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**CURRENT LEED STATISTICS**

AS OF APRIL 2018

Total commercial LEED projects globally ▶ 93,492

CERTIFIED: 41,725
CURRENTLY REGISTERED: 51,767
LEED FOR NEIGHBORHOOD DEVELOPMENT CERTIFICATIONS: 205

Gross square footage of LEED projects* ▶ 19.808 Billion

Includes LEED-certified, LEED-registered

LEED for Homes Units ▶ 426,364

*Excludes ND and LEED for Homes

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Washington, D.C., has a big goal: Within one generation, a mere 20 years, we will become the healthiest, greenest, and most livable city in the United States. To build on our status as the world’s first Leadership in Energy and Environmental Design (LEED) Platinum City and move us toward our goal, we’re thinking globally and acting locally.

As the nation’s capital, we see it as our responsibility to send a strong message to the rest of the world that the United States is all in on building a greener, more sustainable future. It is in the best interest of our country’s safety, economy, and future to take climate change and environmental issues seriously, and as the mayor of a major city, I have a special obligation to protect our environment for generations to come and to create policies and programs that reflect the values of the residents I serve. This is why we have pledged to make Washington, D.C., carbon neutral and climate resilient by 2050 and why we recommitted to honoring the goals of the Paris Climate Accord.

Washington, D.C., has a long history of proven environmental stewardship. The passage of the Green Building Act in 2006 set the stage for a greener District. The Act, which requires all new public and private buildings to be constructed to LEED standards, was a first-of-its-kind regulatory framework in the country. It resulted in a transformed market for sustainable buildings, and today, we have the highest square footage of LEED space per capita of any state in the country.

The District is a leader in tech and innovation, a city of makers and creatives, and a place where small and local businesses can thrive. As we continue to grow and prosper, we’re focusing on the nexus between climate resilience and economic opportunity. By expanding access to solar- and wind-generated clean power and training residents for jobs in clean energy, we’re showing what’s possible when you combine sustainability with inclusive prosperity.

During my first year in office, we invested in the largest wind power deal of its kind ever entered into by an American city, and recently, we celebrated the launch of one of the largest municipal onsite solar projects in the country. We’re also integrating sustainability into our efforts to train and connect D.C. residents to jobs and careers that are available in our city today and that will help us reach our sustainability goals. To do this, we have created programs like Solar Works DC, which trains underemployed residents for jobs in solar and related clean energy industries and installs cost-saving solar energy systems on the homes of low-income residents.

In order to fully realize our city’s vision and reach the level of sustainability we know is possible, we will remain steadfast in our commitment to tracking and measuring our progress. Currently, buildings account for 74 percent of the District’s greenhouse gas emissions. In the coming years, this will change. The next generation of the built environment will move toward net zero energy, integrate resilient infrastructure systems, and ensure that all residents have access to affordable housing and a prosperous future.

Being a global leader while restoring and protecting our local environment for all residents is what it means to be a LEED Platinum city.

LEED ON,
CONTRIBUTORS

ILLUSTRATIONS BY MELISSA MCGILL

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LEED, the most widely used green building program, is helping buildings and homes everywhere use less water and energy, provide a healthier environment for occupants, and save money.

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#FindyourLEED
District energy provides communities with reliable and resilient heating and cooling while meeting green goals.

BY JEFF HARDER

Once upon a time, coal was king in Saint Paul, Minnesota, creating steam that traveled through a network of underground pipes and tunnels to illuminate and heat downtown. The underlying infrastructure, known as a district energy system, had been around for a century, a relic from when streetlights and trolleys arrived en masse in American cities. But with a few game-changing ideas and decades of hard work, District Energy St. Paul—the city’s nonprofit heating and cooling utility—is on the cutting edge of decarbonization today, relying heavily on locally harvested wood chips, a solar thermal installation, and other renewables to power 200 buildings ranging from Fortune 500 offices to condominiums.

District energy helps building owners and communities provide reliable, resilient heating and cooling while meeting their sustainability goals and curbing carbon emissions. It bypasses the need for single-building boilers and chillers (and the accompanying maintenance and repairs), allows operators to harness waste heat and water, cheaply divert and store surplus energy, and match local renewable energy sources with local thermal use. And the notion of decarbonizing through district energy has reached critical mass in North America, with projects underway or under development from San Francisco to Ohio and beyond.
“I find so many people talking about district energy because figuring out how to decarbonize the natural gas grid is really complicated,” says Nina Axelson, vice president of public relations at Ever-Green Energy, the Minnesota-based company that operates District Energy St. Paul and advises a host of community energy projects elsewhere. “With district energy, it’s a more simplified approach to adding renewables on the thermal side and leveraging wasted energy from local sources.”

Essentially, district energy involves heating and cooling a group of buildings—whether a few dozen structures on a college campus to a few hundred in a city’s downtown—with a system of insulated underground pipes that transmit steam, hot water, or chilled water directly from a local plant. By some estimates, heating, cooling, and hot water account for 60 percent of buildings’ energy use around the world. Meanwhile, district energy systems can cut urban buildings’ energy consumption by up to half. These systems have already provoked profound changes: Sweden’s district energy systems, which relied on fossil fuels exclusively 30 years ago, today function on 90 percent renewable and recycled energy and heat nearly half the country.

“There are exciting projects that look for 100 percent renewable electricity, but it can still be tough to address the thermal load building by building,” says Axelson. “That’s why people have gone back to some of the countries that are leading in carbon reduction with these low-temperature district energy systems.”

In 1983, Saint Paul’s creaky system was nearly shuttered before the city’s mayor and Hans Nyman, a Swedish native and the first president of District Energy St. Paul, decided to transition the existing steam-powered infrastructure to an updated hot water district heating system. Its current incarnation is the largest hot-water district energy system on the continent, circulating and recirculating a million gallons of water per hour—heated to 250 degrees Fahrenheit in the winter and 190 degrees in the offseason—to some 31 million square feet of building space through a closed loop, operating at a steady, optimal capacity throughout the day. “You aren’t wasting any water because it’s a closed loop, it’s higher efficiency, and you can add renewables,” Axelson says.

In subsequent decades since the initial conversion of infrastructure, the city added a chilled water district cooling system, thermal storage, a combined heat and power plant fed by wood chips harvested from the metro area that produces 65 megawatts of thermal energy as well as 25 megawatts of electricity. Also added was a 1.4MW solar-thermal installation on the roof of the Saint Paul RiverCentre—the first such system in the country tied into district heating. Most recently, Saint Paul added 2.5 million gallons of chilled water storage tanks. “Instead of putting stress on the downtown grid to cool all those buildings when they turn on for the day, you’ve shifted the cooling load overnight and the tanks can dispatch to those buildings at eight o’clock in the morning,” Axelson says. District Energy St. Paul expects to completely eliminate coal from its
operations by 2021, reducing carbon emissions by 27 percent overall.

These days, Ever-Green Energy advises clients around the country. After signing a pact to achieve net zero carbon emissions by 2050, Carleton College—a private school roughly 40 miles from Saint Paul—created a utility master plan to cut energy costs while meeting its future energy needs. “This strategic planning milestone allowed us to consider the best approach to providing our campus with reliable utility service into the 21st century, which means incorporating more efficient and lower carbon technologies,” says Martha Larson, Carleton College’s manager of campus energy and sustainability.

After installing its second wind turbine, the college transformed its old central steam system into a hot water plant, connecting 40 buildings with 60 miles of underground piping. The move, says Larson, “opens up much more flexibility in terms of technologies that can be integrated into the system.” A pair of geothermal well fields heat or cool the campus depending on the season. Upon completion in 2021, the system will curb both operating costs and carbon emissions by up to 40 percent.

Similarly, Oberlin College, a small private college in Ohio, is using district energy as part of its carbon reduction efforts, which include a recent commitment for a carbon-neutral campus by 2025. And while the school uses 97 percent renewable electricity through a combination of green energy in the local municipal electric grid as well as campus solar installations like a 2.27MW ground-mounted tracking system, “I find so many people talking about district energy because figuring out how to decarbonize the natural gas grid is really complicated.”

NINA AXELSON, VICE PRESIDENT OF PUBLIC RELATIONS, EVER-GREEN ENERGY
Meghan Riesterer, Oberlin’s assistant vice president of campus energy and sustainability, says, “The opportunity for carbon neutrality lies within the thermal solutions for campus.”

Oberlin’s district energy systems—steam that serves 56 buildings and central cooling that serves 15—date back to the early 20th century. “After eliminating coal as a fuel source four years ago, now three natural gas–fired boilers send steam to campus with a supply temperature at approximately 250 degrees Fahrenheit,” Riesterer says. Three electric chillers transport chilled water at approximately 60 PSIG at a temperature of about 43 degrees Fahrenheit; a condensate return system helps save water and minimize energy consumption. Oberlin is now exploring ways to capture waste heat from a local electric generation station as well as move the campus to a low-medium hot water system. “District energy systems are so efficient because they can deliver enormous thermal resources to large campuses while operating with minimal staff,” says Riesterer.

Ever-Green Energy is also leading a project team at Mission Rock, a mixed-use waterfront property under development in San Francisco Bay that aims to run on 100 percent renewable energy. The district energy system under design recovers local wastewater, an approach expected to save 5 million gallons of water while eliminating 1.6 million gallons of sewer discharge. “You could still do some of these solutions for one or two buildings, but you can’t look at 30 buildings and give each a separate sewer interface,” Axelson says. “District energy is really what allows you to aggregate and do it cost effectively.”

Axelson cautions that district energy isn’t a panacea. “We have to have high-efficiency buildings to meet these carbon goals,” she says, and district energy is a capital-intensive investment that won’t work for every project—when buildings are miles apart, for instance. But with so many projects underway, the advent of decarbonizing through district energy signals something important: a pipeline of enthusiasm.

Left: Carleton College. Top: Carleton’s Utility Master Plan. Carleton’s geothermal system was sized to optimize the highest benefit for the least capital cost. On their coldest day, the geothermal system will serve only 20 percent of Carleton’s heating load, but on an annual basis it will deliver 70 percent of total heating and cooling energy.

Above: Oberlin’s Adam Joseph Lewis Center for Environmental Studies features photovoltaic panels on the roof and parking pavilion to capture renewable energy from the sun. Indoors, a specially engineered wetland purifies nonpotable wastewater for reuse in toilets and the landscape.
The United Nations’ Sustainable Development Goals offer a framework for profound, positive change. After years of negotiations among 193 countries, in September 2015 the UN issued 17 Sustainable Development Goals (SDGs) seeking action on a range of fronts—ending poverty, ensuring access to clean water and sanitation, expanding availability of quality education, combating climate change, and more—with an eye toward achieving them by 2030. SDGs seek to draw in everyone from the governments of developed and developing countries to private-sector businesses to the general public, aiming to lift up our global citizenry, foster thoughtful growth, and tackle our world’s most pressing issues.

The points of overlap and alignment between the SDGs and the green building sector are familiar to anyone acquainted with the benefits of Leadership in Energy and Environmental Design (LEED), from furthering clean energy and reduced water consumption to resilient infrastructure and an overall ethos intended to minimize our adverse effects on the planet. “Just getting people to pay attention to the material they’re buying, where it came from, who’s involved in mining those materials—that overall life cycle approach is a core tenet of our system, and that’s really the thinking that’s behind these sustainable development goals,” says Elizabeth Beardsley, senior policy counsel for the U.S. Green Building Council (USGBC). “It’s also about connecting better with people and creating more opportunity for everyone to have a higher quality of life. And our mission at USGBC focuses on community, people, and support for taking action through tools, sharing best practices, and recognizing leadership performance, and those things translate in different contexts and settings.”

