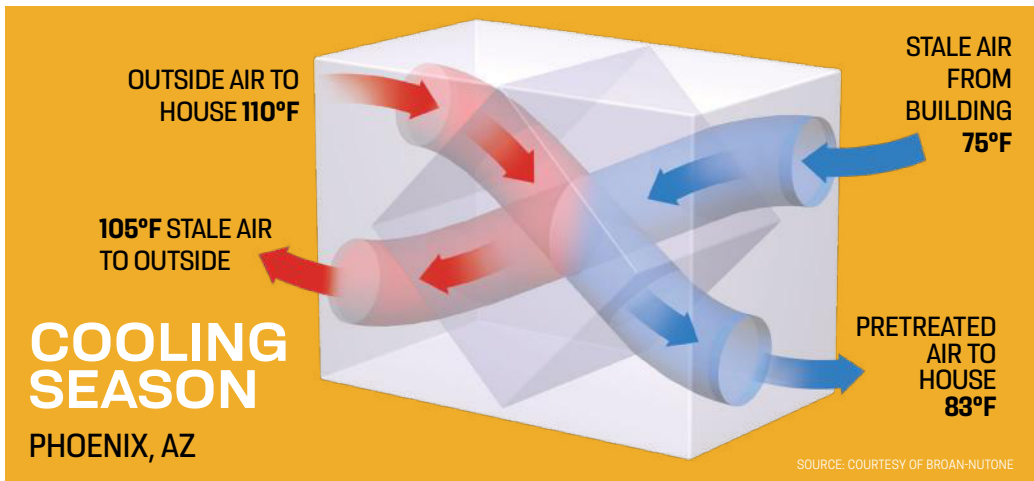
CREDIT: COURTESY OF STEVE EASLEY

HEATING AND AIR

The HVAC system will consist of seven Mitsubishi high-seasonal energy efficiency ratio (SEER) inverter-driven heat pump ceiling cassettes, and one multi-position inverter-driven heat pump. This will allow for individual zoning and temperature control for all major rooms. These units have the ability to vary the speed of the compressor to the exact heating or cooling load, providing even, consistent temperatures for comfort and efficiency.

Broan *AI Series* auto-balancing energy recovery ventilators (ERVs) can take 110-degree outdoor air and pretreat incoming fresh air to 83 degrees. These ERVs can filter the air to MERV 13 rating, removing 85 percent of particles that are 1-3 microns in size. The ERVs' low wattage draw also enables them to simply recirculate and filter the air at very low cost. The guest room has its own HVAC zone and ERV, so it can provide a quarantine space from the other living spaces should a family member get sick.

We will also use a Broan-NuTone *Overture* indoor air quality controller. *Overture* monitors and measures indoor air quality and automatically turns on the ERV, range hoods or bath fans as needed to provide healthy air quality. It monitors VOCs, carbon dioxide (CO₂), fine particulate matter (PM 2.5), humidity and temperature. This prevents over ventilation, thus saving energy.



CREDIT: COURTESY OF BROAN-NUTONE



CREDIT: COURTESY OF BROAN-NUTONE



CREDIT: COURTESY OF STEVE EASLEY

INTERNAL ELEMENTS

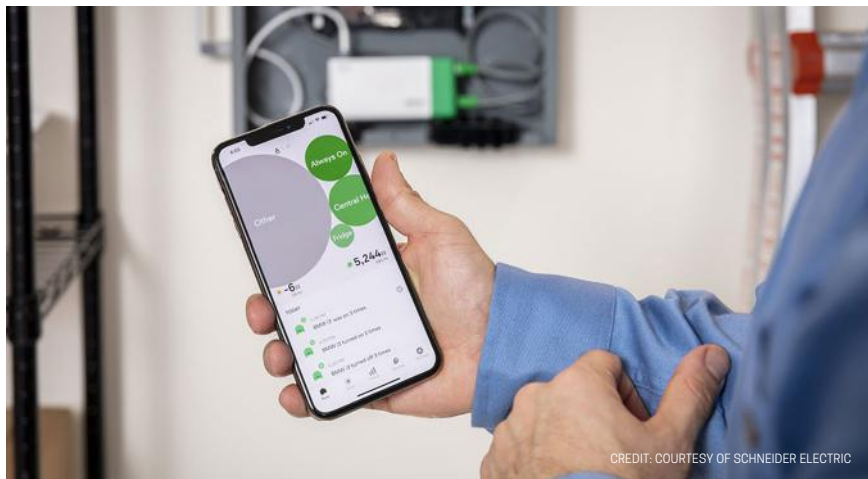
ReVISION House Scottsdale will use the Schneider Electric *Wiser Energy* home power monitoring system, smart panels, and circuit breakers. *Wiser Energy* tracks a household's electricity use, helping the residents manage power usage and solar power generation. *Wiser Energy* pairs with the company's *Sense* app to read the currents from various appliances throughout the house and processes that data to visualize home energy usage.

