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GREEN BUILDER®

July/August 2020 / www.greenbuildermedia.com

THE NET ZERO IMPERATIVE

The world is in turmoil, and we *must* drastically reduce our CO_2 impacts. This year's industry Eco-Leaders point the way.

Seattle Cascades

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FOR MORE INFORMATION:

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

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EDITOR'S NOTE

The Inside Scoop

By Matt Power
Editor-in-Chief

Remodeling Rises as Industry Stalwarts Rally

Interest in remodeling is protecting the shelter industry from COVID-19's worst outcomes. Meanwhile, a few manufacturers are getting serious about reducing CO_2 impacts for future resilience.

IF YOU'RE LIKE ME, you've done a lot of deferred maintenance over the weeks and months of COVID-19 lockdowns—replacing appliances, putting in new ventilation, fixing broken faucets and addressing nagging issues with how space is organized and used.

And I'm not alone. Interest in remodeling and do-it-yourself (DIY) will probably remain strong, unless things get much, much worse. So far, sales at DIY stores and interest in remodeling project have surged. We know this thanks to our data research tool, COGNITION Smart Data, which weighs sentiment and other metrics in markets all over the U.S.

Self inspired. According to COGNITION Smart Data, Green Builder Media's market intelligence division, do-it-yourself projects have increased by up to 75 percent in some markets since the onset of the pandemic—even with high levels of concern about spending.

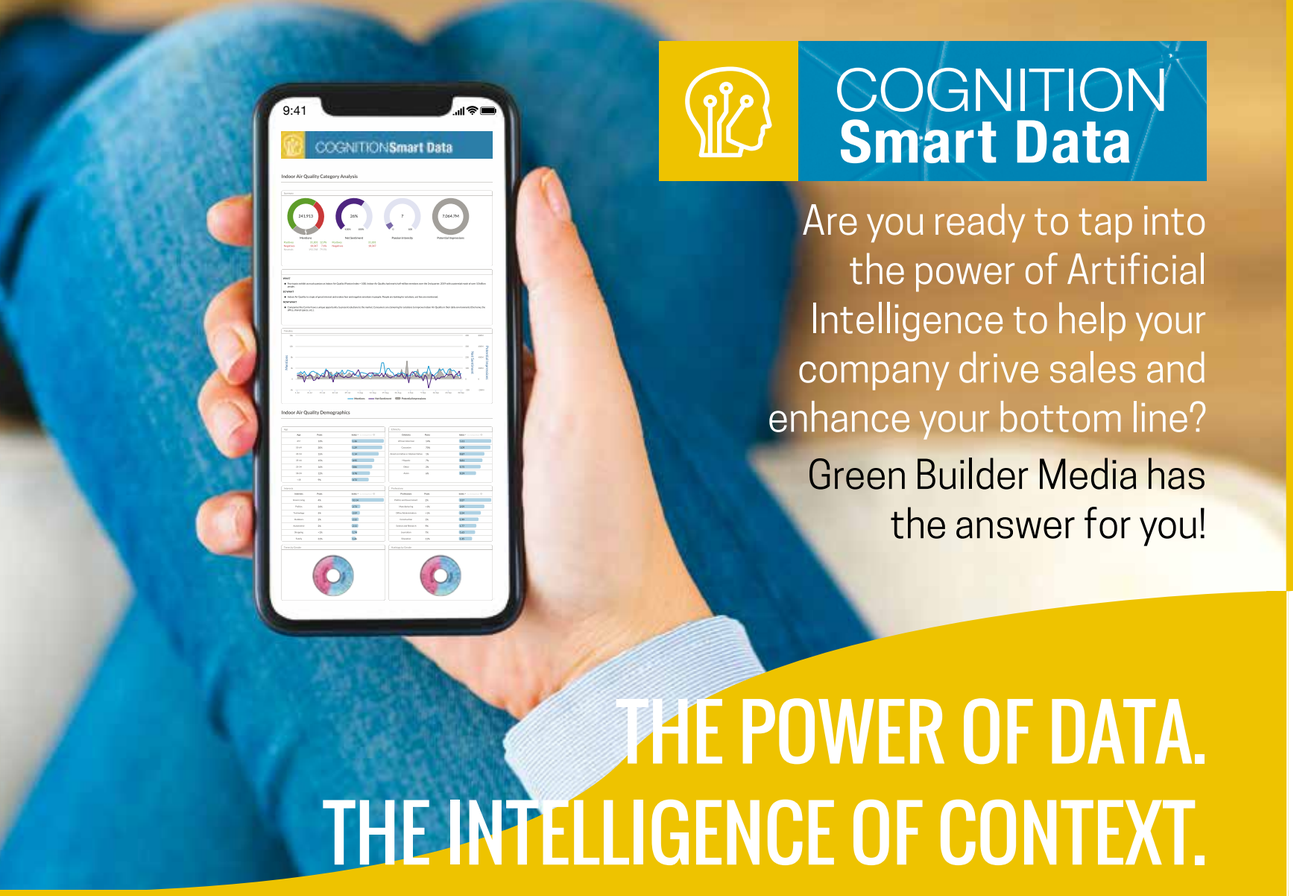
Where's the money going? Redefining work spaces; upgrading kitchens and replacing appliances; creating special space for exercise and Zoom conferencing; increasing storage and pantry spaces; adding or upgrading bedrooms.

The new housing market, also, has so far stayed ahead of crippling coronavirus damage. According to Census data, privately owned housing completions in June were at a seasonally adjusted annual rate of 1,225,000. This is 4.3 percent above the revised May estimate of 1,174,000 and is 5.1 percent above the June 2019 rate of 1,166,000.

The long-term outlook for new housing, however, remains a mixed bag. Many builders have furloughed or laid off workers. The pandemic is far from over, and it's premature to predict where we'll be in six months.

Meanwhile, a few building product manufacturers have not been idle. They've taken note of the pandemic's chilling insight into how quickly a Climate Change disaster might unfold in the U.S. That's what makes this year's list of Eco-Leaders different. We used as criteria companies that have integrated "net zero" goals into their planning and operations. They're taking positive steps to reduce their greenhouse gas footprint, and increase the resilience of their brands and services.

We're not out of the woods with COVID-19—not even close. But in the inevitable list of "silver linings" that could be recorded years from now, once the mobile morgues and heart-rending stories of family tragedy fade into history, perhaps one footnote will be that certain corporations began to take the existential threat of Climate Change seriously. And their leadership created a new wave of change. They showed the way to redemption and renewal. GB



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Green Building NEWS
The Latest on Sustainability and Renewable Energy

One-quarter of Americans Lack Space to Follow COVID-19 Guidelines

Tighter quarters means a higher risk of the coronavirus spreading among families, study shows.

TWENTY-FIVE MILLION HOMES that house 81 million Americans lack adequate space or plumbing to allow compliance with U.S. Centers for Disease Control and World Health Organization recommendations. Their homes are simply not designed to prevent possible spread of COVID-19 among family, according to a new study.

The study by Case Western Reserve University (CWRU) in Cleveland and City University - Hunter College in New York City also finds that inadequate room for self-imposed quarantine is much more common among minorities hardest hit by the pandemic, worsening spread within families.

About 46 percent of Latinos, 43 percent of Native Americans, and 32 percent of Blacks live in dwellings where separation is not feasible, compared to less than 20 percent of non-Hispanic whites. Crowding is worst for apartment dwellers, particularly in the Northeast.

Before COVID-19, small homes and large family gatherings seemed natural. Now, they could be putting everyone's lives at risk, the researchers note.

"To help contain family spread, we should immediately offer free masks, gloves and disinfection supplies to all families of potentially contagious persons," notes study lead author and CWRU Professor of Medicine Dr. Ashwini Sehgal.

Sehgal adds that doctors and nurses caring for COVID-19 patients are routinely put up in hotel rooms that lie vacant because of the pandemic. The same option should exist for potentially infectious patients in homes that are too small for safe isolation, he says.

The article appears in the *Annals of Internal Medicine*. Story by Claire Faulk, Physicians for a National Health Program.

Study: Wealthy Suburbs Produce 15 Times More Emissions than their Neighbors

Large homes account for 25 percent more GHGs than those in modest neighborhoods, but they're just part of the problem.

THE HOMES AND LIFESTYLES OF THE WEALTHY represent a major contribution to global warming, according to a new study by the University of Michigan. The report notes that affluent suburbs produce up to 15 times the greenhouse gas (GHG) emissions as nearby, poorer districts, and larger homes are responsible for nearly 25 percent more GHGs through lighting, heating and cooling than smaller ones.

This disparity has significant implications for climate change: one-fifth of U.S. emissions come from residential power use. The typical American uses more than 30 times the amount of electricity at home than the average person in India, the study notes.

Smaller impact. Modest neighborhoods and homes produce less than a tenth as much pollution as wealthy suburbs.

CREDIT: MICHELLE AMBRY

"Although houses are becoming more energy efficient, U.S. household energy use and related [GHGs] are not shrinking," says study lead researcher Benjamin Goldstein. "This lack of progress undermines the substantial emissions reductions needed to mitigate climate change."

Such emissions would plummet if the power grid switched entirely away from fossil fuels and toward renewables such as solar and wind, the researchers note. But far more extensive changes would need to occur to "help avoid disastrous impacts from the climate crisis." This includes a shift to smaller homes and xeriscaping that does not demand regular and extensive lawn, driveway and grounds maintenance chores typically performed with combustion devices. The analysis of 93 million homes in the continental U.S. found that the most-energy intensive dwellings, per square foot, are in Maine, Vermont and Wisconsin, while the least energy-intensive are in Florida, Arizona and California.

The study appears in the *Proceedings of the National Academy of Sciences*.

Heat Waves Turn Deadly, Will Become Even Deadlier

The pattern of record-setting temperatures will worsen in coming months and years.

NATIONWIDE, HEAT CAUSED at least 10,000 deaths from 1999 to 2016 – more than hurricanes, tornadoes or floods in most years, according to research by the Columbia Journalism Investigations and the Center for Public Integrity. And although the heatwaves are likely to continue courtesy of global warming, the lead agency for dealing with the problem is getting increasingly less support from the White House.

According to a report in *The Guardian*, the tepid federal response "has left state and local health workers ill-equipped to act, exposing communities to underappreciated threats that will only get worse." Some states receive more than $200,000 a year to fund climate teams. But most of the country's 3,000 state and local health departments get no such funding.

Condition red. Air conditioners and other climate control devices have become life support necessities.

CREDIT: SPATESISTOCK

They're on their own to figure out what to do and how to pay for it, *The Guardian* notes.

The ever-increasing temperatures make it increasingly important for people to have functional air conditioning and other amenities such as a swimming pool and exceptional insulation in homes and factories if possible, the U.S. Centers for Disease Control notes. But the reality is that not everyone can afford any or all of those, the agency says.

CDC has its own problems. During his administration, President Donald Trump has been highly critical of the agency, including resisting every Congressional bill that has tried to improve the department's annual budget.

Something in the air. As companies continue to try to meet sustainability goals, wind power has become an attractive, ever-reliable energy option.

CREDIT: AMERICAN WIND ENERGY ASSOCIATION (AWEA)

Wind Energy Demand Reaches New Record

The nation's wind capacity can now supply electricity to 5 million homes per year.

WIND POWER'S GROWING popularity led to a record number of annual procurements in 2019, with commercial and industrial companies buying almost 4,500 megawatt (MW) of U.S. wind capacity—enough to power 5 million homes annually—and total corporate agreements approaching 17,000, according to a new report from the American Wind Energy Association (AWEA).

Corporate customers from the various U.S. industry sectors now purchase 10 percent of all wind capacity nationwide, according to AWEA's first *Wind Powers American Business* report. Total contracts have risen from fewer than 800 MW at the end of 2013 to more than 16,800 MW at the end of 2019, as businesses strive to meet sustainability targets and improve their bottom lines.

"These companies are leaders in their industries, making sustainability commitments that are good for business and good for the environment," says AWEA CEO Tom Kiernan. "The U.S. wind industry is proud to not only power millions of American homes, but to also provide affordable, reliable, and zero-carbon electricity to the brands that are driving this country's economy forward, even as the U.S. continues to recover from the global pandemic."

More than 140 companies have purchased U.S. wind energy. Google is the top corporate wind energy customer, with 2,397 MW contracted. Facebook is the second-largest purchaser, with 1,459 MW, followed by Walmart, AT&T, and Microsoft. **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."

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THE NET ZERO IMPERATIVE

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Righting Systemic Wrongs

The construction industry's battle against racial inequity must start from within.

BY PAUL ROBINSON

WE ARE LIVING among what is considered to be one of the largest civil rights movements in history. People throughout the country have participated in protests in solidarity with the Black Lives Matter movement, and as the issue of racial injustice has gained the much-needed traction and worldwide attention like never before, we have to be solution-oriented. With that in mind, one imperative question remains: What's next?

The construction industry, specifically, should be very in tune as to what is transpiring, as feelings of racial inequity and systematic oppression that communities of color experience translates almost seamlessly into the construction industry.

As a black man working in the construction industry and rising through the ranks, the lack of diversity I saw, experienced, and felt was overwhelming. Leaders in the construction industry felt it too—and they were worried.

CREDIT: COURTESY OF CONSTRUCTREACH

In the construction industry, minorities struggle to find a seat at the table. As of 2017, according to the Bureau of Labor Statistics, more than 88 percent of the industry was white, and more than 90 percent were men. Furthermore, only 5.8 percent of construction employees were African American.

That's a problem as the newest generations head into the workforce. Forty-four percent of Millennials and 49 percent of Gen Zs are non-white. Teaching this young audience and providing reachable opportunities in the construction industry for minorities is vital for the growth of the industry.

My company, ConstructReach, was born out of this need. ConstructReach is a workforce development and social enterprise company that increases the visibility of the construction industry by educating students about career opportunities within construction. It connects general contractors to interns and innovative internship curricula, creating content and experiences that expose a diverse population to sustainable construction careers, and uniting stakeholders to ensure the construction industry continues to thrive.

Yet, diversifying an entire industry starts with recognizing that we have work to do, not only as a company, but as a society. For our industry to grow, we must evolve and incorporate a diverse array of voices to bring new perspectives and viewpoints to conversations and company cultures. Additionally, including diverse voices across industries helps us in building a safe and supportive diverse community.

Building a better future starts from within. Industries that fuel the economy, such as construction, should reflect the diverse nation we are living in today. By amplifying diverse voices and supporting those who have historically been disadvantaged and marginalized, we can work together to ensure our industries and our world are places that allow minorities to thrive and find success. We must use this time of social upheaval as an opportunity to reevaluate our industry's infrastructure and chart a new pathway of building to heal. Only then will our founding principles resonate for all. **GB**

Paul Robinson is the founder and CEO of ***ConstructReach****, a workforce development initiative and diversity and inclusion enterprise. He has an extensive background in domestic new and remodel construction, and international expansion construction.*

2020 ECO-LEADERS

Green Builder® Media

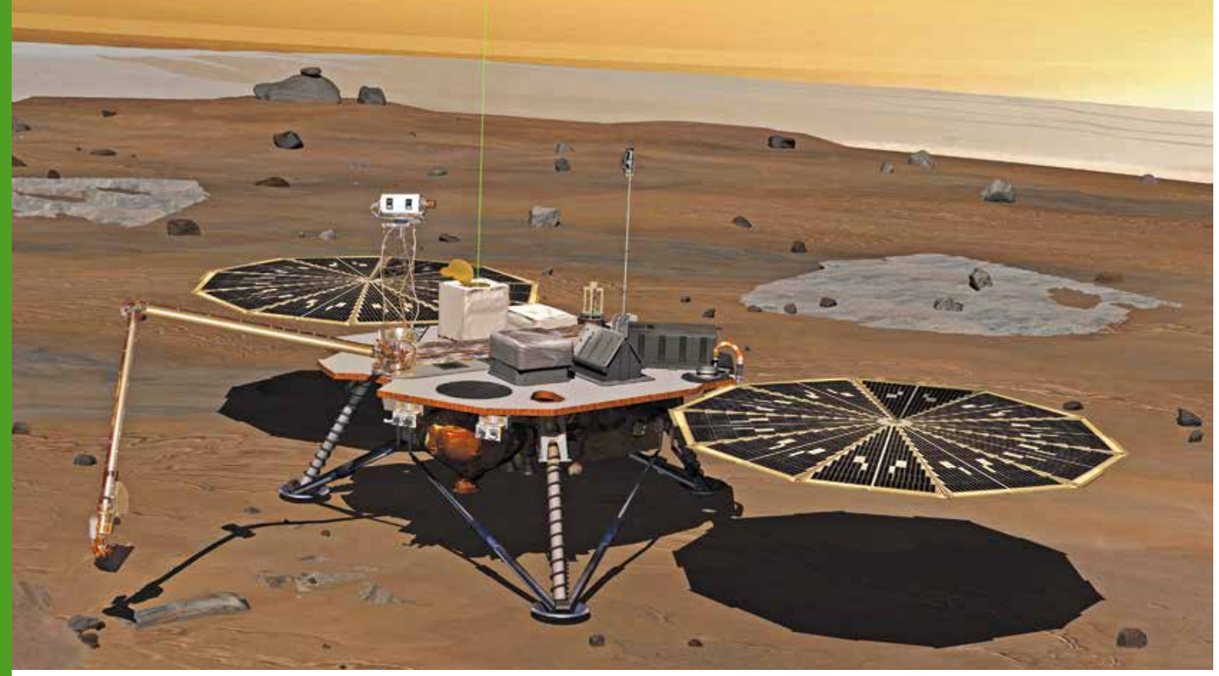
An Existential Moment

Words and promises are no longer enough. Corporations need to take immediate, decisive action to head off global catastrophe.

In May, the town of Verkhoyansk, Siberia, hit 100.4 degrees Fahrenheit. Although this was a new record, it wasn't a freak event. This area of the Arctic Circle has been sweltering with heat, and ice loss is creating a "feedback loop" of long-term heat and melting.

This is just one sign of how man-made CO_2 pollution, combined with other natural sources, is accelerating rapidly. Scientists warn that within a short number of years (and the estimate of how many years keeps shrinking), our continued reliance on fossil fuels could render the planet uninhabitable for all but the most basic life forms.

The pandemic, by comparison, is a mere symptom of our abuse of Earth's resources. Companies and governments must change course to cut greenhouse gas and methane emissions to near zero now, or risk losing everything. The Eco-Leaders highlighted in this issue offer different templates for what that might look like. It's time governments, and the rest of the building industry—and beyond—followed suit. Our very survival is at stake.