Beginning in this issue and lasting through 2018, USGBC+ takes a closer look at member company efforts toward achieving the UN’s Sustainable Development Goals—undertakings as thoughtful as they are impactful. “These aren’t always things you’d think of for-profit companies doing, but they all have impressive commitments and are backing them up with action,” Beardsley says. “We understand that the SDGs are helping them invest toward areas that can support achievement, to tell their story in a way that resonates, and to hopefully create opportunities for others to follow.”
Sustainable Development Goal 8 promotes sustained, inclusive, and sustainable economic growth; full and productive employment; and decent work for all. The UN has identified 10 specific targets under this goal. Taken together, the targets reflect the integrated nature of the Sustainable Development Goals, with some targets focused on economic activities, others on workers. For example, targets focused on supporting and protecting individuals include providing safe and secure working environments, eradicating forced labor, as well as ending modern slavery and human trafficking and child labor. Economic targets include achieving full and productive employment and decent work for all women and men, providing equal pay for work of equal value; promoting development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation; as well as achieving targets for economic productivity and global resource efficiency.

MARS & Economic Growth
It’s only natural that MARS—best known as the candy maker behind Snickers, 3 Musketeers, and other confections—would source raw materials from West Africa, a region abundant with cocoa crops. But in recent years, as the company took a closer look at its supply chain, it saw a critical situation within its workforce: Women, who represent more than 40 percent of the region’s cocoa farmers and are vital to the industry, weren’t receiving the support they needed to thrive. It was an ethical and economic conundrum: a gender bias-driven lack of access to plants and fertilizers, to loans and financing, and to training in technical and life skills saw female farmers’ crop yields total up to 30 percent lower than men’s.

“In many cases, particularly with small family farms, [women] are often unpaid,” says Lisa Manley, MARS’s senior director of sustainability engagement and partnerships. “And in many places they have no access to land rights. Those are dynamics that aren’t empowering.”

In response, MARS started the Women’s Empowerment Plan, a multipronged program intended to chip away at gender discrimination wherever MARS has a presence, largely in Côte d’Ivoire (otherwise known as the Ivory Coast). Progress has been made toward Sustainable Development Goal 8: Decent Work and Economic Growth. By working with humanitarian organizations, the plan affords women access to technical skills, economic opportunities, and other resources proven to advance their independence and social standing alongside better harvests.

“When we look specifically at women in the supply chain, they’re not benefitting from the training or access to resources that male farmers are benefitting from,” Manley says. “It’s not fair, and for a company like ours that’s really focused on principle-based leadership, it’s not going to help build the resiliency and strength that we need in our supply chain for our business to continue to thrive.”
MARS is addressing several Sustainable Development Goals—including tackling poverty, climate change, and good health and well-being—through a variety of initiatives. Last September, the company launched Sustainable in a Generation, a $1 billion, science-driven effort to reduce their environmental impacts and better the lives of roughly 1 million of its people throughout the supply chain. And while MARS has assisted agricultural workers through actions like the Sustainable Cocoa Initiative, the particular plight of female farmers warrants special attention.

“Whether it's in our workplaces or marketplaces or supply chains, we’re focused on increasing income, respecting human rights, and unlocking opportunities for women,” Manley says.

Launched in 2015 in conjunction with partner organizations like CARE International, a humanitarian NGO, the Women’s Empowerment Plan revolves around two different programs. Farmer Field Schools, located in some 166 communities around Côte d'Ivoire and elsewhere, providing training in best practices for vegetable and cocoa farming, financial literacy, and marketing. “We're helping them understand the basics—how to plant, where to plant, growing seeds, using fertilizers—of good farming practices,” Manley says. “On the economic side, we're trying to help them understand the importance of making investments back into their farming activities, and in some cases giving them resources to help with those investments.”

Additionally, village savings and loans associations (VSLAs), a type of microfinancing mechanism, were first established by CARE in the 1990s. The organizations have established VSLAs around Côte d'Ivoire, making funds available to some 4,000 farmers, both men and women. “Oftentimes we start these programs and we see no

“No one company or one industry can solve these issues, but we’ve all got a role to play.”

LISA MANLEY, MARS SENIOR DIRECTOR OF SUSTAINABILITY ENGAGEMENT AND PARTNERSHIPS
history of savings, no history of active finance, high rates of illiteracy, and a high aversion to financial risk,” Manley says. (Meanwhile, research from MARS and other organizations shows women are more conscientious spenders, who are more inclined than men to reinvest their dollars into their families and in endeavors that benefit their communities.)

Within a year, fortunes change. With 4,465 members enrolled in the MARS & CARE VSLA program at the end of 2017—80 percent of whom were women—average savings per member grew to $152, which marks a 58 percent increase. The loans and savings are paths to generating even more income: Manley recalls hearing of a 31-year-old mother of five who used a $70 loan to buy seedlings and plants to establish a hectare of cocoa. Another, she says, used VSLA funds to start up a fish-selling business.

“We’re finding that the people participating in the program feel more connected not just with the work within the farm, but into their broader community as well,” Manley says. “And we’re finding that these women and men feel more empowered to share in decision making that’s happening at the household level.”
MARS has made great progress regarding other crops in its supply chain: a sustainable rice farming program that the company fostered in Pakistan has increased farmers’ incomes by 75 percent, increased yields by 17 percent, reduced water use by 30 percent, and saved MARS roughly $12 million. The company still has plenty of work to do on decent work and economic growth, Manley says, pointing to its partnerships with the World Cocoa Foundation and The Consumer Goods Forum to end child labor and forced labor in its supply chain as well as plans to address gender pay gaps in its direct operations.

By helping disenfranchised female farmers in one of its most productive agricultural regions, however, the company has plotted a course for greater good. “No one company or one industry can solve these issues,” Manley says. “But we’ve all got a role to play.”

Digging into the supply chain, MARS has taken a multipronged approach. The company uses its contract power and expects its direct suppliers to meet its Supplier Code of Conduct. Collaboration is the key to effecting change in second tier and beyond. MARS has found partners with independent certification programs that share its goals, conducted its own research to fill gaps in best practices, and joined with expert NGOs working in key regions.

Connecting a business in North America with the lives of workers around the world two or more steps removed can be daunting, but working through the supply chain can lead to new opportunities for all parties. “It’s instructive how MARS applies the lens of the Sustainable Development Goals as it has taken on its raw materials sourcing, systematically working towards coupled sustainability and equity goals, rather than just mitigating individual impacts in isolation,” comments Beardsley. “We can all learn from this example. The Sustainable Development Goals intentionally integrate dimensions of people, planet, prosperity, peace, and partnership. By pushing us to understand the full scope of our actions, the Goals set us on a process that helps reveal new ways to positively influence outcomes and do better for everyone.”

Above: MARS Sustainable Sourcing program is focused on mapping key supply chains to better understand where we source products, understanding the nature of the supply chains and seeking to understand the relevant sustainability impacts.
In August 2017, when a once-in-a-century solar eclipse darkened the sun above Arlington, Virginia, students at local Discovery Elementary School found raw material for a math lesson. The newest incarnation of the kindergarten-through-fifth-grade institution, which became one of a handful of net zero energy schools in the country when it opened in 2015, features a digital energy dashboard created by the building’s engineers that measures how much energy the school consumes as well as how much its 1,710-panel solar array produces. Students looked at the data—solar generation dipped from 274 kilowatts of energy just prior to the eclipse to 53 kilowatts during the eclipse—and calculated the decrease in the school’s solar production. The 81 percent decrease in solar power generation, students learned, matched the 81 percent of the sun obscured by the moon at the height of the eclipse.

It’s a far cry from learning multiplication tables by rote. “Educators use the word ‘authentic’ because the students are experiencing it and seeing it for themselves,” says John Chadwick, assistant superintendent of facilities and operations for Arlington Public Schools. “They learn and understand it much more deeply than if it was some abstract exercise.”

Discovery Elementary is living proof of the net zero energy design concepts published within the newest Advanced Energy Design Guide for K-12 School Buildings, released earlier this year. The guide—funded by the Department of Energy and developed by the U.S. Green Building Council (USGBC), the National Renewable Energy Laboratory, ASHRAE, the Illuminating Engineering Society, and the American Institute of Architects—is the first such publication to provide specific recommendations for zero energy-ready buildings, bringing benefits to a wide audience that go well beyond lower energy bills—as Discovery’s celestial arithmetic lesson proves.
“Today, building owners can say, ‘I want a LEED-certified building,’ and even if they don’t fully know what that means, they know they can hire someone who does understand and will design one,” says Paul Torcellini, principal engineer at the National Renewable Energy Laboratory and project committee chair for the K-12 schools design guide. “Now we’re moving into an era where a building owner can also pick up this design guide, wave it around to their design teams and contractors, and say, ‘This is what I want, and this is the performance I expect to get.’”

Schools are at the vanguard of net zero for a host of reasons, Torcellini says: They’re typically owner occupied, they’re in virtually every community, and they’re generally three stories or fewer with ample roof space. By some estimates, K-12 schools in the United States spend $8 billion or more on energy bills each year, the second greatest expense behind educator salaries—and cutting energy consumption by 25 percent could free up $2 billion to reinvest in education.

While previous iterations of the design guides—two of which Torcellini helped produce—aimed to reduce buildings’ energy consumption by 30 and 50 percent, maturing technologies (like low-power laptops replacing energy-sucking desktops), ever more stringent building codes, and ever more adept contractors have made buildings that balance renewable energy production with energy consumption (or that produce an energy surplus) a newly viable ideal. “Thinking of buildings as energy exporters, or able to provide more energy than they take, is a paradigm shift,” says Torcellini. “That’s important because buildings use material and land resources—all these things that LEED looks at—and the question is, what good can they do in return? One way is that they can produce more energy than they use and send it to others.”

The 226-page guide focuses on policies, design strategies, and practical advice—from modeling energy performance to managing plug loads, writing RFPs to optimizing daylighting—for schools to drastically reduce energy loads to a minimum that a renewable energy system can reliably cover. “The basic principles of saving energy still have the biggest impact,” Torcellini says. They’re also the most easily transposed from one location to the next, regardless of the renewable energy incentives available or absent in a given school district. Zero energy design is remarkably affordable. (Discovery Elementary came in $1 million under the allotted budget.) And the focus on actual performance leaves little room for confusion. “You look at your utility bill at the end of the year, and you either hit the target or you didn’t,” Torcellini says. “Zero energy is zero energy.”

Net zero-ready schools fit into a variety of locales and circumstances. The Friends School of Portland, a 15,000-sq-ft private, pre-K through eighth-grade school in rural Maine, is just one example of a school working toward zero energy. “One of the Quaker values we live by is stewardship, so it was a priority to design our new school to reflect that commitment,” says Jenny Rowe, head of the school.

The Friends School of Portland—which served as one of the case studies used to develop the design guide—features an airtight building envelope and solar energy acquired through a power purchase agreement, and construction was an exercise in frugality: construction costs (not including site work) totaled $196 per square foot—far less than costs
that, in the Northeast, can run north of $325 per square foot. The school is a work in progress: Energy models that didn’t account for LED parking lot lighting and a heavier-than-expected burden on heating and cooling systems mean the school consumes 60 percent more energy than it produces. Still, that’s less a measure of failure than a jolt of motivation. “We are speaking with potential donors about adding more solar panels in order to reach net zero—we haven’t given up on that goal,” she says.

