Award-Winning Coverage of Sustainable Construction, Products and Lifestyles

GREEN BUILDER®

November/December 2020 / www.greenbuildermedia.com

SCANNING THE HORIZON

Our annual State of Sustainable Building Report points to surging demand for new and better housing, rising from the painful passage of the pandemic.

MARIPOSA MEADOWS

Green Builder Media proudly introduces our first entirely self-sufficient, off-grid project in the VISION House Series.

The VISION House at Mariposa Meadows is perched high in the Rocky Mountains of Colorado, uniting extraordinary design with extreme performance, resilient building, renewable energy, connected living, and health and wellness.

The goal of the project is to demonstrate how homes built in an extreme, high-altitude setting can be optimized for performance, self-sufficiency, durability and resource management. The homes will display solutions that can be applied in climate zones across the nation.

Learn more at www.greenbuildermedia.com/vision-house-mariposa-meadows

THANK YOU TO OUR SPONSORS

Whirlpool Corporation · SIPA Structural Insulated Panel Association · uponor · JamesHardie Siding | Trim · Panasonic Ventilation · Trex · JinKO Solar Building Your Trust in Solar · Maze Nails · BOSCH Invented for life · TRUSTILE · DUPONT · ASSA ABLOY · Norbord · SCHOTT · CROSSVILLE Elevate Your Space · fresco harmony · NFPA · THE BOLD LOOK OF KOHLER · Delta Millworks · EuroLine Windows Inc. · SCHLAGE · Nudura · Clopay America's Favorite Doors · BEAM · LAMPS PLUS · CREATIVE MINES Makers of Stone and Masonry Veneer · caesarstone · BEHR · FABRAL Metal Wall and Roof Systems · PIONEER Landscape Centers

EDITOR'S NOTE

The Inside Scoop

By Matt Power
Editor-in-Chief

Building the New Normal Together

THE RHETORIC HAS COOLED NOW. The election has come and gone, but the shape of the outcome will depend on us. I'm not talking about who won and who lost. That's decided. I'm talking about how we choose to go forward.

I have a suggestion. Let's build together. If you're like me, you have friends and family all over the political spectrum. Sometimes you argue, even heatedly, but a short time later, you're leaning into their car, wishing they would visit more often. That's because in the real world—not the rapid fire comments on social media, most of us care about the same things. Family. Safety. Purpose; a life filled with more joy than anxiety. We just have different views about how to achieve them. So what? That's human.

The country has problems, deep problems of injustice, inequity, poverty—and that's AFTER we get through the pandemic nightmare. Then there's Climate Change, with natural threats coming on strong. We can rage about it, or throw up our hands in despair, or we can take local action toward a new normal.

As building pros, we're in a position to push the needle in the right direction on ALL of the major concerns. By creating affordable, energy efficient housing, we lighten the financial load on families. By creating sustainable communities, we reduce dependence on foreign oil, top-down utilities and automobile-centric infrastructure.

The promise of an imminent vaccine has lifted our spirits. But for many in our industry, demand for building, remodeling and repair never slowed. If anything, it became more intense. As we emerge from a strange year of partial economic restraint, into a landscape of distrust, post-traumatic stress and heart-opening relief, we'd be fools to ignore what's been learned in this time when our homes became go-to sanctuaries.

So take a few minutes and look at what we've learned in our annual "State of the Industry" roundup. Here is wide-ranging data collected over the past months, about housing preferences, needs, desires and fears. The pandemic will end. We can look at it as the harbinger of collapse, or use this existential experience as a springboard for our future prosperity. The latter sounds a lot better to me. In this difficult dark season, keep your eye on the light ahead. Put your arm around that family member who won't stop spouting conspiracy theories. Buy a beer for the plumber who thinks socialism is the only answer. Come together. Build something cool. Celebrate the stuff we do share, and see the challenges as motivation to do better. We're Americans. We've got this. **GB**

Working together. With daunting challenges for the nation ahead, the work of building pros has become even more essential. It's time to rebuild trust and kinship, and trends show us how.
CREDIT: CINEBERG/ISTOCK

Seattle Cascades

VISION House® by Green Builder® Media

Imagine what your house would look like if the greatest minds in sustainability, performance, and design came together to build it – with the goal of remaining within your design parameters and budget.

THE EXPERIENCED PROFESSIONALS at Green Builder Media have joined forces with internationally-acclaimed building scientist and production builder CR Herro (VP Innovation, Meritage Homes) and pioneering green architect Stace McGee (Founder, Environmental Dynamics Inc) to create the VISION House Seattle Cascades: The House the Experts Built.

Located in Enumclaw, WA (the gateway to Mount Rainier National Park) the VISION House Seattle Cascades features the most advanced products, systems, and technologies to achieve extraordinary performance results – all at a reasonable price point. The net-zero, solar powered, high performance, resilient, healthy, and intelligent home boasts stunning design details, an open floor plan, and innovative materials.

Through meticulous planning, space is optimized to significantly reduce material use, jobsite waste, and cost. By deploying advanced building science and superior construction techniques, the home will exemplify resource efficiency and promote occupant well-being.

The result: a simple, replicable template that homeowners and builders can follow, based on decades of experience in the fields of green building, sustainable design, and building science.

FOR MORE INFORMATION:

Look for ongoing editorial coverage about the VISION House Seattle Cascades from Green Builder Media in the coming months. In the meantime, be sure to check out the project microsite at **www.greenbuildermedia.com/vision-house-cascades** for updated articles, videos, and news about the project.

PROJECT SPONSORS:

Whirlpool Corporation · Panasonic · Control4 · uponor · western window systems · Rheem (The new degree of comfort®) · VIEWRAIL · Cultured Stone · Boral Steel Stone Coated Roofing · Square D by Schneider Electric · Schott Robax · Premier SIPS · MoistureShield Composite Decking · System Components Corporation · Nudura

Study: Boomers Most Likely to Act on Climate Change

Stand aside, millennials—when it comes to real change, baby boomers tend to take more real steps than younger generations.

PEOPLE BORN BETWEEN 1984 AND 2002 — the millennials — have earned the nickname "generation green" for their pro-environmental stance and their occasional digs at the older generations that failed to keep Climate Change in check. But according to a survey by research firm Opinium Research, baby boomers are the ones who are most likely to promote and support sustainability.

The firm polled 2,000 people about their green habits. Half of the respondents aged 55 or older — the baby boomer set — prefer to shop locally, buy clothes that last longer, and try to avoid single-use plastics. By comparison, only 25 percent of millennials do the same.

Also, while 78 percent of all respondents believe they have a "personal responsibility" to deal with the climate crisis, a substantial number are not prepared to make sacrifices. For example, respondents want to eat less meat, avoid fast fashion or bicycle instead of drive, but some have been unable to do so, Opinium notes.

"The will is there," says Steven Day, co-founder of renewable energy supplier Pure Planet, which commissioned the survey. "People have told us they want to live more sustainably than they currently are. But clearly the challenge we face is how we harness people's energy and intent, and channel it on the things that have the most impact."

Who still loves ya, baby? Once known for a "me first" attitude, baby boomers now take a better pro-green stance—in preparation for comfortable golden years—than the eco-minded millennial generation.
CREDIT: JOHN ENGLART/FLICKR

A Not-So-Instantaneous Solar Tech

Before a plan to help control global warming can work, people need to slow down air pollution.

SOLAR GEOENGINEERING, a method of cooling Earth's atmosphere and reducing the impact of Climate Change, holds great promise but will only succeed if carbon emissions are kept under control, according to researchers at the California Institute of Technology and Pacific Northwest National Laboratory. As such, the highly touted process, which includes the reflection of sunlight off of an aerosol-derived sheath to reduce temperatures on a planetary scale—is not a "get out of jail free card" from the climate crisis, scientists note.

That's because low-lying stratocumulus clouds, which also shade the earth from sunlight, break up as carbon dioxide gasses increase. If the clouds were to break up entirely, there could be an almost instant 12 degree increase in global temperature, researchers note.

It could also harm agricultural yields, change rainfall patterns or set off an irreversible feedback loop, according to Caltech professor and report co-author Tapio Schneider.

So why consider pursuing the technology? Because, used properly, solar geoengineering could cool down some of the world's hottest, driest regions, such as parts of Africa and the Sahara, making them more habitable, according to Dr. David Keith at Harvard, a longtime field researcher who was not involved with the current study. It could also more quickly reduce warming in some of the world's largest cities, which also produce most of the planet's greenhouse gasses.

Sky fall. Clouds, which are Earth's first defense against excessive sunlight, will vaporize as global emissions rise — leaving the planet even more vulnerable to Climate Change. CREDIT: NICHOLAS A. TONELLI/FLICKR

The study appears in the journal Proceedings of the National Academy of Sciences

(Electric) city by the bay. In an effort to cut carbon emissions, San Francisco will implement a ban on the use of natural gas in all new residential and commercial buildings starting next summer.
CREDIT:BOGDAN MIGULSKI/FLICKR

San Francisco Bids Goodbye to Natural Gas

The city's ban will require electric appliances in all new construction as of 2021.

THE CITY OF SAN FRANCISCO is banning natural gas in new buildings, meaning that stoves, furnaces and water heaters must all be electric powered. The ban takes effect in June 2021.

According to a report in InsideClimate News, San Francisco becomes the latest addition to a list of municipalities — most of them in California — that are attempting to tackle the climate crisis by shrinking the massive climate footprint of their buildings.

Residential and commercial buildings account for more than 40 percent of San Francisco's total greenhouse gas emissions, with the burning of natural gas responsible for most of that, according to city supervisor Rafael Mandelman. The gas itself, methane, is a climate super-pollutant capable of warming the planet 87 times faster than CO2 when leaked into the atmosphere, he notes.

Natural gas is also responsible for nearly 40 percent of the country's total annual carbon emissions, or 619 million metric tons of CO2, according to the Energy Information Administration.

San Francisco's ban is a big deal, according to Amanda Myers, a senior policy analyst for clean energy think tank Energy Innovation. If cities in California continue to rely on gas to heat new buildings through the next decade, Myers says, it will become increasingly difficult — if not impossible — for the state to meet its binding climate target of reaching carbon neutrality by 2045.

Panic or Practicality?

Increasing numbers of companies large and small are getting the word out about their commitment to the environment.

MORE PUBLICLY TRADED corporations are taking action to improve the environment. They also want people to know about it. According to a study by the Governance & Accountability Institute (G&A), 65 percent of the companies included in the Russell 1000 published sustainability reports in 2019, up from 60 percent in 2018. The finding marked the eighth straight year of increase, the institute notes.

Most large companies are now on the green bandwagon. Researchers found that 90 percent of the largest 500 companies in the index published sustainability reports in 2019, an increase from 86 percent in 2018. The smaller 500 companies publishing reports rose from 34 percent in 2018 to 39 percent over those years, according to G&A.

The Russell 1000 generally mimics the better-known S&P 500 Index because most of the same corporations appear on each list. "While sustainability reporting by [mid- and smaller-sized] public companies has lagged behind that of [larger] companies, our research shows that reporting by smaller companies is accelerating," says G&A co-founder Louis Coppola. **GB**

Green leader. Electronics giant LG is among corporations that publish sustainability reports to demonstrate commitment to environmental responsibility. CREDIT: MIKE MOZART/FLICKR

GREEN BUILDER®

Volume 15, Issue 6
November/December 2020
Published by Green Builder® Media

GREEN BUILDER MAGAZINE
EDITORIAL OFFICES
PO Box 97
Lake City, CO 81235
303-246-8890
www.greenbuildermedia.com

GREEN BUILDER MEDIA LEADERSHIP
Sara Gutterman CEO
sara.gutterman@greenbuildermedia.com
303-246-8890

Ron Jones President
ron.jones@greenbuildermedia.com

Cati O'Keefe
Chief Development Officer / Editorial Director
cati.okeefe@greenbuildermedia.com
513-532-0185

ADVERTISING SALES
Craig M. Coale Publisher
craig.coale@greenbuildermedia.com
512-344-9754

AUTOMOTIVE ADVERTISING SALES
Ron Frederick
ron@focusmm.net
586-808-3478

EDITORIAL
Matt Power Editor-in-Chief
matt.power@greenbuildermedia.com
207-619-2713

Alan Naditz Managing Editor
alan.naditz@greenbuildermedia.com
916-899-5563

John O'Brien Art Direction
john.obrien@greenbuildermedia.com
207-865-9908

Grania Power Copy Editor
power.graniae@gmail.com

Melissa Smith Web Editor / Cognition Project Manager
melissa.smith@greenbuildermedia.com

PRODUCTION
Mary Kestner Production Manager
mary.kestner@greenbuildermedia.com

CIRCULATION
Mary Kestner
mary.kestner@greenbuildermedia.com

GENERAL INFORMATION
admin@greenbuildermedia.com

FINANCE
Hannah Judson Chief Financial Officer
hannah.judson@greenbuildermedia.com
970-397-5483

ISSN 1559-4971

www.greenbuildermedia.com/subscribetogreenbuilder
Click above to subscribe to *Green Builder* magazine today!

www.greenbuildermedia.com/about-green-builder-media
Click above to learn more about Green Builder® Media.

Problems with your subscription?

For assistance, please contact
Mary Kestner, Production Manager
mary.kestner@greenbuildermedia.com

Subscription Information
Subscribe to *Green Builder* magazine and receive valuable information about how to increase your bottom line, differentiate your business and change the world. At $39.95, it's an easy return on your investment. Just go to www.greenbuildermedia.com and click on "subscribe." To unsubscribe or change your address, email your name, company and address to: mary.kestner@greenbuildermedia.com.

Green Builder reduces its environmental impact through the purchase of carbon offsets. Almost all of the natural resources used to produce *Green Builder* will be returned to the environment by planting trees and restoring watersheds. Also, greenhouse emissions will be mitigated through carbon offsetting (printed on recycled paper).

NEW! SUBSCRIBE TO OUR NEWSLETTERS
www.greenbuildermedia.com/enewsletter-subscribe

@greenbuildermag
@visionhousegbm

instagram.com/greenbuildermedia

facebook.com/GreenBuilderMedia

linkedin.com/company/green-builder-media-llc

pinterest.com/greenbuilder

MISSION STATEMENT: "Our mission is to effect meaningful, positive change for a better world. As advocates for sustainability, we provide mind-expanding information that catalyzes and inspires commitment to sustainable living."

TABLE OF CONTENTS

PAGE 41

FEATURES

DEPARTMENTS

HERE'S A SAMPLE OF WHAT'S INSIDE

"The major effect [on the housing market] will be seen next summer, because a foreclosure that starts today is probably not going to be processed until mid-2021." **PAGE 14**

ON THE COVER

THE STATE OF SUSTAINABLE BUILDING 2021

Visit us at www.greenbuildermedia.com

for up-to-date news analysis, case studies, new green projects, code and reg updates, thought-provoking blogs, cutting-edge products and much more.

THE STATE OF
SUSTAINABLE
BUILDING 2021

THE GREAT CHANGE

The housing industry has withstood everything this historic year has thrown at it. What's next?

BY GREEN BUILDER STAFF

LIKE IT OR NOT, THE CORONAVIRUS HAS reminded us that nothing is permanent or guaranteed. We've been tested on all fronts: politically, personally and economically. Yet, it's fair to say the building industry has been lucky. We've come through the first months of upheaval with fewer injuries than most of the economy. Work has continued, albeit against a background of anxiety.With help from our proprietary COGNITION Smart Data research tools, it's time to take stock of where we are—and where we're going in 2021.

WHAT'S INSIDE

A SUSTAINED SURGE?

The housing market is proving to be a bright spot in the economy—at least for now. Housing sales are strong, inventory is limited, prices are stable, and mortgage rates remain low.

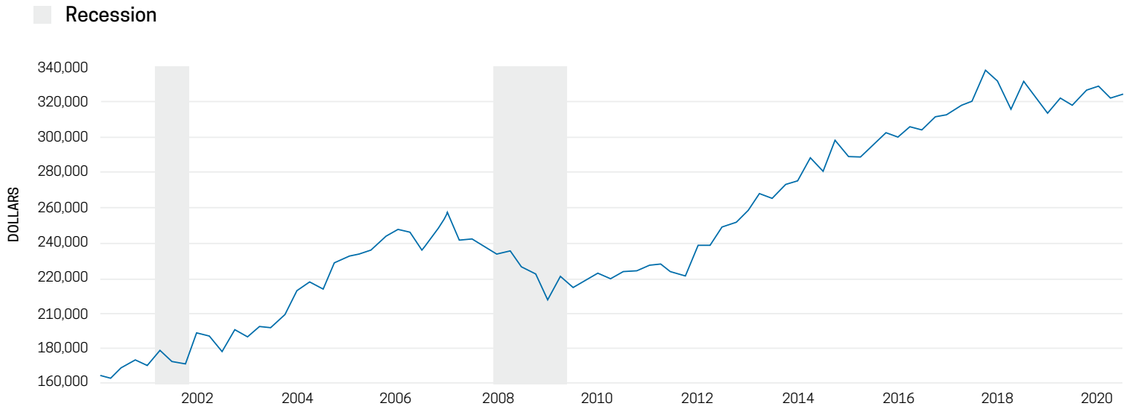
SOMEHOW, WHILE businesses large and small have perished in this COVID-19 crazy world, the home sales and construction industries have managed to survive.

But how much longer before they also have to pay the piper?

According to numerous experts, not for a while: three months, six months, even a year from now, depending on who you talk to. Most economists had originally projected that the coronavirus would result in a "short but sharp" event, with a steep tumble during summer and recovery starting in fall. But that projection went out the window with the massive wave of new infections to hit the nation (and the world) starting in late October. Questions now abound—rather than a "V," "W," or "swoosh" recovery, it's likely that there will be waves of recovery, with ebbs and flows, until there a reliable and safe vaccine is fully distributed.

Not to worry, according to Marco Santarelli, CEO of Norada Real Estate Investments in Laguna Niguel, California. COVID or no COVID, people continue to shop, inventory and interest rates remain low and home prices continue to rise. "This trend shows that the housing market is as strong as it was during the housing bubble," Santarelli says. "We typically see a decline in demand and a big increase in time on the market before the end of November. If this trend remains steady in the weeks ahead, that points to a seasonal slowdown, but if the time on market shrinks by a greater amount, that's a signal that 2020's housing market is going to remain hot even during holidays."

Home Prices Keep Rising



Upward bound. Median home prices nationwide have moved steadily upward in 2020, reaching the second-highest level seen since 2018.
CREDIT: FRED ECONOMIC RESEARCH ST. LOUIS

ECONOMIC STRENGTH IN HARD TIMES.

