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GREEN BUILDER®

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THE STATE OF SUSTAINABLE BUILDING 2020

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EDITOR'S NOTE

The Inside Scoop

By Matt Power
Editor-in-Chief

To House the Many, We Need Smarter Data

A perfect storm of labor, regulatory, land and materials costs have crushed the housing market to half its former size. Can data transparency revive the boom times?

BUILDERS OFTEN TAKE the heat for high housing costs. But often, they're playing the role of reactors, not actors. That's not to say there aren't some operators out there who ask too much in terms of margins and do inferior work that's destined to cause heartache for homeowners.

But by and large, these are not the readers of *Green Builder*. What's facing our sector—the high-performance segment of the homebuilding industry—are powerful external forces, including labor shortages, radical tariffs on lumber, a dysfunctional lending system and populations migrating toward urban hubs.

To borrow a little data from an article by Erik Franks, "In 2003, before subprime lenders broke the rules, half of the new homes in the country were priced below $191,000. Today, half of new homes are priced above $313,000, and 15 of the 18 largest publicly traded home builders sport an average sales price north of $365,000."

Franks notes that it's not like builders aren't trying to create entry-level product. They know that's a huge, eager market. But they can't seem to make the numbers work. In some cases, they're moving to lower-quality materials, smaller lots, less-desirable neighborhoods and so on. My concern is that this could swiftly become a "race to the bottom," where buyers end up with ticking time bombs, and builders end up with class action lawsuits.

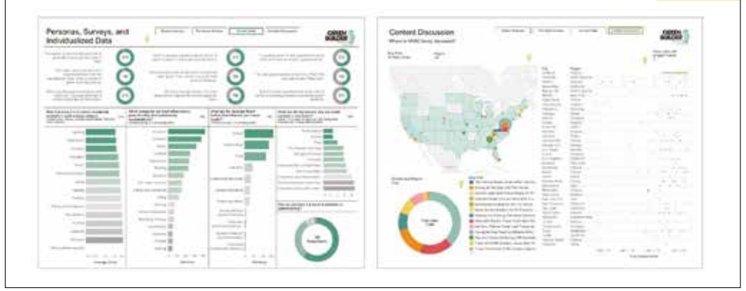
The situation clearly has to change. But how? The more we understand the forces behind the trends, the more we have the ability to make political, geographic and building science choices that will bring housing affordability back into the mainstream.

For example, why do materials cost more? Which states have the best value per acre for land? What's causing the labor shortage? Where are the "hidden" land values and untapped markets? Where do codes and sustainability intersect?

Answering questions like these is the purpose of this new addition to our *Green Builder* toolbox. Our first annual *State of Sustainable Building* report takes advantage of our proprietary data service, COGNITION Smart Data, to dig deep into the trends behind the trends.

So take a tour through the "back end" of the home building industry with us. We hope you'll come away with new ideas about how and where to bring more-diverse housing projects to your region, and a sense of where the white space of building lies. It's still a big country. Opportunities still abound, but you have to know where to look, when to act, and how to access the smart data. **GB**

COGNITION **Smart Data**



Getting 'Smart.' Data services such as COGNITION Smart Data are playing a key role in helping contractors, manufacturers and consumers understand crucial trends in sustainable building.

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- The Built Environment Today: Are we designing and constructing properly for our changing climate and growing social and economic inequity issues?

SPEAKERS:

ANDREW WINSTON, globally recognized expert on how companies can navigate and profit from humanity's biggest challenges, and author of *Green to Gold*, *The Big Pivot*, and *Green Recovery*.

ED MAZRIA, founder of Architecture 2030 and internationally recognized architect, author, educator and visionary with a long and distinguished career.

RHIANNA GUNN-WRIGHT, Policy Director for New Consensus, was one of the co-authors of the Green New Deal. A 2013 Rhodes Scholar, Gunn-Wright worked as the policy analyst for the Detroit Health Department and on the policy team for First Lady Michelle Obama.

GENE MYERS, CEO/founder of Thrive Home Builders, six-time winner of the Department of Energy's Grand Award for Innovation, and the first production builder to deliver "solar standard" homes, build net-zero communities, and use Colorado beetle-kill lumber in the construction of its homes.

KALPANA KOTAGAL is a Civil Rights & Employment Litigation Partner at Cohen Milstein. She is also the co-author of the "Inclusion Rider," and is a highly-accomplished and award-winning plaintiffs' lawyer.

JAVON JOHNSON, Ph.D. is an Assistant Professor and Director of African American & African Diaspora studies at the University of Nevada, Las Vegas. Through performance poetry and the spoken word, Johnson creatively addresses crucial social justice issues.

HOME OF THE YEAR AWARDS DINNER : JANUARY 19

Green Builder® Media's annual Home of the Year Awards are recognized as one of the industry's most innovative and important programs that identify authentic, advanced, beautiful and sustainable projects and the professionals who design and construct them.

Green Builder® Media will celebrate our annual Home of the Year Awards winners at a special VIP dinner, held on January 19 at the elegant Zappos Bistro on Zappos Campus.

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Thinking Green is Good–But Not Good Enough

Americans believe the environment's health is a big deal—but not bad enough to worry about.

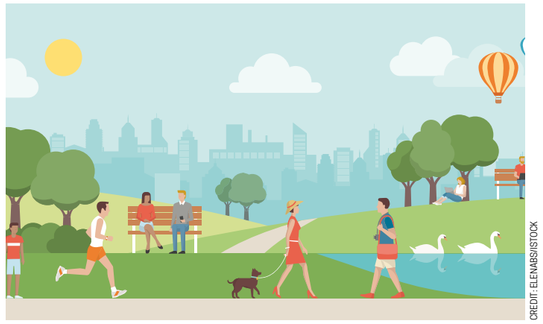
A GROWING NUMBER OF AMERICANS believe we're trashing the planet, but more than half don't see an urgency to act, according to a research report from Living Standard and the U.S. Green Building Council (USGBC). And, only half of the report's respondents say it's important to improve a building's health conditions.

According to Mahesh Ramanujam, president and CEO of USGBC, 82 percent of respondents believe environmental problems are "very" or "somewhat" important, an increase of 8 percentage points in the six months since USGBC began conducting this research. However, of those, only 49 percent are in the "solve right now" camp, while the other 33 percent are pretty much of the "solve when possible" philosophy, USGBC notes. This suggests that the overwhelming pro-environmental majority is not all alike, and that people view environmental matters with different levels of intensity,.

Meanwhile, when asked how often they think of the impact of the buildings they spend time in upon the environment and their health, 39 percent of respondents said they never considered it or do not know. The lack of awareness is significant, yet 50 percent consider it very important that green buildings improve health, USGBC notes.

Overall, the research suggests the simplest way to connect with others on the importance of the environment is to frame the conversation around people and the health, safety and wellbeing of their friends and families.

"Sustainable spaces help reduce the immediate and direct health outcomes that environmental problems create, as well as provide important economic benefits for neighborhoods and cities," Ramanujam says. "But to make real progress, convince the public of the reality of climate-related threats and increase demand for green buildings, we've got to empower and mobilize those beyond our community to get involved and take action."



CREDIT: ELENABSI/ISTOCK

Fine for now. Contrary to logic, much of the public does not consider environmental health to be a critical issue to contend with, according to a new U.S. Green Building Council (USGBC) survey.

The report is available at **https://livingstandard.org/standard-issue**.

Structural Algae

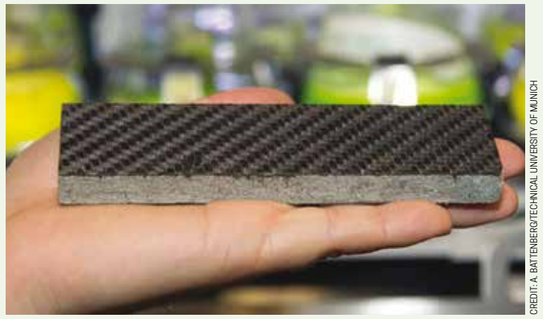
Could super-strong algae-based fibers one day replace steel and concrete?

RESEARCHERS AT TECHNICAL University in Munich (TUM) have developed a way to create a lightweight, industrial-grade material made from algae that is as strong as steel.

According to Prof. Thomas Brück at TUM's Algae Cultivation Center, the process uses algae oil to create polyacrylonitrile, carbon fibers which can then be woven into bricks suitable for use in cars, airplanes and buildings—or in this case, a TUM e-scooter. Producing the fibers uses less energy and generates less carbon pollution than creating concrete or steel. The fibers also absorb and entrap CO_2 as the algae grows, making for easy disposal when ready. The carbon fibers can be ground up or even simply stored out of place as desired.

"When you make plastics from carbon dioxide, it is quickly returned to the atmosphere through waste incineration plants following a few years of use," says Dr. Kolja Kuse, a second project researcher. "With the final safe storage, we remove the carbon dioxide from the atmosphere for millennia. This also makes the process clearly superior to carbon capture and storage in the underground."

Brück notes that it will take quite a while to cultivate enough algae to launch such an industry. But when ready, "this new technology could create strong industrial materials that also benefit the climate," he notes.



CREDIT: A. BATTENBERG/TECHNICAL UNIVERSITY OF MUNICH

Solid state. *Don't let looks deceive you: This brick, made from algae oil, is strong as steel, and absorbs CO_2 as it's formed.*

CREDIT: NICK TAFT/FLICKR

City of EV lights. San Jose, now California's third-most-populated city, is the nation's largest when it comes to requiring electric vehicle compatibility in all new construction.

San Jose Makes Way for EVs

California city sets the path for electric vehicles in all U.S. municipalities.

SAN JOSE, home to more than 1 million people, is now the largest U.S. city to pass building codes encouraging all-electric construction. The building "reach code," passed unanimously by a bipartisan city council, will "slash climate pollution from new construction and deliver significant health benefits to residents," according to Mayor Sam Liccardo.

The ordinance, which takes effect in January 2020, requires new multi-family buildings to include 70 percent of parking, as electric vehicle (EV)-capable spaces, at least 20 percent as EV-ready spaces and at least 10 percent as full EV service equipment spaces. "Studies show that transitioning to clean electricity-powered appliances in new construction will allow developers to build more quickly and affordably," Liccardo says. "This will also save homeowners considerable cash."

Before the end of 2019, the city council also plans to consider the phase-out of gas infrastructure in single-family and low-rise residential new construction. If approved, the requirement will take effect in January, Liccardo adds.

Natural Resources Defense Council (NRDC) senior scientist Pierre Delforge notes that the growing interest in electrification of buildings and transportation is a sign that local governments are reacting to a lack of action at the federal level. "We do expect this is the kind of climate action that cities can own," says Delforge. "At a time when the federal government is trying to repeal climate policies, cities are stepping up and doing their own thing." **GB**

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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."

PAGE 36

TABLE OF CONTENTS

FEATURES

THE STATE OF SUSTAINABLE BUILDING 2020 13
Green Builder's first look at a spectrum of megatrends—labor shortages and rising material costs, indoor air quality, connected living, and clean water—that will shape housing trends for decades to come.

The Back Story: Labor, Materials and Land Costs 14
The trifecta of money-related pressures has dramatically limited the number and types of new homes being built.

A Shifting Marketplace 20
Consumers now call the shots when it comes to specifying products for their homes, and they're willing to spend more to save more.

Connected Living Comes of Age 24
As connected living becomes the new normal, Americans are on track to spend billions on smart home devices by 2023.

Water: A Balancing Act 28
The increasingly limited availability of water will make future construction efforts even more challenging.

Indoor Air Pollution: New Threats and New Tools 32
Indoor air quality has gone from 'nice to have' to 'absolute must.' For some consumers, it's now as important as location when buying a home.

A WINNING PAST 36
As *Green Builder*'s Green Home of the Year 2020 competition draws near, we take a look at several of 2019's finalists to see what made them so special.

PACKAGE DEAL 40
This living laboratory is a home performance triple play: zero energy, zero water and zero sewer.

THE VISION HOUSE: TRIPLE PLAY 46
Energy, air quality and connectivity are key areas residential homebuilders need to address. The VISION House® Seattle Cascades project embodies all of them.

DEPARTMENTS

EDITOR'S NOTE 02
GREEN BUILDING NEWS 06
INTERNET OF THINGS 52
FIELD NOTES 54
SMART CITIES 58
CODE ARENA 60
TAILGATE 64

HERE'S A SAMPLE OF WHAT'S INSIDE

"Water is the most basic of all resources. Civilizations grew or withered depending on its availability."

PAGE 28

ON THE COVER

THE STATE OF SUSTAINABLE BUILDING 2020

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THE STATE OF
SUSTAINABLE
BUILDING 2020

Make Way for the Megatrends

Green housing faces tough challenges in the years ahead. Are you ready?

BY GREEN BUILDER STAFF

THERE ARE TRENDS, and then there are megatrends. A series of gradually warming days in a region over one summer is a trend. Global warming, occurring everywhere and impacting everyone long term, is a megatrend. According to our research, the green building industry has several of the latter.

Green Builder Media's suite of market intelligence services, COGNITION Smart Data, uses Artificial Intelligence and the logic of IBM's *Watson* to mine web and social media content. Through COGNITION, we can take a deep dive into the data behind critical market dynamics that every building professional should be aware of to make informed business decisions. We're currently watching a spectrum of crucial megatrends that will undoubtedly impact the housing industry for years to come: labor shortages and rising material costs; indoor air quality; connected living; and clean water. Our findings follow.

The Back Story: Labor, Materials and Land Costs

The triple impacts of a labor shortage, rising material costs and out-of-sight land costs has dramatically limited the number and types of new homes being built.

HOME BUILDING has undergone massive changes over the last few years. As mentioned in the Editor's Note (page 2), far fewer homes are being constructed now, at far higher price points. Home ownership has declined, renters are on the rise. Scarcity of housing, especially in urban markets, has inflated rents and home values, leaving a large segment of the population on the sidelines.

CONSTUCTION OCCUPATION	TOTAL	NO HS DIPLOMA	IMMIGRANTS SHARE
General Laborer	1,849,815	30.7%	34.1%
Carpenters	1,097,577	25.2%	27.6%
Painters/Paperhangers	575,490	36.7%	42.6%
Roofers	237,133	45.6%	43.5%
Drywall Installers	152,939	43.3%	49.2%
Carpet/Tile Installers	152,658	37.3%	41.0%
Stucco Masons	36,339	47.3%	59.0%

SOURCE: NATIONAL ASSOCIATION OF HOME BUILDERS

Immigrants matter. Nationwide, homebuilders have become highly dependent on reliable, low-cost immigrant labor.

LABOR WOES

There's plenty of blame to go around for the lack of construction laborers. First, there was the building boom, followed by the recession. According to the National Association of Home Builders (NAHB), about 1.5 million workers left the industry between 2007 and 2009, and many never came back.

Housing starts (single- and multi-family) have picked up to a pace of 1.2 million a month, more than twice as many as at their trough in April 2009. However, the number of *nonsupervisory workers* in residential construction has increased by only 40 percent since 2011.

The immigrant labor issue is a complex one. The *Los Angeles Times*, for example, asserts that the reason immigrant labor became so important in homebuilding was because contractors and their corporate clients, for 10 years, worked hard to undercut unionized labor—and immigrants rushed in to fill the gap at a lower cost per hour.

The reality, of course, is that many immigrants—legal and otherwise—such as tile setters and roofers, offer extreme proficiency at low cost. They've been the backbone of the building industry for more than a decade. They keep the building timeline on track by meeting or exceeding project deadlines, which increases builder profits.

Skilled trades, immigrant and otherwise, have also become scarce. According to *The Washington Post*, global staffing firm Manpower Group reported that skilled trade vacancies are the hardest jobs in the country to fill. Skilled trades (electricians, carpenters, welders, bricklayers, plasterers, plumbers, masons and more) have maintained the No. 1 position in vacancies from 2010 to the present.

According to the Dallas Builders Association, the labor shortage alone has added $6,000 to the cost of a new home, due primarily to delays in completion.

Given this scenario, *reducing the overall need for labor* has become an important goal to those companies that survived the last recession. This has loosened the normally conservative approach to building systems and products. Structural Insulated Panels (SIPs), Insulated Concrete Forms (ICFs), and less-known panelized systems, for example, are getting a long overdue second look.

MATERIALS: HIGHER PRICES STEER BUILDERS TO ALTERNATIVES

Along with lack of workers, other forces have made alternatives to stick-built homes more attractive. For example, according to the NAHB, President Trump's tariffs on Canadian lumber alone have added another $9,000 to the cost of each new home. And it's not just lumber. The tariffs have had a ripple effect on engineered wood products, including plywood and cabinets.

The silver lining to higher material costs is that it's become incentive to try alternative systems.

CREDIT: COURTESY OF PREMIER SIPS

Electric ready. Precut chase cavities in this Premier SIP will save electricians from drilling hundreds of holes through stud framing.

SIP SOLUTIONS

SIPs, for example, have seen a marked increase in market share. The ability to buy Oriented Strand Board (OSB) in bulk has largely shielded SIP makers from major price hikes. Add to that the labor savings for new home construction with SIPs, and these products have actually benefitted from the political climate.

By some estimates, builders may save as much as *nine days of labor per home* on framing and inspection time on a 2,500-square-foot home built with SIPs, compared with conventional framing, according to the Structural Insulated Panel Association (SIPA). The Association compared SIP construction with typical stick framing, and found that "the reduced time for framing, electrical, and insulation labor saved $3,440 per home."

The biggest learning curve for stick frame builders switching to SIP systems may be the level of planning. To use SIPs most efficiently, panels must be sized and built in the factory, and should include important details such as electrical and plumbing chases.