At Discovery Elementary School, Chadwick—who contributed to the Advanced Energy Design Guide for K-12 School Buildings as a project committee member—said he expected a net zero school to weave together teaching, learning, design, and sustainability into an environment where as many as 630 students love to learn. Those expectations have been exceeded, he says, with a design for a three-level, 98,000-sq-ft, north-south oriented building—ideal for daylighting while minimizing solar gain—terraced into the grade. Along with the 496-kw solar array, 150 geothermal wells dug under a ball field service a distributed heating and cooling system inside.

In its first year, Discovery Elementary produced 18,600 kWh more energy than it consumed. (Real-time and historical data from the energy dashboard is available to all, from iPad-toting students in classrooms, to visitors navigating the oversize touchscreen in the school’s lobby, to anyone who types http://158.59.255.83 into their web browser,) “It is by far our [district’s] easiest building to maintain and operate,”
Chadwick says. It saves roughly $100,000 in energy costs each year, enough to pay two teachers’ salaries. Another net zero-ready elementary school in the district is under construction.

Beyond making for more engaging math problems, there have been other happy unintended consequences attributed to the design. A month after the school opened, Chadwick says, a phenomenon emerged: Instead of heading home after late-in-the-day doctor and dentist appointments, students regularly insist that their parents bring them back to class—a testament to the teaching as well as the environment, Chadwick says. And with students still navigating their formative years, the influence of the school environment has only begun to emerge.

“Our Energy Dashboard engages students in authentic learning. Math and science inquiry lessons are more exciting when data is about their school. Overall, the sustainability features of our school have greatly impacted our students,” says Erin Russo, principal of Discovery Elementary. “We are growing green leaders who truly care about their school and the natural environment. Students feel challenged to make the world a better place and when we have visitors they are excited to explain how their green building works and the green practices we have set up.”

“You’re training them to be environmentalists at a very early age,” Chadwick says. “They [become] much more aware of these issues. They become advocates. And in many ways, they call the adults to task.”

Left: Inside classrooms, flexible details such as foldable partitions, retractable garage doors, and various furniture offerings support teacher collaboration and cross-pollination. Throughout the school, one-to-one technology enables research and collaboration to happen anytime, anywhere.

Below: Paul Torcellini is the principal engineer at the National Renewable Energy Laboratory.
The East Coast couple, dual-income earners in their 30s, were ready to take the leap into home ownership. They took the usual first step: a leisurely drive through their community to see what they liked, optimistic and happy about the investment they were going to make in their future.

Just one problem with the scenario: One of the most important features for the couple was virtually invisible—each property’s potential for energy efficiency and smart technology. The couple knew the positive effect these features would have on them and their environment: A dwelling built on sustainability and smart technology would be more comfortable, more economical, safer, and healthier for their family and the planet.

Millennials—people who came of age at the turn of the century—are changing the face of the real estate market, driven by their desire for a more sustainable environment. Raised with a solid grounding in environmental values, young adults are ahead of the game, using rapidly developing technology to create homes very different from the ones they grew up in. And recent studies show that homes with sustainable features are selling for higher prices: A study conducted by the University of Texas at Austin in connection with the U.S. Green Building Council showed an 8 percent boost in home price for homes with green certifications in the Austin metro area.
It is a cultural and social shift that is influencing not just the market of existing homes but also how these first-time homebuyers interact with their community and their home, says Amanda Stinton, director of sustainability and the National Association of Realtors’ (NAR) Green Designation at NAR in Chicago.

“One of the main drivers for these homebuyers is their different values,” Stinton says. “They were raised with technology and a certain set of values that tie to sustainability; they’ve never known a culture where it was okay to throw litter out the window.”

Millennials, now in their late 20s to late 30s, comprise the biggest percentage of homebuyers in the country. “We’re really only at the tip of the iceberg,” Stinton says. “It’s a massive group.” These homebuyers don’t just have desires about greening their world; they have expectations that their homes will supply them with the tools that help make it happen, options their parents didn’t have. “They want a healthier environment, lower maintenance, and smart technology; they don’t want wasteful or leaky,” she says. “They interact with their homes in a different way.” Millennial homebuyers generally purchase older housing stock and make repairs and retrofits, according to research by Better Homes & Gardens.

The NAR introduced a Green Designation credentialing program almost a decade ago to train realtors in energy efficiency and sustainability in all aspects of real estate. Still, Stinton stresses that more education is needed in the real estate market, both for consumers and professionals.

“[These homebuyers] were raised with technology and a certain set of values that tie to sustainability.”

AMANDA STINTON, DIRECTOR OF SUSTAINABILITY PROGRAM AND NAR’S GREEN DESIGNATION
Andy Warren, president of Maracay Homes in Scottsdale, Arizona, sees ENERGY STAR, LEED, and Maracay’s proprietary program, LivingSmart®, as the ideal complementary systems for building energy-efficient homes. In 2017, Maracay brought to market 300 Phoenix-area homes with the goal of earning LEED certification.

“Our road toward sustainable building practices began more than a decade ago, when we committed to building only homes that were ENERGY STAR certified,” Warren says. “Today our company’s ENERGY STAR and LEED-certified homes feature the latest generation of high-efficiency technologies and sustainable building materials and practices. The LivingSmart program continues this comprehensive approach to green living.”

LivingSmart began in 1998 as an extension of Maracay’s dedication to environmentally friendly home construction. The program utilizes the latest materials, technologies, and features to promote and improve the well-being of homeowners and their houses. Advanced technology helps reduce energy consumption and utility bills through features, finishes, and filters that promote comfort and better air quality, while the use of sustainable materials also helps conserve natural resources. In 2010, Maracay joined the EPA’s ENERGY STAR program, and recently expanded new-home offerings that include LEED-certified homes in select communities.

Will Doyle, a Millennial and the operating manager of Allied Energy Efficiency Experts in Cherry Hill, New Jersey,
sees firsthand how his peers are impacting real estate. Allied Energy, a home improvement business, retrofits existing homes for energy efficiency. “Millennials are looking to be more sustainable and using as little energy as possible,” Doyle says.

Working with the energy-efficiency program—New Jersey Home Performance with ENERGY STAR—Allied Energy typically installs air sealing, insulation, and energy-efficient water heaters, furnaces, and HVAC. Often, their clients are Millennials who own homes, apartments, and condos in urban settings, such as nearby Philadelphia, which is experiencing a boom in redevelopment. “They want to live in a smaller footprint and walk more than drive,” Doyle says.

The average savings in utility bills for homeowners is around 27 percent, Doyle says, which—depending on household income—can have a substantial impact. But the monetary effect on homeowners likely will be greater when they put their home on the market. In the 2017 REALTOR and Sustainability Report, 71 percent of realtors said they consider energy efficiency promotion for homes important. The association began its Sustainability Program in 2016 as a platform for dialogue among real estate professionals, trade associations, and consumers.

Doyle estimates that 95 percent of Allied Energy’s work is retrofitting homes in New Jersey. “New Jersey has a lot of older housing stock, which cannot be forgotten in the energy equation,” he says. “While new homes are becoming more efficient and sustainable, the average age of a home in America is 30 years. My company has the mission to make those homes as efficient as we can make them while being economically feasible for homeowners.”

Doyle lives in the Northern Liberties community in Pennsylvania, one of the revitalized neighborhoods outside Philadelphia’s Center City district that are creating a new green sweep in living. Northern Liberties and the neighboring community of Fishtown are experiencing new construction and refitting of existing homes. Many of the new houses are passive or LEED certified, Doyle says.

The nearby East Falls neighborhood is home to the largest net zero-capable development in the country, a 126-unit apartment complex that uses factory-built modular construction. Each neighborhood has an association that tackles issues of sustainability and planning. “We worry about things like walkability, bike availability and lanes, and energy efficiency,” Doyle says.

Millennials have become accustomed to the lower utility bills and greater comfort associated with LEED housing, says Marc Heisterkamp, vice president of strategic relationships at USGBC. “Given the high frequency of LEED certification in new apartment communities, it’s not surprising that younger homebuyers are valuing LEED when they go to purchase,” he says. “If that’s been their experience in a rental, they’ll certainly expect it when they take the huge life step of purchasing a home.”
The past two-and-a-half decades have seen a boom in sustainable development, countless new green building jobs, and an ever-expanding definition of the term “sustainability.” Here, industry leaders reflect on how far the U.S. green building sector has come—and where it’s set to go in the future.

WRITTEN BY CALVIN HENNICK
When the U.S. Green Building Council (USGBC) was founded 25 years ago, the Leadership in Energy and Environmental Design (LEED) rating system was spearheaded by half a dozen volunteers. Few corporations had any staffers in full-time sustainability roles. Green building products were difficult to come by, and it was virtually impossible to find information about the recycled content or chemical composition of materials. Sustainable development efforts were focused almost solely on commercial office space, with green building considered impractical for sectors like manufacturing.

All that has changed. Today, hundreds of thousands of LEED APs (Accredited Professionals) and Green Associates apply their knowledge on projects around the globe. Each day, 2.2 million square feet of building space achieves LEED certification. The marketplace has shifted so drastically that, in some cases, environmentally friendly products have entirely supplanted more damaging materials. And innovation and leadership are coming from virtually every industry.

Even more fundamentally, the very definition of “sustainability” has morphed over time, coming to encompass elements far beyond greenhouse gas emissions, energy consumption, and water usage.

“How we talk about sustainability has evolved,” says Kimberly Lewis, senior vice president of market transformation and development in North America for USGBC. “In the early days, people were saying, ‘Build green, everybody profits.’ We were trying to grab the business community and incentivize growth through policy. Then, as more disasters started happening, people started looking at the stability of our infrastructure and systems, and it became a conversation around how we need more resilient communities—how we need to not just build, but we need to be more proactive and make our communities last. Then, the conversation turned to how buildings need to be more regenerative, how they need to give back. Now, people are talking about wellness, health, and social equity, how the benefits of green building can be shared with all.”

“We’ve moved our focus beyond just being a building design and construction system, to focusing on existing building operation and maintenance, continuous and ongoing improvement, and we’ve transitioned from not just the building but to community and to the city scale for performance,” she adds.

Lewis points out that, although the sustainability marketplace has not completely transformed in the past several decades, it is still very much in flux and the leaders are still committed. Performance metrics are becoming more important. Concerns about resilience in the face of a changing climate are magnified with every major storm that floods streets and shuts down businesses. And conversations about sustainability are increasingly focused on factors outside the physical footprint of the building, touching on things like human health, safe and equitable communities, and leveraging the supply chain with diverse hiring practices.

Just as it would have been impossible in 1993 to say with any certainty where the sustainable development market would stand today, it’s difficult to predict what major changes will unfold in the future. But one thing is for sure: The changes of the next 25 years will be driven by the many thousands of green building professionals who have been attracted to the field over the course of the past quarter century.

“We’ve seen the built environment evolve, and we’ve seen sectors change and lead,” Lewis says. “But it began with the people. Over time, we have embraced a mantra of—all buildings in, all people in!”

Here, some of today’s industry leaders share their thoughts on the state of the sustainability market—past, present, and future.
Customers have come to expect that businesses are taking steps to implement sustainable practices—including in building design and operations. And while consumers largely haven’t shown a willingness to pay more for green products, businesses risk alienating their customers if they’re seen as being irresponsible stewards of the environment.

SCOTT JENKINS, General Manager, Mercedes-Benz Stadium, Atlanta, Georgia: What’s really driving sustainability is the demand of our customers, and the expectations they have for us. It matters that our brand is responsible. It matters that we protect air and water and promote public transit, because our customers expect us to. When we surveyed sports fans across the country, around half of them expected us to operate in more environmentally friendly ways. It’s becoming an expectation by consumers, and therefore it makes good business sense for us to pay attention to it.