Powerful partnership. A key ingredient in JinkoSolar's successful *Eagle* solar panels— DuPont *Tedlar*-based backsheets—also helped NASA's Phoenix Lander conduct business on Mars. CREDIT: NASA

Wonder-full world. JinkoSolar has invested heavily in research and development to produce innovative solar panels tailored to the needs of net-zero homes. COURTESY OF JINKOSOLAR

Right at home. The message going out to today's builders and homeowners is clear: no matter what size of home, solar power can be functional and stylish. OURTESY OF JINKOSOLA

2020 ECO-LEADERS Green Builder® Media

JinkoSolar

Honestly representing a green energy product means keeping your own act clean—and that's just what JinkoSolar is doing.

THE WORLD OFTEN ASSUMES that solar panel manufacturers, by definition, have sustainable practices. However, just because a manufacturer produces a clean product such as photovoltaic panels does not necessarily mean that its manufacturing process and overall operation are always resource conscious.

As the world's largest solar panel manufacturer, JinkoSolar wants to be in that first group—the green product company that practices what it preaches. The goal, according to company officials, has always been to consume minimal resources and renewable energy to produce a solar panel that is truly clean.

They note that there has been a conscious effort to reduce emissions and conserve resources throughout its operations. The company has achieved significant strides in reducing its greenhouse gas emissions per megawatt of solar panel production (1 MW is about 3,000 solar panels), posting a 60.19 percent reduction since 2014. JinkoSolar's electricity consumption, water consumption and waste water discharge per MW of solar panel production has decreased 27.82 percent, 15.51 percent and 21.21 percent, respectively, since 2014.

In addition, the company believes so strongly in the importance of sustainable manufacturing that it recently became the first solar panel manufacturer to join an illustrious list of global brands (which also includes the likes of Apple, BMW, Coca Cola, Dell, Facebook, GM, Google, IKEA, Lululemon, Microsoft, Nike, Starbucks, Target, Visa and Walmart) in the RE100 Climate Initiatives Platform. Companies in this collaborative pledge to power all of their operations with 100 percent renewable energy. At the time of its pledge, JinkoSolar was already well on its way to this goal and currently remains on track to be all-green powered by 2025.

The company has also spread the word about solar energy environmental responsibility and sustainable living through various strategic partnerships. These include a multi-year effort with the NBA's Golden State Warriors as a solar power product provider, and a venture with Green Builder Media as a co-sponsor of the Arc House, Flex House and Align Project "tiny home" demonstration dwellings.

JinkoSolar has invested heavily in research and development to produce innovative solar panels tailored to the needs of net-zero homes. Its current-generation *Eagle G2* solar panels help homeowners generate more power out of their system. The units feature Diamond half-cell technology that provides high power and resistance to shading. Homeowners can enjoy their trees and at the same time reduce their electric bills to zero with the G2 panels.

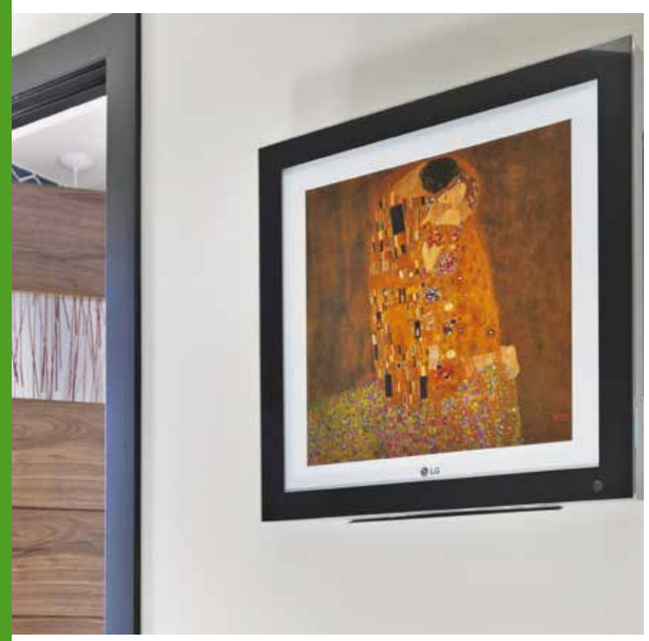
It gets better: With many environmentally conscious builders and homeowners demonstrating that homes with small footprints can be just as functional and stylish, the next generation E*agle G4* debuting later in 2020 features supreme energy density and is perfectly suited for space-constrained rooftops. The tiling ribbon technology removes the horizontal spaces between cells, thus allowing more cell material coverage in a similar amount of space.

JinkoSolar recently became the first solar panel manufacturer to join the RE100 Climate Initiatives Platform and pledge to power all of its operations with 100 percent renewable energy. The company is on track to be all-green powered by 2025.

JinkoSolar also has a strategic partnership with DuPont™. All *Eagle* solar panels come equipped with DuPont *Tedlar*®-based backsheets, which protect the solar panels from extreme heat on the rooftop. Tedlar is also used in the International Space Station and commercial jetliners, and has even been to Mars as part of the NASA Phoenix Lander in 2008. If it works more than 100 million miles away on the Red Planet, imagine how efficient the Earth-based solar cells must be.

"Customers certainly have taken notice of JinkoSolar's dedication to sustainable production, so it is not surprising that [it] has been the most-chosen brand globally for each of the last four years," the company notes. "[We're] manufacturing an energy efficient product, producing responsibly, and using clean power for global operations. You could say that JinkoSolar has set the bar at net zero." **GB**

(Cutting) board room. A massive demonstration model kitchen suite provides an effective way to display and educate consumers about sustainability.
COURTESY OF LG ELECTRONICS



Room with a (cool) view. LG offers a myriad of super-efficient HVAC systems and controls that complement any home's unique design characteristics. This includes the aesthetically pleasing *LG Art Cool™ Gallery and Mirror*. COURTESY OF LG ELECTRONICS

Clean scene. Smart technology-driven appliances, such as LG's *TurboWash* and *TurboSteam* washers and dryers, help keep energy efficiency in the forefront of consumers' minds.
COURTESY OF LG ELECTRONICS

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LG Electronics USA

Net zero begins with a new look geared toward teaching the public about the merits of going green.

EMBRACING A NET ZERO IMPERATIVE FUTURE beyond efficient products, LG is taking its environmental commitment to the next level, setting its sights on achieving carbon neutrality by 2030. It plans to do so through a variety of strategic initiatives such as highly energy efficient buildings, renewable energy, fleet electrification, and carbon offset projects that encourage the development and adoption of a low-carbon lifestyle. The company hopes to meet the goal through a variety of strategic net zero carbon emissions goal for its global operations.

LG Electronics USA has already achieved its ambitious goal to reduce greenhouse gas (GHG) emissions in the United States by 50 percent by the end of 2020, compared to a 2008 baseline. The company accomplished this goal a year ahead of schedule with the help of energy efficiency upgrades and energy conservation, and by utilizing more than 80 percent renewable energy across its operations.

To achieve the reduction, the company invested in energy efficiency projects using LG's own highly efficient technologies, such as HVAC and energy management systems, across its U.S. facilities—including its 1 million-square-foot distribution center in Fort Worth, Texas.

Employee-led campaigns in energy conservation had a direct impact on energy use in offices and distribution facilities. LG incorporated renewable energy through green energy contracts for power and renewable energy credits from recognizable sources across six facilities in four states.

In 2019, LG opened its first carbon neutral building, the Experience and Design Center in Napa, Calif. This is the company's brand immersion hub for builder and design trade communities.

LG has achieved LEED certification for its new North American headquarters campus. Opening during 2020 in Englewood Cliffs, N.J., the facility incorporates energy efficient technologies and generates clean solar electricity onsite to help reduce carbon emissions. The new building is 100 percent powered by renewable energy, "further underscoring LG's commitment to greener living," the company notes. In addition, the onsite "LG Exploratorium" science and environmental learning center will educate school-aged children about environmentally friendly technologies and products.

Corporate LG has lofty goals also. According to the company's *2019-2020 Sustainability Report*, they include increasing the ratio of Green 3 Star-certified products up to 80 percent by 2030 as part of internal eco-friendly product assessment, achieving a 95 percent waste recycling rate at production sites by 2030, and ensuring sustainable growth in the areas of renewable energy and electric vehicles that "reflects future-oriented, eco-friendly and human values."

Carbon reduction remains on the docket. To achieve carbon neutrality by 2030, LG Electronics continues to invest in reduction technologies to minimize carbon emissions, as well as proactively engaging in external carbon reduction activities such as securing carbon credit units.

LG Electronics CEO and President Brian Kwon says success comes down to universal appeal. "LGE has been committed to creating economic, social, and environmental value for over half a century," he notes. "Going forward, we remain fully committed to providing better value to our stakeholders, customers, the environment, business partners, local communities and employees. [All it will take is] continued support and interest in our journey toward sustainable development founded on growth, change and innovation." GB

Head start. LG's new North American headquarters in New Jersey has already received LEED certification, and is 100 percent powered by renewable energy. COURTESY OF LG ELECTRONICS

The company implemented a series of energy efficiency upgrades and energy conservation efforts, and utilized more than 80 percent renewable energy across its operations—and met its goal of a 50 percent carbon emissions reduction a year ahead of schedule.

Award-winning synergy. Mitsubishi Electric Trane's net zero accomplishments extend to personal efforts, such as CEO Mark Kuntz's custom built, renewable energy powered, award-winning smart home. COURTESY OF MITSUBISHI ELECTRIC GROUP

Broad appeal. Energy-efficient products such as the *MLZ One-Way Ceiling Cassette*, which regulates indoor temperatures and is constructed in part from recycled materials, are found in consumers' homes as well as METUS facilities. COURTESY OF MITSUBISHI ELECTRIC GROUP

2020 ECO-LEADERS Green Builder® Media

Mitsubishi Electric Trane HVAC US

Promoting all-renewable energy is an 'everyday' affair for the folks at METUS.

A HOME THAT OFFSETS a family's energy usage and feeds the electric grid; a passive house multi-use commercial building that utilizes water-based technology for heating and cooling; an office space in Minnesota that doesn't require cost-heavy and energy-intensive auxiliary heat to keep employees warm through frigid winters. For Mitsubishi Electric Trane HVAC US (METUS), these outcomes are all in a day's work—results garnered from developing effective solutions for high-performing net-zero buildings and homes.

The company proudly points to its product line as its most impactful contribution toward sustainability and net-zero infrastructure. By engineering energy-efficient, all-electric HVAC technologies, METUS provides all stakeholders with a means of decarbonizing the built environment without compromising comfort. As demonstrated by incorporation into the Carbon Neutral Cities Alliance—a collaboration of leading global cities achieving carbon neutrality before 2050—the company's non-fossil fuel burning products limit electrical waste, and are ideal for electrified buildings and homes that run on renewables. Also, all METUS indoor units are made from recycled materials.

While its equipment enables decarbonization, the company's internal efforts speak to its collective commitment to sustainability. METUS operates under Mitsubishi Electric's *Environmental Sustainability Vision 2050*—a long-term plan for creating a low-carbon, recycling-based society. By 2030, Mitsubishi Electric aims to reduce CO_2 emissions from product use by 30 percent compared to 2001 levels, and reduce total production emissions by 30 percent compared to 1991 levels. By 2050, Mitsubishi Electric will reduce these emissions by more than 80 percent.

In a quiet lead-by-example action, emissions in Mitsubishi Electric's LEED®-certified facilities are controlled and reduced with the same energy-efficient products provided to customers. METUS also maintains internal key performance indicators (KPIs) for sustainability in its equipment and operations.

Since its establishment in 2017, the Mitsubishi Electric Performance Construction Team has worked as high-performance building consultants on residential projects to provide guidance to home builders, homeowners, developers and green specifiers on building homes that meet sustainability criteria such as LEED®, Passive House and net-zero status, among other green certifications. The team has also established partnerships with Southface, Viridiant, EEBA, Earthcraft, Zero Energy Ready Home and Earth Advantage to educate the industry on the benefits of energy-efficient homes that feed into the electric grid.

Tech tactics. Already a leader in sustainable HVAC innovation, Mitsubishi Electric Trane has a portfolio of new technology that's ready for net zero, with ultra-efficient heat pumps and refrigerants hitting the market over the next year. CREDIT: JOJO/FOURSQUARE

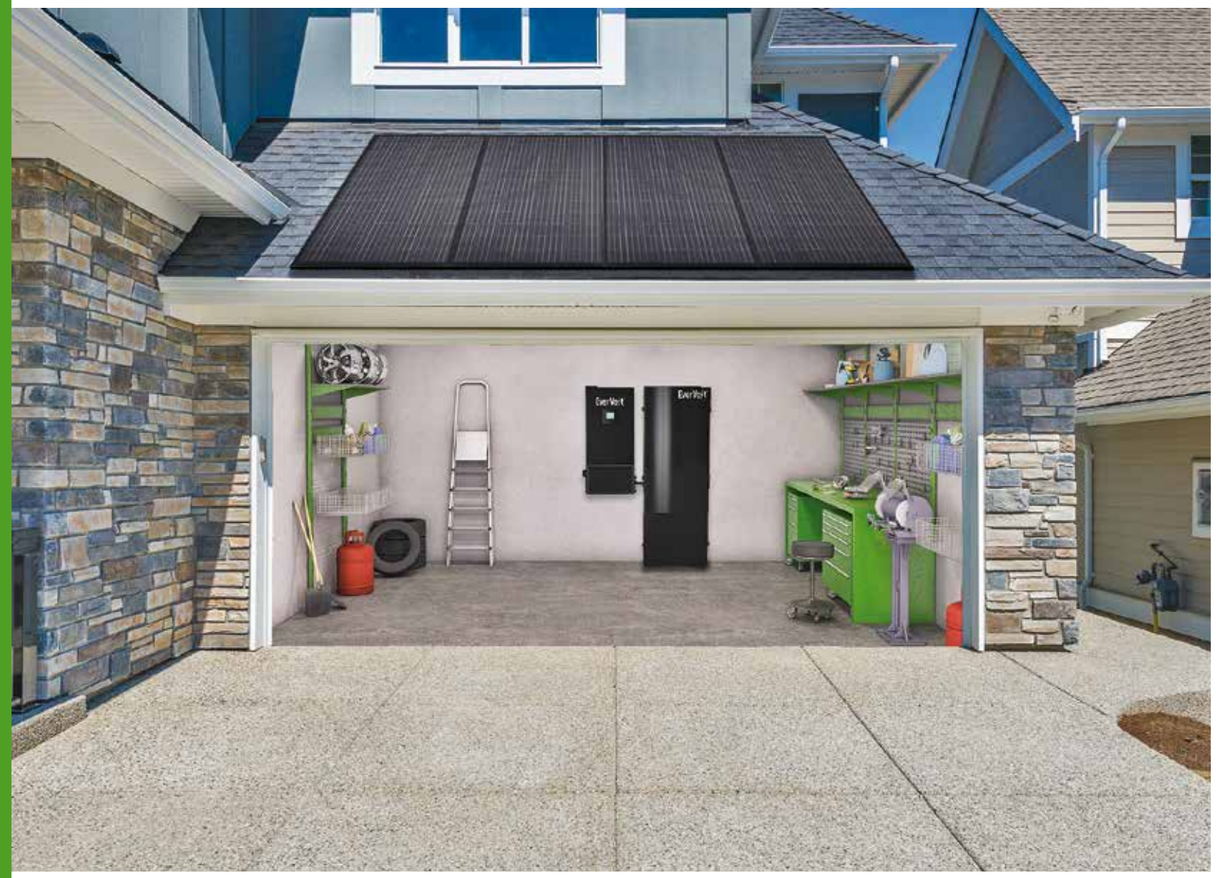
> With each net-zero project achieved, we are that much closer to decarbonization and a fully electrified society that promotes positive stewardship of the environment.

So why the passion for net-zero development and sustainability? METUS CEO Mark Kuntz stated it best after touring a fully electric smart home that Mitsubishi Electric built in Ofuna, Japan. "A fully-integrated, high-performance house can be even more impactful to the owner," he says.

In 2019, Kuntz and his family put passion into practice by developing a DOE Zero Energy Ready Home that also met Energy Star®, EPA Indoor airPLUS and Earthcraft certifications. With high-performance heat pumps, a prototype hot water heat pump and a solar array all from Mitsubishi Electric, as well as a charging station, Kuntz and his family now reap the cost, efficiency and environmental benefits of owning and operating a net-zero home. With a confirmed HERS score of minus 13 and net-positive energy output, this house, the Monroe Farmhouse, was a Grand Winner at the **2019 DOE Zero Energy Ready Home Housing Innovation Awards**.

"As a company, this is the goal," Kuntz says. "With each net-zero project achieved, we are that much closer to decarbonization and a fully electrified society that promotes positive stewardship of the environment." **GB**

Breaking down the broken down. At Panasonic's Eco Technology Center (PETEC), everyday home appliances such as washers, refrigerators and air conditioners are carefully broken down and sorted for recycling. COURTESY OF PANASONIC



Bringing the outdoors indoors. Solar energy storage can now be as simple as a vertical *EverVolt* unit mounted to a garage wall. COURTESY OF PANASONIC

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Panasonic

Projects on three continents showcase this electronic giant's commitment to net zero.

CALL IT "NET ZERO BY THE NUMBERS." For Panasonic, operating in a sustainable fashion means more than just implementing policy. It also means showing the world what happened when you did.

In the past three years, the electronics maker has made its home appliance recycling site, Panasonic ECO Technology Center (PETEC) and its battery manufacturing site, Panasonic Energy Belgium (PECBE), carbon emissions-neutral. Three more factories making up Panasonic do Brazil (PANABRAS) recently became the first on the American continent to achieve net zero greenhouse gas status.

Each facility has its own success story. PETEC boosted its photovoltaic systems—largely due to a 600-plus kilowatt (kW) generator—switched to LED lighting, and bought the additional green energy it needed to compensate for lesser use of fossil fuels. PECBE went for wind turbines—fueled by a 100-meter tall, 2 megawatt (MW) system—switched to energy-saving type boilers, and buying carbon credits. And PANABRAS uses a combination of wind, solar and hydro for its renewable energy generation.

When it comes to emissions reduction, the results are huge. PECBE cut its CO_2 output by 3,200 tons annually. PETEC has eliminated 1,800 tons. There is also a change in resource management. PECBE has adopted an electric car as its company vehicle, and used waste wood for new walls within the factory's cafeteria. PETEC plans to promote measures that utilize internally developed technologies, including strengthening energy conservation activities, further utilization of renewable energy such as geothermal heat, and introducing technology to absorb, separate, and utilize CO_2 emitted from fossil fuels.