This results in a zero-waste jobsite, and close tolerances for all parts of the envelope. This, in turn, reduces the labor required to achieve the necessary air sealing for zero net energy performance.

ICF INROADS

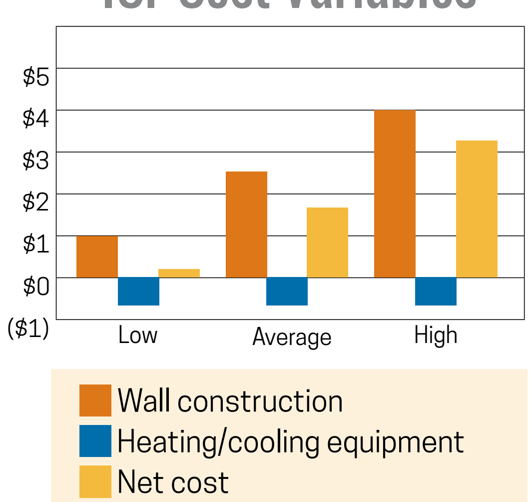
Makers of Insulated Concrete Forms (ICFs) also have attracted new clients, thanks to material and labor pressures. HUD estimated back in 1998 that an ICF home (prior to the current labor shortage) would cost about 3 percent more than stick framing with 2-by-6 lumber.

Other, more-recent estimates put the cost difference lower. *Concretebuilding.org* suggests that building walls of ICFs adds $1 to $4 per square foot over stick framing. But since ICF buildings are more energy efficient, the heating and cooling equipment can be smaller than in a frame structure. This can cut the cost of the final building by an estimated 75 cents per square foot, so the net extra cost is about 25 cents to $3.25.

That cost gap for materials has closed as lumber prices have risen. But the real value in ICFs, according to advocates, may go to the homeowner, not directly to the builder. For example, *concretenetwork.com* suggests that in reality, "you may save money by building with concrete when you factor in lifecycle costs, utility and insurance savings, maintenance requirements and overall health of the occupants."

Hurricane armor. ICFs have done remarkably well in major hurricanes, and insurers are beginning to take notice. Some companies now offer ICF homeowners insurance discounts.

ICF Cost Variables



HVAC dividend. One way ICFs save on overall construction costs is by reducing the need for larger-capacity heating and cooling equipment.

ICFs are also appealing because of their extreme resilience in hurricane and flood events.

The only caveat with ICFs is that detailing involves many additional components. For example, finishing doors and windows, sealing penetrations, bracing for the pour and so on add time and expense.

Here's what one experienced builder noted as "extras" associated with an ICF project:

- Rented or site-built bracing
- Foam gun and a lot of cans of foam to fill voids
- Material for door and window framing
- Clips to keep ICFs from floating
- Wire ties in the corners
- Sill material at the top of the wall, and fasteners such as J-bolts to secure it
- Ledger system for the floor(s) and related hardware

Share of Builders Reporting Shortages

OF RESPONDENTS WHO PURCHASE THE MATERIAL

Framing Lumber	31%
Trusses	24%
Steel (light for framing)	20%
OSB	20%
Plywood	19%
Gypsum wall board	18%
Cabinets	17%
Steel beams	17%
Millwork	16%
Clay brick	16%
Windows and doors	15%
Roofing materials	13%
Ready-mix concrete	13%
Insulation materials	12%

Structural insecurity? Nearly one-third of builders have recently experienced shortages in framing materials.

SOURCE: NAHB 2018

Land Costs, State by State

STATE	VALUE PER ACRE ($)
Wyoming	1,558
New Mexico	1,931
Nevada	2,116
South Dakota	2,135
Montana	2,283
North Dakota	2,517
Nebraska	2,936
Idaho	3,435
Kansas	4,220
Arizona	4,328
Utah	4,664
Mississippi	5,565
Maine	6,142
Colorado	6,462
Oregon	6,503
Iowa	6,590
Arkansas	6,739
Kentucky	7,209
Missouri	7,233
Oklahoma	7,364
Vermont	7,439
Texas	7,542
Minnesota	8,191
Wisconsin	9,924
West Virginia	10,537
Louisiana	12,008
Georgia	14,242
Tennessee	14,411
North Carolina	16,230
Washington	16,752
Indiana	16,903
South Carolina	17,610
New Hampshire	19,480
Virginia	21,921
Illinois	23,492
Michigan	23,765
Florida	28,961
Pennsylvania	31,923
Ohio	32,077
California	39,092
New York	41,314
Delaware	57,692
Maryland	75,429
Massachusetts	102,214
Connecticut	128,824
Rhode Island	133,730
New Jersey	196,410

Complex variables. While high land costs seem intuitive for small, densely populated states, the reasons are more complex. Lifestyle, economic opportunities, local climate and building codes often raise or lower local land costs. SOURCE: "NEW ESTIMATES OF VALUE OF LAND IN THE UNITED STATES," BUREAU OF ECONOMIC ANALYSIS, AND *USA TODAY*

Different ICF products, of course, have their own solutions for some of these detailing needs, and you may be able to reduce or avoid certain extras if the ICF maker has integrated a solution into the products. But the point is that erecting an ICF home is not simply a matter of stacking hollow blocks and pouring cement. If you plan to use unskilled labor and switch to ICFs to get around the labor shortage, you probably won't achieve the immediate price parity or time savings over stick framing.

As your crews become more experienced, however (based on the experience of other builders), your labor hours should shrink and the ICF option becomes more efficient in terms of your scheduling and costs.

Of course, it's not just lumber and OSB that have seen price escalation, and not every material has an equitable replacement. For example, metal roofing is hard to beat in terms of durability and performance. But higher steel costs have forced builders into a corner: pay more for metal, or switch to less-sustainable products such as asphalt.

This choice, at best, leads to builders passing on the additional costs to the buyer, and feeds into the bigger issue of ballooning home costs. Higher material costs create yet another obstacle to affordable housing.

LAND: SCARCE AND COSTLY

The final pressure in the trifecta of forces driving home prices up is land. Historically, land almost always increases in value over time. It's a favorite safe haven for investors. A comprehensive study of the value of land used for construction of housing found that land prices increases have actually outpaced home price hikes since 2012.

A less-sophisticated analysis of the average cost per acre in each state (see sidebar) is also revealing. While some of the data is intuitive (e.g., New Jersey has high land costs, because it's a small state with a large population), other data is less predictable. For example, land in Texas remains comparatively affordable, despite that state's rapid and ongoing growth. Certain regions, such as Central Texas (greater Austin) are among the nation's "hottest" areas with regard to home sales.

Urban areas have seen the greatest increase in land value. This is in part because desirable metro areas have begun to reach their maximum buildout, based on local zoning, to the point that teardowns often offer the only viable way to break into an existing neighborhood.

But higher land costs can't always be pinned on population pressures. Often, archaic zoning has locked out a significant area of buildable properties.

For example, in Portland, Maine, dozens of unrecognized streets, sometimes called "paper streets," have stymied homebuilders. The issue is related to the building code. In the mid-1980s, planners added a clause to the local code that requires any would-be developer to upgrade the *entire* street with curbs and pavement before adding even one new home.

Ironically, many of these unofficial streets are already maintained by the city, with snow and trash removal, and water and electric services on hand—and existing homes in place.

Green Builder Media analyzed one neighborhood in Portland, the Riverton area. By combining Geographic Information System (GIS) mapping with city records, we counted 300 empty, potentially buildable parcels in this small area alone. This suggests that there may be room for many times that number of new projects, if the building code were changed.

Instead, one of the handful of legally "buildable" lots in the city sold recently for about $90,000.

Portland is just one example of how outdated codes and rules have made the housing crisis worse. But unlike labor and material costs, it's an area where building pros can make their voices heard, and push for solutions that could make other types of housing possible.

COGNITION Key Fact: Reliability Blues

Even when building companies do manage to fill labor openings, they're unhappy with the performance of their hires:

Q: WHAT IS THE BIGGEST ISSUE THAT YOUR COMPANY STRUGGLES WITH?

STATE	VALUE PER ACRE ($)
Labor shortages/lack of skilled labor	33.54%
Unreliable contractors	16.46%
Rising construction/ labor costs	9.49%
High material costs	2.53%
Access to buildable lots	2.53%
Stringent codes	5.06%
Access to capital	6.96%
Other (please specify)	11.39%

SOURCE: COGNITION SMART DATA

COGNITION**Smart Data**

CREDIT: NELSON MINAR/FLICKR

Growing pains. With many cities reaching maximum buildout, suburban areas are exploding in popularity--bringing higher property values and ecological pressures with them.

A Shifting Marketplace

Consumers now call the shots when it comes to specifying products for their homes, and they're willing to spend more to save more.

Information society. Greater access to real-time data has turned consumers—especially Millennials and Generation X—into a wiser, more-demanding group.

CREDIT: LILDMYLASUPYNSKAHISTOCK

GREEN BUILDER MEDIA has been surveying readers for more than a decade, asking how much of an impact consumers have on product specification decisions. Ten years ago, builder and architect respondents indicated that homebuyers only influenced such decisions 10 percent to 20 percent of the time, and that was generally in categories such as appliances and finishes.

As the internet has evolved, now offering access to real-time information and product reviews, so, too has consumers' level of involvement in specifying products for their homes. Armed with research, recommendations and targeted information to justify purchase decisions, consumers are selecting specific brands and products—even in categories like insulation—that they never used to touch.

Today, survey respondents (across all audience segments—trade and consumer) indicate that consumers engage in product specification decisions nearly 70 percent of the time, and that they're willing to spend money on products that increase the sustainability, efficiency and health of their homes.

In fact, according to the National Association of Home Builders (NAHB), 50 percent of consumers want net-zero energy homes and will spend up to $9,000 in products that will increase energy efficiency. And COGNITION Smart Data shows that nearly 70 percent of homeowners are investing in products that improve indoor air quality.

This shift in consumer mindset—and spending—is transforming the way we value our homes. We're moving away from the antiquated upfront cost and price per square foot metrics and towards something entirely different that incorporates quality, performance, intelligence, resiliency and wellness.

Homebuyers across all housing categories realize that upfront strategic investments will increase the long-term value of their homes, enabling them to save money on energy, maintenance and operations; keep their families healthy and safe; protect their homes from natural disasters; and save time by streamlining daily chores.

RAPID RESPONSE

It's a new frontier for smart, sustainable, and affordable products and technologies, and savvy manufacturers and building professionals are capitalizing on shifting paradigm.

Manufacturers are moving at warp speed to develop innovative products that address a spectrum of market trends, solving for labor shortages, achieving net zero energy goals, and creating healthy spaces.

Building professionals are also deploying innovative approaches to sustainability to differentiate themselves from their competition, enhance value and increase revenues, including integrating services—like solar and smart home technology installation—to expand their portfolio of services.

THE STATE OF SUSTAINABLE BUILDING 2020

What makes you loyal to a brand?

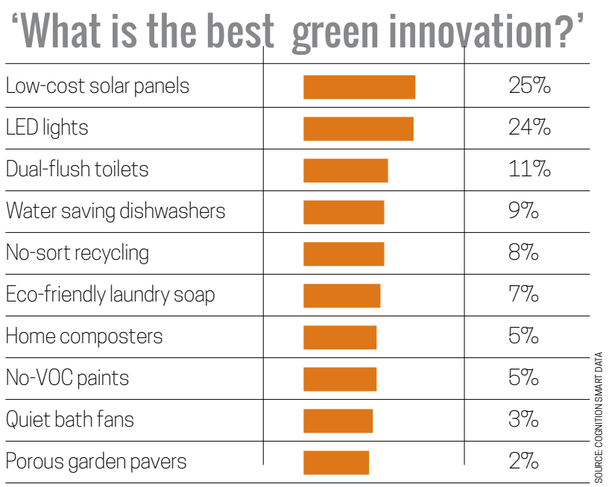
Quality	9.6%
Performance	8.8%
Price	7.4%
Customer Service	6.4%
Features	6.2%
Ease of installation	5.8%
Warranty	5.6%
Sustainability	5.5%
Pre-purchase support	4.2%
Post-installation support	3.5%
Resale value	3.3%

Quality counts. Price is no longer king—consumers now indicate that they value brand attributes like quality and performance over price.
SOURCE: COGNITION SMART DATA

What's your No. 1 energy-saving tool?

Insulation	15%
Windows	12%
HVAC	11%
Appliances	9%
Lighting	8%
Roofing	8%
Structure	7%
Paints and Adhesives	6%
Hot water systems	5%
Siding	4%
Flooring	4%
Home Automation	3%
Plumbing Fixtures	3%
Faucets	2%
Decking	1%
Cabinets	1%
Countertops	1%

Building science savvy. No longer relegated to the domain of countertops and finishes, consumers understand how important high-performance building envelope and mechanical systems are to the sustainability and efficiency of their homes.
SOURCE: COGNITION SMART DATA



Lighting things up. Consumers think that low-cost solar panels and LED lights are some of the best green innovations on the market today. SOURCE: COGNITION SMART DATA

THE FUTURE IS (NET) ZERO

It's a simple equation: consumers understand that energy efficiency-related products, like enhanced building envelope and mechanical systems, will save money.

The energy revolution is well underway, and efficiency and renewables are top of mind for consumers.

POWER TO THE PEOPLE

From coast to coast, energy efficiency has become a top decision-making factor when purchasing a home. COGNITION research indicates that, in many markets, a growing number of consumers claim that they won't even consider buying a home if it doesn't have energy-efficient products. In fact, they say that efficiency has become as important as location when making home buying decisions.

The blend of exploding consumer demand, increased energy efficiency investments (which reached a whopping $11 billion in the U.S. in 2018), demand-side energy management programs implemented by utilities and municipalities, and ratcheted codes and mandates has facilitated a massive transition to net zero energy homes and buildings.

The number of net zero residential structures in the U.S. and Canada grew by 59 percent in 2018 (when compared to 2017) according to the Zero Energy Residential Buildings Study, recently published by Team Zero.

"Net zero is becoming normalized as people gravitate to the concept," says Ann Edminster, Founder of Design AVEnues LLC. "The market is exploding across the U.S. and Canada, irrespective of location, climate and political jurisdiction. It's important to understand that zero energy isn't just for boutique, high-end homes—it's available for market rate and affordable housing projects as well."

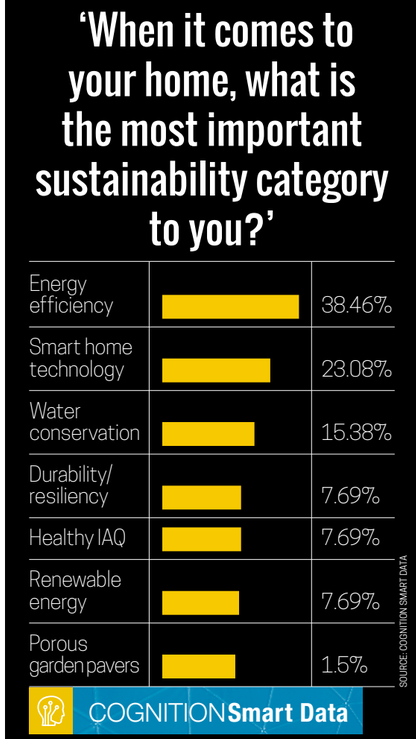
This transition to zero will continue to drive further innovation in high-performance products, renewable energy and automation technologies, estimated by Grand View Research Inc. to reach $78.8 billion by 2025.

Some industry experts anticipate that net zero requirements will begin to appear in codes as quickly as the 2024 or 2027 cycle, especially as states like California New York move aggressively towards full electrification of both buildings and transportation systems.

Beyond the net zero energy revolution, we can expect to see further market shifts as awareness about healthy homes, connected living, and the urgent need to solve for water continues to snowball. Expect to see impactful innovations and more-stringent codes in all of these areas coming to a municipality near you soon.