ROB ZIMMERMAN, Director of Sustainability, Kohler, Kohler, Wisconsin: When I started, there was no such thing as high-efficiency plumbing fixtures. Now, pretty much all that’s sold by Kohler and other manufacturers carry the EPA’s WaterSense high-efficiency label. They’re all at least 20 percent more efficient than they were 10 years ago, and in some cases, they’re substantially more efficient than that. If you ask most consumers, they don’t even know that it’s happened. We’re using substantially less water today per capita than we were in 2005, and most people don’t know that. Their toilet works, and that’s all they care about.

What we get from the consumer research is that consumers expect that companies are doing this stuff. But they don’t want to be inconvenienced. They want what they want, but they expect that we’re going to give it to them in a form that’s environmentally friendly and as efficient as it can be. We’ve never had a period where a significant portion of the marketplace is saying, “Either you provide me with this type of product, or I’m going somewhere else.” It went from never getting those questions, to the expectation that everyone is doing it.
Reductions in water and energy use remain central to green building efforts, but expanding views of what constitutes “sustainability” are pushing the marketplace to develop products and practices that promote human health, business productivity, vibrant communities, and other benefits.

BRETT PHILLIPS, VICE PRESIDENT FOR SUSTAINABLE AND RESPONSIBLE INVESTMENTS, UNICO PROPERTIES, SEATTLE, WASHINGTON: Whether it’s somebody’s home, or place of work, or a healthcare facility where people are recovering from treatment, the built environment and the things we surround ourselves with and things like access to natural light have a huge impact on people’s bodies and their well-being. For many organizations, people are their biggest investment. Someone from a very well-known technology company said, “Do you know what a 1 percent increase in productivity does for our bottom line?” We’d be silly not to be looking at things like indoor air quality and natural light. Those things are real, and they move the needle. That’s where I think the next evolution of this industry moves—it doesn’t move away from conservation and resource reduction, but it brings that along, and it starts to evolve the conversation to also include people’s health, wellness, and productivity.

BEN MYERS, DIRECTOR OF SUSTAINABILITY, BOSTON PROPERTIES, BOSTON, MASSACHUSETTS: The sustainability circle of consciousness has grown from a purely environmental focus to a broader view of externalities, including environmental, social, and governance issues. Since the early days of LEED, we have examined how our buildings impact the environment through operational energy and water consumption, waste streams, building material selection, and greenhouse gas emissions. Today, there is an even greater focus on how buildings impact occupants, the lives inside. Our portfolio of energy- and water-efficient green buildings must also provide superior indoor environments, daylighting, views, and fresh air. Social and governance
issues often extend beyond the boundaries of buildings, to the company itself and how it operates. The social and governance components of sustainability include issues such as diversity, health, safety, and employee training.

**Katarina Tesarova, Vice President of Global Sustainability, Las Vegas Sands Corp., Las Vegas, Nevada:** Through the LEED standard, USGBC opened our eyes to a more holistic view of sustainability. It showed that there’s more beyond electricity and water. That’s what we’ve learned, that there are things like indoor air quality and materials that we need to pay attention to. One thing that’s already started is, we’ve moved from sustainability of the infrastructure to sustainability of people, communities, and even overall humanity. There is definitely a big shift.

Previously considered almost solely the domain of commercial office buildings, LEED and green building practices have spread across a wide swath of sectors. This growth has not only directly increased the number of certified buildings, but has spread knowledge and passion about sustainability to new corners of the business world, and made sustainability more visible to people outside the green building industry.

**Jenkins:** To solve environmental issues, we have to have broad adoption. Sports venues are anchor institutions in their communities. Eight years ago, the Green Sports Alliance was launched. Back then, there were only a small number of LEED venues. Here we are in 2018, and it’s the norm now. I think any professional sports team, or even collegiate campus that was to build a new sports venue, would really be missing the boat if they didn’t adopt an environmentally friendly approach. The real promise with sports is the visibility it provides. That takes it from just an environmental initiative, into a broad brush that crosses all walks of life in a visible way. I think the opportunity to engage and rally people is the real potential of the intersection between sports and sustainability.
As the business benefits of green building practices become more evident, corporations are continuing to add full-time sustainability positions and embed a focus on sustainability into other roles throughout the business—helping to drive innovation and spur further adoption.

Myers: The influence of full-time staff members working on sustainability issues is significant. Many of the people I know that work in sustainability are among the most talented people in the real estate industry. They are change agents that must understand the many layers of real estate: legal, leasing, development, construction, and property management. To be successful, you need the determination of a startup founder and the perspective of all stakeholders that influence the full life cycle of the built environment.

The business case for energy efficiency is strong. There’s a correlation between reduced operating costs and profitability.

Jim Hanna, Director of Datacenter Sustainability, Microsoft, Redmond, Washington: I think the primary driver for continued sustainability progress is going to be relevance to business success. We’ve gotten really adept at measuring the traditional metrics around carbon footprint, but translating those metrics directly into business metrics has led to the continued relevance of sustainability within businesses.

More and more people are coming into sustainability roles from very diverse backgrounds. I love this. We’re seeing people come from supply chain, operations, engineering and design roles—all of these traditional business functions are really leading sustainability initiatives. That’s such a powerful movement.

Above: In order for the green building market to continue to grow, industry leaders must focus on hiring sustainability specialists.

Right page: The building interior finishes market, such as flooring and carpeting, have been making strides in sustainability for more than a decade.
Whereas green building materials were once hard-to-find niche products, they are now often the “default” or “standard” options in their product classes—a development that sustainability leaders attribute to LEED and other standards that reward the use of sustainable materials.

Phil Ivey, Global Sustainability Leader for Floor Covering Division, Milliken, Spartanburg, South Carolina: USGBC has changed the face of building materials and building practices. To a large extent, sustainability has been incorporated into building standards overall—not just green building standards. I’ve been asked multiple times why floor covering seems to be ahead of other products, and I point back to 2005, when we had a sustainability assessment that came out for carpeting—similar to the way that LEED is a scorecard for entire buildings. It really pushed us ahead. We went from worrying about regulatory compliance to going way above and beyond what the government said you had to do.

Philips: You look at things, from carpet, to paint, to adhesives, even to the cleaning products—it’s phenomenal how much has changed. It’s been a painful process, being someone who’s at the end of that supply chain. But we are light-years ahead of where we were 10 to 15 years ago. I think we’ll continue to make more and more progress. Whether you’re doing an individual home project or you’re building a corporate headquarters or a healthcare facility, there are more and more options at the ready. The real story around materials is a human story. It’s about human health for the people that are installing the material, and the people interacting with that material after it’s installed. That’s where this conversation is going. It’s very hard to tell somebody, “I’m going to use something that’s going to expose you to something that’s unhealthy for you.”
Increasingly, the green building market is being—and will continue to be—driven by measures that demonstrate an ability to improve the environmental performance of a building over time. As performance tracking continues to mature, ongoing assessment will continue to become more important.

HanNA: The measurement of actual performance is the next logical step and smart evolution of green building. We are promising our customers that, if they move from on-premises servers to the cloud, that will significantly lower their environmental footprint. Building green data centers and having them verified by USGBC is a part of that promise to our customers.

TesaroVA: We track our performance very closely, and that provides accountability. When you’re on the business side, in order to do anything that requires capital, you have to get approval. If you spend this money to enhance efficiency, there has to be some kind of return on that. You need to be able to show results—that there’s good feedback from our guests, or we’re seeing savings on our utility bills. Once you have one LEED hotel or one LEED-certified building, you have to look into the operations. You can’t have a green building and just go back to operating it the way you did before.

MyERS: There’s always the danger of diluting sustainability, or greenwashing. The antidote to greenwashing is accountability. We’re seeing this in the transition from a labeling and certification era to an ongoing performance measurement era. It’s a transition from “black-and-white” sustainability to “vivid color” sustainability, where collection methods and technologies support the synthesis of massive real estate datasets. We’re hopeful that the outcome will be more meaningful sustainability analysis, building performance benchmarks, and actionable discoveries that help drive the continuous improvement of our in-service portfolio.
Although climate change remains a contentious issue in the national political arena, extreme weather events in recent years seem to have underscored the importance of sustainability for affected cities, states, and private organizations. As the negative consequences of climate change continue to be felt in a tangible way, society may begin to respond more actively—including through new regulations.

Jenkins: It’s not the 100-year flood you’re worried about anymore. It’s the 500-year event. I think people are starting to realize that climate change is happening, and it’s happening at somewhat alarming rates. It impacts kids’ ability to get outside and play. It impacts people’s ability to have playable fields in a drought. I hope people start to connect the dots and say, “What I decide to do is impacting this.”

Zimmerman: Drought is a periodic thing, but we’re heading into a period of much more sustained water scarcity. There’s going to continue to be a push for water efficiency. At some point, the water and wastewater systems as designed will no longer be viable. That’s already the case in some parts of the world. I hate to say this, because in the private sector, you like to think that capitalism works. But I don’t think things will change until they’re regulated. I’ve seen so many examples of, when the building code changes, then people figure out how to do it. It’s hard to imagine getting where we need to go without some sort of intervention.

Phillips: Polling shows that the American public identifies and acknowledges climate change as an issue and accepts the science. It’s well over 60 percent, if not 70 percent. That’s a significant majority. That’s a big change, a major change in acceptance from where we were. But how does that translate into policy change? Climate still ranks relatively low on national priorities that Americans identify with. Things like healthcare and taxes are ranked much higher on their list of priorities, and climate usually ranks somewhere between eighth and tenth. While we’ve made ground on acceptance, I think there needs to be a greater urgency.
In order for the green building market to continue to grow, the sector will need to find new ways to connect with the public and talk about sustainability in ways that feel relevant to people’s everyday lives.

SARA NEFF, SENIOR VICE PRESIDENT OF SUSTAINABILITY, KILROY REALTY, LOS ANGELES, CALIFORNIA: We have an “invisible buildings” problem. Buildings account for 40 percent of carbon emissions and the impact on our health is enormous, but people just don’t think about them. Until customers start complaining, and until people who move into homes and rental units say, “I’m not going to move in unless you’ve done this,” or “I’ll pay more if you’ve done these things,” it’s not going to work.

Last year, my daughter started coughing herself to sleep every night. We took her to the doctor, and they put her in a breathing mask, and that wasn’t really helpful. She finally got diagnosed with asthma. And I wondered, “Does this have to do with the fact that I live next to a freeway?” I got a standalone air filter, and her symptoms were gone in two days. But I hadn’t made the connection, and I do this for a living. That really drove home—if I’m not making this connection, no one is making this connection.

ZIPPERMAN: We’re seeing that consumers are getting smarter about this. Because of social media, and because of the explosion of information that’s out there, consumers have more power than ever. If they start a movement around sustainability, it can spread really quickly. We’re seeing companies taking a stand on social issues, taking a stand on political issues. You’re seeing that more and more. To the extent that those kinds of things are meaningful to consumers, they can vote not only with their dollars, but with their shares and their likes. That’s how movements get started, and that’s how markets can change. Consumers have a lot of power, and they’ve got to use it.

Above: Student participation has far-reaching impacts—from the classroom to the community to the consciousness of tomorrow’s green industry leaders.
Join us at A’18, where some of the most creative architects, designers, and firms will share how they’re creating their own blueprint for better to make a difference in cities all over the world, like New York City and Bisbee, Arizona.
MOVING FORWARD TOGETHER
Building professionals move toward a unified green code by streamlining and simplifying the code enigma.

In August 2014, the U.S. Green Building Council (USGBC) and a group of its industry peers decided on a common goal: to work together in service of simplicity.