Our windows are locally manufactured by Bonelli Doors + Windows. The company specializes in large-format glass with minimal frames and doors, and the insulated glass units are made locally by Cardinal Glass at their Buckeye, Arizona plant. The glass is Cardinal *LoE³-366* with Argon gas, with an additional interior low E coating of i89.

Our water supply piping is *FlowGuard Gold* CPVC. It meets the stringent National Sanitation Standard 61 and is certified by the National Green Building Standard. This product has been successfully used in homes for over 60 years. We also selected *BlazeMaster* CPVC piping for our fire sprinkler system.



CREDIT: COURTESY OF STEVE EASLEY



CREDIT: COURTESY OF SCHNEIDER ELECTRIC

SWIMMING POOL

The filtering of water for swimming pools is often the second-largest energy user in homes.

We selected the Hayward *TriStar VS 950* variable speed pump because it has a Weighted Energy Factor (WEF) of 12.9, nearly double the efficiency of every other manufacturer. We also selected Paramount's in-floor cleaning system, which saves chemicals and heating energy, and provides better circulation. **GB**



CREDIT: COURTESY OF STEVE EASLEY



CREDIT: COURTESY OF PARAMOUNT



CREDIT: COURTESY OF HAYWARD

RESILIENCE FOCUS

Dealing With Megadrought

Here are five water-saving technologies every home should include. **BY ALAN NADITZ**



BRACE YOURSELF: The U.S. could be on its way to a record hot summer this year, breaking the high temperature set in 2021 – which itself had surpassed the previous hottest year, the 1936 Dust Bowl summer. The National Oceanic and Atmospheric Administration (NOAA) also expects another year of record heat waves in the Western U.S. – a region that has already endured massive wildfires and megadrought for most of the past decade.

This makes water-saving technologies a crucial part of survival as states continue to dry up, according to NOAA. Here are a handful of product categories that can help homeowners and builders cope with drought while meeting water use regulations.

1 ULTRA-LOW FLOW FAUCETS AND FIXTURES

Faucets, showerheads and toilets are the most-prevalent and most water-wasteful items in a house. The U.S. Environmental Protection Agency (EPA) estimates that upgrading to *WaterSense*-labeled products could save a household about \$170 per year in water costs and reduce overall water usage by up to 50 percent.

Switching from a standard flow (around 2.2 gallons per minute [GPM]) to low-flow (less than 1.5 GPM) faucets can cut a home's water usage by 30 percent or more, which adds up to thousands of gallons saved each year. GROHE, with its *EcoJoy* line, and Pfister, with the *Minta Dual Spray Kitchen Faucet*, are examples.

Similarly, a low-flow showerhead can reduce the GPM rate from 2.5 to under 1.5, saving about 2,700 gallons of water per year in a four-person household. Delta and its *Fundamentals*

Single-Setting Showerhead, and Flow Loop's *Eco Loop* recirculating shower, cover this element.

The biggest water thief – largely due to its degree of use within the home – is the toilet, which since 1994 has evolved from requiring 20 gallons of water per person per day, to 25 gallons total per household now. Many toilets are exceptionally water tight: Models like Niagara's *Shadow* and its miserly 0.8 gallons per flush (GPF) and American Standard's *Baby Devoro FloWise* at 1.28 GPF are among those that have led to guilt-free flushing.

2 LEAK DETECTION

Next to inefficient fixtures, leaks are the bane of existence for water conservation. Luckily, there are smart home devices aimed at solving such a problem. Products such as the *Flo* by Moen *Smart Water Detector* and the *Phyn Plus* smart water assistant specialize in alerting homeowners as soon as a leak is detected within the home. Such units can also shut off water to the damaged region or device, preventing massive, expensive damage to floors, walls and other parts of the house, and keeping the water bill from skyrocketing.