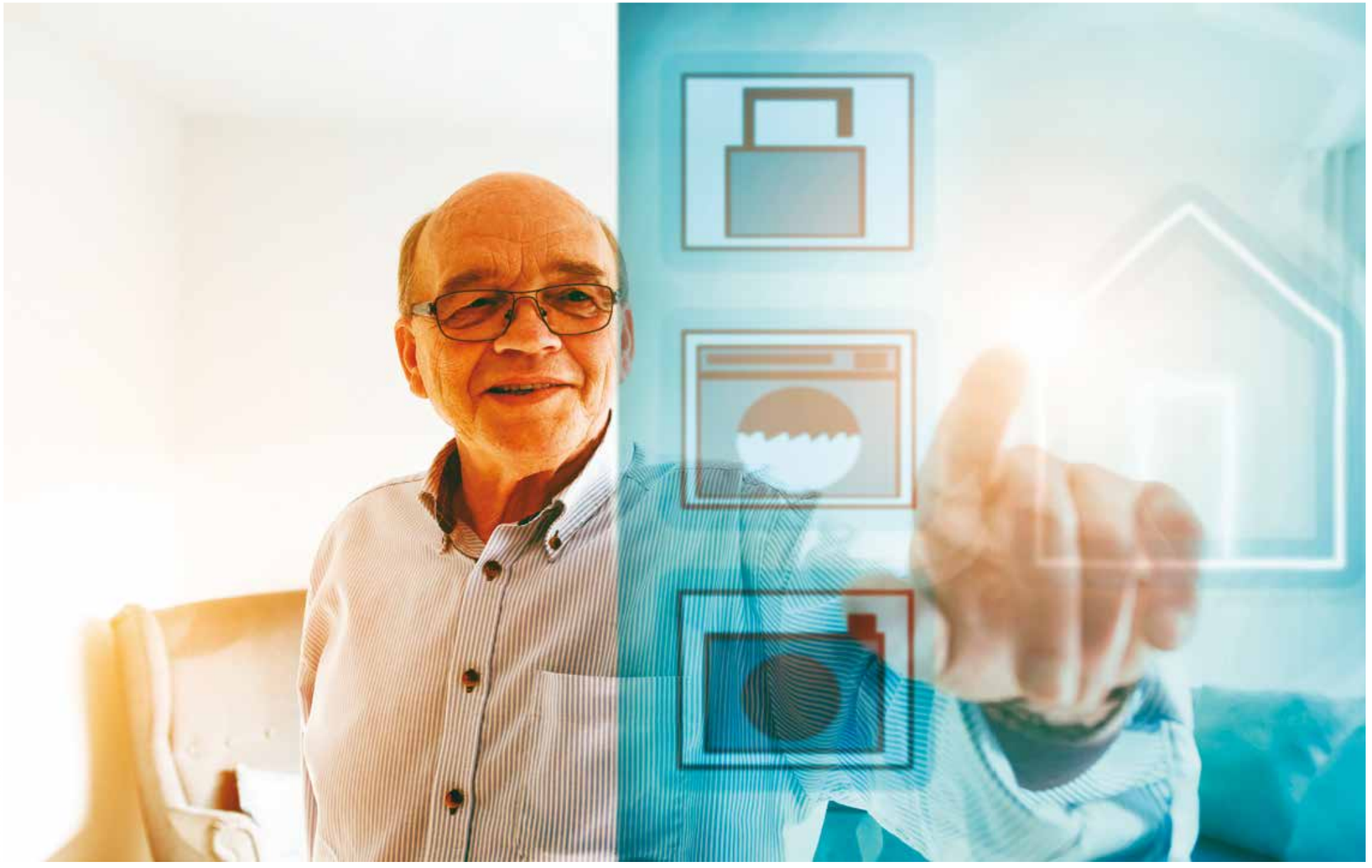
COGNITION Key Fact: What Matters Most

Consumers now recognize smart home technology as a pathway to better energy performance, a welcome mental shift for products once known primarily for their entertainment value.



Connected Living Comes of Age

Americans will spend $90 billion on smart home devices by 2023, as connected living becomes the new normal.



CREDIT: MIKKEL WILLIAM/ISTOCK

CALL IT A CASE of "getting smart." According to COGNITION Smart Data, nearly 40 percent of Americans currently use smart technology in their homes, and acceptance continues to grow. About 65 percent of homeowners own a smart home device or plan to purchase one this year. Once a homeowner purchases one smart home device, they are 70 percent likely to purchase another one. And 60 percent of homebuyers say they will pay more for a smart home.

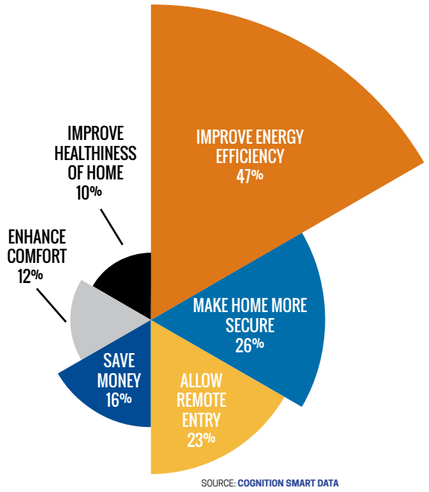
Yet, that's not to say the wholesale conversion to Wi-Fi-enabled living is a done deal. Important concerns about privacy and "hackability" still need better solutions. A fair assessment of public attitudes toward smart home technology at this point might be "cautiously fascinated."

Two demographic groups play a key role in this emerging market: Millennials and Active Adults.

Millennials, representing about 83 million Americans, ages 25-39, have grown up with technology—it's in their DNA. Thirty-seven percent of them are now in the housing market, and 74 percent of those say they are looking for a home with smart features.

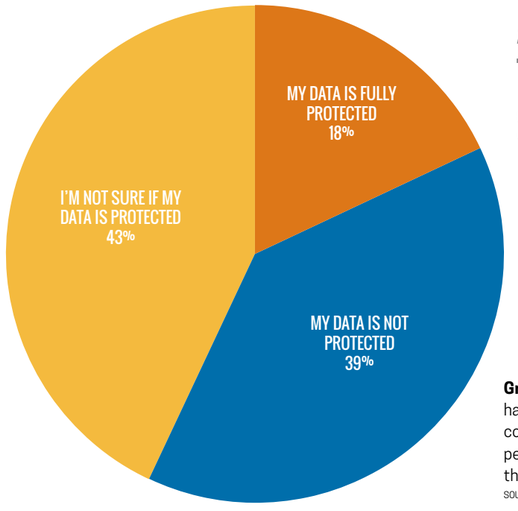
The other group, Active Adults, includes a record 46 million people age 65 and older in the U.S., a number that is projected to grow to more than 67 million by 2050. These Active Adults (and their caretakers) are embracing smart home technology that can

Why Consumers Buy Smart Technology



SOURCE: COGNITION SMART DATA

Attitudes Toward Data Security



Gray area. Clearly, smart tech has a long way to go before consumers trust that their personal data is safe using these devices.

SOURCE: COGNITION SMART DATA

Consumer Feelings About Connected Living

Great, Definitely Makes Life Easier	38%
Good, But Not Sure of Impact	37%
Neutral	18%
Skeptical	6%

Mixed verdict. Not all users of smart tech are sure if it improves their daily life cycle. This is an area where manufacturers need to make a better case.
SOURCE: COGNITION SMART DATA

help them age in place and stay in their homes longer, adopting a range of Assisted Living Technologies (ALT) such as motion sensors, fall detection devices, health monitors and prescription dispensers. While these technologies do require an upfront investment, it's only a fraction of what it costs to place an individual in an assisted living facility.

SECURITY: THE GREAT UNKNOWN

Security is the No. 1 purchase consideration for consumers with respect to smart home devices, but it is also the elephant in the room. Metadata collection and privacy concerns are top of mind across all consumer audience segments.

Homeowners want their smart home systems to protect their data and detect dangers in the house (fire, intruders, etc.) and send alerts. They're also looking for proactive systems that can protect their homes from things such as poor indoor air quality, water leaks and mechanical equipment malfunctions (with diagnostics that can alert a homeowner before an air conditioner or water heater breaks down).

The technology exists to address these privacy concerns, but so far, what's often lacking is the will. This is in part because many companies use the data they collect from smart devices to inform their marketing efforts, or as a secondary product to sell to other companies. If they're not willing (or compelled by new laws) to change this

COGNITION Key Fact:

Millennials are Key to Connected Living Growth

Forty-seven percent of Millennials already own a smart home device.

Millennials: First In

SOURCE: COGNITION SMART DATA

Millennials have embraced connected living devices early. They grew up with phones and tablets in their hands, so they're open to extending control over their living environment. They now comprise 37 percent of the housing market, and 74 percent of them plan to buy a home in the next five years. About 43 percent of Millennials say they will be looking for smart features when they do buy a home.

Primary Frustrations with Smart Tech

Won't Connect with Other Devices/Hub	37%
Unforseen Glitches	34%
Address Security	26.2%
Batteries Don't Last Long	17.7%
Not Intuitive	14.2%
Difficult to Use	13.8%
Doesn't Work as Advertised	8.3%

Too many standards. The current level of fragmentation in the smart device space, pertaining to device integration as well as the lack of unified technology platforms, standards and protocols, needs to be addressed by manufacturers, policy makers and building professionals alike—and quickly. SOURCE: COGNITION SMART DATA

approach, the question is whether their buyers will ultimately consider the loss of privacy too high a cost for the convenience of connected living.

On the technical side, however, many of the roadblocks to connectivity are disappearing. Technological advances, have begun to eliminate integration issues by allowing devices to talk directly to one another; enhanced intelligence systems that process behavioral patterns and create intuitive experiences for homeowners; local data processing (on a home level rather than in the cloud) to address privacy concerns; and a transition from personal computing (one person controls one device) to communal computing (several people can control devices in a shared space.)

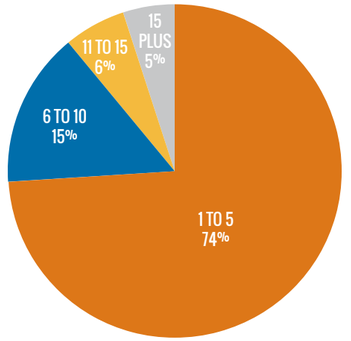
While these advancements sound complex, the general market movement in the smart home space will actually be towards further simplification and unification of protocols, hubs and devices.

U.S. Market Smart Device Penetration

Water (leaks & irrigation)	10 million
Smart Plugs	11 million
Carbon Monoxide/Smoke Detector	12.3 million
Audio	14.2 million
Lighting	19.1 million
Energy (thermostats/monitors)	19.6 million
Home Security (lock/cameras/sensors)	22.5 mllion

Security first. Although home security is the entry point for many homeowners, other technologies are rapidly gaining acceptance.

Avg. Number of Smart Devices in Home



Time Savings: A New Angle for Smart Appliances

New devices aim to help with mundane tasks.

CONNECTED APPLIANCES SUCH as ovens, dishwashers and clothes dryers now include smart features such as smartphone-based remote controls, self-diagnostics, sensors and alerts. As connected tech in the home evolves from novelty to invisible helper, the brands and products that flourish will reduce time spent on mundane chores.

How much time? More than half of Americans surveyed say that having smart products in their home saves them about 30 minutes per day, which equates to 182.5 hours a year, or roughly a week and a half of time bought back.

To illustrate, let's look at time management in a connected kitchen. Kitchens are home to three

COURTESY OF SAMSUNG

Fast top. Induction cooktops, such as this model from Samsung, have matured. This model includes a virtual flame illusion for people used to cooking on gas.

time-consuming tasks: meal planning, grocery shopping and meal preparation/cooking. The right technology can shave precious minutes from these mundane tasks. Here's how:

Let's begin with smart refrigerators. The latest models include built-in barcode scanners, smart screens, interior cameras and more. They can inform the homeowner about which products need refilling, which ones are past their expiration date, and more. These appliances streamline the shopping process, saving time driving, shopping and refilling regularly used items.

Smart dishwashers, as another example, can optimize water use, detect how dirty dishes are, and remind users that they left a full load ready for use.

Electric cooktops, as another example, can combine induction technology with smart connectivity. Induction tops heat up much more efficiently that element stoves, and can ultimately run on clean, renewable electricity, not natural gas. With induction, homeowners can prepare meals more quickly, at less resource cost.

Water: A Balancing Act

Two-thirds of Earth is water—yet its increasingly limited availability will make future construction efforts even more challenging.

CREDIT: NICOLAS_JUSTOCK

Precious resource. People take the availability of clean water for granted. But a changing climate and tougher government regulatory stance could make the public really value every drop.

DR. NATHAN W. SNYDER may have said it best: "Water is the most basic of all resources. Civilizations grew or withered depending on its availability."

That statement, made by Snyder when he was an environmental engineer for The Parsons Company, has been quoted numerous times over the decades—probably because it's true.

Water has become the most pressing issue of our time. If you're in the building industry, you know its importance: Simply put, if there is no water, there is no interest in homebuying. No homebuying, no homebuilding. No homebuilding, no business.

Mother Nature, with its gift of multi-year droughts, has been a tough-enough challenge for the construction industry to overcome. But rapidly changing water-related codes, mandates, programs and pricing will continue to place new demands on the building sector, impacting every home and building.

Green Builder Media and COGNITION Smart Data have studied the problem and discovered numerous issues. Here's some of what was found.

What Makes People Buy Water Technology?

Safety tool. Green Builder Media's consumer survey places security above all other reasons for investing in any water-related technology. Totals shown are the numbers of responses gathered from January to August 2019.

SOURCE: COGNITION SMART DATA

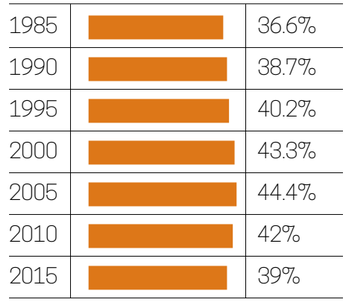
THERE'S NOT ENOUGH TO GO AROUND- AND WHAT'S THERE ISN'T ALWAYS USEFUL

Due to the combination of increased water consumption, climate change, pollution, poor infrastructure, and weak governance, nearly two-thirds of the global population lives in water-stressed areas, making the need for innovative water solutions dire.

According to the United Nations, humans withdraw about 4,000 cubic kilometers of water globally every year (approximately the volume of all the water in Lake Michigan)—triple what we withdrew 50 years ago. Water consumption continues to increase at an annual rate of about 1.6 percent.

Within the U.S., demand for water is exploding as our population swells, especially in water-parched areas like the Southwest and West. By 2030, experts predict more than 100 percent growth in states like Nevada and Arizona, 60 percent in Texas, and upwards of 30 percent in California and Colorado. Many states throughout the nation are exploring stringent policies, programs and pricing to proactively solve for the water predicament.

Low Supply, High Demand



Diminishing returns. The nation's water supply grew steadily until nearly 15 years ago, when population growth and drought finally impacted what's underground and in the mountains. Available water dropped by more than 13 percent from 2005 to 2015. Totals reflect billions of gallons per day.

SOURCE: U.S. GEOLOGICAL SURVEY

Like most countries across the globe, the U.S. isn't just struggling with water quantity, but quality as well. Dilapidated infrastructure and agricultural practices have deposited toxins into drinking water supplies throughout the nation, resulting in widespread water pollution (the U.S. is currently listed 64th on the World Health Organization's global drinking water quality assessment.)

CREDIT: VILDEEPBAKYP/FLICKR

Water Can Make or Break a Project

NOTHING WILL SLOW DOWN the construction industry faster than a lack of water. A long-term or permanent shortage will have a wide impact on everyone from developer to homeowner. To compensate for an increasingly dry landscape, builders and manufacturers will need to:

- Consider water use, monitoring, leak detection, recycling/reuse and discharge.
- Set site water targets to drive effective action and decision making
- Examine and prioritize local water challenges, regulations and pricing by reducing water risk.
- Consider a growing list of water-related criteria, including quality, quantity, sanitation, local governance, important ecosystems, extreme weather events and possible climate impacts.

COGNITION SMART DATA

CREDIT: DAVID GREITZER/ISTOCK

Warning sign. California's recent four-year drought sent a message to everyone—even motorists—that a water shortage is a very bad thing.

Dealing With Drought

AS MOTHER NATURE makes things tougher, governments have acted to deal with present and future water shortages. For example:

- **Federal:** In May, Congress approved a seven-state Drought Contingency Plan to share water cuts in the Colorado River Basin. Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming will co-handle management of 5.5 million acres of irrigated agriculture to cities and towns across the West.
- **State:** Regional utilities and providers have net zero water policies and price increases to drive water use reduction. Meanwhile, California wants to limit indoor water use per person to 55 gallons a day by 2050.
- **Municipalities:** Smart growth and zoning plans are being implemented in cities and counties throughout the U.S. For example, Santa Fe, N.M.'s stringent water policies and high water prices have resulted in the nation's lowest daily per capita water usage, at 87 gallons per day (Las Vegas, by comparison, sits at 200 gallons per day).

SOURCE: COGNITION SMART DATA

WATER'S USE IS BECOMING EVEN MORE REGULATED

Within the building sector, water has the potential to become the No. 1 limiting factor to growth. Water quality and quantity concerns will increasingly affect the way we address the built environment, and will force sweeping changes to codes, mandates, programs and pricing.

Across the country, builders and developers will soon be required to create water plans for building projects, taking into consideration water challenges as determined by climate change, extreme weather events, ecosystem impacts, and local governance. Some municipalities have already implemented offset programs that require builders to show net-zero demand on aggregate water resources in order to receive a permit.

Interestingly, when asked about the global risks of highest concern, nearly 40 percent of consumers cited water crises—ranking higher than the failure of climate change mitigation and adaption (36 percent), extreme weather events (26 percent), food crises (25 percent), and profound social instability (23 percent).

CONSUMERS WANT EVEN GREENER, SMARTER WATER

When analyzing water-related purchase drivers, security topped the list, followed by energy efficiency (proving that consumers understand the nexus between energy and water), sustainability, comfort and wellness. Do-it-yourself (DIY) consumers are the most active with respect to water content on the web and social media.

The hottest innovation in the water space: leak detection and water monitoring systems, offered by companies like Phyn and Moen, that learn the water footprint of a home and alert homeowners of leaks or irregular usage.

Greywater systems from companies like Greyter that recycle water for interior non-potable use as well as exterior landscaping, along with smart irrigation systems and innovative technologies such as atmospheric generators (that pull water out of the air for fresh water supply), are also gaining market traction.

LOCAL GOVERNMENTS ARE GETTING ON BOARD—AND GETTING PRICEY

States and municipalities are adopting net zero water policies and restructuring water pricing to address water shortages.

Municipalities and water utilities are also increasing water pricing and tap fees to incentivize conservation. For example, along the Front Range in Colorado, water prices have soared—increasing an astronomical over 400 percent between 2011 and 2018—causing home prices to surge and developments to stall, compelling builders and developers to become extremely creative in how they manage water in their projects. For example, the city of Arvada (near Denver) is no longer supplying water to large residential developments until a new water source is built out.

Codes are transforming too—there are several proposed changes that may be implemented as early as the 2021 code cycle (underway now) that will require enhanced water conservation in all types of homes and buildings.

EXPECT A 'ZERO' FUTURE

With respect to water, the future is certainly zero. There is a definitive business opportunity for building professionals and manufacturers alike to offer innovative solutions that solve for the mushrooming water crisis.