For years, USGBC; the International Code Council (ICC); the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE); the American Institute of Architects (AIA); and the Illuminating Engineering Society (IES), had all been working on their own green building standards and regulations. USGBC partnered with ASHRAE and IES to develop ASHRAE Standard 189.1, a document that establishes the minimum standard of care for high-performing green buildings; meanwhile, ICC developed the International Green Construction Code (IgCC), a model code that effectively does the same thing for a different audience. Kindred spirits in principle, the contrasting guidelines baffled the building community because of both their similarities and differences—and things had to change. “Having a standard (in 189.1) and a code (in IgCC) that were doing the same or similar things created confusion in the marketplace,” says Dave Walls, executive director of sustainability programs for ICC. “So a collaboration made sense: Let’s all get together and create something that will be a driving force.”

Just under four years after signing a memorandum of understanding announcing that collaboration, the 2018-IgCC—a new model code that synthesizes both the IgCC and ASHRAE Standard 189.1—arrives this summer. The 2018-IgCC sets forward-thinking minimum standards in enforceable code language, enabling jurisdictions around the globe to adopt a set of credible policies around indoor environmental quality, resource conservation, water safety, land use, site development, and building energy performance beyond energy code baselines. More than simplifying similarly focused green building guidelines, the 2018-IgCC promises to align building code guidelines with LEED credits and prerequisites, creating an on-ramp to LEED certification and incentivizing projects to go beyond code-mandated minimums—an arrangement benefiting all partners involved. “To accomplish our mission of greening all buildings within this generation, we need to have a strong green building code,” says Wes Sullens, director of codes technical development at USGBC. “For the 2018-IgCC, we plan to align portions of our LEED rating system to the model code, thereby hoping to spur more adoptions of the green code and simultaneously making LEED achievement simpler in those adopting jurisdictions.”

The code-plus-LEED concept has a high-profile, successful precedent: California’s eight-year-old Green Building Standards Code, popularly known as CALGreen. In recent years, USGBC has taken steps to recognize the leadership of strong green codes by simplifying documentation of equivalent measures when a project pursues LEED certification.

By applying a similar tongue-and-groove concept to the 2018-IgCC, the partners hope to catalyze the widespread uptake of greener building practice across the country, maybe even the world. And by officially uniting five industry leaders in service of the same goal via the 2018-IgCC, the partnership illuminates the
common cause among professions that’s existed all along. “All of us who are working in the green building community are trying to move the industry in the same direction,” says Mara Baum, vice president and sustainable design leader for health and wellness at HOK, who’s based in the design and architecture firm’s San Francisco office. “Ultimately, we share the same goals and the same values, although we sometimes implement them in different ways.”

Both ASHRAE 189.1 and the IgCC set requirements for high-performing green buildings that states, cities, or other jurisdictions can use to craft technical and performance standards for buildings within their purview. LEED and other rating systems, meanwhile, are typically (though not always) voluntary, flexible, and adaptable frameworks for building industry leaders to demonstrate leadership, while also outpacing a given jurisdiction’s building code.

And while many codes have adopted and adapted LEED’s guidelines for water conservation, energy efficiency, and recycled materials, LEED has responded to shifts in code too, evidenced by LEED’s reference to volatile organic compound (VOC) standards conceived in California. It’s a positive feedback loop—one that’s pushed both green building standards and codes to become more progressive. “I think of code as the floor and rating systems like LEED as the ceiling,” Baum says. “And as the ceiling has gone up, it’s moved the floor as well.”

It’s also led to confusion. USGBC, ASHRAE, and IES began their efforts to develop Standard 189.1 in 2005; ICC independently developed the IgCC four years later; and certain jurisdictions continued using LEED as a fill-in for a green building policy—something, Sullens notes, it was never designed to do. There’s a degree of fluidity to these classifications: Since 2002, when the city of Normal, Illinois, first required LEED certification for certain private development, LEED has been adopted on a few dozen occasions as a de facto building code. (The City of San Francisco, for instance, requires LEED Gold for municipal buildings.) More than 400 local jurisdictions have referenced LEED in public law in some fashion, although most commonly as a leadership commitment for civic structures.

Ultimately only a handful of jurisdictions adopted the early versions of the IgCC, and however well intentioned, the clashing frameworks puzzled even the most well-versed building professionals. “As a [designer], it can be frustrating to have to understand and remember the small differences between two sets of requirements that are otherwise the same or similar,” Baum says. “…Once you get into the minutiae of code language, the devil is in the details, and understanding those details is important to having a successful project.”

To overcome those differences, the 2018-IgCC seeks points of connection, melding the technical provisions of ASHRAE Standard 189.1 with the administrative packaging of the IgCC. The new provisions in Standard 189.1-2017, which serves as the technical content for the 2018-IgCC, incorporate 75 updates, large and small, from the 2014 iteration of the standard. Some of the most substantive changes involve adding resilience to the scope of 189.1, requiring projects to incorporate...
electric infrastructure for electrical vehicles, and real-time display of energy use, among other measures, says Andrew Persily of the National Institute of Standards and Technology, who chairs the 189.1 project committee.

Changes were all approved using the American National Standards Institute (ANSI) consensus process and delivered to ICC in late 2017. “Most of the changes are incremental,” Persily says. “Ideally, now that there is one document instead of two, it will reduce confusion and increase adoption.”

Meanwhile, the 2018-IgCC—one of a suite of 15 model codes that ICC develops and administers—retains ICC’s instructions for issuing permits, requirements for construction documents, administrative charging language, and the responsibility of creating support materials like user manuals and commentaries. Aside from ironing out outside reference standards, reconciling 189.1 and IgCC was straightforward, Walls says. “Both the standard and the code are essentially addressing all the same issues—just differently. It was a matter of bringing all of those together and figuring out how they could work as one.”

ASHRAE President Bjarne Olesen expects the new iteration of IgCC to shed light on the holistic nature of green building practices. “By having this code, I hope people will understand that you cannot focus on only one issue to get a sustainable, high-performance building,” says Olesen. “… It’s so important to have a document that looks at the broad range of issues, from the indoor environment to energy efficiency, indoor illumination, water consumption, the use of building materials, and so on. And it’s important for the user that you don’t have to look at several different documents to look at these many different issues: You have them combined into one, and I think that will increase its usability as well as the chances for it to be used more and more in the U.S.”

A key feature of the 2018-IgCC is the degree to which fundamental concepts of LEED are reflected into the code’s foundations. Meeting 2018-IgCC requirements for measures like “allowable sites” and “prohibited development activity,” for example, closely matches the criteria to earn LEED points for the Sensitive Land Protection credit; the requirements for “water consumption measurement” line up with the LEED prerequisite for Building-Level Water Metering. That alignment incentivizes design-build teams to seek LEED certification by ensuring that an IgCC-compliant project, by definition, meets criteria for several LEED credits and prerequisites, and reduces redundancies in documentation. By transposing the benefits of LEED to a model code, it also broadens the audience for sustainable building beyond the usual cast of professionals—architects, designers—to building departments, city planners, and city councils. It could also fill a void of innovation in building codes and enforcement that’s materialized in the last half-century. “Things like water conservation, energy efficiency, and selecting low-emitting products—things that are readily available and cost-effective everywhere—can and should be normal parts of the building code now,” Sullens says.
In fact, they already are in California, where Green Business Certification Inc. (GBCI)—the third-party reviewer that conducts LEED certification—is now recognizing compliance with statewide standards, including the CALGreen code, as sufficient for all 12 prerequisites and up to 6 points in LEED v4 for Building Design and Construction (BD+C). The IgCC could spread minimum green code requirements far and wide, and opportunities for deeper greening along with it. Walls, who headed the California Building Standards Commission during the rollout of CALGreen in 2010, says despite initial pushback, the code has since become widely and enthusiastically accepted throughout the state. “One of our main goals was to make sure we had a significant code that provided significant provisions toward eliminating some of the negative environmental impacts from buildings, but also to provide practical things that builders could implement into their systems,” he says. “For the most part, everyone I talk to now thinks it’s a great code, from builders to the enforcement community.”

It’s also a guiding light for ambitious projects like a redevelopment underway at San Francisco International Airport (SFO). Roughly five years ago, the airport began planning the rebuilding of the airport’s Terminal 1 (which comprises Terminal 1 Center and Boarding Area B), a $2.4 billion, 1.18 million-sq-ft project that sees some 17 million passengers annually. Anthony Bernheim, currently SFO’s healthy and resilient buildings program manager, developed a computer program that set minimum standards and confirmed the airport’s high-level sustainability goals for the project by consolidating a batch of regulations: CALGreen 2016, the San Francisco Environment Code, LEED v4, and the airport’s own additional sustainable planning and design guidelines. The project also incorporated a series of stretch goals—among them net-zero energy, zero waste, and zero carbon by 2022—all with an eye toward constructing a new airport terminal that could last for 30 years or more. Teams used Autocase software to do a triple-bottom-line cost-benefit analysis on the various systems under consideration, and also pursued the LEED pilot credit for informing design using triple bottom line analysis. “The Terminal 1 redevelopment is slated for completion by 2022. Despite the project site’s functional constraints, it incorporates an astonishing range of innovative sustainability features, from vast rooftop solar arrays to radiant heating and cooling in hold rooms—the areas where passengers and other occupants wait for their flight departures—and dynamic window glazing to reduce glare while also affording views of the hills and mountains beyond. The Terminal 1 projects were designed to connect to the airport’s planned future central heat recovery chiller plant that when completed will significantly reduce the airport’s natural gas usage, resulting in reduced GHG emissions. Other important features include an energy efficiency monitoring system, a new plant to recycle wastewater to use for irrigation and toilet flushing, a baggage and handling system estimated to be 50 percent more energy efficient than conventional systems, and interior and exterior building products selected to meet LEED v4 and CALGreen requirements for reduced volatile organic compounds.
Prior to the most recent effort to streamline LEED with CALGreen, which was announced in April 2018, some 25 projects had signed up for LEED alternative compliance paths through CALGreen—a development that emphasizes code and LEED as complements to each other, not substitutes. While feedback is still coming in from the relatively new program, Baum says it’s been beneficial thus far. “In my experience, no building in California can be permitted without basic energy, water, construction-waste management, and other types of requirements—things that have been implemented here for a very long time,” Baum says. “It’s a relief to get credit for that and not have to create double documentation… The new alternative compliance paths make it very clear what we get, what we don’t get, and where there’s general alignment between LEED v4 and CALGreen. The benefit extends beyond the notion of getting ‘free’ points and prerequisites: It also provides a sense of what additional value LEED brings to the process by indicating where LEED goes above and beyond code minimum.”

California is also a case study in how codes can transform a marketplace. Walls recalls low-VOC paints and water-efficient plumbing fixtures as early targets of grievances; now, he notes, those are the only such materials on the shelves at Home Depot and Lowe’s. The precedent in California helps Baum make the case for the viability of these materials to clients outside the Golden State. “Sometimes I get funny looks from clients in other parts of the country—like, ‘Of course you do that in California, but that doesn’t make it mainstream;’”
she says. “But now I can say, ‘This has been code in California for years. You can’t buy anything else, and it’s gone fine,’ and our clients in other parts of the country have become more accepting.”

In time, expect jurisdictions to overcome their trepidation over the 2018-IgCC and embrace the long-term cost savings of minimizing buildings’ resource consumption. “When adopted by jurisdictions, the IgCC will help significantly reduce water and energy use and help reduce the impact buildings have on our environment,” Walls says. “By integrating the provisions of the IgCC into building construction regulations, local governments can help meet their specific environmental goals while at the same time increasing property values and reducing operational costs for building owners.”