3 SMART IRRIGATION

For those homeowners who still have yards to water, intelligent sprinkler systems are the way to go if they want to keep things green while using the least amount of water. According to the International Center for Water Technology at California State University-Fresno, outdoor water use averages more than 9 billion gallons of water every day, mostly for landscape irrigation. Up to 50 percent of the water is wasted due to overwatering caused by traditional, inefficient irrigation methods and systems. Those antiquated models can be replaced with



Grass guardian. The Rachio 3 smart sprinkler controller creates tailored smart schedules based on a lawn's needs and components, including plant type, soil type and sun exposure. SOURCE: COURTESY OF RACHIO



evapotranspiration (ET) controllers, which use local weather data to make irrigation runtime adjustments, or soil moisture content sensors to accurately determine the moisture level in the soil, then transmit the reading to the controller. Smart sprinkler controllers like *Rachio 3* and Rainbird's *SMRT-Y Soil Moisture Sensor Kit*, combined with native xeriscaping – the use of plants whose natural requirements are appropriate to the local climate – can really get the job done.

4 GREYWATER RECYCLING SYSTEM

Greywater – the water that goes down the drain from a laundry machine, bathroom sink, shower, tub, and dishwasher (but not a toilet) – accounts for up to 65 percent of the H₂O used in a home. Reusing it to irrigate plants, wash cars, flush toilets, or even do laundry, can significantly impact total water consumption, cut the water bill, and more positively impact the environment. Greyter Water Systems' *Greyter Home* residential water recycling system and Saniflo's *Saniswift Pro* can make second-hand water a cool thing inside or outside of the house.

5 RAINWATER HARVESTING

A rainwater harvesting system – such as those from Rainwater Management Solutions and ROTH North America – provides distributed stormwater runoff containment while simultaneously storing water that can be used for irrigation, watering indoor plants, flushing toilets, washing clothes, washing cars, and pressure washing. It can also be purified for drinking. The system also reduces demand on existing water supply by up to 50 percent during the wet season, according to marketing firm Precision Reports, and reduces run-off, erosion, and contamination of surface water. **GB**

www.greenbuildermedia.com

A THUMBS-UP FOR PEX PIPING

Many of the ways homeowners can conserve water would fail if not for another crucial item: the pipeline. How water goes down the drain or onto the landscape depends on how efficiently the plumbing can move things along.

Cross-linked polyethylene (PEX) piping, manufactured by **Uponor**, doesn't experience the corrosion and mineral buildup commonly found with traditional copper pipe. This can lead to benefits such as faster emergence of hot water – which, for example, results in shorter showers – saving time, energy and water.

PEX piping also tends to have fewer connections, which reduces the chance of water-wasting leaks. Plumbing layout can also be more direct with PEX versus copper pipe, making for a shorter overall trip for water through the home. The PEX layout results in greater energy efficiency and less water wasted down the drain.

BROUGHT TO YOU BY

uponor

CLOCKWISE, FROM TOP LEFT

Second life. Greyter Water Systems' *Greyter Home* residential water recycling system puts used household greywater back to work for flushing toilets, the No. 1 water user in the typical U.S. home.

SOURCE: COURTESY OF SANIFLO USA

Nature's harvest. A rainwater collection system can reduce demand on an existing water service infrastructure by up to 50 percent and keep an ample supply on hand for later use.

SOURCE: JAN SMITH/Flickr

This flow's a go. GROHE *EcoJoy* single-lever faucets feature a flow-limiting mousseur with aerator, which reduces water consumption while offering a voluminous flow that never exceeds 5.8 liters per minute.

SOURCE: COURTESY OF GROHE

Pressure performer. The *Phyn Plus* (2nd Generation) smart leak detector is 25 percent smaller, with a more-compact power supply and redesigned enclosure to reduce size and volume for installation in tight spaces.

SOURCE: COURTESY OF PHYN

HOUSING 2.0

WORKFORCE CRISIS:

High Impact, Low-Cost First Step

Even three years ago, the construction industry expected to have a tough time finding workers. How do we prevent more of the same in 2022 and beyond?

BY SAM RASHKIN

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

IN MY WANING DAYS AS CHIEF ARCHITECT with the U.S. Department of Energy (DOE) Buildings Office, I was one of three staff members asked to pitch a new program idea to help resolve the construction industry's huge workforce crisis. For more than a decade, annual surveys by the National Association of Home Builders (NAHB) revealed worsening labor issues related to cost, availability, recruitment, quality, training, productivity, and waste. This includes recent survey results showing that 85 percent of builders expected cost and availability of labor to be a significant problem in 2020 (see Figure 1). During the COVID pandemic, this crisis has only gotten worse.

To address this challenge, I chose an ultra-low-cost, high-impact communication strategy about the compelling business case for a career in the trades that could effectively leverage thousands of stakeholders with concomitant interests to get past this crisis.