Research conducted by Green Builder Media backs up Santarelli's assertion. According to COGNITION Smart Data, GBM's suite of market intelligence services, the housing market will continue unprecedented growth even in these uncertain times.

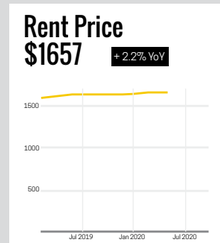
As reported by the U.S. Census Bureau and the U.S. Department of Housing and Urban Development (HUD), the growth in single-family starts throughout the summer continued into fall. The seasonally adjusted annual rate reached 1.42 million in September, up from 1.39 million in August, and 1.27 million in September 2019. These are the highest production rates since this past February. Single-family permits continue to rise as well, up more than seven percent on a year-to-date basis.

Meanwhile, the national median home sale price hit $324,900 for Q3 2020, up slightly from $322,600 in Q2, but down a bit from $329,000 in Q1. The first quarter's numbers, however, are pre-COVID and were the best since Q3 2018. That makes the most-recent quarter's totals even more impressive, according to HUD.

And, inventory continues to dwindle. HUD's report on September housing sales notes that the current supply of on-market properties would last 3.3 months, the

Buying Beats Renting: By the Numbers

High rents, coupled with long-term isolation and working from home, have made homeownership more attractive than ever.



Over the top. On a national scale, the median monthly cost for a rental is $1,657, and the median monthly home mortgage is $1,556. That means that, on average, it costs about $101 less to own a home than to rent.
CREDIT: COGNITION SMART DATA

RENTING A HOME isn't what it used to be. Long seen as the option for people who can't afford to buy their residence, it has, in recent years, become a springboard for home ownership.

With the arrival of the coronavirus—and the resulting fallout—buying a house seems like the only sensible choice. According to a report in Mansion Global, the coronavirus pandemic has many Americans rethinking the kind of lifestyle they want. "Apartment living in central, densely populated urban areas," MG notes, "is losing its appeal as residents are subject to building restrictions and risk coming into contact with people infected by the virus."

A Harris Poll from this past summer indicates that nearly one-third of Americans are considering moving to less densely populated areas in the wake of the pandemic. That has resulted in a residential shift that has helped push up real estate sales and home prices.

Suburban life has also gained popularity due to the need for people to work from home during the pandemic. "The rapid uptick in telecommunications and remote working has made it possible for people to move away from congested urban markets to lower priced, less dense areas," notes COGNITION Smart Data. "Homeowners can get more bang for their buck while still maintaining their jobs."

There's a financial element, too. The median 30-year home mortgage payment for a three-bedroom, two-bath home is $1,556 per month, according to the U.S. Census Bureau. By comparison, the median monthly rental cost is $1,657. And in investment terms, each house payment offers a future return. Money for rent is gone with every monthly check.

A different world. Builders and designers are rethinking how homes are used. Will they accommodate long periods of self isolation and working at home? CREDIT: GERENME/ISTOCK

Confidence Roller Coaster: Spend or Hunker Down?

Just as the economic freefall caused by the early pandemic began to stabilize, new fears shook up the market. Is another slide just around the corner?

CONSUMERS MAY HAVE POSITIVE FEELINGS about home buying, but their feelings about the economy—which has a major impact on how many homes are built and sold—aren't so rosy. The University of Michigan (UM)'s broader headline consumer sentiment index in November posted its first monthly decline since July. According to UM officials, the setback was driven by "growing pessimism about the future, rather than unease about the present."

The report also highlighted the differences in sentiment across political party lines. Survey respondents who identify as Republican expressed far less optimism for the next six months than they did in October, while the outlook for those who identify as a Democrat did not change.

The pandemic is also to blame for consumer ennui. According to Kaye Hermanson, a psychologist at the University of California-Davis, the term "COVID fatigue" sums it up. "Many people are exhausted by it all," she says. "They'd rather risk getting sick than stay home or be careful. Others have simply stopped listening to health leaders and science."

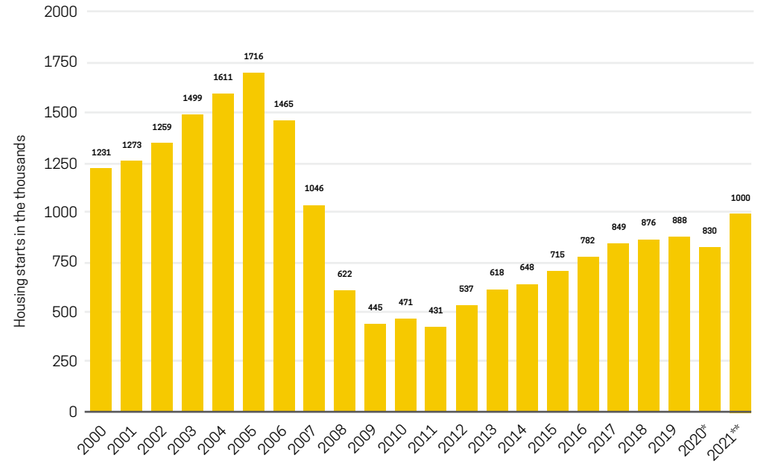
Here are ways that COVID-19 has impacted consumer behavior, as noted by COGNITION Smart Data:

Consumer confidence: Despite efforts to reopen the economy, net consumer optimism remains low. Most consumers expect that COVID-19 will impact the economy, their finances, and their lives for a long time to come.

Spending: As incomes have declined, unemployment persists, and uncertainty remains. Consumers have reduced discretionary spending, focusing on essentials only. Groceries, household supplies and home entertainment are among the necessities. Items such as restaurants, apparel, home furnishings, outside entertainment, personal care, travel and recreation; not so much.

Enhanced digitization: Whether feeling fatigued or frightened, many consumers are keeping an online presence. Those with the means are shopping online. When given the choice, people continue to work and school from home through videoconferencing, video chat, and remote learning. Consumers are also far more reliant on telemedicine, home healthcare and home fitness.

Housing Starts Climb Higher



* 2020: Total housing starts through September. ** 2021: Projected housing start total

On the rise. Housing starts—here showing only part of 2020—are on their way to the busiest year since 2006. There could be even more active times ahead for the construction industry in 2021.
CREDIT: STATISTA

shortest time frame since HUD began tracking the data in 1963.

The biggest driver for all of this good news has been record low interest rates, which hit 2.99 percent in June, and dropped to 2.86 percent in September, according to Freddie Mac's Economic & Housing Research Group (EHRG). That rate should remain intact though at least early 2021. "Given weakness in the broader economy, the Federal Reserve's signal that its policy rate will remain low until inflation picks up, and no signs of inflation, we forecast mortgage rates to remain flat over the next year," notes EHRG, in its market forecast for Q4 2020.

As a result, homeowners are more comfortable selling their homes now than at any other time since early 2018, according to Zillow economist Matthew Speakman. In Fannie Mae's Home Purchase Sentiment Index for October 2020, 59 percent of respondents said they believe now is a good time to sell a home—up from 29 percent in April. Consumer optimism increased for the fourth straight month and fifth time in the past six, according to Fannie Mae.

"Strong demand from home buyers is driving remarkable growth in home sales and prices, despite an ongoing and historic inventory shortage," Speakman notes. "Improved seller sentiment is an encouraging sign that more sellers may soon emerge to help relieve the inventory crunch."

Home sales are expected to hit 6.2 million units for 2020, up from 6 million in 2019. But then things will start to cool off, EHRG notes.

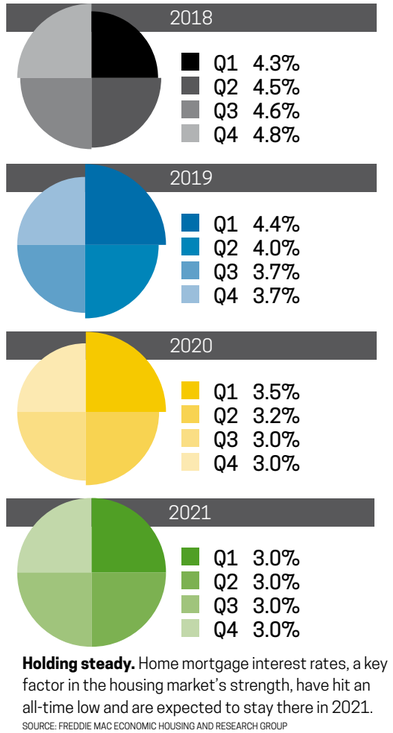
FORECLOSURE RELATED PROBLEMS ON THE HORIZON?

With the advent of COVID-19, many consumers lost jobs and, in many cases, only avoided losing their homes to foreclosure due to temporary forbearance programs. More than 6 million households fell behind in payments in September, according to the Mortgage Bankers Association's Research Institute for Housing America, and 1.2 percent of all loans were at least 150 days past due, according to Irvine, California-based marketing firm CoreLogic. Yet, overall foreclosures thus far are down 80 percent from 2019, Santarelli notes.

"At the moment, the moratoriums on foreclosure have kept lenders from being able to even start their processing of defaults," he says. "The major effect [on the market] will be seen in the summer of 2021 because foreclosure that starts today is probably not going to be processed until mid-2021."

All of those foreclosures will cause the housing supply to overwhelm demand by next summer. "The result," Santarelli predicts, "would be that prices are going to plummet again and the real estate sector will likely cool off." GB

Ultra-Low Mortgage Rates Fuel the Market



Holding steady. Home mortgage interest rates, a key factor in the housing market's strength, have hit an all-time low and are expected to stay there in 2021.
SOURCE: FREDDIE MAC ECONOMIC HOUSING AND RESEARCH GROUP

UPDATING THE HOME OFFICE

With more people than ever shifting to full-time, in-house work, many household designs need rethinking.

ONCE UPON A TIME — about 35 years ago — working from home was considered the way of the future. Telecommuting was where everyone was headed; labor marketing experts predicted that driving to work was going to be obsolete by the end of the century. And this was before a little thing called the internet came along.

It actually took a bit longer for technology to grow up, and for major companies to seriously consider allowing their employees to work from home even part time. But by the time President George W. Bush went into his second term, corporations such as IBM, Google, Bank of America and Best Buy were letting workers do their thing from inside their homes. Those same companies reversed direction within about 10 years because innovation and productivity suffered. So, almost everyone went back to work on site.

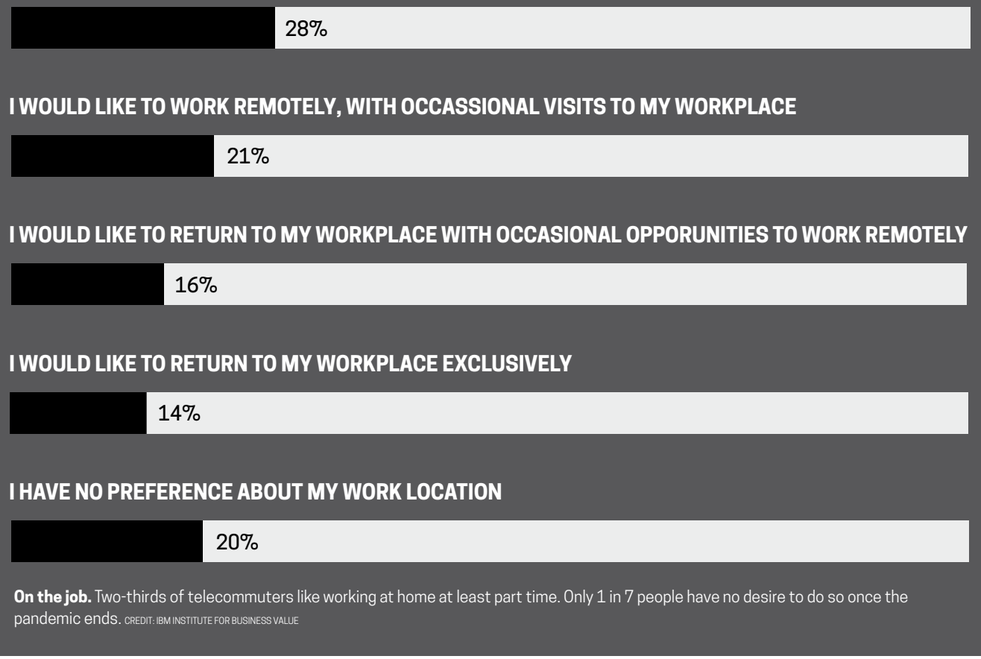
But with the arrival of COVID-19 and the lockdown that everyone has had to live with since last spring, being a stay-at-home employee is getting the thumbs-up again. The Brookings Institution estimates that up to 50 percent of workers now do so remotely, more than double the total who did in 2018. Twenty-five to 30 percent of those persons may keep that status once the pandemic is over, according to research-based consulting firm Global Workplace Analytics.

An Even Smarter Home

AS MORE PEOPLE WORK FROM HOME, numerous optional amenities have become must-haves. Here are 10 things that telecommuters expect in their current and/or next homes:

- Security cameras, locks, intruder alerts, and remote check-in/monitoring
- Smart thermostats that link to intelligent HVAC and mechanical systems
- An integrated indoor air quality (IAQ) system—monitors/sensors connected to vent fans, energy recovery ventilators (ERVs) and range hoods—to facilitate fresh air exchange
- Aging-in-place functionality for active adults: Non-intrusive cameras/monitors, fall detection devices and voice-controlled technologies
- Smart switches/plugs, appliances and irrigation systems
- Built-in data protection and privacy technologies/protocols
- Enhanced connectivity and bandwidth capabilities
- Water heating, monitoring, and leak detection
- Household audio speakers
- Capability to integrate home with a solar-power system

SOURCE: COGNITION SMART DATA



On the job. Two-thirds of telecommuters like working at home at least part time. Only 1 in 7 people have no desire to do so once the pandemic ends. CREDIT: IBM INSTITUTE FOR BUSINESS VALUE

Similarly, research by COGNITION Smart Data reveals that one-third of all American workers are able to work from home, and that 98 percent of these would like the option of continuing to telecommute for the rest of their career.

HOW WILL A YEAR AT HOME AFFECT WORK PRACTICES?

There are reasons for society's shift to a telecommuting mentality. The obvious one is the pandemic: For months, persons in "non-essential" jobs simply weren't allowed to go back to the workplace. Also, a faster, more-stable internet has made it the remote worker's premiere information and communication tool—for example, web services giant Comcast reports a 60 percent increase in internet usage and a 212 percent jump in video conferencing tools in use since March. Smart phones, the cloud, and communication aids such as *Zoom*, *Skype* and Microsoft *Teams* have made it easier to collaborate with coworkers. Schedules can be more flexible, with some employers taking a "just get it done on time" approach. And, there's the appreciated informality—formal office attire and being constantly clean shaven are out; working in a t-shirt and jeans, with three days' facial growth, is in.

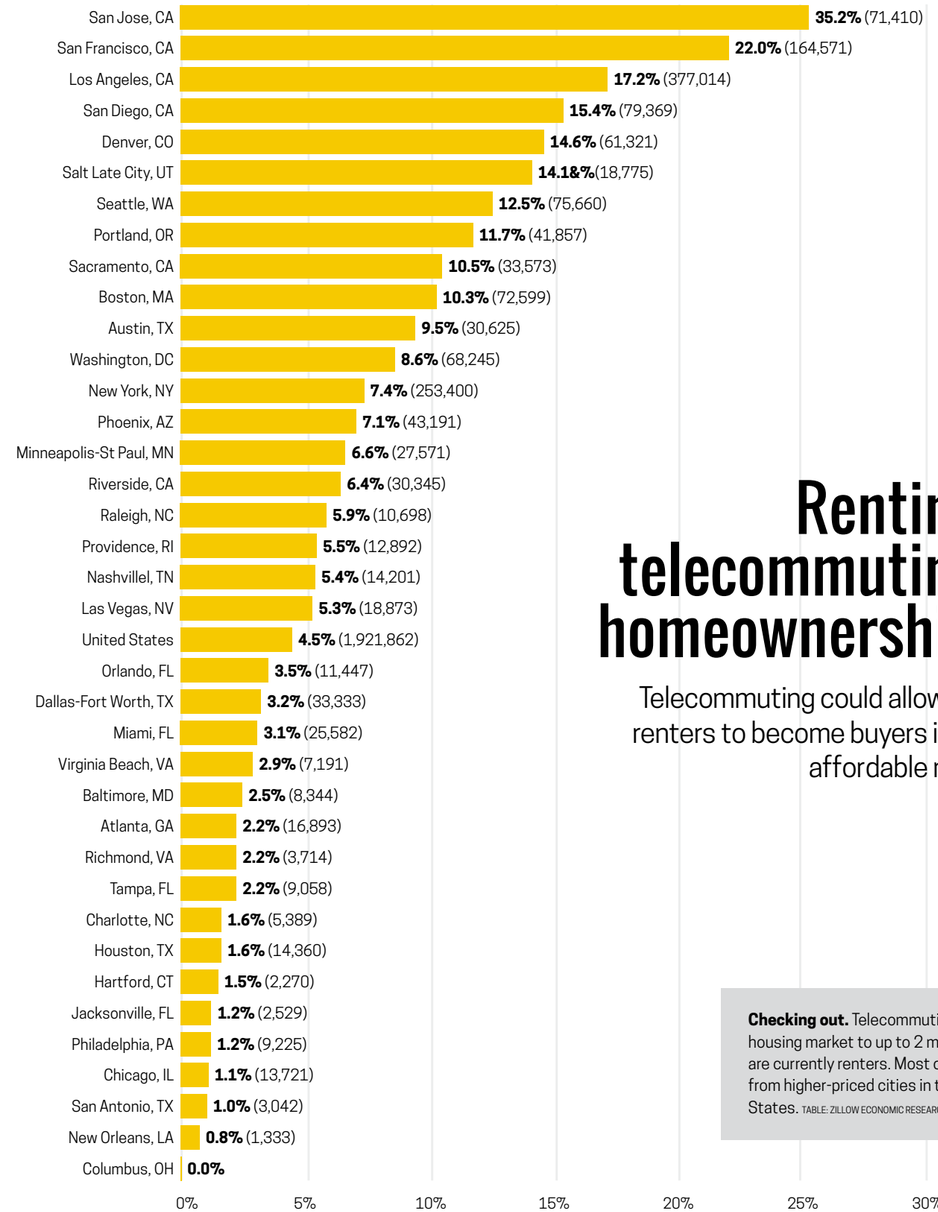
In an April 2020 Brookings Institution report on the pandemic's impact on telecommuting, coauthors Katherine Guyot and Isabel V. Sawhill note that employers are pushing telecommuting harder than they used to because it saves them money through lower operating costs. It keeps employees off the road (up to 164 billion miles annually, according to researchers at the University of Chicago) and out of traffic jams, which reduces stress. Driving cars less also cuts down on air pollution (by a mere 66 million metric tons of CO_2 emissions annually, according to UChicago), which helps the environment. And, in many cases, employees' productivity increases from working at home because they are happier, which leads to better worker retention.