The curve for net zero water will likely follow that of net zero energy. There will be a growing dependence on water programs, such as Water Efficiency Rating Score (WERS), the $HERS_{H2O}$ Index, and the Water Efficiency and Sanitation Standard (WE•Stand) that offer performance- and prescriptive-based approaches to residential water efficiency. These programs are now being incorporated into codes, standards and even financial incentives.

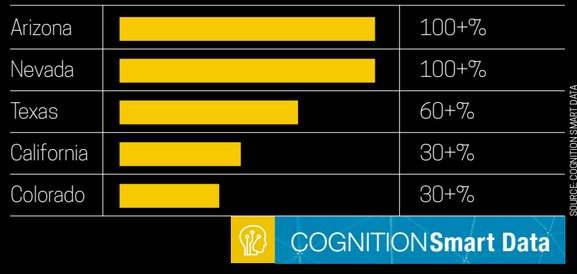
No doubt, water pressures will require enhanced situational awareness, accurate water assessments, water risk mitigation, and ongoing monitoring and management. But for innovative building professionals and manufacturers, there is a blossoming opportunity to provide creative water technologies and solutions that proactively address water quality and quantity.

COGNITION Key Fact:

Dry Times Ahead?

States in the West and Southwest have the biggest population growth expectations within the next 10 years, a fact that will place those areas at greatest risk of water shortages.

Growth rate by 2030



SOURCE: COGNITION SMART DATA

Aquatic Administrators

VARIOUS WATER USAGE programs and performance tools enacted throughout the United States will play a large role in keeping the shortage under control in coming years. These include:

- **Water Efficiency Rating Score (WERS):** A performance-based approach to residential water efficiency, WERS covers single-family and multifamily new and existing properties. This third-party tool looks at all water use and is frequently cited in codes and financial incentives.
- **$HERS_{H2O}$:** Another performance-based approach to residential water efficiency, RESNET's $HERS_{H2O}$ Index rates a home's indoor and outdoor water usage. Currently in draft form as an ANSI standard, it covers single-family and duplex properties. $HERS_{H2O}$ does not address capture and reuse.
- **Water Efficiency and Sanitation Standard (WE•Stand):** Taking a prescriptive approach to residential water efficiency, IAPMO's WE•Stand is the first ANSI standard that focuses solely on achieving safe and efficient water use in both residential and non-residential buildings.
- **Florida Water Star:** This state-level water conservation certification program is for new and existing homes and commercial developments. Standards and guidelines for water efficiency are included for indoor fixtures and appliances, landscape design and irrigation systems.
- **Water Smart Home:** A metropolitan-area program run by Southern Nevada Water Authority, the Water Smart Home program promotes water efficiency, requiring homes built through the program to include water-smart landscaping and water-efficient appliances. It changed from a prescriptive program to a performance-based one in 2017.

SOURCE: COGNITION SMART DATA

Indoor Air Pollution: New Threats and New Tools

Indoor air pollutants can now be measured inexpensively, and consumers want full transparency.

CREDIT: ROSS CHANDLER/CHANDLER PHOTOGRAPHY

Smarter choices. Consumers now consider paints, carpets and furnishings as part of their clean air equation.

INDOOR AIR QUALITY (IAQ) has historically been the equivalent to the hypothetical monster lurking under the bed. No one quite understood it, and, even though people had an inkling that it was scary and worth paying attention to, they hoped that by ignoring it, they could simply wish it away.

But that's not the case anymore. The concept of healthy homes, driven primarily by IAQ, has evolved substantially over the past few years and can no longer be overlooked. Indeed, IAQ has evolved beyond the realm of early adopters and is firmly situated in the mainstream.

Clean Air = Peace of Mind

COGNITION**Smart Data**

IAQ: Purchase Drivers

Number of mentions: Jan-Aug 2019

WHAT?
- Comfort is referenced more than the other purchase drivers and is a key benefit to communicate.
- The other top 5 purchase drivers—security, sustainability, price, quality and energy efficiency—are referenced fairly evenly, indicating that all are about of equal importance to buyers.
- Across audience segments, Do-It-Yourself (DIY) consumers most frequently talk about these purchase drivers.

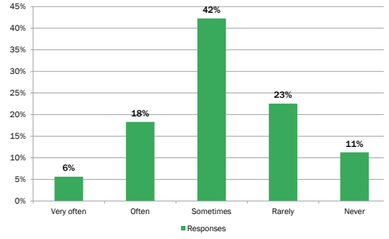
SO WHAT?
- Comfort and sustainability are both directly tied to good Indoor Air Quality.

NOW WHAT?
- Manufacturers have the opportunity to create positive messaging around healthy homes and good IAQ, particularly as it pertains to comfort and sustainability.
- For elevated web and social media engagement, focus on DIY consumers.

COGNITION**Smart Data**

Mechanical Air Scrubbing

How often do your customers purchase devices that improve their Indoor Air Quality?



WHAT?
- Building professional respondents answered that nearly one-quarter (24%) of their customers have very often or often purchased devices to improve Indoor Air Quality (IAQ).
- Over one-third (42%) said their customers sometimes purchase products to improve IAQ.

SO WHAT?
- There is a large and growing whitespace in the market to offer products and technologies that improve IAQ.

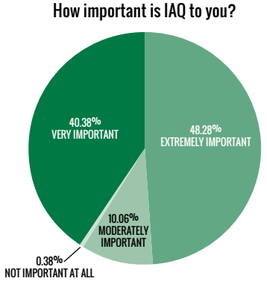
NOW WHAT?
- Manufacturers have an opportunity to address this growing demand for IAQ products with innovative product enhancements and/or strategic partnerships withother manufacturers that offer complementary products.

SOURCE: GREEN BUILDER MEDIA SURVEY

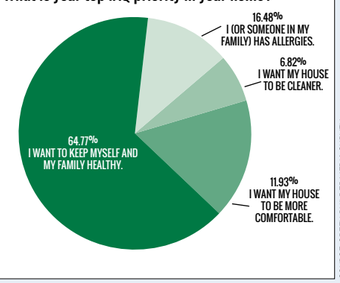
COGNITION**Smart Data**

Healthy Air Matters. Period.

How important is IAQ to you?



What is your top IAQ priority in your home?



SOURCE: GREEN BUILDER MEDIA SURVEY

General concern. Most homebuyers simply want an indoor space free of pollution, and safe for family members.

THE STATE OF SUSTAINABLE BUILDING 2020

There's a good reason: Americans, according to researchers at Lawrence Berkeley National Laboratory, spend 87 percent of their time indoors, with 70 percent of that time spent at home. With that kind of devotion to the pleasures of their homes, LBNL notes, "it's only a matter of time before people want to feel as good being indoors as they do about being there."

Green Builder Media recently conducted a survey of housing market trends, polling consumers and construction industry professionals. There are some compelling insights.

PEOPLE KNOW WHAT THEY WANT

Within the healthy home space, more than 90 percent of consumers consider IAQ to be "extremely important" or "very important." It's also the leading category that consumers associate with green building—more so than performance, renewable energy and building science.

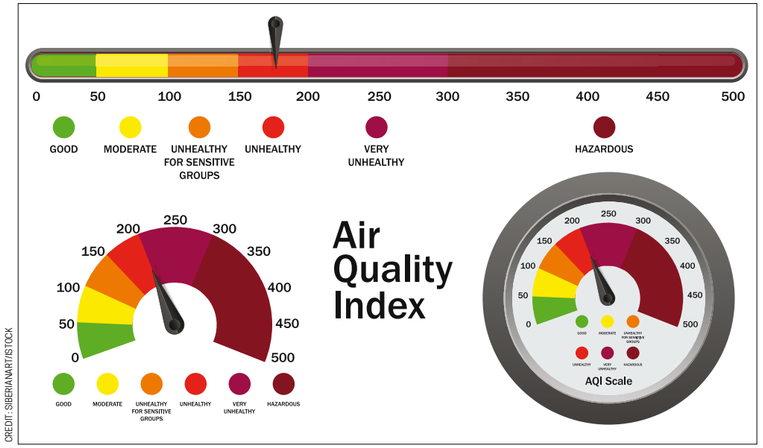
Nearly 70 percent of consumers interested in IAQ want to keep themselves and their families healthy. Close to 20 percent of consumers interested in IAQ struggle with allergies.

Twenty-five percent of consumers (so far) ask about IAQ often or very often, and nearly 25 percent are purchasing products that proactively address IAQ-related issues. Given that those numbers were in the single figures only a short while ago, the sector is clearly experiencing considerable growth on an annualized basis.

Homeowners have become quite savvy about green products and smart home devices, and they're demanding proof points to show that IAQ products can back up manufacturer claims. So, it's important for manufacturers and builders to provide certifications, case studies, research and data that demonstrate clear performance results.

ALL THE COMFORTS OF HOME

Comfort is the leading purchase driver behind IAQ considerations across all consumer audience segments, followed by (in order) security, sustainability, quality and wellness.



CREDIT: SIBERIANART/ISTOCK

In the red. An air quality index is used by government agencies to communicate how polluted the air is or how polluted it is expected to become—a situation that is spending more time than ever in the unhealthy range.

Do-it-yourself (DIY) consumers are the most active with respect to IAQ content on the web and social media, so for elevated engagement, manufacturers may want to target DIYers for enhanced exposure, pickup and earned public relations (PR).

There is subtle difference in consumers' perception about sustainability versus health and wellness. While consumers perceive energy efficiency, water conservation and resiliency as part of the sustainability equation, they associate indoor air quality with health and wellness rather than sustainability. It's a delicate nuance for sure, but an important one for any manufacturer or builder wanting to create effective, targeted messaging for customers.

One of the hottest trends in the IAQ category is a proliferating interest in sensors and monitoring systems that provide real-time observation and reporting. This is resulting in a mushrooming demand for proactive, intuitive systems that can provide alerts and notifications, and can interconnect devices, mechanical systems, ventilation fans and other products in the home (such as windows) to manage IAQ in an automated and streamlined manner.

THINKING AHEAD

The surging interest in healthy homes, as well as the adoption of IAQ sensors and monitors, is placing new demands on manufacturers and building professionals. To achieve optimal success in today's marketplace, manufacturers and building professionals need to become invaluable resources for homeowners in their journey towards understanding the impact of indoor air quality on their family's health and productivity.

> "Americans spend 87 percent of their time indoors, with 70 percent of that time spent at home...it's only a matter of time before people want to feel as good being indoors as they do about being there."
> –Lawrence Berkeley National Laboratory

To do that, it's important to emphasize situational awareness, enabling homeowners accurately measure and manage IAQ through real-time data and develop a deeper understanding of how to solve any IAQ issues (for example, specifying low VOC/non-toxic products, proper ventilation, fresh air exchange and regularly changing filters).

As the market continues to evolve, look for ongoing innovation with respect to demand-controlled, intelligent systems that integrate mechanical systems with sensors, windows and other IAQ devices.

Correspondingly, as research on the health impacts of pollutants in homes and buildings progresses, expect enhanced codes, regulations and mandates that address IAQ issues in a comprehensive and methodical manner. There are changes that may be implemented as early as the 2021 code cycle (underway now) in the single-family and multi-family sectors that address ventilation and exhaust systems, proper airflow and air exchange, and range hoods. Stay tuned. **GB**

COGNITION Key Fact:
Dual Identity:

For many buyers healthy air and green buildingn are synonymous terms.

Q. WHICH OF THE FOLLOWING DO YOU CORRELATE WITH GREEN/SUSTAINABLE BUILDING?	
Indoor Air Quality	11%
Best Building and Design Practices	9.8%
Quality Construction	9.75%
High Performance Homes	9.7%
Building Sciences	9.7%
Renewable Energy	9%
Durability and Low Maintenance	8.5%
Selecting Quality/ Performing Building Product	8.25%
Above Code	8%
Achieving a Performance Target	6%
Resiliency	5.75%
Smart/Connected Homes	5.5%

*Totals reflect rounded numbers

SOURCE: COGNITION SMART DATA

COGNITIONSmart Data

CREDIT: BRAUNS/ISTOCK

Cognitive contributor. Cleaner indoor air quality helps everyone do their jobs better, according to a study by Harvard and Syracuse universities.

Research: Poor Air Quality Makes It Hard to Think

Cognitive tests show that reducing VOCs boost mental performance.

IN THE 1700S, Ben Franklin professed, "I am persuaded that no common air from outside is so unwholesome as the air inside a closed room that has been often breathed and not changed."

Franklin appears to have been more than 250 years ahead of his time when it comes to poor indoor air quality (IAQ). This has been proven once again in a **study conducted by researchers** at Harvard and Syracuse universities.

In this study, the researchers enrolled 24 "knowledge workers," people who were corporate managers, architects and designers. The workers spent six days in a controlled work environment, working from 9 a.m. to 5 p.m. each day.

During this time, the indoor air quality conditions fluctuated without their knowledge, shifting from:

- An optimized environment, where ventilation was increased; chemicals and products—including cleaning products—that released volatile organic compounds (VOCs) were minimized or eliminated; and carbon dioxide levels in the air were reduced.
- The other work environment was a more conventional setting which met minimally accepted IAQ standards.

Each day, the participants took tests measuring their cognitive (thinking) functions. Test scores were higher across nine cognitive function domains when workers were exposed to increased ventilation rates, lower levels of chemicals and lower carbon dioxide, according to the study.

"The results showed the biggest improvements in areas that tested how workers used the information to make strategic decisions and how they plan, stay prepared, and strategize during crises," the researchers noted. "These are exactly the skills needed to be productive in the knowledge economy."

The researchers then conducted a second test involving 100 knowledge workers. This one test evaluated the influence of using green-certified cleaning solutions. Green cleaning solutions are designed to protect IAQ.

"We found that workers in buildings that used green certified [cleaning solutions] scored higher on the tests," the scientists reported.

The takeaway is simple: Better indoor air quality results in better [worker] performance—something the professional cleaning industry has known for years.

Article is courtesy of Mike Watt, director of training and new product development at Avmor, a leading North American manufacturer of professional cleaning solutions. He can be reached at **mwatt@avmor.com**.

A Winning Past

BY GREEN BUILDER STAFF

A lot of care goes into being a candidate for *Green Builder*'s Green Home of the Year, as these four past finalists show. 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 a glimpse at what lies ahead, *Green Builder* revisited several of the entrants from our 2019 competition. Here's what made these finalists so special.

The Andrew Avenue Residence

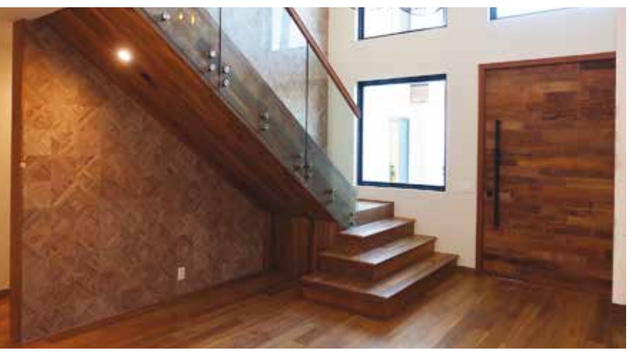
What's old—***very*** old—is new again with this WWII-era beach house.

THE ODD, ORANGE-COLORED HOME on Andrew Street in the self-proclaimed "funky" beach town of Leucadia was once a single-level 1940s-era home that sat in its original state in the Southern California sun until early 2018. That's when Bradley Schalacter and Frank Ragen saw the diamond in the rough.

Soon, the home began its transformation from 1940s relic into a modern/rustic masterpiece. The home was expanded from one story to two stories, and upgraded from 1,400 to 2,100 square feet. Featured throughout the home is FSC-certified 100 percent reclaimed teak flooring, decking, siding, stair treds, tile, soffits, custom cabinets and more.

Why teak? Thank designer El Lovaas, who researched the history of the wood and found that it was considered sacred in many countries. Its healing properties have been used for centuries. Also, the product had gorgeous tones. The commitment to using teak—especially reclaimed variety—was therefore very important to the group.

The wood used comes from buildings, some 100 to 300 years old, in Southeast Asia that were scheduled for demolition. All of the wood used is painstakingly recycled and reclaimed by hand, and no trees were cut down in the materials creation. Big pieces became flooring and small pieces were used for decking. Tile and even the substrate used is made of reclaimed teak. The last fragments are used to patch holes, and the teak dust is used to fuel the furnaces for drying the teak, making the process as near-zero waste as possible.



Built to a 'T'. Reclaimed teak's gorgeous tones and adaptability made it suitable for use throughout the home, including as flooring, doors, stair treds and wall tiles.

CREDIT: KEN LEWIS

Ancient renewal. Upgrading the exterior of this beach home with centuries-old recycled wood gave it an up-to-date appearance.

An all-downstairs living area features the master bedroom, Jack and Jill bedrooms and an office, while the upstairs features an open floorplan encompassing the kitchen, dining area and den. The house also features white water views of Ponto Beach, and the eclectic stores and restaurants of Leucadia are a five-minute bike ride away.

Other features of the home include custom concrete and a 100 percent FSC-reclaimed teak fireplace and outdoor bar area, a main bathroom featuring walk-in shower and freestanding soak tub, a rooftop bird's nest viewing area with a spiral staircase, off-street RV parking and utility shed or artist studio, and custom landscaping and slab stone pavers in backyard.

B-Austin Community Project

Bringing the 'green' to this multipurpose dwelling is a family event.

THE DEVELOPERS OF THIS PROJECT are not your average clients: they are a family. Will and Janice Godwin had a vision of creating a housing project on a site occupied by their marketing company, Special Audience Marketing; a place where people could live a sustainable and community-rich lifestyle with amenities that embraced and furthered it. This vision included ideas of how the lives people lead impact the world, cities, communities and families.