So, why did I choose to write an article about workforce for a *Green Builder* audience devoted to sustainable building? This is the same question I posed in my prior article about the myth that homes increase in value (see *Green Builder* March/April edition). The answer is that high-performance buildings cannot happen without a qualified workforce. High-performance building advocates have to be part of the process for ensuring adequate growth and training for the trades.

I saw the construction workforce challenge as primarily a communication problem. There is a Tsunami of older trades professionals retiring and a miniscule of interest to join the trades among the younger demographic. At the same time, there is a compelling business case to work in the trades. This includes the following career benefits:

- Less time and cost burden for education
- Competitive compensation
- Greater job security
- Great job availability

LESS TIME AND COST BURDEN FOR EDUCATION FOR CONSTRUCTION

There is such a shortage of construction workers that often trade jobs and apprenticeships are available with no training requirements. This means no cost or time to start a career in construction. In the worst case, the average time and cost for attending a trade school is six months to two years, and \$30,000, compared to four years and \$150,000 for a college bachelor's degree. This means a bachelor's degree, compared to trade school, imposes up to eight times greater time burden and seven times greater cost (see Figure 2).

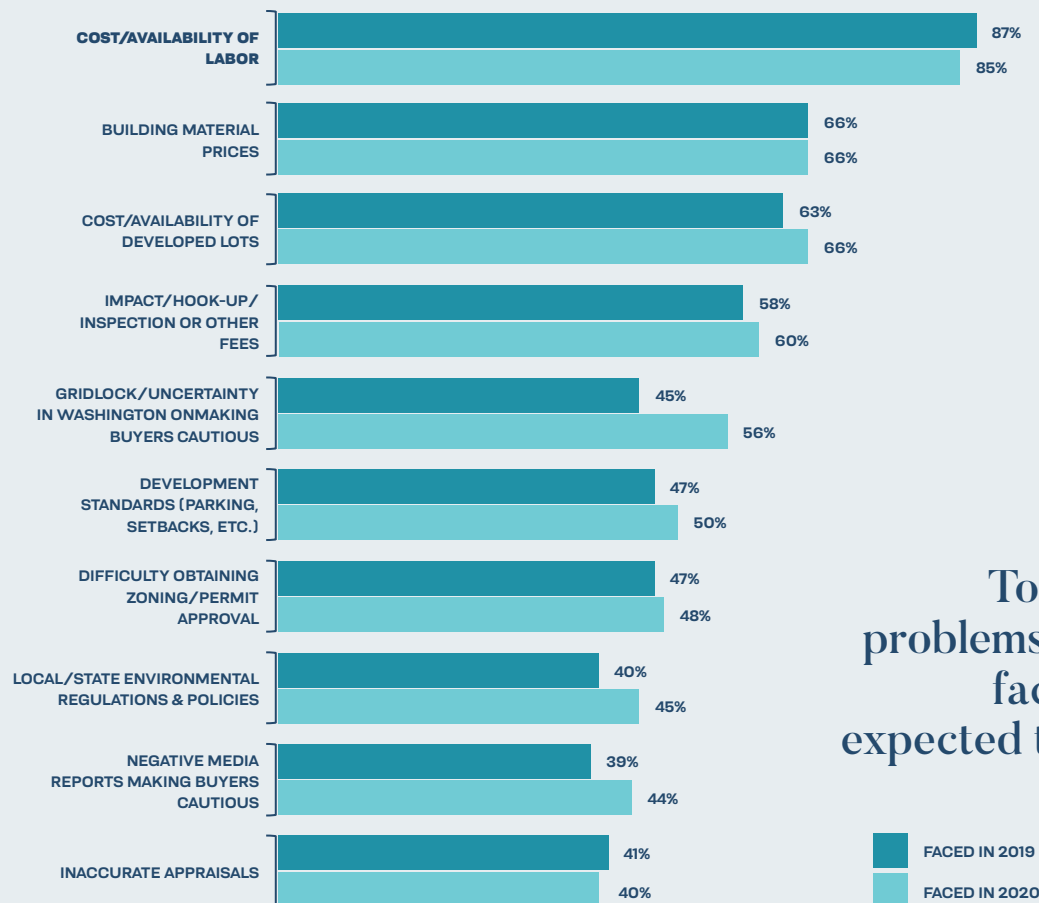


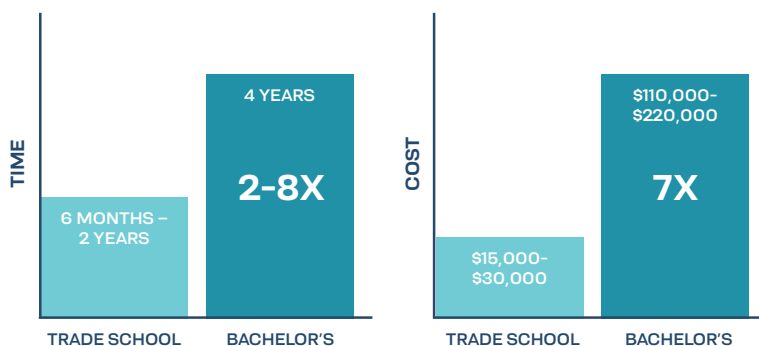
FIGURE 1
Top 10 significant problems home builders faced in 2019 and expected to face in 2020.

SOURCE: NAHB

FIGURE 2

Time and cost burden for bachelor's degree compared to trade school.

SOURCE: TOPTRADE SCHOOL



COMPETITIVE SALARIES FOR CONSTRUCTION

I researched the average annual salaries associated with key trades and more-desirable college degree programs and summarized them in Figure 3. This comparison reveals that trade careers offer highly competitive salaries.

GREAT JOB SECURITY IN CONSTRUCTION

Jobs in the trades require hands-on work that cannot be outsourced, while jobs in the information, technology, or customer service sectors can easily be contracted out. In fact, the total contract value of the outsourcing market in the Americas between 2000 and 2019 has grown over 50 percent to \$62 billion (see Figure 4). Thus, trade careers experience much less stress related to job security compared to many careers for college graduates.

GREATER JOB AVAILABILITY

The Bureau of Labor Statistics publishes the compound annual rate of change for a diverse array of job classifications. A recent summary shows that the number of construction jobs had the second highest rate of increase behind health care and social work (see Figure 5). Of course, with the massive trade shortage, it is no surprise that jobs are plentiful in the construction industry.

FIGURE 3

Average annual salary for trades in Virginia compared to average annual salary for college graduates.