All facilities are models of what Panasonic hopes will one day be a companywide situation: net-zero everywhere. "Currently, relative to the amount of energy used, the amount of energy created is merely one-tenth," the company notes. "From now on, for the energy used, we will develop technologies for improving energy-saving performances of products and innovate manufacturing processes to reduce the amount of energy consumption."

That goal is one of two making up the company's "Environment Vision 2050," Panasonic's long-range plan for implementing a green environment internally and externally. The first initiative, "creating a safe and secure society with clean energy," calls for development of environmental technologies through energy creation, conservation, storage and management. The company has amped up its solar cell and fuel cell technologies that use hydrogen derived from clean energy as a power source. It's also working on technologies relating to storing and/or supplying hydrogen, and storage batteries. These will "expand the possibilities of utilizing clean energy anywhere in the society," the company notes.

The other part, "promoting businesses aiming for a sustainable society," focuses on sustainable use of resources through the reuse of parts and materials and product recycling. The various now-net-zero production facilities are key examples.

There's also a consumer-oriented element. Panasonic offers products, such as its *EverVolt* battery, marketed through its solar products division—which is designed to encourage net-zero status in residential homes. *EverVolt*, known for use in electric cars, has now been optimized for residential solar. The product stores electricity for instant access during peak hours and grid outages, providing homeowners with the ability to tap into their private energy storage anytime. It can be easily installed in a garage in a matter of hours by a qualified electrician.

"Achieving a net-zero home starts by lowering energy consumption and waste, and there are plenty of small changes that help toward that goal," the company notes. "However, one of the biggest steps toward creating a net-zero home include lifestyle transformations, such as becoming grid independent." GB

Panasonic's goal by 2050 is to create and more-efficiently utilize energy to where it exceeds the amount of energy used.

Geared up. Sustainability training for employees at the Fort Smith, Ark., facility helped reduce waste and protect natural resources.

Tall order. Rheem's three-pronged approach to achieving net zero calls for major reductions in carbon emissions and extensive training of a quarter-million new plumbers and contractors. COURTESY OF RHEEM

Learning room. The company's state-of-the-art Innovation Learning Centers offer fast-paced online and hands-on training to bring employees up to speed on the latest technologies. COURTESY OF RHEEM

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Rheem Manufacturing

Training and education are setting the tone for the company's sustainability efforts.

THERE'S NO ONE WAY TO GO NET ZERO—which is why Rheem Manufacturing is using three of them. The heating and cooling product manufacturer, under its "Greater Degree of Good" mantra, plans to meet 2025 sustainability goals through innovation, efficiency and leadership.

The overall goals are challenging but accomplishable, according to company officials. For innovation, it means launching a line of heating, cooling and water heating products that boasts a 50 percent reduction in greenhouse gas (GHG) footprint. Similarly, under efficiency, the plan is to reduce GHG emissions by 50 percent and achieve zero waste to landfill in its global manufacturing operations. Leadership is charged with training 250,000 plumbers, contractors and key influencers on sustainable products or sustainable installation and recycling best practices.

That last one is probably the most crucial, given that without the best-trained employees and contractors, the other two sets of goals aren't going to work. The company lays it out pretty clearly on its website: "We hire and inspire our teams to be next-generation thinkers and responsible stewards of our industry, greater community and the environment. And, through training and supporting our customers and partners, we strive to help them strengthen and grow their businesses. We also work to build a thriving industry workforce—supporting the recruitment and empowerment of tomorrow's plumbers and contractors, leading the way to a prosperous future, together."

Among the accomplishments: opening state-of-the-art Innovation Learning Centers worldwide that are designed to accelerate training through hands-on and online education modules; sponsoring contractor and plumber-focused trade groups, including the Air Conditioning Contractors of America (ACCA) and Plumbing Heating Cooling Contractors Association (PHCC); sponsoring the Energy & Environmental Building Alliance (EEBA) National Summit Manufacturing Expo and hosting a panel session about how to create "utility ready" products and programs; and, providing on-the-go tools and resources for contractors via the innovative *Rheem Contractor App*.

"Our customers are becoming more climate conscious," notes Philip Oglesby, manager of education and content development for Rheem's air conditioning division. "It's imperative that we offer our plumbers and contractors sustainability training to better serve our customers' growing demand for sustainable products."

There are other more subtle, internal-oriented training efforts. The company encouraged its customer service team to take a green zero-waste challenge, which led to the elimination of paper cups from the office. Workers at the Heat Transfer Products Group (HTPG) facility in Scottsboro, Ariz., were provided with sustainability initiatives and tips to help reduce the environmental impact and cost of recycling waste there.

> Students may come in never having thought about running a sustainable business, but when they leave, they understand the importance of it.

The company even educated itself when it polled new hires, and 44 percent answered "highly or very highly" that Rheem's sustainability initiatives impacted their decision to join the company.

"Our training message is not just 'be green to save the planet,'" notes Mark Roach, manager of the water heating division's product training and content development. "We share practical benefits and real-life success stories. Students may come in never having thought about running a sustainable business, but when they leave, they understand the importance of it."

Benefits of this training appear elsewhere, most prominently in waste reduction and energy efficiency: Pretreatment of metals at Rheem's Nuevo Laredo, Mexico, factory eliminates 1,500 metric tons of greenhouse gas (GHG) emissions per year. Packaging updates at the Fort Smith, Ark., facility have reduced cardboard usage, saving trees. Reprocessing steel dust in the company's Australian factories prevents more than 100 tons per year from ending up in landfills. Using inflated bags instead of foam for packing at the Waterbury, Conn., factory avoids 26,600 cubic feet of Styrofoam packing material per year. Switching tankless packaging from foam to honeycomb-shaped cardboard significantly reduced hard-to-recycle waste, while maintaining the same level of product protection. Replacing cooling towers and switching to LED lighting at the Nuevo Laredo facilities resulted in a 4.1 million kilowatt hour (kWh) reduction in electricity consumption per year. And, a solar array installed at the company's Rydalmere, Australia, facility has generated 136.5 megawatt hours (MWh) of electricity and reduced GHG emissions by 112 tons.

"Sustainability is just a byproduct of being efficient," notes Rheem Engineering Manager Dan Partin. "You have to be responsible in manufacturing. I think we owe that not only to our own employees and to the company, but to everybody in America and throughout the world." GB

Powerful group. The Soleil Lofts is the first all-electric apartment complex in the U.S. to run on a virtual power plant (VPP) network where smart energy generated can be shared by the entire community. COURTESY OF SONNEN

Hidden in plain sight. A *sonnenBatterie* energy storage unit, seen here on the far left, can sit nearly inconspicuously in a room next to other household appliances. COURTESY OF SONNEN

Big dreams. sonnen co-founders Christoph Ostermann and Torsten Stiefenhofer changed the landscape of energy storage when they introduced *sonnenBatterie* in 2010. COURTESY OF SONNEN

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sonnen

An innovative approach to home solar storage is just one example of this company's groundbreaking steps forward in sustainability.

IT WAS ONLY A DECADE AGO when Christoph Ostermann and Torsten Stiefenhofer introduced a radical product that addressed a simple question: Why shouldn't a homeowner's solar power stay with their home instead of sending it back to the grid?

Enter the *sonnenBatterie*, the world's first all-in-one Lithium ion home battery system. Consumers now had a way to save their photovoltaic system's excess energy for a rainy day—literally. "Our vision was for every household to become a clean, small power plant," recalls Ostermann, the company's co-founder and global CEO. "The *sonnenBatterie* was ahead of its time when the market for a home battery did not exist. We had no competition...and we had no customers, either."

Fast-forward 10 years, and sonnen's focus has gone from solely home batteries to smart energy storage systems. It has become one of the largest producers of clean power storage options, with some 50,000 units installed around the world, and factories in Germany, North America and Australia.

While sonnen of 2010 and sonnen of 2020 are completely different, the overall goal is the same, according to Ostermann. "In a new market, that did not exist before, you have to adjust to new situations and to continually reinvent yourself," he admits. "That's why we did not stop being a manufacturer for smart storage systems...we realized that it was just the first step of creating a new energy world that is clean, decentralized, digital and affordable. And that is where we're going."

The key to success is to think about what a consumer wants in terms of electric power, a philosophy sonnen has embraced since day one. There has always been somewhere else to go with an idea. That has kept the company very busy—and very successful.

With new Virtual Power Plant (VPP) software, sonnen has developed a critical platform for a new energy system that connects electric devices to form a VPP. It allows a network of storage units to participate in the control power market via a simple internet connection. Providers can license to network micro-installations of up to 25 kilowatts (kW), which includes home storage systems, such as the *sonnenBatterie*, heat pumps, and various charging devices for electric vehicles.

Linked to this is sonnenCommunity, an energy group that combines all sonnen customers, who can participate in producing, storing or even sharing their energy with others. Customers can, for example, participate in a VPP that provides grid stability when needed for the benefit of anyone who is connected to the grid. In some markets, households that participate in the sonnenCommunity receive an annual profit share in return.

sonnen, in conjunction with real estate firm Wasatch Group and Salt Lake City-based Rocky Mountain Power, recently launched the first VPP in North America. Soleil Lofts, a 600-unit all-electric apartment community in Herriman, Utah, has a sonnen energy storage unit in each apartment. The design encompasses all amenities including heating, hot water and cooking powered by clean energy. Residents also benefit from access to 100 electric vehicle chargers, on-site solar and batteries for lower total electric bills, cleaner energy, and backup power for reliable electricity.

If we succeed to free our energy production from carbon-based emissions within the next 10 years, we will not only protect our environment but also our economic and political freedom.

Two other innovations aren't available in the U.S.—yet. sonnenNow allows customers to rent a photovoltaic system and a *sonnenBatterie* for a monthly fee, rather than having to purchase one outright. sonnenDrive is an all-inclusive-subscription for a brand-new electric car. It offers a six-month trial period to help a consumer decide if an electric vehicle suits their lifestyle. Both programs are only available in Germany. **GB**

Lofty goal. More than one-third of the energy needed to power Uponor North America's facilities comes from wind. By 2025, the company hopes all of it will COURTESY OF UPONOR NORTH AMERICA

Miles of pipe. More than 10,000 feet of Ecoflex piping went toward replacing an Austin, Texas, apartment complex's plumbing network built back when Gerald Ford was President. COURTESY OF UPONOR NORTH AMERICA

Plumbing powerhouse. At 150 square feet, this mobile Tiny Home seems, well, tiny. But the ProPEX expansion fittings needed to survive constant motion and vibration fulfilled a large purpose. CREDIT: DAVID SALO PHOTOGRAPHY

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Uponor North America

Moving toward 100 percent renewable energy for production.

WHEN IT COMES TO ENCOURAGING net zero status with customers' homes, it never hurts to start with your own. Uponor, which manufactures plumbing and radiant heating systems and tools, recently took that step when its Lakeville, Minn., distribution center became 100 percent wind powered last spring.

Since 2017, the company has been increasingly buying blocks of wind-produced renewable energy from local utilities. About 36 percent of its power in North America is now breeze-generated; the company has set 2025 as the year for the entire operation to reach all-green status.

This year, about 2.2 million kilowatt hours (kWh) of the distribution center's wind-generated energy will come from its participation in the Dakota Electric Association (DEA)'s Wellspring Renewable Energy program, according to DEA President and CEO Greg Miller. That's enough to power 263 residential homes for a year.

Uponor is the first major manufacturer to participate in Wellspring, he notes.

"[We] provide a way for businesses to receive all their power from renewable sources without having to build infrastructure or get in the energy business," Miller says. "Uponor has demonstrated its environmental commitment in a tangible way, and we are happy to assist the company in achieving its environmental goals."

Globally, Uponor's sustainability platform is centered on four key areas: conserve water, reduce waste, improve energy efficiency and empower labor, according to Bill Gray, president of Uponor North America. "The milestone reached at our Lakeville facility," he says, "is a leap toward achieving not only our goals for improving energy efficiency in North America, but also on a global scale."

Uponor took on environmentally sound water management a few years ago, when it expanded its Apple Valley, Minn., facility by 90,000 square feet—almost tripling its size—largely through use of its own products such as the *AquaPEX* plumbing system and *Wirsbo hePEX*™ radiant heating. Upgrades included rainwater collection to be used in landscape irrigation and toilet flushing, waterless urinals, low-flow toilets, and sensor-activated faucets. These features reduced potable-water usage by up to 100 percent, when collected rainwater is available, equating to 34,000 gallons of saved city water per year. "It was important to the company to design a sustainable facility that would provide a superior environment for workers with respect to safety, work environment and amenities," says Dan Hughes, Uponor's director of Real Estate, Security and Environmental Health and Safety.

Uponor, also known for its *Phyn Plus* leak detection technology, has been helping other entities work toward goals such as these for

How we manage our most precious resources affects the well-being of people and the planet for generations. By leading progress on the critical environmental challenges we face, we are preparing our communities and industry to thrive in a changing world.

years, and there have been a lot of them. There was, fittingly, the $64 million new research facility for the National Renewable Energy Laboratory (NREL) in Golden, Colo.; the Fairway Village Apartments and the replacement of its 45-year-old plumbing in Austin, Texas; and even a green plumbing system for a Tiny Home that has toured the East Coast since 2015, to name a few.

The company has also set 2025 as a deadline for reducing waste on its building sites to half of 2015 levels, with 100 percent of the scrap and packaging to be recyclable or reusable. And this point, 40 percent of 1 million square feet of plant and office space is LEED-certified, Uponor notes.

Uponor also takes part in leading eco-advocacy groups, such as the World Green Building Council, the U.S. Green Building Council (USGBC) and the Minnesota Sustainable Growth Coalition to help improve environmental policy and practice industrywide.

"How we manage our most precious resources affects the well-being of people and the planet for generations," the company notes. "As pioneers in water and energy efficiency, Uponor takes that responsibility seriously." GB

Tall order. The Heights Building in Arlington, Va., is a LEED Gold certified, state-of-the-art middle school adorned with YKK AP's heavily insulated walls, windows and doors. CREDIT: LAURIAN GHINITOIU

Inner vision. Massive windows throughout The Heights Building provide a good supply of natural light and offer a pleasant learning atmosphere for students.
CREDIT: COURTESY OF YKK AP AMERICA

Team effort. There is no shortage of volunteers when it comes to YKK AP-sponsored educational green events, such as this recent tree planting near the company's headquarters in Cobb County, Ga.
COURTESY OF YKK AP AMERICA

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YKK AP America

For this residential door and window maker, green is good—very good.

YKK AP AMERICA MANUFACTURES commercial facade systems, and residential doors and windows, and considers the environment in everything it does. The environmental pledge which governs the company's practices states, "It is recognized today as being a most important duty for all humankind that we preserve the abundantly endowed global environment and that we transfer it to the next generation in a sound condition." YKK Group proclaims it will address and promote "harmony within the environment" as the "highest priority of its business activities."

The company has a two-pronged approach to sustainability. First, YKK AP develops innovative products designed to block heat, provide insulation and improve ventilation in homes and offices around the world. Simply put, it manufactures architectural products that provide safe, comfortable environments for building occupants and help reduce energy usage.

Its second strategy takes innovation a step further, extending beyond "what" YKK AP manufactures to "how" YKK AP manufactures it. YKK AP works to minimize its carbon dioxide emissions across manufacturing, sales and distribution processes. It actively invests in energy-saving technology to cut the amount of energy used per-unit weight of products shipped.

YKK Group, which includes YKK and YKK AP, recently announced its Environmental Vision 2050, "Towards a brighter future for nature and humanity," in response to the great need for environmental actions on a global scale.

According to the company, YKK AP was the first residential window maker to launch a product line that spotlights energy efficiency within the building materials industry. It established tools like *My Thermal Assistant*, an app that helps architects calculate their desired energy performance and better identify environmentally friendly products to meet their needs.

The company's manufacturing plant in Dublin, Ga., is ISO 14001 certified and has a 73 percent recycling rate. The plant recycles 100 percent of aluminum waste on site and has reduced the amount of other waste materials sent to landfills by 40 percent. The manufacturing plant also uses regenerative burners to save 50 percent of the melting/casting operation's fuel consumption.

Additionally, the plant captures and burns 93 percent of all solvent emissions from the paint line, and uses state-of-the-art techniques for wastewater treatment.

The manufacturing facility is located on 204 acres of land. One hundred and twenty acres are still maintained as a natural habitat, where turkey and deer thrive and are regularly seen on the grounds. In 2000, when the company built its fabrication plant, there was a need to utilize a section of identified wetland area for the plant. YKK AP worked with the Army Corps of Engineers to develop and maintain an even larger wetland area in place of the one needed for the expansion.

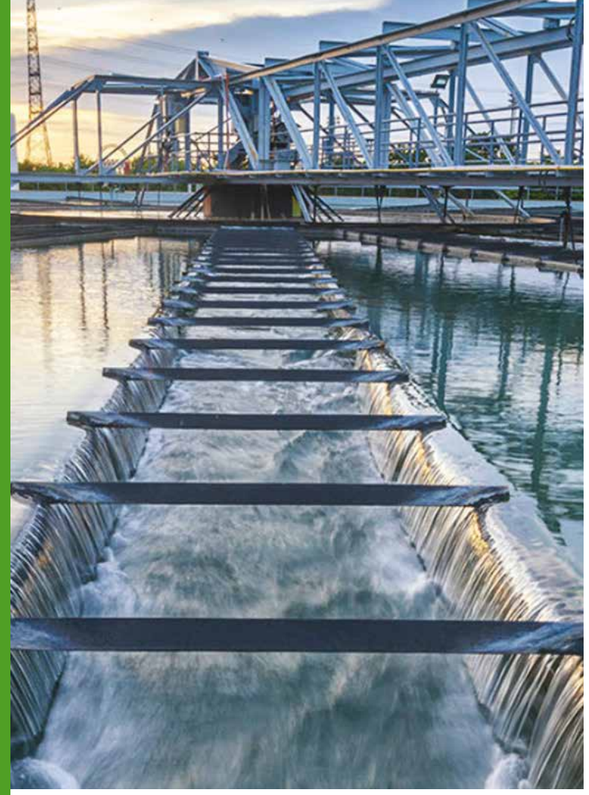
The most important duty for all humankind [is] that we preserve the abundantly endowed global environment and that we transfer it to the next generation in a sound condition.