The B-Austin Community Project, designed by Clark Richardson Architects and built by BPG Construction, was crafted to minimize its environmental footprint and maximize the health of its residents and the planet. The project has received a four-star Austin Energy Building rating. Besides having low energy consumption levels—producing its own solar energy with room for expansion—the project implements several innovative measures.

Developers believe B-Austin is the first multiuse-multifamily project in Austin and possibly Texas to have an integrated greywater system. The greywater system is backed up by the rainwater system, which is then backed up by potable water if needed. The edible gardens take advantage of a direct feed from the rainwater tanks in a fully integrated system.

Natural catchment. Decorative vegetation and edible gardens benefit from a direct feed from rainwater tanks in a fully integrated system.

Dual purpose. The B-Austin Community Project offers employees of marketing firm Special Audience Marketing a way to live onsite, and also provides an option for Austin residents seeking affordable housing.

Showers and changing rooms encourage employees to ride to work. Car chargers are integrated into the site plan. Compost and recycling are valeted from each apartment, making it easier to adapt to sustainable living. Furthermore, residents are active participants in maintaining a sustainable lifestyle by using "My Energy Planner," a tool that operates like "My Fitness Pal," to quantify energy and water consumed and waste produced, and monitor expenses.

Developers integrated a wellness component where food is grown on site, and healthy cooking and nutrition classes are offered in the community amenity space. Additionally, the complex has an onsite fitness program run by the Godwins' son, a professional fitness trainer who lives there. Exercise, yoga and other health and wellness services are provided in the project's commercial suites. These businesses offer direct programming for mobility impaired occupants.

The developers also participate in Austin's Safe, Mixed-Income, Accessible, Reasonably Priced, and Transit-Oriented (SMART) affordable housing program—designed to increase the amount of price-friendly homes available to city residents—and take the concept of SMART housing a step further. The Godwins offer co-housing for the three-bedroom apartments, where a tenant can be introduced to others looking for roommates.

For the developers, this wasn't just a building; it was a lifestyle project.

Sustainable sensation. Hampton Courtyard includes a variety of Earth-friendly features, from energy-efficient outdoor lighting and upscale landscaping on the outside, to gourmet kitchens with quartz countertops and tile backsplashes, and smart stainless steel appliances on the inside.
CREDIT: BRUCE DUNN

Hampton East Apartments

It all happens behind the walls at this Arizona multi-family project.

MILLENNIALS, THE RENTAL HOUSING industry's current customer base, are also a green-thinking group. Into this arena steps the developers of Hampton East Apartments, a 143-home development in Mesa, Ariz. that combines the elements of smart single-family residential living with the rental arrangement and management of an upscale apartment project.

Developers note that more individuals these days want the freedom and flexibility that come from renting, while at the same time enjoying the privacy and independence one obtains from living in a home environment and planned community.

Hampton East, they say, is the first upscale rental community with sophisticated smart homes that use the latest in energy efficient technology, including the cost-effective, concrete-reinforced panelized wall system provided by HercuTech Inc. The *HercuWall* system provides R-30 insulated panels (instead of the more-common R-19 insulation), which reduces the HVAC sizing requirements while also providing a quieter, more-comfortable home.

In addition, every home includes a Wi-Fi-controlled thermostat for energy efficiency, along with an automatic air circulation system that provides a constant supply of fresh, filtered air (and controlled humidity), and reduced indoor pollution, dust and other allergens.

As a result, Hampton East Apartments are fully qualified Energy Star units, with Home Energy Rating System (HERS) indexes below 60, resulting in greatly reduced energy costs.

The luxury gated community also includes a resort-style pool and spa consisting of a fire pit and outdoor kitchen, ramadas, large park areas and paseo parks with upscale landscaping and access gates to office and retail projects. The homes feature modern features and finishes with 10- and 11-foot ceilings, gourmet kitchens with quartz countertops and tile backsplashes, stainless steel appliances, upgrade lighting and hardware packages, full-size washers and dryers, oversized showers and bath tubs, large walk-in closets and private yards with patios.

CREDIT: BRUCE DUNN

Amenity abundance. Hampton East Apartments in Mesa, Ariz. combines smart single-family residential status with the convenience of rental apartment living—and tops it off with green lights, flooring, walls and fixtures.

Hidden Hills View Showcase Home

Logical design and green enhancements give this home real eye appeal.

THIS YOUNGER HOME in Jonestown, Texas, was built with sustainability and integrated design in mind to compliment the everyday lifestyle of a Texas Hill country family. The starting point for integrated design of this five-bedroom, three-and-a-half bath home was orientation—working with aspects such as solar orientation, tree locations, wind/breeze directions, slope, view, accessibility and outdoor living spaces.

Like many homes in the Texas Hill country, the home site has a great view, paired with a severely sloped topography. Determining orientation, while designing for the most efficient use of building and foundation materials, was challenging, but cost effective, and was one of the first places integrated design paid off in the home design process.

Architects and engineers worked together to take advantage of the slope as much as possible by designing the main living space slightly above grade at the front of the house and a daylight basement to work into the slope for the lower bedrooms and game room.

Also, a fundamental goal was to size rooms appropriately in order to avoid wasteful space and unnecessary leftover material. When designing for energy efficiency, a southerly facing home is most ideal for solar orientation and collecting prevailing breezes, especially coming up from the water in the valley. Due to this, as well as the integration of the daylight basement and crawl space, large overhangs, efficient orientation, and other sustainable features, this 4,243-square foot home can operate on one HVAC unit and achieve Energy Star certification.

Other subtle sustainable features include a roof that is simple but elegant and will provide an excellent foundation for green features, such as rainwater collection and solar panels. For comfort and health in everyday living, the design allows for the traffic flow and visual flow of the house to work well and be pleasing to the eye while keeping private spaces private, public areas open with good sight lines, and reflecting careful consideration of interior and exterior views of the lake and surrounding mature hardwood trees. **GB**

CREDIT: MADELINE HARPER

Intelligence indoors. Carefully integrated lighting, airflow control, window placement and other sustainable features allow owners to run a 4,243-square-foot home on a single HVAC unit, and achieve Energy Star certification.

Natural contours. Builders utilized a sloped topography to best effect, whether it was for rainwater control or allowing more sunlight to enter the lower level of the home.
CREDIT: MADELINE HARPER

Coming up zero. When it comes to operating efficiency, The Birch Case Study House goes three-for-three by achieving net zero in energy, water and sewer use.
COURTESY OF BUNDLE DESIGN STUDIO

Package Deal

This living laboratory is a home performance triple-play: zero energy, zero water and zero sewer.

BY GREEN BUILDER STAFF

ACCORDING TO BUNDLE DESIGN STUDIO architect Dan Welch, the Birch Case Study House was "developed as our business card." Welch now lives in the home with his wife in the Birchwood neighborhood of Bellingham, in northwest Washington state. Welch had designed or consulted on several high-performance homes since leaving a traditional commercial architecture firm to start Bundle Design in 2014, but this was the first home he actually built.

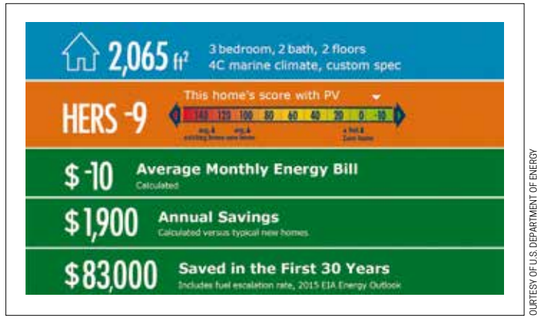
Welch and builder Chris Tretwold of Tretwold Construction built the home to the high energy performance standards of the U.S. Department of Energy's Zero Energy Ready Home (ZERH) program. All DOE ZERHs must be certified to Energy Star Certified Homes Version 3.0 or Version 3.1 standards and the U.S. Environmental Protection Agency (EPA)'s *Indoor airPLUS* program. Each ZERH home also meets the hot water distribution requirements of the EPA's *WaterSense* program and the insulation requirements of the 2015 International Energy Conservation Code. In addition, homes are required to have solar electric panels installed or have the conduit and electrical panel space in place for their future installation.

In the case of Birch House, solar panels produce more power than the highly efficient home uses in a year, while rain water provides all of the home's water supply and waste water is disposed on site. The home carries a Home Energy Rating System (HERS) Index rating of minus 9 when photovoltaics are used and a 36 when they are not.

Welch designed the 2,000-square-foot, two-story home with a shed roof. The entire asymmetrical roof faces south at a 7/12 pitch to maximize the roof space available for the 9.28-kW solar photovoltaic array. Together with the highly insulated building envelope and passive solar heating elements, the solar panels help the house achieve net zero energy bills over the course of the year. A web-based monitoring system tracks solar power production and energy usage.

Sustained efficiency. The ultra-green home, with a Home Energy Rating System (HERS) Index score of as low as minus 9, includes high-efficiency appliances and is entirely LED lighted.
COURTESY OF BUNDLE DESIGN STUDIO

> "The culture continues to quickly learn the importance of energy efficiency. However, it is when customers realize that energy-efficient design also provides the byproducts of comfort and quality that real change happens."
> – Dan Welch, Bundle Design Studio

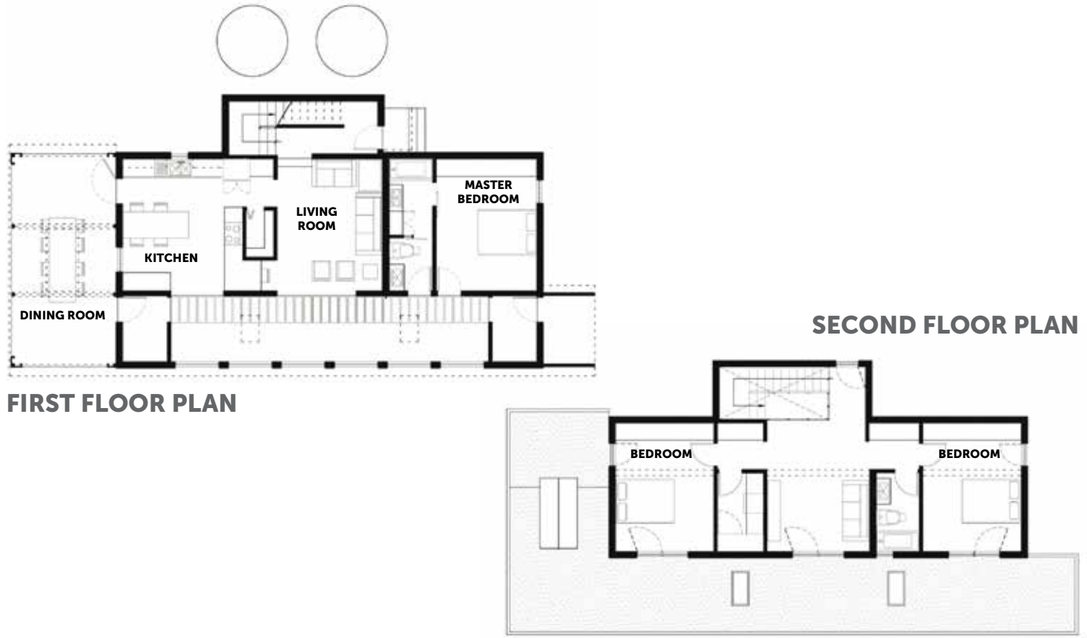


COURTESY OF U.S. DEPARTMENT OF ENERGY

WATER WARRIOR

Birch House is completely net-zero water with no connection to the City of Bellingham municipal water and sewer system. Water is collected, stored and treated onsite. To reduce demand, the house is equipped with ultra-water-efficient appliances and plumbing fixtures and composting toilets.

Inside heatsaver. The home includes a solarium with nearly floor-to-ceiling windows and a thermal mass floor of dirt, stone and concrete pavers to absorb solar heat.
COURTESY OF BUNDLE DESIGN STUDIO



Planning ahead. Birch House's first- and second-story floorplans are nearly identical, allowing for future conversion of the home into separate units if desired.

Water for all uses, potable and non-potable, comes from rain water catchment off the metal roof and solar panels. The rain water is stored in two 5,000-gallon tanks located on the north side of the house among the existing trees. Water that is used for indoor uses is drawn from these cisterns, and filtered and treated with ultraviolet light prior to use.

The house has a "green roof" of plants installed on a lower-level roof over the first-floor solarium. Downspouts from this green roof carry overflow downhill through woodchip-lined trenches to two native-plant rain gardens. Water from the showers, tubs, sinks, clothes washer and dishwasher is treated in a small septic tank. An indoor planter was designed and constructed in the solarium to treat this grey water prior to the septic tank.

Although the building department would not approve the use of grey water in this planter, the planter was constructed and planted, but is watered with approved potable water. In winter, the water from the septic tank is distributed in two small infiltration beds. In summer the grey water from the septic tank is instead routed to irrigate 30 fruit trees that line the driveway. Beyond the food garden and the grey water irrigation at the orchard, no irrigation is used to maintain landscape plantings.

Welch notes the decision to achieve net-zero water use was initially not prompted by a desire to save water but rather to highlight how much community energy is used to convey water to the house and back to the sewer treatment plant. This energy is not accounted for in most zero energy projects.

ON FRIENDLY TERMS

The two-story home is designed with a solarium along the south-facing side that has nearly floor-to-ceiling windows and a thermal mass floor consisting of dirt, stone and concrete pavers to absorb beneficial solar heat. A few operable windows face east and west for cross ventilation.

To minimize heat loss, only two of the home's windows face north. The shed roof allowed for the construction of a loft above the second-floor bedrooms. Aside from the solarium and the loft, the first and second floors have identical floor plans, with the assumption that, as needs change over time, the house could be converted from a three-bedroom, two-bathroom home to two one-bedroom, one-bath units.

In constructing the home, Welch wanted to create a "builder friendly" assembly that met all the high-performance requirements of DOE ZERH while using construction techniques that most builders are familiar with. Prior to permit and construction, Bundle held a peer review session to evaluate the constructability of the project. The peer review included the builder, designers, structural engineers, contractors, plumbers and solar installers.

Although Welch was an experienced designer and Tretwold was an experienced builder, neither had worked on a high-performance building before. "We met constantly to review the construction documents, brain storm applications, oversee product installs, and check completed construction for deficiencies," Welch says.

BUILDING BLOCKS

Welch and Tretwold used 2-by-6 wood-framed walls, with only two inches of exterior mineral wool rigid insulation to reduce changes in window flashing details. The wall cavities were filled with R-23 mineral wool batts for a total wall assembly of about R-29. They used a liquid-applied sealant to seal seams in the plywood and flash around the windows, then covered the entire sheathed walls with a roller-applied silyl ether terminated product that provides a durable, seamless, elastomeric weatherproofing membrane over the exterior sheathing. Windows were sized and placed to keep rough openings within the framing layout. Over this, the builder installed 1-by-4 fir battens to provide a rain screen and air gap behind the exterior siding, which included metal panels and cedar planks.

All of the roof's insulation was installed above the ⅝-inch plywood roof decking. Seams in the plywood were sealed with seam filler, then three 3-inch layers (R-60) of polyiso rigid insulation were stacked on the decking and covered with 30-minute roofing felt, 2-by-4 battens (for ventilation), half-inch oriented strand board (OSB), and a continuous ice and water shield. The roof was then covered with standing seam roofing that was Energy Star Cool Roof certified.

Welch used a common Northwest foundation type, a framed floor over a vented crawlspace, selected because the site is primarily clay and has sub-surface water issues that would be difficult to control with a slab-on-grade floor. The floor was constructed from salvaged 2-inch-by-15-inch joists spaced 24 inches on center. The floor joists were filled with two layers of R-30 mineral wool batts for R-60 total. A ¾-inch plywood subfloor was installed that was glued in at all edges with construction adhesive and sealed on top of the floor with a putty knife-applied seam filler.

A layer of ½-inch Expanded Polystyrene (EPS) rigid foam was laid over the plywood and glued to the wall studs to provide a thermal break around a two-inch suspended concrete floor slab. Before pouring the floor slab, the builder laid down tubing for radiant floor heat. The concrete for the slab was reinforced with a product consisting of tiny pieces of twisted steel micro-rebar rather than standard rebar or wire mesh; the product is reported to distribute loads for less cracking. The floor assembly had a total insulation value of R-58 (when calculated with framing reduction).

For the home's air barrier, Welch used liquid-applied sealants to air seal the sheathing for floors, walls and roofs. This approach paid off. Results from three blower door tests (conducted at dry-in, just prior to wall cavity insulation, and at completion of the project) showed final blower door results of 0.4 air changes per hour at 50 Pascals pressure difference, one-third lower than the maximum air leakage rate allowed by Passive House. Balanced ventilation was a necessity in such a tight home. Welch installed a heat recovery ventilator (HRV) with a Minimum Efficiency Reporting Value (MERV) 13 filter that runs continuously to bring in fresh air while exhausting stale air.

KEY FEATURES

DOE ZERO ENERGY READY HOME PATH: Performance.

WALLS: 2-by-6 24-inch o.c., R-23 rockwool batt, 0.5-inch plywood sheathing, fluid-applied air barrier and window flashing, 2-inch R-8 rigid rockwool exterior insulation, 1-by-4 fir battens rainscreen, metal and cedar siding.

ROOF: R-60 total: 5/8-inch plywood roof sheathing, fluid-applied membrane, three 3-inch layers R-60 polyiso rigid foam, 30 min. roofing felt, 2-by-4 battens for venting, 0.5-inch OSB, full ice and water shield, standing seam metal roof, Energy Star Cool Roof certified.

ATTIC: Cathedral ceilings.