SOURCE: SALARY.COM; NATIONAL ASSOCIATION OF COLLEGES AND EMPLOYERS

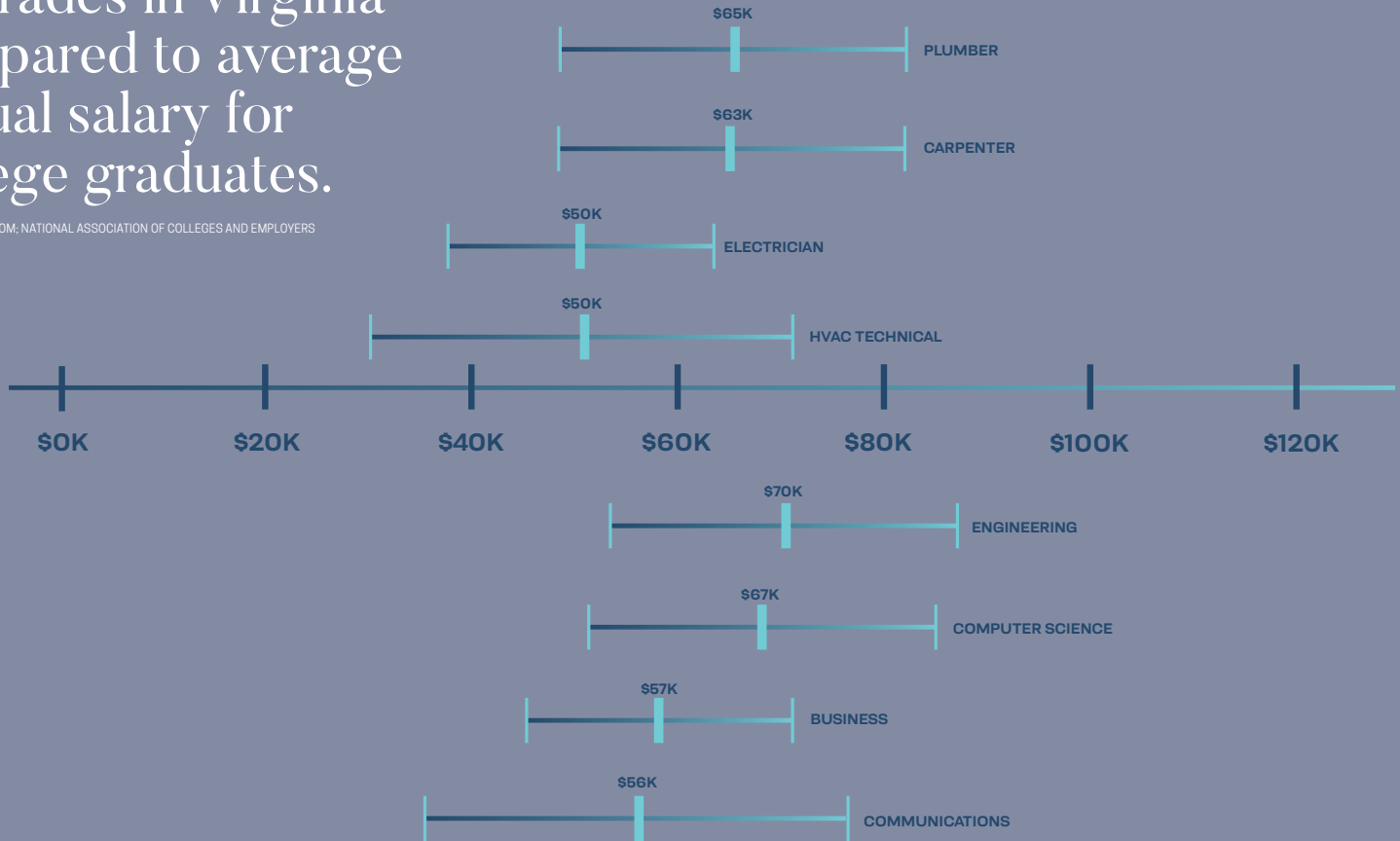


FIGURE 4

Total contract value of outsourcing market in the Americas, 2000 to 2019, in billion of U.S. dollars.