YKK AP elevated its commitment to sustainability by becoming the first façades manufacturer to voluntarily provide third party-certified environmental product declarations for all products in its portfolio. YKK AP now offers product-specific Type III Environmental Product Declarations (EPDs) for storefront systems, window walls, curtain walls, windows, balcony doors, sun control products, and entrances. From these categories, YKK AP can contribute up to seven of the 20 products needed to receive LEED credit for a single project within LEED v4—the USGBC's first major update to credit requirements for the global standard in green buildings. Projects seeking LEED v4 certification can earn "Materials and Resource" credits by using products with EPDs.

Product-specific Type III EPDs provide the highest credit value, as their environmental footprint can be more accurately reported. YKK AP utilizes EPD data to refine and manage its manufacturing processes to improve product performance and become a more sustainable company.

YKK AP also supplies residential windows for the U.S. Department of Energy's biannual Solar Decathlon. In 2019, Georgia Tech won first place for a net-zero energy, urban single-family home. Using YKK AP's residential windows, the team designed a community-driven, low cost, net-zero home in Grove Park, Atlanta.

Lastly, employees at all levels volunteer—through educational programs, community revitalization projects, and international exchange promotion — to bring meaningful change to the communities where they work and live. Employees at YKK AP's headquarters in Austell, Ga., recently initiated the company's participation in Keep Cobb Beautiful's Adopt-a-Mile Program, in which workers help maintain their dedicated mile of highway in their own backyard of Cobb County, Ga., to improve the area's environmental and waste management processes. **GB**



Water awareness. By 2030, Trane hopes to become net positive with its water use. COURTESY OF TRANE

Keeping up with the times. Over the next decade, newer, more energy efficient products will hit the shelves, meaning technicians will need to keep up with the new technology. COURTESY OF TRANE

Intentional diversity. The company plans to continue with diversity efforts, hoping to build upon the 20-plus percent of the workforce that are women. COURTESY OF TRANE

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Trane Technologies

With most early goals met, this heating and cooling industry giant makes even bigger commitments for 2030.

NOW, IT'S TIME fOR ROUND TWO.

In 2013, the phrase "climate change" was finally being recognized as a legitimate, global term related to the environment. The Paris Agreement, which called for participating companies to voluntary reduce or eliminate greenhouse gas (GHG) emissions over the next three decades, was getting started. In many countries, renewable energy reached cost parity with fossil fuels. Companies were first initiating work within their supply bases to address environmental, social and governance (ESG) challenges. Diversity and inclusion became a global imperative, while positive community impact became a central need for companies. And investors increasingly evaluated ESG characteristics of the companies they invested in.

Into this new green world stepped Trane Technologies, which in 2014 unveiled its 2020 Climate Commitment. The goal, Trane officials say, was to become an industry leader in sustainability, and do so by example. "The message was simple," the company notes. "[We wanted to] boldly challenge what's possible for a sustainable world and cultivate a sustainable and innovative supply chain."

Trane's 2020 Climate Commitment called for emissions and waste reductions in several areas, and steady increases in the number of eco-friendly products manufactured from 2014 on, and using less energy overall than in 2013. After seven years, the numbers indicate the high level of progress:

- Trane has avoided 21 million metric tons of its customers' carbon emissions, the equivalent of avoiding 3.7 coal-fired power plants.
- The company has reduced its own operational emissions by 45 percent, enabling it to achieve its Climate Commitment for operations two years early.
- Energy intensity has been reduced by 22 percent.

There's more to come, according to Paul Camuti, the company's executive vice president, and chief technology and strategy officer. "By the numbers, it's been an incredible story, but what's most exciting is that now when we evaluate a proposed course of action, we do it through a sustainability lens which reflects the strategy and vision of our company," he says. "We ask ourselves, 'Is it an energy- and resource-efficient solution that creates value for our customers? Will it reduce our environmental impact as an organization? Will it contribute to a better world?'"

People will find out. Trane's 2030 Sustainability Commitments set the bar even higher, challenging the company to lead by example, collaborate with customers to drive sustainable innovation, and create opportunity for everyone in the workplace and in their communities.

Trane's 2030 Commitment is changing every major facet of its business: operations, supply chains, employee and community development, and governance.

There's the Gigaton Challenge, which calls for reducing the carbon footprint of customers by 1 gigaton, or 1 billion metric tons of GHGs—equivalent to the annual emissions of Italy, France and the United Kingdom combined, by 2030. Thus far, 20 million metric tons have been avoided, and Trane customers in more than 30 countries are buying newer, greener heating and cooling products.

The company will also design systems for circularity and transform its supply chain and operations to have a restorative impact on the environment, including achieving carbon neutral operations, zero waste to landfill, becoming net positive in water use, and obtaining a 10 percent absolute reduction in energy consumption.

There are also a slew of employee-related goals that indirectly tie in to sustainability, They call for enhanced diversity in the workforce, gender parity in leadership roles, maintaining world-class safety and engagement metrics, and providing wellness offerings for a full global population.

"Sustainability is inextricably linked to being a premier-performing company," Camuti says. "That's why we will continue to innovate and invest in new products, services and solutions to help our customers achieve their own sustainability goals...in all these ways and more, we will continue to create a more sustainable future for the next 10 years and many more years to come." GB

Complete package. Trane's Tranquility platform enables every home to provide an affordable, sustainable, efficient and healthier environment for homeowners, while every builder can become more efficient at home design and HVAC install.

CREDIT: HIGHMARK HOMES/FLICKR

High Road to HVAC

The path to going green is a large degree of Tranquility

IN CONJUNCTION with Trane Technologies' overall sustainability commitments, Trane Residential has launched a new initiative to elevate the conversation and buying experience with the homeowner, incorporating key consumer trends around wellness, healthy home and energy savings. The trends are incorporated by creating a home that is a sanctuary via a program called "Tranquility."

According to Trane officials, the *Tranquility by Trane* platform equips builders with innovative and efficient strategies to transform traditional processes for heating, ventilation and air conditioning (HVAC) installation. Tranquility applies building sciences at the home's inception to optimize performance, deliver efficiency and provide ultimate comfort. For consumers, Tranquility ensures every home provides a sustainable, efficient and healthier environment that all homeowners want and deserve, at an affordable cost.

"At the heart of Tranquility is our brand's unparalleled knowledge of home comfort, performance and reliability," says Melissa Foley, Trane marketing leader for Builders & Property Managers. "Tranquility leverages our extensive expertise with mechanical system design to ensure homeowners experience the benefits of improved indoor air quality, higher energy efficiency, and sense of calm when living in a well-balanced environment."

From a builder's perspective, Tranquility makes it easier to align building envelopes and mechanical systems by bringing third-party expertise to premium home design, the company notes. "Essentially, Tranquility delivers what smart homebuyers want: comfort, sustainability, efficiency and most importantly, a healthier home environment," the company notes.

Tranquility also offers concierge-style services to multi-family property managers. Services include tools to manage a property owners' fleet of air conditioners, increase in accessibility when navigating refrigeration transitions and replacement schedules.

As America's most trusted HVAC system every year since 2015, per the annual *Lifestory Research 2020 America's Most Trusted HVAC Brand* study, Trane Technologies and its residential HVAC brand, Trane Residential, are devoted to providing the tools needed to ensure every home can provide a sustainable, efficient and healthier environment that all home owners want and deserve, the company notes. The Trane portfolio of systems comes together to "address not only comfort but quality of air, complete control of the system from anywhere, and energy savings opportunities from the thermostat settings to the variable speed air conditioner."

Every Trane device is tested to withstand the harshest conditions nature and its engineers can throw at it—such as freezing conditions in its System Extreme Environmental Test (SEET) lab, or five inches of water per hour in its Climate Chamber. These types of tests, Trane notes, "ensures that the heating or cooling unit can run through anything." **GB**

For more information about Trane Technologies, visit the Trane Sustainability *and* Trane Residential *web pages.*

2020 ECO-LEADERS Green Builder® Media

Here are several of Trane Residential's key products that mesh with the Tranquility platform and are environmentally sustainable:

XV20i TruComfort™ Variable Speed:

- Rated up to 22 SEER with 750 stages of comfort for ultimate climate control and max efficiency.
- *TruComfort* technology automatically adjusts temperature while maintaining speeds to avoid temperature swings.
- Quiet running fan measured at 4 decibels (dB) below competitor's minimum.

Trane XL824 Connected Control:

- The ability to control humidity and maintain healthy levels within the home.
- Additional features:
  - Wi-Fi or Ethernet connectivity
  - 4.3-inch Diagonal Color Touchscreen
  - Built-in *Nexia* Bridge
  - Program up to four schedules a day, seven days a week

Trane CleanEffects™ Air Cleaner

- Removal of up to 99.98 percent of particles and allergens from the home's filtered indoor air. It removes particles as small as 0.1 microns to 1/1,000 the diameter of a human hair—a size that eludes most air cleaners.
- Industry-leading clean air delivery rate of 1,200.
- Low operating costs, with no replacement filters to buy.

HONORABLE MENTIONS

Aspirational Leaders

A few companies that did not make our Eco-Leaders final cut this year still deserve a callout for their sustainability efforts.

Out of the 'sticks'. An E-Tech home offers an environmentally friendlier, lower-cost alternative to the traditional "stick built" home—and it looks pretty good, too. COURTESY OF MELISSA PETER

Environmental Technology Group (E-Tech)

This company's new construction technique promises an end to the wasteful practice of 'stick building'.

HOMEBUILDERS HAVE BEEN CRITICIZED for years for the method used to obtain the wood needed for housing construction and the process in which the homes are erected. The process, known as "stick building," is the traditional wood-framed home constructed on a building site stick by stick. Opponents say most of the wood used comes from mature trees that are unceremoniously cut down en masse, with most of the end product disposed of at landfills or burned, causing pollution problems and destroying wildlife habitats.

Enter the Environmental Technology Group (E-Tech), a coalition of concerned individuals who say the problem can be solved if the housing industry adopts the process used by manufacturers of nearly all consumer products: outsourcing individual sub-components to specialized plants which use automated equipment to stamp out engineered elements designed to be easily assembled. For almost every consumer product, specifically designed components are shipped to a warehouse location where they are assembled and a completed product is created, packaged and sent to a consumer.

E-Tech is marketing a home built in this fashion, with the one exception being its assembly taking place at the home site instead of at a factory. The process, performed by a trained workforce of a few builders instead of a dozen or more, ends up being faster—construction takes days instead of weeks under stick building—and far less expensive. The home's smaller footprint makes it far more energy efficient, and the overall technique results in less construction-generated waste. More importantly, according to E-Tech founder Barry Rosengrant, this method has far less negative impact on the environment.

"The ultimate test of sustainability is that all components are easily re-purposed to new structures without further waste of recycling energy," he says. "Thus, design professionals, contractors and homeowners can responsibly collaborate in creating a far better quality home while making a meaningful, positive difference for our planet. We welcome all others who share our commitment."

Greenfiber

By making cellulose insulation from post-consumer waste, this company raises the sustainability bar.

CELLULOSE INSULATION—made from plant fiber—is one of the oldest forms of insulation. It comes in many forms--newspapers, cardboard, cotton, straw, sawdust, hemp and corncob, to name a few. It's an environmental friend, capturing carbon instead of releasing it into the atmosphere.

Pushing the envelope. Unlike many insulation manufacturers, Greenfiber uses mostly recycled paper in its product as a show of respect for natural ecosystems. COURTESY OF GREENFIBER

Light it up, please. Electric lights are in rare form—literally—at IceStone's production facility, which relies primarily on natural lighting from a massive window setup. COURTESY OF ICESTONE

But the one drawback, according to officials at Greenfiber, is the fact that nearly all of the plant fiber-based insulation is made only from virgin material. *Nearly* all. "We use paper products that have had a previous life in the consumer cycle, instead of adding the cost of continually harvesting raw materials," the company notes. "This allows us to offer an environmentally responsible option for professional insulation contractors, builders and homeowners."

Eighty-five percent of the company's cellulose insulation comes from recycled paper, and doing so keeps all of the captured carbon within the product instead of releasing it into the environment. Manufacturing also requires one-tenth of the energy needed to produce fiberglass insulation, and the production process—electric-driven facilities vs. gas-fired furnaces—merits a little bit of bragging.

Greenfiber's low-energy manufacturing process generates zero waste, other than dust which is confined within the production system and filtered out of the air that gets discharged into the atmosphere, the company notes. Electric-driven machines are used in all facilities and recycled paper is sourced near Greenfiber's plants. "This carbon neutral process keeps 160,000 tons of paper out of landfills annually, which is equivalent to 2.72 million trees," Greenfiber states. "You could actually fill 8,000 semi-trucks with the paper that we have diverted from landfills!"

Greenfiber has a plant in each region of the country to keep delivery of raw materials and shipping of the finished product to within a 500-mile radius, the company adds.

IceStone

For this countertop maker, the green way is the right way.

THE OFFICIALS at countertop maker IceStone know they're not a 100 percent zero waste facility—yet. But it's a goal to reach that milestone as soon as possible.

IceStone practices sustainability not only in its products but in its facility and production efforts. Steam-powered kilns are used to cure countertop material. A calibration machine requires a lot of water; a recycling water system enables water's re-use. The company uses electric/hybrid forklifts, and a huge skylight provides natural light in the factory to save energy.

To take even more advantage of the natural light, factory employees start work at about 7:30 a.m. "This is especially important during the winter months," the company notes. "Where we are located (Brooklyn, N.Y.), it starts to get dark at 4 p.m. in the winter. Therefore, we want our employees to take advantage of as much natural light as possible."

The company has also cut down on paper used for everyday work. The fax machine is gone, and all marketing materials are available for download on IceStone's website. And, IceStone tries to work with like-minded vendors who also believe in sustainability and an eco-friendly way of living and working, the company notes.

This attitude ties in perfectly with its countertop products, which are made from 100 percent pre-consumer recycled glass. All of it is produced in the United States, which reduces the amount of energy and pollution that would otherwise occur due to the transportation distance. Certifications and accolades received over the years include EPA's Environmental Leadership Award; B Corporation's Best for the Environment; Cradle to Cradle's Legacy Award; and *Inc.* magazine's 50 Greenest Companies, to name a few.

Stena Bulk

An eco-friendly shipper proves that net zero can also happen on open water.

SHIPPING IS A HUGE NECESSITY for much of the green building industry. One international shipping company is developing a way to cut customers' costs and clean the environment. Sweden-based Stena Bulk has begun offering services priced by grade of biofuel, from a 20 percent mixture to a 100 percent waste-based biofuel. The fuel has the potential of putting shipping on the trajectory towards the International Maritime Organization (IMO)'s greenhouse gas (GHG) reduction targets, without having to wait for new technology and zero-carbon fuels to emerge as commercially viable options, according to Stena Bulk President and CEO Erik Hånell.

The new offerings will also allow customers to make use of low-carbon shipping options regardless of fuel availability on the specific route, and guarantees that operation is performed without any disturbance to the shipment, Hånell notes.

Offering low-carbon shipping options is initially an ambitious initiative, but is reflective of Stena Bulk's ambition to reduce the environmental footprint of tanker operations through innovation,

Bon voyage, sustainable style. Customers who need products shipped to them overseas now have a number of low- or no-carbon ways to do so, courtesy of international shipping company Stena Bulk.
COURTESY OF STENA BULK

Hånell says. New fuels and new technology such as the company's recently unveiled IMOFlexMAX vessel design will also be important. "We can test and learn through challenges and thus take further steps in developments for the future," he says. "Collaboration within the industry will also be a key element, and [we] will continue to develop new solutions together with customers, partners and suppliers."

Whirlpool Corporation

A historic home offers keys to the future of household resource planning.

SOMETIMES, DECIDING HOW to move ahead with net zero plans requires taking a step back. For Whirlpool Corporation, the answer came in the form of the ReNEWW (Retrofitted Net-zero Energy, Water and Waste) House.

According to Whirlpool executives, the aspirational vision for the West Lafayette, Ind., home was to offset all of its energy use with solar power, rely on locally available water sources and have waste-handling systems that prevent any household waste from going to the landfill. The retrofit also sought to preserve the historic character of the house, built in 1928 and located on the Purdue University campus.

The first phase, completed in 2015, focused on energy capture and retrofitting the home to include systems and materials such as geothermal systems, solar paneling, low GWP insulation and triple-pane windows.

The second phase focused on updating the house's water systems to achieve the goal of net-zero water. This included installing a rooftop rainwater collection system and an interior system that filters water for drinking water usage; and implementing water reuse systems, such as shower-to-toilet greywater recycling and energy-efficient fixtures.

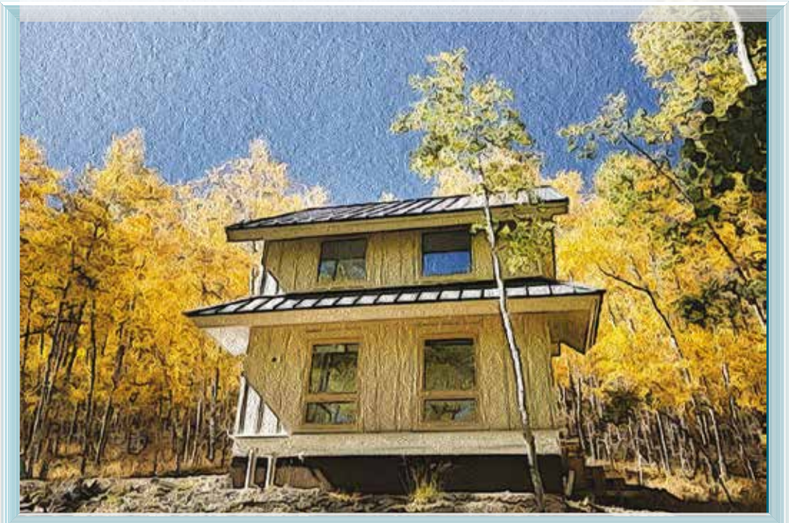
The third phase was focused on reducing the home's production of municipal solid waste to zero. Initial efforts focused on reducing the generation of food waste by researching multiple concepts around composting.

Following this, much focus was on the residents' purchasing of products with recyclable materials to the maximum degree possible, while also teaching good habits regarding recycling.

Meanwhile, data was collected on ReNEWW's efficiency from before and after the retrofit. There are more than 120 different data streams monitored, and 30 sensors that monitor temperature. Electrical monitoring is on every household circuit and flow meters are attached to virtually every pipe in the home.

In 2019, the ReNEWW House continued studying innovative techniques for tracking and disposing of traditional waste, including developing a smart bin that gives immediate feedback to consumers on the quantities and types of trash that they are producing. ReNEWW is also studying how to use waste energy, with research ongoing into how to reuse waste heat that is generated throughout the home. **GB**

Ever inspiring. Whirlpool's ReNEWW House continues to discover and demonstrate unique and efficient ways to manage energy, water and waste. COURTESY OF WHIRLPOOL



MARIPOSA MEADOWS

Building for Relevance

As consumer expectations change due to COVID-19, the VISION House at Mariposa Meadows shifts with it through unique design, construction and specifications.