FOUNDATION: Vented crawlspace. R-60 rockwool batt, 3/4-inch plywood subfloor, 2-inch concrete slab w/micro-rebar, 0.5-inch EPS under and at slab edge. Radiant heat tubes in slab.

WINDOWS: Fiberglass-framed, triple-pane, argon-filled, U=0.16, SHGC=0.47.

AIR SEALING: 0.4 ACH 50.

VENTILATION: HRV with MERV 13 filter.

HVAC: Air-to-water CO2 heat pump for hot water and radiant floor heat, EF=4.50.

LIGHTING: 100 percent LED lighting.

APPLIANCES: Energy Star refrigerator, dishwasher, clothes washer; HP dryer, induction range

RENEWABLES: 9.28 kW solar PV array.

WATER CONSERVATION: Net-zero water: rainwater catchment plus onsite waste treatment and infiltration, ultra-low-flow fixtures, waterless composting toilets.

ENERGY MANAGEMENT SYSTEM: Web-based energy monitoring.

OTHER: Extensive salvaged wood from local demolition, FSC-certified countertops. Indoor solarium for edible plants plus oxygen, greywater treatment and passive solar gain. Green roof.

Waste no water. A green roof helps catch any rainwater runoff that isn't collected in the two 5,000-gallon cisterns located behind the house.
COURTESY OF BUNDLE DESIGN STUDIO

'COMBI' CULTURE

Bundle Design worked with Washington State University (WSU) to field test a unique heating system, an air-to-water CO2 heat pump that was installed to supply floor heat and meet domestic hot water uses. As a result, the Birch Case Study House was the first in North America to use the CO2 heat pump as a "combi" system.

In addition to collaborating with WSU, Welch has partnered with the local non-profit Sustainable Connections on workshops, with the Northwest Energy Efficiency Alliance (NEEA) to do electrical, water and humidity monitoring, with the Northwest Clean Air Agency (NWCAA) on a video, and with the Northwest Eco Building Guild on its Code Innovation Database. Welch's unique Birch Case Study House has also captured the attention of numerous local and national media outlets.

Welch knows that affordability is an important consideration and he will use lessons learned on this project to evaluate ways to be cost effective in future projects.

The architect notes that Bundle Design's business is steadily growing as the culture continues to quickly learn the importance of energy efficiency. However, it is when customers realize that energy-efficient design also provides the byproducts of comfort and quality that real change happens. "Every builder and client we have worked with using high-performance building strategies has become an advocate," Welch says. "Most are astonished at the drastic difference they experience between living in a conventional house and their new, well-designed, high-performance house." GB

Seattle Cascades
VISION House® by Green Builder® Media

TRIPLE PLAY

Energy, air quality and connectivity are key areas residential homebuilders need to address. The **VISION House® Seattle Cascades project embodies all of them.**

Classic Vision. When it comes to sustainability, the VISION House Seattle Cascades project covers multiple bases in terms of energy savings and air quality.

CREDIT: COURTESY OF EQUITERRA

BY CATI O'KEEFE

GREEN BUILDER MEDIA'S VISION House Seattle Cascades aims to be a replicable pattern for high-performance housing, and by replicable, that means for all housing types—from affordable to custom off the grid. When the VISION House team members, including homeowner C.R. Herro, envisioned this project, they turned to Green Builder Media's COGNITION Smart Data to double-check the planned characteristics and features of the house against emerging housing trends.

COGNITION, a technology platform that uses artificial intelligence to mine web and social media content for market intelligence and insights, highlighted the following crucial housing trends, which dovetailed perfectly with Herro's plans for his home. Here are his thoughts on how these trends can be accommodated in today's homes.

NET ZERO ENERGY

Because the VISION House is off the grid, conserving energy was a big piece of the building puzzle. (We covered the VISION House team's high-performance building envelope choices in a previous article.)

A unique feature to the house is part design, part product selection, part yesteryear. "The fireplace at the center of the house is designed to function as thermal mass, which eliminates the need for air conditioning and provides for a very low BTU demand throughout the year," Herro explains. "We will incorporate outside ventilation into a 'charging process' to store hot and cold air during the right time of the daily temperature cycle." (See diagram, page 48.)

It works like this: The innovative Panasonic *Cosmos Healthy Home System*, the thermal mass of the fireplace wall, and the U.S. Environmental Protection Agency (EPA)-certified combustion chamber in the fireplace work synergistically to use waste fuel (wood) and store its heat in the winter (and retain cool air in the summer), which reduces the need for a mechanical HVAC solution.

Seattle Cascades
VISION House® by Green Builder® Media

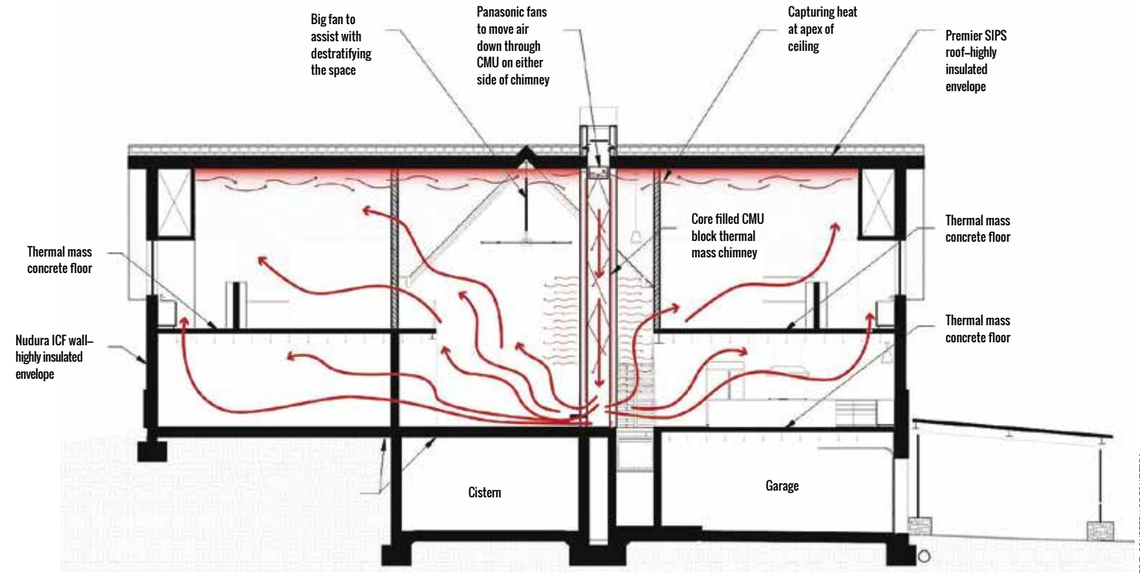
Formidable beauty. SCHOTT ROBAX heat-resistant, transparent glass-ceramic panels, shown here in an application by Spartherm, provide a visually appealing, closeup view and feel of the fire without danger from flying sparks. COURTESY OF SPARTHERM

"We did in-depth modeling on this design, and it demonstrates the load of the house to be one-fifth of a conventional home's energy load," Herro says. "The high-performance envelope is like a cooler, separating the interior from the variation swings of the climate outside. Inside, we are taking advantage of diurnal swings to store the right temperature air in a thermal mass 'battery'—a battery that is also aesthetic, structural, and provides steady comfort."

Herro is particularly proud of this feature of the house because it harkens to yesteryear, a time when people heated, cooled and humidified their homes using conceits such as home siting, window placement or by hanging wet sheets in doorways. "This isolated fireplace wall design sitting inside a super-insulated building envelope is an example of getting dollars of benefit for pennies of material," he says. "It's a significant financial benefit and brings back the

COURTESY OF CULTURED STONE

Set in stone. Cultured Stone's *Country Ledgestone*, a manufactured stone veneer product, is the VISION House team's literal all-around choice for fireplace composition.



CREDIT: COURTESY OF EQUITERRA

HVAC amended. The VISION House uses a super-insulated envelope, a ventilation system, and thermal mass to heat and cool the house without the need for a mechanical HVAC system.

lost building practices of 80 years ago. For a well-designed net-zero house, you don't just make energy, you need to drastically reduce the need for energy."

HEATING THINGS UP

VISION House features special amenities that help manage heat and provide an Earth-friendly look to the inside and outside of the home.

The fireplace is wrapped in Cultured Stone's Country Ledgestone, a manufactured stone veneer product that the VISION House team considers a perfect visual fit. "For aesthetic reasons, we are using Cultured Stone on both the interior and exterior," Herro says. "We want that connectivity to nature by pulling the outside back in." The house features the product in Gunnison, a charcoal and gunmetal color punctuated by highlights of powdery light gray.

Meanwhile, SCHOTT ROBAX heat-resistant, transparent glass-ceramic panels in the fireplace provide full protection, visual appeal and heat. The glass enables a closeup view and feel of the fire with no danger from flying sparks. "Temperature-tolerant SCHOTT glass is key to the VISION House's ability to harvest heat in the winter," says

COURTESY OF PANASONIC

Command center. The Panasonic *Cosmos Healthy Home System*—a combination of the Command Center, indoor air quality (IAQ) Sensors and Panasonic's *WhisperHood IAQ Range Hood*, *WhisperGreen Select*, and *WhisperFresh Select* Fresh Air Supply Fan—maintains IAQ and comfort, and provides passive heating and cooling.

Seattle Cascades
VISION House® by Green Builder® Media

The Ways We Think Green

Indoor air quality	11%
Best building and design practices	10%
Quality construction	10%
High performance homes	9%
Building science	9%
Renewable energy	9%
Durability and low maintenance	9%
Selecting quality/performing building product	8%
Above code	8%
Achieving a performance target	6%
Resiliency	5%
Smart/connected homes	5%

Building basics. What we breathe and how our homes are built are what's most on our minds when it comes to home ownership. SOURCE: COGNITION SMART DATA

Herro. "With this product, you get the benefits of aesthetics and an energy-efficient combustion chamber, so there is no negative indoor air quality."

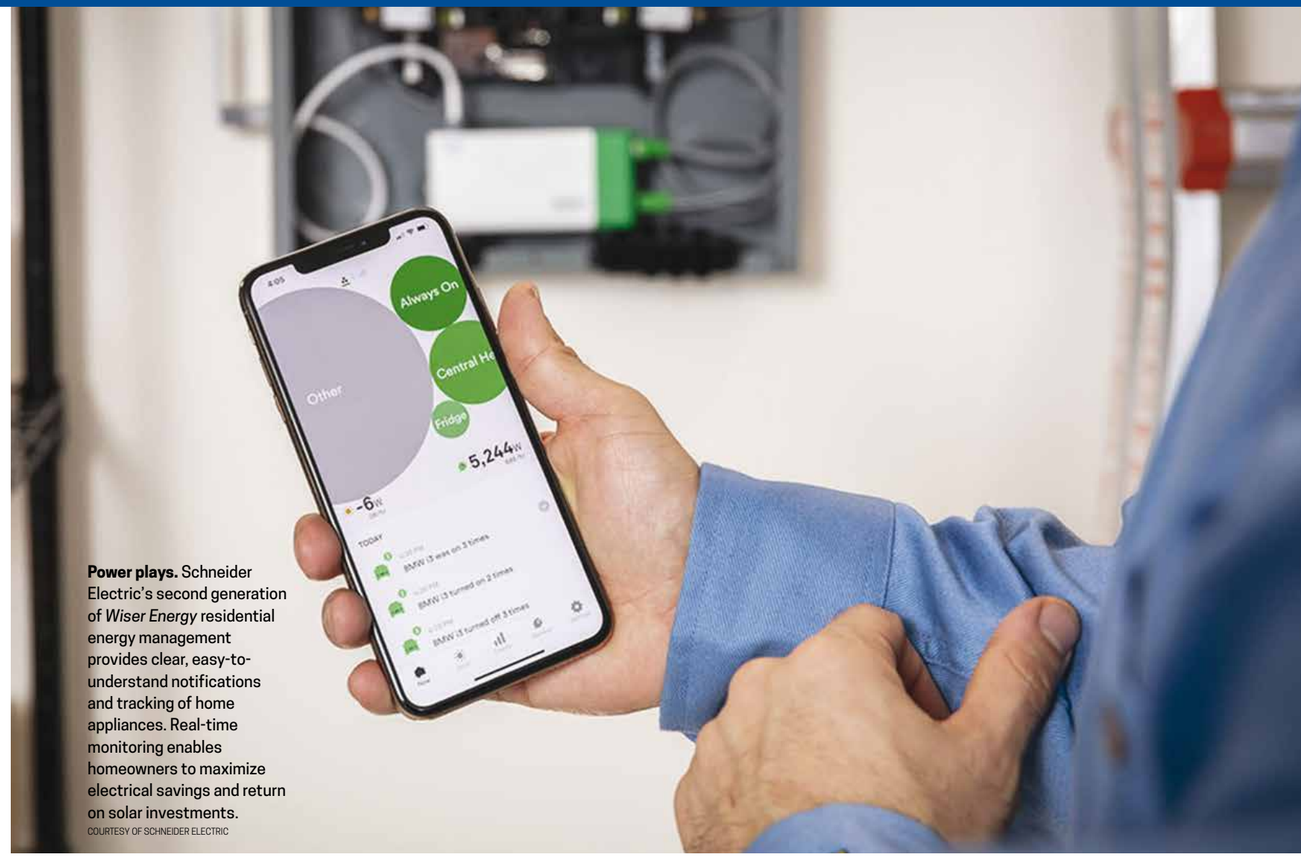
INDOOR AIR QUALITY

Health and wellness continues to drive demand for more sustainable homes, moving beyond early adopter and first mover audience segments to the mainstream. COGNITION Smart Data is tracking the adoption of indoor air quality products among consumers. Homebuyers not only care about the health of their indoor environments, but they are willing to spend money on products that provide healthy air.

The Panasonic *Cosmos Healthy Home System* was selected for the VISION House project, not just for its role in the net zero energy story, but also because of its ability to automatically keep fresh air circulating through the house. "You need to ensure a house is homogenous in temperature so there is comfort and fresh, clean air that enhances the life of the people in the home," says Herro. "This is why Panasonic was a critical partnership for me in this project. The company has a tremendous amount of expertise in home ventilation and air control, and its products allow you to control air in a smarter way."

The *Cosmos Healthy Home System* is able to take seasonality into account with its ventilation scheme. "Because we are not using air conditioning in the summer, we want to bring air in at night when it is coolest, and then seal the house and not bring in air during the daytime to have comfortable temperatures all day long," Herro explains. "Smart controls that know the difference between January and July is one of the critical functions. We can bring in the daily American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard for fresh air during the night in the summertime and during the day in the winter time and not ventilate at all in the opposite temperatures during those seasons."

Grand 'Vision'. Control4's *EA-5 Controller* is the hub or brain of the whole-house control system. This unit communicates with all the connected products in the house, such as the *Cosmos* and *Wiser Energy* system. In addition, it has music streaming services built into it, which can be used as an audio source for up to five zones. COURTESY OF CONTROL4



Power plays. Schneider Electric's second generation of *Wiser Energy* residential energy management provides clear, easy-to-understand notifications and tracking of home appliances. Real-time monitoring enables homeowners to maximize electrical savings and return on solar investments.
COURTESY OF SCHNEIDER ELECTRIC

CONNECTED LIVING

To tie systems of the house together, the VISION House team selected Control4's *EA-5 Controller* and tied other systems' controls into the interphase, such as the Schneider Electric *Wiser Energy* system and *Cosmos*. "From a 30,000-foot view, one of the things we had to consider is the remote nature of the site," Herro says. "The potential to control and monitor product remotely means that we need everything from heating, cooling, security, lighting and ventilation to talk to each other."

Herro notes that if the Control4 *EA-5* wasn't included in this house, the team would have had to invent a control system by hand timing and switching. "It would have made every experience in the home complicated," Herro says. The Control4 *EA-5* is an off-the-shelf solution to advance energy-efficient controls. "It uses clouded algorithms and is much more surgical at harmonizing controls to provide continuous comfort, good indoor air quality, and smart energy management."

"It doesn't take an electrical engineer to operate this house," Herro continues. "This can happen because Control4 makes the interface and achieves the types of synergies that fulfill a high level of systems-based energy and health requirements."

Herro believes that for any system like this to be useful to a homeowner, they have to coordinate under one roof. "You have to have one system and not have 20 separate controls of 20 separate things," he says. "By creating this seamless integration, Control4 is creating a template that can be used anywhere in the country using optimization algorithms without input by the homeowner." GB

Most Desirable Smart Home Categories

Security	24%
Thermostats	21%
Indoor Air Quality	17%
Solar System Monitoring	12%
Camera/Sensor	7%
Lighting	5%

Locked up. Security and thermostats lead the list of smart home devices consumers want in their home.
SOURCE: COGNITION SMART DATA

Connected Living: Benefits for Both Landlords and Tenants

Smart appliances and other Wi-Fi-enabled products have features that can appeal to building owners and residents.

BY MATT POWER, EDITOR-IN-CHIEF

LANDLORDS, DEVELOPER/BUILDERS and building owners have used building management software for many years. The addition of new devices and appliances in the connected living space is further transforming the way building owners run their business, along with the way renters live their lives. But to effectively communicate the value of smarter buildings, both parties need to understand specific ways that connected living can improve quality of life.

New products, with enhanced control and communication, are transforming how building comfort is maintained (smart thermostats), how residents get in and out (smart keypads and locking systems), and what happens when a device fails or needs repair (self-diagnostics, leak detection and remote reconstruction).

As we'll explore in more detail below, the right collection of connected products allows landlords to keep track of most of the important mechanical systems in the building. Residents, on the other hand, can enhance their own comfort and security, save time on tedious chores, and have the easy access to online services that they want.