There are secondary positives. Employees are healthier thanks to home gyms, lower-stress household environments, and better eating habits. There are few, if any, personality clashes with colleagues. They get to spend more time with family.

And, of course, working from home means increased protection from the coronavirus.

Also, remote work means some people can upgrade their lifestyles by moving from a cramped residence in a densely populated urban center to less-packed, and often less-expensive, outer suburbs and rural areas.

According to real estate marketplace



Renting + telecommuting = homeownership?

Telecommuting could allow some renters to become buyers in more affordable metros

Checking out. Telecommuting could open the housing market to up to 2 million people who are currently renters. Most of them will come from higher-priced cities in the western United States. TABLE: ZILLOW ECONOMIC RESEARCH

Comfort Zone

The most effective home offices are built around one thing: contentment.

STEINBERG HART ARCHITECT AND CEO DAVID HART remembers when a home office was merely an add-on to a floorplan, or an option for an existing room. But the stay-at-home status most people experienced during the early months of the pandemic has changed all of that.

"Pre-COVID, only about 10 percent to 15 percent of the apartments we built had some type of dedicated office space," Hart says in a report to Bloomberg CityLab. "Going forward, we expect that figure to be more like 75 percent."

Designers and contractors today have a lot to consider when meeting that demand. People who plan to work from home want more than just a kitchen table and chair to work from. They want a place where they can feel comfortable—because they're going to be spending a lot of time there.

Here are several design elements that architects, builders and customers should keep in mind whether crafting a home office for a client, or even for themselves.

Purpose, location and size. According to residential developer Harris Doyle Homes in Birmingham, Alabama, it's not enough for a customer to say, "I just want somewhere to work." What exactly will they be doing? If they will be taking client calls, hosting virtual meetings or require constant alone time to concentrate on their work, make sure the office is tucked away from the busy places in the home. Also, consider best access to the home's Wi-Fi network to avoid "dead zones."

Productivity. The office should accommodate workflow. Work with the client to think through which items are essential for productivity and how to create a home for each item. Clutter has been scientifically proven to limit productivity, so adequate storage is key. "Solutions are as simple as pencil cups or trays to keep all writing instruments in one place, plus memo and business card holders, wall shelves, chic storage cabinets," Harris Doyle notes. "Literally, there is a place for everything."

Adequate lighting. Many impromptu home offices end up being in a basement or attic, or in a small spare room. "A well-lit room is essential to feel awake and ready to conquer the day," Harris Doyle notes. "Lighting can make all the difference when it comes to boosting creativity, as a dark space can leave [the user] tired and feeling uninspired." When designing, make sure the office utilizes as much natural light as possible. Install overhead lights to use "cool" (white) bulbs. And, ensure there are adequate outlets throughout the room in case the customer needs to plug in lamps of their own.

Ventilation. A home office, when isolated, isn't of much use with stale air. Focus on natural airflow efforts first, through use of windows and cross ventilation. The other key provider, an air circulatory system or HVAC unit, will probably already be part of the home's master design.

Modern style. According to University of Virginia associate professor of urban and environmental planning Dr. Jessica Sewell, if someone is asked to describe a typical imaginary home office, it would probably include traditionally masculine features such as dark wood furniture, built-in bookshelves, and an oversized desk and chair. "That's coming straight out of Victorian ideas of the masculine space," she says in Bloomberg CityLab. "[Those] masculine offices are very much the kind of style that then comes into the home office or the study."

Color scheme. Encourage color that the customer will feel good about and pair it with accent colors that balance the room, but aren't too distracting, Harris Doyle notes. Scientifically speaking, a strong blue promotes clear thought while softer blues calm the mind and aid concentration. Brighter colors such yellow and orange help spark creativity and energy, but they can also foster nervousness. Green can reduce anxiety, reduce stress on eyes, and give the office an outdoor-like feel for those into nature. And good old-fashioned white or off-white can make a room feel more spacious, even if it can instill a fear of dirt.

Wide open spaces. When it comes to comfort, a home office should feel like living quarters and a workplace because of its modern, mind-pleasing design.
CREDIT: DIT26978/ISTOCK

Nice or nightmare? While some people would like to spend the rest of their careers as remote workers, others become stressed out after a few months. CREDIT: KRAPHIX/ISTOCK

operator The Zillow Group, many of the suburban transplants will be renters who have a chance to finally buy a home. Zillow economist Jeff Tucker says that could mean a housing market that includes almost 2 million new homeowners within a few years. "It's going to be huge," he says. "If remote work becomes a bona fide long-term option, especially with the pandemic, that could reshape the U.S. housing market."

NOT-SO-BRIGHT TELECOMMUTING MOMENTS

But remote working is not without its drawbacks. Telecommuters report feelings of loneliness and being "disconnected" from their coworkers. They often end up working longer hours than they might if they were still in the office. There's a lack of privacy, as many employees' homes weren't designed for on-demand videoconferencing and all-day laptop use. There are even career concerns, as being off site means not being seen by the boss when doing something exceptional—which could mean missed promotions, or possible job elimination.

"We traditionally tend to think of working from home as a perk," notes work advice writer Allison Green in Slate. "You can do your laundry while you work. You can stay in pajamas and control your own thermostat. You can take the dog for a walk. But after being abruptly forced to work from home full time this year, a lot of people have discovered they don't like it nearly as much as they thought they would."

An ongoing study by the IBM Institute for Business Value indicates the arrival of "work from home fatigue." In July, the percentage of Americans who indicated that they would like to continue remotely even part time sat at 80 percent. By September, that optimism had dropped to 67 percent. In addition, only 50 percent reported they wanted to primarily work remotely, down from 65 percent two months earlier, according to the study.

The bottom line is that telecommuting, and its pros and cons, are here to stay. "COVID-19 may permanently change the way many of us work," Brookings coauthors Guyot and Sawhill note. "At present, shifting as many people as possible to home-based telework is a necessary response to a terrible crisis. In the post-pandemic world, it may stay with us as a popular practice."

Architect David Hart, CEO of Steinberg Hart in San Francisco, agrees. "The renewed emphasis on dedicated home offices will persist even as the pandemic passes," he predicted in Bloomberg CityLab. "Now that millions have gotten a tantalizing taste of life without daily commuting, we'll insist on keeping one foot of our laboring lives in our homes." **GB**

CREDIT: TRAPEZNIKOV/ISTOCK

QUANTUM SHIFT

The coronavirus has increased buying interest from millennials, and altered size and design priorities.

THERE WERE A LOT OF FIRSTS in 1984. Apple's Macintosh computer crashed its way into the world during the Super Bowl. The Soviet Union boycotted the U.S.-hosted Summer Olympic Games for the first time in its history. A deadly virus known as HIV struck humanity. Tetris arrived to test people's minds and fingers. A new guy named Alex Trebek helped relaunch a game show called "Jeopardy."

And, a new generation of children arrived: The millennials.

Fast-forward to 2020. Those same generational forerunners are turning 36, and they and the rest of their millennial colleagues — anyone born from 1984 to 2002 — are ready for prime time, as the nation's key marketing targets.

Housing industry, this is your cue.

According to a study by Realtor.com, this group of 72 million (more than the baby boomer and Generation X groups combined) has gone from young, self-centered and generally pessimistic, to mature and family minded. "It's an age at which they are on their first or second jobs," notes Realtor.com senior economist George Ratiu during an interview with CNBC. "Many of them are having kids, and with that their preferences have shifted. We're seeing that they obviously are very much interested in buying homes."

Ready, Willing, Waiting

Millennials want to buy homes, baby boomers want to downsize, and Gen Xers just want a second chance.

WITH THE CORONAVIRUS increasing the number of people wanting to change their living situation by 2.1 million households, the three principal generations—baby boomers, Generation Xers and millennials—are out shopping for homes (or at least they hope to). According to COGNITION Smart Data research, each group has its own preferences for its new residences.

Millennials: In full force. Millennials, who have been renting and want to own a home, are the most motivated homebuyers. These individuals are looking for spaces to work from home, advanced connected living and communication technology, home gyms, and for young families, larger yards.

Boomer: Going small. Boomers who want to downsize are the second-most motivated buyers. They are looking for germ-resistant finishes, touch-free fixtures, air and water filtration systems, energy efficiency, and assisted living technologies. They're more interested in private outdoor decks and patios than large yards that will require maintenance.

Generation X: On the sideline. Gen Xers are least likely to buy again in today's market. They are still feeling hangovers from the "just charge it!" Reaganomics years that led to poor spending habits, followed by system shock from economic downturns in the 1990s, and early and late-2000s. As a result, now-skeptical Gen Xers are delaying further home purchases and improvements. This is critical for building professionals given that, in 2019, Gen Xers made up 30 percent of the home improvement market, spending an average of $12,000 per household on remodeling projects and hiring professionals 85 percent of the time.

Holding Pattern

Millennials may want to buy homes, but not everyone's ready — or able — to move.

THANKS TO MILLENNIALS' emergence as a real estate buying power, there's a lot of construction work ahead for new homebuilders. Realtor.com senior economist George Ratiu notes that the housing market is underbuilt by about 4 million homes, based on current inventory.

But although the thirty-something crowd may want to contribute to that supply shortage, some of them aren't ready yet. The financial website Investopedia offers five reasons why millennials can't yet ask for keys to their new home.

AFFORDABILITY. How much home a person can buy is generally limited to 25 percent of their monthly gross income. The nationwide median new home purchase price was $327,000 as of September, according to U.S. Census Bureau Housing and Urban Development (HUD) — about double that amount if trying to buy in a pricey market like California. Meanwhile, a millennial's annual salary averaged $47,000, HUD reports. Pencil out all the figures and a single-person or even a two-person household usually can't meet the payment threshold.

There are lower-priced areas of the U.S. where a millennial household could make such an income work. "The question is whether millennials are willing to relocate and leave jobs, friends, and family in order to buy a home," foreign exchange trader Aaron Hankin says.

LATER MARRIAGES. In 1960, 80 percent of people aged 25 to 34 lived with a spouse or partner. By 2019, that number had dropped to 60 percent, according to the Census Bureau. People are also waiting longer to get married—approximately age 21 in 1960 vs. age 29 as of last year. And, they're starting families later: the Department of Health and Human Services Center for Disease Control reports that the first-time mom's average age has increased from 21 years in 1970 to 26 years in 2020. Delays in those life events lead to less of an urgency to buy a home, Hankin notes.

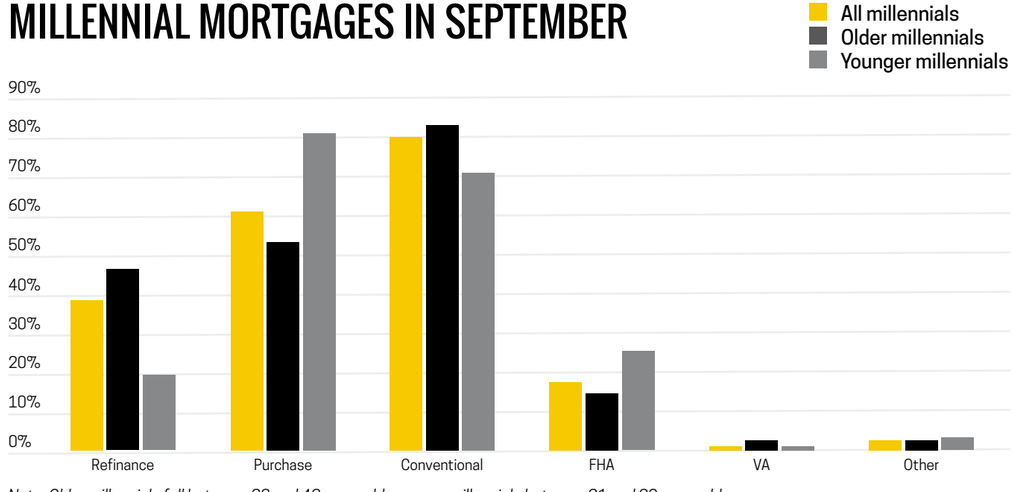
STUDENT DEBT. Student loans topped $1.6 trillion at the start of 2020, according to the U.S. Department of Education. Most millennials coping with this type of post-college expense aren't thinking about buying homes—according to a NAR survey, 50 percent of homeowners age 35 or younger said they waited at least a few years before taking the plunge.

Debt or no, it now takes a long time for millennials to come up with the typical 20 percent down payment needed for purchase: almost 12 years for anyone with student debt versus eight years for those without.

TIGHTER LENDING STANDARDS. Banks have toughened up credit underwriting rules to reduce risk, including not bending on the 20 percent down payment rule. Not surprisingly, it is taking millennials longer to accumulate enough cash.

BIG CITY LIGHTS. According to Pew Research, as of 2018, 88 percent of millennials now live in metropolitan areas. Many live in regions with a larger proportion of renters to homeowners, pushing up rental prices. In addition, millennials seem unwilling to commute or even own a backyard. Home sales within five miles of the center of any of the 10 most-dense cities are above levels from 2000. But sales drop to 50 percent below 2000 if they're for homes more than 10 miles outside a city.

MILLENNIAL MORTGAGES IN SEPTEMBER



Note: Older millennials fall between 30 and 40 years old, younger millennials between 21 and 29 years old

Buying time. The number of millennials who are taking on a new or refinanced home loan, and the type of loans they're going for (conventional, FHA, VA or other) has held steady for several months and is expected to remain there through at least next spring. SOURCE: ELLIE MAE

All in the family. Technology has been a lifelong thing for millennials, so using items like a tablet to search for a new home is second nature. CREDIT: SPIDERPLAY/ISTOCK

MATURING MILLENNIALS

Ratiu notes that millennials' interests in "family friendly lifestyles and affordable housing" will replace prior affinities for bustling downtown shops and cafés. As a result, millennials are considering new options in housing, such as trading in convenient urban condos for modest, mid-size city apartments and suburban homes, he says.

According to COGNITION Smart Data research, the most active homebuyers in this audience are dual-income, college-educated couples that are living in dense apartment buildings and "want more space, have a strong ethic of sustainability, are totally at home in the digital world, and are at their peak homebuying potential."

They tend to think small. Millennials are looking for compact floor plans, low monthly payments, and smart homes that are sustainable, efficient, and healthy. This audience segment is also intrigued by small footprint living. While they are looking to upsize, it's from a modest 800 to 1,000 square feet to a slightly more indulgent 1,200 to 1,500 square feet.

Having grown up with technology, and in an age where "green" was more than just a color, millennials also want homes with the latest and greatest—and most environmentally compatible—technology.

Millennials have a high level of purchase interest in solar technologies (including photovoltaics, storage solutions, and power management systems) to reduce carbon footprint, decrease energy bills, and increase self-sufficiency. They also consider the ability to net meter, or feed energy back to the grid, a badge of honor.

They want to integrate smart home technologies with solar energy systems, as well as streamlining connectivity and redundant technology to keep hubs, routers, servers, security systems and backup power supplies functioning.

Furthermore, many of these homebuyers believe that connected living technologies such as smart thermostats, security, lighting, indoor air quality (IAQ) sensors, and leak detection, should be included as a standard offering in a home purchase, not as an upgrade.

They can be easier to sell to than their older counterparts. This group, totally comfortable making large purchases online, is already driving the digitization of the housing market, as indicated by a massive uptick in 3D home tours.

STAYING AT HOME—SO WHAT?

Millennials (and their colleagues, the youngest Generation Xers) are comfortable working remotely and are looking to establish a work-life balance that incorporates home fitness, wellness, and healthcare. "Their home buying decisions will be based on different factors than previous generations," COGNITION notes. "No location, location, location here—rather, [millennials are] focused on community amenities, access to trails and recreation, and healthy homes."

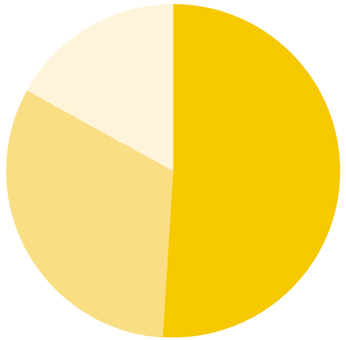
This makes millennials a prime group to target as homebuyers, given the current pandemic, according to Jeff Tucker, an economist with real estate marketplace operator Zillow Group. Millennials, he notes, have the greatest chance to become a homeowner because of their ability to "work from anywhere and live anywhere."

Be patient, though. According to a report by Irvine, California-based marketing firm CoreLogic, millennials can take more than a year to find the right home. That shouldn't surprise anyone, though. "Some of them have lived with their parents for a decade or more while they saved up their down payment," notes Saumi Shokraee, CoreLogic's Professional, Research & Content Strategist. "With a desire for modern home technology and a location that fits their lifestyle, they are quite particular about their investments."

That investment is likely to be a new home, according to a survey from the National Association of Home Builders (NAHB). Millennial home buyers who prefer a brand-new home jumped from 28 percent in 2007 to 41 percent in 2018 and are expected to top 50 percent this year. "Millennials do not have the appetite to buy a home and deal with remodeling it to fit their desires," Shokraee notes. **GB**

'Y' ask? Millennial men may have more money to spend on a new home, but it's women who choose what home to buy and where. CREDIT: SDI PRODUCTIONS/ISTOCK

Who's Buying?



Homebuying? Women Make the Call

MILLENNIALS ARE THE BIGGEST influencers in the home buying market. Most of this marketing segment consists of two-income couples, but women are driving the bus when it comes to decision making.

Approximately 73 percent of these buyers are dual-income, college-educated couples. But female millennials express four times more home buying purchase intent in online conversations than millennial men.

Single female millennials account for 19 percent of home purchases, while single millennial men only represent 8 percent.

Unmarried millennial women have a higher homeownership rate than single male millennials, and purchase more-expensive homes. Their housing choices have a median price of $200,450, compared to $189,920 for men.

Single female millennial homebuyers tend to purchase apartments and condos in urban areas, a trend that hasn't changed even with COVID-19. Single millennial men are more likely to buy homes in rural areas, and millennial couples purchase homes most often in suburbs.

Millennial women make $0.22 per dollar less than millennial males, but their lower annual income doesn't impact their interest in making long-term investments, including home purchases.

SOURCE: COGNITION SMART DATA

COGNITION Smart Data

Are you ready to tap into the power of Artificial Intelligence to help your company drive sales and enhance your bottom line?

Green Builder Media has the answer for you!

THE POWER OF DATA. THE INTELLIGENCE OF CONTEXT.