SOURCE: STATISTA 2021

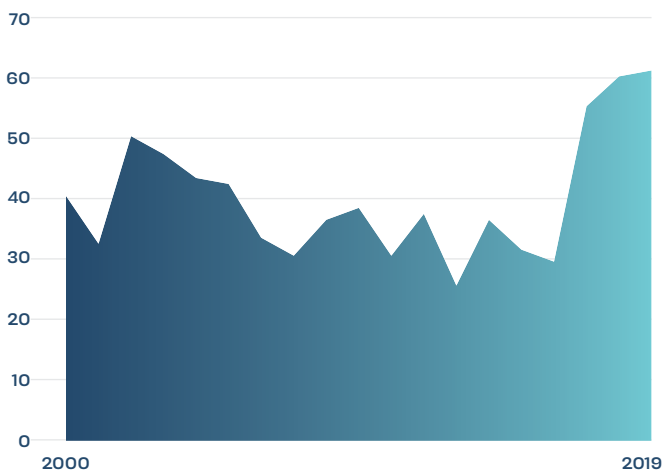
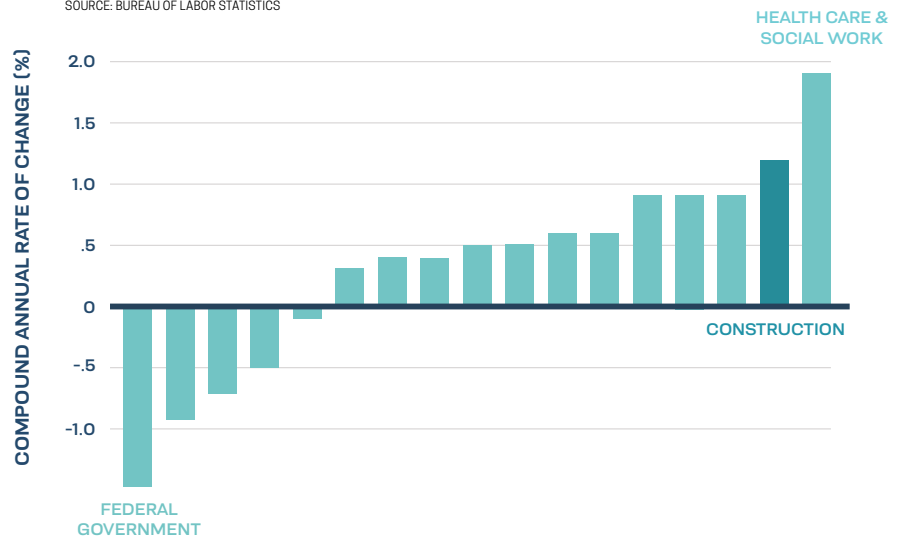


FIGURE 5

Compound annual rate of change for various job classifications.