Bringing so many standard-bearers together can help bring new perspective to building codes, which, Sullens notes, are ripe for updates. “When you pull a building permit, the county or state isn’t typically recording your energy performance numbers or water conservation numbers, but we collect that data through LEED,” Sullens says. “So the question is: Are there things we can put into building codes to enable cities and jurisdictions to track these metrics better than they do right now? That’s the sort of innovation we hope to see as part of this partnership.”

In locales that have never enjoyed a LEED plaque ceremony, a sustainability-centered code can help green building make inroads in new territory. It also sends a message to the rest of the world. “People outside the U.S. see that its federal government may not be so supportive of these kinds of activities,” Olesen says. “Therefore, I think it’s even more important that a private initiative from these different societies and industries are really doing something to save our planet, reduce energy use in buildings, improve the indoor environment, and reduce use of our resources.”

As the 2018-IgCC makes its introduction and CALGreen pushes ever forward—California has set net-zero energy targets for all manner of buildings to be reached by 2030—it’s worth remembering that even a forward-thinking building code represents a bare minimum set of standards. “Building codes are the formal way we say, ‘Here are my community’s minimum expectations for buildings,’” says Jeremy Sigmon, director of technical policy at USGBC. “And one of LEED’s major successes is just how much it has evolved everyday expectations for all kinds of buildings.” As broad and as important as the benefits of a green building code are, this essential role of LEED remains the same.

“The reason [to pursue LEED] is no different than it’s always been: to demonstrate leadership, to push above and beyond code minimum, to achieve higher thresholds of sustainability than we would otherwise,” Baum says. “It’s the same conversation we’ve been having around LEED for 20 years and the answer isn’t any different. But the standards and thresholds are higher than they were just a few years ago, which is great. We’re having these conversations, and we’re moving forward together.”
BUILDING HEALTH
From workplace gardens and honeybees to circadian lighting and toxin-free materials, human health is the next frontier in sustainable design.

Written by Lorne Bell

Last year, Harvard University researchers and project managers gathered for a unique meeting. The subject? Making Harvard’s buildings healthier for people. The professors made their case to a packed house.

“We said, ‘Here’s our research linking adverse birth outcomes, infertility, and asthma to chemicals in people’s bodies because they’re in materials in our buildings and products in our homes,’’ says John Spengler, professor of environmental health and human habitation at Harvard’s T.H. Chan School of Public Health. “Project managers don’t have time to look this up, so we said we’ll write the specs that go into bids and define three suppliers for each product category that meet those specifications.”

Spengler and Joseph Allen, assistant professor of exposure assessment science, are faculty advisors for the Harvard Healthier Building Materials Academy, which uses the latest environmental research and Harvard’s purchasing power to inform and influence the building materials market. “We’re at a pivotal point,” says Spengler.

Across the sustainable design and construction industry, architects, engineers, product manufacturers, and builders are “pivoting” to serve institutions and businesses like Harvard. And toxin-free building materials are just part of the human health equation. From designs that bring nature’s healing effects into the workplace, to lighting that regulates energy levels, industry leaders and clients are prioritizing occupant health alongside energy and resource conservation.

Their efforts are reinforced by the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) program and the International WELL Building Institute’s WELL Building Standard, which set benchmarks for energy and resource efficiency, environmental impact, and health-centered designs and practices. For example, a new LEED pilot credit—Integrative Process for Health Promotion—requires projects to team with a public health professional or organization to find strategies that positively impact health.

From a bottom-line perspective, the new paradigm’s cheerleaders point to the fact that employees—not energy and water bills—are a company’s greatest expense. Even slight improvements in worker well-being can curb absenteeism, increase retention and productivity, and spur meaningful savings. Public health advocates draw on countless studies to support healthier conditions in the workplace. And practitioners say the new, holistic approach is the third evolution of green design—a shift that is redefining the very meaning of sustainability.

“By the end of the first wave of the green building movement, everyone was familiar with the impact of buildings on the energy footprint,” says Rick Cook, founder and partner at the New York City–based COOKFOX Architects. “Then it evolved into the impact buildings and occupants have on natural systems. But we’re now talking about quantifiably better air and access to daylight. We set out to make buildings better for the planet, and what we stumbled on is making buildings better for people.”
Previous spread: AR Green, a sustainability consulting firm, helped Macy’s.com achieve LEED ID+C for their 250,000-sq-ft office space in San Francisco, California. Below: 250 West 57th Street outdoor terraces on the east and west of the building showcases COOKFOX’s commitment to the environment as evidenced by the extensive plantings and beehive to produce their own honey. Photo: Eric Laignel
Nature and Nurture

The renowned evolutionary biologist Edward O. Wilson popularized the term “biophilia” in his 1986 book of the same name. Wilson believed that humans have an innate desire to connect with nature, and that doing so “will engage more of the things close to the human heart and spirit.” His philosophy picks up on the work of the Transcendentalists, and a growing body of evidence is proving all of them correct. Contact with the natural world can have significant, measurable impacts on human health.

For example, a 2008 University of Michigan study titled “The Cognitive Benefits of Interacting With Nature” found that a walk through nature can increase cognitive functioning by 20 percent. A 2012 study of Chinese university students found that immersion in a forest environment can reduce inflammation, oxidative stress, and levels of the stress hormone cortisol. And a 2007 study out of the Nippon Medical School in Tokyo found that natural environments can increase levels of anti-cancer proteins in the blood. Given that 90 percent of our time is spent indoors, it’s no wonder that preventable illnesses such as diabetes, heart disease, and hypertension are on the rise.

Enter biophilic design, a burgeoning field that blurs the line between our built environment and nature. Going far beyond a few plants in the office, designers are creating workplace gardens, cave-like refuge spaces for decompressing from a hectic morning, and hallways that elicit the mystery of a winding path through the woods. In the process, they’re fostering an enhanced sense of well-being and rekindling workers’ love of the natural world.

Bill Browning is a pioneer in biophilic design and founding partner of the sustainability research and consulting firm Terrapin Bright Green, based in New York City. He co-founded the firm with Rick Cook and Bob Fox of COOKFOX Architects, as well as fellow architect, Chris Garvin. And he has been featured in the USGBC podcast series, “Built for Health,” which brings building industry leaders and health professionals together to share best practices and the science behind health-based designs.
Browning’s “14 Patterns of Biophilic Design” serves as an indispensable guide to nature-based designs that cultivate wellness in the workplace. Most clients, he says, are familiar with Nature in the Space: biophilic designs such as green walls, hotel lobby waterfalls, aquarium displays, and office gardens. Another design set, Natural Analogues, provides what he calls a “representational experience of nature: the use of biomorphic forms and natural materials, and the dance between complexity and order that you see in nature and in really great architecture.”

“But some of the most exciting projects are the ones that play on spatial patterns and may not even have plants or water or animals in the workspace,” says Browning.

That third set of biophilic designs produces the same direct responses that occur when we are immersed in nature. For example, designs that provide unimpeded views over a distance elicit feelings of freedom, safety, and control. Refuge spaces can be useful in open-concept offices, providing a contemplative, protective retreat with high-backed chairs and soft materials. And features such as the Guggenheim Museum’s spiraling central ramp, which ascends as the railing inches slightly lower, provide what Browning calls a “risk/peril” experience of exhilaration within a safe environment.

These deep-seated responses play on our most primitive experiences of nature, according to Peter Kahn, professor of psychology and director of the Human Interaction with Nature and Technological Systems (HINTS) Lab at the University of Washington. Kahn studies biophilic designs that mimic humans’ ancient forays into the wild: the “going out and coming back” patterns of our hunter-gatherer ancestors. The more wild the biophilic experience, the more present we become, he says, even within the dizzying pace of our nine-to-five workdays.

“That connection is embedded in the architecture of our bodies, minds, and spirits,” says Kahn. “So, how do we get people to interact more deeply in the environments we build?”
COOKFOX Architects designed its new 18,000-sq-ft studio, which opened in 2017 on the 17th floor of the historic Fisk Tire building in Manhattan. The project achieved both LEED Platinum and WELL Gold, and immersive biophilic designs are a centerpiece. Employees are encouraged to get their hands dirty in an edible terrace garden, and a working beehive provides pollinators and honey. Another terrace serves as a breakout space for impromptu meetings surrounded by greenery. The studio itself has an open, collaborative layout with breakout sections, three enclosed offices, and refuge spaces for employees who need a retreat from their work and colleagues.

In addition to achieving 34 combined LEED credits for energy and water efficiency, the project earned almost every Indoor Environmental Quality credit, including a credit for providing unimpeded views to the outside in 90 percent of occupied spaces. For its unique design approach, COOKFOX also earned all six LEED Innovation credits.

So, does biophilic design produce measurable health results in the workplace? At COOKFOX, postoccupancy surveys are ongoing, but the scientific evidence is compelling. One of Kahn’s studies found that views of nature through windows reduce employees’ heart rates and improve psychological well-being. Even virtual experiences of nature—videos and live webcams—positively impact well-being, although not as much as authentic natural environments.

In a similar study by Spengler and his Harvard colleagues, subjects exposed to biophilic designs reported a decrease in negative emotions, reduced blood pressure, and demonstrated a 14 percent
increase in short-term memory. “Moreover, our findings indicate that participants experiencing a biophilic environment [through immersive virtual reality] had similar physiological and cognitive responses,” the authors wrote. The potential for virtual reality nature in healthcare and nursing home facilities is the next area of exploration.

“We believe wholeheartedly that this makes people happier and healthier,” says Cook, “and these principles are part of all of our projects.”

Clif Bar & Company also consulted with Terrapin Bright Green for the design of its new 300,000-sq-ft bakery in Twin Falls, Idaho, which opened in 2016. The project is seeking LEED certification and integrates extensive biophilic designs. But while gardens and apiaries may work in an office setting, they’re a challenge in a sterile bakery environment. Instead, indoor walls are made of recycled barn wood and natural stone. Many of the windows stretch to the ground to provide views of both the sky and surrounding mountain landscape. “We have a really low turnover rate, and in the bakery industry, that’s one of the biggest challenges,” says Elysa Hammond, the company’s vice president of environmental stewardship.

While she can’t point to biophilic design as the sole factor, Hammond says the features are part of Clif Bar’s strong culture of wellness and environmental stewardship.

“Connection to nature is a fundamental value at Clif Bar,” she says. “Our founders are champions of biophilic design, and our bakery’s general manager has declared himself a ‘biophiliac.’”

Sounds Healthy

In the evolution of workplace design, open layouts have replaced cubicles and partitions as a way to increase collaboration and a sense of community, and anecdotal and scientific evidence support that strategy. A 2010 study out of Iowa State University found that financial workers whose office was redesigned in an open-concept layout “reported more favorable perceptions of culture and work-related attitudes.” But while advances in building shell materials mean less noise from outside, fewer interior walls presents significant communication challenges.

“We’ve seen findings that no matter how much you think you might be unfocusing on a nearby conversation, there is a certain amount of brain power working on background words and sentences,” says Chris Pollock, acoustical consultant and associate principal at Arup, the international firm of designers, planners, engineers, and consultants working across the sustainable building industry.

Most office noise does not pose the high-decibel health risks found on construction sites and factory floors, but distractions and communication breakdowns can lead to increased stress and decreased productivity. Mitigating these issues in offices, healthcare facilities, and classrooms requires innovative designs that isolate and absorb unwanted sound.

In December 2016, Arup moved from its former Cambridge, Massachusetts, location to a new 12,000-sq-ft, open-concept office on State Street in Boston. The new space is seeking LEED certification for Interior Design and Construction (ID+C), which includes Indoor Environmental Quality credit benchmarks for acoustic designs that reduce
HVAC background noise, isolate sound, and reduce reverberation time. The studio was also the first project in New England to achieve WELL Gold, earning top marks for acoustic designs that reduce outside noise intrusion and internally generated noise.