BY SARA GUTTERMAN

DESPITE THE ONGOING uncertainty in many sectors in the economy, the housing industry seems to be a bright spot—at least for now.

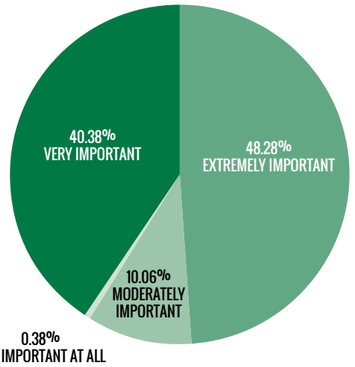
In fact, in some markets, new home sales are surging: qualified buyers are looking to take advantage of low interest rates and purchase homes now, and with resale inventory down 30 percent year over year (YOY), new homes offer an excellent—and available—alternative.

But it's not business as usual in the housing sector: consumer expectations are shifting due to COVID-19, placing new demands on building professionals and manufacturers alike.

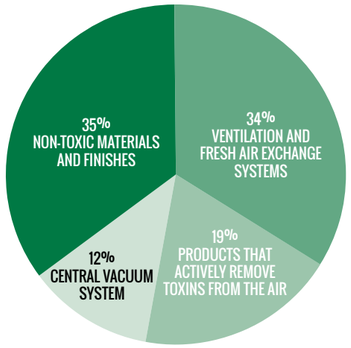
With coronavirus, home has become, more than ever, a sanctuary and a safe space, with strong associations to wellbeing and

COGNITION Smart Data consumer survey results

How important is IAQ to you?



What do you use in your home to improve your home?



peace of mind. Due to significant health concerns and the mounting desire for more space, some consumers are leaving densely populated urban areas in favor of medium-density inner suburbs, outer suburbs and rural areas. In doing so, they're also moving out of higher-priced cities and into more-desirable and tertiary markets.

Many consumers have also taken up telecommuting due to changes at work or stay-at-home orders. This extra time online often means more-convenient shopping, including when it comes to looking for a new house. Home shoppers seek slightly increased home sizes to accommodate offices, gyms and living spaces. They're also demanding healthier homes, smart home technology, resource efficiency, private outdoor spaces, and opportunities for enhanced connections with nature.

Fittingly, the **VISION House at Mariposa Meadows**, Green Builder Media's first completely off-grid, self-sufficient demonstration project, fulfills many of the changing consumer demands stemming from the pandemic. Here are four key trends:

1. HEALTH AND WELLNESS

It's not surprising that, in the age of coronavirus, consumers are prioritizing **health and wellness**, with a particular emphasis on indoor air quality (IAQ).

In fact, according to **COGNITION Smart Data**, Green Builder Media's suite of market intelligence services, IAQ has quickly shifted from a "nice to have" to a necessity. Homeowners are clamoring for solutions that improve IAQ, particularly systems that monitor air quality and then proactively trigger fresh air exchange or ventilation systems (energy recovery ventilation [ERV] units, range hoods, vent fans) once toxins are detected.

Perched high in the Rocky Mountains of Colorado, Mariposa Meadows has plenty of fresh air—the structures are literally surrounded by millions of acres of national forest. But, we're holistically addressing IAQ with an integration of advanced mechanical systems, including Uponor radiant in-floor heat (given that the project is at 10,000 feet in elevation, there is no cooling demand); Panasonic *WhisperGreen* ventilation fans and ERVs to ensure fresh air exchange at a regular cadence; and Beam central vacuum systems.

We're also featuring anti-microbial and non-toxic finishes and furniture, such as Caesarstone quartz countertops, Lee Furniture, and Fresco Harmony gypsum-based wall finishes (in selected areas).

While the entire development is designed to facilitate calmness and reflection, we've included plenty of sanctuary spaces, such as intimate relaxation rooms for reading or meditation, as well as outdoor sitting areas intended to promote contemplation and a direct connection with nature.

Uponor *AquaSAFE* Provides Plumbing Plus Fire Suppression

THE MARIPOSA MEADOWS team selected Uponor's interior fire sprinklers, plumbing and radiant floor heating. The *AquaSAFE* combined plumbing and fire sprinkler system incorporates the fire sprinklers into the home's cold-water plumbing, ensuring fresh water is always available if it is ever needed in the event of a fire.

Ingrid Mattsson, director of brand and sustainability for Uponor North America, says it would be smart to have fire sprinklers in every home. "When we talk about the resilience of a structure we mean that it must be strong on so many levels," she says. "Fire sprinklers are built to allow people to escape, first, but the system is also designed to squelch the fire using a minimal amount of water before it can do much damage."

While the *AquaSAFE* system offers the usual plumbing functions on a daily basis, it has the added upside of knowing water is ready to go in the event of a fire. "This is not a standalone system where water is sitting unused in a closed system and needs to be checked on every year," Mattson reminds. "This is using the water already in your plumbing system for fire suppression. Every time you take a shower, you are drawing water through the system for the ultimate in protection."

For more information, visit **Uponor**.

CREDIT: U.S. FOREST SERVICE

Burn notice. Mariposa Meadows employs a variety of fire-resistant elements to safeguard against wildfires, which cause millions of dollars of damage each year and put thousands of homes at risk.

2. SELF-SUFFICIENCY AND RESILIENCY

The concept of self-sufficiency has also been trending, especially since the onset of the coronavirus.

When people talk about self-sufficiency in online conversations, they often reference onsite power and food production. According to COGNITION data, there has been a pronounced spike in interest in topics like solar power and edible gardens.

Since Mariposa Meadows' closest grid infrastructure is nearly 20 miles away, self-sufficiency is a necessity. The electrical needs of the structures will be powered by an impressive array of JinkoSolar bifacial solar photovoltaic panels, along with a sonnen battery storage system with an integrated inverter.

A four-season greenhouse that offers a reliable level of food security, provides a salve for pandemic-shocked visitors, and highlights ways to create an abundant, sustainable outdoor oasis whether in remote locations like ours or in dense urban areas, is also part of the master plan.

To us, self-sufficiency shouldn't be limited to renewable power and onsite food production. Rather, it encompasses the process of taking personal responsibility, making informed decisions, and specifying products and systems that are durable, resilient and low-maintenance.

In terms of Mother Nature and resiliency, Mariposa Meadows is fortunate enough to not be susceptible to many of the natural disasters that plague other communities such as superstorms, tornadoes, earthquakes or flooding. Our principal concern is wildfire.

We have deployed several strategies to mitigate for wildfire risk. To begin with, we are following the National Fire Protection Association (NFPA)'s FireWise guidelines for "home hardening" and augmented protection.

All of the exterior materials were carefully specified for their durability and fire resistant qualities, including James Hardie fiber-cement siding, Fabral standing-seam metal roofs, Creative Mines engineered stone, and three-hour fire-rated metal entry doors from Assa Abloy.

A suite of durable Trex decking products, in addition to pavers and natural stone from Pioneer Landscape Centers, will also help to create a defensible perimeter around the structures.

In addition, we are employing Uponor sprinkler systems throughout the structures, as well as GreenFire's non-toxic, environmentally friendly food-grade fire suppression technology—indoors and outdoors.

GreenFire: Fire Prevention and Suppression

MADE WITH FOOD-SAFE, plant-based compounds, GreenFire's product line has applications for fire prevention and fire suppression. While most fire retardants are chemical and toxic, the GreenFire compound is certified by NSF International as a food-grade substance. What that means for firefighting is that when the product is sprayed inside or outside a home for fire suppression, it doesn't create an unpleasant odor, leave residue that is toxic to people or animals, or stain most building materials or textiles.

GreenFire is a perfect solution for Mariposa Meadows. "This is an all-green, energy saving and off-the-grid project, which makes it perfect to showcase options for people to protect their homes from fire, on or off the grid," says GreenFire founder Ben Allen.

The GreenFire family includes three products:

- *GreenFire Heat Barrier*: Prevents flare ups and locates gas leaks
- *ProDefense*: A spray-on package for contractors to pre-treat behind-the-walls structural elements and landscapes to reduce fire risk
- *HomeDefense*: A DIY version of *ProDefense*

Learn more at **GreenFire's website**.

No-fire factors. Pavers and hardscapes, such as this flagstone variety from Pioneer Landscape Centers, are an integral part of the NFPA Firewise program's landscaping best practices. CREDIT: PIONEER LANDSCAPE CENTERS

Solid state. The Mariposa Meadows deck design includes Trex *Elevation* steel deck framing and *Enhance* decking. COURTESY OF TREX

3. QUEST FOR ZERO

The coronavirus has increased awareness around comfort, efficiency and cost savings related to energy performance, expediting the massive and rapid transition to net zero energy.

Even before the pandemic, the global market for net zero energy structures was expected to reach a whopping $78.8 billion by 2025. The growth in Net Zero buildings can be attributed to a combination of innovation in high-performance products, renewable energy systems, and automation technologies, along with enhancements to codes and policies (the 2021 IECC brings us closer to zero, and experts predict that we'll take more steps towards net zero in the next code cycle).

Advances in solar technologies (photovoltaics, inverters, storage and solar thermal), heat pump technologies, mini-split HVAC systems, induction cooktops, smart thermostats, high R-Value windows, and high-performance insulation and building envelope systems are all contributing to the transition to zero.

At Mariposa Meadows, we've deployed structurally sound and incredibly energy efficient structural insulated panels (SIPs) for these building envelopes, super high performance triple-paned, European tilt-and-turn style windows from Euroline, Tyvek housewrap and weatherization systems, and high-efficiency tankless Bosch water heaters, which, in conjunction with the Jinko bifacial solar panels and sonnen battery storage system, will allow us to pursue the goal of net zero.

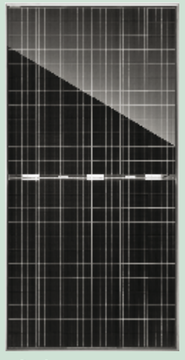
JinkoSolar Powers the Complex

THIRTY-FIVE 400-WATT JINKO *Eagle G3* solar panels provide 14 kW of power to Mariposa Meadows. The modules include the company's bifacial Diamond cells that enable module power up to 405W.

"The bifacial cells are dual-sided cells encapsulated in the panel which offer backside generating potential," explains Director of Business Development Jeff Juger. "If any light reflects around the panel, you get additional energy production."

How much more? According to a test Jinko performed on the panel, the bifacial module generated up to 20-30 percent more energy than conventional monofacial modules. When it snows at Mariposa Meadows, the bifacial effect should be at its greatest.

"What's unique about Jinko's panel is that we have exclusive access to a transparent backsheet made by DuPont, making our bifacial panel extra durable, and essentially the same weight and configuration as a standard one-sided panel," Juger says. "Our competitors use a glass backing, which makes the panel more brittle and extra heavy, and causes compatibility issues with existing racking solutions. Reinforcing the racking to account for the new weight requires extra materials, meaning the additional benefit of competing bifacial systems is offset by the extra costs."



Learn more about the **Jinko G3 Eagle**

4. CONNECTED LIVING

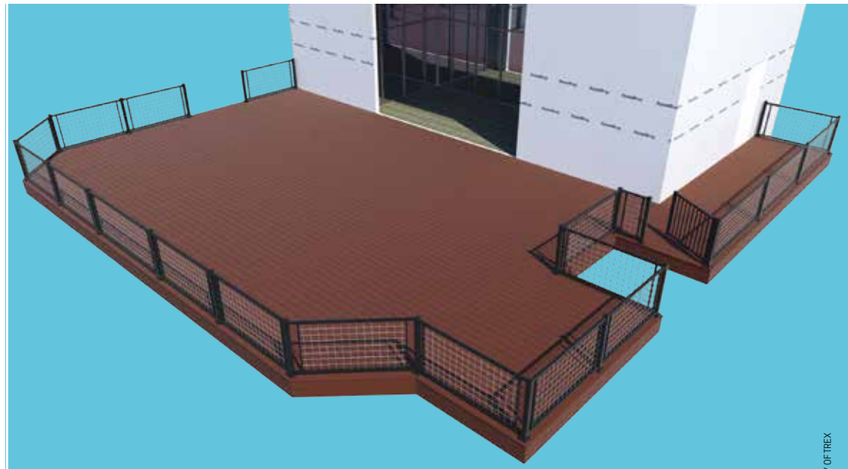
Connected living was already exploding before coronavirus, but the pandemic accelerated demand for smart home technologies even further.

Demand for voice-activated technologies such as door locks, speakers, TVs and appliances is on the rise, along with smart thermostats, lighting, and other devices that improve energy efficiency and comfort.

Proactive smart home technologies that maintain healthy indoor air quality are in high demand, as well as leak detection and water monitoring systems. And with the spike in working and schooling from home, requirements for connectivity and networking technologies are also changing dramatically.

At Mariposa Meadows, we'll deploy a Control4 central smart home hub that will connect with security cameras, door locks, lighting, IAQ monitors, switches, outlets, speakers and other devices for a streamlined, connected living experience.

We'll continue to bring you updates and information from Mariposa Meadows over the coming months. For news from the Meadows, check out the project microsite. **GB**



Solid foundation. Mariposa Meadows' design calls for Saddle-style Trex *Enhance* decking—supported by Trex *Elevation* steel deck framing—constructed in a wrap-around fashion to lend continuity.

COURTESY OF TREX

Return TO THE Great Outdoors

As people spend more time inside, they're finding solace in home remodeling projects.

SUSTAINABLE LANDSCAPING and outdoor living are on the rise, offering a welcome connection with nature and the security of self-sufficiency. Homeowners are rediscovering their gardens, swimming pools, backyards and other at-home recreational activities, as evidenced by market data harvested by COGNITION Smart Data. The volume of landscaping-related conversations has increased dramatically since the onset of the pandemic, with an overwhelmingly positive sentiment.

COGNITION data also shows that people's concept of landscaping is shifting—they're not talking about sweeping lawns with sprawling Kentucky bluegrass that require vast amounts of water and mowing. Rather, they're expressing interest in edible gardens that provide food security, native plants that save water, and urban oases that offer refuge in concrete jungles.

Mariposa Meadows will boast a full spectrum of Trex outdoor living products, including decking, railing, furniture, fire pits and staircases to provide ample sustainable, durable and beautiful outdoor living spaces. "The reality of this location is that it is an area of pristine beauty but also a harsh environment," says Leslie Adkins, Trex vice president of marketing. "It needs products that hold up and still look great after many seasons."

After working with project co-owner and designer Ron Jones on the hardscaping design, the Trex design team suggested a suite of products that would hold up to Mariposa's severe climate. "People think of us as 'decking,' but there are so many products engaged here," she says. "The foundation is Trex *Elevation* steel deck framing. This is relevant for this location with the temperature changes and dryness and snow. *Elevation* will hold up better than wood."

This long-lasting foundation is topped with Trex *Enhance* decking. The company also specified an integrated railing and recessed outdoor deck lights on the Trex *Spiral Stairs*.

Adkins notes that all the products showcased in this high alpine project are the same that would be used in any U.S. climate or region. "This project allows us to showcase all of the elements of Trex: beauty, durability, low-maintenance and eco-friendliness," she says. "The toughness and engineering of our products can survive Mariposa Meadow's environment—and backyard America."

Weather warriors. Trex products, such as the *Spiral Stair*, *Enhance* decking and *Elevation* steel deck framing, can experience all types of harsh environments and still look good. COURTESY OF TREX

Changing times. Tomorrow's multifamily housing will have to include consideration of foot traffic, ventilation and indoor lighting to ensure protection from COVID-19.

CREDIT: FULLVALUE/ISTOCK

MULTIFAMILY MINDSET

COVID-19 will mean major changes to the look and feel of apartment housing. Here's what things could look like.

BY ELLEN CHANG

THERE'S A NEW LOOK COMING to multifamily housing, and it's courtesy of COVID-19.

The lifestyle everyone has had to adjust to is going to catch up to the construction industry, and that's not a bad thing. According to a new report from *Apartment Guide*, here's what's on the horizon.

The construction of new apartment buildings will likely factor in the possibility of people spending more time at home as more companies are allowing employees to work remotely.

Architects will change the design and layouts of apartment buildings to adapt to the new norms caused by the coronavirus pandemic. Common spaces and amenities, such as swimming pools and gyms, will be viewed differently as these areas will need to accommodate social distancing practices and lower the spread of pathogens indoors.

The demand for renting is not likely to decline. More people are hesitant to put their savings toward a down payment to buy a house when it might be needed to pay bills due to the uncertainty in the economy.

Renters could consider larger spaces and additional bedrooms, and eschew open floor plans because the number of people working from home is likely to continue in the near term. As more people spend time at home on video meetings or phone calls, the need for more privacy and space will rise.

With those points in mind, here are eight design trends we expect will soon become part of the norm for apartment features, amenities and layouts for the new construction of apartments.

1. COMMON SPACES NEED TO ALLOW FOR HEAVY FOOT TRAFFIC

Many apartment buildings feature amenities, such as places for renters to work, use a printer, grab coffee and socialize with their neighbors.

Places such as fitness centers, working spaces, coffee lounges and leasing centers will need to be able to accommodate both renters and apartment building employees, and be designed "with enough space to allow for heavy foot traffic without putting people in confined spaces," says Patrick Carroll, CEO of Carroll, an Atlanta-based real estate company that owns 30,000 residential and commercial properties.

Meanwhile, interior spaces will have to be rethought to accommodate the need for social distancing. "The flow of traffic in and out of these spaces will have to be carefully considered, as well, to avoid bottlenecks around entrances and exits," Carroll says. "Unit corridors will likely go unchanged because they are not heavily trafficked, but certainly amenity spaces are on everyone's mind right now."

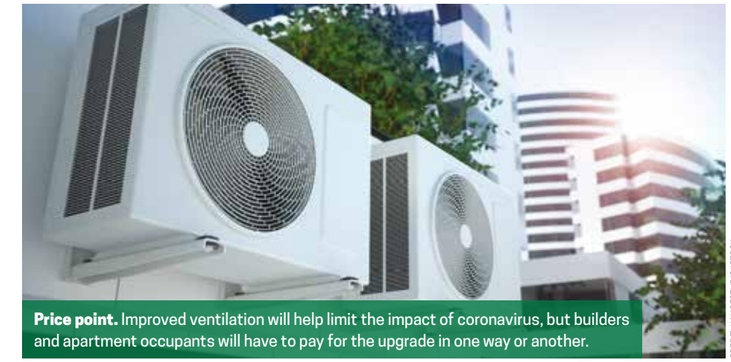
The focus will have to shift so that residents feel safe and that communal areas are sanitary, Carroll notes. Another factor is reducing the number of times residents and staff touch surfaces, whether it's incorporating technology like touchless entry, having the ability to open doors to the community gym or leasing office with feet or switching to lights with motion sensors in communal areas.