SOURCE: BUREAU OF LABOR STATISTICS



Looking to the future, job availability for trades will become even greater in the next 15 years: millions more tradespeople will be retiring than white collar professionals.

WORKFORCE COMMUNICATION CAMPAIGN IMPLEMENTATION

These simple charts and data points tell a compelling story for young students to better inform considerations for a career in the trades: less time and cost, excellent compensation, superior job security, and plenty of jobs available. This is not a hard sell. But it is critical to tell this story simply with easy-to-understand graphics and contrast.

Thus, my simple proposal is to engage all housing industry stakeholders to start a broad education campaign targeting high schools, especially in low-income communities. The goal is to use comprehensive outreach tools (e.g., social media, Ad Council ads, websites, in-person presentations, career day participation, etc.) to share this compelling business case for joining the trades and specific steps for how to start the process. One organization (e.g., government, industry association, etc.) would need to take the lead and facilitate all the vested interest stakeholder groups to fund and execute a coordinated campaign.

The high-performance home community would be expected to actively participate in this campaign, including adding content related to zero carbon as the homes of the future, the special career opportunities constructing them, and solutions for also transforming the aging building stock into high-performance homes.

During my entire federal government career, I had the privilege to specialize in low cost and high impact programs and projects. This workforce proposal was another attempt

to follow that path.

One last note. My recently published new book, "Housing 2.0: A Disruption Survival Guide," is now in its third printing. I'm excited for high performance housing professionals to benefit from the detailed framework for consistently optimizing the housing user experience to position themselves as leaders. We need you at the top of the housing industry. Information on how to order the book or attend one of our workshops is available at: green-buildermedia.com/housing-2.0-a-disruption-survival-guide. **GB**

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

The Housing 2.0 program is sponsored by Mitsubishi Electric, Westlake Royal Building Products and Schneider Electric.



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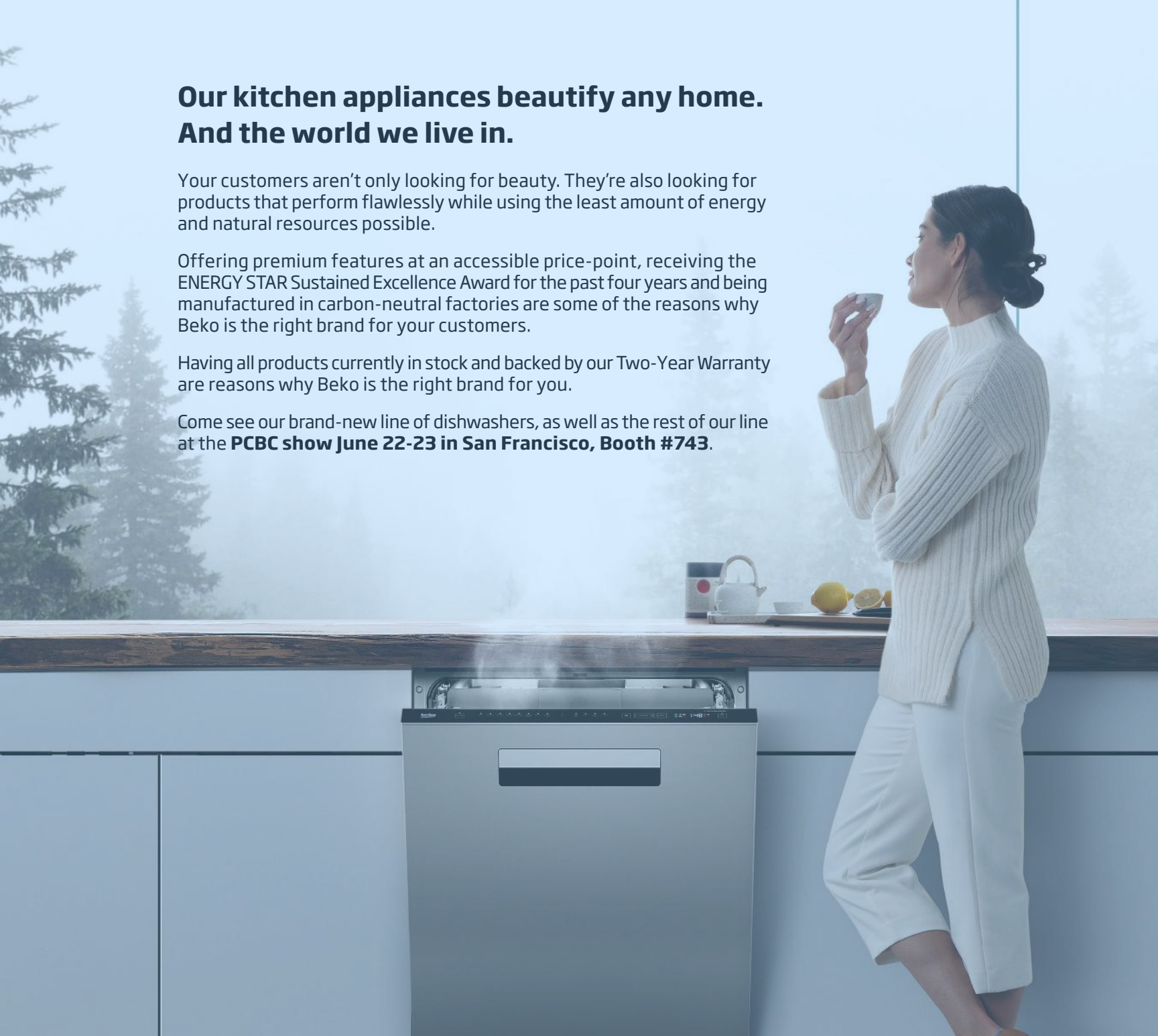
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PAGE 61