Aiming for LEED and WELL acoustic benchmarks means plenty of sound-absorbing materials on both vertical and horizontal surfaces, including high-performance acoustic ceiling tiles and carpet in the open office. It also means a layout that is mindful of workers’ proximity to mechanical systems and provides a variety of sheltered breakout spaces, from cozy nooks with high-backed chairs to enclosed meeting rooms. A separate Wellness Room at Arup is fully walled off and acoustically treated—perfect for cat naps and respite from a long, deadline-driven workday. These spaces help retain the collaborative advantages of an open-concept office while minimizing disruptive chatter and providing some privacy.

Of course, noise-absorbing materials and layout can only achieve so much. “Some of this is acoustical design,” says Pollock, “and some of this is culture and behavior.” Arup asks clients about speakerphone use and what kinds of conversations are appropriate to have at someone’s desk, versus taking them to breakout spaces. Companies that have laptops like Arup—instead of desktop computers—can better facilitate those choices, and seating plays a role. If team members are spread across the workspace, they’re more likely to seek out common meeting places instead of chatting at their workstations. Employees in technical roles may also find the center of an open-concept office more disruptive than design team members would.

In Boston, the impact of this multipronged approach is a collaborative environment that is acoustically balanced, and a workforce that reports significant increases in well-being and workplace satisfaction. Pre- and postoccupancy surveys of Arup’s 85 Boston employees found:

- A 50 percent reduction in “bothersome noise” from colleagues, compared to the firm’s previous office in Cambridge.
- 68 percent reported that office conditions positively impact productivity.
- 55 percent of staff were satisfied that the workplace supports rest and relaxation, compared to just 2 percent in the previous office.
- 83 percent felt the current workplace supports creativity and collaborative thinking.

“It’s very quiet when I’m at my workstation,” says Rebecca Hatchadorian, sustainability consultant and associate at Arup’s Boston location. “That’s a function of both the office design that enables staff to not have to have conversations at their desks, as well as the materials selection and elements on the tech side.”

The health-centered designs are also turning the office into a popular destination for Arup’s projects. “Because the space has been so successful, we’re hosting more project team meetings with clients and architects,” she says.
Get Moving

Businesses generally understand that a healthier workforce increases productivity and decreases absenteeism, but there is a broader public health argument for being physically active at work. According to the Centers for Disease Control, just one in five adults in the U.S. gets the recommended daily amount of physical activity. More than one third (37.7 percent) of U.S. adults are obese, up from just 30.5 percent in 2000. And rates of related preventable diseases—heart disease, type 2 diabetes, and hypertension—are also high.

LEED and WELL tackle both issues with sustainable design and construction benchmarks that increase motion and fitness in the workplace. In the classic example of “stumbling upon buildings that are good for people,” designers and builders have long sought LEED Sustainable Sites credits and Location and Transportation credits for providing access to alternative transportation, reducing the parking footprint, and offering onsite bike storage and showers.

The result is fewer greenhouse gas emissions and more physically active commutes. The WELL Building Standard bolsters LEED’s impact with both passive and active design benchmarks. WELL Fitness Feature 64, for example, recognizes designs that encourage workers to be active indoors with “accessible, safe, and visually appealing stairs, entryways, and corridors.” Fitness Feature 70 recognizes projects that promote cardiovascular health and weight training with free, on-site fitness equipment. And Fitness Feature 68 rewards projects that provide free access to nearby recreation spaces such as parks, trails, swimming, or gyms.

At the award-winning ZGF Architects LLP, a sustainable design firm based in Portland, Oregon, architects employ a range of designs to foster increased activity in the workplace. That includes fitness studios, rooftop gardens and terraces, floorplates designed to encourage walking meetings, and easy access to outdoor trails and pedestrian paths.

Kathy Berg, partner at ZGF, says clients who may not be able to offer high salaries—state organizations, for example—often look to health amenities to bolster compensation.

“So many employees want to work in a place where their health is prioritized, and clients are recognizing that bringing fitness and health opportunities into the workplace is a way to enhance how people can enjoy their day,” says Berg.

Of course, not every company has an office culture conducive to biking, midday runs, or gym breaks. Providing opportunities to get active also does not always translate into increased activity. ZGF advises clients who want fitness-oriented designs to consider policies that can help those designs reach their full potential. Some of the firm’s clients regularly hold walking meetings or provide a paid half-hour for gym use or getting outside. And companies whose leadership models the active lifestyles they want to see in their workforce tend to be more successful in fostering healthy behavior. “It’s important to have both policies and practice in place,” says Berg.

The ZGF team is also pioneering daylighting design and technologies to improve occupants’ energy levels.
In addition to strategically placed windows that bring more daylight to buildings’ interiors, circadian lighting systems mimic the sun’s changing intensity and hue throughout the day, warding off the afternoon office slumps and regulating energy levels. The technology can be especially useful in healthcare settings, where occupants are often less mobile and natural light can enhance mood and even speed healing.

The inspiration for circadian lighting came in the 1990s, when scientists discovered an important link between the ganglion cells in our eyes and our circadian rhythms (patterns of alertness and sleepiness). While rod and cone cells help us see, ganglion cells do not, per se. These photoreceptors detect blue light emitted from the sun, which suppresses levels of the sleep-inducing hormone, melatonin. We experience this process every night and morning, and we can test it ourselves by installing blackout curtains in our bedrooms (or noticing how drowsy we feel on a cloudy day).

While no artificial light can come close to the intensity of the sun’s blue light, circadian lighting uses variably intense blue and warmer light to moderate humans’ alertness, mood, and health. That, in turn, can lead to more activity and healthier occupants.

“You can’t push someone outside, but you can excite their senses,” says Marty Brennan, ZGF’s daylighting specialist and project architect. “All of those things have a deep neural history in our brain. And bringing these healthy light regimens into the workplace or healthcare or even sports facilities, we’re reinforcing rhythms of light and dark that our genetic material evolved with.”

Circadian lighting can also improve health by decreasing energy. ZGF provided planning and design for the 15,605-sq-ft expansion and relocation of Swedish Medical Center—Ballard’s Behavioral Health Unit in Seattle, including designing extensive circadian lighting systems. In addition to light that changes to match the natural light outside and regulate sleep patterns, patients in comfort rooms can fine-tune the shade of lighting as a calming mechanism and a measure of control.

“The behavioral health population can struggle to feel consistent and safe, and lighting is a key strategy to be oriented to the cycle of day and night—to be active during the day and encourage quiet and calm at night,” says Brennan. “It’s really about, ‘How can we make environments that are as therapeutic as medicine?’”
Breathe In

In sustainable designers’ bag of resources, few studies are as often cited as Harvard University’s “The Impact of Green Buildings on Cognitive Function.” Allen and Spengler were principal investigators on the 2015 report, which looked at workers in conventional buildings and green buildings to determine the cognitive impact of carbon dioxide levels and volatile organic compounds (VOCs) in the air.

Employees in spaces with high levels of circulating outdoor air and low levels of VOCs performed 101 percent better on cognitive tests than workers in conventional workplace settings. The researchers calculated that the increase in cognition can generate as much as $6,500 in improved productivity per person per year.

The takeaway was clear. In addition to eliminating VOCs and semi-volatile compounds in flame-retardant rugs, stain-repellent furniture, and plastics, ventilation is vital to improving occupant health. As building envelopes become tighter and more energy efficient, it becomes even more crucial.

Adhamina Rodriguez, founder and CEO of AR Green Consulting in San Francisco, agrees. Her firm provides consulting for design and construction, third-party certifications, and sustainability analysis and education for Fortune 500 companies, government, universities, architects, and developers. The 2015 study, she says, points to a larger truth about buildings’ impact on health.

“When the focus on health came to the green building industry, good insulation, no chemicals, air distribution, active workstations, good water quality, the availability of healthy food—these all became one thing,” says Rodriguez. “But the core of the health of people inside buildings is the type of air they are breathing. And that’s reflected in the energy ratings.”

Under LEED Building Design and Construction (BD+C), for example, projects can achieve up to eight Indoor Environmental Quality credits for meeting air quality benchmarks. Credits are awarded for ventilation designs that bring in and monitor fresh outdoor air and filter particulates. Buildings can also earn credits...
for the use of low-emitting (low- or no-VOC) materials, green cleaning products, and pest management that minimizes exposure to pesticides.

The WELL Building Standard’s Air benchmarks reinforce and complement LEED, recognizing projects with microbe and mold control (Air Feature 06), direct source ventilation (Air Feature 17), and construction pollution management (Air Feature 07). Together, the two rating systems challenge designers and builders to create energy-efficient workspaces with cleaner air and healthier, more productive occupants.

Rodriguez embraces that challenge, helping clients to find both high-tech and natural ventilation designs that achieve top marks from LEED and WELL. Many of her projects are located in “smart buildings,” she says, with sensors that monitor the air for temperature, humidity, and even formaldehyde and CO2 levels. When the air quality dips, ventilation systems kick in to filter the air and bring fresh air inside. The high-efficiency filters are typically MERV 13 and above to trap harmful particulates, and ultraviolet filtration eliminates microbials.

Sometimes, however, the simplest solutions are the most effective. AR Green is the LEED consultant for Oceanwide Center, a $1.6 billion development in San Francisco’s Transbay Area scheduled for completion in 2021. The project totals more than 2 million square feet and includes two mixed-use commercial and residential towers, as well as 22,000 square feet of public spaces. The development will seek multiple LEED certifications, and high-tech, energy-efficient designs will play a role. But when it comes to ventilation, a relatively simple switch from overhead ceiling ducts to underfloor air distribution will reduce the mixing of contaminants and improve both air quality and thermal comfort.

A similar approach is underway just five miles west of Oceanwide Center, where AR Green is sustainability consultant and LEED administrator for the new Golden Gate Park Tennis Center. The Center is scheduled for completion in 2019 and will also seek LEED certification. Photovoltaic solar panels will help the building reach energy neutrality as they strive to achieve multiple LEED Energy and Atmosphere credits, but it will use an increasingly common and simple strategy for improving air quality.

“People are getting back to the basics with operable windows,” says Rodriguez. “The Tennis Center will feature automatically controlled windows, and ventilation is naturally driven by the thermal buoyancy of the building and the wind pressures of the building envelope. It’s then optimized with ceiling fans and highly placed windows in the façade.”

For years, sealed windows have been part of many energy-efficient building envelopes. That may always be the case, but as health and wellness become part of the sustainability equation, designers face a new challenge that requires new innovations.

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In Tabitha Yeager’s classes at Dighton-Rehoboth Regional High School in North Dighton, Massachusetts, students search Google Maps and real estate listings for local abandoned properties. Then they plan out their own developments for the sites, using key concepts from their earlier lessons about rainwater management, urban heat island effect and sustainable transportation.

“This year, a group of students picked a restaurant that had closed,” says Yeager. “They envisioned remaking it into a farmers’ market that would have food gardens on the property and support local businesses. They planned out solar panel canopies for the parking areas, extensive green landscaping, and a green roof for food production.”

If it’s surprising that teenagers would incorporate sustainable transportation into their design plans, consider that Yeager is the creator of a comprehensive Leadership in Energy and Environmental Design (LEED) Prep curriculum that is set to launch nationally this fall. Yeager, who has been teaching her students about LEED for several years, authored the curriculum on behalf of the Austin-based sustainability education organization EcoRise. Portions of the curriculum are already available on USGBC’s Learning Lab portal, and the course is designed to prepare high school students to pass the LEED Green Associate exam.