"In addition to the design and flow of these specific outdoor and interior spaces, communities will need to make sure the shared amenities are cleaned frequently," he said. "Not only that, but the management team will need to communicate what is being done to keep these spaces clean so that residents feel safe."

Several apartment building upgrades and add-ons are being implemented, including sanitizing stations, physical barriers at reception and amenity areas, temperature-monitoring stations, touchless faucets, auto door operators, increased air changing and air sanitizing HVAC systems/ultraviolet (UV) treatment and hands-free elevator technology, according to Ryan Keane, vice president of Nashville operations for James McHugh Construction Co., a Chicago-based full service construction firm.

2. BETTER VENTILATION WILL BE PRIORITIZED

Ventilation will remain a priority when architects design spaces in a post-pandemic world, says Tyler Davis, director of new construction at Bright Power, a New York-based energy and water management services company for real estate owners and operators.



Price point. Improved ventilation will help limit the impact of coronavirus, but builders and apartment occupants will have to pay for the upgrade in one way or another.

CREDIT: KANGEST UDIO/ISTOCK

"Health-savvy developers may investigate increasing ventilation rates or using better filtration to improve indoor air quality," Davis says. "Better ventilation will increase air quality and create healthier spaces for occupants. While occupants themselves will not see a noticeable shift in their spaces, they will reap benefits."

Determining where developers will find additional funding to cover better ventilation will be a critical issue, he says. Funding for affordable housing has already been hit hard by the pandemic, plus there are ever-increasing construction costs.

"It remains to be seen if these will be increasingly value engineered out of building designs in order to keep projects out of the red," Davis says. "We trust that developers will continue to see the value of higher quality ventilation systems to provide healthy spaces for their occupants."

Keane says it will be interesting to see if these items come to fruition. "Projects still need to pencil out, and whether a developer plans to hold or sell the building may dictate how much they are willing to spend on these various upgrades," he notes.

3. SMALL GROUP MEETING SPACE WILL NEED TO INCREASE

Not everyone will want to work from their apartment or will need more space to conduct meetings quietly. The apartment industry will need to offer more workspaces, similar to the shift made by hotel architects and designers incorporating more workspaces and Wi-Fi for business travelers in hotel lobbies.

While coworking spaces or coffee shop replications will not disappear, residents might be more selective in how they choose to occupy those spaces, notes Brad Vogelsmeier, vice president of development at Milhaus, an Indianapolis-based, mixed-use development, construction and property management company that specializes in Class A, urban, multifamily, residential buildings.

"Not everyone is programmed to work in an office and some still want light social interaction that these public spaces provide," he says. "Getting a small group together and not being on top of other people will be valuable. Amenity areas should be configured to accommodate more than just one group at a time."

Apartment complexes will need to adapt as more people will be working remotely, and having this workplace mindset means they can provide tenants the coworking environment they desperately seek, according to Mayank Agrawal, CEO of ZenSpace, a Santa Clara, Calif.-based meeting space company.

"Apartment common spaces will need to think about soundproof workspaces, tech-enabled meeting rooms, quality internet and options to help maintain social distancing," he says. "As we've seen from the pandemic, working from home just doesn't work for many people, whether it's due to noisy levels, multiple family members in a small space or simply a need to get away."

Vogelsmeier notes that any interior or exterior common space that can be broken up should better facilitate multiple conversations or gatherings in the same place at the same time. "We've been forced into our own living spaces for so long and having private space is great, but getting a small group together and not being on top of other people will be valuable," he says. "Amenity areas should be configured to accommodate more than just one group at a time."

4. NATURAL LIGHT DEMAND WILL INCREASE

Even before the impact of the pandemic took place, some building designers were already working on adding demands from customers and rethinking natural light is a no-brainer. Renters have consistently demanded apartment units to have more light, outdoor space and purpose-built office and desk spaces for years, says Jake Dietrich, vice president of development at Milhaus. "This is really pent up demand and developers are trying to figure out how to meet that demand with their products, while still keeping rents affordable and projects in budget," he says.

Inner light. People who spent most of their time indoors during the stay-at-home orders learned to appreciate natural lighting—a trend that will continue after COVID-19 fades.

CREDIT: ALEXSANDRA ZLATKOV/ISTOCK

5. APARTMENTS WILL HAVE DEDICATED WORKSPACES

The compact spaces within apartments can be adapted to incorporate more true workspaces into smaller square footage. "Work from home policies are about to get a lot more flexible moving forward and in order to make that sustainable, we're going to need to get creative," Vogelsmeier says.

Apartment designs also need to include more private workspaces. Sometimes, the separation between work and home is necessary, especially in an apartment. "Some people don't want to trek to a coffee shop or co-working spaces because they're seeking a private work area to crank out work alone," Dietrich says. "Renters will be looking for these spaces and developers that don't adapt the design of their products quickly will be left behind."

6. ACCESS TO OUTDOOR SPACES WILL BECOME MORE KEY

People will want to spend more time outdoors so they can easily social distance from their neighbors. Creating communal outdoor spaces can be more challenging for urban properties because of the scarcity of land and pricing for it continues to increase, according to Dietrich.

The increase in the floor-area-ratio to maximize the number of units over the years has decreased the amount of surface parking or communal outdoor spaces on the properties. "This is where the quality of place comes in," he says. "Developing near public urban parks and open spaces can provide that communal outdoor space off property, often in a more meaningful way than we can achieve in the little remaining square footage we have on our properties."

7. LARGER FLOOR PLANS WILL BE SOUGHT

The trend before the coronavirus was to maximize apartment building density with a high percentage of studios or small one-bedroom apartments, Keane says. With the pandemic, there should be an increase in unit square footage in new construction apartments to give residents more space within their own dwellings, and balconies "may become a must."

More apartment units could also have a den included, Dietrich says. "A den, hopefully with windows, can provide an urban renter with a work from home space, but also a guest bedroom, a nursery, outdoor gear room," he says. "In addition to building in a desk, we could also design these rooms with Murphy beds or large built-in storage."

8. TOUCHLESS FIXTURES COULD BE MORE COMMON IN NEW APARTMENT CONSTRUCTION

Mary Cook Associates, a Chicago-based commercial interior design firm, notes that it has already shifted gears and specifications on a few projects in the works. One example is a renovation in Phoenix for which the company has revised specifications to include touchless plumbing fixtures, says founder and president Mary Cook.

In a Texas project, lighting has been switched to motion sensors that are touchless and also save on energy. Model home designs are also being adjusted. In a newly-constructed, multi-family community in New Jersey, the company revised the leasing office furniture selections. They switched from open café tables and chairs to pods with removable partitions separating individual workstations.

New construction apartments will likely offer many of these features to remain competitive. Apartment buildings and architects that adapt to these changes will likely see higher occupancy rates and beat their competitors who stick to standard offerings. **GB**

This article originally appeared in *Apartment Guide* and has been reprinted by permission.

Ellen Chang is a Houston-based freelance journalist specializing in articles on stocks, personal finance, energy, cybersecurity and architecture.

After the lockdowns, how will kitchens change?

BY MATT POWER

Overwhelmed. When the lockdowns began, cooking became a family affair. But that changed with the arrival of "cooking fatigue."

CREDIT: JACOB LUND/ISTOCK

AMERICANS HAVE A COMPLEX RELATIONSHIP WITH COOKING. About half say they enjoy it. Others have re-discovered it as a way to reduce anxiety during the COVID-19 pandemic.

Will kitchens change measurably due to the pandemic? If you asked that question several months weeks ago, as the federal government essentially greenlighted the re-opening of the U.S. economy, and governors responded in kind, the answer would probably be no. But with enormous surges in infection taking place in many U.S. states, we might soon cross the tipping point that causes lasting behavior change and a true cultural shift.

That's not just a hunch. There's past experience and data to back it up. Sociologists have observed that human beings tend to forget pain quickly and move on like before, unless a crisis is truly world shattering. It's one of our resilient qualities, but also a fault. In the case of a short-lived crisis, even an intense one, we typically don't learn from our mistakes. Instead, we quickly resume the behavior that brought us to the brink.

The 'Cooking Fatigue' syndrome

During the long periods of COVID-19 stay-at-home lockdowns, many people began to use their kitchens in ways they never had. Keep in mind that fewer than half say they like cooking, and that's in the best of times. Suddenly, people used to eating about two-thirds of their meals out of the home had to up their culinary game in a big way, figuring out what to buy, where to store it all, and ultimately producing decent fare.

At *Green Builder*, we've been tracking in real-time how people "feel" about cooking and cleaning, and what they're talking about online. We do this with a combination of web analysis, third-party research, and our own **COGNITION SmartData service**, which analyzes and breaks down trends in communication online.

What we found was a gradual erosion of positive feelings about cooking at home, as lockdown time wore on. Terms such as "cooking fatigue" began to show up in blogs, posts and tweets. Drilling down further, we identified various aspects of kitchen use and performance triggering negative sentiments: spaces that are too small or poorly designed, appliances that underperform, "missing" technology such as range hoods and other variables that basically make cooking a drag.

We also found that sentiment has continued to shift, following the lockdown pattern. At first, online tweets and posts reflected a generally positive vibe about cooking, discovering new recipes and having more time at home. But then, a few months ago, as the COVID-19 crisis appeared to plateau, we noticed a lot of activity online and negative sentiment beginning to peek through around the edges. We've also seen renewed interest in kitchen remodeling.

Then, the interest in all things cooking faded, almost overnight, as states and cities began to open up again.

This wasn't surprising. It fits with general tendency of people to try to re-construct the lives they knew before a crisis, rather than adapt to a new reality.

Back to the brink

Recently, however, about half of the United States saw huge and frightening coronavirus infection spikes. Talk of new lockdowns is afoot. And as the crisis deepens, sentiment about cooking is once again on the rise. Perhaps it's simply human nature to try to make lemonade when handed lemons, and prepare once again for months of cooking at home.

What does this mean to product manufacturers and kitchen remodelers? The longer the period of disruption continues, the more likely people will be looking to radically change and upgrade their kitchens. We haven't yet hit the tipping point that could result in a complete overhaul of the home food prep experience, but that, too, is on the horizon.

Where will the "white space" of this new market be? Faster, more efficient cooktops, such as electric induction technology, faster dishwashers, bigger countertops, better LED lighting, extra freezers, more flexible refrigeration, and a lot more storage for foods of all kinds. Every one of these products and design shifts can be achieved with sustainable products and design principles.

Major change following a crisis is not impossible, however, as Swansea University Psychology Prof. Katie Gibbs points out. Research has also shown that residents in New Jersey became more likely to support environmental policies following two devastating hurricanes, she notes. Experiences of flooding in the United Kingdom have similarly been shown to lead to a willingness to save energy. Meanwhile, bushfires in Australia have boosted green activism.

We can't predict when COVID-19 will end, but we can read the data to see where it's taken us, and where we may be headed in terms of public sentiment. With the right information, at the right time, we can be ready to capture the new reality of serious cooking at home. **GB**

Keeping customers during–and after–COVID-19

'The New Normal' will make consumers demand more in their homes. Be prepared to give it.

Bigger and better? Consumers being forced to spend more time at home are asking for bigger, more tech-savvy homes to help accommodate their altered lifestyles.

CREDIT: HISTERBENISTOCK

BY SUZANNE SHELTON

THE COVID-19 CRISIS is driving Americans to re-evaluate their needs and wants in a home. That will likely be good news for the high-performance home community. My beliefs about the opportunity at hand have only gotten deeper as time has marched on. Here's what I'm seeing:

PEOPLE WILL WANT BIGGER HOMES.

In May, *Fortune* ran its annual Fortune 500 CEO poll and, among other things, found that 27 percent of CEOs believe that a substantial portion of their workforce (more than 10 percent) will never return to the workplace.

Of course, many of us who have offices outside the home have worked from home from time to time, but now we know the reality of what it looks like to work from home every day, amongst kids, animals and the constant squeal of the neighbors' leaf blowers and Weed Eaters. We'll want offices with doors we can close. We'll want dedicated spaces for home schooling if we need to keep doing that. We'll want bigger pantries to hold the food we're now storing "just in case," and we'll want a place to exercise.

That means we'll be seeking more square footage with a hybrid concept—part open concept (for cooking, eating and being entertained), part closed concept (for working, schooling, exercising). More square footage typically means more energy use…so the challenge for the entire home building and home improvement industries is: How can we make homes bigger while cutting their environmental footprints? The answer lies in the next item:

PEOPLE WILL WANT MORE CONTROL OF THEIR HOMES.

Pre-COVID, 72 percent of Americans believed their homes had an impact on their health and 51 percent said it was important to upgrade their ventilation systems. Now that we're painfully aware that the air we breathe could make us sick, we'll be much more interested in taking control over the air we breathe in our homes. And we'll be interested in taking control of everything in our homes.

In the 2008 recession, we saw energy efficiency jump as a driver for home improvement in a way we hadn't seen before or since. That was about control—when we worry about money/our jobs, we want to take control of our energy bills. And as we contemplate a future where we could be stuck in our homes again (due to a pandemic or climate change) or perhaps a future where we just don't feel as safe going out and we want to stay home more, we'll want homes that feel like a sanctuary.

So, yes, that means they must be beautiful. But it also means they must be comfortable, and they must have 24/7 energy. So, look for interest in smart technology, solar plus storage, backup generators, ductless mini-split systems and tight building envelopes to increase substantially. And don't just count on a consumer to bring those things up! Be aware of all that they're likely feeling and recommend these things based on the self-sufficiency benefits they offer. The market is ripe to say yes.

PEOPLE WILL WANT TO BUY NEW HOMES AND HOME IMPROVEMENT PRODUCTS FROM COMPANIES THAT ARE TAKING CARE OF PEOPLE AND THE PLANET.

We've written about this extensively, and we've published an entire report about how COVID has accelerated Americans' demands that our system should change, and that companies should lead in this direction. My favorite illustration of this, as it relates to the built environment, comes not from our hard data, but from the social media eavesdropping we did with fringe consumers in early April:

"My friend works for Home Depot. I [really] hated Home Depot. Now I am a big fan. So far they have:

- Given every employee an extra week of sick time
- Sent thermometers to every employee
- Gave an extra two weeks of sick time to anyone over 60
- Gave an extra $100 if you work your full schedule this week because people are taking time off
- If diagnosed with COVID, you get full salary while you recover
- If your spouse gets diagnosed, you get paid while taking care of them.

It's crazy how well HD is doing [their] employees. My buddy: 'I'm [going to be] retiring from this job.' This is how you get some fiercely loyal employees."

And, in fact, someone responded to that post by saying, "If someone took care of me like that, I don't care if I was sweeping floors for them. I would be loyal for life."

So, what does this mean for marketing?

For starters, you need to DO the right things. Take care of your employees as if they were family, and take care of your customers similarly.

Then, if you make products, ensure there's a health or control value proposition. If you build or upgrade houses, ensure that you're doing it in such a way that it gives the homeowner the control, comfort and health they want, while also actually reducing the environmental footprint. Bring up all the benefits of air filtration systems, solar plus storage, highly efficient ductless systems and tight building envelopes, and talk to them about how they can have the best of all worlds—more comfort, control and peace of mind, alongside the relief of knowing they're not contributing to our world's environmental problems.

Wrap all of this in bold, heartfelt claims about what your organization stands for, believes in and provides to keep people—and our planet—healthy and safe.

Your company will build a lasting, positive legacy. **GB**

This article **originally appeared on the Shelton Group website** *and has been reprinted by permission.*

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Behind Closed Doors: Taking on COVID-19 with Ventilation, Filtration and Humidity

As schools and businesses struggle to open, scientists warn that the coronavirus may be airborne. Here's how to minimize the risk.

BY MATT POWER

BASED ON WHAT we now know about the coronavirus, enclosed spaces without proper ventilation create the condition for airborne coronavirus spread.

Why? Because of the way the COVID-19 virus infection works. Particles need to achieve a critical mass before successfully infecting a host, a scenario most likely when air is static and dry, and particles are being introduced repeatedly. And while masks and good hygiene definitely reduce transmission rates, other factors are at least as important, including humidity levels, speed or air exchange, filters and virus-killing lights.

No mechanical system is guaranteed to reduce infection rate to absolute zero. If masks, eye gear and social distance lower infection rates to less than 3 percent in health care settings (i.e., hospital rooms), adjusting the way indoor air functions can chip away at the remaining last 3 percent of risk.

Here are three building science adjustments that can reduce the risk of airborne coronavirus spread indoors:

1. VENTILATE—BECAUSE STATIC AIR KILLS

One key finding in coronavirus research is that infection is typically not one particle, but a buildup of airborne particles after several minutes near an infected person. The Centers for Disease Control and Prevention (CDC) has created guidelines for hospital ventilation (based on AIA recommendations) that could be applied immediately to any indoor space. For example, to achieve the air-clearing performance of an ER waiting room, the minimum air exchange with the outdoors should be two times per hour.

CREDIT: COURTESY OF TRANE

Quiet powerhouse. Trane's *Hyperion* air handler can move air at high enough CFM to meet hospital standards for filtration and dispersion in homes and other buildings.

But this is just part of the equation. Along with this air exchange, the CDC recommends 12 additional exchanges of indoor air. What that means is that air inside the room recirculates through a filter system a dozen times over the same period. We will look at filtration below, but for now, let's focus on the ventilation component.

Let's assume, for simplicity's sake, that we are clearing the air in an open floorplan in-law suite above a garage. It has a forced hot water heating system with radiators, and is located in a cold climate. The room's dimensions are 40 feet long and 30 feet wide, with 8-foot ceilings, amounting to 9,600 cubic feet of airspace.

The easiest way to increase the overall ventilation is to add a standalone heat recovery ventilator (HRV). This can be mounted in a closet, inside the ceiling, or even on the wall. To size it, divide the cubic feet of space by 60, and multiply by 2 (air changes per hour). This gives you *part of* the minimum cubic feet per minute (CFM) requirement for the space. So, our classroom requires 9,600/60 x 2, or 320 cfm of airflow.

This is a larger volume of airflow than most residential HRV units, but you can find models with this capacity, or simply install two separate units from companies such as Broan, Panasonic or Carrier.