COGNITION Smart Data,

Green Builder Media's pioneering suite of market intelligence and data services, uses **cognitive learning technology** to track web and social media content based on geolocation, sentiment, emotion, tense, user groups, and source feeds to reveal **customer behavior, engagement, purchase drivers, and buying trends**.

This exclusive market trend data is merged with a robust database of **user-specific information**, which Green Builder Media has amassed over the past decades working with **progressive building professionals and homeowners**.

Get your customized COGNITION Executive Dashboard for easy access to market intelligence that will help you make better business decisions, including:

- **Brand Analysis.** View how your brand compares to your competitors.
- **Purchase Drivers and Customer Segmentation Analysis.** Track the activity of audience groups relative to purchase drivers, conversion trends, engagement patterns, and preferences.
- **Personas, Surveys, and Individualized Data.** Engage one-on-one with target customers to access survey responses and personalized information that is specific to your company.

Through COGNITION Smart Data, market information is transformed into actionable business intelligence to help you:

- Develop products or services that exactly match customer needs;
- Create effective, targeted marketing and outreach efforts;
- Enhance your overall business performance, and
- Drive Sales!

For more information and to request a demo, contact Sara Gutterman at sara.gutterman@greenbuildermedia.com

INVEST IN KNOWLEDGE!

GREEN BUILDER® MEDIA
Building a Better World

The world is changing. It's a perfect time to invest in data and insights that will help you optimize your company's positioning in light of the new demands that shifting consumer expectations will place on the building industry.

Cognition Smart Data Subscription Options	JUST THE BASICS	COUNT ME IN	MAKE ME THE BOSS!
INSIGHTS INTO NATIONAL TRENDS			
Weekly Hot Take Email ▪ Don't miss a beat with these quick tips about market trends	✓	✓	✓
Monthly Snapshot Email ▪ Educate yourself about key topic areas like IAQ, connected living, and net zero with these deeper insight reports ▪ Includes national data about housing starts, permits, growth rates, and innovations driving market transformation	✓	✓	✓
Quarterly Market Report ▪ Inform your business decisions with actionable ideas and recommendations packed into these comprehensive reports	✓	✓	✓
COGNITION DASHBOARD			
National Homebuying Market Trends Dashboard ▪ Access to information about today's most important topics, like Energy, Water, Health & Wellness, Connected Living, and Solar ▪ Access to data about national housing starts, permits, growth trends, and innovations driving market transformation		✓	✓
Local Homebuying Market Trends ▪ Access to data about housing starts, permits, growth trends, and innovations driving market transformation in your local market		✓	✓
Dashboard Your Way ▪ Customized Dashboard to meet your data needs, with information that is optimized for your business			✓
MONTHLY COST	$50 per month	$250 per month	$500 per month
ANNUAL COST (1-time payment, 10% discount)	$550	$2700	$5400

SUBSCRIBE TO COGNITION TODAY at www.greenbuildermedia.com/cognition

HEALTH MATTERS

As people spend more time in their homes, thoughts turn to indoor air and water quality.

WITH COVID-19 being the thing you just can't hear enough of from the daily news—and with the No. 1 edict being, "stay indoors until this finally goes away,"—people are retreating inside their homes and staying there for longer times than any other moment in recent history.

Which begs the question: How safe is this house, and how can it be made safer?

According to Sam Rashkin, chief architect at the U.S. Department of Energy's Building Technologies Office, now more than ever, homeowners are searching for successful strategies to improve the health of their homes in an effort to protect their families.

"It's shocking how palpable the benefits of healthy homes are," insists Rashkin. "We spend $40 billion a year on organic food and $20 billion year on bottled water to stay healthy, and the promise of those things are so much less tangible than maintaining a healthy home—primarily because we ingest seven times more air than food and water each day."

Rashkin believes that the most effective way to communicate about the benefits of a healthy home is to keep the message simple. "We make selling homes very complicated," he says. "But interest in healthy

"Interest in healthy homes is not only easy to communicate, it's incredibly bankable for building professionals."

Improvised spa? The pandemic has brought exercise and indoor air quality into the foreground. Homeowners want spaces and systems that help them stay in shape and avoid illness.

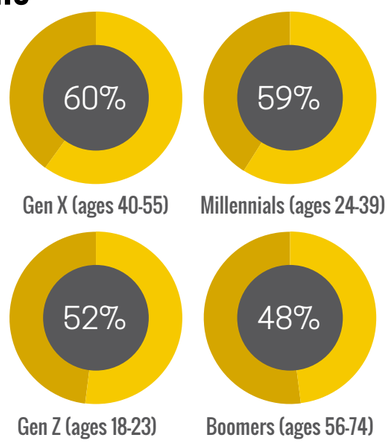
Survey reveals increased concern for healthy homes amid pandemic

Levels of concern vary among generations, with Gen X and Millennials more likely than Boomers to express concern

54%

of survey participants

are more concerned about having a healthy home with good indoor air quality and fire protection since the start of the COVID-19 pandemic



SOURCE: CARRIER/THE HARRIS POLL

Work to do. Builders and designers can clarify IAQ priorities for clients.
CREDIT: JUAN MONINO/ISTOCK

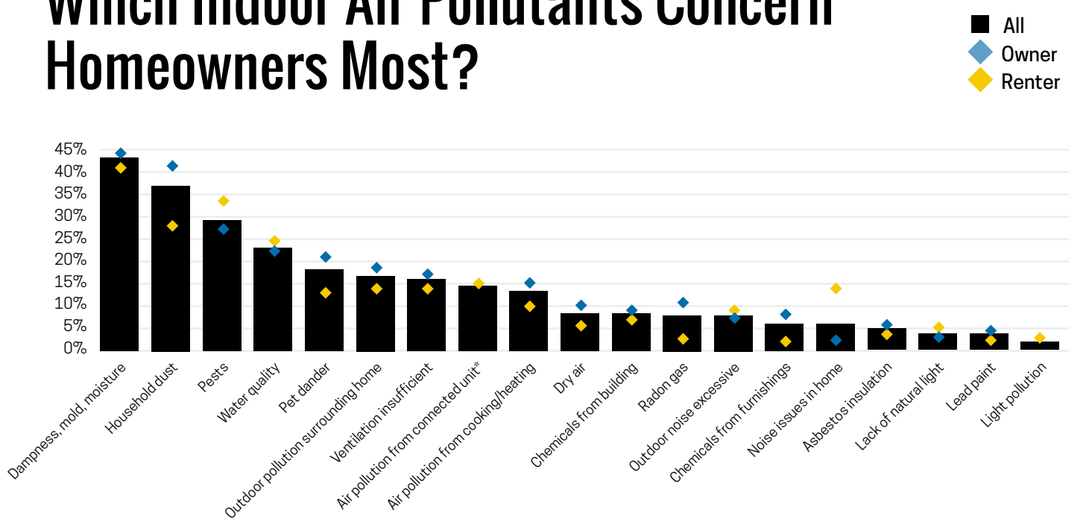
Introducing IAQ to Homebuyers

CONSUMERS' INTEREST IN HEALTHY HOMES offers a tremendous opportunity for building professionals and manufacturers to help homeowners truly understand the nature of IAQ. As a result, builders are changing their approach to promoting healthy homes:

- Generate "situational awareness." Builders work with homeowners to conduct an IAQ assessment. Through this, the homeowner gains an understanding of the health risks within homes, and the builder can address each family's unique situation given physical ailments and concerns.
- Teach homeowners to mitigate IAQ risk. For example, builders are specifying healthy, low- or no-volatile organic compound (VOC) paints, materials, finishes, furniture and cleaners. Lessons are given on how to help purify indoor air through proper ventilation, clean filters and fresh air exchange; keep surfaces clean to prevent infectious particles from becoming airborne; reduce risk of mold and water damage; maintain pest-proof homes by filling cracks on the building envelope and properly storing food.
- Engage at-home monitoring. Homeowners are advised to deploy ongoing monitoring and management by identifying healthy thresholds based on families' specific needs. They can then create IAQ strategies accordingly, such as installing demand-controlled, integrated systems that keep IAQ at healthy levels without human engagement.

SOURCE: COGNITION SMART DATA

Which Indoor Air Pollutants Concern Homeowners Most?



Skewed concerns. Note that respondent fears are not always rational. For example, they underestimate the risk from the most dangerous toxins, such as lead and asbestos. SOURCE: COGNITION SMART DATA

homes, which was surging before pandemic and exploding now, is not only easy to communicate, it's incredibly bankable for building professionals."

IN WITH THE GOOD, OUT WITH THE BAD

When it comes to designing, building, and remodeling healthy homes, Rashkin emphasizes:

- Source control: Making sure that all products, materials, surfaces, furniture and cleaning products brought into a home are non-toxic and will not continue to leech chemicals into the air for years (also known as "off-gassing").
- Containment of containment: Cleaning surfaces regularly and making sure a home has proper filtration systems, ventilation and fresh air exchange.

Rashkin believes that proactive indoor air quality (IAQ) systems—ones with sensors in front to monitor toxins, dust, temperature, humidity, CO_2, and volatile organic compounds (VOCs)—and proactively turn on ventilation fans, range hoods and Energy Recovery Ventilators (ERVs) when those elements are sensed, are the future of IAQ.

That view is shared by Rashkin's colleague, Aaron Johnson, environmental protection specialist at the U.S. Environmental Protection Agency (EPA). "IAQ is eclipsing energy efficiency in terms of the top area of consumer interest," Johnson notes.

He asserts that IAQ improvements can be made virtually anywhere in the home during any new construction or retrofit project. "There is a whole frontier waiting to be explored by builders and contractors who want to integrate products that meet IAQ requirements," Johnson says.

But when it comes to having the air quality improvements made, Rashkin and Johnson warn buyers to beware. "It's kind of like the Wild West in terms of IAQ products right now because there is no certification or labeling," Rashkin asserts. "Consumers who are interested in products that effectively improve and address IAQ need to make sure that a product's claims are legitimate."

Clean air-minded. Nearly 7 of 8 prospective homeowners will pay more for a residence that can better protect against viruses, germs and other toxins, according to COGNITION Smart Data. CREDIT: KRIZZDAPAUL/ISTOCK

Pandemic-Proofed Home

New design approaches and product specification decisions are emerging to virus-proof homes, including:

- Minimalist designs with light, openness and ventilation strategies for fresh air exchange and filtered air
- Minimal decoration and clutter to fight against dust and grime
- Terraces, balconies, rooftop gardens and windows to enhance connection with nature
- Broad integration of touchless technologies like voice-activated doors and elevators, hands-free light switches and cellphone room entry
- Increased specification of bidets, sensor faucets, anti-microbial surfaces, fabrics, paint, and materials
- Onsite food production, greenhouses, and hydroponic growing appliances to ensure food security
- Flex spaces that allow for working and schooling from home

SOURCE: COGNITION SMART DATA

THE VALUE OF CLEAN AIR

There are no disagreements on that statement from consumers. According to a recent COGNITION Smart Data survey, consumers are connecting to health more now than they did before the pandemic. Owners of green homes, however, were much more confident in the quality of their indoor air and less concerned about IAQ problems in their homes than owners of non-green homes. And, among homeowners, 85 percent of survey respondents said they would pay more for healthy home.

The survey also notes that consumer

interest in IAQ has hit a new high, with nearly 92 percent of respondents considering the topic "important" or "very important."

"COVID has captured homeowners' imagination of what is transferrable in air," confirms C.R. Herro, vice president of innovation at Meritage Homes in Phoenix. "Consumers are now aware that viruses and other harmful toxins can be airborne, so investing in products and technologies that reduce pathogens on surfaces and in airways has become a top priority."

A major reason, Herro notes, is that people want to feel secure. "People are moving from places where they didn't feel safe into newer construction and single-family homes," Herro says. "It's simple psychology as identified by Abraham Maslow—one of our most basic needs is the desire to feel safe."

IAQ: FROM OPTION TO MUST-HAVE

Even before the pandemic, IAQ was quickly shifting from a "nice to have" to a necessity. It is now seen by early adopter and first mover consumers as a fundamental homeowner right and as important as location to some homebuyers.

According to COGNITION, few topics "exhibit as much passion intensity as IAQ." Discussion is influenced by strong language and high positive and negative emotions. "People care deeply about healthy homes and get very angry when their homes create health issues."

They also want to learn more. Throughout 2020, there has been an upsurge in online searches for terms such as "fresh air," "contaminate free spaces," "volatile organic compounds," "carbon monoxide," and "duct cleaning." Consumers are also seeking information on products such as demand-controlled ventilation systems to regulate fresh air exchange, indoor air quality sensors, and high performance air filters.

Overall, that is a great sign for the housing construction industry, Herro notes. Meritage Homes has upheld for more than a decade that delivering healthy homes with good IAQ is essential. "At first, we believed it was our responsibility, but now we see it as an opportunity," he says. "As homebuyers lean into the concept of healthy homes, we get the opportunity to evolve our platform." **GB**

Exterior options

Although ventilating and cleaning indoor air is top of mind for many homeowners, outdoor living space has also become a must-have feature. During the pandemic, outdoor gatherings have become an essential lifestyle amenity.

Like the real thing. People spending a lot of time at home who decide to go into the yard for down time should try TimberTech decking. The product looks more like real wood than any other composite (the company's *AZEK Vintage Collection* is pictured), resists scratches and stains, and is easy to maintain. It also saves a few trees, which helps keep Earth green.
CREDIT: TIMBERTECH

Breathe easy. Keeping indoor air clean and ultra-safe against viruses is easy with a product such as Carrier's *Infinity Air Purifier*. With every cycle of air that passes through the system, pollen, animal dander, bacteria and other pollutants are trapped and held tightly to the filter. An electrical charge then bursts the cell walls of pathogens it comes in contact with.
CREDIT: CARRIER

GREEN BUILDER
Green Home of the Year
PREVIEW

Classic Efforts

These projects from last year's "runner up" category demonstrate the high level of building science and design typical of our annual Green Home of the Year Awards.

BY GREEN BUILDER STAFF

It's almost that time again, when we get to see the best that green building has to offer. Next issue is our annual Green Home of the Year Awards edition, featuring eye-popping and forward-thinking structures that set a sustainability standard in single-family, multi-family, contemporary and alternative living. For an example of what lies ahead, check out these four examples of top-notch indoor air quality, energy efficiency, green remodeling, and landscape design. Here's what made these semi-finalists so special.

Compound plan. Designers took a multi-faceted approach to improving the green efficiency of a clustered residential dwelling consisting of a new home, existing cottage and carport. CREDIT: TIM RIDLEY

Historic District Infill Home

For this multi-part project, going green became a real group effort.

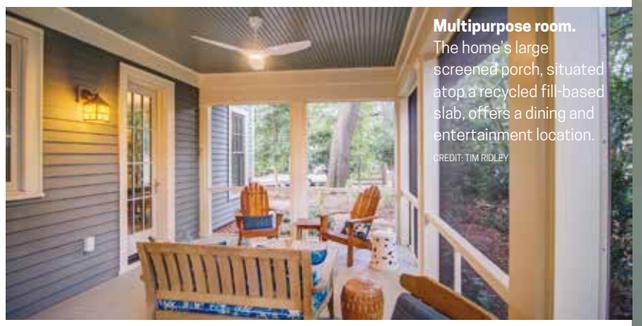
THE GOAL OF THIS PROJECT in Decatur, Georgia, was to construct a new, high-performance main house and parking structure to complement an existing historic cottage set at the rear of the property. The result is a compound of buildings that includes the new home, and carport and an existing cottage, which serves as rental property.

A prominent feature is the large screened porch for dining and entertaining. The drive and carport also serve as an outdoor entertainment area. The home's foundation is a slab installed on recycled fill inside concrete stem walls, faced with thin brick to recreate the look of a historic crawlspace. The slab is insulated at its edge and underneath, 24 inches inside the perimeter.

Framing combined open corners, *T-WALLs*, right-sized headers, 24-inch on center (OC) studs, and *ZIP System* R-sheathing. ZIP sheathing was installed on top of the second floor ceiling framing and taped to wall sheathing, creating an air-tight building envelope. At completion, the house tested at 0.88 air change rate (ACH) and received a Home Energy Rating System (HERS) rating of 41. Due to the number of mature trees surrounding the house, there was no opportunity to employ any solar power.

The environmentally friendly elements continue to stack up: The wall and ceiling insulation is blown fiberglass. Siding is installed over a vented rainscreen for durability and moisture management. Pest control includes

Go with the (air) flow. As part of its space conditioning features, ductless mini-splits and a transfer fan bring conditioned air into the home's bedrooms and bath. CREDIT: TIM RIDLEY



Multipurpose room. The home's large screened porch, situated atop a recycled fill-based slab, offers a dining and entertainment location. CREDIT: TIM RIDLEY

a top-of-slab vapor/termite barrier and borate treatment of all wood three feet above the slab.

Ductless mini-splits provide all space conditioning—one on the first floor, one in the owner's suite, and one in the second floor hallway. A transfer fan operates with the hallway mini-split to bring conditioned air into front bedrooms and bath.

A centrally located water heater and half-inch insulated cross-linked polyethylene (PEX) piping supply hot water to WaterSense fixtures within 20 seconds. Landscaping is all native, drought tolerant, and no turf. Paints are zero volatile organic compounds (VOC) and floor finishes are low VOC. Energy recovery ventilation (ERV) provides outside air. ENERGY STAR exhaust fans were installed with short runs of rigid duct to meet designed flow rates.

The driveway is pervious concrete and pavers, installed over a 9-inch bed of gravel on top of geotextile fabric. This eliminates all runoff from these surfaces. Downspouts from the carport and rear of the house are piped to underground flow-wells to minimize site runoff.

The result is a house that fits seamlessly into this historic neighborhood that meets the highest level of green building criteria, having been certified National Green Building Standard (NGBS) Emerald, LEED V4 Platinum, EarthCraft Platinum, and Department of Energy (DOE) Zero Energy Ready Home (ZERH).

Something old, something new. The Megumi House equally blends new materials, such as Structural Insulated Panels (SIPs), with recycling efforts such as reusing the existing basement foundation. CREDIT: ROSA VISTA/ROMA VISTA PHOTOGRAPHY

Lighten up. Megumi's open-flow space and an abundance of natural light creates spaciousness within a modest footprint. CREDIT: ROSA VISTA/ROMA VISTA PHOTOGRAPHY

Forward thinking. The top level of the home includes a green roof deck and a solar panel-ready design. CREDIT: ROSA VISTA/ROMA VISTA PHOTOGRAPHY

Megumi House

This Cape Code-style home is bigger than its predecessor, but the electric bill sure isn't.

COMPLETED IN SEPTEMBER 2017, the Megumi House was built upon the foundation of a modest 1930s Cape Cod in Arlington, Va. At 2,800 square feet (4 bedrooms, 2.5 baths), the three-story home with a full basement and rooftop deck has more than double the square footage of the original house, but is designed to use only a fraction of the energy.