“What I love about the Green Associate is that it’s an umbrella credential,” says Yeager. “Students learn about indoor environmental quality. They learn about water efficiency. They learn about materials and resources. It does a really great job of giving students an understanding of how sustainability impacts not just the built environment, but also our daily lives.”

While sustainability was once a niche concern, it’s become a fundamental consideration in most design work. Now, green design is making its way into K-12 schools to address what many educators see as an imperative to teach students about global sustainability challenges. Educators like Yeager are working to prepare the next generation of professionals, in green building and beyond.
A Knowledge Gap
Yeager says that, while today's students have a general awareness of sustainability issues, they often lack an understanding of the specifics. "A larger percent of my students today say, 'Yeah, climate change is an issue,'" she says. "But they don't necessarily understand the dynamics of climate change, and what's causing it. When they start the class, they definitely can't define sustainability, or explain what the triple bottom line is. It's more likely that they've heard the term 'sustainability,' but there's a knowledge gap."

In the LEED Prep curriculum, Yeager says, she worked to incorporate engaging activities alongside the raft of specific information students will need in order to pass the LEED Green Associate exam. But she says there's room for other teachers to delve deeper into specific areas. "If you had an electrical teacher, those students might benefit from some of that knowledge about how the electrical components of [sustainable designs] work," she says. "That's why we want to get this curriculum into the hands of career and technical educators. There are lots of opportunities for teachers to take this curriculum and really use it to enhance their students' learning and understanding around these green concepts."

In Carlisle, Pennsylvania, the district has added sustainability-focused content into its middle-school science curriculum, and that learning continues at the high school level—especially for students in the district's career and technical education program. "[Sustainability] is woven into our carpentry program, and also into our engineering and foundation of technology programs," says Michele Barrett, director of the Center for Careers and Technology at Carlisle High School. "It's not a stand-alone course. It's woven into the curriculum." Carlisle has two LEED-certified buildings: Wilson Middle School and Lumberton Elementary School. In fact, Carlisle is tracking building sustainability data in Arc for all of their school buildings and is preparing the documentation to pursue LEED through the Arc platform for their existing buildings.

Barrett adds that new science textbooks often touch on sustainability, and that many students are exposed to the concept through the media. "I think it's an expectation, and it's not a surprise when they come into our course."

Preparing Students for Green Careers
The inherently practical nature of sustainability makes it a good fit for K-12 career readiness programs. And oftentimes, educators will look for resources beyond the four walls of their classroom to connect students with what's happening in the real world.

The Austin-based company Nepris, for example, connects educators via live virtual sessions with professionals across a number of different industries, and the company has partnered with USGBC to connect sustainability professionals with students seeking their expertise. Matt Pronio, a program manager for Nepris, says that these conversations often open students’ eyes to new career possibilities.
“Students have no idea what's out there,” Pronio says. “They know about doctors and accountants and celebrities. But they don’t know about microchip designers. They don’t know about the sustainability professionals that might be solving Austin’s traffic problems.”

Ball State University in Muncie, Indiana, runs a summer camp called DesignWorks for high schoolers, and until recently, the camp has only occasionally touched on sustainability issues. But David Ferguson, an associate dean who oversees the program, is working to better integrate green building concepts into the camp—not only to prepare future design professionals, but also to ensure that future leaders in all fields will have a background in sustainability. This aligns with a growing consensus that sustainability—much like history, algebra, or civics—is something that everybody should learn about, and not a specialized subject that only applies to people who will use the material in their careers.

“To the extent that we can educate the public—because some of these folks will go on to be business people or teachers—‘it’s a win,’” says Ferguson. “And for students who are going to go into design fields, they need to understand that this is now a foundational notion in design.”
Yeager notes that career and technical education programs heavily emphasize practical certifications that students can earn, making the LEED Prep curriculum particularly valuable. And she says that every lesson in the class exposes students to career opportunities they might not have previously considered.

“It’s a great way for students to get enough exposure that they might pursue sustainability careers that they might not have pursued otherwise. They can see that there are careers in stormwater management, and engineering, and architecture.”

In Carlisle, educators place students from the district’s carpentry and other technical programs into internships with a local builder that specializes in green development.

“They will take as many students as I can send to them,” says Barrett. “They’re doing hands-on work. It can involve energy sources, HVAC, electrical … it’s anything that they’re inclined to do and allowed to do.”

Barrett predicts that more schools—especially those with career-focused programming—will come to embrace sustainability as a key touchstone of their curricula. “I think they’re going to have to, because employers are going to demand it at some point, whether they are now or not,” she says. “We need to prepare our students for that.”

**ACTION ITEMS**

- **VOLUNTEER** to virtually connect with teachers and students through Nepris.
- Check with your alma mater to see if they offer a **SUMMER CAMP** where you can talk to students about sustainability concepts.
- Talk with K-12 education leaders in your area to see whether you might be able to assist with an **APPRENTICESHIP PROGRAM**, or talk to science classes about sustainability.
- Look at the LEED Prep curriculum online and **CONTACT USGBC** about helping to implement the program locally.
The U.S. Green Building Council (USGBC) has been in existence for 25 years, and Leadership in Energy and Environmental Design (LEED) for nearly 20 years. “As we travel around the globe, we hear one consistent message from our leaders: USGBC is leading the way. The introduction of LEED nearly twenty years ago helped transform the building sector and contributed to launching the trillion-dollar green building industry and spurring explosive growth in green buildings across the globe. Today, LEED is a full-scale global movement and the most widely used and trusted green building program in the world with projects in 167 countries and territories. Together, USGBC and LEED continue to push the global market toward higher performance, sustainability and improved quality of life.”

— Mahesh Ramanujam, president and chief executive officer, USGBC and GBCI

The Evolution of USGBC

1993

USGBC is founded by David Gottfried, Mike Italiano, and Rick Fedrizzi

1998

19 projects begin pilot testing of LEED 1.0

2000

Public launch of LEED for New Construction

Kandalama Hotel in Sri Lanka is the first LEED-certified hotel and LEED-certified international project

The Chesapeake Bay Foundation Phillip Merrill Environmental Center in Annapolis, Maryland, is the first project to achieve LEED Platinum
Public launch of LEED 2.0
Public launch of LEED v2.1
Third Creek Elementary School in Statesville, North Carolina, is the first elementary school to achieve LEED Gold

Pilot testing begins for LEED for Existing Buildings and LEED for Commercial Interiors
Public launch of LEED for Core and Shell
U.S. General Services Administration mandates LEED certification for all federal projects
▼ The National Geographic Society in Washington, D.C., is the first LEED-certified existing building

▲ Boulder Community Foothills Hospital in Colorado is the first LEED-certified hospital

▲ The Solaire in New York City becomes the first LEED Gold residential high-rise

2001-2002

2003

2004

Public launch of LEED for Existing Buildings
Public launch of LEED for Commercial Interiors
LEED reaches 100 certified projects
▼ Chicago Mayor Richard Daley announces all public buildings in the city will achieve LEED certification
Public launch of LEED v2.2
Number of LEED APs reaches 20,000
▼ Fannie Mae Urbana Technology Center in Maryland is the first data center to become LEED certified

2005

U.S. Army mandates LEED for all major construction projects
Washington, D.C., passes the Green Building Act requiring LEED certification for all new nonresidential construction projects larger than 50,000 square feet

2006

Pilot testing of LEED for Neighborhood Development
Public launch of LEED for Schools
1,000th commercial project achieves LEED certification
▼ Ohio School Facilities Commission adopts LEED for Schools as part of its school design standards

2007

▲ Sidwell Friends Middle School in Washington, D.C., becomes the first school to achieve LEED Platinum

▲ Ohio School Facilities Commission adopts LEED for Schools as part of its school design standards
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<th>Year</th>
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| 2008 | Creation of GBCI to administer LEED project certification and professional credentialing.  
2,000th commercial project achieves LEED certification. |
20,000th project registers for LEED.  
USGBC headquarters is the first project to achieve LEED v2009 certification. |
| 2010 | USGBC launches the Center for Green Schools.  
Public launch of LEED for Neighborhood Development.  
Public launch of LEED for Retail and the LEED Volume Program.  
GBCI certifies the 5,000th LEED project. |

Phillips Arena in Atlanta and American Airlines arena in Miami become the first two professional sports facilities to certify as existing buildings.
Public launch of LEED for Healthcare

12,000th commercial project achieves LEED certification, 12 years after public launch

20,000 LEED for Homes projects achieve certification across the United States

Haworth Beijing Organic Showroom is the first project to achieve LEED v4 certification

Public launch of LEED v4

USGBC launches LEED Earth campaign, offering free certification to the first project to certify in over 100 countries with no prior LEED projects

USGBC celebrates 20th anniversary
More than 20,000 LEED-certified commercial projects worldwide

More than 50,000 residential units certified under LEED for Homes

More than 130 certified LEED for Neighborhood Development projects

LEED projects found in all 50 states and 147 countries and territories

3 billion square feet of LEED-certified space worldwide

First project registers under LEED v4.1

USGBC celebrates its 25th anniversary

*41,725 LEED-certified commercial projects globally

*93,492 commercial LEED-certified and LEED-registered projects globally

*167 countries with projects participating in LEED

*166,000 LEED APs globally

*36,000 LEED Green Associates globally
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What is your greatest fear? Losing my physical and creative capacities. Which historical figure do you most identify with? Eudora Welty. Aside from being an incredible writer, she was such a staunchly independent woman. Which living person do you most admire? My mom, for her strength and 2nd-act career. My mom stayed home with me and my sisters until my youngest sister went to college. She now works at a community college and is just killing it in her career. I admire that she really has been able to “do it all,” on her own terms and timeline. While she wouldn’t identify as a loud proud feminist, I certainly view her as one. What is your greatest extravagance? Boxing and books. I spend a lot of time working with a trainer and then curling up on my sofa with great literature. These are my self-care activities! What is your favorite journey? Architectural pilgrimages are a great love of mine. Particularly traveling to places that have a historic or ancestral importance to me. Last year I revisited my great-grandparents’ home on the coast of France, where they lived during the Nazi occupation. Experiencing the structure and the street and the physical place through that personal lens was intense and important. What do you consider the most overrated virtue? Blind loyalty. That sounds bad, but I think learning how to quit toxic things (especially as women, and especially in our careers and personal relationships) is an essential skill. Which words or phrases do you most overuse? “I’ll take care of it.” I know that we’re supposed to “say yes to life,” but getting better at saying “no” is also important. I think of saying “no” as a way of saying yes to more important things. What is your greatest regret? Not writing or recording every detail of my grandmothers’ life stories before they died. Every person is a library (my grandmothers also both happened to be librarians). I did know and love them dearly, but wish I had been more intentional about documenting their incredible lives. Which talent would you most like to have? Multitasking. I am great at doing one thing with extreme intensity. Two or more, and things fall apart. What do you consider your greatest achievement? Making it to the 10-year mark of running the nonprofit I founded at age 26. I started Project H Design because I wanted to do architectural and design work with and for people, particularly youth. Ten years later, I’m not burned out… I’m just getting started. What is your most treasured possession? My dog, Junebug. We have been through hell and back together and across the country about 5 times. What is your favorite occupation? A handyman/handyma’am. I would love to spend entire days fixing people’s household problems. What is your most marked characteristic? According to my loved ones, I’m unnecessarily stubborn (though I call it tenacious). Who are your heroes in real life? Sandra Cisneros, Amy Poehler, Hung Liu, and Maxine Hong Kingston. Basically female elders who also happen to be creative geniuses and literal or proverbial loudmouths. What is it that you most dislike? Guns. And being talked down to at Home Depot. What is your motto? Fear less. Build more. This also happens to be the motto of the girls’ building program I run. But I’d get it tattooed on my bicep tomorrow.
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