The reason you are installing an HRV (or energy recovery ventilator [ERV] in hot climates) is to save energy and maintain comfort. Blasting 320 cfm of fresh air into the room with a standard one-way fan system, rather than an HRV or ERV, can create a pressure imbalance by pulling air from the garage below or via other appliances.

Now that you have the diffusion component of the necessary ventilation installed, let's move on to filtration.

2. FILTER AND BURN—BECAUSE VIRUS PARTICLES ARE SMALL

Next on the risk reduction list: Air recirculation that includes filtration, backed up by UV lights.

Removing most airborne COVID-19 particles is possible only with high-efficiency Minimum Efficiency Reporting Value (MERV) 16 or high-efficiency particulate air (HEPA) filters, due to the extremely small size of virions (virus particles). These may slow the airflow so much as to make the system ineffective, however. An alternative is to use a MERV 13 filter, which will grab most of the water droplets COVID-19 uses as a piggyback vehicle.

These filters should not be relied upon as a 100 percent solution, however. The good news is that based on our target ventilation level of 12 recirculating exchanges per hour, free-floating particles will have numerous passes at the filter media. The bad news is that these ultra-fine MERV filters may need frequent replacement, as they can quickly become clogged if the room is dusty or contains other airborne pollutants such as skin flakes or pollen.

Another important piece of filtration technology is ultraviolet (UV) lighting. Although these lights are unsafe for human exposure, they will kill viruses and bacteria, depending on how fast the airflow is, and should be installed inside the ductwork of the recirculating air filter.

Keep in mind that on top of HRV air exchange, you must create the substantial airflow of 12 air changes per hour. How much air do you need? Use the same formula we did for the HRV above: 9,600/60 x 12. That's a whopping 1,960 cfm. To achieve this, you will need something like an air handler system, with a powerful fan that will not be damaged by high-performance MERV 13 filters. Trane makes one called the *Hyperion*, for example, that will do the job. It also allows you to add a UV light inside the double cabinet.

It should be noted, however, that some indoor air experts have suggested that recirculation systems should not be used at all in public buildings to control virus spread. The verdict on this is still out. They premise this advice on the fact that many building managers will simply run their existing ventilation system more aggressively. But these lack the requisite filters to clean infections from the air. My suggestions for recycled air filtration are based on CDC guidelines for hospitals, but you could also take a more-conservative approach and use HRV/ERV technology exclusively to avoid any recycling of air and replace all air in the room 12 or 15 times per hour with outdoor air.

3. HUMIDIFY—BECAUSE VIRUS PARTICLES FLY WHEN IT'S DRY

Research by Dr. Stephanie Taylor suggests that when indoor air is dry, airborne drops of water and flakes of skin that contain virions and bacteria stay airborne longer and travel farther, and tend to be resilient enough to remain infectious. Humidity should be kept between 40 percent and 60 percent. Anything lower than 40 percent and viral risks increase dramatically.

In one recent study of how children get sick from indoor air at school, a team at the Mayo Clinic humidified half of the classrooms in a preschool and left the other half alone over three months during the winter. According to a report in *Cleanroom Technology*, influenza-related absenteeism in the humidified classrooms was two-thirds lower than in the standard classrooms.

How much water does it take to humidify a room such as our 9,600 cubic foot in-law apartment? That depends on several factors, including the number of air changes per hour ventilating the space, and the temperature and humidity of outdoor exchange air. So, for example, for a cold climate room (outdoor temperature 0°F, desired indoor temp 70°F, at 50 percent relative humidity), which is 40 feet long, 30 feet wide, with 8-foot ceilings, you start with 9,600 cubic feet. Let's assume, based on good ventilation practices, you are changing the air in the room (with ventilation) three times per hour. You're looking at a formula something like this:

H = 9,600 cu. ft. X 3 per hr. X 47 (grams of water per pound) = 14 lbs. of water per hour, 13.5 cu. ft. per lb. X 7,000 grains/lb

One gallon of water weighs 8.34 pounds. So, you would need about 1.67 gallons of water per hour introduced to this space to achieve a virus-unfriendly humidity level of 50 percent. Note that the more often you exchange the air in the room, the greater the volume of water you need to introduce to the space. If you choose the best case scenario of exchanging indoor and outdoor air completely 12 times per hour, you will need to add 6.68 gallons of water per hour on a cold winter day.

DEFENSIVE, NOT FAIL-PROOF

I've only addressed one aspect of how to manage COVID-19 indoors—the airborne version of the virus. Regular cleaning of surfaces and bathrooms, and many other protocols, must also be followed to reduce contagion risk. No defensive measure can completely defuse the coronavirus threat. But this article, based on CDC standards for hospitals, gives you a good idea of what's involved if you want to make part of a house as safe as possible for isolating a family member with COVID-19 or some other viral disease spread through the air. **GB**

REFERENCE ITEMS:

- CBS Boston: "Sharing Enclosed Space Leads to 'Massive Spread' of Coronavirus"
- *Green Building Law Update*: "COVID-19 and the Risk from Recirculated Air in Buildings"
- Live Science: "Face masks may reduce COVID-19 spread by 85 percent"
- Centers for Disease Control and Prevention: "Ventilation requirements for areas affecting patient care in hospitals and outpatient facilities"
- Iaqsource.com: "Alternate Ways to Size ERVs/HRVs"
- Kendeda Fund Living Building Chronicle: "COVID crisis cries for higher humidity in buildings"
- *Cleanroom Technology*: "COVID-19: Testing for surface and air presence."
- *Humidity Source*: Introduction to Humidity
- *Green Builder*: "The Pandemic Resistant Bathroom"

Comfort Level

A lot goes into ensuring that a multi-story residential building is energy efficient, as this case study demonstrates.

BY ARNAUD GIRIN

WHEN PEOPLE ARE DISSATISFIED with the thermal environment, their productivity, capacity of concentration, well-being and health can be negatively affected. Thus, ensuring thermal comfort for any new building design project through its HVAC system, as well as positioning of windows, doors, stairs and other components, is paramount.

When it comes to green buildings, the challenge is even bigger, as other factors—such as energy consumption or noise and air pollution—need to be kept to a minimum simultaneously. Several factors that determine if a building is "green," including having heating, ventilation and air conditioning systems with low energy consumption, employing renewable energy, efficiently using resources, proper indoor air quality, measures against pollution, and recycling, to name a few.

Both in the case of green and standard buildings, energy efficiency is essential, and finding a middle ground between this and thermal comfort is one of the most commonplace tasks for engineers and architects.

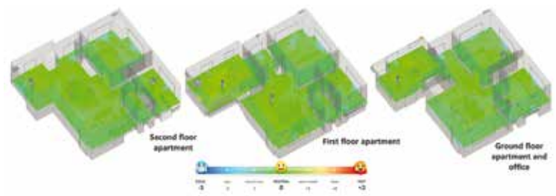
The main tool for accurately testing these two elements for a building's design is numerical simulation with computational fluid dynamics (CFD). This method allows users to investigate elements such as airflow, temperature distribution, pressure field, wind speed and air exchange rate more quickly and efficiently.

FIRST STEPS

In this project, a residential building design was virtually tested with the goal of finding the right capacity settings for its HVAC system in order to ensure thermal comfort in winter. To that end, a computational fluid dynamics (CFD) simulation was performed online to determine a suitable heating capacity of the three-story building in order to guarantee the occupants' thermal comfort while maintaining recommended indoor air quality.

To quantify the thermal comfort of the occupants, two quantities can be calculated through the results of the CFD simulation. These values are predicted mean vote (PMV) and predicted percentage of dissatisfied (PPD), and they determine the probability that an occupant feels cold or warm. The ASHRAE 55 standard defines the PMV as "an index that determines the mean value of votes of a group of occupants on a seven-point thermal sensation scale." The thermal sensation scale is depicted in the picture below.

The PMV takes into consideration different factors—the predicted



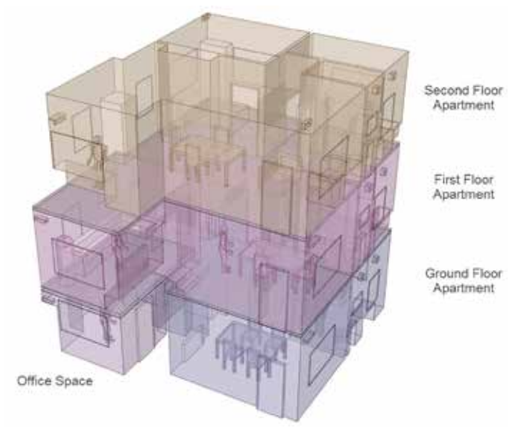
occupant metabolic rate, clothing insulation, temperature, airspeed, mean radiant temperature and relative humidity.

Once the PMV is determined, the PPD—"an index that establishes a quantitative prediction of the percentage of thermally dissatisfied occupants determined from PMV" (i.e., people that may feel too warm or too cold)—can be defined.

The PPD indicates the percentage of people that could experience a condition called local discomfort. There are a few factors causing local discomfort, including draft or lack of airflow, but the resulting consequence is the undesired cooling or heating of an occupant's body. In the presented case, these factors will be taken into account to assess the level of thermal comfort but only the PMV value will be used as a measure.

CAD MODEL

The model presented includes three apartments of about 58 square meters on top of one another, separated by 100 millimeter slabs. At the ground floor level, there is also a 12.6 square meter office space that has its own independent access. In each apartment, there are



two humans and in the office there is one. The furniture—beds, wardrobes, kitchen counters, table chairs—are represented in their simplest form in order to reduce the simulation's complexity while keeping a level that does not impact the results' accuracy.

The airflow will be simulated in the three apartments and the office, through four distinct air volumes. The heat could be transferred from one air volume to the other by thermal conduction through the floors and ceiling. The slabs between the apartments are assumed to be plain blocks of concrete.

The case scenario shows the residential building in winter conditions, with an outdoor temperature of negative 20 and a humidity rate of 50 percent.

Component	U-value (W/K.m²))
Walls	0.2
Windows	1.6
Door	0.2
Roof	0.13
Office Floor (above garage)	0.13

The building is relatively new and has good insulation of its main components. The insulation quantity used for this project is the thermal transmittance (or U-value) and is described as per EN ISO 6946 as the rate of transfer of heat through a material. This can be a single material or a composite. The table below summarizes the U-values used in this project.

HEATING STRATEGY

The main objective of this project is to guarantee the thermal comfort of the dwelling's occupants; this heating power selection is essential in the design process. There are many heating strategies available to the architect and the HVAC engineer in order to reach an acceptable and uniform temperature in the apartments.

The strategy adopted in this project is to implement radiators at different locations throughout the rooms, typically under the windows. The hot air that the radiators generate raises and acts as an air shield against the cold air at the windows surfaces, and enters through small gaps to reach the center part of the rooms where the occupants are most likely to be present.

Using the U-values, surface areas, and heat transfer coefficients (external and internal) of the building's components, one can approximate the heat power necessary to reach a temperature of 21°C (69.8°F) taken as a reference for thermal comfort temperature. The summary of the calculations is shown in the table below for each level.

It can be observed that in this approximation, the heat being transferred from one apartment to the other through the thermal conduction of the slabs has been neglected. The power generated by each individual radiator can then be determined by the pro-rata of each individual room surface area to the total level surface area.

The second approach consists of installing underfloor heating that will generate an even temperature distribution in the rooms. Both of these heating methods will be implemented and compared in this project.

Level	Heating Requirement (W)
Office	151.57
Ground Floor	949.34
First Floor	1,197.87
Second Floor	1485.42

INDOOR AIR QUALITY

To maintain the indoor air quality in the dwellings, and prevent the stagnation of harmful compounds such as carbon monoxide, a constant renewal of the air must be ensured. In recent residential buildings, such as the one presented in this case study, this air renewal is performed by mechanical ventilation means in the form of extracting units placed at different locations around the apartment, typically in toilets facilities, bathrooms, and kitchens. The air introduced in the room would come from different air intakes, located as far as possible from extracting units, to maximize the volume under the stream and taking into account "zone air distribution effectiveness" as per ASHRAE 62.1. It recommends, for example, a supply of air from the ceiling for better effectiveness.

One of the most-used ventilation rate measures is the outdoor air rate calculation presented in the ASHRAE 62.1 standard for indoor air quality.

Therefore, the indoor air quality can be ensured by maintaining sufficient air renewal. The minimum outdoor air rate, which is the amount of air that needs to be introduced in the apartments, is defined by ASHRAE 62.1 as:

$$Vbz = Rp \times Pz + Ra \times Az$$

WHERE

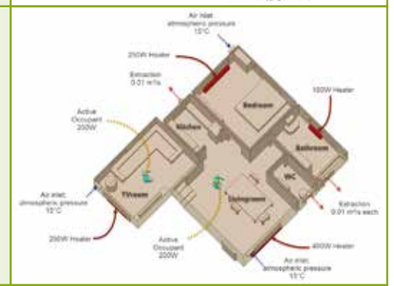
Az = Zone floor area (m²)
Pz = Zone population
Rp = Outdoor airflow rate required per person (l/s. person)
Ra = Outdoor airflow rate required per unit area (l/s)

From ASHRAE 62.1 and for a residential dwelling unit, R_p is 2.5 L/s and R_a is 0.3 L/s.m², for a 58m² space occupied by two people. This gives a Vbz of 21.5 l/s.

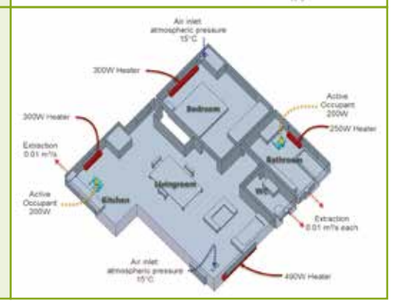
As a baseline, the outdoor airflow rate will be distributed equally among the three extracting units for each flat (7.2l/s or 8.8g/s of air)—one in the kitchen, one in the bathroom and one in the toilet room. The air at the intake, from the outdoor, is filtered. It has come through a double-flow controlled mechanical ventilation (CMV) in order to heat up its temperature by heat exchange with the exhausted air. It is set to a temperature of 15°C.

GROUND FLOOR

FIRST FLOOR



SECOND FLOOR



THERMAL COMFORT AND PREDICTED MEAN VOTE (PMV)

As presented above, the PMV results use values taken directly from the CFD results (surface temperature, velocity, and air temperature) and inputs from the environment and people (clothing coefficient, metabolic rate, and humidity). In this project, and extracted from the ASHRAE 55 standard, a winter clothing coefficient of 1, a "cooking/cleaning" metabolic rate of 1.2 and a humidity of 50 percent are chosen as inputs for the calculation of the results.

CFD SIMULATION RESULTS

Below, the results of this simulation are explained.

TEMPERATURE DISTRIBUTION

The average temperature for each apartment and office show acceptable results, with small error to the target temperature of 21°C, demonstrating a great correlation between the analytical and the numerical approach.

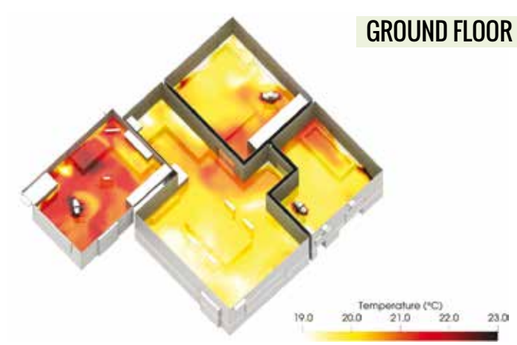
Level	Average Temperature (°C)	Error (%)
Office	21.35	1.66%
Ground Floor	20.06	-4.48%
First Floor	21.06	0.30%
Second Floor	20.68	-1.54%
Average	20.79	-1.01%

In the images below and right, the temperature distribution in the apartments and office helps to identify hot spots such as in the bathroom on the second floor or the TV room on the first floor. The layout of the rooms in each apartment, as well as the location of the inlets/outlets, and radiator greatly impact the heat distribution. One can observe hot spots around the radiator and colder zones at the windows with no radiator underneath—i.e., in the bedrooms.

For the ground floor apartment and the office, the temperature remains mostly evenly distributed, with locally low temperatures, expected in the windows' vicinity

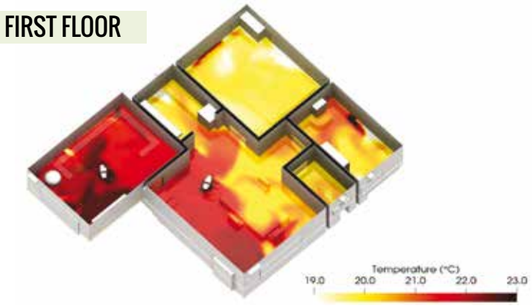
One the first floor apartment heat map, one can observe that the TV room is warmer by 1-2 degrees than the rest of the apartment, at about 20.5°C, indicating that the radiator delivers too much power. The TV room is the warmest space in the apartment. A more evenly distributed temperature could be achieved by moving some of the heat power from the TV room to the bedroom.

GROUND FLOOR

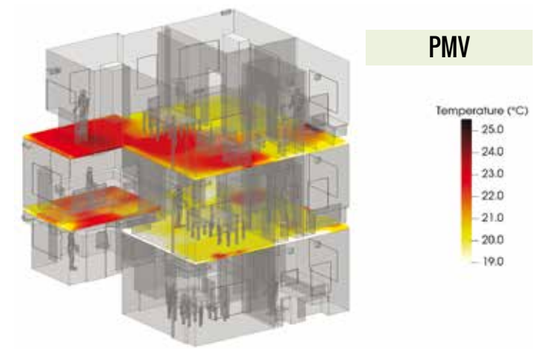


The second floor apartment shows a better distributed temperature than the first floor; there is, however, a hot spot in the kitchen (left part of the apartment). This can be correlated with the warmer first floor TV room where heat is transferred through the slabs to the upper level. The simulation of transfer of heat through the concrete slabs helps understand the importance of building materials and their properties. Slabs with high heat resistance would limit this effect and therefore contribute to keeping the heat within one apartment.

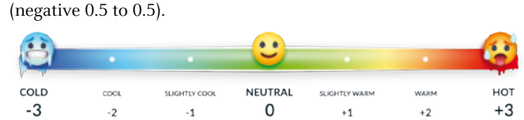
FIRST FLOOR



PMV



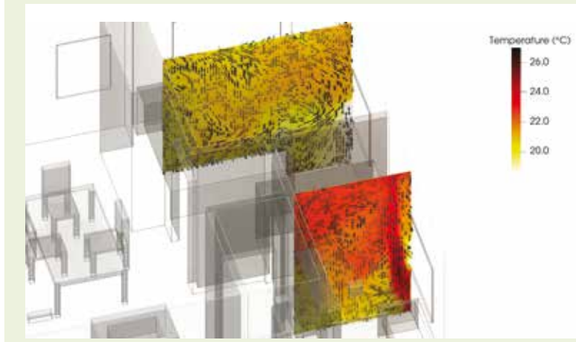
The PMV slices, at 1.2m above each apartment and office floor, shows what a satisfactory thermal comfort map looks like, with very little variance of the PMV value throughout. It can be observed that the occupants would rather feel neutral in terms of thermal comfort and are within the recommended range of PMV as per ASHRAE 55 (negative 0.5 to 0.5).