Sustainable features of Megumi House—designed by John Linam, Jr., and built by award-winning Galaxy Homes—include the structurally insulated panel (SIP) shell (R-23.3 walls, R-45.4 roof) and efficient Marvin *Integrity* windows. Megumi's construction also includes a high-efficiency ENERGY STAR heat pump HVAC, south-facing exterior window awning, a Rinnai tankless water heater, green roof deck, sustainable COREtec flooring, LED lighting, Energy Star appliances, and an energy recovery ventilator (ERV) air purification system and humidity control. It is also solar panel conduit-ready.

Designed with high (9-16 foot) ceilings and expansive glazing, Megumi boasts open-flow space and an abundance of natural light to create spaciousness within the modest footprint.

In addition to Megumi's green design and materials, Galaxy Homes also integrated sustainability principles in the building process. Any salvageable materials of the original home were donated to Second Chance charity in Arlington for reuse, and construction debris was taken off site to a recycling facility. In addition, staying within the footprint of the existing structure minimized land disturbance and maximized the green space of the lot.

Additional sustainable processes included reusing the existing basement foundation, application of a structural bond beam to increase ceiling height of basement, and off-site manufacturing of the SIP shell.

Galaxy Homes was also successful in reducing the cost of green, as the Megumi House was built for a cost similar to traditional stick construction custom homes in the area, the company notes.

All the green efforts worked. Megumi has since achieved a Home Energy Rating System (HERS) score of 54 and Platinum level certification by the Arlington Green Home Choice program.

"We love the house and how beautiful it is, and how green it is, but I am blown away by the secondary effects of the design," homeowner Jim Dooley says. "The house is filled with daylight. The temperature across aII 3.5 floors is always constant and even—that never would have happened in our old house."

Dooley adds that he is "crazy in love" with how quiet the house is. "So, in addition to the environmental benefits, I think folks should understand these everyday comfort issues when considering building a green house," he notes.

De-aging gracefully. It took five years, but the Garner Street residence went from sieve-like to almost airtight, thanks to numerous cosmetic and design upgrades.
CREDIT: MAUREEN M. MAHLE

Restoration on Garner Street

This 'fiscal cliff' became a mountain of energy efficiency.

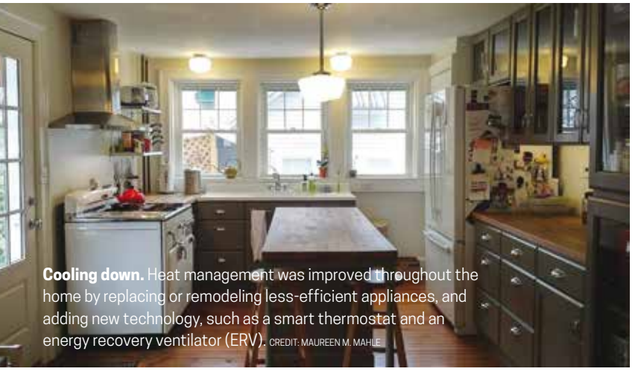
AS MANAGING DIRECTOR of Sustainable Housing Services at Steven Winter Associates, Inc. in Norwalk, Connecticut, Maureen Mahle has certified thousands of Leadership in Energy and Environmental Design (LEED) homes. So, renovating and certifying her own home should be easy, right?

Almost. During the five-year-long occupied gut-rehab of their 1915 home, Maureen, and her husband and coworker Steve, lovingly completed a high-performing restoration in a dynamic and diverse neighborhood that is within a 10-minute walk of work and the commuter rail to New York City.

Affectionately called "the fiscal cliff" during renovations, the home's location on a steeply pitched lot provided challenges and opportunities. Rain barrels—210 gallons worth—capture roof run-off used to water drought-tolerant plants and food gardens. Conventional turf was replaced with "*No Mow*" grass, which gets cut back just twice a year with a trimmer.

Adding new retaining walls, an entry roof over the back door, drainage swales, and redesigned sidewalks all drastically improved the on-site stormwater runoff that previously damaged the foundation.

The home had "good bones" but no insulation and inefficient windows. Original flooring, trim, and plaster walls were all worth saving, so the renovation was completed from the outside by removing the cladding. Sheathing was retained and covered with rigid insulation, then cementitious siding. Stud cavities were filled with cold-poured cell foam, and windows were replaced with ENERGY STAR U-0.28 double-hungs.



Cooling down. Heat management was improved throughout the home by replacing or remodeling less-efficient appliances, and adding new technology, such as a smart thermostat and an energy recovery ventilator (ERV). CREDIT: MAUREEN M. MAHLE

Douglas fir floors were patched with reclaimed porch wood and refinished with low-emitting water-based urethane. Original deco light fixtures were rewired and fitted with LED bulbs. The trim and doors were repaired and repainted, and a dining room China closet door was repurposed for an added half bath.

A leaky wood fireplace was replaced with an EPA-listed, sealed wood-burning insert. The oil boiler was replaced with a condensing gas model for hydronic heat and domestic hot water. The hot water radiators were re-used, but with a vastly improved envelope. The radiator in the living room was removed. A Google Nest thermostat helps anticipate and manage the high-mass, slow-response system comfortably. Vintage sinks and a refurbished environmental chamber retained heat gas range were added.

Originally, the home had no local or whole house exhaust, except that the envelope leaked like a sieve—25.6 air changes per hour at 50 pascals (ACH50) before renovations! The owners tried exhaust-only ventilation with an efficient bath fan, but as the home was tightened to 3.1 ACH50, they found it stuffy. And the range hood (with airflow of 100 cubic feet per minute) was causing a -11 Pa differential, a problem for homes with fireplaces. So, they added an energy recovery ventilator (ERV), and they tied the range hood switch to a through-wall, motorized fresh air damper. Stuffiness and odors were much improved, and the potential for backdraft from the fireplace was significantly reduced.

Before renovations, the home had a Home Energy Rating System (HERS) index score of 173. After renovations, the HERS score dropped to 59. Natural gas usage was reduced from 2,400 therms per year to just 600. In addition, Maureen and Steve have reduced water usage by 40 percent, as compared to the baseline home, and cut CO2 emissions by 3,000 pounds annually.

Ultimately, the residence received LEED v4 Platinum certification.

According to Mahle, while the process was rigorous and taxing, the family is comfortable and happy in their "new," high-performing home.

The Element House

It's lights out at this custom home—and that's a very good thing.

THE HOMEOWNERS' VISION for this project was for a minimalist structure, built beyond the code in terms of structure, systems and performance. The goal, according to designers, was to create a home that reduced dependency on the power grid with a focus on natural and passive systems. The intended performance was to achieve Leadership in Energy and Environmental Design (LEED) Platinum and Net Zero Energy certification.

Situated on a narrow 67-foot-wide lot, this home in Sarasota, Florida was designed as a primary residence that the owners could use just for themselves or to accommodate family and friends.

Strategically placed operable windows allow for passive heating, cooling, ventilation and lighting, thus reducing dependency on mechanical systems for comfort. These fundamental and simple architectural features stand in contrast to the cutting edge controls used to operate the variable speed HVAC and low voltage lighting systems.

Natural light fuses harmoniously with the architecture and windows bring daylight into every room—even closets and pantries. These innovations become the defining feature throughout the home.

Along with being ultra-insulated, the home has achieved one of the lowest air-infiltration rates tested locally and nationally. Performance testing shows it in the top one percent of all ENERGY STAR homes. Passive lighting and ventilation, shading, and use of local materials and a high-performance building envelope all contribute to achieving a Home Energy Rating System (HERS) rating of minus 26.

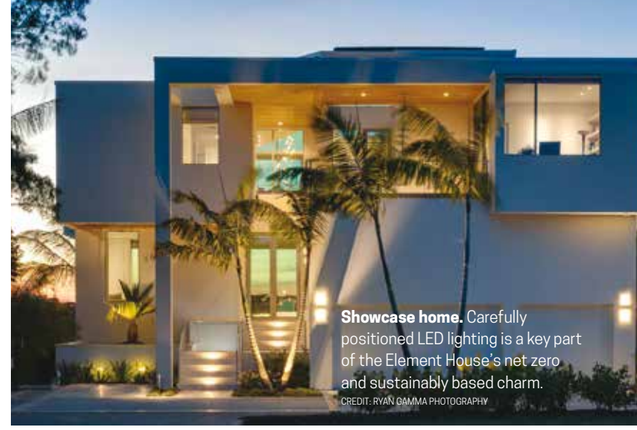
An optimized solar array is in place to pick up where conservation efforts left off. One hundred percent automated LED lighting was installed throughout the project. The home features the owner's artwork, so it was imperative that much thought was given to controlling natural and artificial light. Window blinds that adjust automatically and smartphone operated controls are integrated throughout the home.

Located in a flood zone, the architectural design offers a non-traditional floor plan, employed to maximize natural daylight and tropical breezes.

The landscape was a critical of this project. The minimalist goals of the architecture translated to the landscape design. The existing shoreline vegetation was protected and nursed to health during the construction. The rest of the new landscaping was intentionally selected to lend scale and designed to soften the rigid forms of the architecture. The placement of large trees frame and enhance the views while providing shade. Only Florida-friendly, drought-tolerant plants were used and site water retention and permeability was maximized. All roof runoff is diverted and collected on site, and within cisterns for irrigation needs.

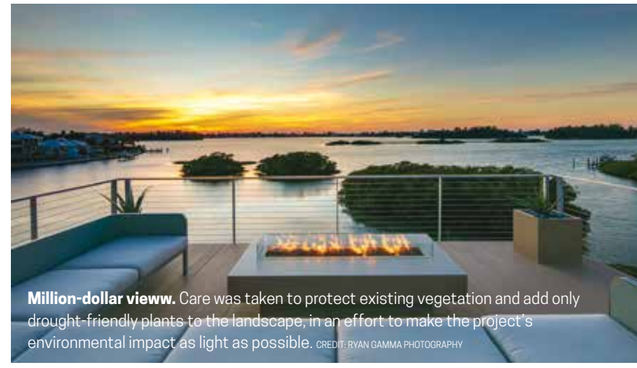
Only brass-bodied LED landscape lighting was purchased and installed. Rainwater on the site is managed through low-sloped swales with non-compacted earth to speed absorption and minimize bay impacts. A bay-friendly maintenance program is in place to help maintain the integrity of the local waterways.

This project marries design technique and advanced engineering to create a truly sustainable house with an emphasis on simplicity, comfort, and efficiency. The design goes back to basics with true sustainability using shade, natural ventilation and daylight, local materials and sympathy with the Florida landscape. **GB**



Showcase home. Carefully positioned LED lighting is a key part of the Element House's net zero and sustainably based charm.
CREDIT: RYAN GAMMA PHOTOGRAPHY

Smart fenestration. Strategically placed operable windows allow for passive heating, cooling, ventilation and lighting, reducing dependency on mechanical systems for comfort. CREDIT: RYAN GAMMA PHOTOGRAPHY



Million-dollar viewww. Care was taken to protect existing vegetation and add only drought-friendly plants to the landscape, in an effort to make the project's environmental impact as light as possible. CREDIT: RYAN GAMMA PHOTOGRAPHY

Seattle Cascades

VISION House® by Green Builder® Media

DISASTER-RESISTANT HOME BUILDING WITH STYLE

This house can stand up to extreme climate, high winds, wildfires and seismic activity while offering stylish interiors, and boasting unfettered views of the Seattle Cascades.

'Vision' quest. A lot has to go into transforming Seattle Cascades from concept home to completed dream. Among the priorities? Making sure the house can stand up to the elements. CREDIT: EQUITERRA

A home takes shape. The Nudura ICF design combines two panels of expanded polystyrene (EPS) foam with the structural strength and thermal mass of concrete. The structure has hurricane wind resistance up to 250 miles per hour and an energy-efficiency rating as high as R-50.

BY CATI O'KEEFE

THE VISION HOUSE Seattle Cascades is well under way. The insulated concrete form (ICF) walls were built as fall descended on the home's pristine mountaintop site. This off-grid, net-positive, healthy home optimizes energy management and incorporates the most-advanced green building products, systems and technologies available on the market today.

"The big features of this demonstration house address changing climate conditions and address the fact that the house sits in the middle of thousands of acres in a forest outside Seattle," says Herro. "In the Pacific Northwest, you're looking at seismic-resistant design in the mountains with high winds. Plus, we considered water intrusion and resistance, fire preparedness, and protection against ground instability and mudslides."

That might seem like a tall order to address, but as Herro explains it, it's not complicated when you leverage the right building science and products to achieve high performance in all areas of the build.

Let's break down the most important pieces that make this house impervious to a host of negative conditions:

BUILDING A DISASTER-PROOF FOUNDATION

This project sits on a hilltop that slopes steeply on all sides. For this reason, Herro and the team had to pay special attention to

Seattle Cascades
VISION House® by Green Builder® Media

soils. They performed extensive geotechnical work to determine the best siting and foundation strategy, and opted to excavate directly into the bedrock, pouring the steel footers directly into the stone.

The structure of the house is made from ICFs by Nudura. Stacked, reinforced and then filled with concrete, ICFs create a solid wall that exceeds the requirements for seismic. "All the subgrade and above-grade structures are poured-in-place ICFs, wrapped in additional weather barriers and steel cladding," Herro explains. "This makes the house airtight, bug resistant and water-resistant."

The foundation's design caught other builders' eyes "People who know construction looked at all the forms laid into the ground and steel reinforcements and asked, 'Are you landing planes on top of this house?'" Herro laughs.

Because the building envelope has the most impact on the home's performance, the VISION House team prioritized it to reduce mechanical heating and cooling demand, including the ICFs, structural insulated panel (SIP) roof structure, light-gauge steel interior framing and ultra-high-performance windows.

FIRE SUPPRESSION

Mitigating fire risk was top of mind for the VISION House team as it chose building products. "There are no combustible materials in the vertical structures of the house," Herro says.

For the exterior, the team picked a formidable collection of fire-resistant products. "The roof is *Boral* stone-coated steel; the siding is *Cultured Stone* and steel, the eaves are steel wrapped. All of these positively reduce fuel sources in and around the house."

With adequate setbacks of vegetation, the house is designed to survive through a regional fire.

"There's a ton of timber in a normal house with flooring trusses, wall systems, cedar shingles, and asphalt. These materials add fuel to fire," Herro explains. "We conscientiously removed these from this house."

The team also addressed fire protection on the inside of the house. "The steel-formed interior has an Uponor fire suppression system," Herro says. "We also have a misting system on the exterior, which will wet the exterior to extinguish embers." Considering that the fire department is far away from this remote location, this system would buy valuable time should a fire emergency occur, he adds.

The Uponor plumbing system does triple duty in this house: fire suppression, potable water, and radiant heating.

PROTECTING HOME FROM WATER

In addition to the weather-cladded ICFs, the Western Window Systems' windows provide a double-sealed barrier on a house that has large sections of glazing.

"We worked with Western to get the best windows designed for the Cascades environment," explains project architect Stace McGee of Equiterra Regenerative Design. "This was important because in King County, where the project is located, each window has to be labeled. They have to have high ratings and [the county] is stringent about it."

The team opted for the performance route versus prescriptive. "In using advanced materials, the system of air changes per hour (ACH), ICFs, SIPs, and windows create the resulting heating load, not just one factor," McGee points out.

"There is also a big water-resistant story regarding the decking," Herro adds. "The MoistureShield composite decking is sustainable, and fire and weather resistant. It is a perfect match for this wet climate in that it is the only composite board you can put directly on the ground and even underwater because it has a solid core."

HIGH-PERFORMANCE BUILDING TECHNIQUES

The process of getting permits for this high-performance house took a long time—partially because of the pandemic, but also because of the performance path the team took toward meeting building codes.

"The county is interested in the build and watching it because they haven't seen anything like it," Herro says. "We've presented them with dozens of new strategies that are outside the normal residential approach to construction, particularly with how it works together as a system to achieve unsurpassed benefits."

Many representatives from the county are involved in the onsite inspections, and Herro and team are helping educate as they go. "We have big opportunities to promote this type of thoughtful, sophisticated, durable building process, which will enable the county to permit these types of dwellings and support other builders to do this going forward," Herro says. **GB**

NUDURA INSULATED CONCRETE FORMS (ICFs) provide superior energy efficiency, consistency in performance, and lower utility costs over the life of a home versus traditional building methods such as wood. ICFs' steel-reinforced concrete cores are disaster-resistant, offering strength, safety and durability against extreme weather conditions, including wind resistance of up to 250 mph (equivalent to an F4 tornado).

The product's 100 percent recycled polypropylene composition lowers a home's carbon footprint and reduces global deforestation.

The roof of this project is built from PREMIER SIPs. This construction method consists of an insulating expanded polystyrene (EPS) foam core laminated between two sheets of oriented strand board (OSB) using a structural adhesive. This engineered system provides an extremely strong building panel that needs no additional frame or skeleton for support.

Premier's large, pre-fabricated SIPs make the framing process faster than other building methods and enable a more airtight, well-insulated building for high energy efficiency.

WESTERN WINDOW SYSTEMS Series 7000 aluminum windows offer the house a low U-value (ratings as low as 0.19) and design pressure ratings above 50. This durable, energy-efficient solution allows for a modern look and more glass in a variety of weather conditions.

The *Series 7000* boasts performance glass options from Cardinal IG, which can be customized in a variety of types, colors, and thicknesses.

The house features CULTURED STONE'S Country Ledgestone in Gunnison siding. The Gunnison product reveals hues of brooding charcoal and gunmetal punctuated by highlights of powdery light gray.

Country Ledgestone profiles provide home builders with an extensive variety of colors (in addition to Gunnison) and incorporate easily into any space. The stark, cut lines and rugged edges of each stone shape complement both rustic and contemporary designs, and the dry grout look makes installation quick and easy.

The product is backed by a 50-year limited warranty and contains 50 percent pre-consumer recycled content.

BORAL ROOFING'S stone-coated steel Stone Coated Roofing offers five distinct profiles that can enhance the curb appeal and value of any home while providing durability, performance and protection that will last even in extreme weather and climate conditions.

This building material has a 50-year limited warranty, fire-resistant materials, hailstone penetration warranty, lightweight 1.5-pounds per square foot, 120 mile-per-hour wind warranty and energy-efficient above-sheathing ventilation.

MOISTURESHIELD manufactures composite deck boards, such as MoistureSeal, and related products made from recycled wood fiber and recycled polyethylene plastic. The company takes steps throughout the manufacturing process to conserve both energy and materials, while diverting common waste items from landfills.