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COVER 2

**COMING NEXT ISSUE****Eco-Leaders**

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Fossil Fuels or Fossil Fools?



Ron Jones
Co-Founder and President
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RECENTLY READ A LETTER to the editor of an electric co-op magazine from a reader who said:

"I am opposed to renewable energy such as wind and solar, not just because the giant wind and solar farms are ugly, but because they are not reliable...I like fossil fuels such as oil, natural gas and coal."

I would respond that in the first half of the 19th century, whale oil was the highest quality lamp fuel and lubricant known. Demands for it were so great that profits from that industry (during the so-called "golden age" of American whaling, which ran roughly from the 1820s up until the start of the Civil War) are largely recognized as the source of funding that made possible the expansion of the nation into the West.

The whaling industry did not meet its decline because all the whales had been slaughtered, although that almost certainly would have occurred if regulations were left to the whalers themselves. The average whaling voyage had reached three years in duration at the industry's peak, and the American fleet alone numbered more than 750 vessels that literally sailed the seven seas. More than 20,000 seamen were directly engaged in whaling and more than 70,000 people directly depended on the \$70 million industry for their livelihoods.

In 1859, a Pennsylvania well driller in search of water struck petroleum instead. That event, along with the outbreak of the Civil War, in which the majority of the whaling vessels were destroyed, led to the realization that a more-plentiful—and therefore cheaper—type of fuel and lubricant was ripe for the plucking. Soon, people began to light their lamps with kerosene and lubricate their machinery with petroleum products. Those who wrung their hands and warned that the economy would collapse if whale oil and the industry built around it should disappear were soon forgotten. The rest, as they say, is history.

The introduction of the petroleum age fostered another

significant advance in technology. For a considerable period of time, the external combustion engine represented the most efficient and versatile source of mechanical horsepower available in the world. Steam locomotives, still the darlings of railroad aficionados and nostalgic hobbyists, burned giant quantities of coal or wood as they drew the immense loads of commerce back and forth across the continent. Steamships, dependent upon those same solid fuels, ferried passengers and freight up and down great rivers and over the vast oceans with speed, endurance and predictability never before imagined, let alone realized.

External combustion technology even took a victory lap in personal transportation for a time as a version of the renowned Stanley Steamer set a world speed record for automobiles in 1906, at a blazing and amazing 127 miles per hour. Their eventual obsolescence came because they could not compete with the fuel efficiency and power delivery of internal combustion technology.

The mass use of whale oil for lighting and lubrication did not end because the last remaining whale had been hunted down and brutally harpooned...that act has apparently been left to the modern-day whaling industry, which continues to relentlessly "harvest" this "resource," mostly for pet food and use in cosmetics.

We won't simply wake up one day and realize that the last trainload of coal has been burned at a power plant, putting an end to the blackening of the skies and stockpiling of toxin laden ash in open heaps and lagoons. Nor will we suddenly switch from petroleum-based fuels to propel our implements of transportation and recreation...planes, trains, automobiles and the rest.

To the aforementioned letter writer, I paraphrase the wisdom of Abe Lincoln, who said, "it is better to remain silent and be suspected a fool, than to speak out and remove all doubt." **GB**



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