LANDLORD BENEFITS

Landlords gain immediate cost benefits with connected technology. First, there are the fundamentals: climate control, security and access.

Climate control. With smart thermostats, for example, building owners can establish flexible scheduling that maintains building comfort, yet still allows tenants temporary override capability. Some Wi-Fi thermostats can send an alert to the landlord when humidity levels spike suddenly to an unusually high level, or when temperatures drop to the point where pipes might freeze.

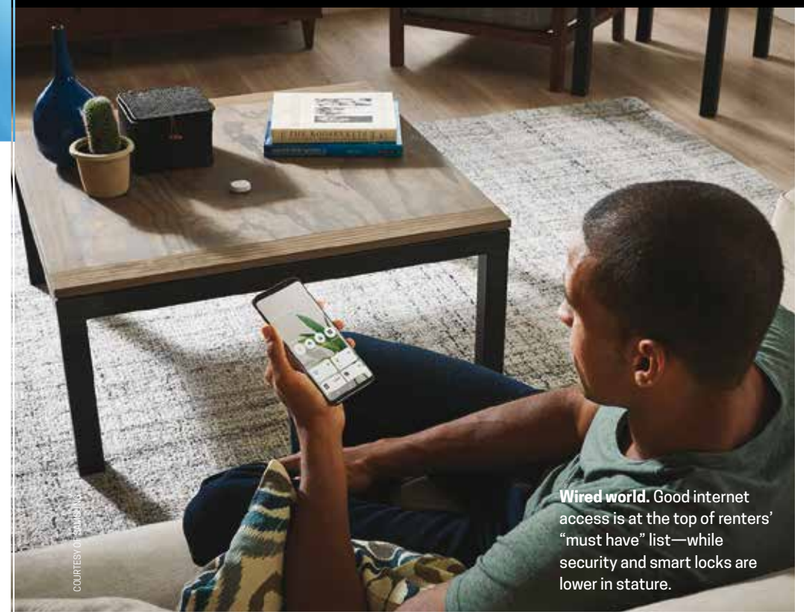
Security. Window and door sensors, surveillance cameras and occupancy sensors can all be integrated into building management. The key for landlords is to strike a balance that allows tenants to feel safe, but without intruding upon their privacy. As this article, "Your landlord turns your apartment into a smart home—now what?" points out, some tenants who suddenly encounter smart technology in their homes may feel their privacy is being invaded. They may worry that the technology will be vulnerable to hackers and want to know how their "data" is being used. Transparency is key.

Access. Hand in hand with security is entry to the building and its sub-units. For landlords, the level of control can be minimal—or extremely tight. For example, some smart locks record which tenant comes and goes at what time of day. Most allow for multiple keypad codes. Some can be changed or deleted remotely. Other systems offer geofencing, so that the door simply unlocks as the phone owner comes into close proximity. How many of these options do landlords need or want? It depends, naturally, on the building and the situation.

Preferred Features for Connected Appliances

FEATURE	APPLIANCE: Washing machine	Stove	Oven	Fridge	Dish washer	TV	Vacuum cleaner	Heater	Cooking hood
Ability to be controlled remotely	9	8	7	6	10	7	3	7	3
Autonomy	10	9	5	5	6	3	6	4	6
Ability to cooperate	3	9	8	5	4	3	3	3	6
Ability to provide guidance	7	4	6	7	2	2	3	1	1
Multi-fuctionaility	9	2	3	4	3	2	4	1	2
Ability to learn	5	1	1	0	1	5	1	3	0
Ugradability	2	2	1	1	2	5	1	1	1
Adaptability	2	2	2	2	2	1	1	2	2
Having human-like interaction	2	3	0	3	1	0	1	1	0

Remote control matters. Research on what people value most in new, smart appliances points to long-distance control first, with little interest in "human-like" interaction.
SOURCE: INTERNATIONAL JOURNAL OF DESIGN



COURTESY ZUMPER

Wired world. Good internet access is at the top of renters' "must have" list—while security and smart locks are lower in stature.

The really exciting news in the connected living space, however, is the next tier of devices and sensors, which augment and integrate with the basics.

Leaks. For example, leak detectors can identify water problems such as leaks before they become bigger, more costly issues. One mitigation company, Restoration Local, estimates that when pipes leak, they can cost building owners about $2,700 in repairs. Then there's the issue of money down the drain. For example, according to this analysis by Express Sewer & Drain, a single leaky toilet can waste up to 6,000 gallons of water per month—about $70 worth of water. And for homes where a centralized leak detecting product is not installed, some connected devices have begun to include their own leak sensor. Samsung's connected dishwasher, for example, includes digital leak detectors.

Air quality. Smart range hoods and bath fans operate automatically when they sense moisture or air pollution, reducing false fire alarms, improving indoor air quality for all tenants, and reducing damage to ceilings and trim from grease, smoke and humidity.

TENANT TURN-ONS

What about renters? Do they actually want smart home technology? According to a 2018 study by Entrata, they do—more than many other amenities, including pools and childcare. But their priorities are not the same as building owners: First, they want good Wi-Fi and cable TV access. Next, they value the ability to manage their laundry in-house. Third, they love the idea of online rent payments, followed by health/fitness amenities, then security and smart locks.

Those opinions are not monolithic, of course. Across a broader sample of demographic groups, consumers may be more open to a wide palette of technology.

As *Multifamily Executive* reports, "Ranked in order of preference (*and across demographic groups*), these include free Wi-Fi connectivity, smart thermostats and Energy Star kitchen appliances. Next are features that offer convenience—keyless electronic front entry, built-in USB charging ports, in-unit motion-detection cameras and motion-sensor lighting."

It's safe to say most tenants don't think of climate control as an "extra" any more than healthy air quality. They expect it as a standard. To talk with them about connected living, it's important to approach the topic from a lifestyle perspective. They need to know how products will save them money or time.

For example, in this comprehensive study of how people perceive and use smart appliances, respondents valued "autonomy" highest for washing machines and stoves. Combine that response with their interest in controlling these devices remotely and you see that what they're really seeking is *time saving*. With remote control of self-diagnostic appliances, they can manage many mundane chores while they're waiting at a doctor's office or standing in line at the Department of Motor Vehicles. Another, more esoteric benefits of connected living that appeals to users is the "mood setting," aspect—part of the urban experience that people are looking for in modern, well-designed apartments.

For example, consider connected living products such as smart refrigerators. A tenant may not seek out this type of technology, but in many ways, it fits nicely with each of those factors. Provided it's not tied to higher rent, they'll inevitably find themselves using it as an extension of their smartphones to save time shopping or preparing meals. And it fits with their modern kitchen. They can check their calendar, chat with a roommate, play music, or figure out what to make with the leftovers in the fridge.

The storyline that will catch the imagination of renters is a practical story about how connected living can keep their monthly costs predictable and modest. Sure, they will pay a little extra for a connected living apartment, but they might save money on water and electric bills, by managing their Wi-Fi-enabled laundry appliances.

CONNECTED CONTROL: EVERYBODY WINS

The market for smart, connected devices in multifamily housing has become much more stable and mature in recent years. For landlords, it's a no-brainer. The ability to monitor and manage energy efficiency, security and damage control remotely greatly reduces the risk to their valuable property. Also, a few insurers have begun to offer discounted rates for certain smart devices, such as Wi-Fi smoke detectors, smart locks and burglar alarms. This trend should continue.

The rental market then, if approached carefully, could be exactly the market niche that tech manufacturers have been looking for. It's a way to normalize connected living in a way that reaches the mainstream by way of cost-conscious renters. Once landlords and tenants find a harmonious balance among products and protocols that integrate comfort, security and convenience, living in a smart, connected apartment will simply become the new normal. GB

Racing Against Extinction

In an age where more companies are 'dying young,' innovation is the key to keeping your business around for another generation.

BY NANDU NANDKISHORE AND JAMES MICHAEL LAFFERTY

WHO WANTS TO LIVE FOREVER? For those of us who don't, a long, healthy life, perhaps of about 90 years, is enough. In the mid-1920s, 90 years happened to be the average lifespan of a leading company. Ninety years for us, 90 years for our companies: a neat mirroring of our own existence in what we made manifest in the world.

By the 1950s, the average company lifespan was down to 60 years. Today, it is a mere 17 years. Why are our companies dying young?

Take Kodak—founded in 1888, ubiquitous in the 1970s and 1980s. The former photography giant declared bankruptcy in 2012. Kodak had decided to cling on to the film-and-paper business model in the throes of the biggest ever disruption to its industry: digital. Incredibly, Kodak invented digital photography in the first place. They even set up a separate division to drive it. But they said it couldn't be monetized and hoped it would go away. Kodak is one of the best examples of what happens to a corporation if it refuses to change with the world around it.

We've noticed a four-stage pattern in the lives of companies that cuts across all sectors and industries. Even the most successful megaliths of the corporate world are not immune from its pull. In fact, many of them exemplify it.

CREDIT: FREAKINGNEWSPINTEREST

Final 'Moment.' Kodak, the vanguard of photographic technology for a century, faded away in 2012—the victim of the very digital tech it invented but refused to embrace as photography's future.

Stage 1: The maverick founder

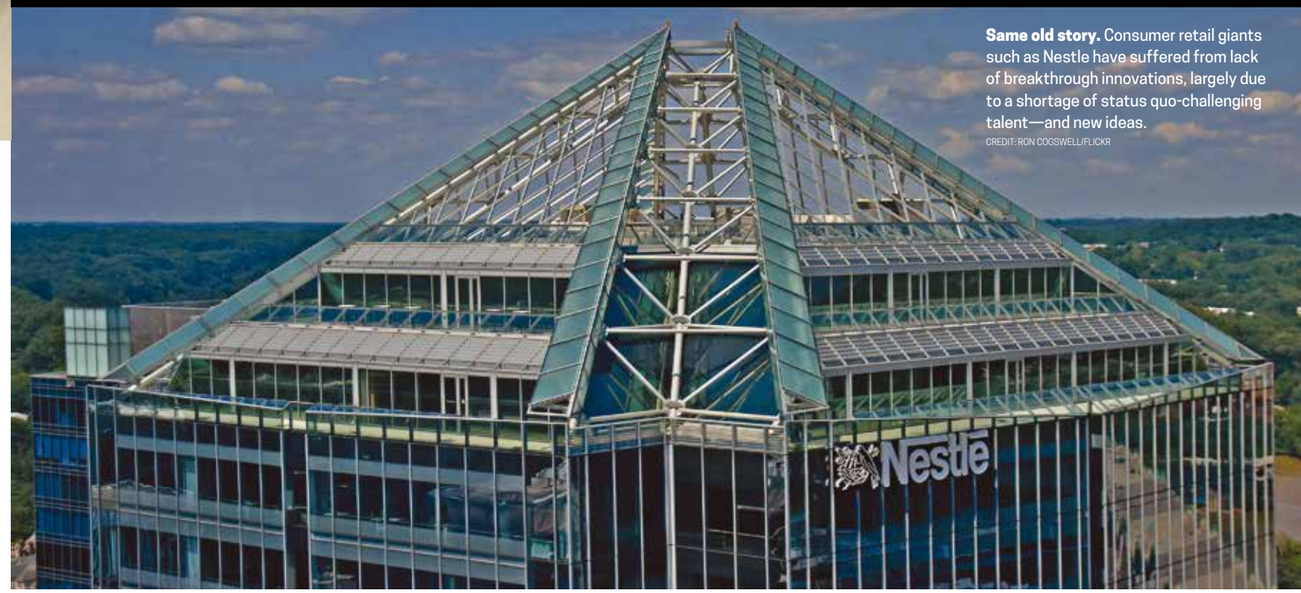
Every famous corporation has a legendary founder. A maverick who knew what the people of the time needed and how to give it to them in a way that revolutionized their whole industry. Look at Ray Kroc, who founded not just McDonalds, but the whole concept of take-away food. Or Anita Roddick, who founded the world's first ethical cosmetics megabrand, the Body Shop. People like them go down in history. But who is creating history today?

Wellness is now one of the fastest-growing global industries, as identified by Gallup. But the golden age of the mega-brand is waning. The fastest-growing wellness companies are not megabrands. They are startups, quite often founded by people with absolutely no background in business. Hollywood star Jessica Alba has had astronomical success with The Honest Company, which did what no mega-brand was doing: It cornered the market for organic bath and beauty products for the whole family. Mass brands are made with chemicals. All of them were ignoring what young, middle-class American families wanted. Alba leveraged her name, e-commerce and niche positioning to win $1.7 billion in 2017.

For millennials, everything has to be moving. It has to be new and it has to make them feel special. That happens with allegiance to an array of diverse brands, not one big brand with one big, constant image. They don't want to be just one identikit consumer in an amorphous mass of people; they want to be individuals. Big business is too corporate, too socially irresponsible and too global.

Stage 2: Going global

Nearly every successful company went through a stage 1 at its conception. But stage 2 is more complicated. To scale up internationally, you need patience, consistent effort with little immediate payoff, and a lot of discipline. The big brands of the 1980s did this with aplomb. It took 20 years or more, but brands like Unilever, Nestle, Coca-Cola and P&G (formerly Procter & Gamble) dominated the planet until the 1990s, when East Asian countries started to create fast-growing markets and easy access to finance. Strong local competitors began to emerge: Asia Pulp and Paper, and the Wings group in Indonesia; Nirma in India; URC and Lucky Me in the Philippines; and many others.



Same old story. Consumer retail giants such as Nestle have suffered from lack of breakthrough innovations, largely due to a shortage of status quo-challenging talent—and new ideas.

CREDIT: RON COGSWELL/FLICKR

When competition for market share emerges, margins are under pressure from the companies who are willing to accept lower returns.

Stage 3: Competition bites

As growth slows, investors and analysts demand higher earnings per share. There are only three ways to do that: price up, sell more or reduce costs.

Pricing up prices your product out of the market, and selling more in the midst of slowing growth is a contradiction in terms. So we strip costs—which might be okay, were it not for the new competitors who show up at this stage. Tech savvy, innovative and nimble, these impostors tend to create, occupy and grow niches the established brand deemed insignificant or fantastical.

Today, they tend to be organic, natural and/or socially responsible. Take a look at Nakd bars—the $40.2 million company making sweet sticky snacks for the health conscious. In 2015, it became the United Kingdom's No. 1 "single" snack bar and has remained there since, growing 45 percent year-on-year. In 2016, Nakd—whose bars and nibbles are made from 100 percent natural ingredients with no preservatives, additives or sugar—sponsored Veganuary, a global awareness month created to encourage a switch to plant-based whole foods.

Stage 4: Distraction

When the returns initially gained from squeezing value begin to peter out, the giant dinosaur crashes to the ground—not before, however, a dazzling show of financial maneuvering by the hangers-on. They want to improve shareholder value but the best they can do is wave and shout in an attempt to distract those watching from the grim reality. Maybe they move revenue to a lower-tax jurisdiction, or sell off one part and buy another, all in an effort to construct a story for the analysts. It's the dance of a dying man.

These four stages of corporate evolution are not inevitable, but they can be slowed down. Innovative and brave pioneers found a company. It becomes so successful that the only place to go is out to the rest of the world. The world is finite, so there comes a time when profits plateau or fall. Then comes the cutting of costs to maintain profit growth. Eventually profits dip anyway—usually due in part to savvier kids on the block—and the only card the established old-timer has left to play is a few financial dance moves to silence the hovering analysts.

Each stage requires a different strategy, and different managers and leaders. The managers and leaders are assessed within each stage according to how well their talents are suited to it. In other words, the creativity and bravery needed for the initial stage is then rejected in the second stage, which is all about bureaucracy, internal politics and towing the line. There are simply too many codes, written and unwritten, for true innovation to happen.

ONTO THE SCRAP HEAP

When growth slows, a stage ends. And eventually, these companies all end up in the same place: the scrap-heap of stage 4. There are three trends that push them there.

1. A tired business model

Thirty years ago P&G knew toothpaste. Gleem made your teeth whiter and Crest prevented cavities. Having two brands in one category worked: P&G had more than two in many categories. If they wanted to cover different consumer benefits, they brought in a new brand. But marketing costs rocketed and large retailers like Walmart now called the shots, and found it easier to support megabrands. And so, Gleem became "Crest Whitening."

The 1990s and early 2000s were the age of the megabrands. Niche brands didn't have the scale to get on the shelves of the massive supermarkets. That didn't mean that customers didn't want niche brands, it just meant they weren't available. But not for long.

COURTESY OF P&G

Logical step. For decades, companies such as Procter & Gamble maintained multiple brands of the same product—in this case, Gleem and Crest toothpastes—until rising costs and competition led to one "new and improved" item.

2. Ecommerce: It won't go away

You don't need volume to achieve scale any more. Got a product idea? Launch it on Amazon or Etsy and away you go. Today, the megabrands need to watch their backs. Anyone can be a serious competitor. And, consumers can get what they want and need instead of being forced to buy megabrands through lack of choice. The megabrands simply can't "do" niche. In 2017, P&G sold off all of its niche beauty brands to Coty, sticking to what it knows best but missing out on an opportunity for growth. There is no doubt that right now, niche is simply where it's at. Ask Walmart who its best suppliers are and P&G is still somewhere at the top. But ask Amazon—responsible for more than five percent of total U.S. retail sales in 2018—and it will list a number of niche players the bigwigs at P&G haven't even heard of.

3. Mavericks are mandatory

Without mavericks, there is no innovation. It's that simple. Companies need people who see things differently, push boundaries and take risks. They might make people feel uncomfortable, but that's the whole point. Without discomfort there is no progress. You can't innovate by appointing a chief innovation officer or making a plan. It has to be enmeshed in the culture of the organization, and the only way to do that is to scatter them strategically throughout it. Mavericks at the most-senior levels inspire those below them to use their difference to transform and create. If you don't fit in and offend some people, all the better.