The decking products are manufactured with 95 percent post-consumer products including recycled plastics and reclaimed wood fibers, diverting more than 100 million pounds of waste from landfills every year (equal to a staggering 7.5 football fields stacked 10 feet high).

Designed with LEED certifications, their state-of-the-art manufacturing facility maintains a low carbon footprint at all levels of production.

For the home's interior fire sprinklers, plumbing and radiant floor heating are provided by UPONOR. The *AquaSAFE* combined plumbing and fire sprinkler system incorporates the fire sprinklers into the home's cold-water plumbing, which ensures fresh water is available if it is ever needed in the event of a fire.

The *AquaSAFE* multipurpose system can save on installation and materials costs compared to separate plumbing and fire sprinkler systems. Often, the fire sprinklers can be installed by the builder's plumber already on the job.

THE FOREVER HOUSE

Remodeling for Sanctuary

Design for Uncertain Times

Our cutting edge whole-house remodel takes into account extreme heat, pandemic prep and stay-at-home priorities.

BY MATT POWER, EDITOR-IN-CHIEF

DESIGN MATTERS. TO PUT THIS IN PERSPECTIVE, you might look no further than the daily temperature readings in Scottsdale, Arizona. Averages keep breaking records. Last year, for example, the region had 14 days where temperatures went above 115 degrees Fahrenheit, and another 312 days where it hovered above 95 degrees Fahrenheit. Climate Change has never seemed so real.

That new reality has informed the design choices of Steve Easley and Susan Raterman as they move forward with a ReVISION House remodel of their home in Scottsdale. The pair planned most of the redesign themselves, although Ed Chavez, AIA, gave meaningful input and should be credited as the architect of record.

BIG ISSUES

Two concerns have dominated the design of this home: the sweltering heat outside, and the views from inside. Then the pandemic came along and added a third goal: creating a "sanctuary" where the couple could hunker down for long periods in the worst of times.

These goals color the hundreds of design decisions made in the house, from window placement to overhangs, roofing style and color, to solar panel placement and the flow of air to to take advantage of passive cooling.

"Most of the design elements were already in place before the pandemic," notes Raterman. "But this crisis really solidified our plans. For example, we knew we wanted a guest suite, and the coronavirus changed our views on how to ventilate that space."

Also, the outdoor living areas took on new importance, according to Easley. "We've always tried to gather outside, but this clinched it," he explains. "Our outdoor space — on both ends of the house – offers us the possibility to physically distance, and is also an alternative place to work."

The seating area in the back of the house will include a 24-foot by 16-foot by 12-foot high covered roof that is specifically angled to reduce heat gain, yet high enough to maintain a breathtaking view of the mountains.

WORK ZONES

Raterman adds that the whole house is "really geared toward separating work and personal life."

That separation becomes apparent with a glance at the new floor plan layouts. The second floor will become a telecommuting hub, with two side-by-side offices, a workout room and, notably, a lot of extra soundproofing.

"The two offices will be isolated in terms of sound," Easley notes. "We both do webinars on a regular basis, so they need to be super quiet." The offices' design calls for sound-reducing drywall, gasketing and insulation, and solid core doors. All glass in the offices will be laminated to attenuate sound.

NEXT STEPS

The flooring for the Forever House still hasn't been chosen, although Raterman is working with surface manufacturer MSI to choose colors and materials.

"We want the colors to be soothing and circadian," Easley notes, "since we spend so much time here." **GB**

ReVISION House Scottsdale | Phase 2

Caveat: Best Laid Plans

We should note, however, that some of these design concepts are familiar, but the technologies have not yet been put to the real world test. That's part of what makes these Green Builder ReVISION projects unique.

As demolition and reconstruction progresses over the coming months, we'll track this project closely, and you'll be able to see which products, concepts and plans make it to the finish line.

Cooler roofing. Reflective roof membranes over a sandwich of spray foam and Thermax insulation will decouple the mass of the roof from living spaces, while solar panels add another barrier to the sun's relentless heat. This image shows a similar roofing system to the one planned. CREDIT: SIMON TURNER/ALAMY STOCK PHOTO

Pause for Reflection

Strict HOA rules required major adjustments in rooflines to allow for solar.

One of the obstacles to rebuilding in this golf-course subdivision is strict rules limiting solar panel visibility. To keep them hidden from sight, Easley and Raterman had to put them on flat roofs over the kitchen and master bedroom areas. Easley hopes to use bifacial panels over the white, reflective roofing, although specific panel types have not been finalized. These double-sided panels generate up to 30 percent more power, using light reflected from below them.

Accessible future.

Placement of the master bedroom and bath on ground level allows the couple to age in place. Wide doors and low thresholds remove trip hazards. A curbless shower allows easy access.

Open flow.

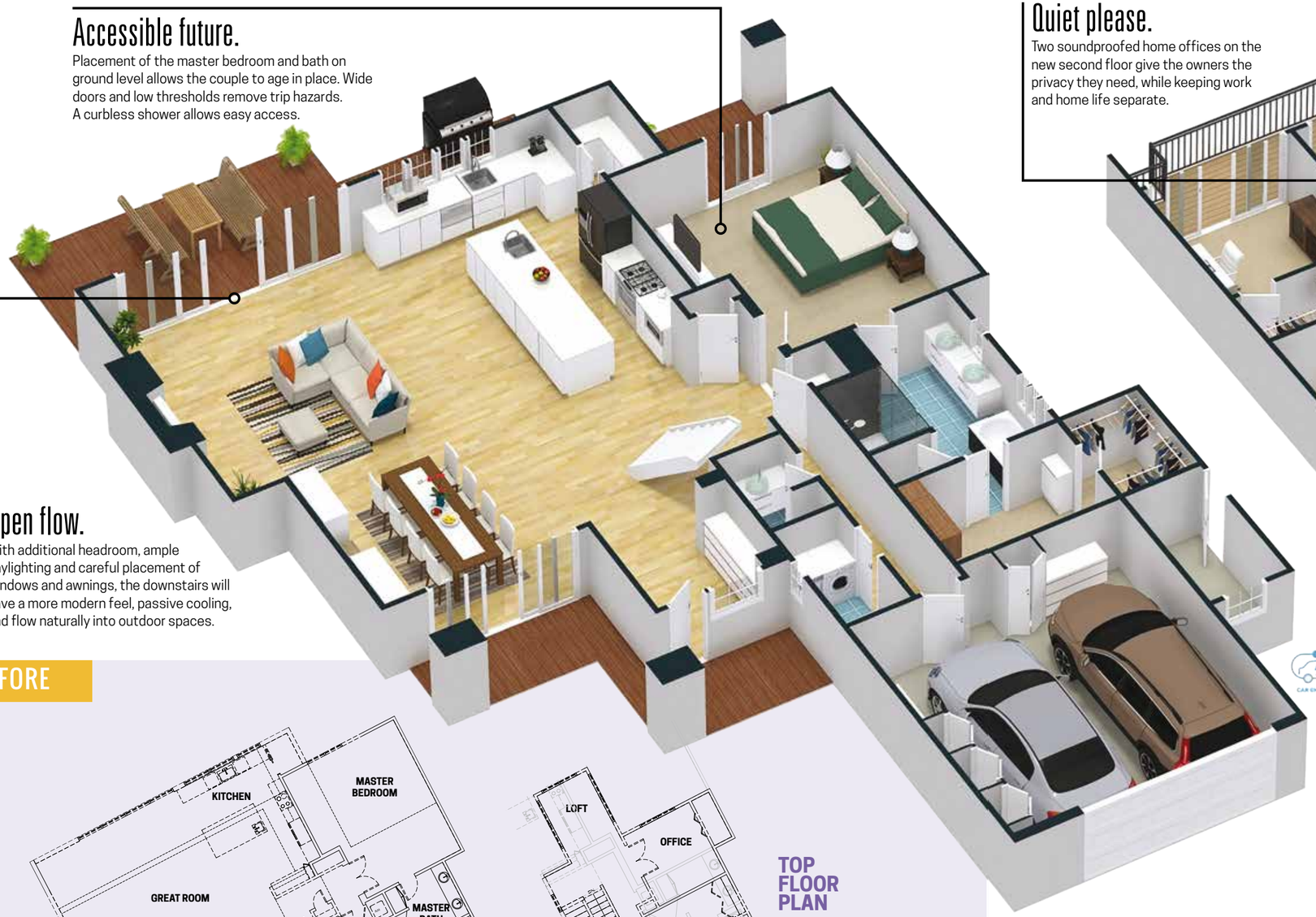
With additional headroom, ample daylighting and careful placement of windows and awnings, the downstairs will have a more modern feel, passive cooling, and flow naturally into outdoor spaces.

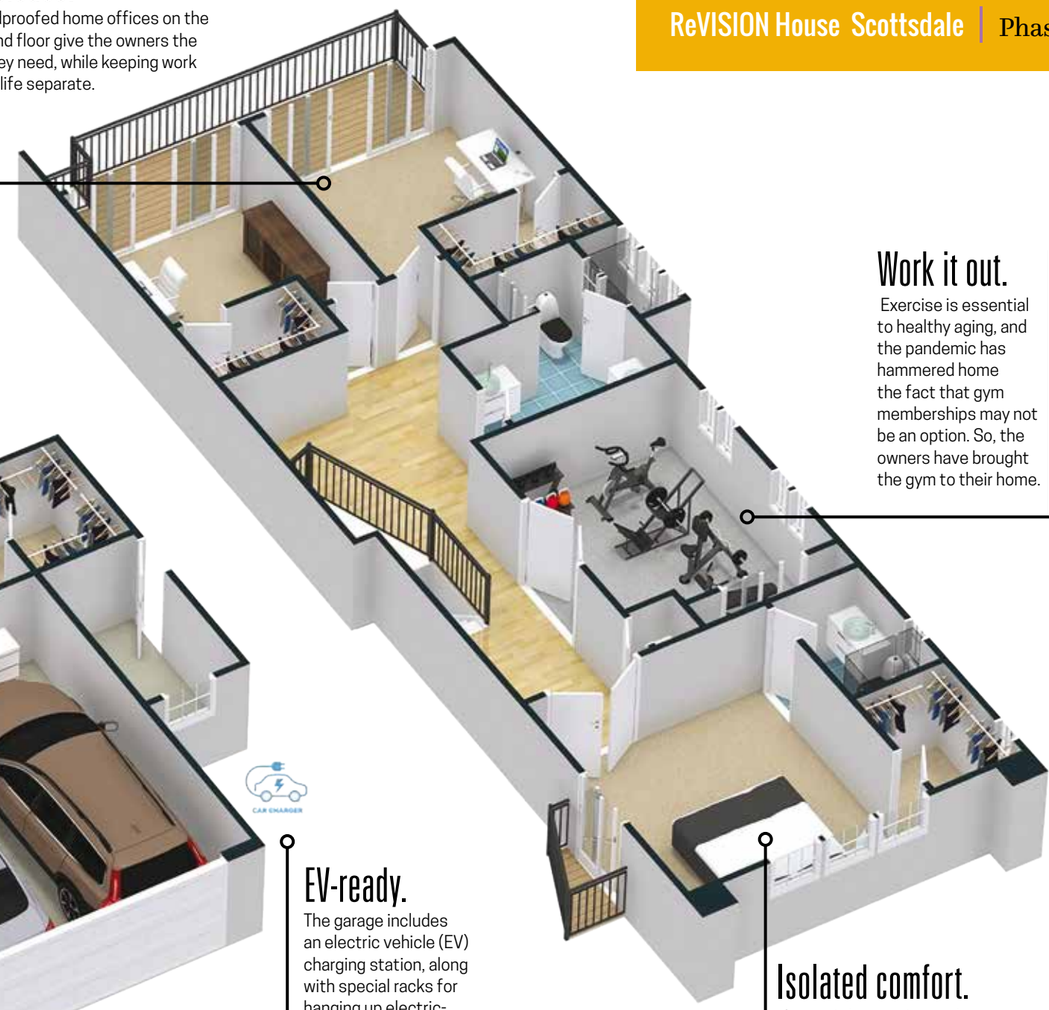
Quiet please.

Two soundproofed home offices on the new second floor give the owners the privacy they need, while keeping work and home life separate.

Work it out.

Exercise is essential to healthy aging, and the pandemic has hammered home the fact that gym memberships may not be an option. So, the owners have brought the gym to their home.





CAR CHARGER

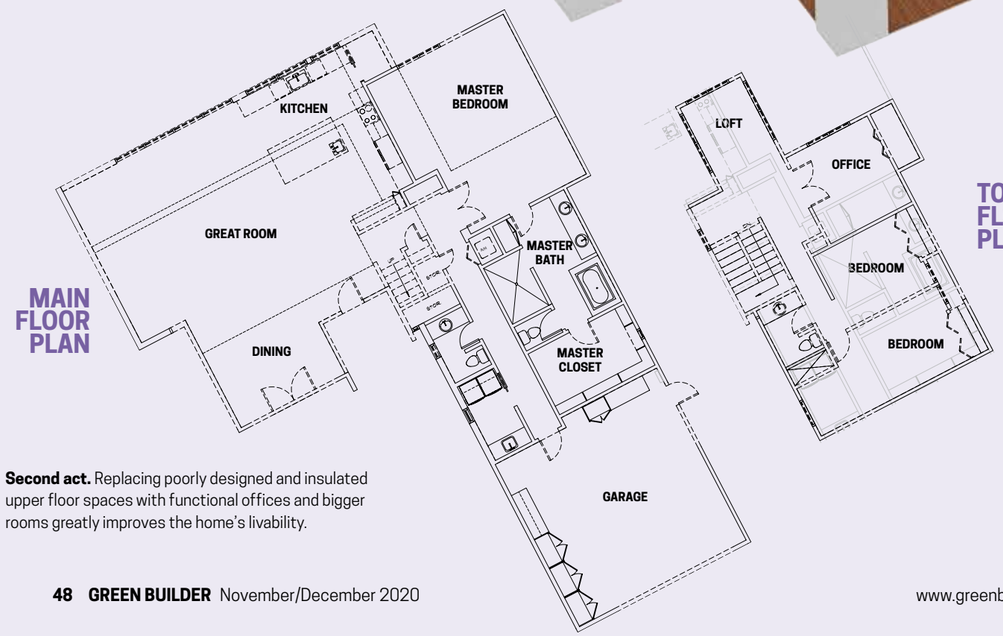
EV-ready.

The garage includes an electric vehicle (EV) charging station, along with special racks for hanging up electric-assisted bicycles.

Isolated comfort.

The upstairs guest room is designed with the pandemic in mind. It will have its own ERV for cooling and ventilation, a dedicated bath, and a small balcony for access to fresh air.

BEFORE



Second act. Replacing poorly designed and insulated upper floor spaces with functional offices and bigger rooms greatly improves the home's livability.

A View to the Future

Once renovated, the Forever House (new plan shown) will include more headroom, solar panels, and a more-functional second floor that's ready for long stay-at-home periods.

Ready for reuse. Original parts of the Forever House, such as this sink, will be sent to a Habitat for Humanity ReStore for use in other homes.

Demolition Diligence

Careful disassembly of the existing structure will allow for many components to be reused.

Overhaul of the Forever House will involve differing degrees of disassembly and demolition. But Easley points out that every piece of the old structure that can be salvaged will be donated to a Habitat for Humanity "ReStore." About half of the exterior walls of the upper floor will be removed, but the present plan is to try to reuse as much of the lower walls as possible. One challenge, however, is that the ceiling will be raised on the first floor.

"We're hoping we can keep much of the original frame and add a pony wall on top of that," Easley notes.

Outdoors, in the pool area, the original concrete patio and pool will be demolished. The new pool will be built in the same area, but with a vanishing edge extended. Easley points out that the new materials around the pool, porcelain pavers from Belgard, will not have the same one-way lifecycle.

"These pavers can be set in a sand base," he explains, "so if you need access beneath them, you can just pull them up, and put them back. Combine that with the fact that we're installing (DuPont) *ForeverLawn* artificial turf (instead of a lawn) and the potential water savings in this climate are enormous."

MEET THE INFLUENCERS

Steve Easley, Msc, is an internationally recognized construction consultant specializing in solving building science related problems, and educating building industry professionals and their trade partners on best building practices.

Susan Raterman, CIH, is the founder and president of The Raterman Group, Ltd., and is an experienced consultant in the critical areas of air quality, mold mitigation, environmental hazards and industrial hygiene in the Scottsdale, Arizona area.

Forever House SPONSORS

Sponsors for the Forever House have provided cutting edge products and technology, including HVAC, smart irrigation, and many other products.

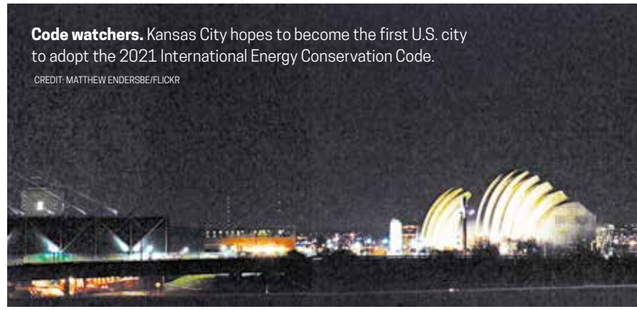
Whirlpool® · DUPONT® · Rheem® The new degree of comfort.® · BlazeMaster® FIRE PROTECTION SYSTEMS · PIONEER LANDSCAPE CENTERS · rachio · BROAN NuTone® COME HOME TO FRESH AIR · MITSUBISHI ELECTRIC · ForeverLawn® · FLOWGUARD GOLD® PIPE & FITTINGS · BELGARD PAVES THE WAY · MSI

CODE ARENA

The Latest Rules, Regulations and Codes Impacting Sustainable Construction

2021 IECC Slated for U.S. Debut in Kansas City

BY MIKE COLLIGNON



Code watchers. Kansas City hopes to become the first U.S. city to adopt the 2021 International Energy Conservation Code.

CREDIT: MATTHEW ENDERSBE/FLICKR

KANSAS CITY, MISSOURI plans to become the first city in the nation to adopt the 2021 International Energy Conservation Code (*IECC*). That code, which has been mired in multiple appeals from home builder trade associations, will be approximately 10 percent more efficient than its predecessor. But how did this Midwestern city get to this decision?

The city's prior codes were based on the 2012 I-Codes, although this energy code was weakened from the 2012 level. According to Karen Uhlenhuth of the Energy News Network, "the local architectural community and other clean energy promoters have been pushing the Kansas City Council to make a leap toward greater efficiency in all new construction". Responding to this persistent call, the council adopted the 2018 I-Codes in late June, with the exception of the IECC. Because of the imminent publication of the 2021 IECC, the council felt it was more prudent to be patient. Otherwise, it would have incurred training costs for the 2018 IECC, only to later go through the code adoption and training process all over again. Council members also didn't want to adopt a code that would immediately be outdated.