With minimal values for outdoor rate change at the extracting units, the resulting flow results show low velocity values (below 0.2m/s), and are therefore considered to have an insignificant adverse impact on the PMV values.

The flow pattern, however, coupled with temperature plots, highlights the heat curtain phenomenon formed by the radiator under the windows. This can be seen in the foreground slice of the picture in the top right, where hot air rises to the ceiling of the second floor bathroom, preventing cold air from penetrating deeper inside the room. The rear slice shows a situation with no radiator under a window, in the bedroom of the same apartment. The cold air can flow directly towards the center of the rooms participating in the overall low temperature.

This phenomenon impacts the average temperature in the room and therefore the thermal comfort of the occupant. In the 20th



century, when the insulation of windows was poor (high U-values), this effect was particularly desired, which is why radiators have been traditionally installed under the windows.

FINAL ANALYSIS

As shown in this project, CFD simulation is a valuable tool in accurately predicting energy consumption, leading to a more environmentally friendly building while guaranteeing a suitable level of thermal comfort.

The hand calculation values for evaluating the radiator heat power for each level were confirmed by the CFD results, leading to an average value of 20.79°C from the three apartments and office. This value is close to the one predicted in the calculation (negative 1.01 percent error margin). With temperature plots and flow pattern visualization, some hot spots and areas of low temperature were identified and linked to specific phenomena such as the hot air curtains created by the radiators. The thermal comfort PMV value indicates that the results for the occupants of the spaces is within a range of negative 0.5 to 0.5 (slightly cold to slightly warm).

This analysis could be extended further and applied to different aspects. One example is the study of different U-values for the components and their impact on the energy expenditures of the heaters. In other words, assessing the impact on energy and potential saving if, for example, new, better-insulated windows were installed in a building. A second example could be to propose designs with different inlet and outlet positions, and evaluate their impact on the heat and flow distribution. A third would be to investigate the effect of an underfloor heating. All these ways of improving the design—whether it is existing or at a concept stage—in order to achieve acceptable levels of thermal comfort and minimizing energy expenditure, are all possible through an iterative design process with CFD simulation. GB

Arnaud Girin is technical marketing specialist for SimScale. He has a mechanical design background and has worked for six years on design performance optimization with CFD and FEA tools. He is currently involved in simulation projects for multiple industries, with a focus on architecture, engineering and construction (AEC).

CODE ARENA

The Latest Rules, Regulations and Codes Impacting Sustainable Construction

Stalled Bills Encourage Solar, Self-Sufficiency

Despite the coronavirus, Illinois lawmakers still have work to do

BY MIKE COLLIGNON

DUE TO COVID-19, a large number of legislative initiatives were understandably sidelined to prioritize the needed public health response. Unfortunately, that meant that many good ideas were shelved until an unknown time period. Some could be resurrected later in the year, while others might have to wait for a future legislative session.

This edition of Code Arena focuses on one state's postponed ideas. Perhaps they will be brought back (sooner rather than later) or perhaps, by publicizing them, they will inspire other states or municipalities to draft something similar.

CREDIT: NOVA FIELDS/FLICKR

Power up? In-home electric charging stations will be more accessible to certain Illinois homeowners if lawmakers resume action on anti-restriction legislation.

ILLINOIS

During the latest session, the state legislature had multiple bills focused focused on renewable energy and resilience. Here's where a number of proposals currently sit:

1. HB4148 is attempting to eliminate restrictions or prohibitions from Common Interest Community Association and Homeowners' Associations (HOAs) on electric vehicle charging stations. The bill would render such onerous restrictions or prohibitions void and unenforceable for "the installation or use of an electric vehicle charging station within an owner's unit or in a designated parking space or an electric vehicle dedicated time-of-use (TOU) meter." Furthermore, if the association "willfully violates the provisions," it is then "liable to the unit owner for actual damages and shall pay a civil penalty to the unit owner in an amount not to exceed $1,000." In late February, HB4148 was referred to a House subcommittee, where it is still parked.
2. The same fate has befallen HB5105, which looks to limit home rule powers over the installation or use of solar energy systems. It's still sitting in the House Rules Committee, though it would go into effect immediately upon passage.
3. HB4069 is a very curious bill. The intent is to provide property tax support for properties with a solar energy system. How would it do that? By stipulating "the alternate valuation shall be *the lesser* of the value of the property without the solar energy system or the value of the property with the solar energy system."

   That's all well and good, but it also provides a potentially conflicting signal to the market. One of the selling points for solar systems has been the increased property values associated with that upgrade. Studies have been conducted to provide evidence of the higher resale values, and the PV Value Tool was created as a nationwide resource. Hopefully, the reduced alternate valuation won't confuse data aggregation systems or analysis used by real estate agents and/or appraisers.

   If passed, this new process would begin in assessment year 2020. Since early February, it has been stuck in a House subcommittee.
4. SB3500 was introduced in mid-February, and aims to "protect the rights of residents to produce, consume, and store their own energy without discriminatory repercussions from a utility company." The bill is also trying to prevent residents from falling victim to "discriminatory rate design, treatment, or excessive compliance requirements".

   It was referred to a Senate committee in mid-April. If it eventually passes, it would go into effect immediately.
5. HB4704 would prevent the preclusion of gardens "whether it be for produce, flowers, herbs, fungi, or grains, and when done so for one's own consumption and enjoyment" by the State or a unit of local government, including home rule powers. One caveat of this bill is that it only applies to one's primary residence. It's sad that there is a need for such legislation, but hopefully with so many people staying home and an associated increase in gardening, the motivation will exist to get this out of the House Cities and Villages Committee (where it has been since early March), passed through both chambers and signed by the Governor for immediate effect.
6. The goal of HB4098 is to create a farther setback for landfills. The current setback is 500 feet; the new distance would be 1,000 feet. This bill is proposing a modification to a state regulation, and would go into effect immediately. It was last seen in mid-March with the House Energy & Environment Committee. GB

CREDIT: DON LAVANGE/FLICKR

Greenery is good. Under HB4704, state and local governments would be barred from preventing homeowners from growing personal enjoyment gardens in their homes—a hobby many have taken up as a result of the recent stay-at-home orders.

CREDIT: MASSIDEP/FLICKR

Garbage time. The size of landfills easements will double if legislation ever makes it out of the Illinois House Energy & Environment Committee.

Reference items:

1. legiscan.com/IL/text/HB4148/2019
2. legiscan.com/IL/text/HB5105/2019
3. legiscan.com/IL/text/HB4069/2019
4. legiscan.com/IL/text/SB3500/2019
5. legiscan.com/IL/text/HB4704/2019
6. legiscan.com/IL/text/HB4098/2019

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

Safe house. Lighting, acoustics and people-friendly design are among the key issues to consider when designing a healthy home.
CREDIT: ROSS CHANDLER/CHANDLER PHOTOGRAPHY

Planning the Post-Pandemic Home

Knowing how to build a healthy home is crucial as we venture through—and eventually away from—the challenges of COVID-19.

BY TERRY BEAUBOIS

SINCE MY ARTICLE IN THE MAY-JUNE ISSUE of *Green Builder*, I've been further researching health-related topics to consider including in the planning, design and construction of green buildings. As I mentioned in last article, we are learning more about human health during this pandemic and the importance of designing for human health in home projects and in all buildings.

Many healthcare professionals that I've talked with, including those at the World Health Organization, the United Kingdom and U.S. national healthcare systems, as well as in India and Bangladesh, agree that a healthy home that can help reduce the number of doctor and hospital visits, "is one of the best elements in a healthcare system that any nation could have." This again shows how important green building will continue to be, as we go forward during and eventually after this pandemic.

The key health issues related to buildings typically include water quality, air quality, ventilation, moisture, thermal health, safety and security, acoustics, and lighting. To those topics, I'm adding financial health and mental health. These are very important and challenging issues in general, and are vital to consider in green building projects.

FINANCIAL HEALTH

Finances are certainly a significant, familiar aspect of all building projects, but not necessarily related to how they can be a significant contributor to the health of clients before, during and after the project. I'll address financial health in future articles, and include input from expert financial advisors and health counselors.

MENTAL HEALTH

Mental health is not a topic that everyone is comfortable addressing, nor are we in the building industry typically trained to address this issue. It can be a challenging topic.

Both financial health and mental health can be difficult to discuss during normal building projects, so considering them ahead of time can be a good idea. The goals are still the same: How to have a successful home or building project that contributes to the well-being of individuals who will be using the building.

In the same ways that we would consider the issues around water quality and air quality, and the physical effects they have on building occupants, we can understand that the occupants' mental health may also be affected. In fact, mental health can be directly affected by water quality and air pollution. Studies show that water or air containing certain allergens or chemicals can affect a person's physical and mental health. Symptoms can include fatigue, dizziness, visual disorders and memory loss.

Also, in many cases something that can seem like a mental problem can be an indication of an environmental issue, and even a future problem of organ or nervous system damage. So, there is a fine line between mental and physical health issues, and the benefit of considering both in green building is significant.

My own professional experiences have contributed to my knowledge in financial health and mental health. But just as I consult with and work with structural engineers, mechanical engineers, electrical engineers, etc., who are specialists in their areas, I will work with financial health and mental health specialists to address these two topics as related to health in green building projects.

CREDIT: TREX

Great outdoors. When it comes to mental health, what's outside a building is as important as any state-of-the-art design elements indoors.

I once designed an addition to a house for clients who had a child with considerable health problems. While not obvious at first, these problems were later determined to be caused by allergies. His sensitivity to certain allergens caused him to not feel well and act in unpleasant ways. Once this was identified, the difficulties could be successfully addressed and cleared up. It involved determining what elements in the natural and built environments caused the reactions and how to eliminate, minimize, avoid or protect him from having such strong reactions to (ones that other people might not experience in the same way). These allergens can be air pollutants from outside air or volatile organic compounds (VoCs), chemicals in building materials, furnishings or consumer products within a building, or moisture/mold-related problems in a building.

Concern for the selection of products and materials from these allergens can be extremely critical for many people. Additional information is continuously developing that contributes to what we know about VOCs as well as the new information about products and materials used in building projects that is frequently updated.

Not accidentally introducing products and materials into such a building has been and is becoming an increasingly important factor in the design and selection of products and materials going into a home or building. This will become even more important as we begin to further understand the effects on our mental well-being.

In a home project, an architect or contractor asking and knowing if any family members have allergies or sensitivities to chemicals is a good thing to determine in early discussions with clients. They may appreciate being reminded to consider this issue in their project. These discussions can continue on to develop ways to address them in the design of the mechanical systems and filtering, and the careful selection of products and materials for the project, with a heightened awareness of the related benefits and the effects of those decisions. It can raise the awareness of the project's value to clients to where they consider including them in the beginning of their project design.

This also applies to commercial projects for real estate developers, including tenant improvement (TI) work and for corporate facilities, as everyone's rising awareness of health requirements is reflected in all buildings. Also, if a project involves remodeling a home or if it is a commercial adaptive-reuse project, being able to recognize existing indications of potential building health problems is an asset before, during and after construction.

An example of this that I experienced was when good friend of mine experienced dizziness and falling. He had visited his doctor who, after examining him, could not determine any reason or cause for his problems. When he mentioned this to me, I visited his house with him.

While walking around the house, I saw indication of water damage in the form of staining of the ceiling of the dining room. He explained it was from a leaky roof that had not been repaired. I mentioned to him that he should have an expert inspect the ceiling for what might be black mold and have the damage removed carefully if that was the case. He also should have his roof repaired so no further damage would be done. I recommended a qualified contractor who could do both. I also asked that he check with his doctor to see if he could be experiencing Meniere's disease (a condition that can be caused by mold). Fixing the roof and alerting the doctor to the possible cause of the problem resulted in him getting proper treatment, and recovering fully and living in a house without a leaky roof.

MEDICAL, HEALTHCARE AND MENTAL HEALTH

My professional architectural experience also includes healthcare facility design where the entire purpose of the building is to create spaces to administer, practice and address health issues. My projects include a medical center in Palm Springs; a new hospital in the Middle East; and serving as the architect for the design of a new Center Core Building for the Veterans Administration in Menlo Park, Calif.

The VA hospital was for patients suffering from various physical and mental health issues. Learning how to design for these patients—and those persons caring for them—required a basic understanding and appreciation for their experiences and how to design environments that were healthy for everyone. It included not introducing products, materials or design features that could make their health worse. Increased safety precautions, including lighting, floor material, acoustics, air quality, doorways and views from the building, and products and materials, were all considerations.

On a return visit to the building years later, I met with a health professional and we walked the building. He pointed out reasons he wanted to work there and had taken the job. He commented that the views of the oak trees and redwood trees (which the supervising agency originally said "should be taken down to make room for the building") from inside the building contributed to the satisfaction of working in the building. He commented that the building seemed like a healthy, safe environment to practice medicine, and a good environment for the patients.

Clean living. Safe drinking water helps keep every home's occupant healthy—physically and mentally.

CREDIT: SONSAM/ISTOCK

LEARNING FROM THE VOICES OF LEADING COMPANIES

I enjoy bringing experience and practices from my non-residential projects into my residential projects and vice versa. There are many things that may not be common practice in residential projects but are common in other building types, such as commercial, corporate and larger building industry projects. Many of those issues are helpful to consider in home projects.

Recently, I sat in on an online discussion of corporate mental health, "Mental Health at Work: Voices From Leading Companies." Learning about the level of care and concern currently being exhibited

CREDIT: MIKE MOZART/FLICKR

Leadership role. Corporations are taking the lead in helping builders design structures that address the mental health of occupants and caregivers, such as with the hosting of online construction discussions.

at the corporate level to employees' mental and physical health was impressive. Verizon, Genentech, the University of Southern California, and the *Harvard Business Review* were involved as participants and moderator. The discussion included how mental and physical health issues can affect employee satisfaction and performance, and how companies are learning about how to successfully deal with these issues in the business environment during this time of shutdowns and health concerns. Designing green buildings with concern for occupants' satisfaction and performance is also a key goal.

In addition, there is the related issue of more companies allowing or requiring employees to work remotely, which in most cases is their homes. How this will affect home projects (home offices) as well as the design of businesses, from offices to stores to events buildings, is still evolving.

I am currently teaching an online class in the Global Architecture Program at the University of Hawaii at Manoa School of Architecture (July-August Summer program). All of the students are "at home" due to the campus being shut down. We will be covering the effect of the current shutdown on the students' academic careers, and in the practice of architecture after their graduation. My students are in mainland U.S., in Hawaii, and in Asia Pacific locations. We will take input from practicing architects from various global firms as guests. I'll be sure to include what is learned in future articles of *Green Builder* magazine.

These are not topics that have been commonly taught in architecture, engineering and construction management schools, and they can't be picked up from construction experience alone. There are specialists and experts who can help us address these important issues in our own work and in our own business practices. They may seem new to green building projects in some ways, but the information will serve to help us be even better at what we already do.

I'll continue to identify and involve specialists in the areas of mental health and financial health, as well as all of the other healthy green building issues, to contribute to future articles about these important topics and how they can apply to successful green building projects. **GB**

Terry Beaubois is an architect with 40 years of experience in residential, commercial, industrial and public buildings. He is the CEO of BKS: Building Knowledge Systems, LLC (www.bksco.com/tbagbm). He may be contacted at tbeaubois@gmail.com

AD INDEX

COMING NEXT ISSUE

GREEN BUILDER®

The Forever House

Our annual deep dive into building science includes behind-the-walls analysis of our new, major remodel in Arizona.

FROM THE TAILGATE

New Offerings for the Sustainable Minded

By Ron Jones

Noise

MODERN LIFE IS RAUCOUS in the best of times but the ones we're experiencing now would hardly qualify for high ratings. Day and night, we're bombarded with images and descriptions of conflict and suffering. In fact, it's hard to remember when the world has felt so unstable, so chaotic, so noisy. The future, it seems, has seldom been more uncertain.

In my experience, nature has ways of letting us know when something is not right, that something is out of balance. We're seeing it in the form of a viral pandemic that's ravaging our species, in blood and broken glass on our streets, teargas in our parks, smoke from burning buildings in our cities, in the despair that comes from decade upon decade of economic hardship and social inequity, and in the collapse of micro-environments and ecosystems around the globe.

I'm not afraid to state aloud that some of this imbalance rests squarely on the shoulders of our elected leadership, on many levels and in many places. But that actually concerns me less than the part of this situation that I attribute to everyday people, like you and me. We witness its manifestation in the faces and voices of our fellow citizens who loudly demand their personal freedoms while expressing little or no regard for those around them.

Some people are quick to let us know that they don't want to be told what to do. However, I usually don't hear them speaking up about what they're doing for the common good, how they may be helping to ease the pain for anyone else.

In a recent meeting of the local elected leaders of our tiny hamlet, a vote was taken to determine whether or not everyone over a certain age should be required to wear a face mask in public places. The measure was adopted by more than a two to one margin but there was dissention. One of those who voted against the measure claimed to not believe in masks.

Everyone is entitled to their beliefs and opinions. But all the noisy conflicts around these details distract us from much larger ideals. Those personal freedoms that folks are so eager to declare inviolate exist in a harmonic balance with something else, personal responsibility. One does not occur without the other. They are interdependent.

Individual rights and personal freedoms are the sweet fruits of our chosen system of governance but they are harvested at a cost. The precious gift of living in a free society didn't magically appear from elsewhere in the universe wrapped in a bow by a benevolent sender. Take a walk through any National Cemetery on a quiet morning and read the names of strangers who did their parts, however large or small, to square the common account.

The cornerstone of this fragile arrangement, this thing we call *democracy*, is in keeping faith with a simple principle, namely that we will honor majority rule. That doesn't mean we have to like the fact that we are legally required to fasten our seatbelts when preparing for takeoff, or that we have to enjoy stopping at all red lights. It doesn't mean that we need to believe in masks in order to be willing to wear one if that is what the majority of decision makers deem the best for everyone.

Yes, we're free to make noise. But only if we're also willing to be quiet and listen. **GB**