In the 1980s, P&G and Nestle had a good smattering of mavericks. People would clamor around them, keen to feed off their energy. But because they didn't conform, others tried to push them out. Mavericks need to be protected. Smart leaders know this. The evaluative systems of today—where success is based on conforming to a standard set of principles—don't treat them well. Once the millennium kicked in, mavericks everywhere started to go the way of the woolly mammoth.

Neither P&G nor Nestle has had a breakthrough innovation in more than 20 years. Their leaders are talented and inspirational but a company without mavericks is like a curry without cumin. It doesn't matter how good the meat is: Without seasoning and sauce, it's a different dish entirely.

Most Fast-Moving Consumer Goods (FMCG) giants are now in stage 4. Embroiled in financial choreography, "nothing to see here" messages are being sent across the globe to keep analysts off the scent of death. And death is the only place to go after stage 4, unless they can do the following:

- Embrace mavericks. Start with your culture.
- Restructure to create, small, niche, independent business units where ideas can bloom. Protect these units from interference.
- Stop shareholder buy-backs—which do nothing but artificially boost earnings per share (EPS)—and re-invest into innovative business models instead.
- Stop letting analysts drive strategy. Manage the expectations of investors as the company moves into a new phase. Take a long view.

It's not easy to make such radical changes. But it is necessary. Companies need to make conscious yet painful choices if they are to survive. But imagine the exhilaration when your breakthrough innovations create real and lasting success. You need the right kind of mavericks to shake things up, turn them upside down and jump all over them before genuine transformation will happen.

Corporate cultures are insular. Mavericks are unpredictable and zany. They don't play it safe: They are the backbone of innovation. Forget that at your peril. **GB**

This article originally appeared in the Oct. 19, 2018 edition *of London Business School Review, a publication of* London Business School. *Reprinted by permission.*

The Future of Green Buildings

Part 2: Project Management, Mother Nature, Disasters and More

This is the second in a series of articles about upcoming challenges and advancements in green city architecture, master planning and technology.

BY TERRY BEAUBOIS

THE TOPIC OF "The Future of Green Building" is continually evolving. Even since I wrote **Part 1**, there have been new developments to consider and include in Part 2, to bring these important green building issues into everyone's awareness.

PROJECT MANAGEMENT: FROM BIDS TO JOB SITE

A future development is the coming incorporation of computer gaming technology into serious business tools. Using the actual computer gaming software's ability to design in 3D is being explored.

One example is the teaming of Graphisoft, the developer of *Archicad*, with Epic Games, the developer of *Unreal Engine*. Epic's new visualization solution, based on the recently acquired Twinmotion, will incorporate state-of-the-art, real-time rendering technology in coming versions of each of the related software programs.

"The same Unreal Engine that powers the popular video game, Fortnite, has been part of Twinmotion for years," says Marc Petit, Epic Games' general manager for *Unreal Engine*. "We are now very excited to work with Graphisoft to promote the use of real-time visualization solutions to help architects and designers visually communicate."

I saw this demonstrated at the 2019 AIA Conference on Architecture and was impressed with its potential.

Another example of computer game software technology making its way into the building industry is DIRTT Environmental Solutions, a modular wall manufacturer in Calgary, Alberta. One of the primary goals was developing software capable of providing a single, seamless experience from initial client concept through manufacture and delivery. Developers based much their software design on existing computer gaming software technology and capabilities.

According to Mogens Smed, DIRTT's founder and CEO, the company allows complete customization in design with its variable product offering. In upholding its "green first" initiatives, DIRTT uses only its *ICE* software and its output documents to communicate the available solutions.

Today, there are more than 90 partners, including architecture and design firms, using their *ICE* software as a visual sales tool and product design to complete specification and ordering. "*ICE* is so easy to use," Smed says. "The salespeople can actually design layouts in front of the client, who always feels engaged and empowered."

Danger signs. An ongoing series of natural disasters, such as mass flooding following a hurricane, means green homes must be more-resiliently designed.
KEITH MOSELEY/FLICKR

Test case. Graphicsoft's *Archicad 23* software allows architects to easily create real-time, photo-realistic renderings of projects, helping them determine designs that work from ones that won't.
COURTESY OF GRAPHICSOFT

Power pack. Span.IO's palm-sized electrical panel can monitor and control up to 32 household circuits, plus solar or battery inverters, EV charger controls and grid connect-disconnect, via a smartphone app.

DISASTERS

The current fire danger situation in California brings attention to the vulnerabilities of homes and communities everywhere. Considering the range of potential disasters nationally—storms, hurricanes, tornadoes, floods, wildfires, earthquakes and droughts—designing and building green homes nationwide that take local dangers into consideration is a must.

In October Pacific Gas & Electric (PG&E), the major California utility, implemented the extreme measure of shutting off electrical energy to numerous communities to reduce the possibility of any electrical line or equipment on the power grid accidentally sparking and setting off a fire. This included 800,000 customers north of San Francisco and 300,000 customers around the San Francisco Bay Area.

The threat of fire danger is due to weather conditions—warm or hot dry air creating dry vegetation. This increases as the amount of available "fuel" (dry brush, plants and trees) continues to increase. For those that have beautiful, wooded landscapes with plants close to the home, proper green building can include taking into consideration the landscaping around a house that will reduce exposure to risk in the event of local fire danger. How we design green building to withstand and endure a variety of disaster-related situations should be on any checklist for green building projects.

Green builder homes in the future would also benefit from self-sufficient, renewable energy solutions for homeowners. This is certainly a feature that homeowners will seriously appreciate and consider.

NEW HIGH-TECH ELECTRICAL PANELS

One area with great potential that I have been following for decades is further advances in electrical panels for homes. There haven't been many changes in the home electrical panel, but there are some products in development that may change that.

One company, Span.IO, has assembled a team with experience on the Tesla *Powerwall* project (home battery and electric car charger). They are currently developing an electrical panel for homes. This panel is now being tested in Hawaii and soon in California. The goal, according to CEO and founder Arch Padmanabhan Rao, is to "bring intelligence to a home's electrical system with a new smart electrical panel that was designed from the ground up with home solar, energy storage, electric vehicles and smart home tech in mind."

Rao says the company is excited to launch a product that will "accelerate the adoption of renewable energy, while transforming the customer and installer experience." Span.IO is initially partnering with leading solar installers in Hawaii and California, and the company has plans to ramp up production volumes in early 2020.

These are just a few of the most important examples of upcoming changes for us to be prepared to integrate into our future green buildings. I will continue to follow up with you in future *Green Builder* magazine articles. **GB**

Terry Beaubois is the CEO of Building Knowledge Systems, LLC, in Palo Alto, Calif. He is involved in research projects, articles, speaking engagement, and guest lecturing in university classes related to the Building Industry, with a specialty in advancing technologies and Green Building.

Taking the Low Road

In the game of residential building codes, Texas shockingly folds.

BY MIKE COLLIGNON

FOR ONE MOMENT, forget everything you thought you knew about Texas.

In August, Gov. Greg Abbott signed into law Texas House Bill 2439, which prohibits a governmental entity (individual municipal governments and the State itself) from adopting or enforcing a rule, charter provision, ordinance, order, building code or other regulation that:

(1) prohibits or limits, directly or indirectly, the use or installation of a building product or material in the construction, renovation, maintenance, or other alteration of a residential or commercial building if the building product or material is approved for use by a national model code published within the last three code cycles. The model code must apply to the construction, renovation, maintenance or other alteration of the building; or

(2) establishes a standard for a building product, material or aesthetic method in construction, renovation, maintenance or other alteration of a residential or commercial building if the standard is more stringent than a standard for the product, material or aesthetic method under a national model code published within the last three code cycles.

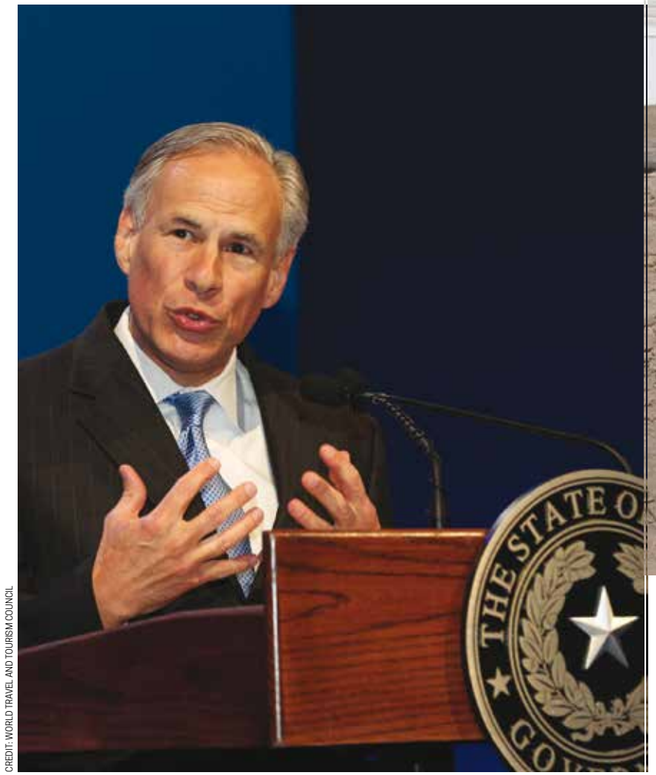
Put into plain English: If it's not in a national model code, you can't require it. And you can't make your code require anything better than what is found in the last three model codes.

Yes, Texas has established a state energy code, but for the most part, this is a home rule state. To pass legislation that lands the state on the exact opposite end of the spectrum is shocking. The state homebuilders association is taking a victory lap, claiming that "it's one of our bills" and "the bill's good for housing affordability". How so, you ask? Well, a homebuilder can now, for example, install aluminum siding on an addition in neighborhoods that were previously using higher-end claddings like masonry. This can save the homebuilder money. Maybe they'll pass those savings along, maybe not. What else might go down? The resale values of the surrounding homes.

This sentiment is echoed by Les Albin, a Houston-based homebuilder. "National codes are a good framework, but they don't work equally all over Texas," says Albin. "Areas on the Gulf Coast have much different conditions than in West Texas." It's a problem he believes will ultimately erode the quality of Texas' housing stock and increase long-term maintenance costs.[2]

Concerns are also being raised by code officials. R.J. Davidson, chief building official of Baytown, about 30 miles east of Houston, shares concerns over builders and developers' frequent focus on price, which he says may lead to cheaper materials (like metal or siding over masonry) becoming commonplace. His concern isn't over quality, but rather with stripping a city and its population of the ability to collectively determine how they want their communities to look. "Codes ensure quality construction," Davidson says. "The bigger problem is the bill takes away a community's ability to control and beautify its environment."[2]

You know—that spirited independence that is pervasive throughout many parts of Texas.



CREDIT: WORLD TRAVEL AND TOURISM COUNCIL

Hero or villain? Texas Gov. Greg Abbott's endorsement of House Bill 2439 weakens government's hand on the types of materials that can be used to build or upgrade homes.

Three steps back. Texas contractors must now rely on national building codes that are up to three cycles old when determining how to construct projects.
CREDIT: U.S. ARMY CORPS OF ENGINEERS

One sponsor of the bill, State Representative Matt Schaefer, employed some pretty interesting logic when defending his bill. Why look to the expert (i.e., the homebuilder or remodeler) who is building or remodeling your home? He feels that if a homeowner is purchasing a home, it's their responsibility and their risk. "People have a responsibility to check out their home and approve it, and there's civil action available against contractors who do poor work," Schaefer says. "People are pretty darn smart. They buy a house and know in 10 to 20 years when it's paid off, 'I'll be able to make repairs.'"[2]

And until they get that home paid off (if that ever happens before they move again), they'll just have to live with a poor product. After all, it's only 1 to 2 decades.

The bill went into effect on Sept. 1, 2019. The full bill can be read here. GB

Resources:

1. Texas House Bill 2439, "Relating to certain regulations adopted by governmental entities for the building products, materials, or methods used in the construction or renovation of residential or commercial buildings." **[https://legiscan.com/TX/text/HB2439/id/2027672/Texas-2019-HB2439-Enrolled.html]**
2. *Pro Remodeler*, Aug. 12, 2019, "Texas Ends Code Amendments." **[https://legiscan.com/TX/text/HB2439/id/2027672/Texas-2019-HB2439-Enrolled.html]**

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

AD INDEX

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PAGES 4 AND 5

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PAGE 12

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COVER 2

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PAGE 63

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www.homedepot.com/waterheaters
COVER 4

KBIS
Where Design is Moving
www.kbis.com
PAGE 9

Lennox
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www.learnlennox.com/greenbuilder
PAGE 23

LG
Achieve a whole new degree of flexibility with LG Air Conditioning Technologies.
www.lghvac.com/flexibility
PAGE 3

Mitsubishi
Greener homes require smarter solutions.
www.mitsubishipro.com/buildbetter
PAGE 57

SCHOTT ROBAX IR Max
The next generation of heat reflection.
www.us.schott.com/robax
PAGE 11

Uponor
Progress means moving water flawlessly and efficiently.
www.uponor-usa.com
PAGE 1

VISION House Seattle Cascades
The House the Experts Built
www.greenbuildermedia.com/vision-house-cascades
COVER 3

WaterFurnace
Breaking ground on groundbreaking communities.
www.waterfurnace.com/neighborhoods
PAGE 7

COMING NEXT ISSUE

GREEN BUILDER®

Green Home of the Year 2020

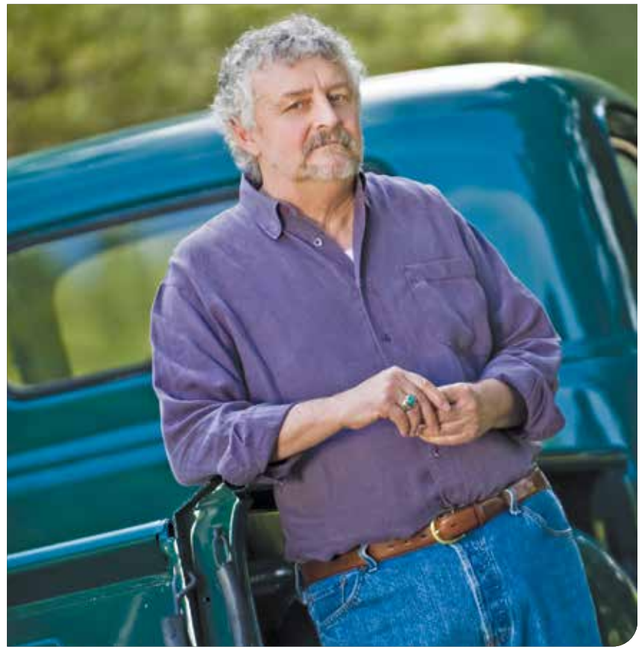
Green Builder's annual Green Home of the Year competition highlights projects that are leading the enviro-friendly charge through technology, net zero, design and other resources. Also, meet GB's newest Sustainability Superhero.

FROM THE TAILGATE

New Offerings for the Sustainable Minded

By Ron Jones

Transparency Lost



ON ONE LEVEL, it may be the quintessential tale of the fox guarding the henhouse or the wolf shepherding the sheep. In this case, the "flock" is composed of the home and building owners, renters, and other occupants of homes and domiciles in the United States. From the 30,000-foot view it just is part of a larger landscape of disasters that unfold in front of our eyes, as special interests not only manipulate entire industries for their own purposes but proceed to hijack our culture, our economy, our environment, and perhaps even our democracy.

On the final Saturday of October, an article in the *New York Times* titled "Secret Deal Helped Housing Industry Stop Tougher Rules on Climate Change," written by Chris Flavelle, publicly exposed the existence of a close-guarded and highly questionable arrangement between the National Association of Home Builders (NAHB) and the International Code Council (ICC) that gives the construction trade group a virtual stranglehold on the code development process in the residential building arena.

The memorandum of understanding between the two non-profit entities has long been the subject of speculation and debate in code development circles. Concerned policy watchers ask why and how a trade association enjoys four seats on two of the most crucial ICC committees that wield tremendous influence on what does, and does not, make it into each new edition of the residential building and energy conservation codes.

As the *Times* article correctly points out, four votes on an 11-member committee may be a minority but given the voting procedures in place, that block of four votes means that any proposal they oppose must gain the support of five out of six remaining votes (the chair generally votes only to break a tie) to secure committee recommendation to the voting members for passage and inclusion in the new edition.

Spokespeople for the Council assert that it is important to have "stakeholders" at the table and cite "evolving needs of the construction industry." NAHB claims that its members "know what works and what doesn't work" in the name of what it calls "affordability." But where does this spirit of cooperation cross the line? And who in this arrangement is protecting the interests of home buyers, building owners, tenants and the public at large?

Who is ready to give the home building industry a pass and say it deserves to be self-regulating? Is it somehow different from aircraft and automobile manufacturers, pharmaceutical giants, financial institutions, insurance companies, and countless others who have betrayed the trust of the people they are supposed to serve?

The profit motive is a powerful force, whether you make a living selling houses or code books. But since homes are responsible for close to 20 percent of all energy-related carbon dioxide emissions in the United States, the performance of those buildings affects a great deal more than the bottom lines of the companies who build them or the organizations responsible for the regulatory framework under which they are constructed. There is a lot more at risk here than the integrity and reputations of a couple of non-profit players.

The performance and future value of the places where we live, and the far-reaching effects on our economic and environmental well-being are in the hands of people we should be able to count on, something that is increasingly hard to do. **GB**

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