A skeptical person might doubt whether the city council is going to truly adopt the 2021 IECC. **Council Resolution 200449** should put those concerns at ease, because it reiterates the city's commitment to its own Climate Protection and Resiliency Plan, with goals to achieve zero greenhouse gas emissions from the electricity sector citywide by 2030, 100 percent greenhouse gas reduction from municipal operations by 2022, and to become climate neutral by 2040 to protect the health and welfare of all its residents. "Adopting modern building codes," the council notes, "is instrumental in meeting this goal".[2] It also resolves that the city is basically waiting for the IECC to be published.

Since the initial voting results came in back in December 2019, the city (and many other municipalities) have had ample time to see what's in the code. Even though a handful of proposals were reversed by the International Code Council (ICC) Board, it largely remains intact from that earlier outcome.

One important note: Nothing will get enacted until 2021 at the earliest. The council will have to wait 90 days after the code's publication before revisiting the matter.

ANTI-PLASTIC POLLUTION BILL NEEDS HELP

Meanwhile in U.S. Congress, **SB 3944**, also known as the "Break Free From Plastic Pollution Act of 2020", was introduced by Sen. Tom Udall (D-New Mexico) in mid-June. The legislation's main goal is to reduce production and use of certain single-use plastic products and packaging. But, it doesn't stop there. Udall also wants to hold plastic producers responsible for the collection and/or disposal of their consumer products and packaging. It's all part of an effort to prevent pollution from consumer products and packaging from entering into animal and human food chains and waterways.

If you read the eye-opening article titled "**Planet Plastic**", published in Rolling Stone magazine earlier this year, you already know that plastic is extremely pervasive throughout our planet. In some regards, it might be too late to undo the damage caused by plastics.

Senator Udall, who is retiring at the end of his term this coming January, has a goal that is admirable and worthy. But he is facing severe headwinds – and he knows it. The beverage industry is going to fight this just as fervently as the tobacco industry fought its (overdue) government-forced accountability. That's probably why this bill has been stuck in the Committee on Environment and Public Works since its introduction. If you'd like to see it gain traction, contact your Senator today.

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

COURTESY OF

The Green Builder® Coalition

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

All For One

The key to becoming a bigger, better construction industry is collaboration on all levels.

BY TERRY BEAUBOIS

STUDIES SHOW THAT over the last 50 years, the building industry has lagged behind others in terms of increased efficiency and effectiveness. Why? A lack of collaboration among the various sectors of the industry.

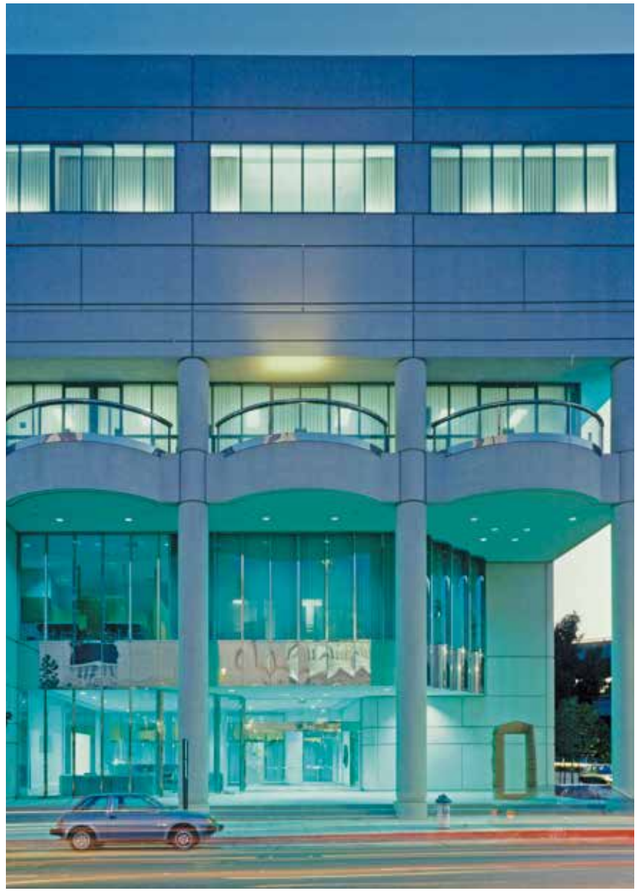
My perspective on collaboration across the architecture, engineering and construction (AEC) industry is influenced by the fact that I have worked construction jobs, worked in a structural engineer's office, worked for architects, have had my own architecture firm with partners and have also been a solo practitioner. I have also taught in a number of college-level architectural programs. My combined 40 years of experience leads me to the undeniable conclusion that increasing collaboration across the AEC is not only a good idea, but will be beneficial to improving the overall efficiency and effectiveness of the entire industry.

THE "SILOS" OF THE AEC

I first experienced the siloing of the AEC in college, when I attended a very good university architecture program that had recently split with the engineering school due to conflicts between the administrations and faculties. We had classes where architectural design, structural engineering and mechanical engineering were taught as separate courses, and required that we design three separate buildings, none of which took all three factors into consideration.

After that experience, we convinced the school to change to a model of team-teaching for one combined course in architectural design, structural engineering and mechanical engineering. In that way, we got to see the interrelated considerations of how simultaneously working with all three aspects of design and engineering worked when applied to one building. There was much resistance to this, as we were told that "it was not the way it had been taught before" and that "it would require the professors to collaborate, and they haven't done that before."

It was not easy to get the school to evolve to that way of teaching. Many architectural schools today still do not teach an integrated approach to AEC. In fact, having taught in universities at the undergraduate, graduate, and doctoral level in architecture, I can say that many students graduate with a limited knowledge of buildings. Many of them graduate without ever having visited a construction site, let alone actually having worked in construction. This shifts education responsibility to architectural firms, which have to continue educating graduates on the job.



Collaborative success. Renowned structures such as the San Francisco Ballet Building are the result of extensive communication between builders, designers and engineers. CREDIT: BRUNNELLESCHI9/FLICKR

Each component of the AEC—architecture, engineering and construction—can significantly increase collaboration across and within the AEC, and each will benefit from that increased collaboration. I have been very fortunate to have had the opportunity to create and lead collaborative teams on my projects in all ways possible.

I led a hospital design project where I met frequently with all members of the engineering team, from the beginning of the project through completion of design. I also was Architect of Record for the San Francisco Ballet Building, where we had a range of excellent consultants that included structural, mechanical, electrical, and acoustic engineers. We also integrated a number of key product representatives to assure the careful integration of dance studios, offices and locker rooms. In addition, I provided the construction period architectural services for that project and got to see the execution of every detail of every part of the building. We had an excellent general contractor that encouraged my complete involvement during the construction period. We often worked out a number of issues on the site as they came up.

Team effort. Taking a collaborative approach to education can help ensure that future architects, engineers and construction workers are fully prepared to enter the workforce. CREDIT: ELVERT BARNES/FLICKR

This is not unusual in practice. Many good AEC companies work collaboratively on projects. Encouraging this kind of interaction, increasing this kind of collaboration and teaching about it in schools will further improve the efficiency and effectiveness of the AEC industry on everything from home projects to the largest complex of buildings.

My single-family residence projects, while significantly different from commercial and industrial projects, have benefited from the combined knowledge, experience and talents of a range of consultants and subcontractors in the development of projects that successfully incorporated, reflected and satisfied the homeowner's needs, requests and requirements.

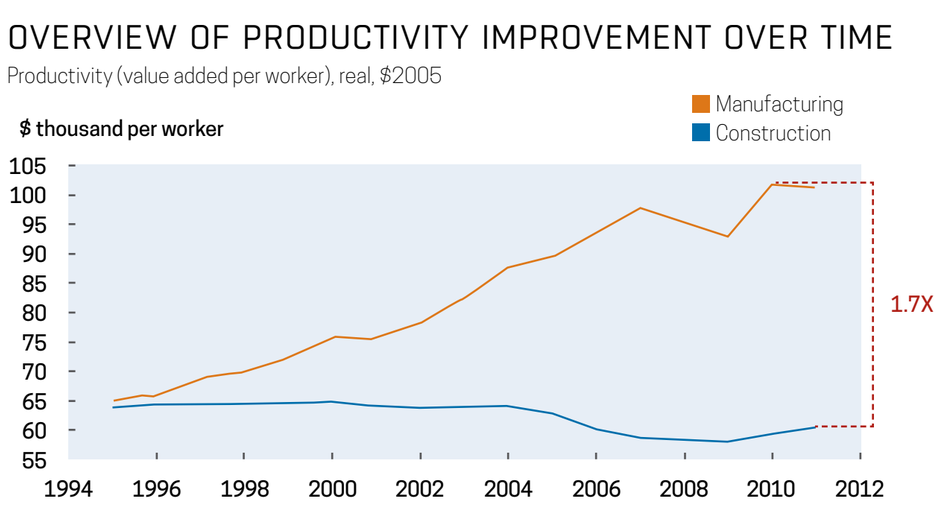
I could not have done such good projects without this type of advice in designing, creating the drawings for review, approval and for the construction of each project.

Visiting the site often during a project and being open to suggestions that improve the project and encourage learning, even during the construction of a building, can bring valuable information back into the design phases of each architecture firm. This can include information from subcontractors about a better way of drawing a detail than the way that may be typically drawn in the architect's office. Architecture is a continuous learning experience. Who better to learn from than an engineer who has done something many times before, or the contractor or carpenter that has to actually build a detail?

MAKING THE LIGHTS GO ON

This leads me to another issue. I have taught in a PhD program in a construction department, where I was asked to present to 14 students who were about to get their degrees. During my class, when I held up a detail and asked if anyone could explain what each line of the detail represented, no one could do so.

I then showed them the same detail on a clear sheet of plastic mylar. I pulled forward a short wall section I had built earlier that



day, for the purposes of this demonstration. I laid the clear detail against the built example, so they could see each line of the detail over the actual elements...and the light bulbs in their heads went on.

A collaborative approach to the AEC is what needs to be presented in every AEC course, globally. We need to teach what buildings are and about to all of the players in the AEC. Each of us doesn't need to know everything about what everyone does and how to do it, but we certainly need to be aware that they all exist. We can create collaborative team members with mutual respect for everyone's role in contributing to one of the oldest, most important industries on Earth.

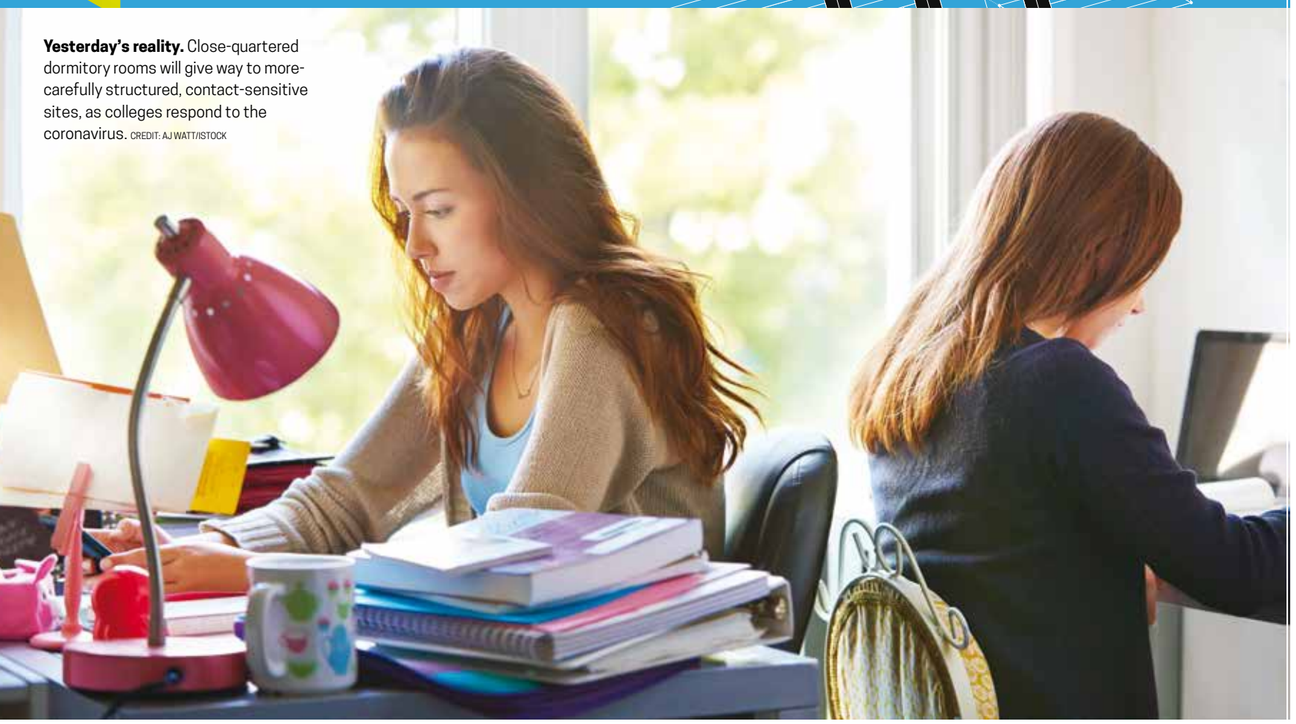
I attended online conferences recently in which construction companies referred to "the construction industry", and didn't use the words "architects" or "architecture", but referred instead to "pre-construction services." An engineering conference I attended online referred to "design engineering" instead of architecture. As architects, we can do a better job of integrating ourselves into the building industry, and can benefit from that when we do.

Today's AEC industry can seem somewhat disjointed and discontinuous. We need to increase our ability to successfully, efficiently and effectively communicate building information across the AEC for the benefit of the entire industry. Beginning in our schools. This can actually unite us in a common goal. We need industry members aware of the benefits of increasing collaboration across the industry. There is need for, and room for, improving.

During this current pause of AEC work due to the pandemic shutdown, I encourage AEC professionals to consider how we all can be more collaborative in successfully working across the AEC and improving the industry for its own benefit, and for our clients. **GB**

Terry Beaubois is CEO of BKS: Building Knowledge Systems, LLC (www.bksco.com/tbagbm). He may be contacted at tbeaubois@gmail.com

Teamwork does it. Increased collaboration will improve the industry's overall efficiency and effectiveness.



Yesterday's reality. Close-quartered dormitory rooms will give way to more-carefully structured, contact-sensitive sites, as colleges respond to the coronavirus. CREDIT: AJ WATT/ISTOCK

Pandemic-Ready Student Housing

When students finally go back to college, what kind of on-campus housing should they move into?

WITH THE HOLIDAYS APPROACHING, universities and colleges continue to try and cope with the fallout from the COVID-19 pandemic. A relatively small number of college campuses resumed class this fall, and more plan to reopen doors in the spring 2021 semester. Others have locked up until at least next fall.

According to KWK Architects Principal Sara Koester, universities and colleges that look to design new residence halls after the current global health crisis will be challenged to safely house students while still providing for their social and academic development. "Social interactions have taken on a new normal: social distancing, limited-size gatherings, and a responsibility to act in a manner that does not make someone else sick," she notes. "Residence hall design will evolve to reflect the current pandemic condition."

THE SIZE OF SAFETY

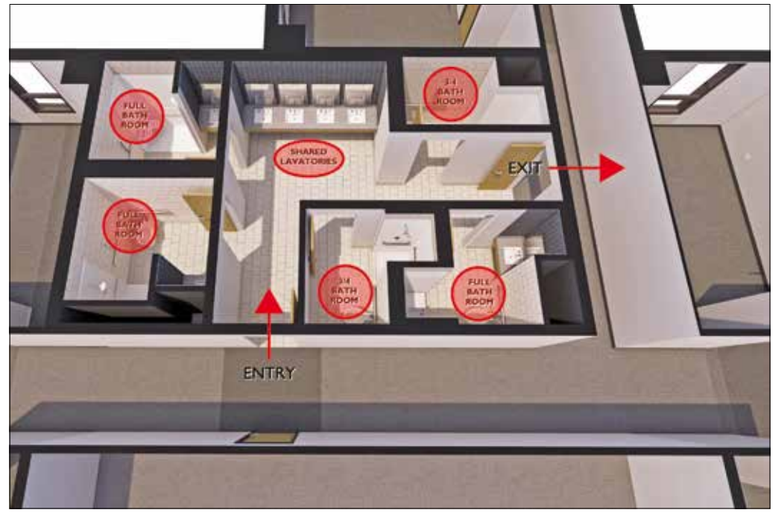
Koester says that safety and security will be paramount for future students and their families, likely resulting in a desire for single-occupancy bedrooms in residence halls. "Single-bedroom units can provide a safe haven," she notes. "[A] personal retreat where students can relax away from others."

She stresses, though, that this configuration may be too isolating for a student away from home for the first time. Many residence halls are designed specifically to house freshmen, and studies have shown that freshman students in double bedrooms with a roommate have a higher rate of retention.

A "next best" bedroom style that will be considered is a double bedroom designed as a "paired-single" unit—two singles side-by-side—with each occupant having furniture, a closet, an operable window on "their side" and only necessarily shared elements, like a corridor door and mechanical unit/thermostat centrally located. The bedroom shape would be wide and shallow, allowing beds, desks and closets to be located further apart.

"The two sides can be marked with floor patterns and paint finishes to distinguish the two zones within the room," Koester explains. "The two roommates will function as a 'family unit' since they are, indeed, sharing a room. These resident students will have experienced the pandemic in their formative years, and can rely on their prior experiences to understand the importance of appropriate space boundaries."

New bathroom designs may favor a clustered single-use bath arrangement where private-use bathrooms—each containing a toilet, lavatory (sink) and shower—are located together. When grouped with a community lavatory area, this offers opportunities for socializing while still providing for privacy.



Multiple access points. A new dorm bathroom design may feature clustered, private bathrooms with their own toilets, sinks and showers, flanking a community lavatory area that offers opportunities for either social connection or privacy. COURTESY OF KWK ARCHITECTS

Two entrance/exit points to the facilities will allow for a one-way traffic pattern to be implemented when environmental health conditions warrant. The common lavatory area, with ample space between fixtures, will allow for ease of hand washing, as well as a chance to chat with other residents while maintaining social distancing, Koester notes. Meanwhile, new staff training and procedures will be required to ensure a constant—or at least much more frequent—cleaning cycle to safeguard the safety of all building users.

INTERACTIVE ACTIONS

Social spaces, such as floor lounges and studies, will be sized and organized to allow for social distancing with distinct "stations" at appropriate intervals, according to Koester. Areas can be demarcated with floor patterns.

Kitchen facilities should, ideally, be arranged for one-way circulation and appliances spaced to permit multiple work areas with adequate buffers between, Koester notes. And hand washing stations should be ample and sufficiently-spaced with accessories at each station.

"It has always been important to provide a variety of social spaces that allow for a range of activities—[such as] 'quiet' to 'active' and 'small group' to 'large group,'" she says. "But now, residence halls should consider including single-person study spaces where a resident may go to focus on studies or simply decompress in a private, safe zone."

Circulation spaces in residence halls will need to evolve, Koester remarks. There are quite a few mandatory changes:

- Entrances to buildings will need to be wider and feature multiple single-entrance doors to avoid compressing residents as they enter the building.
- Lobbies should be large enough to allow for pedestrian flow to the elevators or stairs while social distancing, and elevators should be sized to accommodate multiple occupants at opposite corners.
- Additional elevators may be needed to safely address reduced elevator capacity due to social distancing restrictions.
- Corridors will need to be of ample width, and preferably feature one or more small alcoves at regular intervals off the main hallway, and perhaps one or more small benches with views to the exterior. These can serve as places to "step out" of the way and not be in the traffic flow.
- Doors to bedrooms should be located in recessed pockets off the corridor, allowing a student to transition into the main corridor flow.
- Air flow exchange and mechanical systems may need to be reevaluated with more-frequent filter changes.

"While the program for outdoor spaces in residence hall design has always been important, this will take on a heightened importance in providing places where residents can go for relaxation and space-distant socializing, with individual areas articulated in the design of the hardscape, landscape and outdoor furniture," Koester says. "Individual outdoor activities, like hammocking and swings, can offer places to unwind, while outdoor terraces and patios can offer places for small groups to safely meet while social distancing."

With careful and thoughtful planning, residence hall design can balance environmental health concerns and living preferences of students and their families—and foster community interaction and provide a nurturing environment, she adds. **GB**

Story courtesy of KWK Architects. *With more than $1 billion in construction-valued projects since its founding in 2013, KWK Architects partners with colleges and universities across the United States to create innovative and inspiring places that enhance campus life.*

How Close is Robotic Labor?

Advocates for mechanized help on the jobsite say the shift has already begun with 'smart' excavation equipment.

BY RAMZI JREIDINI

COULD ROBOTS BE THE ANSWER to construction's labor problem? The industry certainly seems to think so, with non-human workers being successfully tested to tackle tasks such as excavation, drywall installation, painting and roofing, and headed for more efforts in the future.

Construction productivity has fallen by half since the 1960s, and this is largely prompted by the industry's prolonged shortage of workers. This makes robots an obvious solution. If you can't hire them, why not build them?

WORKFORCE ROBOTS ARE ON THE WAY

Smart construction has been a long time coming. The sector has continued to grapple with inefficiencies and labor shortages for decades, largely due to a failure to evolve with the times. According to "Reinventing Construction Through a Productivity Revolution," a digitization index by the McKinsey Global Institute (MGI), construction remains one of the least-digitized industries on the planet, lagging well behind its contemporaries in technology uptake. Construction comes in second-to-last and last place, respectively, on MGI's U.S. and European lists.

Given these facts, development of robotic and automated construction tools has been a matter of "not if, but when." And, thanks to a number of up-and-coming startups in this space, it does not look like there will be too much more waiting. Robot bulldozers and backhoes which use sensors such as Light Detection and Ranging (LIDAR) and GPS to "see" the world around them have been tested successfully, along with robots which have the ability to install drywall without human assistance. Such products will be a catalyst to construction's future growth. The sector is in desperate need of a shakeup.

Smarter design, smarter employment practices, and using new and innovative construction technologies have the potential to remove the labor pressures from a sector which has struggled consistently for efficiencies. This, of course, requires flexibility from construction firms—something which could be more difficult than robotic design in such an entrenched industry.

STARTING SMALL, STARTING NOW

Although robotics may seen inevitable, many technical hurdles remain. However, it is a development for the coming decades. Autonomous solutions do not answer today's lingering issues of inefficiency and loss of qualified labor.

Automated effort. Japanese public research body, National Institute of Advanced Industrial Science and Technology (AIST) is developing a robot capable of activities such as drywall application and wall panel installation.
CREDIT: AIST

As noted by the World Economic Forum (WEF), the ongoing labor shortage, including that of professional talent for designers, architects and higher levels of management, has "undermined project management and execution, adversely affecting cost, timelines and quality." Time is money—and the lack of available, skilled workers and professionals is one of the biggest reasons for stagnating productivity and rising construction costs. Some reports, WEF notes, estimate cost increases of 30 percent year-on-year.

The sector needs to start small and start now. This means rethinking construction employment in tandem with better construction practices—a combination that is also being empowered by technology. Less human capital can be answered by the evolutionary thinking and the construction hiring platform.

According to "Engineering and the Gig Economy," a report by Engineering.com, the majority of all workers will be freelance within the next 10 years. Flexible employment terms and freelance conditions could help to ensure there are enough employees to go around.

Moreover, innovative and streamlined processes will be able to deliver important efficiencies for right now that robots cannot. Modular construction is a good example. This allows for the design of prefabricated buildings or homes that consist of repeated sections. This enables construction of sections away from the building site, then delivery to the intended site. Instead of relying upon robots, modular construction streamlines the process itself to save on construction time, resources and human labor.

(Driver) freewheeling. Built Robotics has combined off-the-shelf heavy equipment with AI guidance systems to remotely power equipment used to build critical infrastructure such as wind farms, gas pipelines, and new housing developments.
CREDIT: BUILT ROBOTICS

SHIFTING TODAY FOR TOMORROW

While successful pilot tests are being made, it will still be years until robots enter mainstream use. It is no easy feat to build and teach computers to take over human tasks, especially when they take place in an environment such as the construction site. Startups in this space are still fine-tuning how to integrate robots into an already-complicated building site and empower the robot to maneuver an area that evolves as portions are completed.

Further, it is not just robots which are poised to change the building practices of tomorrow. Companies that have developed software solutions aimed at streamlining processes and increasing efficiencies are now common. Prefab construction has evolved, thanks to innovation in that space, and 3D printing technology can create small homes in a matter of days. Investors have backed such projects and other construction tech startups to the tune of $3.1 billion in 2018.

> The robots are coming. But if they are to solve labor problems, the construction industry needs to make systemic changes now.

Robots on the construction site promise to slash labor expenses and work faster for longer hours. But it makes sense for construction firms today to refine what they can, rather than waiting for robots tomorrow.

The robots are coming. But if they're to solve labor problems, the construction industry needs to make systemic changes now. **GB**

Ramzi Jreidini is the CEO of Handiss, a freelance labor platform made solely for the architecture and engineering industry, where clients connect with top experts.

Resilient Housing

BUILDINGS AND SYSTEMS THAT ARE READY FOR ANYTHING

A Ranch for the Ages

The choice of metal roofing and other super-durable materials raises the bar on this ultra-modern Texas home.

Diverse structure. The home's material palette includes Texas limestone sourced directly from the property, decking wood, steel beams and a generous amount of glass. COURTESY OF PETERSEN ALUMINUM CORP.

AS MANY ARCHITECTS CAN ATTEST, designing a residence for oneself can present challenges. But architect Jack Carson rose to the occasion by creating a striking design for his new home on a ranch in beautiful Hill Country, in Central Texas. Design for the 7,000-square-foot residence follows Leadership in Energy and Environmental Design (LEED) principles and blends a unique palette of "industrial" materials with ultra-modern aesthetics.

"The house is truly on a ranch. We have cattle on the property," says Carson, president of Carson Design Associates in Austin, Texas. "We wanted to keep the design somewhat in the ranch vernacular, but with a contemporary look. The reliance on metal for the roof and cladding and an exposed structure helped create a ranch building feel. We like to think of it as an 'industrial ranch' aesthetic."

Several of Petersen's *PAC-CLAD* profiles contributed to Carson's success in delivering the desired look. Nearly 13,000 square feet of Petersen's *Galvalume Snap-Clad* panels was used to clad the roof. The 16-inch roof panels were roll-formed on site, due to extremely tight site conditions, and because the only access to the site was via a dirt road that wasn't wide enough to allow large trucks to deliver factory-formed panels. An additional 3,000 square feet of *Snap-Clad* panels was also installed vertically as siding around two garages, and at specific locations on the house as accent panels.

Precision parts. Petersen's *Galvalume Snap-Clad* panels provide a fire-resistant shell, and give the building an industrial feel. COURTESY OF PETERSEN ALUMINUM CORP.

The primary wall panel profile utilized was Petersen's *Precision Series* panels, of which 2,400 square feet of the 16-inch *Galvalume* material was installed. All wall panels were manufactured at Petersen's Tyler, Texas plant.

The on-site fabrication of the roof panels, and the installation of all roof and wall panels was performed by Dean Contracting Inc., in Kyle, Texas. "The greatest challenge was executing the architect's dream for his home," says Jesse Brown, vice president of Dean Contracting. "The design included a myriad of varying geometric shapes on many different planes and a blend of materials that required complex detailing. It was probably one of the top five most-challenging jobs that we have ever done."

Solid effort. When building his ranch home, Jack Carson opted for Petersen's **Galvalume Snap-Clad** metal roofing instead of asphalt, to give it a contemporary look, and make it as sustainable and maintenance-free as possible. COURTESY OF PETERSEN ALUMINUM CORP.

A REAL CASE OF 'HOME MADE'

The Petersen profiles highlight the material palette, which also includes Texas limestone sourced directly from the property on which the home sits, steel beams and a generous amount of glass. "We have great views into the valley with no neighbors," Carson says. "A large overhanging soffit covers a large portion of the deck and shades all of the glass."

The underside of the overhanging soffit is clad with wood that ends with an edge that Carson and Brown describe as "the wing" or "the blade." Fabricated with Alcoa *Reynobond* aluminum composite material (ACM), this transitional element smoothly links the standing seam roof with the overhanging wood-clad soffit. Petersen functioned as distributor of the *Reynobond* ACM.

The decision to use Petersen for the roof and siding was arrived at rather easily. "I was familiar with PAC-CLAD and wanted to use it, but also wanted to rely on the builder's recommendations regarding materials and subcontractors," Carson notes. "In our very first meeting, [the roofer, Dean Contracting,] brought samples of *PAC-CLAD* and recommended using it. That made the decision pretty easy."

Carson is a big believer in metal as a roofing and cladding material. "We wanted to be as maintenance-free as possible. And sustainability was an important component as well," Carson says. "We used LEED principles in our design. Metal is far greener than asphalt shingles and other alternatives. It's just a great option for residential construction."

EXPERT HELP, EXCELLENT RESULTS

The installation went smoothly, Carson adds, primarily because he relied on the expertise of Dean Contracting. "My approach is to listen to the experts," he says. "[Brown] and his crew worked out the complex detailing. They use metal all the time and are extremely capable. We collaborated as necessary, but I basically left it in their hands."

Brown was quick to give full credit to the crew that was led by Juan Rojas, sheet metal superintendent. Brown cites Rojas' attention to function and precise detailing as a main reason why the job turned out so well.

The house—in spite of its size, location in the hot Texas climate and the large amount of glass—is energy efficient. Two inches of rigid insulation was installed under the metal roof and an additional four inches of sprayed insulation went under the roof deck. "The heavy insulation and the shade provided by the overhang makes it very energy efficient," Carson says. "The house stays at a very constant temperature."

The entire property captures rainwater in 18,000-gallon collection tanks, which is yet another reason for using metal, Carson adds.

Ultimately, Carson thinks it's easier designing for yourself than for a traditional client. "I was probably more demanding in 'getting it right.' But once I knew I had the right design and materials, I didn't have to convince myself that it was the best direction," he says. "There was no negotiation or comprising the design in any way."

But the main task was keeping his goals centered, according to Carson. "The biggest problem any architect has in designing for themselves is in 'editing out,'" he says. "We know all of the possibilities, and being able to prioritize and filter out the unnecessary options is often the hardest challenge." **GB**

Article courtesy of Petersen Aluminum Corp. Peterson manufactures PAC-CLAD metal cladding products in multiple gauges of steel and aluminum. PAC-CLAD products include standing-seam roof panels, hidden- and exposed-fastener wall panels, flush panels, soffit panels, perforated metal, fascia and coping systems, composite panels, column covers, coil and flat sheet.

AD INDEX

COMING NEXT ISSUE

GREEN BUILDER®

Green Home of the Year 2021

Green Builder's annual Green Home of the Year competition highlights projects that are leading the enviro-friendly charge through technology, net zero, design and other resources. Also, meet GB's newest Sustainability Superhero.

THE FOREVER HOUSE
Remodeling for Sanctuary

Whirlpool® DUPONT BlazeMaster® FIRE PROTECTION SYSTEMS
FLOWGUARD GOLD® PIPE & FITTINGS PIONEER® LANDSCAPE CENTERS BROAN® NuTone® COME HOME TO FRESH AIR
BELGARD® PAVES THE WAY MITSUBISHI ELECTRIC rachio MSI

FOR MORE INFORMATION:

Follow the project at www.greenbuildermedia.com/revision-house-scottsdale, where you'll find updated articles, blogs, photos, videos, and performance information.

THE FOREVER HOUSE: REVISION HOUSE SCOTTSDALE

Given that buildings produce approximately 40 percent of global emissions and are responsible for 40 percent of global energy consumption, the path to a sustainable future inevitably involves the retrofitting of our existing built environment.

That's why Green Builder Media has joined forces with internationally renowned building science expert Steve Easley and his wife, Indoor Air Quality expert Susan Raterman, to retrofit a 3,050 square foot house in Scottsdale, Arizona. The goal of the project is to showcase to consumers and building professionals alike how to optimize performance, sustainability, wellness, aesthetics, intelligence, and durability in a remodeling project using the most advanced products, systems and technologies available on the market today.

Uniquely positioned on a lake in McCormick Ranch, the ReVISION House Scottsdale will showcase cost-effective strategies for achieving net zero in a remodeling project using renewable energy, efficient mechanical systems, and advanced smart home technologies. The project will also highlight trending lifestyle issues, such as health and wellness and aging in place strategies and technologies.

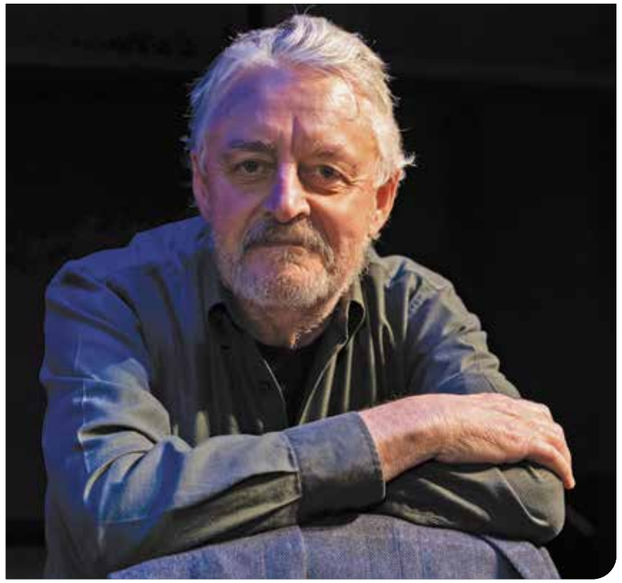
The Forever House is designed to be a truly resilient sanctuary home. It will provide everything that the occupants need for peace of mind in a chaotic world, from remote working spaces to workout rooms to onsite power and food production for enhanced self-sufficiency.

FROM THE TAILGATE

New Offerings for the Sustainable Minded

By Ron Jones

A Box of Rocks



SOMETIMES THERE IS MORE to be learned from failure than from success.

Several weeks ago, I agreed to have a group of college-age students visit us at Mariposa Meadows to provide them insight into our project there and the reasons behind it.

It seemed reasonable at the time. This was a group of students from around the country who were taking part in a program designed around what is commonly called a "gap year." This program allows a student to attend college for credits without having a lot of academic pressure or commitment as they attempt to figure out what field of study, or other endeavors, they want to pursue.

Mariposa Meadows, and our exercises in sustainable development and building there, offered a seemingly logical example for the group to explore since the students generally shared interests in conservation, sustainability and nature-based activities. The group was made up of roughly a dozen students, two adult team leaders and some local participants responsible for arranging program activities.

They arrived at around 11 a.m. and, at least in part due to current social distancing considerations, they were encouraged to explore the structures at Mariposa on their own. They could then come back together outdoors as a group so we could entertain questions and provide an overview of our project goals. In general, the students expressed appreciation for the design and execution of the buildings but didn't have a lot of questions.

While they were courteous and reasonably attentive throughout the discussion, I really never got the impression that we were connecting in any meaningful way. I tried to communicate the deeper motivations behind the project and explain our selections of materials, systems and technologies, as well as the fundamental tenets of green building and building science. But little, if any, seemed to resonate.

Eventually, we broke for lunch and then regrouped for a tour of the actual Meadows project. Here, we executed our fall plant survey, in which we take field measurements on existing grasses, orbs and shrubs to generate data that will allow us to compare the habitat's overall condition from year to year. Some of the students were actively engaged and curious but others mainly tagged along and waited for the time to reboard their transport van so they could head back to town.

Finally, I explained our irrigation improvements and the value of being able to manage the water efficiently, which greatly benefits the meadows and enhances conditions for local wildlife. But by that time, it was clear that everyone was ready to take their leave.

Feeling a bit disappointed, I walked away without even saying goodbye, though I did exchange some brief closing pleasantries with the organizers.

Later that day, I was asked how the visit had gone. I responded that it had been like talking to a box of rocks. From my point of view, it had been a complete waste of time. That dissatisfaction lingered and gnawed at me for several days and I regularly found myself reflecting on the experience, though I couldn't really explain why.

Then it all became clear. What had resulted was partly due to the absence of context. Those students had little or no relevant personal experience to draw on, so there was not a lot they could relate to. All they could do was take in the information. More importantly, I failed to find out what things they were thinking about, what they cared about, what concerned them.

At the end of the day I had simply become another rock in the box, unable to connect. It was a humbling lesson, and one I won't soon forget. I can only hope that they also found some value in our shared experience. **GB**

RENOVATING HOMES SHOULDN'T

DESTROY THEIRS.

Looks like real wood. Does real good. TimberTech is adored by homeowners and animals alike. That's because we use up to 100% recycled wood in our composite products, and no wood at all in our high-end capped polymer decking. In fact, our satisfied customers have already helped us save over 1,000,000 trees. Learn how you can give your clients the beauty and durability they want—with the sustainability the planet needs—**at TimberTech.com/Sustainability.**

TimberTech®
Go Against the Grain.™